maitland city council

Planning Proposal - Proponent-initiated

Public exhibition version

107 Haussman Drive, Thornton

Amendments to Land Zoning Map and Minimum Lot Size Map

Draft Amendment No.X to *Maitland Local Environmental Plan 2011*

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INTRODUCTION AND ADMINISTRATION

This planning proposal has been prepared in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Department of Planning and Environment's '*Local Environmental Plan Making Guideline (August 2023)*. The following tables provides the administrative information of the subject land, and sections of this planning proposal.

Local Government Area:	Maitland City Council (Council)
Name of Draft LEP	Maitland City Council Local Environmental Plan (MLEP) 2011 (Draft Amendment No. X)
Subject land	107 Haussman Drive, Lot 2 DP 1145348
Site area	18.96 ha
Landowner(s)	McCloy Thornton Pty Ltd
Applicant(s)	McCloy Thornton Pty Ltd
Council file number	RZ21002
Previous planning portal number(s)	PP-2021-2820 / PP-2022-4101
Current version date	23 May 2025
Responsible officer(s)	Prior officer: Leonie Bryson; Current officer: Adam Kennedy
Officer(s) position	Senior Strategic Planner
Responsible manager	Brett Gardiner
Manager position	Manager Strategic Planning – Planning and Environment

SECTION 1 DOCUMENT REVISIONS

Version	Description	Date
1.0	Council Report Request for Gateway	24.01.2022
2.0	Council Report Request for Gateway Post Deferral and Councillor Briefing	24.02.2022
3.0	Re-submission Request for Gateway	23.05.2023
4.0	Re-submission of additional information for Request for Gateway	18.10.2023
5.0	Gateway Determination	13.08.2024
6.0	Public Exhibition	23.05.2025

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SECTION 5. SUPPORTING ATTACHMENTS

Attachment	Description
A	McCloy Group Cover Letter to Adequacy Assessment
1A	Preliminary Biodiversity Development Assessment Report (2021)
1B	Streamline Biodiversity Development Assessment Report (2022)
2	Site Compatibility Certificate (SCC_2017_MAITL_001_00)
3	Adequacy assessment (PP-2022-4101) prior information for needed for (PP-2021-2820)
4	Assessment of Hunter and Regional Plan 2041 Strategies
5	Bushfire Threat Assessment (revised 13.08.2024)
6	Aboriginal Due Diligence
7	Preliminary Contamination Assessment
8	Surface Water and Sediment Assessment
9	Mine Subsidence Constraints Advice Letter 2015 and Review 2023
10	Preliminary Geotechnical Assessment
11	Subsidence Advisory NSW Correspondence 2022
12A	Traffic and Parking Impact Assessment
12B	Supplementary Traffic Impact Assessment

13	Preliminary servicing advice from the Hunter Water Corporation
14	Gateway Determination 07 May 2024 and Alteration
15	Proponent response to agency engagement and studies
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PART 1: OBJECTIVES OR INTENDED OUTCOMES

The objective of this proponent-initiated planning proposal (proposal) is to enable a diversity of future residential housing, while protecting environmentally significant areas and biodiversity corridors by amending *Maitland Local Environmental Plan 2011* (MLEP 2011) in the following manner:

1. amend the land zone map (sheet LZN_006A) from the existing RU2 Rural Landscape to part R1 General Residential zone and C3 Environmental Management zone
2. amend the minimum lot size map (sheet LSZ_006A) to amend the minimum lot size for from mostly the 40ha minimum lot size to 450m² for the proposed R1 General Residential zoned land. The remainder of the C3 Environmental Management zoned land will retain the 40ha minimum lot size.

The proposal will enable the site to be developed up to a range of 132 - 142 residential allotments. This number excludes any calculation for the possibility of future dual occupancies or secondary dwellings. This equates to a dwelling density ranging from 10.8 – 11.6 dwellings per/ha. The density outcome is a lower target than that aspired to in the *Hunter Regional Plan 2041.* However, this is due to the unique characteristics of the site, preserving the critical environmental function of the existing remnant vegetation and retaining a key biodiversity corridor for the area, while also providing for public open space and an onsite detention basin. Furthermore, as the R1 General Residential zone includes a broad range of residential accommodation land uses, the proposed amendment does not prohibit a significantly higher density being achieved on the site.

Refer to **Figure 1** below of conceptual subdivision layout.

Figure 1: Conceptual subdivision layout of the subject site

The proposal is intended to be a mix of R1 General Residential and C3 Environmental Management across the site. The indicative land use boundaries included in this proposal reflect the supporting Biodiversity Development Assessment Report (**Attachment 1A and 1B**) ('biodiversity report'). The determination of zone boundaries within the site will be finalised through the Gateway assessment, and agency engagement. This process of determining the final zone boundary and development footprint will further enhance the objectives of this proposal and the intended outcome will be comprehensively assessed.

It is intended that proposal and future development will be managed through a precinct wide development control plan with the adjoining eastern property (Lot 182 DP792071) and the land to the west known as 'the Brickworks' land, consistent with the staging of the Thornton North Urban Release Area. This will provide more detailed development and subdivision controls to manage future staging and allow response to development constraints on the site. It will also enable the consideration of precinct wide outcomes including traffic, drainage and biodiversity.

PART 2: EXPLANATION OF PROVISIONS

The proposed objectives will be achieved by amending the MLEP 2011 by:

Amendment Applies to	Explanation of Provisions
Land Zoning Map	Amend the existing RU2 Rural Landscape zone to a R1 General Residential and C3 Environmental Management zone. Final zone boundaries to be determined through the Gateway assessment and agency engagement. Land Zoning Map - Sheet LZN_006A.

Lot Size Map	Amend the Lot Size Map from 40ha minimum lot size to 450m² minimum lot size applying to land rezoned to R1 General Residential. The 40ha minimum lot size will be remained for land zoned C3 Environmental Management. Minimum Lot Size Map - Sheet LSZ_006A.

The final determination of zone boundary and developable footprint will occur throughout the Gateway assessment, and agency engagement. Therefore, the development footprint (as illustrated in **Figure 1**) may be subject to change following these key milestones.

The existing and proposed maps can be located at Section 4 Maps (Map 1 – 5), which include the land use zones and minimum lots sizes.

PART 3: JUSTIFICATION FOR PROPOSED REZONING

In accordance with the Department of Planning and Environment's '*Local Environmental Plan Making Guideline (August 2023)*', this Part provides a response to the following:

SECTION A – NEED FOR THE PLANNING PROPOSAL

1. Is the planning proposal a result of an endorsed local strategic planning statement, strategic study or report?

Yes. The proposal is proponent-initiated and is identified in several endorsed strategies, these include: the site being identified in the *Maitland Local Strategic Planning Statement 2040+* (LSPS) as a *Planned Investigation Area – Residential*. As shown in the LSPS Structure Map excerpt in **Figure 2**. The LSPS is Council's current long-term planning strategy and provides a vision for how growth will be managed for a 20-year period.

The site is also identified in the *Maitland Greening Plan 2002* as a future opportunity corridor for biodiversity connectivity, which is reflected as a biodiversity corridor within the LSPS.

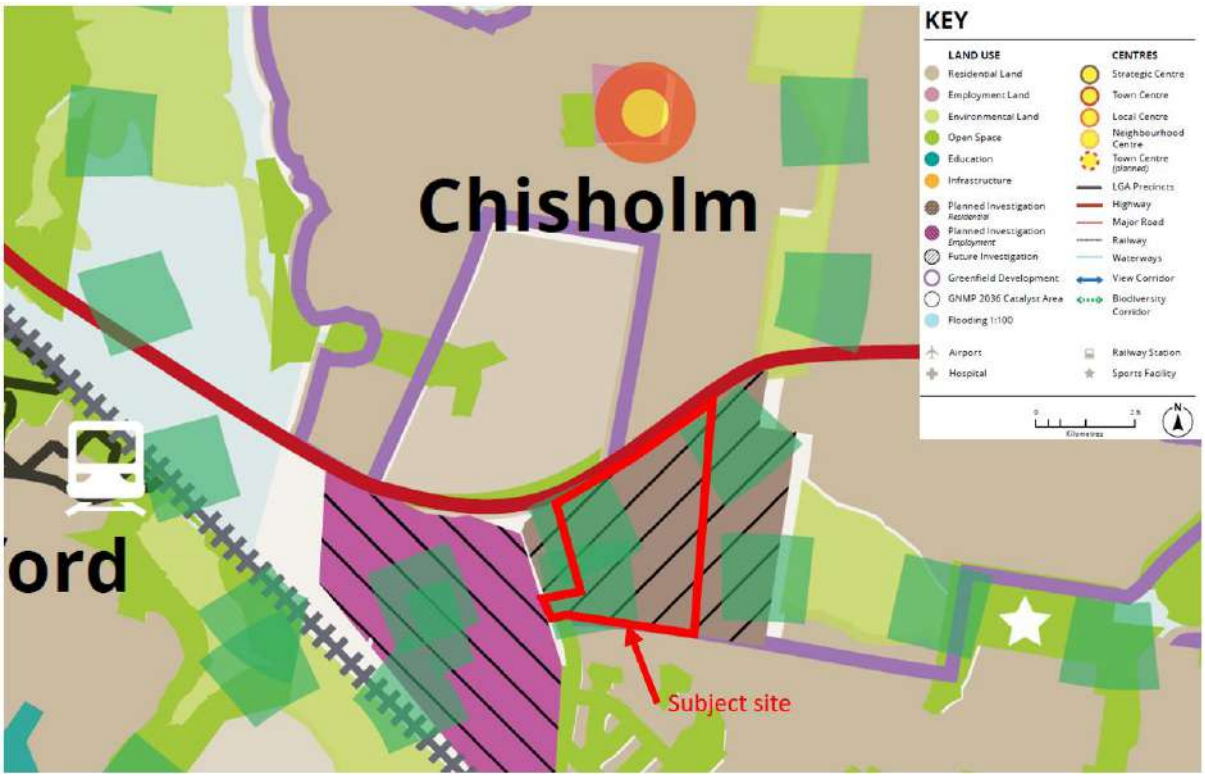


Figure 2: Location of the subject site within the LSPS Structure Plan

The subject site was additionally identified as *Category 1 – Residential Land (Thornton North Stage 3 Investigation Area)* in the *Maitland Urban Settlement Strategy 2001 - 2020 (MUSS).* The MUSS was superseded, and sites incorporated into Council's LSPS as planned residential investigation areas.

The subject site will form *Precinct 8* of the *Thornton North Locality Plan Precincts* within the Thorton North Urban Release Area Development Control Plan 2011, along with the eastern adjoining property 480 Raymond Terrace Road, Thorton (Lot 182 DP792071) refer to **Figure 3**.

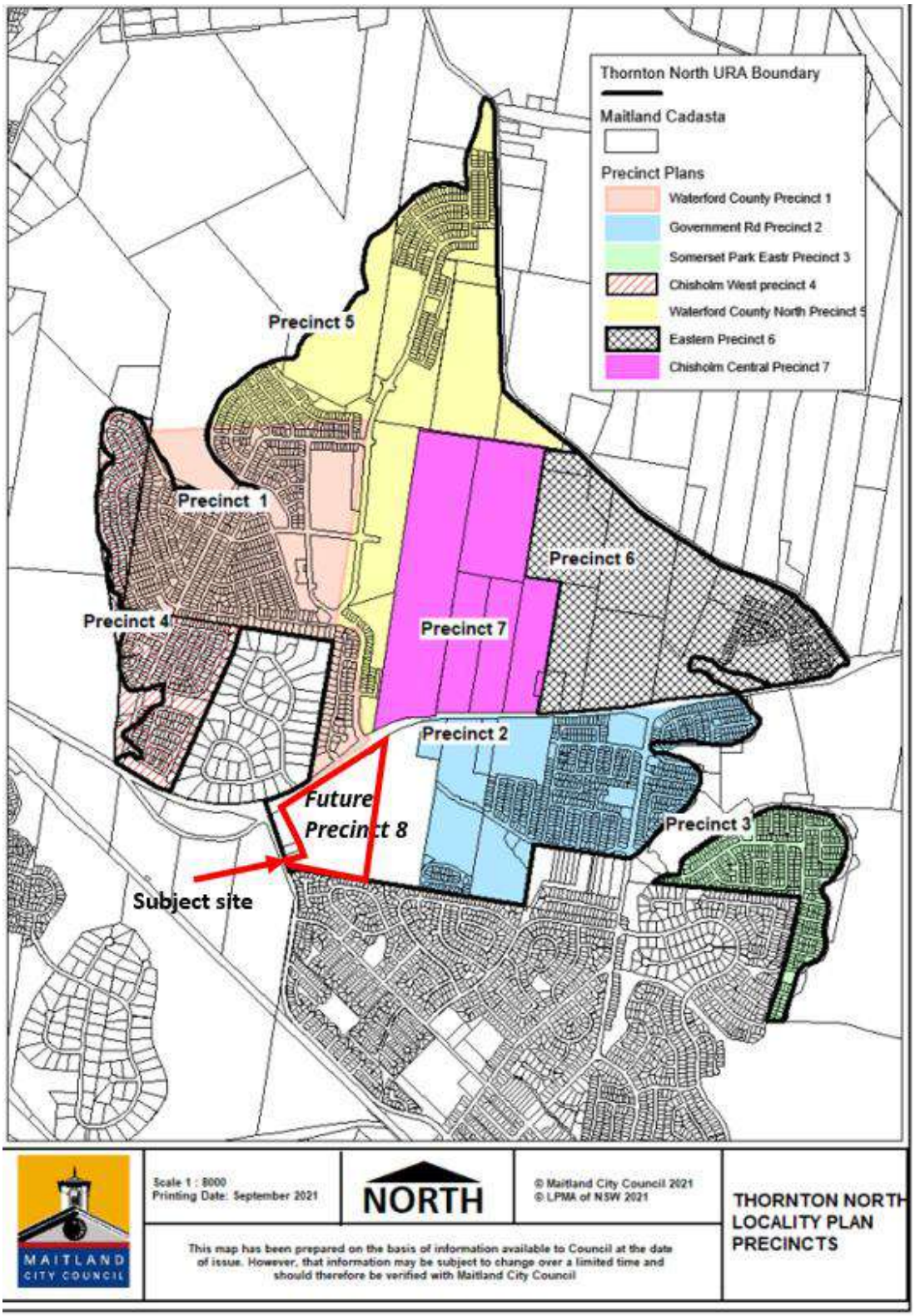


Figure 3: Thornton North Locality Plan Precincts

The MUSS identified the need for future investigations to determine the suitability of the area for development including road network infrastructure, biodiversity and utility provisioning. Site investigations provided by the proponent have identified the key characteristics, constraints, and opportunities of the land. These investigations (in **Attachments 1 – 13**) have formed the basis of a detailed site analysis and the preparation of this proposal.

Geographically, the site forms an irregular shaped parcel bound by Raymond Terrace Road to the north, Haussman Drive to the west, and existing residential and environmental zoned lands to the south and east. The site has a total area of approximately 18.96 hectares.

The site is strategically located in an area with surrounding residential and population growth within Chilsom, Thorton and Metford and has access to existing local and regional commercial centres and services at East Maitland and Thornton.

The site has had an ongoing history of development investigation and subsequent approvals. The site, formally a disused quarry, was granted development consent (DA 17-2593) for the construction of 156 independent seniors' living units granted under a previous Site Compatibility Certificate (SCC_2017_MAITL_001_00) approved by the Department of Planning and Environment (DPE) on 04 October 2017 (**Attachment 2**).

A previous planning proposal (PP-2021-2820) was submitted to Council in June 2021. This proposal sought to provide greater housing diversity than seniors' living units, however, this proposed a much greater residential footprint at the detriment to significant biodiversity lands (per **Figure 4** below).

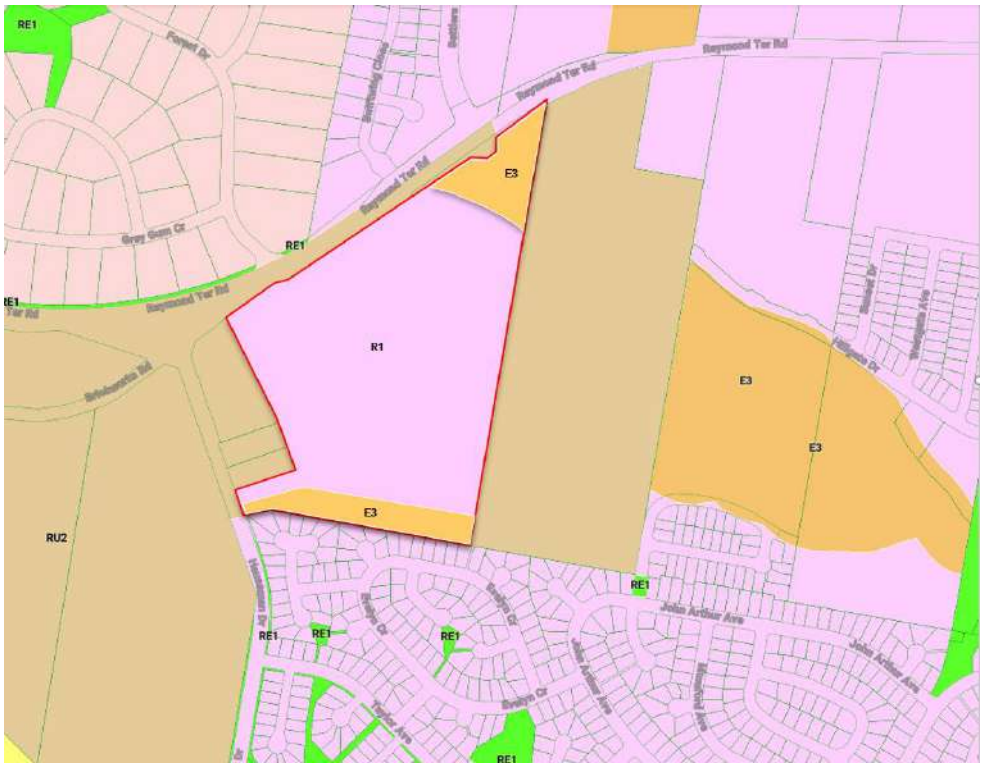


Figure 4: Previously proposed zoning of the subject site

During the assessment of the proposal (PP-2021-2820) in August 2022 to progress to Gateway Determination, the DPE requested additional information and environmental studies to comprehensively consider the impact to the site and surrounds before issuing a Gateway Determination. This included:

- a biodiversity assessment report prepared in accordance with the NSW Biodiversity Assessment Method
- advice from Subsidence Advisory NSW regarding proposed grouting to resolve stability issues and whether these can be resolved at the development application stage
- advice from NSW Rural Fire Services on the need for a secondary access to the site to manage evacuation in the event of a bushfire. Should a secondary access be located on land outside of the planning proposal, confirmation and/or support from adjoining landowners is required.

This information was provided to DPE on 20 October 2022 with the proposal portal number changing to (PP-2022-4101-107). An adequacy assessment was undertaken by DPE and provided to Council on 07 September 2023 (refer **Attachment 3**), This adequacy assessment resolved many of the issues stated above for proposal PP-2021-2820. However, further information was required to continue the process to issuing a Gateway Determination. This included:

- proposal should be prepared by a geotechnical consultant with experience in mine subsidence assessments. After grouting, the geotechnical consultant should undertake sufficient verification boreholes to ensure that the intent of the grout plan has been met and that the risk of pothole subsidence has been effectively eliminated
- Consistency with a number of planning directions within the *Hunter Regional Plan 2041,* and Ministerial Directions 9.1 of the *EP&A Act 1979*
- Consistency with wording and development footprint of supporting studies.

Maps of the current proposed development and environmental footprint can be found at **Section 4 Map 4**.

The proposal provides the additional information and investigations required to justify the LEP amendments as per the first and second requests for information within the adequacy assessment in order to achieve the proposal's intended outcome. A cover letter addressing the adequacy assessment of the DPE has also been prepared by the proponent (**Attachment A**).

2. Is the planning proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

In order to achieve the intended outcome, the following options were considered:

Rezone to R1 General Residential and C3 Environmental Management rezoning (the proposal)

This is the supported option for the subject site. Amending the RU2 Rural Landscape zone to a part R1 General Residential and C3 Environment Management zone will generate a diversity of housing choice, while preserving environmentally significant vegetation that contributes to the wider biodiversity corridor within the surrounding Thorton area. The revised residential and conservation footprint is also similar to the currently approved development approval (DA 17-2593) and issued Site Compatibility Certificate (SCC_2017_MAITL_001_00) for the construction of 156 independent seniors' living units (**Figure 5**) for the site.

Figure 5: Approved 156 independent seniors' living units on subject site

The concept subdivision plan (**Figure 1**) illustrates a residential density of 10 – 11 dwelling per hectare, which even though is lower than the density aspirations within the *Hunter Regional Plan 2041,* accommodates the unique environmental, historical quarry uses and general characteristics of the site. The proposal also seeks to provide a future subdivision layout with a diversity of lot sizes, with opportunities to develop dual occupancies and secondary dwellings potentially increasing this conceptual density figure. The conceptual subdivision also proposes a super 'Development Lot' to facilitate a medium housing density development product such as terrace housing or multi-dwelling housing.

Retaining the senior housing development approval

This is not a supported option. Although, the site has an active development approval (DA 17-2593) and issued Site Compatibility Certificate (SCC_2017_MAITL_001_00) for the construction of 156 independent seniors' living units, surrounding senior housing development and the potential adverse impact from an amenity perspective for senior residents has resulted in this type of development being unfeasible, and undesirable.

1. Surrounding senior housing development

The surrounding area (Berry Park, East Maitland, Tenambit and Morpeth) in total contain seven senior housing developments within a radius proximity of 6km. While a number of these senior housing development provide their own care services and recreational facilities that are over the 800m accessible distance from a centre, such as the Berry Park Retirement Village. Four senior housing developments are under the 400m accessible distance from the regional Greenhills shopping centre. In addition, the Berry Park Retirement Village is only 2km from the subject site. This analysis shows that this cluster already provides an adequate level of senior housing supply while being in close proximity to everyday services and needs without the need for additional seniors housing.

On evaluation of this existing cluster of seniors housing development, the proponent has concluded that the approved seniors housing development has become unfeasible due to the existing number of senior housing developments, and the unfeasibility of the material and construction costs for adhering to the provisions of Part 5 of the *State Environmental Planning Policy (Housing) 2021*.

2. Amenity and safety impacts

The recent adoption of the Brickworks Road Employment Precinct (PP-2022-1187) west of the subject site will fundamentally alter the character and amenity of both Haussman Drive and Brickworks Lane, along with the surrounding area. This future development, although providing some everyday services in an under 200m accessible distance from the proposal, is nevertheless considerably different than a traditional 'high street'.

This future development is an employment precinct (**Figure 6**), which will not only have everyday services but also, specialised retail, large commercial floorspace, service stations, offices and general/light industrial development. Although, some of these everyday services may benefit future senior residents, there are other conflicting uses (i.e. large floorspace retail/commercial, industrial and office development) which may cause increased impacts on noise, odour, traffic, general visual amenity of the employment precinct, and safely accessing pedestrian pathways to

travel to and from the employment precinct from the senior development.

Figure 6: Draft Concept Masterplan of Brickworks Lane Employment Precinct

Retaining the RU2 zone, revegetating and/or rezoning the subject site to a Conservation Environment zoning

This is not a supported option. Possibly rezoning and/or vegetating the subject site to its natural state would improve the Thorton biodiversity corridor and its connectivity, while appeasing aspects of the Maitland Greening Plan 2002 and LSPS. It would nevertheless require revised consideration under the Section 9.1 Ministerial Directions, which critically would require that the site be remediated, prepare a Vegetation Management Plan, and that the land's agricultural potential was not being impacted. Critically, environmentally zoned land is generally transferred to the ownership and management of Council which may place additional unsustainable financial burdens on its ongoing operational and financial planning.

The subject site has been identified as a Residential Investigation Area since the adoption of the MUSS in 2001 and would be inconsistent with this long-term policy position. Additionally, the proponent has designed a residential and conservation footprint that is of almost identical to the approved seniors housing development which seeks to maintain part of the Thorton biodiversity corridor (see further information in Section 7 and **Attachment 1A and B**).

This option is also the most inefficient when considering planning proposal timeframes, the proponent's considerable investment and Council time and resources.

SECTION B – RELATIONSHIP TO STRATEGIC PLANNING FRAMEWORK

3. Is the planning proposal consistent with the objectives and actions of the applicable regional, sub-regional or district plan or strategy? (including any exhibited draft plans or strategies)

Hunter Regional Plan 2041

The objective of the Hunter Regional Plan 2041 (HRP) is to deliver a long-term vision for the region with clear objectives and approaches to pursue the vision. The regional vision of the Hunter seeks to continue to be the leading regional economy in Australia, connected to Country with a vibrant metropolitan core. Refer to **Attachment 4** which outlines the consistencies and any inconsistencies within the Objectives, Strategies and Place Strategy Outcomes of HRP 2041.

Greater Newcastle Metropolitan Plan 2036

The Greater Newcastle Metropolitan Plan (GNMP) 2036 sets goals and strategies to deliver on the vision of the Hunter Regional Plan 2041, but with specific focus on the for the Greater Newcastle Metropolitan Area. The proposal is located in the Metro Frame and is identified as a 'Housing Release Area within the GNMP. The proposal is consistent with the outcomes, strategies and actions in the GNMP, as it will provide additional and diverse housing opportunities surrounding an existing urban area, within a *Residential Investigation Zone,* and neighbouring the Brickworks Road Employment Precinct. It will also preserve part of the Thornton biodiversity corridor improving its flora and fauna connectivity.

As stated, the proposal will result in 132 - 142 residential allotments. This number excludes any calculation for the possibility of future dual occupancies or secondary dwellings. This equates to a dwelling density ranging from 10.8 – 11.6 dwellings per/ha. The density outcome is a lower target than that aspired to in the *Hunter Regional Plan 2041*.

However, this is due to the unique characteristics of the site, preserving the critical environmental function of the existing remnant vegetation and retaining a key biodiversity corridor for the area, while also providing for public open space and an onsite detention basin. Furthermore, as the R1 General Residential zone includes a broad range of residential accommodation land uses, the proposed amendment does not prohibit a significantly higher density being achieved on the site.

4. Will the planning proposal give effect to Council's endorsed local strategic planning statement, or another endorsed local strategy or strategic plan?

Maitland +10 Community Strategic Plan) (CSP)

The Maitland +10 Community Strategic Plan (the CSP) is the key document to give effect to the Integrated Planning and Reporting legislation and guidelines. The proposal is considered consistent with the vision and objectives of the Community Strategic Plan as it provides opportunities for urban growth, housing diversity, public open space and a retention of a biodiversity corridor within the city that meets the needs of a growing population attracted by its unique amenity and close proximity to services and jobs.

Maitland Local Strategic Planning Statement (LSPS)

The LSPS vision aims to provide the right type of housing in the right locations, supported by essential infrastructure and services to support population growth and change at the same time maintaining and enhancing local character

The site is identified in LSPS as 'residential investigation land'. The site is situated within the context of planned residential growth in the north Thornton area. The proposal will enable the subject land to be developed for residential purposes in a manner consistent with long term strategic planning (as stated in **Attachment 4** and within this proposal).

The land currently benefits from development consent (DA 17-2593) for the construction of 156 independent seniors' living units issued under a site compatibility certificate scheme (SCC_2017_MAITL_001_00).

The proposal will allow for a diversity of residential housing typologies to be developed under the R1 General Residential Zone. The provision of housing diversity is a key planning objective of the LSPS, particularly in new residential areas. The concept subdivision layout (**Figure 1**) also illustrates a diversity of allotment sizes which will allow for differing housing typologies, such as dual occupancies and secondary dwellings. The concept subdivision layout also has a super development lot, which is potentially proposed, in future, to be medium density housing such as attached or detached terraces.

Local Housing Strategy 2041

The Maitland Local Housing Strategy 2041(Strategy) aims to provide the right type of housing in the right locations with essential infrastructure and services to meet the housing needs of our growing and changing population over the next 20 years.

The Strategy builds on seven planning principles that serve as a foundation for future planning and decision making to achieve better housing outcomes across the city. The proposal is generally consistent with the Strategy and the consistent with all the planning principles. As the proposal will provide a diversity of housing in a strategic location to service, jobs, open space, public transport and active transport linkages. The proposal will also preserve most of the Thorton biodiversity corridor, while the concept subdivision lot orientation will maximise the resilience and sustainability of future dwellings. Infrastructure will also be sequenced and delivered in a timely matter ap per the *North Thorton Contribution Plan.*

The Strategy also identifies the site as being:

- A rating of 5 for being most suitable / or containing limited environmental constraints within the environmental constraints map
- Is a residential land investigation area within the Strategy's Structure Plan.

Rural Lands Strategy 2041

The purpose of this Strategy is to provide an evidence-based framework and clear direction for planning and managing rural and environmental land in the Maitland LGA over the next 20

years. It aims and set principles to support and protect agricultural land in the long term; provide certainty for land use, highlight resilience and environmental threats, and promote economic diversification and growth.

The proposal is consistent with the Strategy. The subject site is currently zoned RU2 Rural Landscape and is identified as a 'LEP Mineral and Extractive' site. The site is also listed mapped (Sheet MRA_006A) under MLEP 2011 as a 'Identified Resource'. Nevertheless, the Brickworks Employment Precinct proposal (PP-2022-1187) recently adopted for finalisation by Council on 10 October 2023. Proposes to remove the 'Identified Resource' mapping layer of Sheet MRA_006A from the proposed site and surrounding sites (**Figure 7**). This is due to the sites exhausting resources over the years and to why they are currently unused.

Figure 7: Sites currently applied with the "Identified Resource" mapping layer under MLEP 2011 (Sheet MRA_006A)

The subject site also has little to no agricultural value as it was used for decades as a quarry removing any type of agricultural potential.

North Thorton Masterplan 2003 and Maitland Development Control Plan 2011 – Thorton North Urban Release Area

The North Thorton Masterplan 2003 (Masterplan) began the long-term strategic planning for the northern Thorton / Chilsom area. The Masterplan considered the ongoing and future use of quarry sites and their future potential for development or for potential environmental conservation. The proposal is consistent with the Masterplan, as shown in **Figure 8**, the Masterplan envisioned the site to be utilised for residential development with remnant vegetation of the site and adjoining site to be used as a buffer and environmental corridor.

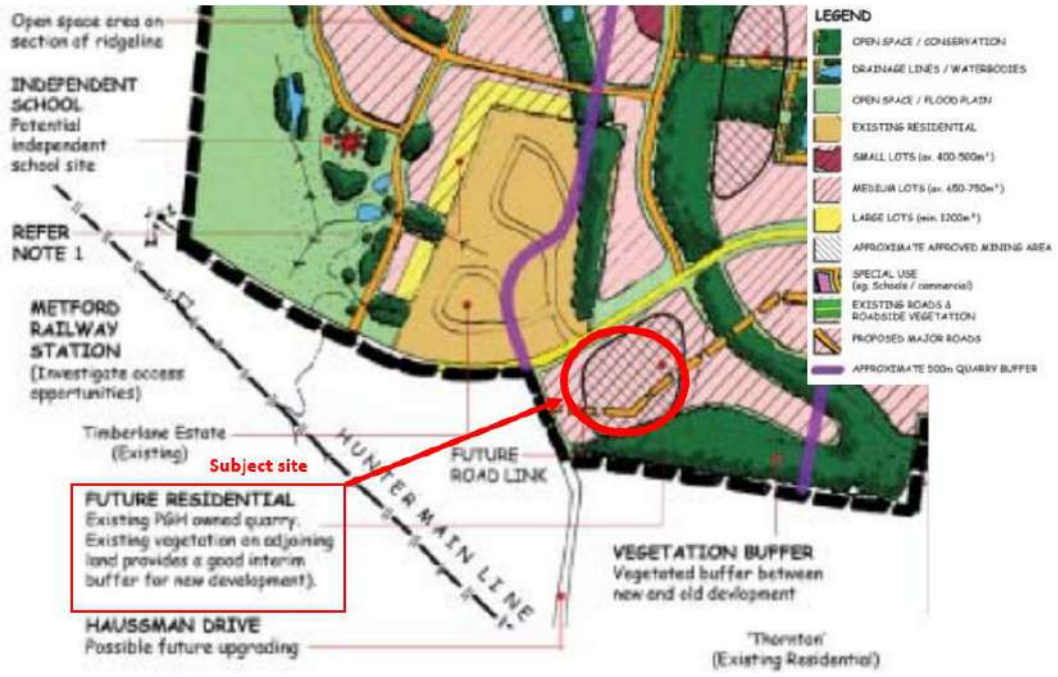


Figure 8: Excerpt from North Thorton Masterplan 2003: Structure Plan

The Masterplan was superseded by the Thorton North Urban Release Area (URA) within MDCP 2011. This URA replicated the key themes, strategic direction and structure planning as the Masterplan and the URA's Structure Plan is identical to that of the Masterplan. This URA identifies the site as a 'Residential Area', with part 'riparian/vegetation conservation and roadside landscape buffer. These features are similar to that of the proposed rezoning development footprint.

North Thorton Contribution Plan 2008

The North Thorton Contribution Plan 2008 (Plan) supports the previous strategic work of the MUSS and Masterplan and identifies the type of local infrastructure required to support the projected growth of the area.

The subject site is within the Plan boundary and identifies a number of local infrastructure upgrades surrounding the site required to support the residential growth. The proposal will support the Plan as it will provide additional contributions to support the delivery of local infrastructure for the northern Thorton area.

5. Is the planning proposal consistent with applicable State Environmental Planning Policies?

Council has undertaken an assessment of the planning proposal against all relevant State Environmental Planning Policies (SEPPs) and a summary is provided in the table below.

Table 1: Assessment of the Planning Proposal against relevant State Environmental Planning Policies (SEPPs).

RELEVANCE	CONSISTENCY AND IMPLICATIONS
State Environmental Planning Policy (Biodiversity and Conservation) 2021	**Consistent**
	Chapter 3/4 Maitland LGA is listed in Schedule 2 of the SEPP. A Preliminary Environmental Assessment was provided in support of the rezoning request (**Attachment 1A**). The report found seven (7) tree species listed under Schedule 2 – Koala Use Tree Species in the SEPP. The report concluded that Koala Use Tree Species comprised greater than 15% of the study area constituting 'Highly Suitable Habitat'. It is noted, however that there have been no Koalas recorded within 2.5km of the subject site within the last 18 years, therefore the vegetation on site would not meet the definition or Core Koala Habitat under the SEPP. It is therefore highly unlikely that Koala inhabit the area and no further investigation is required to demonstrate this. More detail on environmental assessment is provided in Section 7 of this report or **Attachment 1A Biodiversity Development Assessment Report**.
State Environmental Planning Policy (Resilience and Hazards) 2021	**Minor Inconsistency**
	Chapter 2 The subject site is not identified as an area of Coastal Management. **Chapter 4** The subject site was historically used as a quarry and is therefore a potentially contaminated or contaminated activity under the SEPP Contamination Guideline. Nevertheless, the site is not identified as contaminated on Council's mapping system but is identified as a contaminated land risk. Contamination and remediation assessments have determined the site is suitable for residential use with further testing to occur during the development application process.

RELEVANCE	CONSISTENCY AND IMPLICATIONS
	Therefore, this is a considered a **minor inconsistency** and concurrence of the Secretary of the Department of Planning and Environment is requested. More detail on contamination and remediation of the subject site is provided in Section 9 of this report, and within **Attachment 7 Preliminary Contamination Assessment.**
State Environmental Planning Policy (Housing) 2021	**Consistent**
	The proposal will result in an area of land zoned primarily for urban purposes, whereby a variety of residential uses will be permissible. The site is located in an existing serviced area. This planning proposal will support the aims and provisions of the SEPP.
State Environmental Planning Policy (Transport and Infrastructure) 2021	**Consistent**
	Nothing in this planning proposal impacts upon the aims or provisions of this SEPP. Consultation with service providers and government agencies will determine the level of impact and upgrades required associated with future development of a R1 General Residential zone. Engagement with these stakeholders resulted in broad support with no additional studies required until the Development Application stage. Infrastructure provision is to consider the development outcomes of the precinct and neighbouring areas.
State Environmental Planning Policy (Primary Production) 2021	**Consistent**
	Chapter 2 The subject site is not identified as State significant agricultural land and represents an isolated parcel of rural land. The site is not considered suitable for agricultural practice due to its constraints, biodiversity values, proximity to existing residential areas and former use as a quarry. The proposal is therefore consistent with the aims of this policy as it is enabling the orderly and economic use of the land.
State Environmental Planning Policy	**Consistent**

RELEVANCE	CONSISTENCY AND IMPLICATIONS
(Resources and Energy) 2021	
	Chapter 2 Under the SEPP, mining development may be carried out with development consent on land where development for the purposes of agriculture may be carried out. The current zone RU2, therefore enables this to occur only with development consent. The site is identified on the Minerals Resource Area Map as being an identified resource. Subsidence Advisory NSW have identified abandoned undermined coal workings on the northern section of the site. The central portion of the site presents as an exhausted clay quarry void. Further extraction opportunity is considered limited and unlikely given the surrounding residential and biodiversity context of the site. More detail on this is provided in Section 8 of this report, and within **Attachment 7** and **9.**

6. Is the planning proposal consistent with applicable Ministerial Directions for Local Plan making?

An assessment of the Planning Proposal and its consistency against the applicable Ministerial Directions is provided at Table 2 below.

Table 2: Relevant and consistency with Section 9.1(2) Directions.

DIRECTION	CONSISTENCY AND IMPLICATIONS
1. PLANNING SYSTEMS	
1.1. Implementation of Regional Plans	**Consistent**
The objective of this direction is to give legal effect to the vision, land use strategy, goals, directions and actions contained in Regional Plans.	The proposal is consistent with the HRP 2041 and GNMP 2036 and implements key goals and directions of these strategies.
3. BIODIVERSITY AND CONSERVATION	
3.1 Conservation Zones	**Consistent**

DIRECTION	CONSISTENCY AND IMPLICATIONS
The objective of this direction is to protect and conserve environmentally sensitive areas. According to the direction, a planning proposal must include provisions that facilitate the protection and conservation of environmentally sensitive areas.	The proposal is consistent with the objectives of this Ministerial Direction as it proposes to apply the C3 Environmental Management zone over areas of the site that contain biodiversity values. Further detail regarding ecology and conservation can be found in Section 7 of **Attachment 1A and B**. Council is currently seeking independent advice to determine viable biodiversity corridor widths across the wider precinct and will be incorporated into a future DCP for the precinct. Therefore, the identification of zone boundaries may be amended during the Gateway assessment and agency engagement process.
3.2 Heritage Conservation	**Consistent**
The objective of this direction is to conserve items, areas, objects and places of environmental heritage significance and indigenous heritage significance.	An Aboriginal Due Diligence report (**Attachment 6**) including site inspection and consultation with Aboriginal stakeholders was undertaken in 2018. This assessment was for the central portion of the site, relating to the seniors living development footprint. The report concluded that there was no evidence of past Aboriginal use, and a low likelihood for surviving deposits. The Mindaribba Land Council representative indicated concurrence with these findings. An updated report was provided that recorded an Aboriginal site had been registered, salvaged and destroyed on the land. A further item was identified on the eastern boundary of the site. The item is currently proposed to fall immediately adjacent to a proposed R1 – General Residential area. Further Indigenous Heritage assessment and consultation will be required. Any impact proposed in close proximity to this item, or other areas of the site which have not been adequately assessed for Indigenous heritage would trigger the need for further investigation. Potential land use buffers may be required to protect the item which are to be determined post investigation works and through the Gateway process.
4. RESILIENCE AND HAZARDS	
4.1 Flooding	**N/A and Consistent**

DIRECTION	CONSISTENCY AND IMPLICATIONS
The objectives of this direction are: (a) to ensure that development of flood prone land is consistent with the NSW Government's Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005, and (b) to ensure that the provisions of an LEP on flood prone land is commensurate with flood hazard and includes consideration of the potential flood impacts both on and off the subject land.	The subject land is not affected by flooding as identified in the MLEP. The planning proposal is considered consistent with the objectives of this direction.
4.2 Planning for Bushfire Protection	**Consistent**
The objectives of this direction are to protect life, property and the environment from bush fire hazards, by discouraging the establishment of incompatible land uses in bush fire prone areas, and to encourage sound management of bush fire prone areas. It is also a requirement of the direction that a planning proposal must have regard to *Planning for Bushfire Protection 2019.*	The subject site is identified as bushfire prone in the bushfire prone land maps. A Bushfire Threat Assessment Report (**Attachment 5**) has been provided detailing the bushfire risk of the site. The assessment concludes that the proposed residential areas can comply with Planning for Bushfire Protection 2019 through the provision of suitable Asset Protection Zones (APZ's) and development design within the context of the existing seniors living development footprint. Initial discussions with the proponent indicate that secondary access is proposed via the adjoining eastern property (Lot 182 DP792071). Suitable secondary access requirements are to be finalised to the satisfaction of the NSW Rural Fire Service post Gateway Determination. Secondary access requirements will need to be considered wholistically within the context of wider transport and biodiversity outcomes. The proposal was referred to NSW Rural Fire Service for comment, the proposal was supported with no additional studies required.
4.4 Remediation of Contaminated Land	**Minor inconsistency**
The objective of this direction is to reduce the risk of harm to human health and the environment by ensuring that contamination and	A Phase 1 Contamination Assessment (**Attachment 7**) found three (3) potential areas of environmental concern being: • The area used to fill the central portion of the site • Fill observed in the construction of the access track and associated stockpile of bricks, and

DIRECTION	CONSISTENCY AND IMPLICATIONS
remediation are considered by planning proposal authorities.	• The water/sediments in ponds located on the eastern portion of the site Testing demonstrated that the fill in the central portion of the site had concentrations of contaminants below the adopted health investigation levels for residential land use. Precautions were recommended for future development for the area of fill used to construct the access track (subject to detailed development design). Further sampling was undertaken for one of the two (2) dams located on the site which found sediment samples were within health investigation level criteria. The surface water however contained concentrations of metals slightly elevated above values for protection of aquatic ecosystems. The surface water was deemed suitable for dewatering and backfilling. No further observations of gross contamination i.e., odours or staining were observed. It is noted, however, that fill material continues to be brought to the site. Further testing of the water bodies, and validation of fill material has been recommended prior to finalisation of the plan and/or during the development application process. Therefore, this is a considered a **minor inconsistency** and concurrence of the Secretary of the Department of Planning and Environment is requested.
4.5 Acid Sulfate Soils	**Consistent**
	The MLEP 2011 indicates a potential Class 5 Acid Sulfate Soils risk affecting the site. The Preliminary Contamination Assessment (**Attachment 7**) undertaken for contamination did not identify the site as being within an area or known acid sulfate occurrence.
4.6 Mine Subsidence and Unstable Land	**Consistent**
The objective of this direction is to prevent damage to life, property and the environment on land identified as unstable or potentially subject to mine subsidence.	The site is not located within a Proclaimed Mine Subsidence District (MSD) however is identified as being used as a historic quarry and having abandoned underground mine workings on the site. Previous consultation with Subsidence Advisory NSW indicates that fully grouting the area of affectation will be required to support future residential uses.

DIRECTION	CONSISTENCY AND IMPLICATIONS
	A Mine Subsidence Constraints Advice Letter (**Attachment 9**) in 2015 was undertaken as part of the previous senior housing development (DA 17-2593) Site Compatibility Certificate (SCC_2017_MAITL_001_00). This Letter provided high-level preliminary advice on the mine subsidence extent and costings for grouting. A subsequent Preliminary Geotechnical Assessment (**Attachment 10**) was undertaken in 2017 for the seniors housing development, which went into further detail on the extent of subsidence and tunnelling within the site, at request of Council and the Subsidence Advisory NSW. The Subsidence Advisory NSW provided further correspondence in 2022 which sought a grouting remediation strategy be prepared (Attachment 11). Nevertheless, the previous assessments were undertaken at the time when the site was proposed to be a seniors housing development, a much more stringently controlled and sensitive type of land use when considered against general residential. A review of the original advice letter in 2023 confirmed (**Attachment 9)** this justification, which concluded that apart from the grouting cost increasing, the proposed residential rezoning was appropriate when considered against the subsidence risk. Further information can be found at Section 8, **Attachment 9, 10 and 11**. Further concurrence is requested from the Subsidence Advisory NSW. The Subsidence Advisory supported the proposal with no additional studies required.
5. TRANSPORT AND INFRASTRUCTURE	
5.1 Integrating Land Use and Transport	**Consistent**
The objectives of this direction relate to the location of urban land and its proximity to public transport infrastructure and road networks, and improving access to housing, employment and services by methods other than private vehicles.	The proposal seeks to establish a residential area adjacent to local and regional road networks. **Figure 1** displays the concept subdivision layout and road connections. In addition, **Attachment 12A and 12B** provide an impact assessment of the increased road usage from the proposal, which assessed at a higher density yield (160 lots) and determined minimal to no impact on the local and regional road network. The subject site is located in close proximity to alternative transportation modes including bus and train.

DIRECTION	CONSISTENCY AND IMPLICATIONS
	Council is working with the proponent, TfNSW and adjacent landowners to determine the best transportation solution and strategy for the precinct, and this will occur during the preparation of the precinct wide DCP. TfNSW has supported the proposal with no additional studies required.
6. HOUSING	
5.1 Residential Zones	**Consistent**
Encourage a variety and choice of housing, minimise the impact of residential development on the environmental and resource lands and make efficient use of infrastructure and services.	The proposal will amend MLEP 2011 from a rural land use to R1 General Residential. The proposed rezoning will result in a change of land use to enable future residential development of the site making use of existing infrastructure and services in the immediate locality. It is anticipated that the urban outcome of this land can potentially allow for a variety of housing choices and densities.
8. RESOURCES AND ENERGY	
8.1 Mining, Petroleum Production and Extractive Industries	**Consistent**
The objective of this direction is to ensure that the future extraction of State or regionally significant reserves of coal, other minerals, petroleum and extractive materials are not compromised by inappropriate development.	The site is listed mapped (Sheet MRA_006A) under MLEP 2011 as a 'Identified Resource'. Nevertheless, the Brickworks Employment Precinct proposal (PP-2022-1187) recently adopted for finalisation by Council on 10 October 2023. Proposes to remove the 'Identified Resource' mapping layer of Sheet MRA_006A. Subsidence Advisory NSW have identified abandoned undermined coal workings on the northern section of the site. The central portion of the site presents as an exhausted clay quarry void. Further extraction opportunity is considered limited and unlikely given the surrounding residential and biodiversity context of the site.
9. PRIMARY PRODUCTION	
9.1 Rural Zones	**Minor inconsistency**
The objective of this direction is to encourage growth, protect employment land in	The proposal is inconsistent with the objectives of this direction as it proposes to rezone RU2 Rural Landscape zoned land to R1 General Residential.

DIRECTION	CONSISTENCY AND IMPLICATIONS
business zones and support the viability of identified strategic centres.	The inconsistency is considered justified and is a minor inconsistency as the subject site has been identified as a residential investigation area in the endorsed MUSS 2012 and LSPS. The site has also been historically used as a quarry which has exhausted its resources. Therefore, there is little to no agricultural value to the site and is appropriate for future residential development. This is a considered a **minor inconsistency** and concurrence of the Secretary of the Department of Planning and Environment is requested.

9.2 Rural Lands	**Minor inconsistency**
The objectives of this direction are to protect the agricultural production value of rural land and to facilitate the orderly and economic development of rural lands for rural and related purposes.	The proposal is inconsistent with the objectives of this direction as it proposes to rezone RU2 Rural Landscape zoned land to R1 General Residential. The inconsistency is considered justified and is a minor inconsistency as the subject site has been identified as a residential investigation area in the endorsed MUSS 2012 and LSPS. The site has also been historically used as a quarry which has exhausted its resources. Therefore, there is little to no agricultural value to the site and is appropriate for future residential development. This is a considered a **minor inconsistency** and concurrence of the Secretary of the Department of Planning and Environment is requested.

SECTION C – ENVIRONMENTAL, SOCIAL AND ECONOMIC IMPACT

7. 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?

Ecology

A Preliminary Ecological Assessment Report (**Attachment 1A**) was provided in 2021 in support of the rezoning request. The assessment included a review of a 2017 ecological study previously undertaken on the site for the seniors housing development. It is noted that since the 2017 ecological study was produced, vegetation clearing in accordance with the approval for DA 17-2593 was undertaken. This clearing has occurred within the limits of the proposed seniors living development footprint.

The previous assessment relied on survey data taken in 2017 and therefore did not meet the requirements of a Biodiversity Development Assessment Report (BDAR) as prescribed by the *Biodiversity Conservation Act 2016.*

A further Streamline Biodiversity Development Assessment Report (**Attachment 1B**) was provided to Council for consideration in 2022. The report identifies areas of Endangered Ecological Community (EEC) PCT 1592 Lower Hunter Spotted Gum – Ironbark Forest around the permitter of the allotment with significant areas of remnant vegetation along the northern, southern and western boundaries (Refer to **Figure 6**).

The report further found that the site was likely to contain suitable habitat for:

- Little Lorikeet (Glossopsitta pusilla)
- Grey-crowned Babbler (eastern sub-species) (Pomatostomus temporalis temporalis)
- Squirrel Glider (Pteropus norfolkensis)
- Brush-tailed Phascogale (Phascogale tapoatafa)
- Grey-headed Flying-fox (Pteropus poliocephalus)
- Greater Broad-nosed Bat (Scoteanax rueppellii)

A total of 26 hollow-bearing trees were found to be located within the Study area of which 10 (38%) are proposed to be removed to enable residential development (Refer to **Figure 9**).

The total area of impact is reported to be approximately 0.82 ha of native vegetation.

While the area of proposed impact is predominantly within the already disturbed historic quarry and proposed seniors housing development footprint, the remaining vegetation on the site performs a critical function for the precinct.

The critical importance of the site by providing biodiversity connectivity to the north/south and east/west is well documented. It is Councils view that the perimeter vegetation is strategically important for the purposes of biodiversity as well as for mitigating the impacts (view, noise) from Haussman Drive and Raymond Terrace Road for future residents. It must therefore be retained as a key objective of the rezoning.

Council is currently working with the proponents of this proposal, and the adjoining properties to resolve ecological issues at a precinct scale. Independent advice is being commissioned to determine ecological principles for viable corridor widths. This is expected to occur with the preparation of a future precinct wide DCP.

Recommendation: A key objective of final land use configuration is to be the protection and viability of north/south and east/west biodiversity movement corridors through the application of C3 Environmental Management zoning.

It will be important for any C3 zone boundaries and the Precinct Development Control Plan to address practical habitat corridors and widths, condition, and maturity of trees (including hollows) and suitable connection points to the adjoining habitat EEC's.

Cumulative impacts from all development footprints, access arrangements and APZ's are to be reflected in a precinct wide biodiversity outcomes reflected in the future precinct DCP.

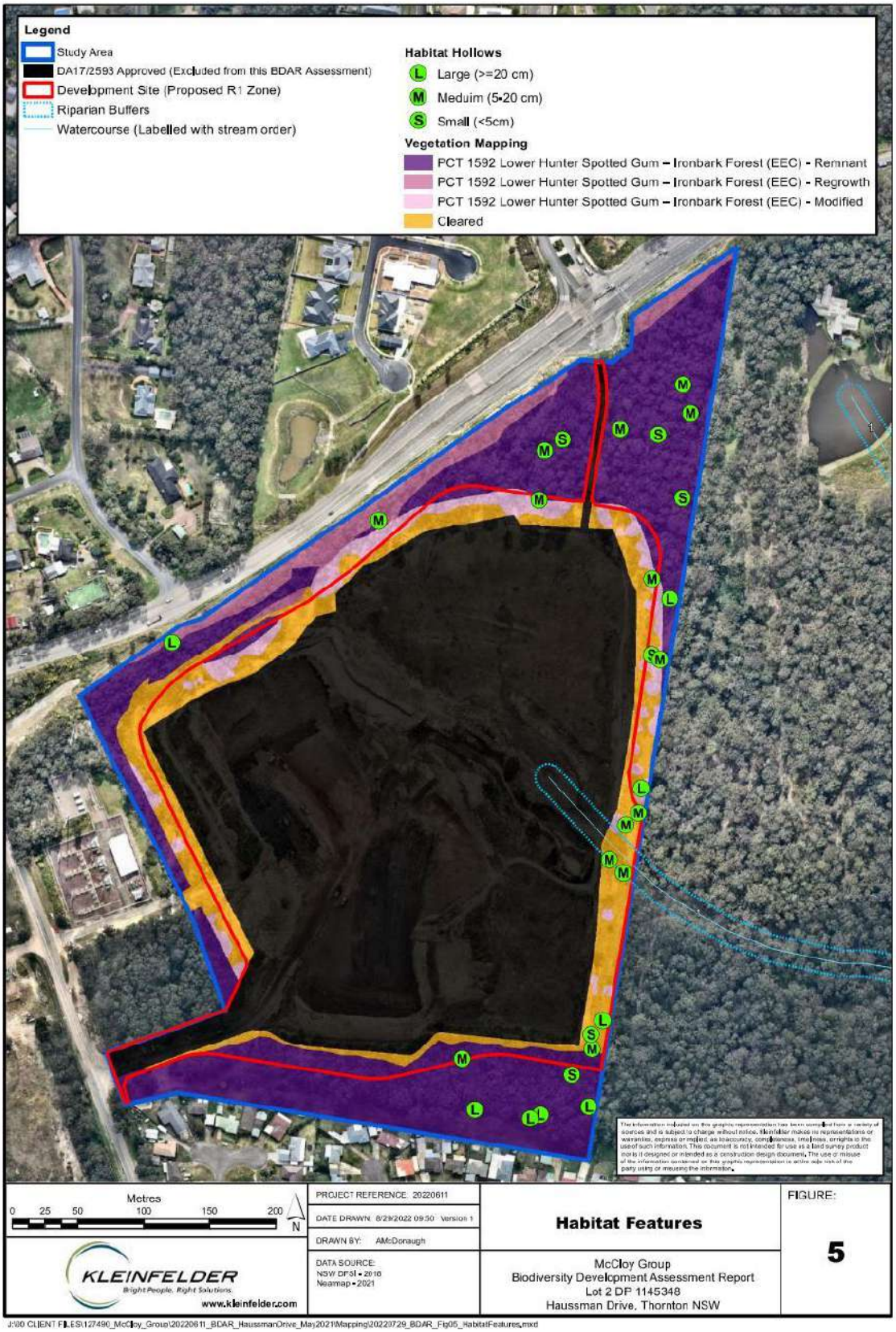


Figure 9: Vegetation Mapping and Hollow Bearing Trees

Agency response

The Department of Climate Change, Energy the Environment and Water sought a number of revisions to documents to ensure consistency between ecological and bushfire studies, sought refinement of BDAR data, and consideration of rezoning environmental land to C2 Environmental Conservation. All these matters were addressed and DCCEW had no further comment. Council as the local plan making authority determined that the zone would stage as C3 Environmental Management as the C2 zone does not allow roads which would impact upon a planned emergency access road. Council will undertake a City-wide review of its environmental zoned lands an uses, which will review the site. This is likely to occur in 2026-27.

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

The following additional environmental studies were submitted as part of the planning proposal.

Contamination

Qualtest Laboratory undertook a Phase 1 Contamination Assessment in 2017 (**Attachment 7**) to support the seniors housing development. The investigation was limited to the area within the former quarry site, located in the centre of the site i.e. the footprint of the Seniors Living Development.

Investigations identified three (3) areas of environmental concern (AEC) being the area used to fill the central portion of the site, fill observed in the construction of the access track and associated stockpile of bricks, and the water/sediments in ponds located on the eastern portion of the site.

Samples were collected for the first AEC of the material used to fill the centre of the site. Samples were tested for:

- Total Recoverable Hydrocarbons (TRH)
- Benzene, Toluene, Ethylbenzene and Xylene (BTEX)
- Polycyclic Aromatic Hydrocarbons (PAHs); and
- Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc)

Samples were compared against Health Investigation Levels A, Health Screening Levels A, Ecological Investigation Levels A and Ecological Screening Levels.

Results found concentrations of contaminants below the adopted residential land use criteria for the above investigation levels. No further observations of gross contamination i.e., odours or staining were observed.

No samples were collected for the AEC relating to fill used to construct the access track, however, the potential for gross contamination was expected to be low based on observations. No asbestos containing material was found at this location.

No surface water or sediment testing was carried out for the water bodies on site which constituted the third AEC, and therefore potential contamination remained unknown.

The report concluded that the site is likely to be suitable for residential development given the sites historic use and the results of investigation. The report recommended that:

- Further sampling and analysis of fill materials on the access tracks and northern portion of the site may be required if these materials are proposed to be used within 2m of the final surface of the residential allotments.
- Sampling of the onsite ponds was also recommended, and
- An unexpected finds procedure be prepared and implemented for earthworks activity on the site.

Given the recommendations and findings of the preliminary contamination assessment, Council requested further sampling be undertaken for the dams present in the investigation area.

In May 2021 Qualtest Laboratory undertook further examination of potential contaminants in the surface water and sediments for the two (2) dams located on the site (refer **Attachment 8**). Of these dams only one (1) was sampled, the second was considered inaccessible at the time of investigation. Samples examined concentrations of:

- Heavy Metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury)
- Total Recoverable Hydrocarbons (TRH)
- Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)
- Polycyclic Aromatic Hydrocarbons (PAH)
- Organochlorine Pesticides (OCP) (Suspended Soils–water sample only), and
- pH and Electrical Conductivity.

Sediment samples were found to be within health investigation level criteria. The surface water however, contained concentrations of metals slightly elevated above values considered acceptable for the protection of aquatic ecosystems. Surface water was deemed suitable for dewatering and backfilling. It is unclear what the proposed use of these onsite waterbodies will be - if they are to be integrated into proposed residential areas or utilised in stormwater management.

Council understands that fill material is continuing to be brought onto the site to remediate the quarry void, as approved by the Seniors Living development consent.

Recommendation: Finalise testing of the second dam and confirm that investigation levels are consistent with the intended use of the water bodies, prior to finalisation of the plan.

Validation of fill material is to be provided to Council upon completion of site remediation and prior to the finalisation of the plan. Alternatively, comprehensive documentation and sourcing of all fill be provided to Council to determine the suitability of the material to support all areas proposed for, and all future land uses permissible under, the R1 – General Residential zone.

Further sampling and analysis of fill materials on the access tracks and northern portion of the site may be required if these materials are proposed to be used within 2m of the final surface of the residential allotments. To be confirmed at detail design phase.

Further consideration of contamination will be required in the instance of any unexpected finds post finalisation of the planning proposal and throughout the development application process.

Agency response

THE NSW Environmental Protection Agency had no further comment to the above.

Archaeology and Heritage

An Aboriginal Due Diligence Assessment was previously undertaken by Mary Dallas Consulting in July 2018 in support of the proposed seniors living development. This Assessment included a site inspection and consultation with Aboriginal stakeholders (a representative of Mindaribba Local

Aboriginal Land Council accompanied the site visit). The assessment reported on environmental and heritage context, predictive modelling, and included impact assessment and recommendations. No archaeological survey pits were established as part of the assessment.

An Aboriginal Heritage Information Management System (AHIMS) database search was provided. The search found eighty-four (84) Aboriginal sites had been recorded within a 4km x 4km area around the subject site.

Investigations found that the subject site had been significantly impacted by quarrying activities and did not contain subsurface archaeological potential within the proposed seniors living development footprint.

The report concluded that there was no evidence of past Aboriginal use, and a low likelihood for surviving deposits. The Mindaribba Land Council representative indicated concurrence with these findings.

An updated desktop 'Due Diligence' report has been undertaken by Heritage Now (2020) (**Attachment 6**) and is provided in support of the rezoning request. The report includes a refreshed AHIMS database search that found one-hundred and sixteen (116) sites recorded nearby to the subject site. It is noted that one Aboriginal site registered within the subject site (AHIMS #38-4-0399) has since been salvaged/destroyed.

A further item (AHIMS #38-4-2001) was identified on the adjoining eastern property, in close proximity to the boundary of the subject site. The Report concludes that further inspection would be required if this area is to be impacted.

There are no listed items of European Heritage on or in the vicinity of the subject site.

Recommendation: Further investigation is required to justify the extent the proposed of R1 – General Residential zone. Further assessment and consultation are required for the artefacts identified along the creek lines and vegetated strips of the subject site which remain unexamined.

An unexpected finds protocol should be adopted and followed if Aboriginal objects or bones suspected of being of human origin are uncovered during any works on the site.

Agency response

The proposal was referred to the Mindaribba Local Aboriginal Land Council for agency consultation no further action was requested and the site was acceptable for development.

The proposal was also referred to Heritage NSW who sought that an Aboriginal Cultural Heritage Assessment Report (ACHAR) be prepared as part of the rezoning process due to the identification of the above stated items. Council has determined as the local plan making authority that undertaking an ACHAR is better suited at the development application stage. This is due to:

- Council did not receive any additional advice from Mindaribba Local Aboriginal Land Council about impact on the items or need for additional studies

- the identified items are within the proposed C3 zone and will not be impacted by the R1 zone development
- The rezoning will not result in immediate development, this will occur after the development application stage. Therefore, the ACHAR is better suited during this time.

Electro Magnetic Fields (EMF)

The subject site is in close proximity to a substation located on the western boundary at Haussman Drive. An Assessment of Electronic Fields Report was produced in October 2017 by EMR Australia as part of the Seniors Living Development Application. The report compared expose levels at the site to the Guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Five (5) measurement positions were taken along the boundary of the subject site to the substation and a further measurement was taken from the proposed access road.

The magnetic field measurements obtained during the assessment were found to be significantly lower than the limits of the ICNIRP Guidelines – designed to prevent specific adverse effects from short-term exposure to EMF's. Measurements were found to be within, and lower than the limits of the International Agency for Research on Cancer's research on the long-term effects of magnetic fields.

The investigation demonstrates the suitability of a residential land use at the site.

Recommendation: No further investigation required.

Stormwater

No Stormwater Management Report or Plan have been submitted in support of the rezoning request. A report was prepared in November 2017 by Costin Roe Consulting for the previous seniors living Development Assessment. The report conceptually demonstrates the ability for a Stormwater Management system to be designed for urban uses within the existing approved development footprint. Further assessment is required given that the proposed R1 – General Residential area extends beyond the original Seniors Living development footprint.

Recommendation: A plan is required to demonstrate that the area of proposed R1 – General Residential is capable of appropriate stormwater management. Future stormwater design will need to be considered as part of a precinct wide DCP with the adjoining eastern property, while also being considered during the development application stage for the site. Design is to adopt water sensitive urban design principles and enhance the quality of the onsite stream that runs from the site terminating in wetlands to the east.

Agency response

Hunter Water had no further comment. However did require a number of studies to be prepared at the Development Application stage.

Traffic

A Traffic Impact Assessment (TIA) was provided in support of the rezoning request (McLaren Traffic Engineering October 2020 report) (**Attachment 12A**). It considered the existing road network and the likely traffic and associated impacts resulting from the development. Based on the assumptions and modelling undertaken, the report found that the proposed residential land would expect to generate 239 vehicle trips per day spread between peak AM and PM periods.

Modelling indicated that the level of service of the intersection of Haussman Drive and Raymond Terrace Road is currently operating at capacity and requires upgrading. The level of service requirements is reported as being dependent on the future upgrades at Raymond Terrace Road.

It is noted that the TIA drew conclusions from traffic count data acquired in 2017 with a nominal growth factor of 2% pa applied to the year 2020.

Traffic Impact had also been modelled on the assumption of one access point to Haussman Drive. An additional ingress/egress has since been proposed to connect the site to Haussman Drive in an easterly direction and through the adjoining allotment. The TIA recommends additional modelling be undertaken for the additional access point to Honeymyrtle Street and consideration be given to potential amenity impacts to the local road network.

Council requested that further Traffic Impact modelling be undertaken to bridge the deficiencies identified above.

A further supplementary report including additional traffic modelling based off of planned road network changes information provided by TfNSW was submitted to Council for consideration (McLaren Traffic Engineering November 2022 Report) (**Attachment 12B**).

The report concludes that:

- The proposal is anticipated to have little effect on the performance of the road network;
- Left-in / left-out and left-in / right-in / left-out access scenarios perform acceptably when considering access options to the site from Haussman Drive; and
- Right-turn into the site is considered superior in terms of amenity to future residents.

The findings of the report rely on the following infrastructure assumptions:

- Duplication of Haussman Drive between Taylor Avenue and Raymond Terrace Road;
- Upgrade of Taylor Avenue / Haussman Drive intersection to a dual-lane roundabout;
- Upgrade of Raymond Terrace / Haussman Drive intersection to signal control, including extra lanes; and
- Duplication of Raymond Terrace Road between Haussman Drive and Harvest Boulevarde.

Council notes that the timing and funding pathways of the above infrastructure has not been fully resolved, and therefor has implications for the planning proposals currently under assessment in the precinct. Specifically, whereby a proposal is relying on the intersection upgrade of Haussman Drive and Raymond Terrace Road which is operating at capacity.

Council is working with TfNSW and adjoining landowners to determine the most effective transport solution for the precinct. Multiple options and configurations are being examined, and it is Council's view that traffic issues are capable of being resolved.

Recommendation: Efficiencies are to be achieved through the consideration of a whole of precinct outcome with adjoining landowners and TfNSW. Depending on the agreed outcome, further traffic modelling may be required, particularly if alternative road arrangements are proposed including secondary access via Honeymyrtle Street or Raymond Terrace Road. It is noted that the impact to the local road network via Honeymyrtle Street under the current proposal remains unexamined.

The proposal is to be referred to Transport for NSW for agency consultation during the exhibition period should a positive gateway be issued.

Agency response

Transport for NSW sought further information on modelling and assumptions on future intersection and road upgrades. These issues were addressed, and Transport for NSW had no further comment. However, studies were requested at the Development Application stage.

Bushfire

The site is identified as bushfire prone. A Bushfire Threat Assessment Report (**Attachment 5**) has been provided detailing the bushfire risk of the site in support of the rezoning request.

The assessment concludes that proposed future residential dwellings areas will be capable of complying with Planning for Bushfire Protection 2019 based on the following assumptions:

- Reticulated water will be extended to the site.
- Future dwellings will be designed and assessed to a sufficient bushfire protection standard.
- Asset Protection zones are adequately provided in accordance with the report.
- Access internal roads are designed to meet performance criteria.
- Fencing to be constructed in accordance with the NSW Rural Fire Service Guideline, and
- Future homeowners prepare a Bush Fire Survival Plan.

It is noted however that the report references required Asset Protection Zones (APZ's) which exceed the level of Ecological Assessment provided.

A previous Bushfire Assessment Report was undertaken in support of DA 17 -2593. It demonstrated that appropriate APZ's could be achieved within the proposed Seniors Living Development footprint, within the context of assessed ecological impact.

It is noted that a secondary access point, for the purposes of safe emergency ingress/egress will be required. Initial discussions with the proponent indicate that secondary access is proposed via the adjoining western property Lot 182 DP792071.

Recommendation: There is currently no nexus demonstrated between the Ecological Assessment and the Bushfire Threat Assessment Report provided to Council in support of the rezoning request. Ecological impact requires quantification to demonstrate the suitability of establishing APZ's.

Suitable secondary access requirements are to be finalised to the satisfaction of the NSW Rural Fire Service post Gateway Determination and this secondary access is to be featured in the precinct DCP. The proposal will be referred to NSW Rural Fire Service for comment as part of the agency consultation process.

Agency response

NSW Rural Fire Service has no additional comments. However, studies were requested at the Development Application stage.

Geotechnical and subsidence

The site has historically been utilised as a clay quarry and has also been identified as having undermined coal workings located towards the northern extend of the site (Refer to **Figure 10**).

No geotechnical subsidence studies have been provided in support of the rezoning request. Council has referenced geotechnical information provided for DA 17-2593, which included:

1. a Mine Subsidence Constraints Advice Letter and Review (**Attachment 9**) was prepared in 2015 and 2023 to provide more clarification around the issue of undermined abandoned coal workings in the northern extent of the site (Refer to **Figure 10**). Investigations suggest that the depth of cover for the workings could vary from approximately 9m to 36m excluding tunnel entrances which are likely to be shallower. The extent has not been fully defined through this investigation and further borehole drilling would be required.

   The assessment also stated:
   For the Glenvale Colliery workings as depicted on the record tracing, trough subsidence is not expected to be a mechanism of concern. This is due to the relatively large dimensions of the pillars shown to remain, their expected height of less than 1.8 m and the depth of cover being relatively shallow. Note that this assessment is based on the validity of the record tracing which may not be a reasonable representation of the mine workings.

   The assessment illustrated the historic quarrying tunnelling extent while identifying boreholes within the site (see **Figure 10** below).

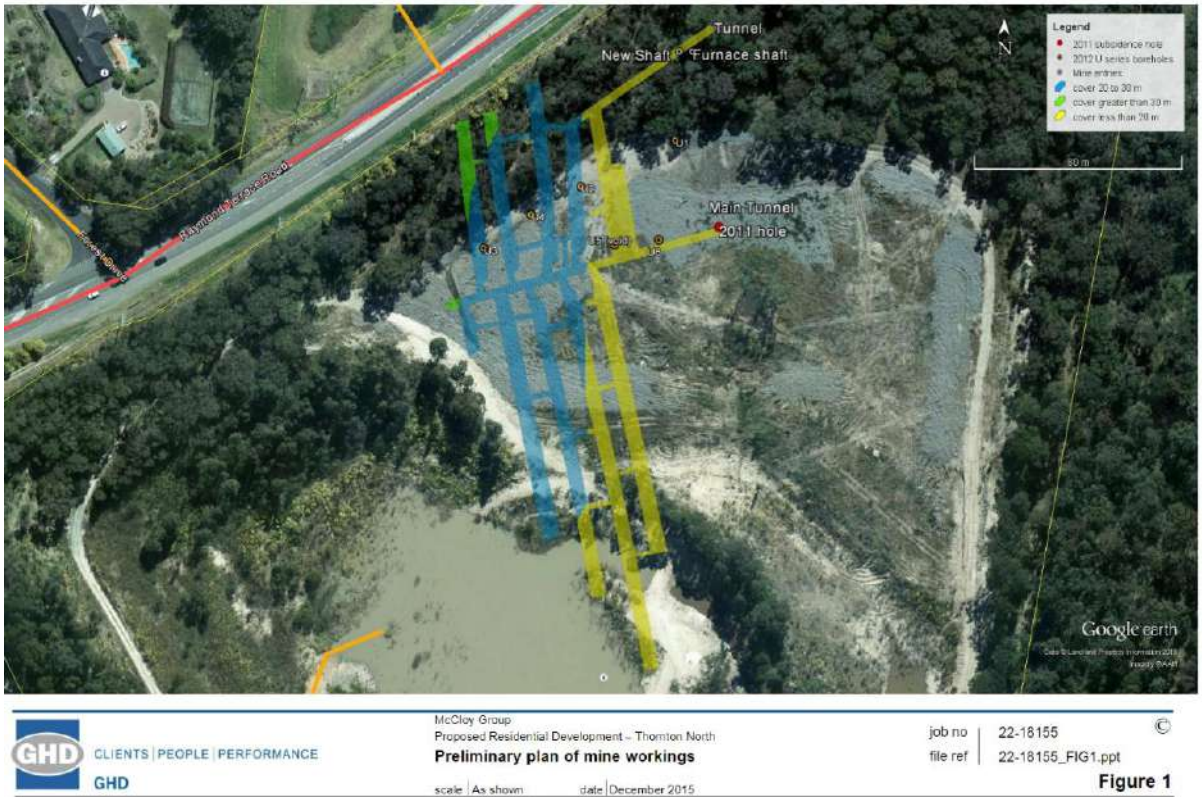


Figure 10: Indicative Location of Mine Workings

The assessment also detailed a preliminary grouting schedule with estimated costings to mitigate subsidence risk for the site (**Figure 11**). Additional detail and updated costings would occur during the development application stage.

Item	Description	Basis / assumptions	Preliminary cost estimate	
			low	high
Geotechnical consulting services	Investigation of mine workings (including location, downhole identification and survey of shafts and tunnels), assessment of risk, risk mitigation strategy and grouting specification, remediation QA and reporting	Estimated from projects of similar nature and not determined through detailed scoping and cost estimating	$ 100,000	$ 150,000
Tunnels and shafts	Engineering filling of excavated shafts and tunnels over approximately 300 m² area to average of 2 m depth	No concrete slab capping required	Cost assumed to be included in site regrade earthworks for subdivision	
Grout plant mobilisation and demobilisation	Set up plant and access, demobilisation following completion of grouting		$ 15,000 [A]	$ 25,000 [A]
Drilling and **plug** grouting	Low mobility gravel and grout to plug workings at about 20 m cover in 7 locations (headings)	14 boreholes to 20 m with gravel and grout plugs ~200 m² area x 1 to 1.5 m depth at $200/m³ [B]	1 m avg. void height $ 40,000	1.5 m avg. void height $ 60,000
Drilling and **infill** grouting	Filling of mine voids shallower than 20 m with higher mobility cementitious grout	~2,400 m² area x 1 to 1.5 m depth at $150/m³ [A]	1 m avg. void height $ 360,000	1.5 m avg. void height $ 540,000
		Preliminary cost estimate (excluding GST)	**$ 415,100**	**$ 645,130**
A: Based on indicative rates for a similar project provided by a grouting contractor recently B: Additional $50/m³ included over base rate for grouting and drilling to allow for more complex and time consuming plug grouting				

Figure 11: Assumed scope and preliminary cost estimation (2015)

As such, the proponent has advised that the scope and estimated cost would not preclude the development feasibility. As generally, the cost to develop a housing estate (dependent on scale) is considerably less than that of a seniors housing development due to the provisions within the *Housing SEPP 2021.*

2. A Preliminary Geotechnical Assessment Report (**Attachment 10**) was undertaken in June 2017 for the seniors housing development which included the excavation of fourteen (14) test pits limited to the quarry footprint. The assessment found steep slopes in the order of 12° to 22° in areas of the site, posing a potential instability risk. Testing also demonstrated the presence/inferred presence of uncontrolled fill across the majority of the quarry footprint.

   The report concluded the following:
   - Further geotechnical investigation should be carried out to ensure design can meet AS2870-2011 (Residential Slab and Footings Classification) and pavement design standards.
   - Previously filled areas should have detailed geotechnical investigation to define the extent, depth and properties of the fill.

- Preliminary investigation of the engineered fill used at the base of the quarry pit approximately 20 years ago demonstrate inadequate capacity to support residential footings. Recommendation is made to remove and replace existing fill materials as controlled fill.
- Potential options of leaving the uncontrolled fill in situ are provided, however carries a greater risk and would require further engineering assessment, and
- At the time of assessment, no records were available to indicate the placement or compaction of the fill, therefore it remained classified as uncontrolled for the purposes of assessment.

It is understood that, at the time of this assessment, imported fill material continues to be brought to the site. A report provided by the proponent identifies this fill as being classified as virgin extractive natural material (NENM), however this report only accounts for approximately 5,000m³ of material.

Concurrence from Subsidence Advisory NSW (**Attachment 11**) on 13 September 2022 and coincidingly Condition 1(b) of the DPE's Adequacy Assessment (**Attachment 3**) indicates that a grout/remediation proposal **should** be prepared by a geotechnical consultant with experience in mine subsidence assessments. After grouting, the geotechnical consultant should undertake sufficient verification boreholes to ensure that the intent of the grout plan has been met and that the risk of pothole subsidence has been effectively eliminated.

However, the 2015 and 2023 assessments were prepared considering the impact of the approved seniors housing development DA 17-2593. This approved development is a substantially more intense and sensitive land use, than a residential subdivision both in resident profile and density. This justification was confirmed within the 2023 subsidence advice review (**Attachment 9**), with the only change being inflationary costs to the grouting plan.

Council also prescribed provisions for DA 17-2593 as shown in Condition 20 excerpt below (**Figure 12**), that sought detail investigations for subsidence ad grouting prior to a construction certificate.

MINE WORKINGS

20. **Prior to the issue of a Construction Certificate** for Stage 2, the extent of mine workings including depth of cover are to be determined by a detailed ***Site Investigation Report*** for the purposes of establishing the appropriate treatment of abandoned mine workings, to permit the staged surface residential development for the purposes of this consent including the internal road network and associated utility installations.

    The Site Investigation is to include conclusions and recommendations on civil design and building construction standards to ensure that the development will be designed to remain safe, serviceable and repairable in the event of mine subsidence.

    The recommendations arising from this *Site Investigation Report* form part of the development consent and are to be incorporated into any relevant construction stage.

Figure 12: Excerpt of Conditions of Consent for DA - 17-2593

Therefore, it seems somewhat pre-emptive to commit to a comprehensive grout/remediation proposal when:

1. The proposal will result in a cumulatively less impact than that of a seniors housing development
2. There is already a historic precedent that this type of comprehensive assessment occur at the development application stage as per DA 17-2593
3. Preliminary assessments (although now outdated) have identified the subsidence risk, and have provided a scope of works and costs to remediate the site, reducing the risk of the development becoming unfeasible at a later date when these comprehensive remediation/grouting studies are undertaken at the Development Application stage
4. The 2023 assessment review concluded that the proposed rezoning was appropriate when regarding the subsidence risk.

Recommendation: A comprehensive remediation strategy is required to demonstrate the ability of the land to support residential use as part of the development during the preparation of the DCP. Such a strategy will need to address the implications of the uncontrolled fill on the site, and validation of the additional fill being brought to the site. This should be undertaken during the preparation of the wider DCP and development application stage.

Once fill works have been completed – the fill material is to be validated and re-assessed for its geotechnical suitability to support residential uses, prior to the adoption of the DCP and development application approval.

The DCP developed for the site is to reflect the staging of works required to grout, remediate and engineer the land to an adequate standard to support proposed development on the site, before its adoption.

The proposal is to be referred to Subsidence Advisory NSW for agency engagement to confirm and approve this proposed approach during any Gateway Determination be issued.

Agency response

The NSW Subsidence Advisory had no objection to the proposal. However, detailed studies will be required at the Development Application stage.

9. How has the planning proposal adequately addressed any social and economic effects?

The proposal is unlikely to have any significantly adverse social or economic impacts. The proposed rezoning will enable the development potential of the land and provide additional housing opportunities adjacent to existing urban areas, current and future services and jobs.

The strong growth experienced in the Maitland LGA and particularly the eastern sector over the last 10 years is well documented. The provision of additional residential land within the eastern sector of the LGA will provide housing opportunity in proximity to existing utilities and services.

SECTION D – STATE AND COMMONWEALTH INTERESTS

10. Is there adequate public infrastructure for the planning proposal?

Provision of Local and State Infrastructure

The subject site is identified as the Thornton North Stage 1 Urban Release Area Urban Release Area under MLEP 2011(Sheet URA_006A). The subject site must adhere to the provision of satisfactory arrangements to be made for the provision of designated State public infrastructure and adequate arrangements for public utility infrastructure.

The proposal is also within the boundary of the *North Thorton Development Contribution Plan 2008*, which seeks contribution for several local infrastructure items within the surrounds of the site.

Access, Transport and Traffic

The subject site gains access from Haussman Drive to the west of the allotment. A secondary access point is proposed to the east of the site from the adjoining property (Lot 182 DP792071). Development of the site proposes an extension of the existing road infrastructure. The subject site is located in the vicinity of bus and rail services. Future road layout should reflect the possibility of improved bus servicing to the proposed residential area.

Infrastructure Services

The site is located adjoining an established residential area and growing residential area. All essential services including telecommunications, electricity, gas, reticulated water and sewer services can be readily extended to service all future development within the development. Preliminary servicing advice from the Hunter Water Corporation (**Attachment 13**) also outlines

the additional plans required and infrastructure upgrades for the previous seniors housing development, which would occur prior to any issue of a construction certificate. This would be a similar process to this proposal, with any plan or strategy required at the Development Application stage.

11. What are the views of State and Commonwealth public authorities consulted in accordance with the Gateway Determination?

Preliminary discussions have been held with TfNSW, Hunter Water, Subsidence Advisory NSW and the Department of Planning and Environment's Biodiversity Conservation Division (BCD). All authorities have reaffirmed the need the need to resolve precinct wide transport, subsidence, contamination and biodiversity issues.

Consultation will occur in accordance with the conditions outlined in the Gateway Determination issued on the 7th May 2024 (Attachment 14).

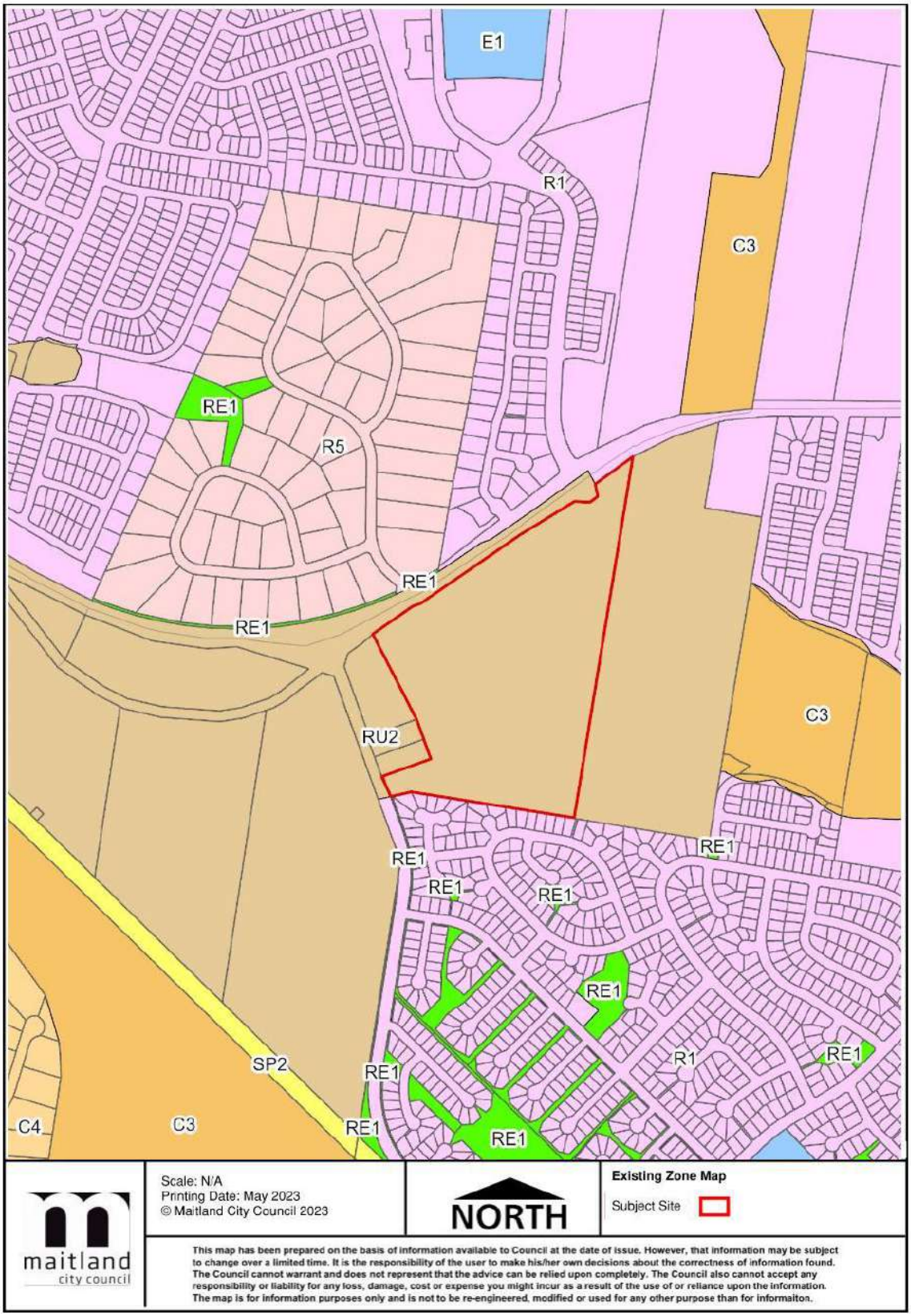
The Gateway Determination required consultation with the following government agencies, providing a minimum of 30 days to comment on the proposal:

- Department of Planning and Environment's Biodiversity Conservation and Science Group
- Transport for NSW (TfNSW)
- NSW Rural Fire Service (RFS)
- Subsidence Advisory NSW (SA NSW)
- Hunter Water Corporation (HWC)
- Mindaribba Local Aboriginal Land Council (LALC)
- NSW Heritage, and
- Environmental Protection Authority.

Formal consultation with State and Commonwealth public authorities was undertaken throughout 7th May 2024 to the 7th May 2025. All environmental matters were responded to and resolved with any remaining studies occurring at the development application stage.

PART 4: MAPPING

The proposal will involve amendments to the following LEP maps: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NORTH
Existing Zone Map
Subject Site
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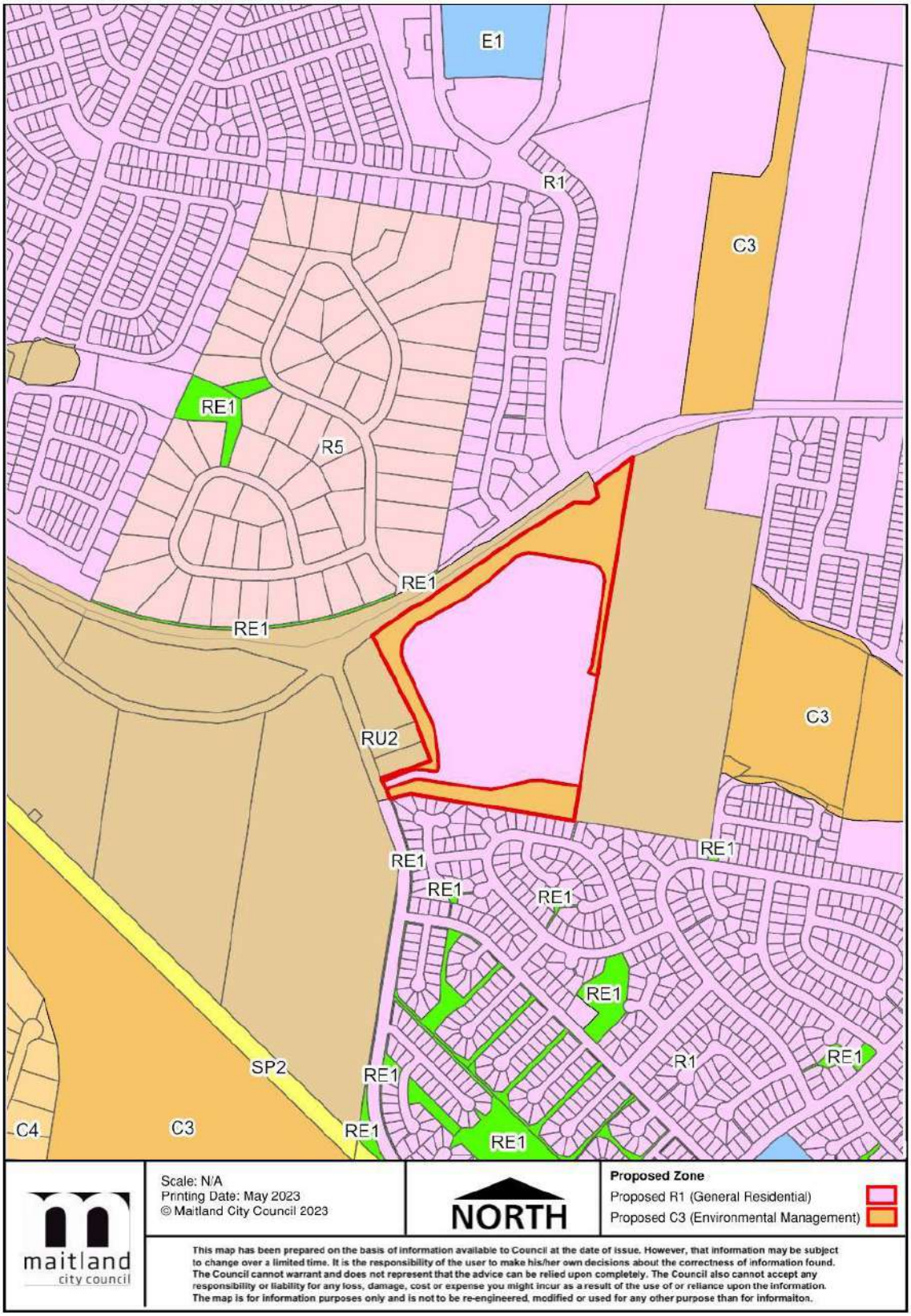
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NORTH
Proposed Zone
Proposed R1 (General Residential)
Proposed C3 (Environmental Management)
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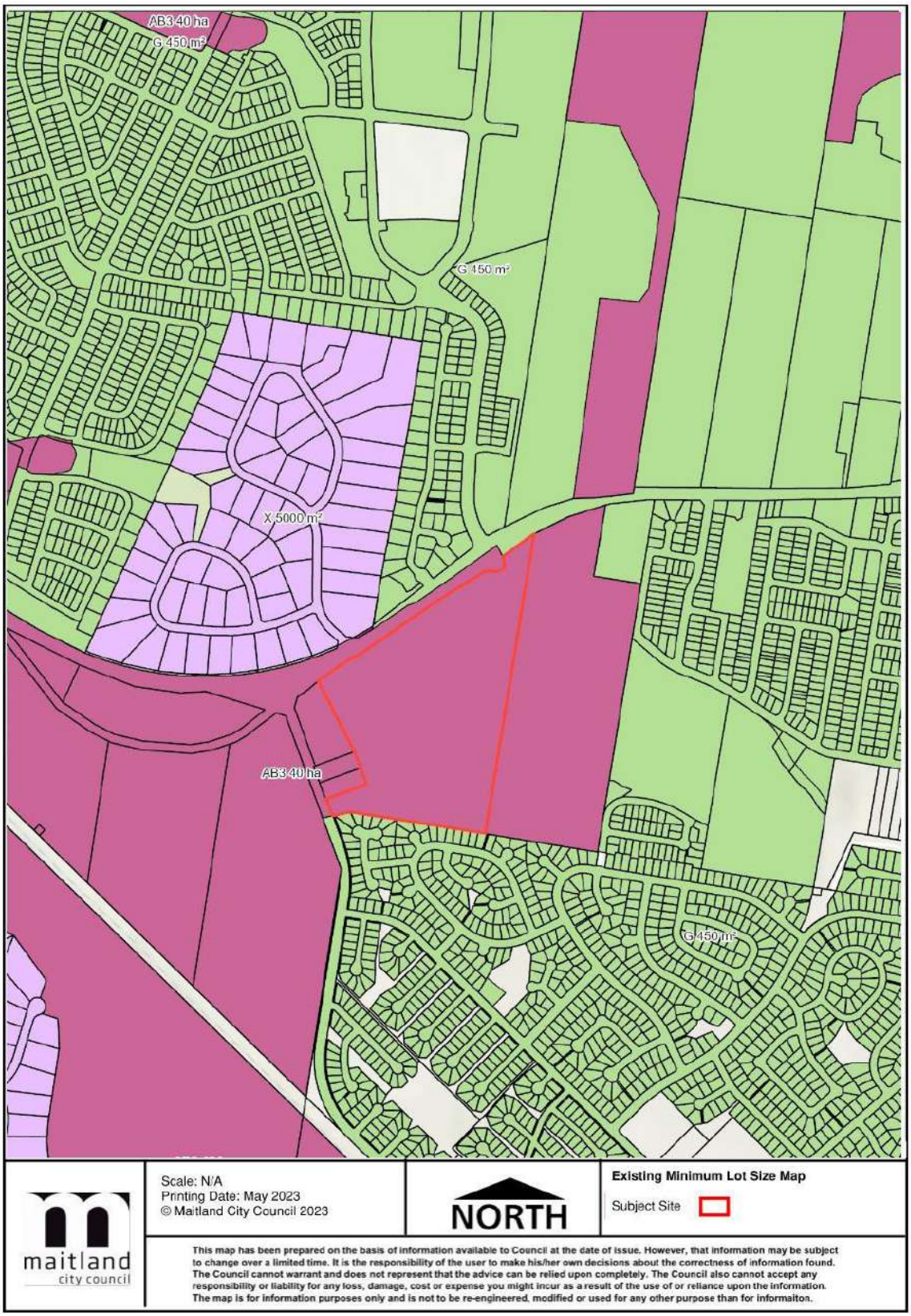
AB3 40 ha
G 450 m²
G 450 m²
X 5000 m²
AB3 40 ha
G 450 m²
Scale: N/A
Printing Date: May 2023
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NORTH
Existing Minimum Lot Size Map
Subject Site
maitland
city council
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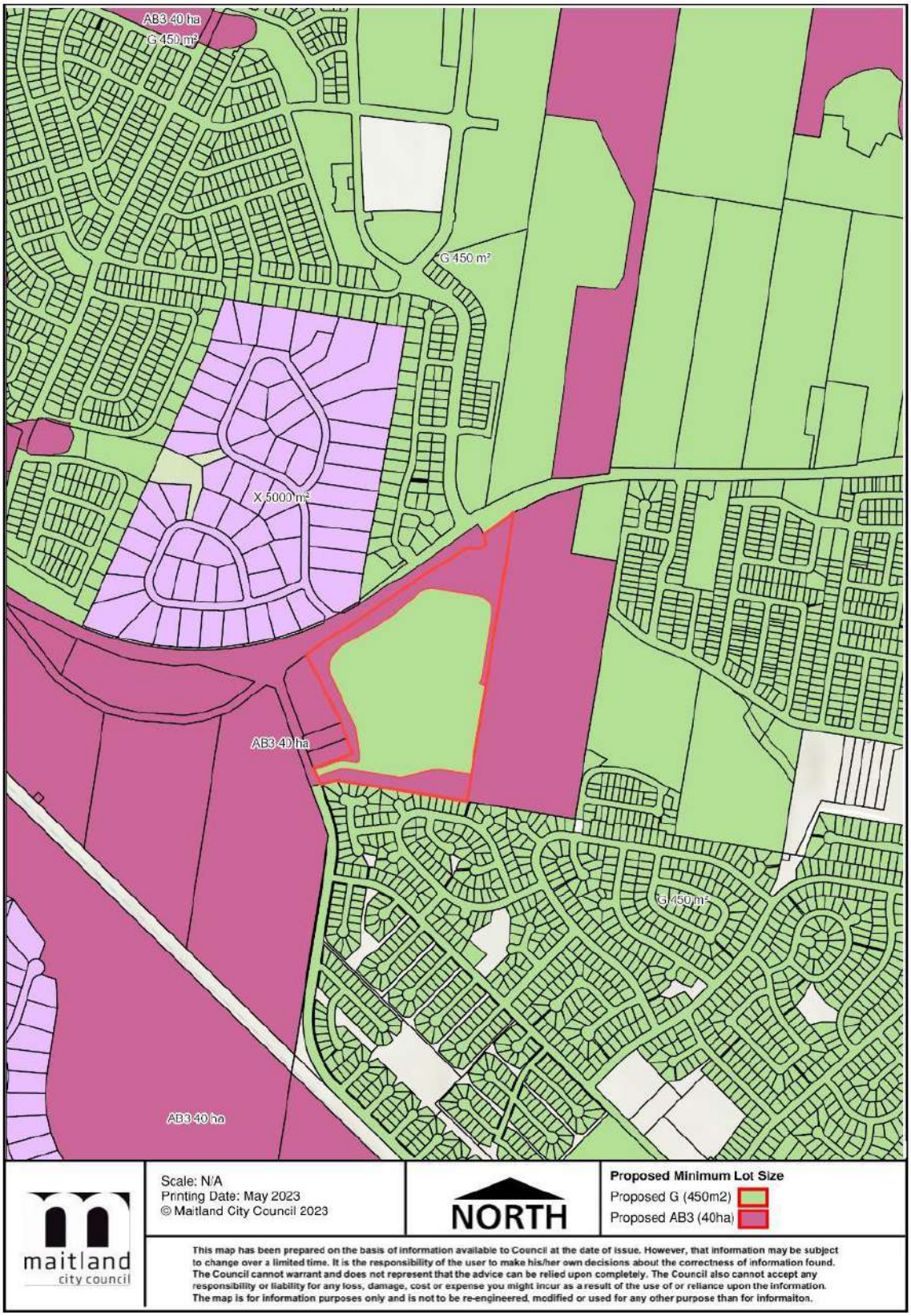
AB3 40 ha
G 450 m²
G 450 m²
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AB3 40 ha
G 450 m²
AB3 40 ha
Scale: N/A
Printing Date: May 2023
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NORTH
Proposed Minimum Lot Size
Proposed G (450m2)
Proposed AB3 (40ha)
maitland city council
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PART 5: COMMUNITY CONSULTATION

In accordance the *Environmental Planning and Assessment Act 1979*, community consultation must be undertaken by the local authority prior to approval of the planning proposal.

The recommended maximum period of public exhibition under the NSW Government's 'Local Environmental Plan Making Guideline' for Planning Proposals categorised as 'standard' is 20 working days. This was reflected within the Gateway Determination.

At the close of the consultation period, Council officers will consider all submissions received and present a report to Council for its endorsement of the planning proposal before proceeding to finalisation of the amendment.

PART 6: TIMEFRAME

The following timelines are provided as an indication only and are based on the 12-month timeframe prescribed by the Department of Planning and Environment's 'Local Environmental Plan Making Guideline (August 2023)'.

Stage	Timeframe and / or date
Gateway determination	25 working days
Pre-exhibition and agency engagement	50 working days
Commencement and completion of public exhibition period	20 working days
Consideration of submissions	10 working days
Post-exhibition review and additional studies	10 working days
Post exhibition planning proposal consideration / preparation	55 working days
Submission to Department for finalisation (where applicable)	10 working days
Gazettal of LEP Amendment	45 working days

Haussman Drive Thornton
Preliminary Ecological Assessment

Lot 2 DP1145348 107 Haussman Drive, Thornton NSW 2322

NCA21R122474

23 March 2021

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Haussman Drive Thornton
Preliminary Ecological Assessment

Haussman Drive, Thornton NSW 2322

Kleinfelder Project: NCA21R122474

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Prepared	Reviewed	Endorsed
Mark Dean	Dr Daniel O'Brien	Dr Gilbert Whyte

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Dr Daniel O'Brien	Dr Daniel O'Brien	Dr Gilbert Whyte

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1 INTRODUCTION

1.1 SCOPE

Kleinfelder Australia was engaged by BARR Property and Planning, on behalf of McCloys Group, to prepare a Preliminary Ecological Assessment (PEA) to identify constraints associated with the rezoning of Lot 2 DP 1145348 from RU2 – Rural Landscape to R1 General Residential and E2 – Environmental Conservation (Figure 1). The following terms are used throughout this report to describe particular geographical areas:

- Locality – land within a 5 km radius of the Study Area (Figure 1);
- Study Area (19 ha) – Lot 2 DP1145348 107 Haussman Drive, Thornton NSW 2322(Figure 2).

This constraints assessment involved:

- A desktop flora and fauna assessment;
- Review of the Ecological assessment for 107 Haussman Drive Thornton (Kleinfelder 2017);
- Discussion of the potential assessment pathway for the project.

This report identifies the threatened species, populations and ecological communities likely to occur within the Study Area, based on species and/or habitats detected during the site visit and threatened species records from the locality. A preliminary likelihood of occurrence assessment for identified threatened flora and fauna has been provided (Appendix 1), as well as a brief description of the vegetation and fauna habitat occurring on the site.

Part of the Lot is subject to an existing DA17/2593 (Seniors Living Development) approval, mainly relating to the central disturbed portion of the site and access tracks (11.27 ha), while fringing vegetation is now managed for APZ purposes (1.39 ha) (Figure 1). Vegetation clearing relating to the approved DA has now been undertaken.

1.2 LOCAL CONTEXT

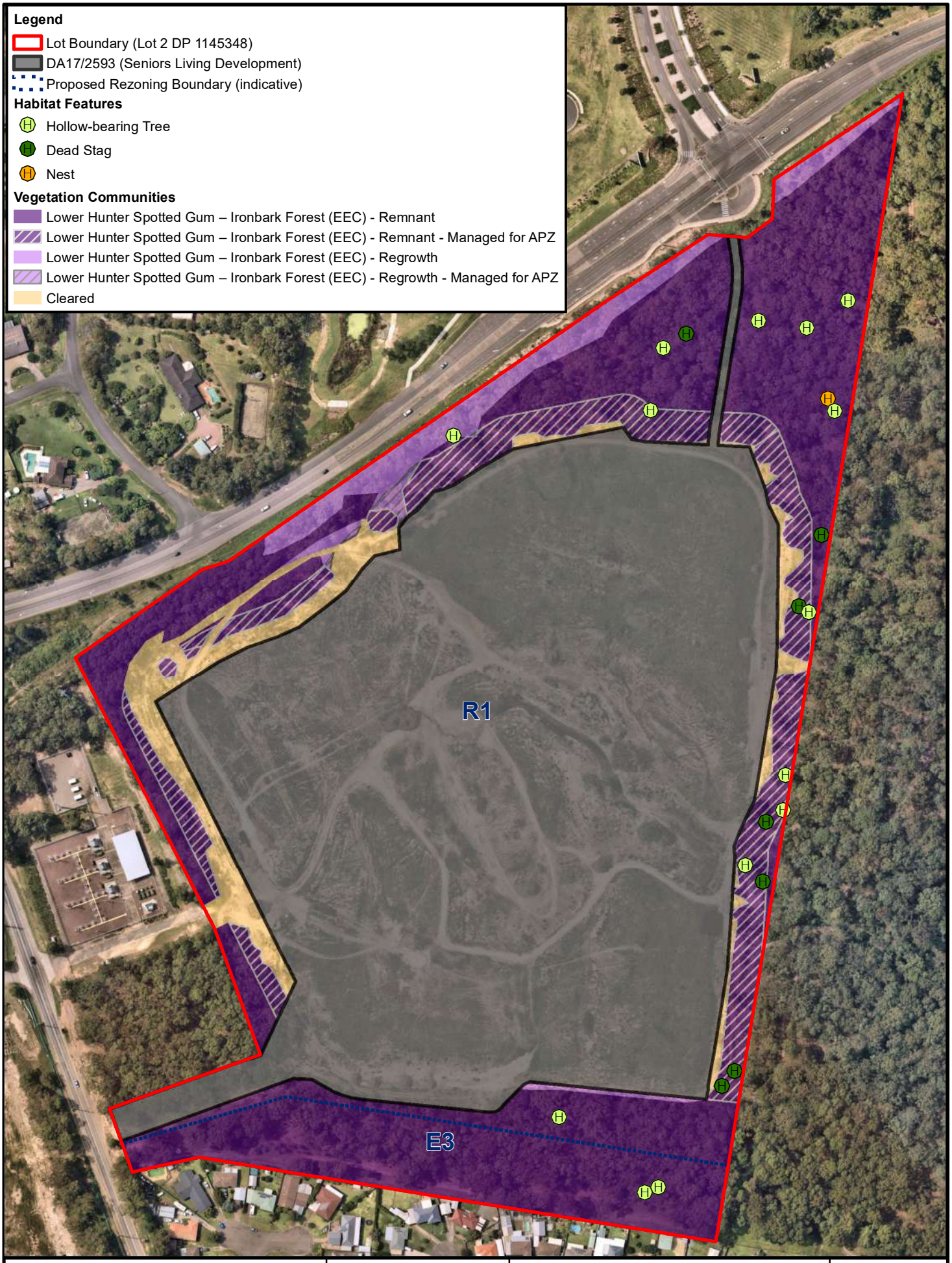
The study area is approximately 19 hectares (ha) and is legally defined as Lot 2 DP 1145348. The study area is located in the Maitland City Council (MCC) local government area (LGA) and is zoned RU2 – Rural Landscape under the Maitland Local Environmental Plan 2011 (Maitland LEP 2011).

The study area adjoins Rural lands (RU2) to the east and west, General Residential lands (R1) to the north and south, and Large Lot Residential lands (R5) to the north-west. It is located generally on the south-eastern corner where Haussman Drive intersects with Raymond Terrace Road. Lands zoned E3 – Environmental Management are located further to the east, and also further to the south-west on the southern side of the train line. It is understood that a rezoning/subdivision is proposed on the adjacent land to the east (480 Raymond Terrace Road, Lot 182 DP 792071).

1.3 SITE DESCRIPTION

The study area is situated on gently undulating hills around a disused quarry and is still partially vegetated. The native vegetation remaining within the study area includes remnant open forest and forest in various states of regrowth. The native vegetation connects to larger patches of remnant vegetation (approximately 222ha) extending offsite to the east and north-east. Additional areas of native vegetation occur south of the rail line to the south-west of the study area.

The study area occurs on the Permian sediments of the Beresfield residual soil landscape (Matthei, 1995) and is located in the catchment area of Woodberry Swamp. The elevation of the site falls generally from 40 metres (m) above sea level (asl) in the west to 20 m asl in the east. The site drains into a dam on the eastern boundary, which overflows into a first order drainage line that flows eastward to Woodberry Swamp.



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PROJECT REFERENCE: 20213789

DATE DRAWN: 2021/03/23 10:59 Version 1

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2021
Nearmap - 2021

Proposed Rezoning Boundaries, Vegetation Communities and Habitat Features

McCloy Thornton P/L
Preliminary Ecological Assessment
Proposed Rezoning of Lot 2 DP 1145348
107 Haussman Drive Drive, Thornton

FIGURE:

1

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1.4 LEGISLATIVE CONTEXT

This assessment was undertaken in accordance with and/or in consideration of the following Acts and Policies:

- **Commonwealth:**
  - *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- **NSW:**
  - Biodiversity Assessment Method (BAM) (DPIE 2020f).
  - *Biodiversity Conservation Act 2016* (NSW) (BC Act).
  - *Biodiversity Conservation Regulation 2017* (NSW) (BC Regulation).
  - *Biosecurity Act 2015* (NSW).
  - *Coastal Management Act 2016*.
  - *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).
  - *Local Land Services Act 2013* (NSW) (LLS Act).
  - *State Environmental Planning Policy (Koala Habitat Protection) 2021* (NSW) (Koala SEPP).
  - *State Environmental Planning Policy (Coastal Management) 2018* (NSW) (Coastal Management SEPP).
  - *State Environmental Planning Policy (Vegetation in Non-Rural Areas)* 2017 (NSW).
  - *Water Management Act 2000* (NSW) (WM Act).
- **Local:**
  - Maitland Local Environmental Plan 2011 (MLEP 2011)
  - Maitland Development Control Plan 2011 (MDCP 2011)

1.4.1 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Under the EPBC Act, an approval is required for actions that are likely to have a significant impact on MNES. An action includes a project, development, undertaking, activity or series of activities. When a person proposes to take an action they believe may need approval under the EPBC Act, they must refer the proposal to the Australian Government Minister for the Environment. The Act identifies nine MNES:

1. World Heritage properties.
2. National heritage places.
3. Wetlands of international importance (Ramsar Convention).
4. Listed threatened species and communities.
5. Migratory species listed under international agreements.
6. Great Barrier Reef Marine Park.
7. Commonwealth marine areas.
8. Nuclear actions; and
9. Water resources in respect to CSG and large coal mines.

A review of the nine matters of NES determined that points 4 and 5 are relevant to this assessment.

1.4.2 Biodiversity Conservation Act 2016 (NSW)

The BC Act commenced on 25 August 2017. The BC Act repeals the Threatened Species Conservation Act 1995 (TSC Act) as well as animal and plant provisions of the NP&W Act.

Schedules 1 and 2 of the BC Act contain lists of species, populations and ecological communities, which have been determined by the NSW Scientific Committee as being under threat of serious decline that could ultimately lead to extinction. The BC Act provides for a five-part test of significance and impact to be applied to any species, populations or communities that are found in an area subject to proposed development. Schedule 4 of the BC Act contains a list of 'key threatening processes' that are deemed to have a negative impact on threatened species, populations or ecological communities.

1.4.3 Biodiversity Offset Scheme

The Biodiversity Offset Scheme (BOS) is established under the BC Act. Where certain thresholds are triggered by a development, biodiversity offsets are subsequently required. The triggers for the BOS are as follows:

- Clearing area thresholds – Section 7.2 of the BC Regulation;
- Clearing of native vegetation, or other prescribed impacts under Part 6.1 of the BC Regulation, within an area mapped on the NSW Biodiversity Values Map (BV Map); and
- Significant impact based on application of a 'Test of Significance' (5-part Test) pursuant to Section 7.3 of the BC Act.

Developments that trigger the BOS are assessed as per the Biodiversity Assessment Method (BAM). Developments that do not trigger the BOS require a Flora and Fauna Impact Assessment to determine the likely impact of the development on biodiversity, as required under the EP&A Act.

Currently the minimum lot size of Lot 2 DP 1145348 is 40 ha. As such, the vegetation clearing threshold for entry into the BOS is 1 ha. In this situation a streamline BDAR (small area module) could be undertaken if vegetation clearing is equal to, or less than, 3 ha.

However, it is understood that the minimum lot size following rezoning (prior to subdivision/development) will be reduced to <1ha, such that the vegetation clearing threshold for entry into the BOS will be 0.25 ha. If this minimum lot size was applied, a streamline BDAR (small area module) could be undertaken if the vegetation clearing is equal to, or less than, 1 ha. A standard BDAR would be necessary for vegetation clearing >1 ha.

1.4.4 Koala SEPP 2021

The Koala SEPP aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to support a permanent free-living population over their present range and reverse the current trend of koala population decline. Where an approved Koala Plan of Management (KPoM) applies to the land, council's determination of the development application must be consistent with the approved koala plan of management that applies to the land.

There is currently no KPoM for the Maitland LGA, therefore, a suitably qualified and experienced person is required to assess the site to determine if the land contains 'Core Koala Habitat'. A Koala Assessment Report will be required to support a Development Application.

1.4.5 Coastal Management SEPP 2018

The Coastal Management SEPP gives effect to the objectives of the Coastal Management Act 2016 from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the

coastal zone. It defines the four coastal management areas in the Act through detailed mapping and specifies assessment criteria that are tailored for each coastal management area. Councils and other consent authorities must apply these criteria when assessing proposals for development that fall within one or more of the mapped areas.

No mapped coastal wetlands or proximity to coastal wetlands are mapped within the study area. The closest mapped area of coastal wetland occurs 1.2 kms to the east of the study area.

1.4.6 Biosecurity Act 2015 (NSW)

Under the *Biosecurity Act 2015* (NSW) all plants are regulated with a general biosecurity duty "to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable." Under the Act, a biosecurity impact "is an adverse effect on the economy, environment, or the community that arises, or has the potential to arise, from a biosecurity matter."

1.4.7 *Water Management Act 2000*

Controlled activities carried out in, on or under waterfront land are regulated by the Water Management Act (WM Act). 'Waterfront land' is defined as the bed of any river, lake or estuary, and the land within 40 m of the river banks, lake shore or estuary mean high water mark. A first order stream flows through the centre of the Study Area and over 40 m to the east of the Development Site. As such, the Project has avoided impacts to the waterbody and the vegetated riparian zone along the western bank of the waterbody. The Project therefore does not constitute a 'controlled activity' as per the WM Act.

2 METHODOLOGY

2.1 DATABASE AND LITERATURE REVIEW

2.1.1 Databases

A list of threatened species, populations and ecological communities that have been reported or modelled to occur within a 5 km radius of the Study Area was obtained from the following databases:

- NSW Department of Planning, Industry and Environment (DPIE) BioNet database: (http://www.bionet.nsw.gov.au/); and
- Department of Agriculture, Water and the Environment (DWAE) Protected Matters search tool: (www.environment.gov.au/erin/ert/epbc/index.html).

Based on information available concerning habitat requirements of threatened species, populations and ecological communities; an assessment was made as to the likelihood of any of the reported matters occurring within the Study Area or using the habitat as an essential part of their foraging range. Marine species, pelagic bird and wading bird species have been excluded from the assessment due to the obvious lack of suitable habitat within the Study Area, however, indirect impacts on these species have been considered.

2.1.2 Literature Review

An ecological assessment has previously been prepared which covered the entirety of the study area. Regional vegetation mapping was reviewed, as part of the ecological assessment, in conjunction with field surveys to confirm the vegetation types onsite. As such, no further review of regional vegetation mapping was undertaken. The following assessments were reviewed to inform this preliminary ecological assessment:

- Ecological Assessment, 107 Haussman Drive Thornton (Kleinfelder, 2017)
- Addendum Assessment – Targeted Threatened Species Survey, 107 Haussman Drive Thornton (Kleinfelder 2017).
- Advice on consideration of native vegetation under the Seniors Housing SEPP, 107 Haussman Drive Thornton (Kleinfelder 2017).

2.2 FIELD SURVEYS

Field survey data obtained during the Ecological Assessment undertaken in 2017 were used to inform this Preliminary Ecological Assessment.

Field surveys were undertaken between 8 June, 18 August and 21 November 2017. These surveys collected data on the vegetation, flora and fauna present and potential habitat for threatened flora and fauna species likely to be present within the study area. The following sections outline the methodologies used.

Field surveys were conducted with due consideration of the Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) Flora and Fauna Survey Guidelines (Murray et al., 2002). Floristic quadrat surveys were undertaken in accordance with the BioBanking methodology (OEH, 2014) as was current NSW standards set by the NSW Office of Environment and Heritage (OEH) at the time of survey.

2.2.1 Survey Activity and Timing

A full list of survey activities and dates they were conducted on is provided in **Table 1**.

Table 1 Schedule of activities and survey effort during the survey period.

Activity	Dates	Total Effort
Flora Surveys		
Floristic Quadrats, Random Meanders, Vegetation Community Mapping and Threatened Species Surveys	8-9 June 2017 14, 17 August 2017	12 person hours
Fauna Surveys		
Fauna Trapping (terrestrial, arboreal and harp)	14 – 18 August 2017	4 nights
Spotlighting	17, 18 August 2017	2 person hours
Call Playback	17, 18 August 2017	40 minutes
Diurnal Birds	16 August 2017	40 minutes
Diurnal Herpetofauna	16, 18 August 2017	1 person hour
Passive Anabat Recording	16 August 2017 (left overnight)	Approx. 24 recording hours
Fauna habitat assessments and Habitat Tree Survey	17 August 2017	2 person hours

2.2.2 Flora

2.2.2.1 Vegetation Identification and Mapping

A total of 12 person hours were spent undertaking random meanders over the study area and quadrat (i.e. plot) sampling.

Meandering transects were walked to undertake targeted searches for threatened flora species known to occur in the locality. All additional vascular plant species observed during meander transect surveys that were not observed in quadrat samples were recorded.

Systematic floristic sampling using 2 x 0.04 ha quadrats (20 x 20 metres) and 50 x 20 metre (m) transect lines were completed within areas considered to be representative of the major floristic variations present across the study area **Figure 2**.

Within each 0.04 ha quadrat, all vascular plant species were recorded and the following data collected:

- The percentage foliage cover (1-5%, and then to nearest 5%); and
- An abundance rating (number of individuals or stems: 1-10, 20, 50, 100, 500, 1000). Numbers greater than 20 were treated as estimates.

Along each 50 x 20 m transect line, the following data was collected:

- Percentage cover of native overstorey and mid-storey species (at every 5 m along the 50 m transect line;
- Percentage cover of grasses, shrubs and other ground cover species (calculated from presence data recorded at every metre along the 50 m transect line);
- Percentage cover of exotic species (calculated from presence data recorded at every metre along the 50 m transect line);

- Number of trees with hollows (within 20 m x 50 m area); and
- Total length of fallen timber (within 20 m x 50 m area).

Floristic identification and nomenclature was based on Harden (1992, 1993, 2000 and 2002) with subsequent revisions as published on PlantNET (The Royal Botanic Garden and Domain Trust, 2017). If a plant was unable to be identified using these references or a specimen was potentially rare or threatened, a sample was sent to the National Herbarium of New South Wales.

2.2.2.2 Vegetation Community Mapping

The identification of vegetation communities was based on dominant species present in the overstorey, midstorey, shrub and ground layers. The species association recorded in the study area were compared to descriptions of vegetation communities published in the NSW Vegetation Information System (VIS) classification (OEH, 2016), the Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS) Vegetation Mapping (Somerville, 2009), the LHCCREMS Vegetation Mapping (NPWS, 2000), and the Maitland LGA Vegetation Mapping (Hill, 2003).

Published vegetation communities in the NSW VIS classification database that best matched those observed in the study area were adopted by this assessment.

The boundaries of each of the identified vegetation communities within the study area were mapped using a combination of rapid data points (RDP) and aerial photograph interpretation (API). At RDP brief notes are recorded on the dominant vegetation at multiple waypoints across the study area. RDP were then overlaid on an aerial photograph and used in conjunction with API to delineate vegetation community boundaries.

2.2.3 Fauna

Fauna survey methods were designed to satisfy standards established by the LHCCREMS Flora and Fauna Survey Guidelines (Murray et al., 2002). For the purposes of fauna survey, the study area was considered to contain one stratification unit; a Spotted Gum – Ironbark open forest type.

The range of methods used to detect fauna at the study area included; trapping, spotlighting, call playback, timed observations and active searches and are listed in **Table 1. Table 2** provides details of the types and number of traps set and the total trap night count during the field surveys. **Figure 3** shows the locations of where the various fauna survey methods were applied.

Table 2 Trapping Methodology for the Subject Site 2017

Trap Type	No. of Traps	No. of Nights	Total No. of Trap Nights
Elliot A (Terrestrial)	20	4	80
Elliot B (Arboreal)	20	4	80
Elliot B (Terrestrial)	4	4	16
Cage	2	4	8
Harp Trap	2	4	8

2.2.3.1 Arboreal & Terrestrial Mammals

Terrestrial and arboreal trapping was conducted over four nights (14 – 17 August, 2017). Spotlighting was undertaken from dusk for a 1 hour period on two nights (17 and 18 August 2017). Trees were inspected during daylight hours for the presence of habitat hollows and these were watched at dusk to detect emerging nocturnal birds or mammals. Call-playback for the Squirrel Glider (*Petaurus norfolcensis*) was conducted on two non-consecutive nights (17 and 18 August 2017).

2.2.3.2 Bats

Two AnaBatTM ultrasonic recorder (Titley Scientific, Lawnton QLD) was used to passively record the calls of any Microchiropteran bats feeding in the area. The unit was set to start at dusk and recording occurred overnight (5:15 pm to 6:30 am) on one night (16 August 2017). Recorded calls were analysed using AnalookWTM and matched to reference calls published by Pennay et al. 2004.

One harp trap was installed, and left in place for four nights (14 – 17 August 2017). Spotlighting searches of any blossoming trees were undertaken in conjunction with the other mammal spotlighting surveys in order to detect Megachiropteran bat species feeding in the area.

2.2.3.3 Birds

Surveys for diurnal birds were conducted on one morning (16 August 2017) between 09:20 and 10:15 hours. Two 1 ha areas were searched for 20 minutes. Opportunistic bird sightings were also noted during other diurnal survey work. Birds were identified either visually, with the aid of binoculars, or by call interpretation. Call-playback for large forest owls was conducted on two non-consecutive nights (17 and 18 August 2017).

2.2.3.4 Herpetofauna

Two 30-minute diurnal searches for reptiles and amphibians were conducted on two separate days (16 and 18 August 2017) by turning over ground debris such as logs, fallen branches, leaf litter and dumped rubbish within the subject site. Opportunistic records of herpetofauna were also noted during nocturnal spotlighting surveys.

2.2.3.5 Fauna Habitat

Habitat Assessments

Fauna habitat values observed during inspections of the study area were recorded. Attributes considered important to fauna include: Koala feed trees, hollow-bearing trees, nests, fallen timber/hollow logs, abundance of nectar and fruit resources, water bodies, vegetation cover and structural complexity, fallen timber, and leaf litter. Suitability of habitat for threatened fauna species occurring in the locality was also assessed during the survey.

Habitat Tree Survey

A survey of trees within the study area was undertaken to locate hollow-bearing trees, dead standing stags and trees containing nests. The location of any Habitat Trees was recorded using a Trimble® Juno® 5s and the type of feature it contained was recorded. For trees with hollows the number and size of hollows was recorded. Hollow size was classified as either small (< 8 cm diameter), medium (8 – 20 cm diameter) or large (> 20 cm diameter) based on the size of the hollow entrance.

2.3 SURVEY LIMITATIONS

The survey effort is consistent with the LHCCREMS flora and fauna survey guidelines (Murray et al., 2002) and provides an indication of the types of habitat and species assemblage present in the study area. The survey is also augmented by an updated database search of threatened species records for the locality (February 2021). As part of the biodiversity assessment and approval pathway for future development of the study area, further surveys are likely to be required to assess the likelihood of occurrence of other threatened species in accordance with the BAM (depending on the level of vegetation clearing required). Additionally, vegetation plots in accordance with the BAM would be required to the determine the Plant Community Type (PCT).

metres
0 10 20 40 60 80 100

N

PROJECT REFERENCE: 20213789

DATE DRAWN: 2021/03/22 17:05 Version 2

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2021
Nearmap - 2021

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Flora Survey Effort

McCloy Thornton P/L
Preliminary Ecological Assessment
Proposed Rezoning of Lot 2 DP 1145348
107 Haussman Drive Drive, Thornton

FIGURE:

2

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DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2021
Nearmap - 2021

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Fauna Survey Effort

McCloy Thornton P/L
Preliminary Ecological Assessment
Proposed Rezoning of Lot 2 DP 1145348
107 Haussman Drive Drive, Thornton

FIGURE:

3

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3 RESULTS

3.1 DATABASE AND LITERATURE REVIEW

3.1.1 Database

Database searches were conducted in February 2021 using the EPBC Act Protected Matters Search Tool and the Atlas of NSW Wildlife (BioNet).

Eighty-one threatened and/or migratory species had previously been recorded or are modelled to occur within a 5 km radius of the study area. These include 19 plant, two amphibian, 30 bird and 18 mammal species (outlined further Section 4.2.1). Five of the threatened bird species are also listed as migratory under the EPBC Act. A further 7 additional bird species listed as migratory were recorded/modelled to occur within a 5 km radius of the study area (outlined further in **Appendix A**).

Note: Additional to the 81 species, 10 migratory shorebird species, four threatened shorebird species, five migratory wetland bird species and six threatened wetland bird species have been excluded due to the lack of any suitable habitat within the study area. The remaining 81 species have been assessed for the likelihood of occurrence within the study area in **Appendix A**.

One ecological community was modelled to occur within the study area. There is also one Wetland of International Importance (i.e. Ramsar wetland) approximately 11kms to the south-east of the study area.

3.2 FIELD SURVEYS

3.2.1 Flora

A total of 95 flora species were recorded during field surveys (**Appendix B**). No threatened flora species were detected within the study area.

Of the flora species recorded, 20 are considered to be exotic or weed species. Planted Australian native species that are not endemic to the locality were also considered as exotic species. Under the Biosecurity Act 2015, there is a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk posed by any plant species in NSW. Within the study area, four weed species that were recorded are identified as priority weeds for the Hunter region : *Lantana camara* (Lantana), *Asparagus aethiopicus* (Ground Asparagus), *Senecio madagascariensis* (Fireweed), and *Bryophyllum delagoense* (Mother-of-Millions). There is a mandatory measure across New South Wales that prohibits the import and sale of the first three of these species; these three species are also listed under the National Weeds Strategy as Weeds of National Significance.

Mother-of-Millions is not a Weed of National Significance but does carry the following Recommended Measure for the Hunter region:

Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. The plant should not be bought, sold, grown, carried or released into the environment.

3.2.2 Vegetation Communities

3.2.2.1 Site Condition

The study area is currently zoned for rural use and has been previously disturbed. In addition, vegetation clearing and APZ management has been undertaken recently within the study area (relating to an existing DA approval). The remnant vegetation around the old quarry clearing is affected by *Lantana camara* (Lantana), with areas of high infestations located in the north-east corner and along the western boundary (Plate 1), and low levels of infestation along the southern boundary (Plate 2).

Other exotic species include *Senecio madagascariensis* (Fireweed), *Asparagus aethiopicus* (Ground Asparagus), *Cenchrus clandestinus* (Kikuyu Grass), and *Paspalum dilatatum* (Paspalum) in low abundance and cover.

Areas of regrowth forest were recorded along the northern boundary of the study area (Plate 3).

3.2.2.2 Vegetation Type

The vegetation across the study area is a grass/shrub open forest is consistent with the VIS plant community type, HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (**Figure 1**). This community is equivalent to several other Spotted Gum-Ironbark forest types as published in other regional mapping projects. A description of the vegetation is provided in Section 3.2.2.3.

The area of HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter occurring within the study area consists of approximately 6.26 ha that is remnant forest and 0.59 ha that is regrowth forest. Of the remnant and regrowth areas, 1.39 ha is managed for APZ standards. There is approximately 0.8 ha of cleared land within areas that are exclusive of the existing DA (11.27 ha) (Plate 4). The proportion of native vegetation and cleared land within each rezoned area is detailed in the table below.

Table 3 Approximate area of vegetation within each proposed rezoned area.

Vegetation Type	R1 zone	E3 zone	Total
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest (Remnant)	3.45	1.46	4.91
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest (Remnant – Managed for APZ)	1.35	-	1.35
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest (Regrowth)	0.55	-	0.55
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest (Regrowth – Managed for APZ)	0.04	-	0.04
Cleared	0.8	-	0.08
Cleared (existing DA approval)	11.27	-	11.27
Total	17.46	1.46	18.92

Plate 1 **Remnant open forest with a high level of Lantana infestation**

Plate 2 **Remnant open forest with low levels of Lantana infestation**

Plate 3 Regrowth open forest

Plate 4 Cleared areas in the central portion of the study area

3.2.2.3 Vegetation Description

Equivalent Map Unit (LHCCREMS): MU 17 Lower Hunter Spotted Gum – Ironbark Forest

NSW Vegetation Information System Classification: HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter. This community is likely to be commensurate with PCT 1592 (Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter), however, field surveys in accordance with the BAM would be required to confirm.

The canopy is dominated by *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Red Ironbark), *Eucalyptus acmenoides* (White Mahogany) and *Eucalyptus punctata* (Grey Gum). Other tree species recorded in low

abundances include *Eucalyptus globoidea* (White Stringybark) and *Eucalyptus moluccana* (Grey Box). *Casuarina glauca* (Swamp Oak) was recorded in the regrowth areas of the study area.

The midstorey and shrub layers support a number of wattle species (*Acacia elongata, A. implexa, A. falcata, A. parvipinnula, A. fimbriata, A. ulicifolia, A. stricta*) as well as a diversity of other shrub species including *Bursaria spinosa* (Blackthorn), *Persoonia linearis* (Narrow-leaved Geebung), *Ozothamnus diosmifolius* (Rice Flower), *Hibbertia obtusifolia* (Hoary Guinea Flower), *Daviesia ulicifolia* (Gorse Bitter Pea), *Dillwynia retorta*, and *Breynia oblongifolia* (Coffee Bush).

The ground stratum is characterised by an assemblage of grass and forb species, including *Aristida vagans* (Threeawn Speargrass), *Cheilanthes sieberi* (Poison Rock Fern), *Entolasia stricta* (Wiry Panic), *Dianella revoluta* (Blueberry Lily), *Glycine clandestina, Lepidosperma laterale, Lomandra multiflora subsp. multiflora* (Many-flowered Mat-rush), *Microlaena stipoides var. stipoides* (Weeping Grass), *Pomax umbellata, Pratia purpurascens* (Whiteroot), *Themeda triandra* (Kangaroo Grass), *Billardiera scandens* (Hairy Apple Berry) and *Phyllanthus hirtellus* (Thyme Spurge).

This community occurs within the study area in two condition states: low to moderate Lantana infestation; and moderate to high Lantana infestation.

3.2.2.4 Conservation Significance

The area of HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter occurring within the study area conforms to the BC Act Final Determination for the Endangered Ecological Community (EEC), Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion as it:

- Is a dry sclerophyll forest with an open forest structure and a mixed shrub/grass understorey characterised by:
  - A canopy dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Red Ironbark);
  - A shrub layer characterised by *Acacia parvipinnula* (Silver-stemmed Wattle), *Acacia implexa* (Hickory Wattle), and prickly shrub species *Bursaria spinosa* (Blackthorn) and *Daviesia ulicifolia* (Bitter Gorse Pea); and
  - A diverse ground layer characterised by a range of grasses and forbs described by the Final Determination for the EEC.
  - Occurs within the known geographic distribution of the EEC (generally Cessnock to Beresfield); and
  - Occurs on Permian geology (and not Carboniferous sediments, on which other similar Spotted Gum – Ironbark communities occur).

This community does not conform to any threatened communities listed under the EPBC Act.

3.2.3 Fauna

A total of 37 native fauna species were detected during the field surveys, comprising 24 bird, nine mammal and four reptile species (**Appendix B**). Most of these species are considered locally common; four species are threatened and are listed as Vulnerable under the TSC Act. One mammal species is introduced.

The four threatened species recorded within the study area are Microchiropteran bat species.

3.2.3.1 Fauna Habitat

Remnant Open Forest

The study area generally provides moderately well-connected remnant open forest habitat around the margins of the site for Microchiropteran bats, arboreal mammals (such as the Squirrel Glider), and bird species that forage in the canopy and tall midstorey on insects or eucalypt blossoms. The open forest habitat would also provide habitat for tree roosting Microchiropteran bat species as well as other arboreal fauna known to occur in the locality.

The understory of some parts of the remnant open forest areas (such as the north-eastern corner of the study area) is highly affected by *Lantana camara* (Lantana) infestations which reducing the habitat suitability for some fauna.

The open forest in the study area is also likely to provide habitat for terrestrial fauna as the study area is situated at the western edge of the larger patch of habitat.

Regrowth Forest

In the regrowth areas of open forest, the vegetation structure is simplified and provides less suitable foraging and roosting habitat for forest birds, arboreal mammals and Microchiropteran bat species; however, the regenerating canopy and midstorey in the regrowth areas continue to provide marginal habitat for nectarivorous and insectivorous birds and may be utilised from time to time.

Grassland

The grasslands within the study area contain few fauna habitat features due to the low structural complexity of the vegetation. The grassland habitat contains some habitat in the form of isolated paddock trees and scattered areas of dead wood and logs on the ground (predominantly around dead stags). While these habitat features do occur, the habitat within the study area lacks structural complexity and external connectivity. When in bloom, scattered paddock trees have the potential to provide foraging resources to bird and Megachiropteran bat species occurring in the locality.

Habitat Trees

Several hollow-bearing trees and dead stags occur within the study area (Figure 1) but are limited to the areas of remnant open forest around the perimeter of the study area. These habitat trees have the potential to provide roosting and nesting sites for Microchiropteran bat, arboreal mammal and bird species.

Aquatic Habitat

There are assumed to be two small dams within the study area (additional fieldwork is required to verify the condition of the waterbodies). These dams are relatively small and previously contain some aquatic vegetation and fringing vegetation (**Plate 5**). At the time of survey (2017), water turbidity was noted to be very high further limiting habitat suitability for native fauna. These dams are likely to only provide habitat to generalist amphibian species.

Plate 5 Dam habitat near eastern boundary of the study area (photo taken 2017)

Koala Habitat Protection SEPP (2021)

Seven tree species listed under Schedule 2 of the SEPP (for Central Coast Koala Management Area) was identified within the study area:, *Casuarina glauca* (Swamp Oak), *Corymbia maculata* (Spotted Gum), *Eucalyptus acmenoides* (White Mahogany), *Eucalyptus fibrosa* (Red Ironbark), *Eucalyptus globoidea* (White Stringybark), *Eucalyptus moluccana* (Grey Box) and *Eucalyptus punctata* (Grey Gum). Within the study area, it is expected that Koala Use Tree Species comprise greater than 15% of the total number of trees throughout the study area. Further assessment would be required to estimate the proportion of Koala Use trees. However, it is likely that the native vegetation meets the definition of 'Core Koala Habitat', requiring a Koala Assessment Report.

3.3 LIMITATIONS

The current assessment does not fulfil the requirements of a Biodiversity Development Assessment Report (BDAR) as required by the NSW BC Act. Furthermore, the assessment does not fulfil the requirements of a Commonwealth significant impact assessment of relevant Matters of National Environmental Significance (MNES); namely, 'Listed threatened species and ecological communities' and 'Migratory species' which have the potential to occur on the study area. However, relevant MNES have been identified during the desktop assessment and have therefore been considered as part of the Assessment of Likelihood of Occurrence in **Appendix A**. Additional field surveys and impact assessment will be required to fulfil the relevant statutory requirement to support any future proposed development of the site.

3.4 BIODIVERSITY CORRIDORS

The Hunter Regional Plan (2036) (NSW Government, 2016) has mapped the Thornton area as part of the "Indicative Greater Newcastle Metropolitan Area" and identified area of growth. The plan identifies a 'green grid' which will link open space, natural areas and recreation facilities, supplemented by the protection of high environmental value areas and biodiversity corridors. The 'green grid' does not overlap with the study area or the immediate surrounds.

The study area is not connected to any Conservation Areas, National Parks or State Forests within the locality. The nearest reserve is Pambalong Nature Reserve Area, which occurs approximately 10 km to the south of the Study Area and Hunter Wetlands National Park approximately 15km to the South East. The study area is separated from these reserves by the multiple larger and a number of smaller roads.

Parts of the study area are, however, mapped as a riparian/vegetation conservation corridor within the Maitland City Council Development Control Plan (2011) – Thornton Area Plan (F.7). The development controls require that mechanisms are put in place with development to ensure the integrity and protection of established vegetation and riparian areas. Within the study area, riparian/vegetation conservation corridors are mapped within the southern, eastern and north-eastern portions of the site. A strip of vegetation that buffers Raymond Terrace Road is also mapped a roadside landscape corridor.

A Wildlife Corridor Feasibility Assessment has previously been undertaken (2020, RPS) which assessed two alternate routes providing connectivity through the study area. These two routes go around a central disturbance area in the central portion of the site (former quarry), including:

- A remnant corridor that extends along the northern then western boundary (Option A); and
- A remnant corridor that extends along the southern boundary (Option B).

The assessment considered the potential impact as a result of either corridor being removed and revealed that Option B was superior in function as a wildlife corridor than Option A. The proposed rezoning plans to rezone the southern corridor (Option B) as E2 – Environmental Conservation. Additionally, the connectivity through the study area should be considered in conjunction with the plans for the property to the east to ensure the continued maintenance of the wildlife corridor throughout the locality.

4 CONSTRAINTS ASSESSMENT

4.1 ASSESSMENT OF LIKELIHOOD OF OCCURRENCE

A summary of the likelihood of threatened species, communities and migratory species to occur in the Study Area based on the habitat requirements of each matter is provided in **Appendix A**. Obligations with respect to these species and communities and regulatory requirements are discussed below.

4.2 THREATENED SPECIES, POPULATIONS AND COMMUNITIES

4.2.1 Biodiversity Conservation Act 2016

Section 7.3 of the BC Act provides a 'test of significance' for determining whether proposed development or activity [is] likely to significantly affect threatened species or ecological communities, or their habitats.

Several threatened species were identified as potentially occurring in the Study Area. Tests of significance under the BC Act have not been provided at this stage but will be required as part of any future development application.

4.2.1.1 Ecological Communities

One TECs listed under the BC Act was assessed as occurring in the Study Area:

- Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC.

4.2.1.2 Flora

No listed vulnerable flora species was detected within the Study Area during surveys.

Two listed threatened flora species were assessed as having potential habitat and a moderate likelihood of occurrence within the Study Area based on database records within the locality however we not detected during targeted surveys:

- *Grevillea parviflora subsp. parviflora* Small Flower Grevillia– Vulnerable.
- *Tetratheca juncea* Black-eyed Susan – Vulnerable.

4.2.1.3 Fauna

Four vulnerable BC Act listed fauna species, four microbat species were detected within the Study Area during surveys and will require more detailed assessment (test of significance) for future proposed development of the site (refer to **Appendix A**).

Sixteen BC Act listed fauna species, including seven birds and nine mammal species were assessed as having potential habitat and a moderate or higher likelihood of occurrence within the Study Area based on database records within the locality, and will require more detailed assessment (test of significance) for future proposed development of the site (refer to **Appendix A**):

- Black-chinned Honeyeater (*Melithreptus gularis gularis*) – Vulnerable.
- Black-necked Stork (*Ephippiorhynchus asiaticus*) – Endangered.
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) – Vulnerable.
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis)* Vulnerable.
- Eastern Freetail-bat (*Micronomus norfolkensis*) – Vulnerable.

- Greater Broad-nosed Bat (*Scoteanax rueppellii*) – Vulnerable.
- Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable.
- Little Bentwing-bat (*Miniopterus australis*) – Vulnerable.
- Little Eagle (*Hieraaetus morphnoides*) – Vulnerable.
- Little Lorikeet (*Glossopsitta pusilla)* – Vulnerable.
- Large Bentwing-bat (*Miniopterus orianae oceanensis*) – Vulnerable.
- Masked Owl (*Tyto novaehollandiae*) – Vulnerable.
- Southern Myotis (*Myotis macropus*) – Vulnerable.
- Squirrel Glider (*Petaurus norfolcensis*) – Vulnerable.
- Varied Sitella (*Daphoenositta chrysoptera*) Vulnerable.
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) – Vulnerable.

4.2.2 Environment Protection and Biodiversity Conservation Act 1999

4.2.2.1 Ecological Communities

No TECs listed under the EPBC Act were assessed as occurring in the Study Area.

4.2.2.2 Flora

Two threatened flora species listed as vulnerable under the EPBC Act was assessed as having potential habitat and a moderate likelihood of occurrence within the Study Area, based on database records within the locality.

- *Grevillea parviflora subsp. parviflora* Small Flower Grevillia– Vulnerable.
- *Tetratheca juncea* Black-eyed Susan – Vulnerable.

4.2.2.3 Fauna

No vulnerable fauna species listed under the EPBC Act was detected within the Study Area during surveys of the site.

Two threatened EPBC Act listed fauna species were assessed as having moderate likelihood of occurrence within the Study Area based on database records within the locality and potential habita, namely:

- White-throated Needletail (*Hirundapas caudacutus*) – Vulnerable.
- Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable.

These species will require more detailed assessment (against the Endangered and Vulnerable species significant impact criteria listed in the Matters of National Environmental Significance Significant Impact Guidelines 1.1) as part of future proposed development of the site.

4.2.2.4 Migratory Species

Three migratory EPBC Act listed fauna species were assessed as having potential habitat within and a moderate likelihood of occurrence within the Study Area based on database records within the locality, namely:

- Black-faced Monarch (*Monarcha melanopsis*).
- Pacific Swift (*Apus pacificus*).
- White-throated Needletail (*Hirundapas caudacutus*).

These species will require more detailed assessment (against the Migratory species significant impact criteria listed in the Matters of National Environmental Significance Significant Impact Guidelines 1.1) as part of future proposed development of the site.

4.2.3 Koala Habitat Protection SEPP (2020)

One tree species listed under Schedule 2 of Koala SEPP was identified within the study area: *Eucalyptus punctata* (Grey Gum). Within the study area, the native vegetation community is dominated by *Corymbia maculata* (Spotted Gum), *Eucalyptus acmenoides* (White Mahogany) and *Eucalyptus fibrosa* (Red Ironbark). *Eucalyptus punctata* (Grey Gum) was observed to generally occur in low densities (below 15% of the total number of trees in the upper or lower strata of the tree component) throughout the study area. In addition, the database search of the NSW Wildlife Atlas only contained one record of the Koala occurring within five kilometres of the study area. Therefore, further consideration of the SEPP is not considered necessary.

4.3 ASSESSMENT REQUIREMENTS UNDER THE BC ACT

The BC Act will be applicable to any future subdivision, or development applications within the Study Area. Under the BC Regulation, there are four potential triggers for the development to be assessed under the Biodiversity Offset Scheme (BOS), and require the submission of a Biodiversity Development Assessment Report (BDAR). These triggers and the potential for any future proposal to exceed one, or more triggers, and therefore require assessment under the BOS, is outlined below:

Clearing on land mapped on the Biodiversity Land Values Map (Section 7.3 of the BC Regulation).

Part 7 of the Act states that 'a proposed development exceeds the biodiversity offsets scheme threshold for the purposes of if it is or involves: (b) the clearing of native vegetation, or other action prescribed by clause 6.1, on land included on the Biodiversity Values Map published under clause 7.3.

The Study Area is not mapped on the Biodiversity Values Map.

Impacting the prescribed biodiversity features listed under Section 6.1 of the BC Regulation, on land included on the Biodiversity Values Map.

The Study Area is not mapped on the Biodiversity Values Map.

Clearing native vegetation above the thresholds (outlined in Section 7.2 of the BC Regulation).

The allotment proposed for rezoning has a minimum lot size of 40 ha, as such according to Section 7.2 of the BC Regulation, an area of native vegetation clearing of 1 ha or more exceeds the clearing threshold and the BOS would be triggered, requiring a BDAR.

However, it is understood, that the minimum lot size following rezoning (prior to subdivision/development) will be reduced to <1ha, such that the vegetation clearing threshold for entry into the BOS will be 0.25 ha. If this minimum lot size was applied, a streamline BDAR (small area module) could be undertaken if the vegetation clearing is equal to, or less than, 1 ha.

Areas of vegetation clearing are subject to the final design of the subdivision.

Significant impact on a threatened species (determined through a 5-part test set out in the BC Act).

If none of the above triggers are exceeded by the proposed development, then 'tests of significance' (5-part test) would be conducted for all species known or likely to occur within the Study Area. If the proposal was deemed to have a significant impact on any threatened species, populations or ecological communities, then the BOS would be triggered. Further survey work within the Study Area would be required to inform these assessments. The main consideration for the project is the potential to limit movement through the site which has the potential to impact threatened species such as the Squirrel Glider.

4.4 BAM SURVEY REQUIREMENTS

4.4.1 Recommended Fieldwork Timing

Preliminary data relating to the PCTs predicted to occur on the site were entered into the BioNet database to produce a list of target species credit species that would require survey for future development of the site (table 4). The surveys recommended in the table 4 would be required to fulfil the requirements of the BAM.

4.5 OFFSETTING CONSIDERATIONS

A future development application should consider the following implications of potential offsetting requirements under both the BOS and relevant Maitland City Council planning and management guidelines:

- If the BOS is triggered, ecological impacts of the proposal development on native vegetation and threatened species (species credit species) must be offset in accordance with the BAM, including the potential removal of:
  - PCTs, (including EECs);
  - Threatened species (and associated habitat); and
  - Hollow-bearing trees.
- Offsetting the loss of habitat at the ecosystem and species level can be achieved under the BAM either by:
  - The creation of ecosystem and species credits from an on-site or off-site offset (i.e. establishment of a Biodiversity Stewardship Site Agreement);
  - Purchase of available credits from the market; or
  - By paying into the Biodiversity Conservation Trust Fund.

4.5.1 Species Credits

The total number of species credits required for any future development within the Study Area would be dependent upon further survey work to identify the occurrence of species credit species.

Table 4 Candidate threatened species (potentially requiring targeted surveys) and potential survey months dictated by the BAM.

Class	Scientific Name	Common Name	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Amphibian	*Litoria aurea*	Green and Golden Bell Frog	x	x	x								x	x
Amphibian	*Litoria brevipalmata*	Green-thighed Frog	x	x	x							x	x	x
Bird	*Ninox connivens*	Barking Owl					x	x	x	x	x	x	x	x
Bird	*Burhinus grallarius*	Bush Stone-curlew	x	x	x	x	x	x	x	x	x	x	x	x
Bird	*Callocephalon fimbriatum*	Gang-gang Cockatoo	x							x	x	x		
Bird	*Calyptorhynchus lathami*	Glossy Black-Cockatoo				x	x	x	x	x				
Bird	*Hieraaetus morphnoides*	Little Eagle								x	x	x		
Bird	*Tyto novaehollandiae*	Masked Owl					x	x	x	x				
Bird	*Lophoictinia isura*	Square-tailed Kite	x								x	x	x	x
Bird	*Haliaeetus leucogaster*	White-bellied Sea-Eagle							x	x	x	x	x	x
Flora	*Eucalyptus parramattensis subsp. decadens*		x	x	x	x	x	x	x	x	x	x	x	x
Flora	*Pterostylis chaetophora*										x	x	x	
Flora	*Thesium australe*	Austral Toadflax	x	x									x	x
Flora	*Tetratheca juncea*	Black-eyed Susan									x	x		
Flora	*Acacia bynoeana*	Bynoe's Wattle	x	x	x	x	x	x	x	x	x	x	x	x
Flora	*Rutidosis heterogama*	Heath Wrinklewort	x	x	x	x	x	x	x	x	x	x	x	x
Flora	*Cryptostylis hunteriana*	Leafless Tongue Orchid	x										x	x
Flora	*Callistemon linearifolius*	Netted Bottle Brush	x									x	x	x
Flora	*Diuris praecox*	Rough Doubletail								x				
Flora	*Pomaderris queenslandica*	Scant Pomaderris	x	x	x	x	x	x	x	x	x	x	x	x
Flora	*Prostanthera cineolifera*	Singleton Mint Bush									x	x		
Flora	*Eucalyptus glaucina*	Slaty Red Gum	x	x	x	x	x	x	x	x	x	x	x	x
Flora	*Grevillea parviflora subsp. parviflora*	Small-flower Grevillea								x	x	x	x	
Flora	*Cynanchum elegans*	White-flowered Wax Plant	x	x	x	x	x	x	x	x	x	x	x	x

Class	Scientific Name	Common Name	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Mammal	*Phascogale tapoatafa*	Brush-tailed Phascogale	x	x	x	x	x	x						x
Mammal	*Planigale maculata*	Common Planigale	x	x	x	x	x	x	x	x	x	x	x	x
Mammal	*Cercartetus nanus*	Eastern Pygmy-possum	x	x	x							x	x	x
Mammal	*Pteropus poliocephalus*	Grey-headed Flying-fox										x	x	x
Mammal	*Phascolarctos cinereus*	Koala	x	x	x	x	x	x	x	x	x	x	x	x
Mammal	*Myotis macropus*	Southern Myotis	x	x	x							x	x	x
Mammal	*Petaurus norfolcensis*	Squirrel Glider	x	x	x	x	x	x	x	x	x	x	x	x
Reptile	*Hoplocephalus bitorquatus*	Pale-headed Snake	x	x	x								x	x
Reptile	*Aprasia parapulchella*	Pink-tailed Legless Lizard									x	x	x	
Reptile	*Delma impar*	Striped Legless Lizard									x	x	x	x

5 CONCLUSIONS AND RECOMMENDATIONS

The preliminary ecological assessment has been conducted to inform future development of the Study Area by identifying potential ecological constraints and future assessments that will be required, should such development proceed.

One threatened ecological communities were detected within the Study Area during the site inspection, namely:

- Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion – listed as an EEC under the BC Act.

Based on the habitat assessments conducted, the following species listed as threatened under either the BC Act or EPBC Act were identified as having potential habitat within the Study Area and a moderate or high likelihood of occurrence:

- Threatened flora species:
  - *Grevillea parviflora subsp. parviflora* (Small Flower Grevillia).
  - *Tetratheca juncea* (Black-eyed Susan).
- Threatened fauna species:
  - Black-chinned Honeyeater (*Melithreptus gularis gularis*)
  - Black-necked Stork (*Ephippiorhynchus asiaticus*)
  - Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
  - Eastern False Pipistrelle (*Falsistrellus tasmaniensis)*
  - Eastern Freetail-bat (*Micronomus norfolkensis*)
  - Greater Broad-nosed Bat (*Scoteanax rueppellii*)
  - Grey-headed Flying-fox (*Pteropus poliocephalus*)
  - Little Bentwing-bat (*Miniopterus australis*)
  - Little Eagle (*Hieraaetus morphnoides*)
  - Little Lorikeet (*Glossopsitta pusilla)*
  - Large Bentwing-bat (*Miniopterus orianae oceanensis*)
  - Masked Owl (*Tyto novaehollandiae*)
  - Southern Myotis (*Myotis macropus*)
  - Squirrel Glider (*Petaurus norfolcensis*)
  - Varied Sitella (Daphoenositta chrysoptera)
  - Yellow-bellied Sheathtail-bat (*Saccolaimus* flaviventris)
  - White-throated Needletail (*Hirundapas caudacutus*) – Vulnerable.
- Migratory species:
  - Black-faced Monarch (*Monarcha melanopsis*).

- Pacific Swift (*Apus pacificus*).
- White-throated Needletail (*Hirundapas caudacutus*).

If any additional threatened species are identified during future targeted field surveys, offsets for impacting these species will be required.

Future development of the site would require:

- Biodiversity Assessment in accordance with the BC Act. If future proposed development would trigger the thresholds of the BOS under the BC Act and the BC Regulation, then an assessment in accordance with the BAM and submission of a BDAR would be required. The following are triggers for Part 4 Development Applications (for projects which are not State Significant Development (SSD), all SSDs require the submission of a BDAR):
  - Clearing thresholds (area and land on the Biodiversity Values Map) under Part 7 of the BC Regulation:
    - Thresholds for clearing are set out under Section 7.2 of the BC Regulation, and are dependent upon the minimum lot size of the land – Under the current minimum lot size for the study area (40 ha), any clearing above 1 ha would trigger the BOS. However, with the understanding that the rezoning will result in a minimum lot size of <1 ha, the clearing threshold for entry into the BOS will be 0.25 ha. As such it is likely that entry into the BOS will be triggered, requiring a BDAR. A streamlined BDAR (small area module) could be undertaken if vegetation clearing was limited to less than 1 ha.
  - Significant impact based on 'test of significance' (5-part Test) under Section 7.3 of the BC Act – an assessment of the potential for any future development to have a significant impact on any potentially occurring threatened species would require information provided from future surveys.
- If the BOS is triggered and a BDAR is to be provided for future development of the land, then appropriate biodiversity offsets would be required to be retired as part of the development.
- Any future proposed development would require assessments against the EPBC Act Significant Impact Criteria for any MNES which would be impacted or indirectly impacted on due to the proposal.

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APPENDIX A Threatened Species Database Search

THREATENED SPECIES DATABASE SEARCH

A list of threatened species, populations and ecological communities that have been reported or modelled to occur from within a five-kilometre radius of the Study Area was obtained from the following databases:

- NSW Department of Planning, Industry and Environment (DPIE) BioNet Atlas: (http://www.bionet.nsw.gov.au/).
- Protected matter database search tool (https://www.environment.gov.au/epbc/protected-matters-search-tool)

An assessment was then made of the likelihood of the threatened species, populations, and / or ecological communities reported or modelled to occur in the locality occurring within the Study Area or using the habitat within the Study Area as an essential part of a foraging range.

The table below summarises the likelihood of threatened species and EPBC Act listed migratory species occurring within the Study Area based on the habitat requirements of each species. A brief definition of the likelihood of occurrence criteria is provided below:

- Known – species identified within the site during surveys.
- High – species known from the area (DPIE Wildlife Atlas records), suitable habitat (such as roosting and foraging habitat) present within the site.
- Moderate – species may be known from the area, potential habitat is present within the site.
- Low – species not known from the area and/or marginal habitat is present within the site.
- Nil – habitat requirements not met for this species within the site.

Note: Marine species identified within the desktop assessment i.e. marine bird species, have been excluded from the list based on obvious habitat constraints. However, indirect impacts on these species and ecological communities have been considered.

Table A1 'Likelihood of Occurrence' table

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
Flora								
1.	***Caladenia tessellate*** Thick-lipped Spider-orchid	E	V	-	PMST	The Thick Lip Spider Orchid is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	Low	Marginal suitable habitat within the Development Site.
2.	***Callistemon linearifolius*** Netted Bottle Brush	V	-	234	NSW Atlas	The species grows in dry sclerophyll forest on the coast and adjacent ranges. The species flowers in spring and summer months.	**Low-Moderate**	There are 234 records within the locality and suitable habitat occurs in the study area. The species was not identified during previous survey.
3.	***Cryptostylis hunteriana*** Leafless Tongue Orchid	V	V	-	PMST	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community.	Low	Marginal habitat within the study area. There are no records in the locality.
4.	***Cynanchum elegans*** White-flowered Wax Plant	E	E	-	PMST	Occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub.	Low	Suitable habitat present within the study area. However, species has not been recorded within the locality.

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
5.	***Eucalyptus glaucina*** Slaty Red Gum	V	V	-	PMST	Observed in a variety of habitats: shallow soils or stony hillsides, but not on poor sandstones; grassy woodlands on deep, moderately fertile and well watered soil; gentle slopes near drainage lines in alluvial and clayey soils. Associated with the following vegetation classes: Hunter-Macleay Dry Sclerophyll Forests; Northern Gorge Dry Sclerophyll Forests; North Coast Dry Sclerophyll Forests; Sydney Sand Flats Dry Sclerophyll Forests; Western Slopes Grasslands; Coastal Valley Grassy Woodlands; Northern Hinterland Wet Sclerophyll Forests; North Coast Wet Sclerophyll Forests.	Low	Suitable habitat present within the study area. However, species has not been recorded within the locality. Readily identifiable species not detected during previous survey.
6.	***Eucalyptus parramattensis* subsp. *decadens*** Earp's Gum	V	V	-	PMST	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland.	Nil	No suitable habitat. There are no records in the locality and the species was not identified during survey.
7.	*Eucalyptus camaldulensis population in the Hunter Catchment*	EP	-	1	NPWS Atlas	This population occurs from the west at Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River, in the Port Stephens local government area. It has been known to with *Eucalyptus tereticornis*, *Eucalyptus melliodora*, *Casuarina cunninghamiana* subsp. *cunninghamiana* and *Angophora floribunda*.	Low	There is one record in the locality and marginal habitat is present on site. Readily identifiable species not detected during previous survey.
8.	Euphrasia arguta	CE	CE	-	PMST	Historically, Euphrasia arguta has only been recorded from relatively few places within an area extending from Sydney to Bathurst and north to Walcha. Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'.	Nil	No suitable habitat. There are no records in the locality and the species was not identified during survey.
9.	***Grevillea parviflora* subsp. *parviflora*** Small-flower Grevillea	V	V	-	PMST	The species occurs in a range of vegetation types from heath and shrubby woodland to open forest, in sandy or lightly clay soils usually over thin shales. Flowering has been recorded between July to December as well as April-May.	**Low-Moderate**	There are no records in the locality. There is suitable habitat for the species within the study area. Species not identified during survey

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
10.	***Persicaria elatior*** Tall Knotweed	V	V	-	PMST	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Nil	No suitable habitat within the Development Site.
11.	***Prasophyllum* sp. Wybong (C.Phelps ORG 5269)** a leek-orchid	-	CE	-	PMST	*Prasophyllum* sp. Wybong is known to occur in open eucalypt woodland and grassland. It is known from seven populations in eastern NSW near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield.	Nil	No suitable habitat present and the study area is outside the known distribution of the species.
12.	***Pterostylis gibbosa*** Illawarra Greenhood	E	E	-	PMST	It is apparently extinct in western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage.	Nil	No suitable habitat within the Development Site.
13.	***Rhodomyrtus psidioides*** Native Guava	E	-	4	NPWS Atlas	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.	Nil	No suitable habitat within the Development Site.
14.	***Rhizanthella slateri*** Eastern Australian Underground Orchid	V	E	-	PMST	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed. Flowers September to November.	Nil	No suitable habitat within the Development Site.
15.	***Rhodamnia rubescens*** Scrub Turpentine	CE	-	1	NSW Atlas, PMST	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	Nil	No suitable habitat within the Development Site.
16.	***Rutidosis heterogama*** Heath Wrinklewort	V	V	-	PMST	The species grows in heath on sandy soils and moist areas in open forest.	Nil	No suitable habitat within the Development Site.

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
17.	***Syzgium paniculatum*** Magenta Lilly Pilly	CE	-	5	PMST, NSW Atlas	Occurs from Broken Bay, approximately 90 km north of Sydney, New South Wales, to Maryborough in Queensland. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines	Nil	No suitable habitat within the Development Site.
18.	***Thesium australe*** Austral Toadflax	V	V		NSW Atlas	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	Nil	No suitable habitat within the Development Site.
19.	***Tetratheca juncea*** Black-eyed Susan	V	V	1	NSW Atlas, PMS	The species is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. This species flowers from July-December and is cryptic outside of flowering periods. Ideal survey times are within the September-October period.	**Low-Moderate**	There is one record in the locality and marginal habitat is present on site. Surveys did not detect the species within the study area.
Birds								
1.	***Anseranas semipalmata*** Magpie Goose	V	-	1	NSW Atlas	Inhabits shallows of dams, swampy well-vegetated margins of deep waterways.	Nil	No suitable habitat in the study area.
2.	***Anthochaera phrygia*** Regent Honeyeater	CE	CE	3	PMST, NSW Atlas	Mostly recorded in box-ironbark eucalypt associations. At times of food shortage, the species also uses other woodland types and wet lowland coastal forest dominated by Swamp Mahogany or Spotted Gum.	Low	Marginal habitat in the subject site (Spotted Gum canopy feed trees).
3.	***Artamus cyanopterus cyanopterus*** Dusky Woodswallow	V	-	3	NSW Atlas	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.	**Moderate**	Suitable habitat within the study area, however, not known from the locality in recent years.

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
4.	***Botaurus poiciloptilus*** Australasian Bittern	E	E	1	PMST, NSW Atlas	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha spp*.) and spikerushes (*Eleocharis spp*.).	Nil	No suitable habitat within the Development Site.
5.	***Calidris ferruginea*** Curlew Sandpiper	E	CE	-	PMST	It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	Nil	No suitable habitat within the Development Site.
6.	*Callocephalon fimbriatum* Gang-gang Cockatoo	V	-	2	NSW Atlas	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests; in autumn and winter, favours drier more open eucalypt forests and woodlands (particularly box-gum and box-ironbark assemblages) or dry forest in coastal areas. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	Low	Marginal habitat in the study area.
7.	***Calyptorhynchus lathami*** Glossy Black-Cockatoo	V	-	2	NSW Atlas	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Feeds almost exclusively on the seeds of several species of she-oak (particularly Black She-oak, Forest She-oak, or Drooping She-oak). Dependent on large hollow-bearing eucalypts for nest sites.	Low	Low suitability of habitat low occurrence of Casuarina and Allocasuarina species within the study area.
8.	***Daphoenositta chrysoptera*** Varied Sittella	V	-	7	NSW Atlas	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	**Moderate**	Potential foraging habitat in the study area. There are records in the locality.
9.	***Erythrotriorchis radiatus*** Red Goshawk	CE	V	0	PMST	Occurs in tropical and warm-temperate woodlands and forests. Mostly occurs in northern Australia with populations also occurring in the southeast of QLD and northeast of NSW.	Nil	No suitable habitat onsite. No known records of this species within locality.
10.	***Ephippiorhynchus asiaticus*** Black-necked Stork	E	-	24	NSW Atlas	Black-necked Storks are mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands.	**Low-Moderate**	Marginal foraging habitat within the study area in dam.

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
11.	***Falco hypoleucos*** Grey Falcon	E	V	P	PMST	Medium-sized, compact, pale falcon with a heavy, thick-set, deep-chested appearance. The species is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	Nil	No suitable habitat within the Development Site. No records within locality.
12.	***Glossopsitta pusilla*** Little Lorikeet	V	-	21	NSW Atlas	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in *Angophora*, *Melaleuca* and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.	**Moderate**	Suitable foraging habitat within the Development Site. Marginal nesting habitat present. Species not detected within the Development Site during targeted surveys.
13.	***Grantiella picta*** Painted Honeyeater	V	V	P	PMST	Inhabits Acacia pendula, Acacia harpophylla, Box-Gum Woodlands and Box-Ironbark Forests. Feeds on the fruits of mistletoes growing on woodland eucalyptus and acacia.	Nil	No suitable habitat within the study area.
14.	***Haliaeetus leucogaster*** White-bellied Sea-Eagle	V	M	7	NSW Atlas	Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest).	Low	Marginal foraging habitat within the Development Site. No nests were detected during habitat assessments within the Development Site. Species not detected during targeted surveys.
15.	***Hamirostra melanosternon*** Black-breasted Buzzard	V	-	1	NSW Atlas	Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat.	Nil	No suitable habitat in the study area. Study area is outside usual range of the species. Only one record in the locality.
16.	***Hieraaetus morphnoides*** Little Eagle	V	-	1	NSW Atlas	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	**Moderate**	There is one record in the locality and potential habitat is present in the study area.

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
17.	***Hirundapas caudacutus*** White-throated Needletail		V,M		PMST	Most often seen in eastern Australia before storms, low pressure troughs and approaching cold fronts and occasionally bushfire. These conditions are often used by insects to swarm (eg termites and ants) or tend to lift insects away from the surface which favours sighting of White-throated Needletails as they feed.	**Moderate**	Broadly suitable habitat within the Development Site. The species may occasionally utilise the aerial habitat above the site as part of a broader range. Species not detected during targeted surveys.
18.	***Lathamus discolor*** Swift Parrot	E	CE, M	2	NSW Atlas, PMST	This migratory species has been recorded on the mainland from a variety of habitat types including dry and wet sclerophyll forest, forested wetlands, coastal swamp forests and heathlands. This species does not breed within mainland Australia.	Low	Marginal habitat in the subject site (Spotted Gum canopy feed trees). Only two records of the species in the locality.
19.	***Melithreptus gularis gularis*** Black-chinned Honeyeater (eastern subspecies)	V	-	3	NSW Atlas	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*Eucalyptus albens*), Inland Grey Box (*Eucalyptus microcarpa*), Yellow Box (*Eucalyptus melliodora*), Blakely's Red Gum (*Eucalyptus blakelyi*) and Forest Red Gum (*Eucalyptus tereticornis*). It is often found along waterways, especially in arid and semi-arid areas and in northern Australia. It is occasionally seen in gardens and street trees.	**Moderate**	Marginal habitat in the study area. There are three records in the locality, from 1998 and 2004.
20.	***Neophema pulchella*** Turquoise Parrot	V	-	2	NSW Atlas	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland, feeding in the shade of a tree. Spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Forages quietly and may be quite tolerant of disturbance. However, if flushed it will fly to a nearby tree and then return to the ground to browse as soon as the danger has passed. Nests in tree hollows, logs or posts, from August to December.	Low	Marginal foraging habitat within the subject site in some areas with an open understorey; however, most of the vegetation was considered too dense in the understorey for this species foraging requirements.

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
21.	***Ninox connivens*** Barking Owl	V	-	2	NSW Atlas	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile riparian soils.	Low	Potential foraging habitat across the study area but marginal breeding habitat. There are two records in the locality but these are at least 19 years old.
22.	***Ninox strenua*** Powerful Owl	V	-	13	NSW Atlas	The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine, Black She-oak, Blackwood, Rough-barked Apple, Cherry Ballart and a number of eucalypt species. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	Low	Potential foraging habitat across the study area. There are 13 records in the locality.
23.	***Numenius madagascariensis*** Eastern Curlew	-	CE	-	PMST	The eastern curlew is Australia's largest shorebird and a long-haul flyer. It is easily recognisable, with its long, down-curved bill. The species takes an annual migratory flight to Russia and north-eastern China to breed, arriving back home to Australia in August.	Nil	No suitable habitat within the Development Site.
24.	***Oxyura australis*** Blue-billed Duck	V	-	1	NSW Atlas	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover.	Nil	No suitable habitat within the study area.
25.	***Pandion haliaetus*** Eastern Osprey	V	M	3	NSW Atlas	Found mostly in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia.	Low	Marginal habitat within the study area. No nests present.

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
26.	***Petroica boodang*** Scarlet Robin	V	-	1	NSW Atlas	The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	Low	Marginal habitat within the Development Site. Only one record within the locality.
27.	***Pomatostomus temporalis temporalis*** Grey-crowned Babbler (eastern subspecies)	V	-	3	NSW Atlas	Inhabits open forests, woodlands, road verges with grassy groundcover, sparse shrubs. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. A nest is used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts.	Low	Marginal foraging habitat within the subject site in some areas with an open understorey; however, most of the vegetation was considered too dense in the understorey for this species foraging requirements.
28.	***Ptilinopus magnificus*** Wompoo Fruit-Dove	V	-	1	NSW Atlas	Occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula. Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests.	Low	Marginal foraging habitat within the subject site. Only one record within the locality.
29.	***Stictonetta naevosa*** Freckled Duck	V	-	4	NSW Atlas	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	Low	Marginal habitat within the study area in dam.
30.	***Tyto novaehollandiae*** Masked Owl	V	-	8	NSW Atlas	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	**Moderate**	Marginal foraging suitable habitat within the Development Site. There are 8 records within the locality.
Mammals								

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
1.	***Chalinolobus dwyeri*** Large-eared Pied Bat	V	V	1	PMST, NSW Atlas	Found in well-timbered areas containing gullies. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features.	Nil	No suitable nesting habitat (caves) within the Development Site.
2.	***Dasyurus maculatus*** Spotted-tailed Quoll	V	E	1	NSW Atlas, PMST	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Low	Suitable foraging habitat potentially present onsite but no denning habitat present in the surrounds. Species last sighted within locality in 2004.
3.	***Falsistrellus tasmaniensis*** Eastern False Pipistrelle	V	-	25	NPWS Atlas	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in tree hollows but has also been found under loose bark on trees or in buildings.	**Moderate**	Suitable foraging habitat present within the Development Site. No roosting habitat present.
4.	***Micronomus norfolkensis*** Eastern Coastal Free-tailed Bat	V	-	40	NSW Atlas	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	**Known**	Found during Fauna surveys (Kleinfelder 2017)
5.	***Miniopterus australis*** Little Bentwing-bat	V	-	67	NSW Atlas. BAM	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings.	**Known**	Found during Fauna surveys (Kleinfelder 2017)
6.	***Miniopterus orianae oceanensis*** Large Bent-winged Bat	V	-	29	NSW Atlas,	Forages in forested habitats. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings, and other man-made structures.	**Known**	Found during Fauna surveys (Kleinfelder 2017)

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
7.	***Myotis macropus*** Southern Myotis	V	-	21	NSW Atlas	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	**Known**	Found during Fauna surveys (Kleinfelder 2017)
8.	***Petauroides volans*** Greater Glider	-	V	2	PMST, NSW Atlas	Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Shelters during the day in tree hollows.	Nil	No suitable habitat within the Development Site.
9.	***Petaurus norfolcensis*** *Squirrel Glider*	*V*	-	*26*	*BioNet Atlas*	The occurrence of the species is highly dependent on availability of suitable foraging habitat with abundant tree hollows for nesting. To the west of the Great Dividing Range, the species is known to inhabit mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range. In coastal areas, the species is known to utilise a range of dry and moist sclerophyll forest types, swamp forest and woodland vegetation communities dominated by winter-flowering eucalypts or flowering banksias, and summer flowering-eucalypts with an understorey of Acacia species that provide edible gum exudates in winter (e.g. A. irrorata, A. parramattensis, A. longifolia). In the Lake Macquarie LGA, the species is known to occur in vegetation communities containing Corymbia maculata (Spotted Gum), Eucalyptus haemastoma (Scribbly Gum), E. robusta (Swamp Mahogany) and C. gummifera (Red Bloodwood). Squirrel Gliders are highly localised and feed on nectar, pollen and sugary plant and insect exudates. They also nest in tree hollows with small hollow entrances to exclude predators.	**High**	Marginal foraging and nesting habitat in the subject site. Most the habitat within the subject site is regrowth vegetation around a disused quarry. The understorey lacks the abundance of foraging resources required by the species and areas of denser understorey is highly weed affected. There is also a low number of hollow-bearing trees within the subject site. The habitat to the east of the subject site within the remnant open forest would provide better habitat for the species. There are 26 records in the locality of the study area; most of these records are located within remnant open forest vegetation to the east and north-east of the study area.

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
10.	***Petrogale penicillata*** Brush-tailed Rock-wallaby	-	E	-	PMST	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.	Nil	No suitable habitat within the Development Site. No records within locality.
11.	***Phascogale tapoatafa*** Brush-tailed Phascogale	V	-	5	NPWS Atlas	Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. The species also inhabits heath, swamps, rainforest and wet sclerophyll forest. It is an agile climber, foraging preferentially in rough barked trees of 25 cm DBH or greater and nests in tree hollows with entrances 2.5-4 cm wide.	Low	Marginal habitat in the study area. Has been recorded in the locality but at least four km away in vegetation that is disconnected to the habitats in the study area.
12.	***Phascolarctos cinereus*** Koala	V	V	1	NSW Atlas PMST	Found in a variety of forest types with suitable feed tree species.	Low	Potential habitat due to the presence of feed tree species. Species last sighted within the locality in 2017.
13.	***Potorous tridactylus tridactylus*** Long-nosed Potoroo (SE Mainland Population)	V	V	-	PMST	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	Nil	No suitable habitat in the study area
14.	***Pseudomys novaehollandiae*** New Holland Mouse	-	V	P	PMST	Inhabits open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	Nil	Marginal habitat within the Development Site. No records within locality.
15.	***Pteropus poliocephalus*** Grey-headed Flying-fox	V	V	51	NSW Atlas, PMST	Occurs across a wide range of habitat types along the eastern seaboard of Australia, depending on food availability. Fruit from myrtaceous trees and rainforest trees form the major components of their diet.	**Moderate**	Suitable foraging habitat present across the Development Site when Eucalypt species are in flower. No camps detected on site.

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
16.	***Saccolaimus flaviventris*** Yellow-bellied Sheathtail-bat	V	-	7	NSW Atlas	Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Roosts in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	**Moderate**	Potential foraging habitat present within the Development Site. Roosting habitat present.
17.	***Scoteanax rueppellii*** Greater Broad- nosed Bat	V	-	22	NSW Atlas	This species occurs in a variety of habitats including rainforest, dry and wet sclerophyll forest and eucalypt woodland.	**Moderate**	Marginal foraging and roosting habitat present within the Development Site.
18.	*Vespadelus troughtoni* Eastern Cave Bat	V	-	5	NSW Atlas	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	**Low**	No suitable breeding habitat in the study area or within 2kms
Amphibians								
1.	***Litoria aurea*** Green and Golden Bell Frog	E	V	1	PMST, NSW Atlas	This species prefers open water bodies, fringed by reeds and other aquatic vegetation for breeding and foraging purposes. Needs fallen logs and debris for shelter and over-wintering purposes.	Nil	No suitable habitat within the Development Site.
2.	***Mixophyes balbus*** Stuttering Frog	E	V	P	PMST	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	Nil	No suitable habitat within the Development Site. No records within locality.
Migratory Species								
1.	***Apus pacificus*** Pacific Swift	-	M	-	PMST	Almost entirely aerial and give spectacular displays of high-speed flying above any habitat, urban or rural. Swifts are most often seen in late summer, nearly always in flocks. They are typically associated with stormy weather when they feed on nuptial swarms of various insects.	**Moderate**	Potential aerial foraging habitat across study area.

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
2.	***Cuculus optatus*** Oriental Cuckoo	-	M	-	PMST	Inhabits rainforest margins, monsoon forest, vine scrub, riverine thickets, wet densely canopied Eucalypt forests, paperbark swamp and mangroves.	Low	Unlikely to occur in the Hunter region (regional status is 'Accidental' (Hunter Bird Observers Club, 2015).
3.	***Hirundapus caudacutus*** White-throated Needletail	-	M,V	2	NSW Atlas, PMST	Forages in high open spaces over varied habitat types. May aerially forage over the Development Site.	**Moderate**	Potential aerial foraging habitat across study area. Known from the locality
4.	***Monarcha melanopsis*** Black-faced Monarch	-	M	-	PMST	Found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	**Moderate**	Marginal habitat in the study area, potential habitat within the wider locality.
5.	***Monarcha trivirgatus*** Spectacled Monarch	-	M	-	PMST	Prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	Nil	No suitable habitat within the Development Site.
6.	***Motacilla flava*** Yellow Wagtail	-	M	-	PMST	Typically inhabits inundated fields, saltmarsh and wetlands and occasionally coastal areas.	Nil	No suitable habitat within the Development Site.
7.	***Myiagra cyanoleuca*** Satin Flycatcher	-	M	-	PMST	Found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	Nil	No suitable habitat within the Development Site.
8.	***Rhipidura rufifrons*** Rufous Fantail	-	M	-	PMST	Found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground.	Nil	No suitable habitat within the Development Site.
Threatened Ecological Communities								

	Species	Status		Records	Source	Habitat	LoO	Summary
		BC	EPBC					
1.	*Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregion* (BC Act)/*Central Hunter Valley eucalypt forest and woodland* (EPBC Act)	E	CE	-	PMST	Occurs in areas of relatively low rainfall and high temperatures. It is associated mostly with Permian lithology, and is situated on gently undulating hills, slopes and valleys, or occasionally on rocky knolls.	Nil	Absent from Development Site.
2.	*Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community*	-	E	-	PMST	Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees.	Nil	Absent from Development Site
3.	Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion	E	-	--	Surveys	Restricted to a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area in the Central and Lower Hunter Valley. Within this range, the community was once widespread. A fragmented core of the community still occurs between Cessnock and Beresfield. Remnants occur within the Local Government Areas of Cessnock, Maitland, Singleton, Lake Macquarie, Newcastle and Port Stephens but may also occur elsewhere within the bioregion. Outliers are also present on the eastern escarpment of Pokolbin and Corrabare State Forests on Narrabeen Sandstone.	Known	Identified within the study area
4.	River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	E	CE	P	PMST	Given its habitat, the community has an important role in maintaining river ecosystems and riverbank stability Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level.	Nil	Absent from Development Site

APPENDIX B FLORA SPECIES LIST

Table B1 Flora Species List

Scientific	Common Name	BAM Growth Form*	Status
General Biosecurity Duty			
Thunbergia alata	Black-eyed Susan	Exotic	
Agave americana	Century Plant	Exotic	
Ageratina adenophora	Crofton Weed	Exotic	
Bidens pilosa	Cobbler's Pegs	Exotic	
Hypochaeris radicata	Catsear	Exotic	
Trifolium repens	Clover	Exotic	
Senna pendula var. glabrata	-	Exotic	
Sida rhombifolia	Paddy's Lucerne	Exotic	
Andropogon virginicus	Whisky Grass	Exotic	
Cenchrus clandestinus	Kikuyu Grass	Exotic	
Chloris gayana	Rhodes Grass	Exotic	
Megathyrsus maximus	Guinea Grass	Exotic	
Paspalum dilatatum	Paspalum	Exotic	
Paspalum urvillei	Vasey Grass	Exotic	
Solanum seaforthianum	Climbing Nightshade	Exotic	
Verbena bonariensis	Purple Top	Exotic	
Weeds of National Significance **Priority Weeds for the Hunter**			
Asparagus aethiopicus	Ground Asparagus	High Threat	
Senecio madagascariensis	Fireweed	High Threat	
Lantana camara	Lantana	High Threat	
Priority Weeds of the Hunter **Regional Recommended Measure for the Hunter**			
Bryophyllum delagoense	Mother-of-Millions	Exotic	
Canopy Species			
Casuarina glauca	Swamp Oak	Tree	
Corymbia maculata	Spotted Gum	Tree	
Eucalyptus acmenoides	White Mahogany	Tree	
Eucalyptus fibrosa	Broad-leaved Ironbark	Tree	
Eucalyptus globoidea	White Stringybark	Tree	
Eucalyptus moluccana	Coastal Grey Box	Tree	

Scientific	Common Name	BAM Growth Form*	Status
Eucalyptus punctata	Grey Gum	Tree	
Midstorey			
Acacia elongata	Swamp Wattle	Shrub	
Acacia falcata	Hickory Wattle	Shrub	
Acacia fimbriata		Shrub	
Acacia implexa	Hickory Wattle	Shrub	
Acacia parvipinnula	Silver-stemmed Wattle	Shrub	
Notelaea longifolia	Large Mock-olive	Tree	
Glochidion ferdinandi	Cheese Tree	Tree	
Bursaria spinosa	Blackthorn	Shrub	
Persoonia linearis	Narrow-leaved Geebung	Shrub	
Understorey Shrubs			
Ozothamnus diosmifolius	Rice Flower	Shrub	
Hibbertia obtusifolia	Hoary Guinea Flower	Shrub	
Leucopogon juniperinus	Prickly Beard-heath	Shrub	
Leucopogon lanceolatus		Shrub	
Acacia ulicifolia	Prickly Moses	Shrub	
Daviesia ulicifolia	Gorse Bitter Pea	Shrub	
Dillwynia retorta	-	Shrub	
Indigofera australis	Australian Indigo	Shrub	
Pultenaea spinosa	Spiny Bush-pea	Shrub	
Pultenaea villosa	Hairy Bush-pea	Shrub	
Acacia stricta	Straight Wattle	Shrub	
Breynia oblongifolia	Coffee Bush	Shrub	
Phyllanthus hirtellus	Thyme Spurge	Shrub	
Solanum prinophyllum	Forest Nightshade	Shrub	
Understorey Natives			
Pseuderanthemum variabile	Pastel Flower	Forb	
Arthropodium milleflorum	Pale Vanilla-lily	Forb	
Parsonsia straminea	Common Silkpod	Other (Vine)	
Brachyscome multifida	Cut-leaved Daisy	Forb	
Chrysocephalum apiculatum	Common Everlasting	Forb	

Scientific	Common Name	BAM Growth Form*	Status
Vernonia cinerea	-	Forb	
Wahlenbergia gracilis	Sprawling Bluebell	Forb	
Einadia hastata	Berry Saltbush	Forb	
Commelina cyanea	-	Forb	
Juncus usitatus	-	Rush	
Lepidosperma laterale	-	Sedge	
Glycine clandestina	-	Other (Vine)	
Hardenbergia violacea	Purple Coral Pea	Other (Vine)	
Kennedia rubicunda	Dusky Coral Pea	Other (Vine)	
Goodenia rotundifolia	-	Forb	
Cycnogeton procerum	Water Ribbons	Forb	
Pratia purpurascens	Whiteroot	Forb	
Lomandra filiformis	Wattle Mat-rush	Rush	
Lomandra longifolia	Spiny-headed Mat-rush	Rush	
Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush	Rush	
Eustrephus latifolius	Wombat Berry	Other (Vine)	
Geitonoplesium cymosum	Scrambling Lily	Other (Vine)	
Caladenia catenata	White Caladenia	Forb	
Pterostylis longifolia	Tall Greenhood	Forb	
Pterostylis pedunculata	Maroonhood	Forb	
Oxalis perennans	-	Forb	
Dianella revoluta	Blueberry Lily	Forb	
Billardiera scandens	Hairy Apple Berry	Other (Vine)	
Cheilanthes sieberi subsp. sieberi	Poison Rock Fern	Fern	
Pteridium esculentum	Common Bracken Fern	Fern	
Clematis aristata	Old Man's Beard	Other (Vine)	
Opercularia aspera	Coarse Stinkweed	Forb	
Pomax umbellata	-	Forb	
Typha orientalis	Broadleaf Cumbungi	Rush	
Grass Species			
Aristida vagans	Threeawn Speargrass	Grass	
Cynodon dactylon	Couch	Grass	

Scientific	Common Name	BAM Growth Form*	Status
Dichelachne micrantha	Shorthair Plumegrass	Grass	
Echinopogon caespitosus	Bushy Hedgehog-grass	Grass	
Entolasia marginata	Bordered Panic	Grass	
Entolasia stricta	Wiry Panic	Grass	
Imperata cylindrica	Blady Grass	Grass	
Microlaena stipoides var. stipoides	Weeping Grass	Grass	
Poa labillardierei var. labillardierei	Tussock	Grass	
Rytidosperma fulvum	Wallaby Grass	Grass	
Themeda triandra	Kangaroo Grass		

APPENDIX C FAUNA SPECIES LIST

Table C1 Fauna Species List

No.	Scientific Name	Common Name	Status		Observation Type*
			BC Act	EPBC Act	
	Birds				
1.	*Acanthiza lineata*	Striated Thornbill	-	-	H
2.	*Acanthiza pusilla*	Brown Thornbill	-	-	VO
3.	*Dacelo novaeguineae*	Laughing Kookaburra	-	-	VO
4.	*Cracticus nigrogularis*	Pied Butcherbird	-	-	H
5.	*Cracticus tibicen*	Australian Magpie	-	-	VO
6.	*Strepera graculina*	Pied Currawong	-	-	H
7.	*Cacatua galerita*	Sulphur-crested Cockatoo	-	-	VO
8.	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	-	-	VO, H
9.	*Streptopelia chinensis*	Spotted Dove	-	-	H
10.	*Corvus coronoides*	Australian Raven	-	-	VO, H
11.	*Malurus cyaneus*	Superb Fairy-wren	-	-	H
12.	*Malurus lamberti*	Variegated Fairy-wren	-	-	VO
13.	*Lichenostomus chrysops*	Yellow-faced Honeyeater	-	-	VO, H
14.	*Manorina melanocephala*	Noisy Miner	-	-	H
15.	*Pachycephala inornata*	Gilbert's Whistler	-	-	VO
16.	*Pardalotus punctatus*	Spotted Pardalote	-	-	H
17.	*Trichoglossus haematodus*	Rainbow Lorikeet	-	-	H
18.	*Rhipidura albiscapa*	Grey Fantail	-	-	VO, H
19.	*Rhipidura leucophrys*	Willie Wagtail	-	-	H
Mammals					
1.	*Antechinus stuartii*	Brown Antechinus	-	-	VO
2.	*Mormopterus norfolkensis*	Eastern Freetail-bat	V	-	R
3.	*Tadarida australis*	White-striped Freetail-bat	-	-	R
4.	*Rattus rattus*	*Black Rat	-	-	VO
5.	*Trichosurus vulpecula*	Common Brushtail Possum	-	-	VO
6.	*Chalinolobus gouldii*	Gould's Wattled Bat	-	-	R
7.	*Chalinolobus morio*	Chocolate Wattled Bat	-	-	R
8.	*Miniopterus australis*	Little Bentwing-bat	V	-	R
9.	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V	-	R

No.	Scientific Name	Common Name	Status		Observation Type*
			BC Act	EPBC Act	
10.	*Myotis macropus*	Southern Myotis	V	-	R
Reptile					
1.	*Amphibolurus muricatus*	Jacky Dragon	-	-	VO
2.	*Acritoscincus platynotum*	Red-throated Skink	-	-	VO
3.	*Ctenotus robustus*	Robust Ctenotus	-	-	VO
4.	*Lampropholis guichenoti*	Grass Skink	-	-	VO

* Observation Type: VO (Visual Observation), H (Heard whilst on site), E (Evidence recorded inc scats, tracks or markings), C (Caught on Remote Camera), T (Trapped), R (Recorded through the use of call detectors).

** General Abundance: I (Individual record), UC (Uncommon, 2-5 records), C (Common occurrence on site >5 records). Anabat Detections are classed by confidence: Confident (C), Probable (Pr), and Possible (Po)

^ Denotes introduced species.

APPENDIX D STAFF CONTRIBUTIONS

The following staff were involved in the compilation of this report.

Table E1 Staff Contributions

Name	Qualification	Title/Experience	Contribution
Mark Dean	BEnvSc & Mgt	Ecologist (Zoologist)	Fauna surveys and Report Preparation
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	GIS and figure preparation
Dr. Daniel O'Brien	BEnvSc&Mgt (PhD)	Senior Ecologist	Report preparation
Dr. Gilbert Whyte	BSc (PhD) Accredited BAM Assessor	Senior Ecologist	Report Review

APPENDIX E LICENCING

Kleinfelder employees involved in the current study are licensed or approved under the *Biodiversity Conservation Act 2016* (License Number: SL100730, Expiry: 31 March 2021) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.

107 Haussman Drive, Thornton
Biodiversity Development Assessment Report

107 Haussman Drive (Lot 2 DP1145348), Thornton NSW 2322 20220611

09 September 2022

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107 Haussman Drive, Thornton
Biodiversity Development Assessment Report

107 Haussman Drive (Lot 2 DP1145348), Thornton NSW 2322

Kleinfelder Project: 20220611

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Prepared	Reviewed	Endorsed
Ben Stewart	Dan O'Brien	Dallas Milburn

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1 INTRODUCTION

1.1 SCOPE

Kleinfelder Australia Pty Ltd (Kleinfelder) was engaged by McCloy Group, to prepare a streamline Biodiversity Development Assessment Report (streamline BDAR) to identify constraints associated with the rezoning of Lot 2 DP 1145348 from RU2 – Rural Landscape to R1 General Residential and E2 – Environmental Conservation (Figure 1). The following terms are used throughout this report to describe particular geographical areas:

- Study Area (19 ha) – Lot 2 DP1145348 (107 Haussman Drive, Thornton NSW 2322) (**Figure 2**)
- Development Site – proposed R1 Zone (**Figure 2**)
- Retained – proposed E3 Zone (**Figure 2**)
- Locality – land within a 5 km radius of the Study Area (**Figure 1**).

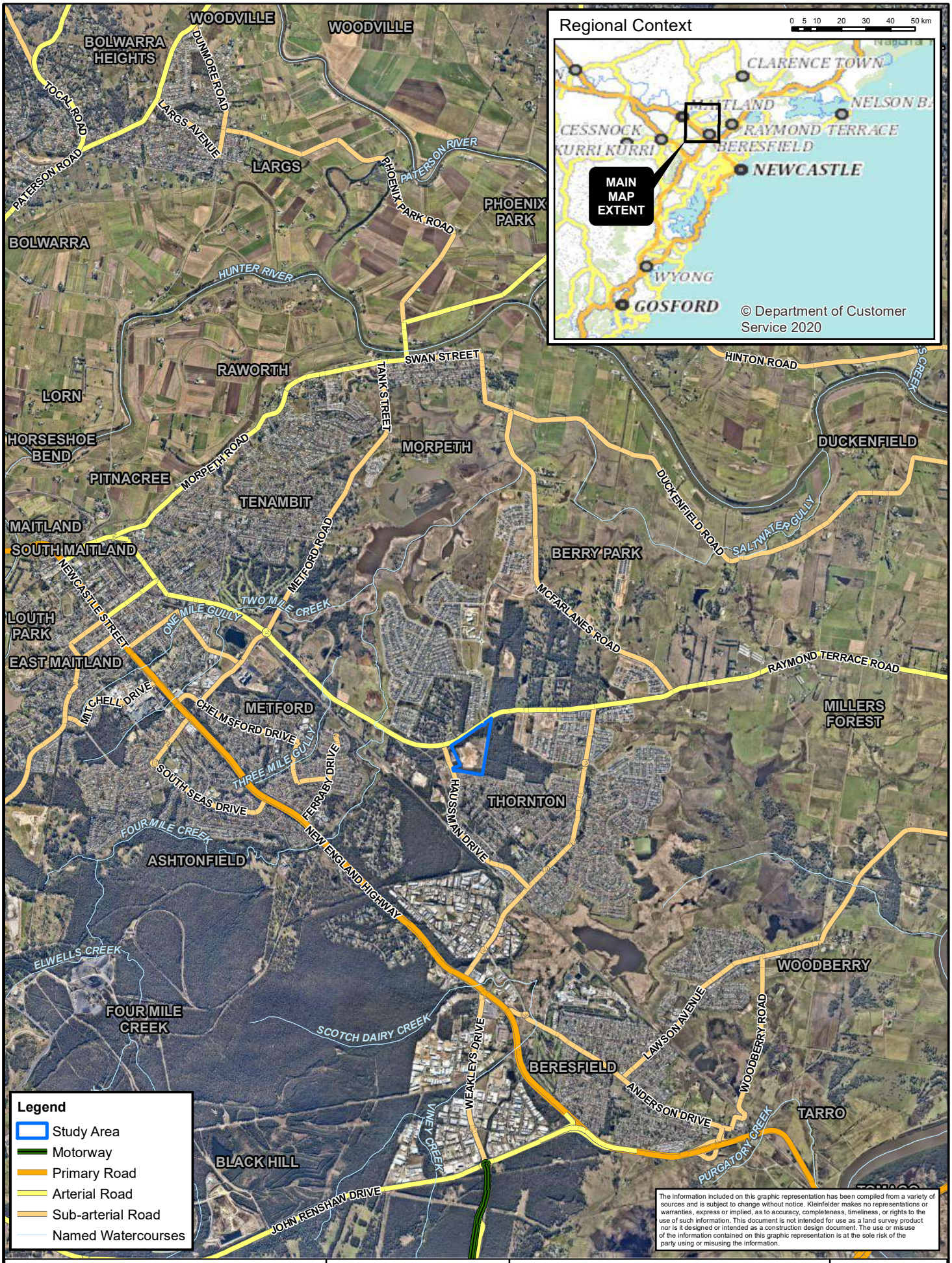
1.2 LOCAL CONTEXT

The study area is approximately 19 hectares (ha) and is legally defined as Lot 2 DP 1145348. The Study Area is located in the Maitland City Council (MCC) Local Government Area (LGA) and is zoned RU2 – Rural Landscape under the Maitland Local Environmental Plan 2011 (Maitland LEP 2011).

The study area adjoins Rural lands (RU2) to the east and west, General Residential lands (R1) to the north and south, and Large Lot Residential lands (R5) to the north-west. It is located generally on the south-eastern corner where Haussman Drive intersects with Raymond Terrace Road. Lands zoned E3 – Environmental Management are located further to the east, and also further to the south-west on the southern side of the train line. It is understood that a rezoning/subdivision is proposed on the adjacent land to the east (480 Raymond Terrace Road, Lot 182 DP 792071). The site is mapped as Category 1 land in the Maitland Urban Settlement Strategy.

1.3 PROPOSED REZONING

Kleinfelder understands that large part of the site is subject to an approved development (DA17/2593). The extent of the approved development is shown on Figure 2. The approved development also includes an Asset Protection Zone (APZ) which extends beyond the extent of the approved DA boundary as shown on Figure 2. The proposed rezoning of the central portion of the site to R1 – General Residential includes the area of approved development and a narrow band around the extent of the approved DA (mostly cleared). The remaining areas of the site are proposed to be rezoned E3 – Environmental Management.



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DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2021

Locality

McCloy Group
Biodiversity Development Assessment Report
Lot 2 DP 1145348
Haussman Drive, Thornton NSW

FIGURE:

1

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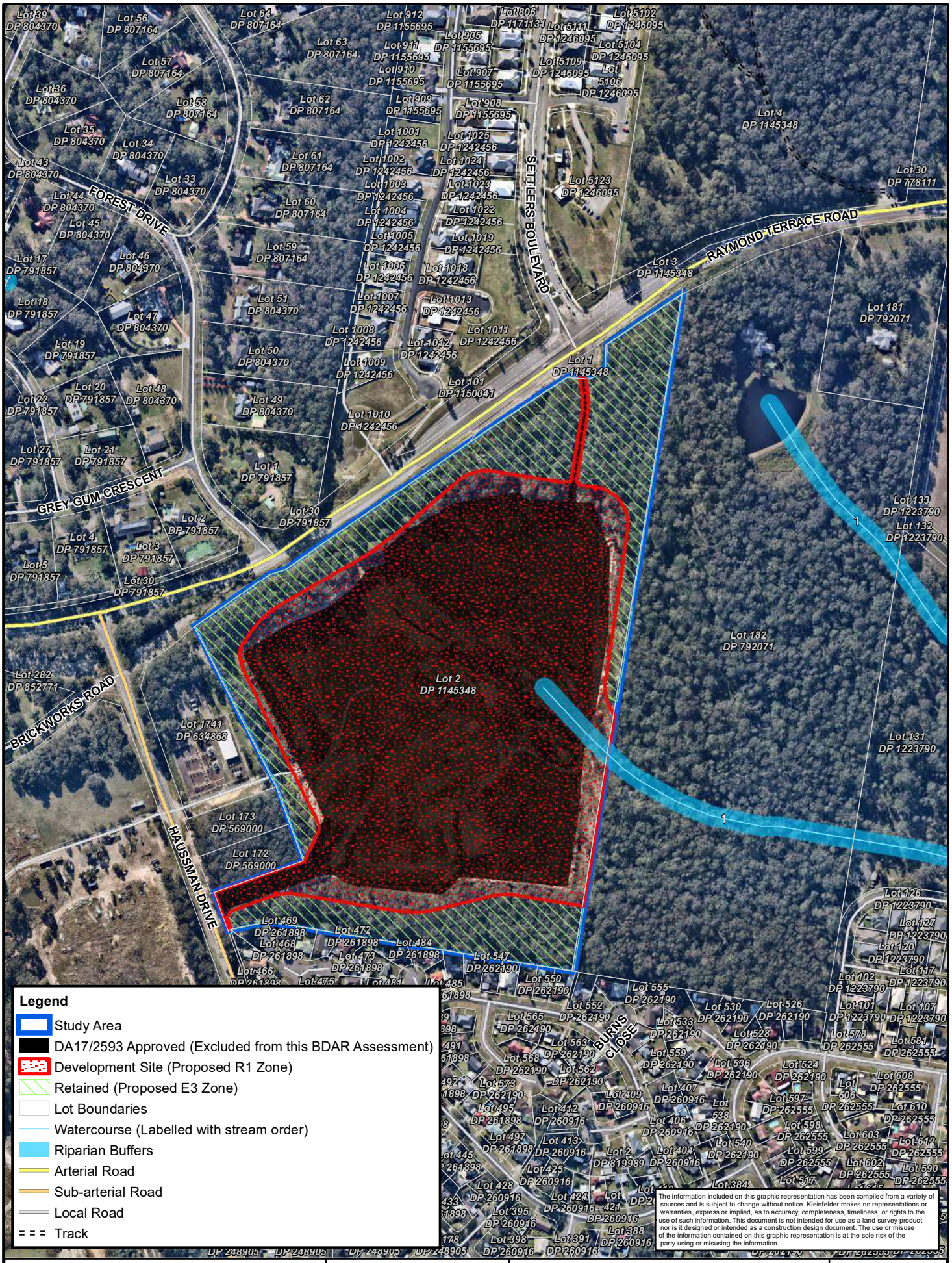

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Study Area and Development Site

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Lot 2 DP 1145348
Haussman Drive, Thornton NSW

FIGURE:

2

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1.4 INFORMATION SOURCES

The following information sources were utilised to inform the biodiversity development assessment which provided knowledge of existing literature pertaining to the Development Site and broader locality:

- The NSW DPE BioNet Vegetation Classification (formerly known as the NSW Vegetation Information System Classification Database) (DPE, 2022a).
- The NSW DPE Threatened Biodiversity Data Collection (formerly known as the Threatened Species Profile Database) (DPE, 2022b).
- The NSW DPE BioNet Atlas of NSW (formerly known as the NSW Wildlife Atlas) (DPE, 2022c).
- The Commonwealth Department of the Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES) (DAWE, 2022a).
- The Commonwealth DAWE *Species Profile and Threats Database* (SPRAT) (DAWE, 2022b).
- Relevant published literature.

1.5 LEGISLATIVE CONTEXT

Assessment of the proposed development was undertaken in accordance with and in consideration of the following Acts and Policies:

- Commonwealth:
  - *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- State:
  - *Biodiversity Assessment Method (DPIE, 2020a)*
  - *Biodiversity Conservation Act 2016* (NSW) (BC Act)
  - *Biodiversity Conservation Regulation 2017* (NSW) (BC Regulation)
  - *Environmental Planning and Assessment Act 1979* (EP&A Act)
  - *Biodiversity Conservation (Savings and Transitional) Regulation 2017*
  - *Biosecurity Act 2015*
  - *State Environmental Planning Policy (Biodiversity and Conservation) 2021 – Chapter 3 (Koala Habitat Protection) 2020.*
- Local:
  - Maitland Local Environmental Plan 2011 (MLEP 2011)
  - Maitland Development Control Plan 2011 (MDCP 2011).

1.5.1 Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

Under the EPBC Act assessment, an approval is required for actions that are likely to have a significant impact on matters of national environmental significance (MNES). An action includes a project, development, undertaking, activity, or series of activities. When a person proposes to take an action, they believe may need approval under the EPBC Act, they must refer the proposed development to the Australian Government Minister for the Environment. The Act identifies nine MNES:

1. World Heritage properties;
2. National heritage places;
3. Wetlands of international importance (Ramsar Convention);
4. Listed threatened species and communities;
5. Migratory species listed under international agreements;
6. Great Barrier Reef Marine Park;
7. Commonwealth marine areas;

8. Nuclear actions; and
9. Water resources in respect to Coal Seam Gas and large coal mines.

While this BDAR is not required to address MNES, the proponent is required to address the EPBC Act as part of their development application. Items 3, 4 and 5 are relevant to the current proposed development.

1.5.2 Biodiversity Conservation Act 2016 (NSW)

Biodiversity Assessment Pathway

As per Part 7.7 of the BC Act, all applications for development consent under Part 4 of the EP&A Act are to be accompanied by a BDAR[1] unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values. Part 7.2 of the BC Act states that a development is *likely to significantly affect threatened species* if it:

- Is carried out within an area of Outstanding Biodiversity Value, or
- Exceeds the Biodiversity Offset Scheme (BOS) thresholds, which includes:
    - Clearing of native vegetation, or undertaking a prescribed activity, on land mapped on the NSW Biodiversity Vales Map (BV Map), or
    - Clearing of native vegetation of an area declared by clause 7.2 of the BC Regulation as exceeding the threshold.
- Is likely to significantly affect threatened species or ecological communities, or their habitat, according to the test in section 7.3 (5-part test).

The proposed development does not occur within an area of Outstanding Biodiversity Value (AOBV).

The NSW biodiversity values map was reviewed, and there are no areas of biodiversity value mapped within the Study Area.

Under clause 7.2 of the BC Regulation, the area of native vegetation clearing threshold for the proposed development is 1 ha or more, as the minimum lot size of the Development Site is 40 ha. However, it is understood that the minimum lot size following rezoning (prior to subdivision/development) will be reduced to <1ha, such that the vegetation clearing threshold for entry into the BOS will be 0.25 ha. If this minimum lot size was applied, a streamline BDAR (small area module) could be undertaken if the vegetation clearing is equal to, or less than, 1 ha. The proposed development will directly impact on approximately 0.82 ha of native vegetation. As such, the proposed development exceeds the native vegetation clearing threshold set out in the BC Regulation, and a BDAR is required for the proposed development.

Biodiversity Assessment Method

Section 2.2 of the BAM (DPIE, 2020a) summarises the streamlined assessment modules that may be used by an assessor. These streamlined assessment modules may be used where the proposed development impacts on:

a) scattered trees (Appendix B of the BAM).
b) a small area (Appendix C of the BAM).

[1] With the exception of:
(a) an application for development consent for State significant development, or
(b) an application for a complying development certificate.

c) planted native vegetation, where the planted native vegetation was planted for purposes such as street trees and other roadside plantings, windbreaks, landscaping in parks and gardens, and revegetation for environmental rehabilitation (Appendix D of the BAM).

Appendices B, C and D of the BAM set out the circumstances where each of the streamlined assessment modules can be used to assess a proposal and the specific assessment requirements. Streamlined assessment modules cannot be used to assess clearing within areas mapped by the Biodiversity Values Map.

The proposed rezoning of land to residential comprises 0.82 ha of native vegetation. Any development within the future residential zoned land will have the potential to impact 0.82 ha of native vegetation. Given the minimum lot size of 1 ha, the small area module of the BAM (streamline BDAR) is applicable to the project.

The Biodiversity Accredited Assessor System (BAAS) Case number for the project is 00024274. The BAM Calculator number for the project is 00024274/BAAS18041/21/00025808.

1.5.3 Biosecurity Act 2015

Under the *Biosecurity Act 2015* all plants are regulated with a general biosecurity duty *"to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable."* Under the Act, a biosecurity impact is *"an adverse effect on the economy, environment, or the community that arises, or has the potential to arise, from a biosecurity matter."*

All matters of biosecurity identified during the assessment, including High Threat Weeds (HTW) and Weeds of National Significance (WoNS) have been considered within this report.

1.5.4 State Environmental Planning Policy (Biodiversity and Conservation) 2021

The State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Biodiversity and Conservation SEPP) consolidates, transfers and repeals the provisions of eleven (11) SEPPs into a single environmental planning instrument. The Biodiversity and Conservation SEPP aims to promote the protection and improvement of key environmental assets for their intrinsic value and the social and economic benefits they provide. Relevant chapters of the Biodiversity and Conservation SEPP are considered below:

Chapter 3 - Koala Habitat Protection State Environmental Planning Policy (SEPP 2020)

This Chapter of the Biodiversity and Conservation SEPP incorporates the provisions of the now repealed Koala Habitat Protection SEPP 2020 (Koala SEPP 2020) and the Koala Habitat Protection SEPP 2021. The Koala Habitat Protection SEPP 2021 was made and commenced on 17 March 2021. The Koala SEPP 2021 reinstates the policy framework of SEPP Koala Habitat Protection 2019 to 83 Local Government Areas (LGA) in NSW; however, for all RU1, RU2 and RU3 zoned land outside of the Sydney Metropolitan Area and the Central Coast, Koala SEPP 2020 continues to apply.

The Koala SEPP aims to encourage the conservation and management of areas of natural vegetation that provide habitat for Koalas to support a permanent free-living population over their present range and reverse the current trend of Koala population decline. The Koala SEPP 2021 applies to each Local Government Area listed in Schedule 1 of the SEPP. However, for all RU1, RU2 and RU3 zoned land outside of the Sydney Metropolitan Area and the Central Coast, Koala SEPP 2020 continues to apply.

The Study Area is zoned RU2 – Rural Landscape under the Maitland LEP 2011, as such, the provisions of the Koala SEPP 2020 apply. See Section **4.1.1.** for a summary of the Koala habitat assessment.

2 LANDSCAPE CONTEXT

2.1 LANDSCAPE FEATURES

The landscape features and site context detailed in Section 3 of the BAM (DPIE, 2020a) are described in **Table 1**. These landscape features are also shown in **Figure 3**.

Table 1 Landscape context of Subject Site (107 Haussman Drive, Thornton).

Landscape Feature	Development Site
IBRA bioregion	Sydney Basin IBRA Region
IBRA subregion	Hunter IBRA Sub-region
LGA	City of Maitland
Mitchell Landscapes	**Newcastle Coastal Ramp** This landscape occurs on undulating lowlands and low to steep hills on complex patterns of faulted and gently folded Carboniferous conglomerate, lithic sandstone, felspathic sandstone, and mudstone. General elevation 50 to 275m, local relief 40 to 150m. Stony red texture-contrast soils on steep slopes, yellow and brown texture-contrast soils on lower slopes and deep dark clay loams along streams (Mitchell, 2002).
Rivers, streams and estuaries	One first order stream starts within the Study Area and flows to the west, outside of the Study Area (**Figure 3**). The current development design of the Subject Site impacts the head of the stream.
Wetlands	The closest mapped wetlands are the Woodberry Swamp (Approx. 1.3km from the Development Site) and Tarro Swamp (Approx. 4.3km from the Development Site), which are mapped under the SEPP Coastal Management Act 2018 as Coastal Wetlands. Additionally, the Hunter Wetlands National Park, listed as a RAMSAR Wetland, occurs approximately 11.5km from the Development Site.
Connectivity of different areas of habitat	The Development Site occurs within the Thornton north residential area that has majority cleared of wooded vegetation. Limited connectivity to other areas of wooded vegetation exists due to the intersection of Raymond Terrace Road to the north, Haussman Drive to the south-west and high-density residential areas to the south-east. Large areas of wooded vegetation occur to the south-west of the Development Site, however, these areas have limiting connectivity to the Development Site due to Haussman Drive, the Railway corridor adjacent to Haussman Drive, and the New England Highway further to the south-west.
Areas of geological significance and soil hazard features	The Development Site occurs on Class 5 land as mapped under the Maitland Local Environmental Plan 2011, and therefore has a low risk of acid sulfate soils occurring within the site. Class 2 Acid Sulfate Soils are mapped approximately 1km away to the south-east of the Development Site.
Areas of outstanding biodiversity value	The Development Site does not occur on an area mapped as Outstanding Biodiversity Value, or within proximity to an area mapped as Outstanding Biodiversity Value.

2.2 Site Context

Details of the landscape assessment for the Development Site, according to the BAM (DPIE, 2020a) using the site-based assessment methodology and determined by remote sensing and GIS are detailed below.

2.2.1 Native Vegetation Cover

Native vegetation cover estimated to remain in the landscape proximal to the Development Site has been calculated within a 1,500 m site buffer. The 1,500 m site buffer area has a total area of 1022 ha, of which 329 ha is native vegetation. This equates to 32% native vegetation cover (**Figure 3**).

2.3 Geology and Soils

The Study Area is mapped as occurring on the Beresfield soil landscape (DPE, 2022f). The Beresfield soil landscape is described as occurring on undulating low hills and rises on Permian sediments in the East Maitland Hills region. Soils are typically moderately deep (<120 cm) Podzolic soils. The dominant materials are described as fine sandy-clay or silty loams. These soils are prone to water erosion and localised seasonal waterlogging in low lying areas can occur.

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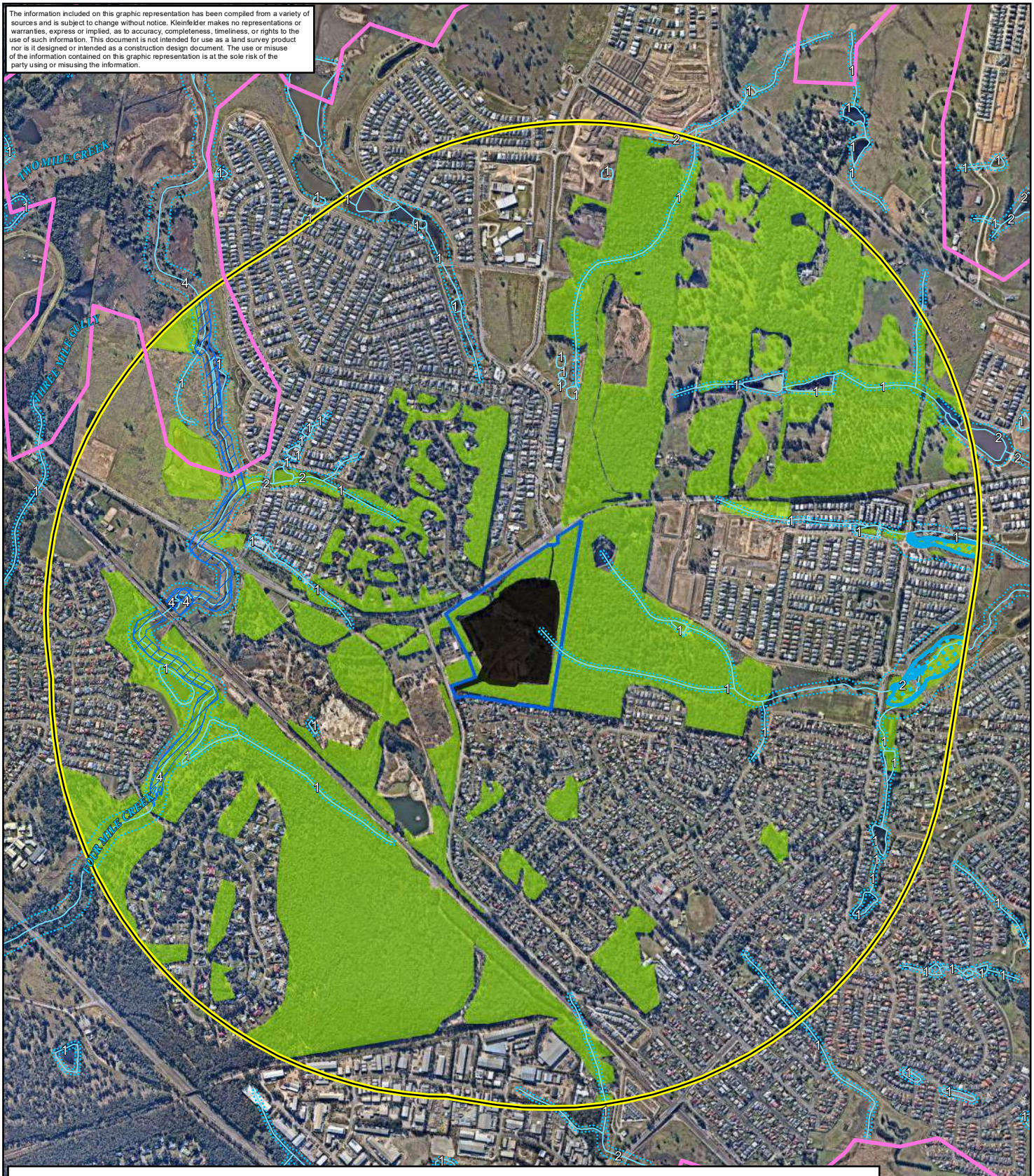

Legend

- Study Area
- DA17/2593 Approved (Excluded from this BDAR Assessment)
- Landscape Assessment - 1500m Buffer
- Landscape Assessment - Native Vegetation

Biodiversity Values (V11.4)

- Coastal Management Act - Wetlands
- Protected Riparian Land
- IBRA Sub-region Boundary (V7)
- Mitchell Landscapes Boundary (V3)
- Watercourse (Labelled with stream order)
- Riparian Buffers

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DATA SOURCE:
NSW DFSI - 2020
NSW EOH - 2020
Nearmap - 2020

Site Location - Landscape Context

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Lot 2 DP 1145348
Haussman Drive, Thornton NSW

FIGURE:

3

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3 NATIVE VEGETATION

3.1 METHODOLOGY

Native vegetation (**Figure 3**) at the Development Site was assessed in accordance with Section 4.2 of the BAM (DPIE, 2020a).

3.1.1 Data Review

Previous vegetation mapping within Lot 2 DP 1145348, completed as part of the Flora and Fauna Assessment Report (Kleinfelder, 2017) for a senior housing development, was reviewed in conjunction with plot-based surveys conducted as part of the current assessment.

3.1.2 Vegetation Mapping Surveys

Vegetation Mapping and Surveys

Detailed vegetation surveys were conducted across the Study Area on 12 and 26 May 2021. Areas of vegetation to be impacted by the amended development design were mapped during this period.

The ecotonal boundaries of each PCT within the development footprint were validated through ground-truthed surveys using a combination of rapid data points (RDPs) and vegetation boundary polygons. These attributes were collected in the field using a hand-held Trimble™ GPS unit. Additionally, aerial photographic interpretation (API) was used to aid in determining boundaries of PCTs within the Study Area.

Plant Community Type Determination

Each vegetation community identified within the Study Area was assigned to the closest equivalent PCT from those listed in the BioNet Vegetation Classification database (DPIE, 2020b). This was based on field data confirming dominant species present and floristic structure and composition within those vegetation communities. Other diagnostic features to aid in PCT classification included landscape position, soil type and descriptive attributes for those communities.

Relevant attributes of each PCT, such as floristic composition and structure, regional location, dominant species, etc, were assessed to determine if the vegetation within the Study Area is commensurate with known Threatened Ecological Communities (TECs) as defined by NSW (BC Act) and Commonwealth (EPBC Act) legislation.

Vegetation Zones

Vegetation zones were identified and delineated on the Development Site in accordance with Section 4.3 of the BAM (DPIE, 2020a). A vegetation zone is defined in the BAM as a relatively homogenous area that is the same vegetation type and broad condition. Vegetation zones identified within the Development Site are presented in Section 3.2.

Assessing Vegetation Integrity (Vegetation Condition)

Following stratification of the Development Site into vegetation zones, plots/transects were undertaken to collect site condition data for the composition, structure and function attributes listed in **Table 2** in accordance with Section 4.3 of the BAM (DPIE, 2020a). The location of the plots/transects were selected through stratified random sampling to provide a representative sample of the variation in vegetation composition and condition within each vegetation zone.

Table 2 Growth form groups and condition attributes used to assess the composition, structure and function components of vegetation integrity.

Condition attributes used to assess composition	Condition attributes used to assess structure	Attributes used to assess function
Tree richness	Tree cover	Number of large trees
Shrub richness	Shrub cover	Tree regeneration
Grass and Grass-like richness	Grass and Grass-like cover	Tree stem size classes
Forb richness	Forb cover	Total length of fallen logs
Fern richness	Fern cover	Litter cover
Other richness	Other r cover	High threat weed cover

Five (5) vegetation integrity plots were undertaken across the Development Site (**Figure 3**) which meets the minimum number of plots/transects required for each vegetation zone, based on their area, as detailed in Section 4.3.4, Table 3 of the BAM (DPIE, 2020a).

Floristic Identification and Nomenclature

Floristic identification and nomenclature were based on Harden (1992, 1993, 2000 and 2002) with subsequent revisions as published on PlantNet (http://plantnet.rbgsyd.nsw.gov.au).

3.2 Assessment Results

3.2.1 Vegetation within the Development Site

Vegetation Description

One PCT was identified within the Study Area (**Figure 4**); 1592 -Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter.

Table 3 Plant Community Types (PCTs) identified within the proposed R1 and E3 Zones.

Vegetation Zone	Vegetation Formation	Vegetation Class	PCT	Condition	R1 Area (ha)	E3 Area (ha)
1	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	1592 -Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Regrowth Meets EEC determination	0.00	0.58
2	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	1592 -Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Remnant - Moderate Meets EEC determination	0.50	4.23

Vegetation Zone	Vegetation Formation	Vegetation Class	PCT	Condition	R1 Area (ha)	E3 Area (ha)
3	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	1592 -Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Modified Meets EEC determination	0.32	0.27
				Subtotal	0.82	5.08
	-	-	Cleared	-	1.30	0.47
			Approved DA	-	11.27	0.00
				Total	13.39	5.55

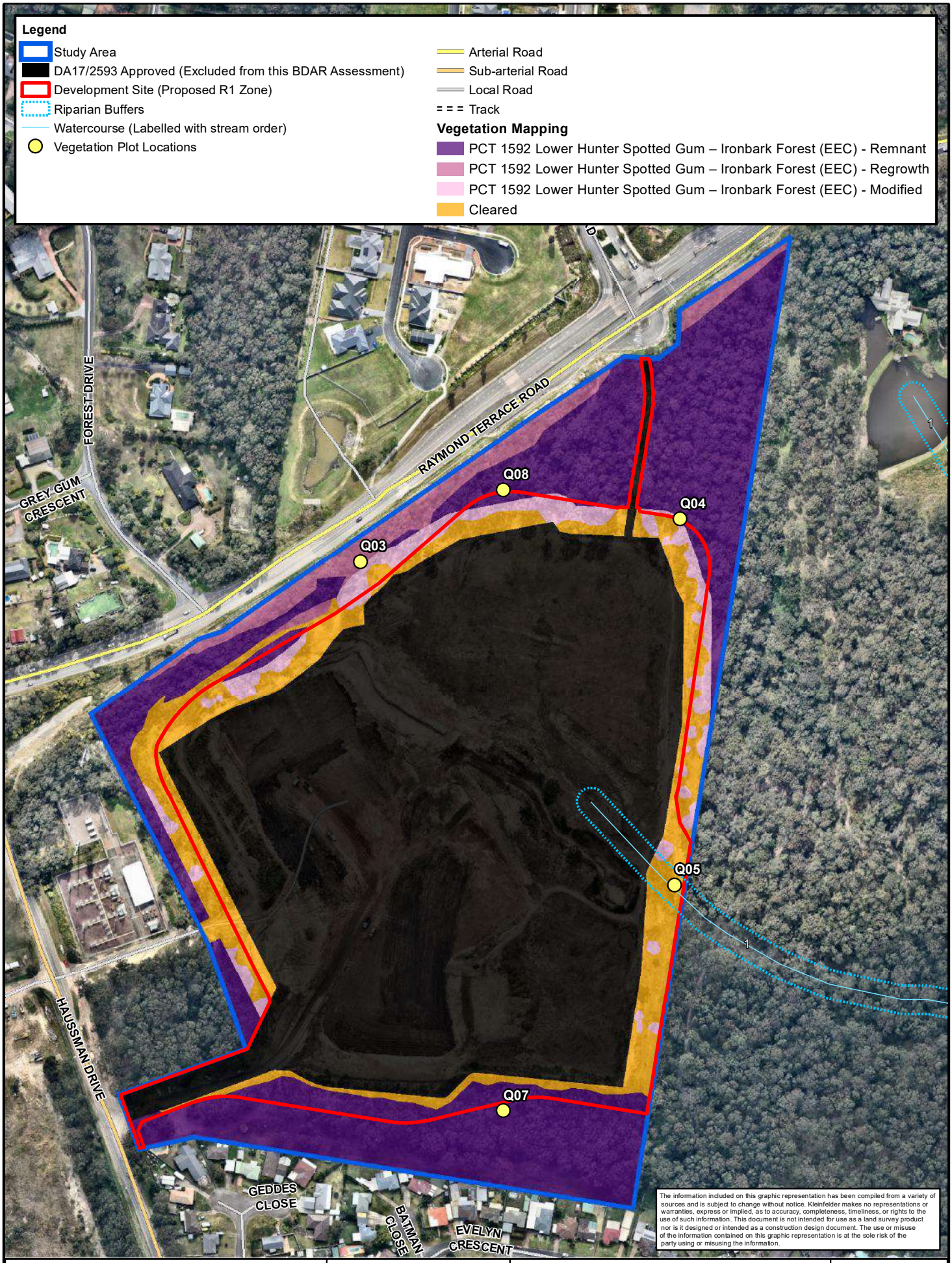
Threatened Ecological Communities (TECs)

Within the Development Site, Vegetation Zone 2 and 3 (0.82ha) is commensurate with the vegetation assemblage of one Endangered Ecological Community (EEC); *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions* (hereafter referred to as Lower Hunter Spotted Gum Ironbark Forest) (**Figure 4**). Lower Hunter Spotted Gum Ironbark Forest occurs within the Sydney Basin IBRA region and typically occurs on Permian geology. The EEC is characterised by a dominant canopy stratum of *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Red Ironbark), with a *Eucalyptus punctata* (Grey Gum) influence.

Vegetation Zones

The Plant Community Type within the Study Area is comprised of three (3) vegetation zones (**Figure 4**). Vegetation Zone 1 (zone 1) is considered to exist in a low/degraded condition within some evidence of regrowth occurring within the north-western strip of the Study Area. Vegetation Zone 2 (Zone 2) is considered to be in a moderate condition and occurs within the northern and southern portions of the Study Area. Vegetation Zone 3 (zone 3) is considered to be in a modified/managed condition due to APZ vegetation management associated with the approved DA.

Details on the vegetation zone (including condition class, area, patch size, survey effort and vegetation integrity score) are outlined in **Table 3** and full descriptions of each vegetation zone is provided in the following sub-sections **Figure 4** shows the distribution of vegetation zone within the Development Site. Plot data is provided in **Appendix H**.



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DRAWN BY: AMcDonaugh
DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2021

Vegetation Communities

McCloy Group
Biodiversity Development Assessment Report
Lot 2 DP 1145348
Haussman Drive, Thornton NSW

FIGURE:
4

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3.2.1.1 Vegetation Zone 1

Plate 1 Vegetation Zone 1

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Regrowth condition)	
Vegetation Formation and Class	Dry Sclerophyll Forests (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests
Area within Development Site	0.00
Survey Effort	**Required:** 1 plots/transects
	Conducted: 1 plots/transects (Q03)

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Regrowth condition)	
Floristic description	This community occurs as an open forest with the mixture of canopy species. The most dominant species within this vegetation zone include *Eucalyptus punctata* (Grey Gum), *Eucalyptus siderophloia* (Grey Ironbark) and *Eucalyptus globoidea* (White Stringybark). The shrub layer is generally sparse within this community. Species such as *Ozothamnus diosmifolius* (White Dogwood), *Acacia fimbriata* (Fringed Wattle), *Breynia oblongifolia* (Coffee bush) and *Bursaria spinosa* (Native Blackthorn) were present throughout. The ground stratum varies within the area but is generally dominated by grasses such as *Themeda australis* (Kangaroo Grass), *Microlaena stipoides* (Weeping Grass) and *Entolasia stricta* (Wiry Panic). Forbs such as *Lobelia purpurascens* (Whiteroot), *Dichondra repens* (Kidney Weed), *Oxalis perennans* were also common.
Condition within Development Site	Vegetation within this zone is considered to be in degraded condition due to previous clearing and weed incursion. Regrowth is evident.
Justification for PCT selection	Although the canopy structure is slightly different to that of the moderate condition vegetation zone of PCT 1592, shrub species and ground cover species are commensurate with the PCT 1592. Therefore, PCT 1592 is considered the most appropriate PCT for this vegetation zone.
Status	**BC Act Listed – Endangered** *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*. The vegetation assemblage within this zone is commensurate with vegetation characteristic of this EEC. The Development Site is commensurate with descriptive attributes of this EEC, i.e., regional location, soil type and geology. **EPBC Act - Not Listed.**
SAII	No
PCT % Cleared	44 % (obtained from NSW BioNet Vegetation Classification)

3.2.1.2 Vegetation Zone 2

Plate 2: Vegetation Zone 2

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Remnant - Moderate condition)	
Vegetation Formation and Class	Dry Sclerophyll Forests (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests
Area within Development Site	0.50
Survey Effort	**Required:** 2 plots/transects
	Conducted: 2 plots/transects (Q07 & Q08)

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Remnant - Moderate condition)	
Floristic description	This community occurs as an open forest with the canopy stratum dominated by *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Red Ironbark). *Eucalyptus punctata* (Grey Gum, *Eucalyptus siderophloia* (Grey Ironbark) and *Eucalyptus umbra* (Broad-leaved White Mahogany) are co-dominant species, depending on the area within the Development Site. Commonly encountered shrubs within this vegetation zone include *Ozothamnus diosmifolius* (White Dogwood), *Acacia fimbriata* (Fringed Wattle), *Acacia elongata* (Swamp Wattle) and *Bursaria spinosa* (Native Blackthorn) with minor occurrences of *Acacia falcata, Daviesia ulicifolia* (Gorse Bitter Pea) and *Pultenaea villosa* (Hairy Bush Pea). The ground stratum varies within the area but is generally dominated by grasses such as *Themeda australis* (Kangaroo Grass), *Microlaena stipoides* (Weeping Grass), *Entolasia stricta* (Wiry Panic). Forbs such as *Gonocarpus teucrioides* (Raspwort), *Lobelia purpurascens* (Whiteroot) and *Dichondra repens* (Kidney Weed) were also common. *Cheilanthes sieberi* (Poison Rock Fern) was common in certain areas.
Condition within Development Site	Vegetation within this zone is considered to be in moderate condition.
Justification for PCT selection	PCT 1592 is considered the most appropriate PCT for the community present within the Development Site based on the dominant canopy species, *Eucalyptus fibrosa* (Red Ironbark) and *Corymbia maculata* (Spotted Gum) with an influence of *Eucalyptus punctata* (Grey Gum).
Status	**BC Act Listed – Endangered** *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*. The vegetation assemblage within this zone is commensurate with vegetation characteristic of this EEC. The Development Site is commensurate with descriptive attributes of this EEC, i.e., regional location, soil type and geology. **EPBC Act - Not Listed.**
SAII	No
PCT % Cleared	44 % (obtained from NSW BioNet Vegetation Classification)

3.2.1.3 Vegetation Zone 3

Plate 3 Vegetation Zone 3

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Modified/Managed condition)	
Vegetation Formation and Class	Dry Sclerophyll Forests (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests
Area within Development Site	0.32
Survey Effort	**Required:** 2 plots/transects
	Conducted: 2 plots/transects (Q04 & Q05)

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Modified/Managed condition)	
Floristic description	This community occurs as an open forest with the mixture of canopy species. The most dominant species within this vegetation zone include *Corymbia maculata* (Spotted Gum) *Eucalyptus punctata* (Grey Gum), *Eucalyptus fibrosa* (Red Ironbark). The shrub layer is generally sparse within this community. Species such as *Breynia oblongifolia* (Coffee bush) and *Bursaria spinosa* (Native Blackthorn) were present throughout. Scattered occurrences of *Ozothamnus diosmifolius* (White Dogwood) was evident within this community. The ground stratum varies within the area but is generally dominated by grasses such as *Microlaena stipoides* (Weeping Grass) and *Entolasia stricta* (Wiry Panic). An influence of *Themeda triandra* (Kangaroo Grass), *Imperata cylindrica* (Blady Grass) and *Aristida vagans* (Three-awn Spear grass) was present. Forbs such as *Lobelia purpurascens* (Whiteroot) and *Arthropodium milleflorum* (Pale Vanilla-lily) and the fern *Cheilanthes sieberi* were also evident throughout.
Condition within Development Site	Vegetation within this zone is considered to be in moderate condition due to previous clearing and weed incursion.
Justification for PCT selection	PCT 1592 is considered the most appropriate PCT for the community present within the Development Site based on the dominant canopy species, *Eucalyptus fibrosa* (Red Ironbark) and *Corymbia maculata* (Spotted Gum) with an influence of *Eucalyptus punctata* (Grey Gum).
Status	**BC Act Listed – Endangered** *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*. The vegetation assemblage within this zone is commensurate with vegetation characteristic of this EEC. The Development Site is commensurate with descriptive attributes of this EEC, i.e. regional location, soil type and geology. **EPBC Act - Not Listed.**
SAII	No
PCT % Cleared	44 % (obtained from NSW BioNet Vegetation Classification)

Assessment of Patch Size

The patch size for Vegetation Zone 1, 2 and 3 were assessed as >100 ha as this zone is connected to large intact areas of native vegetation extending to the east, south and west, any gaps in the vegetation patch are less than 100 m.

Vegetation Integrity Score

The current vegetation integrity score of the vegetation zones is outlined in **Table 4**.

Table 4 Condition scores and current Vegetation Integrity (VI) scores of each vegetation zone within the development footprint (proposed R1 Zone).

Zone	PCT	Condition Class	Area (ha)	Condition scores (Current Score)			Vegetation Integrity Score
				Composition	Structure	Function	
1	1592	Regrowth	0.00	72.8	39.2	49	51.9
2	1592	Remnant	0.5	81.4	22.7	44.8	43.6
3	1592	Modified	0.32	84.1	43.5	44.5	54.6

3.2.2 Vegetation within the Study Area

The vegetation within the Study Area is floristically consistent with *PCT 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter*. A large portion of the Study Area consists of previously cleared vegetation, pertaining to an approved DA. This vegetation within this area occurs as a managed form of PCT 1592. Species observed within these areas that differ from the current Subject Site consist of *Andropogon virginicus* (Whisky Grass), *Gonocarpus tetragynus* (Raspwort), *Dillwynia retorta, Pultenaea spinosa, Leucopogon juniperinus* (Prickly Beard-heath), *Goodenia paniculata, Acacia irrorata* (Green Wattle), *Acacia parvipinnula* (Silver-stemmed Wattle), *Casuarina glauca* (Swamp She-oak) and *Typha orientalis* (Broad-leaved Cumbungi). The main floristic difference within this part of the Study Area in comparison to the Subject Site is the limited overstorey vegetation and large areas dominated by Whisky Grass. **Plate 4** and **Plate 5** displays the vegetation condition within this part of the Study Area.

Plate 4 **Condition of vegetation within cleared sections of the Study Area.**

Plate 5 **Patches of Whisky Grass (*Andropogon virginicus*) dominating parts of the Study Area.**

4 THREATENED SPECIES

4.1 ASSESSING HABITAT SUITABILITY

To help inform the assessment of suitable habitat for threatened species and populations within the Study Area, a database search of the NSW Department of Planning and Environment (DPE) BioNet Atlas and the Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) were conducted. Results are provided in **Appendix A**. A site-based survey assessing the suitability of threatened flora and fauna species habitat was undertaken on 12 and 26 May 2021. This assessment id detailed in the Section 4.1.1.

4.1.1 Habitat Assessment

Flora

A BioNet Atlas search of the area returned five (5) threatened flora species recorded within the locality, of which, one species, *Callistemon linearifolius* (Netted Bottled Brush), was considered to have a moderate likelihood of occurring within the Study Area. Based on the findings of the previous Flora and Fauna Assessment Report (Kleinfelder, 2017) and the site surveys, undertaken on 12 and 26 May 2021, no threatened species were identified to occur within the Development Site. Therefore, the vegetation within the Development Site is unlikely to support habitat for threatened flora species.

Fauna

Habitat Assessment

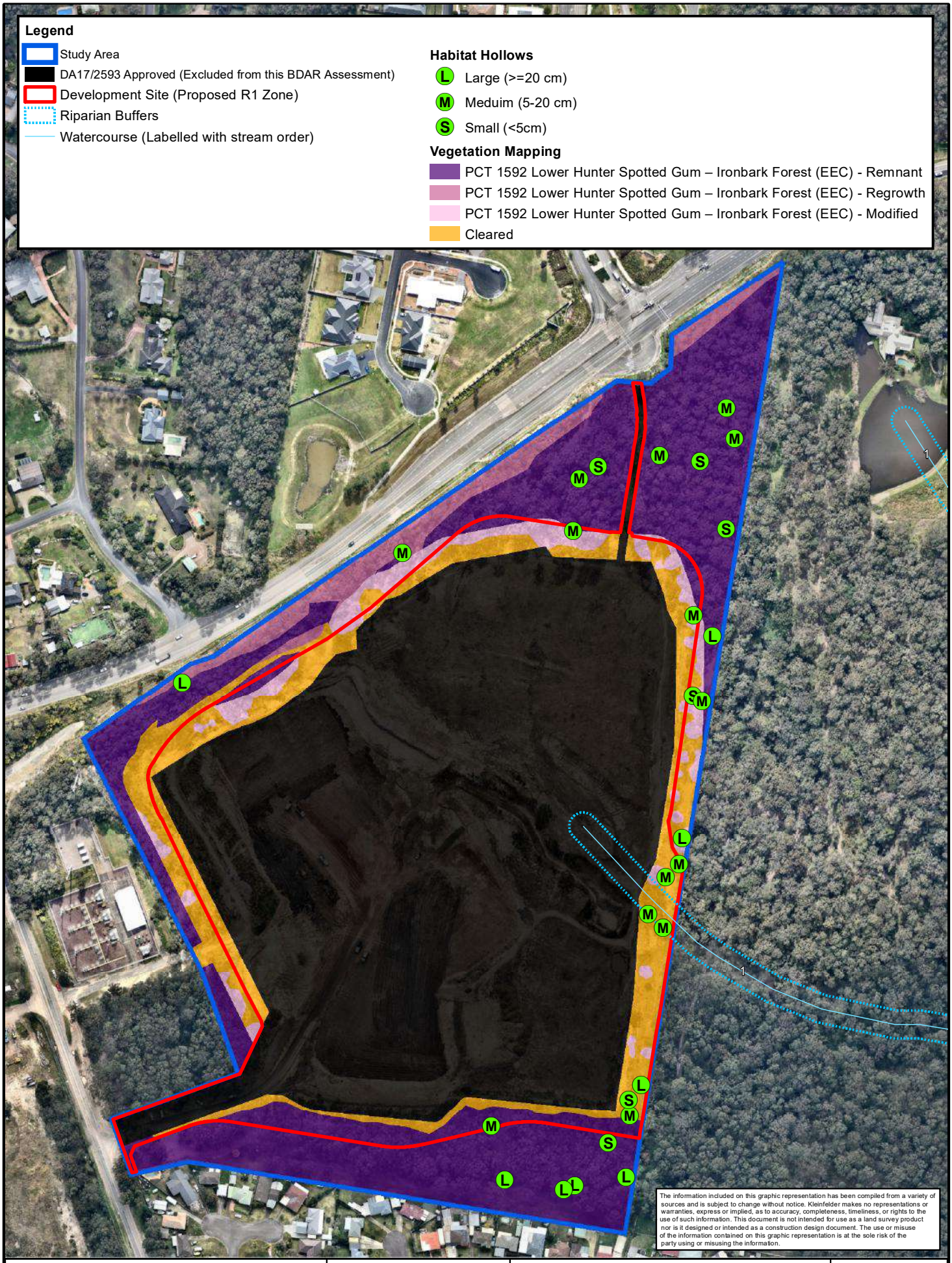
A BioNet Atlas search, applying a 5-kilometre buffer to the Development Site, returned 53 threatened fauna species within the locality. Based on site surveys conducted on 12 and 26 May 2021, and previous records of threatened fauna species (Kleinfelder, 2017), the Development Site is likely to contain suitable habitat for the following fauna species:

- Little Lorikeet (*Glossopsitta pusilla*)
- Grey-crowned Babbler (eastern sub-species) (*Pomatostomus temporalis temporalis*)
- Squirrel Glider (*Pteropus norfolkensis*)
- Brush-tailed Phascogale (*Phascogale tapoatafa*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)

Habitat Tree Survey

A ground-based survey of habitat trees within the Study Area was undertaken on 26 May 2021 to validate the number and size of hollows previously identified in 2017 (Kleinfelder, 2017) and identify additional hollow-bearing trees, dead standing stags and trees containing nests. The results of the habitat tree survey are used to determine the suitability of hollows for hollow-dependent threatened fauna species likely to occur within the Study Area.

A total of 26 hollow-bearing trees are located within the Study Area with ten (10) being located within the proposed R1 Zone. Within the proposed R1 Zone, there is one (1) hollow-bearing tree containing a large hollow and nine (9) containing medium-sized hollows (**Figure 5**).



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DRAWN BY: AMcDonaugh
DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2021

Habitat Features

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FIGURE:
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Koala Habitat

Vegetation within the Study Area and Subject Site does not meet the definition of 'Potential' Koala habitat as defined by SEPP 2020, due to a lack of listed Koala feed tree species (according to Schedule 2 of the SEPP 2020). *Eucalyptus punctata* comprised less than 15% total cover of species. In addition, there are no BioNet atlas records of Koalas within 2.5 kilometres of the Study Area within the last 18 years indicating that the area lacks a resident Koala population. As such, the vegetation within the Study Area does not meet the definition of 'Core' Koala habitat under the Koala SEPP 2020.

4.1.2 Ecosystem Credit Species

The following assessment of habitat suitability for ecosystem credit species was conducted in accordance with Section 5.2 of the BAM. Ecosystem credits represent threatened species that can be predicted to be present by the type and condition of vegetation at the Subject Site. Targeted survey is not required for ecosystem credit species.

Step 1: Identify threatened species for assessment.

A list of predicted ecosystem credit species for the Subject Site was reviewed in the BAM calculator, according to PCTs present on the subject land.

Step 2: Assessment of the habitat constraints and vagrant species on the subject land

The potential for identified ecosystem credit species to occur on the Subject Site was assessed according to species specific habitat requirements, as detailed in **Table 5**.

Table 5 Assessment of ecosystem credit species within the Subject Site.

Scientific Name	Common Name	Confirmed predicted species	Justification
Anthochaera phrygia	Regent Honeyeater	Yes	-
Callocephalon fimbriatum	Gang-gang Cockatoo	Yes	-
Calyptorhynchus lathami	Glossy Black-cockatoo (foraging)	Yes	-
Chthonicola sagittata	Speckled Warbler	Yes	-
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Yes	-
Daphoenositta chrysoptera	Varied Sittella	Yes	-
Dasyurus maculatus	Spot-tailed Quoll	Yes	-
Falsistrellus tasmaniensis	Eastern False Pioistrelle	Yes	-
Glossopsitta pusilla	Little Loriket	Yes	-
Grantiella picta	Painted Honeyeater	Yes	-

Scientific Name	Common Name	Confirmed predicted species	Justification
Haliaeetus leucogaster	White-bellied Sea-eagle	Yes	-
Hieraaetus morphnoides	Little Eagle	Yes	-
Lathamus discolor	Swift Parrot	Yes	-
Lophoictinia isura	Square-tailed Kite	Yes	-
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Yes	-
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Yes	-
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Yes	-
Miniopterus australis	Little Bent-winged Bat	Yes	-
Miniopterus orianae oceanensis	Large Bent-winged Bat	Yes	-
Neophema pulchella	Turquoise Parrot	Yes	-
Ninox connivens	Barking Owl	Yes	-
Ninox strenua	Powerful Owl	Yes	-
Petaurus australis	Yellow-bellied Glider	Yes	-
Petroica boodang	Scarlet Robin	Yes	-
Phascolarctos cinereus	Koala (foraging)	Yes	-
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Yes	-
Pteropus poliocephalus	Grey-headed Flying-fox	Yes	-
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Yes	-
Scoteanax rueppellii	Greater Broad-nosed Bat	Yes	-
Stagonopleura guttata	Diamond Firetail	Yes	-
Tyto novaehollandiae	Masked Owl (foraging)	Yes	-

4.1.3 Species Credit Species

Step 1: Identify threatened species for assessment.

A list of predicted Species Credit Species for the Development Site was reviewed in the BAM calculator. Species credits pertain to threatened species that cannot be predicted by the vegetation present within the Subject Site.

Step 2: Assessment of the habitat constraints and vagrant species on the subject land; and

Step 3: Identify Candidate Species Credit species for further assessment.

The potential for identified Species Credit Species to occur on the Development Site was assessed according to species specific habitat requirements, as detailed in **Table 6**. Where woodland habitat features were not present due to the degraded condition of the site vegetation, Species Credit Species were determined to not be candidate species and no further assessment was required (**Table 6**).

No candidate species were identified as potential entities for a Serious and Irreversible Impact (SAII).

Table 6 Species Credit Species identified as Candidate Species.

Scientific Name	Common Name	Confirmed Candidate Species	Justification
Anthochaera phrygia	Regent Honeyeater	**No**	**Vegetation within the Subject site not mapped as important habitat for this species.**
Chalinolobus dwyeri	Large-eared Pied Bat	**No**	**Subject Site not within 2km of caves, cliffs, overhangs, escarpments or tunnels**
Lathamus discolor	Swift Parrot	**No**	**Vegetation within the Subject Site not mapped as important habitat for this species.**
Miniopterus australis	Little Bent-winged Bat	**No**	**No caves, tunnels, mines or culverts within the Subject Site or Study Area.**
Miniopterus orianae oceanensis	Large Bent-winged Bat	**No**	**No caves, tunnels, mines or culverts within the Subject Site or Study Area.**
Persoonia pauciflora	North Rothbury Persoonia	**No**	**Subject Site not within 10km of North Rothbury.**
Petrogale penicillata	Brush-tailed Rock-wallaby	**No**	**Subject Site not within 1km of rocky outcrops, gorges or escarpments.**

Scientific Name	Common Name	Confirmed Candidate Species	Justification
Vespadelus troughtoni	Eastern Cave Bat	**No**	**Subject Site not within 2km of caves, cliffs, overhangs, escarpments or tunnels**

4.1.4 Threatened Flora and Fauna Survey Results

No threatened flora or fauna species were identified within the Subject Site during the site assessment. A list of species identified during the surveys is provided in **Appendix 2**.

Weather Data

Weather data for the survey period is summarised per month in **Table 7**. Temperature rainfall data retrieved from Maitland Airport AWS (061428).

Table 7 Weather data experienced during the site assessment. Weather data collected from Maitland Airport AWS (Station 061428).

Date	Temps.		Rain	9am				3pm			
	Min.	Max.		Temp.	RH	Dir.	Spd.	Temp.	RH	Dir	Spd.
	°C	°C	(mm)	°C	%	Km/h		°C	%	Km/h	
12/05	11.8	22.0	8.2	14.8	80	WNW	8	20.9	71	S	11
26/05	7.4	23.0	0	15.8	70	NNW	4	22.5	46	WNW	17

5 AVOID AND MINIMISE IMPACTS ON BIODIVERSITY VALUES

5.1 AVOIDING AND MINIMISING IMPACTS DURING PROJECT PALNNING

5.1.1 Avoid and Minimise Impacts on Native Vegetation and Habitat

The proposed Residential (R1) zoning largely encompasses areas subject to an existing approved DA, including APZs. The vast majority (4.23 ha or 89%) of higher-quality remnant Lower Hunter Spotted Gum – Ironbark Forest (EEC) is being retained and is proposed to be zoned Environmental Management (E3). These areas support higher quality habitats suitable for threatened species. In addition, sixteen hollow-bearing trees (62%) of all hollow-bearing trees within the Study Area are to be located within the proposed E3 zone.

The extent of the proposed R1 zone has undergone multiple iterations to ensure ecological connectivity is maintained within the site and to adjacent land. Specifically, an assessment of the importance of various corridors through the site was undertaken (RPS 2020). This assessment showed that, while connectivity around the western and northern boundary of the Study Area serves as a valuable ecological corridor, the strip of vegetation along the southern boundary of the Study Area was likely to be of greater importance to maintain fauna movement from land in the south-west to land in the east/north-east. Subsequently, a wider strip of intact bushland has been retained along the southern boundary (to be zoned E3), in addition to retained areas of bushland around the western, northern and eastern extents (also to be zoned E3). The retention of the areas will ensure that connectivity internally and externally to the site will be maintained.

The site is mapped as Category 1 land in the Maitland Urban Settlement Strategy. The site is considered to have high strategic merit and strong site specific merit for rezoning for residential purposes. Rezoning and development of the site for residential purposes reflects the highest and best use of land already highly disturbed due to its previous use as a quarry.

5.2 ASSESSMENT OF IMPACTS

5.2.1 Impacts on Native Vegetation and Habitat

5.2.1.1 Direct Impacts

The proposed rezoning will have the potential to impact all vegetation within the Development Site (proposed R1 Zone). The area of native vegetation within the proposed R1 totals 0.82 ha. Each vegetation zone equates to one management zone, and the future value of each attribute (composition, structure, and function) and the vegetation integrity score for all management zones will be zero.

5.2.1.2 Indirect Impacts

The proposed development has the potential for indirect impacts on the E3 Zone surrounding the proposed R1 Zone. Potential indirect impacts include:

- Increased weed invasion and potential spread or introduction of pathogens from the site to nearby vegetation
- Erosion and sedimentation into nearby vegetation
- Reduced viability of adjoining habitats due to increased noise, dust or light spill during operational phase
- Increase in rubbish dumping in adjoining habitats
- Accidental clearing

- Predation/exclusion of native fauna by domestic animals.

Provided appropriate mitigation measures and management plans are adhered to, it is unlikely to have a significant long-term effect on threatened species, ecological communities and their habitats.

5.2.2 Prescribed Impacts

The proposed development is not considered to have the potential to impact on any prescribed impacts.

5.3 Mitigating and Managing Impacts on Biodiversity Values

The measures outlined in **Table 8** should be adhered to prior and during vegetation clearing to ensure that impacts are minimised.

Table 8: Summary of direct, prescribed and indirect impacts of the proposed development.

Impact	Action and Outcome	Responsibility	Timing
• Direct impact / prescribed impact			
Clearing of native vegetation	• Clearing boundaries (R1/E3 Zone) should be clearly marked prior to clearing works (i.e., no-go exclusion fencing and signage). Permanent fencing is to be installed following vegetation clearing. • Ensure vehicle and equipment parking areas and stockpile areas are identified and positioned to avoid areas containing ecological value. • Identify and communicate the location of any 'no go zones' in site inductions.	Construction site manager	Prior to and during vegetation clearing
Vehicle collision with fauna	• Speed limits within the Development Site should be limited to 40 km/hr. • Driving during dawn and dusk to be avoided where practicable.	Construction site manager	During vegetation clearing and construction
Indirect Impact			
Transfer of weeds and pathogens to and from site	• The fungal pathogens *Phytophora cinnamomi* and Myrtle Rust (*Puccinia psidii*) are known to occur in the LGA however, it is unknown if they occur within the Development Site. These pathogens can have devastating impacts on native plant communities and inhabiting fauna if not properly managed. • Vehicle movements restricted to bitumen road and a haul road through the site. • All soil and seed material from site to be disposed of at landfill (no dumping in adjacent areas).	Construction site manager	During vegetation clearing and construction
Increase in dust, light and noise during clearing works	• Impacts from operational activities, such as disturbance to an animal's normal behaviour patterns due to noise, vibration, lighting or dust may cause surrounding areas of previously suitable habitat to become sub-optimal and may cause fauna species to vacate areas of previously suitable habitat.	Construction site manager	During vegetation clearing and construction

Impact	Action and Outcome	Responsibility	Timing
	• Construction works to be limited to daylight hours. • Reduce machinery noise where possible during clearing. • Dust suppression measures such as water to be utilised as necessary.		
Erosion and sedimentation	• Erosion and sedimentation mitigation measures to be put in place prior to commencement clearing works to prevent sedimentation into off site areas (e.g., bunds or sediment fencing).	Construction site manager	Prior to commencement of works.
Waste	• Waste management procedures to be identified prior to commencement of works. • Spill Response Procedures to be in place and spill kits to be present during clearing works. • All general waste to be removed from site.	Construction site manager	Prior to and during tree clearing.
Accidental Clearing	• Permanent fencing along R1/E3 boundary	Construction site manager	Prior to and during tree clearing.
Disturbance by domestic animals	• Permanent fencing along R1/E3 boundary	Construction site manager	Prior to and during tree clearing.

6 IMPACT SUMMARY

6.1 SERIOUS AND IRREVERSIBLE IMPACTS

No species at risk of Serious and Irreversible Impact (SAII) were identified during the study.

6.2 IDENTIFICATION OF IMPACTS REQUIRING OFFSETS

This section provides an assessment of the impacts requiring offsetting in accordance with Section 10.1 of the BAM (DPIE, 2020a).

6.2.1 Impacts on Native Vegetation

A summary of the impacts on native vegetation and the required ecosystem credit is provided in Table 9. The vegetation integrity score threshold is >17, therefore impacts to vegetation Zone 1 are required to be offset.

Table 9: Summary of ecosystem credit requirements

Vegetation Zone	Vegetation Zone Name	Area (ha)	Current Vegetation Integrity Score	Future Vegetation Integrity Score	Credits Required
1	VZ1 - 1592_regrowth	0.00	51.9	51.9	0
2	VZ2 – 1592 remnant	0.50	43.6	0	9
3	VZ3 – 1592 modified	0.32	54.6	0	11
				Total Credit Requirement	**20**

The Biodiversity Credit Reports (like-for-like and variation options) is provided in **Appendix E**.

7 ASSESSMENT OF OTHER BIODIVERSITY LEGISLATION

7.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

A database search of relevant threatened species databases and an assessment of the likelihood of occurrence of threatened and migratory species is provided in **Appendix A**. No threatened or migratory species, or ecological communities listed under the EPBC Act were identified within the Development Site. One species, Grey-headed Flying-fox, was assessed as having a moderate likelihood of occurrence due to suitable foraging habitat within the site. No breeding camps are located in proximity to the site. As the proposed rezoning only has the potential to impact a small area of foraging habitat for this highly mobile species, it is unlikely there will be a significant impact on these species. As such, a referral to the Commonwealth Minister for the Environment is not considered necessary.

7.2 BIOSECURITY ACT 2015

Species which require control prior to and post construction to ensure they are not spread due to works, include the high threat species listed in **Table 10**.

Table 10: Weed species requiring control within the Development Site

Scientific Name	Common Name	Weeds of National Significance (WONS)	Priority weeds of the Maitland LGA (Biosecurity Act)	High Threat Weeds (BAM)
Andropogon virginicus	Whisky Grass	-	-	✓
Asparagus aethiopicus	Asparagus Fern	✓	✓	✓
Bidens pilosa	Cobbler's Pegs	-	-	✓
Chloris gayana	Rhodes Grass	-	-	✓
Cortaderia selloana	Pampas Grass	-	✓	✓
Cyperus eragrostis	Umbrella Sedge	-	-	✓
Lantana camara	Lantana	✓	✓	✓
Paspalum dilatatum	Paspalum	-	-	✓
Senecio madagascariensis	Fireweed	✓	✓	✓
Senna pendula var. glabrata		-	-	✓
Triadica sebifera	Chinese Tallowood	-	-	✓

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APPENDIX A THREATENED SPECIES DATABASE SEARCH

THREATENED SPECIES DATABASE SEARCH

A list of threatened species, populations and ecological communities that have been reported or modelled to occur from within a five-kilometre radius of the Study Area was obtained from the following databases:

- NSW Department of Planning and Environment (DPE) BioNet Atlas: (http://www.bionet.nsw.gov.au/).
- Protected matter database search tool (https://www.environment.gov.au/epbc/protected-matters-search-tool)

An assessment was then made of the likelihood of the threatened species, populations, and / or ecological communities reported or modelled to occur in the locality occurring within the Study Area or using the habitat within the Study Area as an essential part of a foraging range.

The table below summarises the likelihood of threatened species and EPBC Act listed migratory species occurring within the Study Area based on the habitat requirements of each species. A brief definition of the likelihood of occurrence criteria is provided below:

- Known – species identified within the site during surveys.
- High – species known from the area (DPIE Wildlife Atlas records), suitable habitat (such as roosting and foraging habitat) present within the site.
- Moderate – species may be known from the area, potential habitat is present within the site.
- Low – species not known from the area and/or marginal habitat is present within the site.
- Nil – habitat requirements not met for this species within the site.

Note: Marine species identified within the desktop assessment i.e. marine bird species, have been excluded from the list based on obvious habitat constraints. However, indirect impacts on these species and ecological communities have been considered.

Table A1 'Likelihood of Occurrence' table

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
Flora								
1.	*Acacia bynoeana* Bynoe's Wattle	E	V	0	PMST	The species is endemic to central eastern NSW, currently known from only 30 locations, many of only 1-5 plants. Grows mainly in heath/ dry sclerophyll forest on sandy soils, prefers open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches.	Low	Marginally suitable habitat within the Study Area. No known records within the locality.
2.	*Angophora inopina* Charmhaven Apple	V	V	0	PMST	This species is endemic to the central coast region of NSW and is known to occur in four main vegetation communities: *Eucalyptus haemastoma / Corymbia gummifera / Angophora inopina* woodland / forest; *Hakea teretifolia / Banksia oblongifolia* wet heath; *Eucalyptus resinifera / Melaleuca sieberi / Angophora inopina* sedge / woodland; and *Eucalyptus capitellata / Corymbia gummifera / Angophora inopin*a woodland / forest elegans. Flowering generally poor and sporadic.	Not present	This species was not identified during the assessment.
3.	*Arthraxon hispidus* Hairy-joint Grass	V	V	0	PMST	The species has been recorded from scattered locations throughout Queensland and on the northern tablelands and north coast of NSW. Hairy-joint Grass is found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps as well as woodland.	Nil	Habitat not suitable within the Study Area. No known records within the locality.
4.	*Asperula asthenes* Trailing Woodruff	V	V	0	PMST	This small herb occurs only in NSW. It is found in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens/Wallis Lakes area. Occurs in damp sites, often along river banks.	Nil	No suitable habitat within the Study Area. No known records within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
5.	*Caladenia tessellata* Thick Lip Spider Orchid	E	V	0	PMST	In NSW this species is found sporadically on the coast from Swansea and extends onto the Tablelands further south. *Caladenia tessellata* is normally found on clay or sandy soils in grassy sclerophyll woodlands, although it has been recorded on stony soil. The species is now known with certainty from only two populations on the NSW Southern Tablelands.	Nil	Marginally suitable habitat within the Study Area. No known records within the locality.
6.	*Callistemon linearifolius* Netted Bottlebrush	V	-	253	BioNet	This shrub grows up to 3-4 m tall, with red flowers that are clustered into the typical "bottlebrushes". The species grows in dry sclerophyll forest on the coast and adjacent ranges.	**Moderate**	Potentially suitable habitat within the Study Area, however, species was not identified during the assessment. No records in proximity to the Study Area.
7.	*Commersonia prostrata* Dwarf Kerrang	E	E	0	PMST	Occurs on sandy, sometimes peaty soils in a wide variety of habitats: Snow Gum (*Eucalyptus pauciflora*) Woodland and Ephemeral Wetland floor at Rowes Lagoon; Blue leaved Stringybark (*E. agglomerata*) Open Forest at Tallong; and in Brittle Gum (*E. mannifera*) Low Open Woodland at Penrose; Scribbly Gum (*E. haemostoma*)/ Swamp Mahogany (*E. robusta*) Ecotonal Forest at Tomago.	Nil	No suitable habitat within the Study Area. No known records within the locality
8.	*Cryptostylis hunteriana* Leafless Tongue-orchid	V	V	0	PMST	In New South Wales the species occupies a variety of habitats. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*). The species grows most often on the flat plains close to the coast, favouring moist soils.	Nil	No suitable habitat within the Study Area.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
9.	*Cynanchum elegans* White - flowered Wax Plant	E	E	0	PMST	Occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; *Leptospermum laevigatum* (Coastal Tea-tree) – *Banksia integrifolia* subsp. *integrifolia* (Coastal Banksia) coastal scrub; *Eucalyptus tereticornis* (Forest Red Gum) aligned open forest and woodland; *Corymbia maculata* (Spotted Gum) aligned open forest and woodland; and *Melaleuca armillaris* scrub (Bracelet Honeymyrtle) to open scrub.	Nil	No suitable habitat within the Study Area.
10.	*Dichanthium setosum*	V	V	0	PMST	Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture.	Low	Marginally suitable habitat in cleared areas of the Study Area. No known records within the locality.
11.	*Eucalyptus camaldulensis* Endangered population in the Hunter	E2	-	1	BioNet	In NSW, Eucalyptus camaldulensis occurs along the western flowing rivers but is known from only one coastal catchment, the Hunter. The western-most individuals in the Hunter are at Bylong, south of Merriwa, and the most easterly at Hinton, on the bank of the Hunter River, in the Port Stephens local government area. It has been recorded in the local government areas of Lithgow, Maitland, Mid-Western Regional, Muswellbrook, Port Stephens, Singleton and Upper Hunter.	Not present	Species not identified to occur within the Study Area during the assessment.
12.	*Eucalyptus glaucina* Slaty Red Gum	V	V	0	PMST	A medium-sized tree to 30 m tall. The bark is smooth and mottled white to slaty grey. Produces flowers that a usually white but occasionally pink. Grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils.	Not present	Species not identified during the assessment.
13.	*Eucalyptus parramattensis subsp. decadens* Earp's Gum	V	V	0	PMST	Occurs in low-lying, often swampy areas and in woodlands with associates such as *Eucalyptus racemosa* (Narrow-leaved Scribbly Gum), *E. globoidea* (White Stringybark) and *Angophora bakeri* (Narrow-leaved Apple) on poor sandy soils.	Not present	Species not identified during the assessment.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
14.	*Euphrasia arguta*	CE	CE	0	PMST	Known from Nundle State Forest and adjacent private land, in New South Wales. The species is known from three locations in two areas approximately 14 km apart. Occur in eucalypt forest with a mixed grass and shrub understorey within Nundle State Forest.	Nil	Unsuitable habitat within the Study Area.
15.	*Grevillea parviflora* subsp. *parviflora* Small-flower Grevillea	V	V	0	PMST	The species occurs in heath and shrubby woodland, in sandy or lightly clay soils usually over thin shales.	Nil	Species not identified during the assessment.
16.	*Maundia triglochinoides*	V	-	3	BioNet Atlas	Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct. Grows in swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients.	Low	No suitable habitat for this species occurs within the Development Site. Potential suitable habitat may occur within damp areas and artificial water bodies within the Study Area.
17.	*Melaleuca biconvexa* Biconvex Paperbark	V	V	0	PMST	Scattered, disjunct populations in coastal areas from Jervis Bay to Port Macquarie, with most populations in the Gosford-Wyong areas. Grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Nil	Species not identified during the assessment.
18.	*Persicaria elatior* Tall Knotweed	V	V	0	PMST	Grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Nil	Habitat not suitable within the Study Area. No records within the locality.
19.	*Phaius australis*	E	E	0	PMST	Distribution has been tentatively described as being north from Lake Cathie but mainly north of the Evans Head area to the Barron River in northeast Queensland. Commonly associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest and often where Broad-leaved Paperbark or Swamp Mahogany is found.	Nil	Habitat for this species is not present within the Study Area. No records within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
20.	*Pomaderris brunnea* Rufous Pomaderris	E	V	0	PMST	Shrub growing up to 3 m tall with distinctly hairy stems. The species occurs in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. Habitat for this species includes moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Nil	Habitat not suitable for this species within the Study Area. No records within the locality.
21.	*Prasophyllum sp. Wybong (C.Phelps ORG 5269)* (EPBC Act) / *Prasophyllum petilum* (BC Act) A Leek-orchid	V	CE	0	PMST	Known from open eucalypt woodland and grassland.	Nil	Habitat not suitable within the Study Area for this species. No records within the locality.
22.	*Pterostylis gibbosa* Illawarra Greenhood	E	E	0	PMST	In the Hunter region, this species grows in open woodland dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *E. tereticornis* (Forest Red Gum) and *Callitris endlicheri* (Black Cypress Pine).	Nil	No suitable habitat within the Study Area. No records within the locality.
23.	*Rhizanthella slateri* Underground Orchid	V	E	0	PMST	The species grows in eucalypt forest but no informative assessment of the likely preferred habitat for the species is available. Currently known only from 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra.	Low	Marginally suitable habitat within the Study Area. No known records within the locality.
24.	*Rhodamnia rubescens* Scrub Turpentine	-	E	2	BioNet Atlas	Often found in wet sclerophyll associations in rainforest transition zones and creek side riparian vegetation. The species occupies a range of volcanically derived and sedimentary soils and is also a common pioneer species in eucalypt forests.	Low	No suitable habitat present within the Study Area. Species not identified during the assessment.
25.	*Rhodomyrtus psidioides* Native Guava	E4	-	4	BioNet Atlas	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.	Low	No suitable habitat present within the Study Area. Species not recorded during the assessment.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
26.	*Rutidosis heterogama* Heath Wrinklewort	V	V	0	PMST	Grows in dry sclerophyll forests, native grasslands, grassy woodlands and heathlands.	Low	Marginally suitable habitat present within the Study Area. No known records within the locality.
27.	*Syzygium paniculatum* Magenta Lilly Pilly	E	V	0	PMST	Grows on sandy soils in subtropical and littoral rainforest near the coast from Bulahdelah to Jervis Bay.	Nil	No suitable habitat present within the Study Area. Species not recorded during the assessment.
28.	*Tetratheca juncea* Black-eyed Susan	V	V	18	BioNet Atlas, PMST	Grows in sandy, occasionally swampy heath and in dry sclerophyll forest; chiefly in coastal districts from Bulahdelah to Lake Macquarie.	Low	No suitable habitat for this species present within the Study Area. Low number of records within the locality.
29.	*Thesium austral* Austral Toadflax	V	V	0	PMST	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*).	Low	Potentially suitable habitat within grassland areas dominated by *Themeda australis*. No known records within the locality.
Birds								
1.	*Anseranas semipalmata* Magpie Goose	V	-	1	BioNet Atlas	Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW.	Low	Potentially suitable habitat are in shallow water bodies within the Study Area; however, breeding is unlikely to occur within south-east NSW. One BioNet record from 1980 within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
2.	*Anthochaera phrygia* Regent Honeyeater	E	CE	3	BioNet Atlas, PMST	Mostly recorded in box-ironbark eucalypt associations. At times of food shortage, the species also uses other woodland types and wet lowland coastal forest dominated by *Eucalyptus robusta* (Swamp Mahogany) or *Corymbia maculata* (Spotted Gum).	Low-	Potential foraging habitat within wooded vegetation of the Study Area. Low number of records within the locality, not in proximity to the Study Area. Study Area is not mapped as important habitat for this species under the BAM important habitat mapping (DPE, 2022e).
3.	*Artamus cyanopterus cyanopterus* Dusky Woodswallow	V	-	4	BioNet Atlas	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.	Low	Broadly suitable foraging habitat within the Study Area. Low number of BioNet records within the locality. No records within proximity to the Study Area.
4.	*Callocephalon fimbriatum* Gang-gang Cockatoo	V	E	2	BioNet Atlas	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. Gang-gang Cockatoos feed mainly on seeds of native and introduced trees and shrubs, with a preference for eucalypts, wattles and introduced hawthorns.	Low	Marginally suitable foraging habitat within wooded vegetation dominated by *Eucalyptus spp.* Most recent BioNet record within the locality is from 2004.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
5.	*Calyptorhynchus lathami* Glossy Black-Cockatoo	V	-	2	BioNet Atlas	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of She-oak occur. Black She-oak (*Allocasuarina littoralis*) and Forest She-oak (*A. torulosa*) are important foods. Potential nest trees contain hollows that are; (i) at least 8 m above the ground; and (ii) in stems with a diameter of at least 30 cm; and (iii) hollow diameter is at least 15 cm; and (iv) stem angle is at least 45 degrees, and may be near-vertical or vertical.	Low	No suitable foraging habitat within the Study Area. Low number of BioNet records within the locality.
6.	*Daphoenositta chrysoptera* Varied Sittella	V	-	8	BioNet Atlas	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Low - moderate	Potentially suitable foraging habitat within the Study Area. Low number of BioNet records within the locality. Two recent records within proximity to the Study Area.
7.	*Ephippiorhynchus asiaticus* Black-necked Stork	E	-	25	BioNet Atlas	Inhabits wetlands, such as floodplains of rivers with large shallow swamps and pools, and deeper permanent bodies of water. Occasionally individuals will stray into open grass, woodland areas or flooded paddocks in search of food. Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the floodplain habitat).	Low	Primarily unsuitable foraging habitat within the Study Area. No suitable breeding habitat within the Study Area. Most sightings are located within the vicinity of the Woodberry Swamp, to the south-east of the Study Area.
8.	*Erythrotriorchis radiatus* Red Goshawk	CE	V	0	PMST	Occurs in tropical and warm-temperate woodlands and forests. Mostly occurs in northern Australia with populations also occurring in the southeast of QLD and northeast of NSW.	Low	Broadly suitable foraging habitat within the Study Area. No known Records within locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
9.	*Falco hypoleucos* Grey Falcon	-	V	0	PMST	Medium-sized, compact, pale falcon with a heavy, thick-set, deep-chested appearance. The species is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	Nil	No suitable habitat present within the Study Area. No known records within the locality.
10.	*Glossopsitta pusilla* Little Lorikeet	V	-	27	BioNet Atlas	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in *Angophora, Melaleuca* and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m).	**Moderate**	Potentially suitable habitat within eucalypt dominated areas of the Study Area. Records within the locality including 2 records adjacent to the Study Area in wooded vegetation.
11.	*Haliaeetus leucogaster* White-bellied Sea-Eagle	V	M	14	BioNet Atlas	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest. This species hunts for fish, turtles and sea snakes however will feed on carrion along the waterline. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'.	Low	Primarily unsuitable foraging habitat within the Study Area. No suitable breeding habitat within the Study Area. This species may, on occasion, fly over the site.
12.	*Hamirostra melanosternon* Black-breasted Buzzard	V	-	1	BioNet Atlas	Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands.	Low	No suitable breeding or foraging habitat within the Study Area. One BioNet record within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
13.	*Hieraaetus morphnoides* Little Eagle	V	-	2	BioNet Atlas	Occupies open eucalypt forest, woodland or open woodland. She-oak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	Low	Potentially suitable habitat within the Study Area due to remnant eucalypt woodland. Only 2 BioNet records, with the most recent sighting in 2014, approx. 5kms from the Study Area.
14.	*Lathamus discolor* Swift Parrot	E	CE	2	BioNet Atlas, PMST	This migratory species has been recorded on the mainland from a variety of habitat types including dry and wet sclerophyll forest, forested wetlands, coastal swamp forests and heathlands. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Forest Red Gum (*E. tereticornis*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*). The Study Area is not mapped within important areas for this species (DPIE, 2021b).	Low	Potentially suitable foraging habitat within the Study Area when *Eucalyptus spp.* and *Corymbia spp.* are in flower. This species does not breed on the Australina mainland. The Study Area is not mapped as important habitat under BAM important habitat mapping (DPE, 2022e).
15.	*Lophoictinia isura* Square-tailed Kite	V	-	1	BioNet	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	Low	Not particularly suitable habitat for foraging or breeding within the Study Area. Only one BioNet record from 1993 within the locality.
16.	*Melithreptus gularis gularis* Black-chinned Honeyeater (eastern subspecies)	V	-	3	BioNet Atlas	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially *Eucalyptus sideroxylon* (Mugga Ironbark), *E. albens* (White Box), *E. microcarpa* (Inland Grey Box), *E. melliodora* (Yellow Box), *E. blakelyi* (Blakely's Red Gum) and *E. tereticornis* (Forest Red Gum). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river she-oaks (nesting habitat) and tea-trees.	Low	Broadly suitable foraging habitat within the Study Area. Low number of records within locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
17.	*Neophema pulchella* Turquoise Parrot	V	-	2	BioNet Atlas	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants or browsing on vegetable matter. Nests in tree hollows, logs or posts, from August to December.	Low	Marginal foraging habitat present within Study Area around eucalypt woodland. Low number of BioNet records within the locality with the most recent being 2004
18.	*Ninox connivens* Barking Owl	V	-	2	BioNet Atlas	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile riparian soils. Potential nest trees are living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.	Low	Potentially suitable foraging habitat within the Study Area. No suitable hollows for breeding within the Study Area. Low number of BioNet records.
19.	*Ninox strenua* Powerful Owl	V	-	20	BioNet Atlas	The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as *Syncarpia glomulifera* (Turpentine), *Allocasuarina littoralis* (Black She-oak), *Acacia melanoxylon* (Blackwood), *Angophora floribunda* (Rough-barked Apple), *Exocarpos cupressiformis* (Cherry Ballart) and a number of eucalypt species. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	Low	Potentially suitable foraging habitat within the Study Area due to the fragmented vegetation across the site. No suitable hollows for breeding with the Study Area. Low-moderate number of records with a recent record (2019) within 1.2kms of the Study Area.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
20.	*Oxyura australis* Blue-billed Duck	V	-	2	BioNet Atlas	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. Forages far from the shore, particularly if dense cover is available in the central parts of the wetland, on the bottom of swamps. Usually nest solitarily in Cumbungi over deep water.	Low	No water bodies within the Development Site. Water bodies within the Study Area do contain dense vegetation, however, they are shallow and not substantial enough in size for this species.
21.	*Pandion cristatus* Eastern Osprey	V	M	3	BioNet Atlas	This species favours coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Low	No suitable foraging or breeding habitat within the Study Area. Low number of BioNet records.
22.	*Petroica boodang* Scarlet Robin	V	-	1	BioNet Atlas	Occurs in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Habitat usually contains abundant logs and fallen timber. Over Autumn and Winter often lives in open grassy woodlands, and grasslands or grazed paddocks with scattered trees.	Low	Broadly suitable within the Study Area. Only one BioNet record within the locality form 1995.
23.	*Pomatostomus temporalis temporalis* Grey-crowned Babbler (eastern subspecies)	V	-	33	BioNet Atlas	Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions. Forages on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses.	**Moderate**	Potentially suitable foraging habitat within the Study Area. Records within the locality, including some within proximity to the Study Area. No nests were identified during the assessment.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
24.	*Ptilinopus magnificus* (Wompoo Fruit-Dove)	V	-	1	BioNet	Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Most often seen in mature forests, but also found in remnant and regenerating rainforest.	Low	Preferred habitat does not occur within the Study Area due to lack of rainforest and/or wet eucalypt forest. One recent BioNet record within the locality.
25.	*Stictonetta naevosa* Freckled Duck	V	-	5	BioNet	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	Low	Marginally suitable habitat around waterbodies within the Study Area that contain *Typha spp.*. Low number of BioNet records within the locality, with the most recent being 1985.
26.	*Tyto novaehollandiae* Masked Owl	V	-	13	BioNet Atlas	Lives in dry eucalypt forest and woodlands from sea level to 1100m. Optimal habitat includes an open understory and a mosaic of sparse (grassy) and dense (shrubby) ground cover on gentle terrain. Masked Owls nest in large hollow eucalypts usually with an internal diameter of 35-50cm and 12-20m high and tend to be within 100m of a creek line (LMCC, 2014). Dead stags are especially popular for roosting/breeding habitat and are a limited resource due to natural attrition.	Low	Potential foraging habitat within the Study Area. No suitably sized hollows for breeding habitat within the Study Area. Recent BioNet records within 500m of the Study Area.
27.	*Tyto tenebricosa* Sooty Owl	V	-	1	BioNet	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. This species forages on arboreal mammals. Nest trees usually consist of large trees with hollows approximately 12m high and have an internal diameter of 35-50cm and tend to occur within 100m of creek lines (LMCC, 2014).	Low	Potential foraging habitat within the Study Area. No suitable breeding hollows within the Study Area. Only one record within the locality form 2002.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
Mammals								
1.	*Chalinolobus dwyeri* Large-eared Pied Bat	V	V	2	BioNet Atlas, PMST	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Found in well-timbered areas containing gullies.	Low	Unsuitable roosting habitat within the Study Area. Low number of BioNet records
2.	*Dasyurus maculatus* Spotted-tailed Quoll	V	E	1	BioNet Atlas, PMST	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites. Mostly nocturnal, although will hunt during the day; spend most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds.	Low	Marginally suitable foraging habitat within the Study Area. Marginal breeding habitat within wooded areas containing large hollows. One record from 2004 within the locality.
3.	*Falsistrellus tasmaniensis* Eastern False Pipistrelle	*V*	-	36	BioNet Atlas	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows but has also been found under loose bark on trees or in buildings.	Low	No suitable habitat within the Study Area. Species previously recorded in 2008 to the east of the Study Area. Low-moderate number of records within the locality.
4.	*Micronomus norfolkensis* Eastern Coastal Freetail-bat	*V*	-	50	BioNet Atlas	Tall open forest, Melaleuca, dry sclerophyll forest, River Red Gum and Yellow Box woodlands and riparian open forest. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	**Known**	Previously identified within the Study Area as part of the Flora and Fauna Assessment (Kleinfelder, 2017).

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
5.	*Miniopterus australis* Little Bent-winged Bat	*V*	-	116	BioNet Atlas	Occupies moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings.	**Known**	Previously recorded within the Study Area in 2017 (Kleinfelder, 2017). No suitable breeding habitat.
6.	*Miniopterus orianae oceanensis* Large Bent-winged Bat (recently renamed from *Miniopterus schreibersii oceanensis* Eastern Bentwing-bat)	*V*	-	39	BioNet Atlas	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	**Known**	Previously recorded within the Study Area in 2017 (Kleinfelder, 2017). No suitable breeding habitat.
7.	*Myotis macropus* Southern Myotis	*V*	-	39	BioNet Atlas	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	**Known**	Previously recorded within the Study Area during the Flora and Fauna Assessment for the 107 Haussman Drive (Kleinfelder, 2017). No suitable foraging habitat.
8.	*Petauroides Volans* Greater Glider	-	V	2	BioNet Atlas, PMST	Open woodland and tall remnant forests where there is suitable eucalypt trees. Rests in hollow trees during the day and feeds at night. Presence and density of Greater Gliders is related to soil fertility, eucalypt tree species, disturbance history and density of suitable tree hollows.	Low	Marginal habitat suitability in remnant vegetation within the Study Area. Low number of records within the locality, most recent being 1998.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
9.	*Petaurus norfolcensis* Squirrel Glider	V	-	28	BioNet Atlas	Inhabits mature or old growth Box, Box-Ironbark woodlands and *Eucalyptus tereticornis* (River Red Gum) forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	**Moderate**	The Study Area may represent potential foraging and breeding habitat for this species. Records occur within the locality.
10.	*Petrogale penicillata* Brush-tailed Rock Wallaby	E	V	0	PMST	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night when foraging.	Nil	No suitable habitat present within the Study Area. No known records within the Study Area.
11.	*Phascogale tapoatafa* Brush-tailed Phascogale	*V*	-	5	BioNet Atlas	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span	**Moderate**	Potentially suitable foraging and breeding habitat within the Study Area. Low number of records within the locality. One recent (2018) record in proximity to the Study Area.
12.	*Phascolarctos cinereus* Koala	E	E	1	BioNet Atlas, PMST	Found in a variety of forest types with suitable feed tree species. Feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Low	Site contains low numbers Koala Feed Trees as listed under the Koala SEPP 2020 - *E. punctata*. Very few records within the locality.
13.	*Potorous tridactylus tridactylus* Long-nosed Potoroo (SE Mainland Population)	V	V	0	PMST	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	Low	Potentially suitable habitat within the Study Area. No known records within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
14.	*Pseudomys novaehollandiae* New Holland Mouse	-	V	0	PMST	Inhabits open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	Nil	No suitable habitat within the Study Area. No known records within the locality.
15.	*Pteropus poliocephalus* Grey-headed Flying-fox	V	V	64	BioNet Atlas, PMST	Occurs across a wide range of habitat types along the eastern seaboard of Australia, depending on food availability. Fruit from myrtaceous trees and rainforest trees form the major components of their diet.	**Moderate**	May forage within the Study Area of flowering *Eucaloyptus spp.* No Flying-fox camp within the Study Area. Closest known nationally significant camp occurs at Tenambit, East Maitland.
16.	*Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat	V	-	8	BioNet Atlas	Roosts in tree hollows and buildings. In treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees.	Low	Potential habitat within the Study Area. Low number of records within the locality.
17.	*Scoteanax rueppellii* Greater Broad-nosed Bat	V	-	26	BioNet Atlas	This species occurs in a variety of habitats including rainforest, dry and wet sclerophyll forest and eucalypt woodland.	**Moderate**	Potentially suitable habitat within the Study Area. Low-moderate amount of records within the locality, including some in proximity to the Study Area.
18.	*Vespadelus troughtoni* Eastern Cave Bat	V	-	15	BioNet Atlas	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	Low	No suitable roosting habitat within the Study Area. No records within proximity to the Study Area. No suitable breeding habitat.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
Amphibians								
1.	*Heleioporus australiacus* Giant Burrowing Frog	-	V	0	PMST	The species occurs along the coast and eastern slopes of the Great Dividing Range south from Wollemi National Park, appearing to exist as 2 populations between Jervis Bay and Eden. Habitat for the species includes sandy soils supporting heath, woodland or open forest. The species breeds in ephemeral to intermittent streams with persistent pools. Only infrequently moves to breeding sites, most commonly found on ridges away from creeks, several hundred metres from water.	Nil	No suitable habitat within the Study Area. No known records within the locality.
2.	*Litoria aurea* Green and Golden Bell Frog	E	V	1	BioNet Atlas, PMST	This species prefers open water bodies, fringed by reeds and other aquatic vegetation for breeding and foraging purposes. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Needs fallen logs and debris for shelter and over-wintering purposes.	Low	No water bodies are present within the Development Site. Water bodies within the Study Area, but outside of the Development Site contain dense *Typha orientalis* vegetation with no open water space. One BioNet record within the locality. Sighting is from 1976.
3.	*Mixophyes balbus* Stuttering Frog	-	V	0	PMST	The species occurs along the east coast of Australia. Habitat for the species includes rainforest and wet, tall, open forest, sheltering in deep leaf litter and thick understorey vegetation on the forest floor. Within Sydney Basin the species is now confined to populations in the Watagan Mountains, the southern Blue Mountains and Macquarie Pass. The species does not occur in areas where the riparian vegetation has been disturbed or where there have been significant upstream human impacts.	Nil	No suitable habitat within the Study Area. No known records within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
4.	*Mixophyes iteratus* Giant Barred Frog	-	E	0	PMST	Occurs on the coast and ranges from south-eastern QLD to the Hawkesbury River in NSW, particularly in Coffs Harbour - Dorrigo area. Forage and live amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest. Breed in shallow, flowing rocky streams. Within Sydney Basin, confined to small populations in tall, wet forest in the Watagan Mountains north of the Hawkesbury and the lower Blue Mountains.	Nil	No suitable habitat within the Study Area. No known records within the locality.
5.	*Uperoleia mahonyi* Mahonyi's Toadlet	E	E	0	PMST	Current observations indicate Mahony's Toadlet inhabits ephemeral and semi-permanent swamps and swales on the coastal fringe of its range. Known records occur in heath or wallum habitats almost exclusively associated with leached (highly nutrient impoverished) white sand. Commonly associated with acid paperbark swamps, Mahony's Toadlet also is known to occur in wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland.	Nil	No suitable habitat within the Study Area. No known records within the locality.
Migratory Terrestrial Species								
1.	*Calidris acuminata* Sharp-tailed Sandpiper	-	M	7	BioNet Atlas, PMST	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. Also occur in saltworks and sewage farms. Use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. Use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
2.	*Calidris melanotos* Pectoral Sandpiper	-	M	2	BioNet Atlas, PMST	Prefers shallow fresh to saline wetlands. Found in coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. Has also been recorded in swamp overgrown with lignum. Forage in shallow water or soft mud at the edge of wetlands.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
	Calidris ruficollis Red-necked Stint	-	M	1	BioNet Atlas	Mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Also occur in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats. Sometimes use flooded paddocks or damp grasslands.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
	Chlidonias leucopterus White-winged Black Tern	-	M	1	BioNet Atlas	Non-breeding visitor, inhabits fresh, brackish or saline, and coastal or subcoastal wetlands. Frequents tidal wetlands, such as harbours, bays, estuaries and lagoons, and their associated tidal sandflats and mudflats. Terrestrial wetlands, including swamps, lakes, billabongs, rivers, floodplains, reservoirs, saltworks, sewage ponds and outfalls are also inhabited.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
	Cuculus optatus Oriental Cuckoo	-	M	0	PMST	Occurs at rainforest edges, leafy trees in paddocks, river flats, roadsides and mangroves.	Nil	No suitable habitat present onsite. No known records of this species within locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
	Gallinago hardwickii Latham's Snipe	-	M	5	BioNet Atlas, PMST	Often recorded in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
	Gelochelidon nilotica Gull-billed Tern	-	M	2	BioNet Atlas	Found in freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
	Hirundapus caudacutus White-throated Needletail	-	M	3	BioNet Atlas, PMST	Forages in high open spaces over varied habitat types although probably recorded most often above wooded or partly wooded areas, including open forest and rainforest, and may also fly between trees or in clearings.	Low	This species may utilise areas above wooded vegetation for foraging within the Study Area. Low number of BioNet records within the locality.
	Monarcha melanopsis Black-faced Monarch	-	M	0	PMST	Found in rainforests, moist eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	Nil	Habitat not suitable for species within the Study Area
	Monarcha trivirgatus Spectacled Monarch	-	M	0	PMST	Inhabits the understorey of mountain/ lowland rainforests, thickly wooded gullies and waterside vegetation including mangroves.	Nil	
	Motacilla flava Yellow Wagtail	-	M	0	PMST	Found in a variety of habitats including short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns.	Low	Marginally suitable habitat present within the Study Area. No known records within the Study Area.
	Myiagra cyanoleuca Satin Flycatcher	-	M	0	PMST	Found in tall forests, preferring wetter habitats such as heavily forested gullies.	Nil	No suitable habitat present within the Study Area. No known records within the Study Area.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
	Rhipidura rufifrons Rufous Fantail	-	M	0	PMST	Found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground.	Nil	No suitable habitat present within the Study Area. No known records within the Study Area.
	Thalasseus bergii Crested Tern	-	M	1	BioNet Atlas	The Crested Tern is usually a strictly coastal species. They breed in colonies on small offshore islands	Low	No suitable habitat present within the Study Area. One BioNet record within the locality from 1986.
	Tringa glareola Wood Sandpiper	-	M	3	BioNet Atlas	Occupies well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. Typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially *Melaleuca* and *Eucalyptus camaldulensis* (River Red Gums) and often with fallen timber. Also frequents inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops. This species uses artificial wetlands, including open sewage ponds, reservoirs, large farm dams, and bore drains.	Low	Marginal habitat may be present around artificial waterbodies within the Study Area. Low number of BioNet records.
	Tringa nebularia Common Greenshank	-	M	4	BioNet Atlas, PMST	Found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. Uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
	Tringa stagnatilis Marsh Sandpiper	-	M	2	BioNet Atlas	Lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
Threatened Ecological Communities								
1.	*Central Hunter Valley Eucalypt Forest and Woodland*	-	CE	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.
2.	*Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South Eastern Queensland ecological community*	-	E	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.
3.	*Lowland Rainforest of Subtropical Australia*	-	CE	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.
4.	*River-flat Eucalypt Forest on Coastal Floodplains of Southern New South Wales and Eastern Victoria*	-	CE	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
5.	*Subtropical and Temperate Saltmarsh*	-	V	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.
6.	*White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*	-	CE	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.
7.	*Lower Hunter Spotted Gum Ironbark Forest*	E	-	-	-	Vegetation present on site is commensurate with the endangered ecological community	**Present**	**Known**

* Status. *Biodiversity Conservation Act 2016* (BC), *Environment Protection and Biodiversity Conservation Act* (EPBC), M (Migratory), V (Vulnerable), E (Endangered), CE (Critically Endangered), E3 (Endangered Ecological Community), E4B (Critically Endangered Ecological Community)

** Records. # (number of records within locality), P (Predicted), K (known to occur with the locality).

*** Source. Bionet (NSW Department of Planning, Industry and Environment (DPIE) BioNet Atlas), PMST (Protected matter database search tool).

APPENDIX B FLORA SPECIES LIST

Table B1 Flora Species List

No.	Scientific Name	Common Name	BAM Growth Form*	Status
1.	*Acacia elongata*	Swamp Wattle	Shrub (SG)	-
2.	*Acacia falcata*		Shrub (SG)	-
3.	*Acacia fimbriata*	Fringed Wattle	Shrub (SG)	-
4.	*Acacia irrorata*	Green Wattle	Shrub (SG)	-
5.	*Acacia parvipinnula*	Silver-stemmed Wattle	Shrub (SG)	-
6.	*Acacia spp.*	Wattle	Shrub (SG)	-
7.	*Ambrosia tenuifolia*	Lacy Ragweed	Exotic	-
8.	*Amyema spp.*	Mistletoe	Other (OG)	-
9.	*Andropogon virginicus*	Whisky Grass	HTW	-
10.	*Angophora costata*	Sydney Red Gum	Tree (TG)	-
11.	*Aristida vagans*	Threeawn Speargrass	Grass & grasslike (GG)	-
12.	*Arthropodium milleflorum*	Pale Vanilla-lily	Forb (FG)	-
13.	*Asparagus aethiopicus*	Asparagus Fern	HTW	-
14.	*Aster subulatus*	Wild Aster	Exotic	-
15.	*Bidens pilosa*	Cobbler's Pegs	HTW	-
16.	*Billardiera scandens*	Hairy Apple Berry	Other (OG)	-
17.	*Brachyscome multifida*	Cut-leaved Daisy	Forb (FG)	-
18.	*Breynia oblongifolia*	Coffee Bush	Shrub (SG)	-
19.	*Bursaria spinosa*	Native Blackthorn	Shrub (SG)	-
20.	*Callistemon salignus*	Willow Bottlebrush	Shrub (SG)	-
21.	*Casuarina glauca*	Swamp Oak	Tree (TG)	-
22.	*Centella asiatica*	Indian Pennywort	Forb (FG)	-
23.	*Centella cordifolia*		Forb (FG)	-
24.	*Cheilanthes sieberi*	Rock Fern	Fern (EG)	-
25.	*Chloris gayana*	Rhodes Grass	HTW	-
26.	*Cirsium vulgare*	Spear Thistle	Exotic	-
27.	*Commelina cyanea*	Native Wandering Jew	Forb (FG)	-
28.	*Conyza bonariensis*	Flaxleaf Fleabane	Exotic	-
29.	*Cortaderia selloana*	Pampas Grass	HTW - Manageable	-
30.	*Corymbia maculata*	Spotted Gum	Tree (TG)	-
31.	*Cyanthillium cinereum*	Purple Fleabane	Exotic	-

No.	Scientific Name	Common Name	BAM Growth Form*	Status
32.	*Cymbopogon refractus*	Barbed Wire Grass	Grass & grasslike (GG)	-
33.	*Cynodon dactylon*	Common Couch	Grass & grasslike (GG)	-
34.	*Cyperus eragrostis*	Umbrella Sedge	HTW	-
35.	*Cyperus spp.*		Grass & grasslike (GG)	-
36.	*Daviesia ulicifolia*	Gorse Bitter Pea	Shrub (SG)	-
37.	*Desmodium rhytidophyllum*		Forb (FG)	-
38.	*Desmodium varians*	Slender Tick-trefoil	Other (OG)	-
39.	*Dianella caerulea*	Blue Flax-lily	Forb (FG)	-
40.	*Dichelachne micrantha*	Shorthair Plumegrass	Grass & grasslike (GG)	-
41.	*Dichondra repens*	Kidney Weed	Forb (FG)	-
42.	*Digitaria parviflora*	Small-flowered Finger Grass	Grass & grasslike (GG)	-
43.	*Dillwynia retorta*		Shrub (SG)	-
44.	*Echinochloa colona*	Awnless Barnyard Grass	Grass & grasslike (GG)	-
45.	*Echinopogon caespitosus*	Bushy Hedgehog-grass	Grass & grasslike (GG)	-
46.	*Einadia nutans*	Climbing Saltbush	Forb (FG)	-
47.	*Entolasia stricta*	Wiry Panic	Grass & grasslike (GG)	-
48.	*Eragrostis brownii*	Brown's Lovegrass	Grass & grasslike (GG)	-
49.	*Eucalyptus fibrosa*	Red Ironbark	Tree (TG)	-
50.	*Eucalyptus globoidea*	White Stringybark	Tree (TG)	-
51.	*Eucalyptus moluccana*	Grey Box	Tree (TG)	-
52.	*Eucalyptus punctata*	Grey Gum	Tree (TG)	-
53.	*Eucalyptus paniculata*	Grey Ironbark	Tree (TG)	-
54.	*Eucalyptus spp.*		Tree (TG)	-
55.	*Eucalyptus umbra*	Broad-leaved White Mahogany	Tree (TG)	-
56.	*Exotic Palm seedling*		Exotic	-
57.	*Facelis retusa*		Exotic	-
58.	*Fimbristylis dichotoma*	Common Fringe-sedge	Grass & grasslike (GG)	-
59.	*Gamochaeta spp.*		Exotic	-
60.	*Geitonoplesium cymosum*	Scrambling Lily	Other (OG)	-
61.	*Glycine clandestina*	Twining glycine	Other (OG)	-
62.	*Glycine microphylla*	Small-leaf Glycine	Other (OG)	-
63.	*Glycine tabacina*	Variable Glycine	Other (OG)	-

No.	Scientific Name	Common Name	BAM Growth Form*	Status
64.	*Gonocarpus tetragynus*	Poverty Raspwort	Forb (FG)	-
65.	*Gonocarpus teucrioides*	Germander Raspwort	Forb (FG)	-
66.	*Goodenia paniculata*		Forb (FG)	-
67.	*Goodenia rotundifolia*		Forb (FG)	-
68.	*Hardenbergia violacea*	False Sarsaparilla	Other (OG)	-
69.	*Hydrocotyle laxiflora*	Stinking Pennywort	Forb (FG)	-
70.	*Hypericum gramineum*	Small St John's Wort	Forb (FG)	-
71.	*Hypochaeris radicata*	Catsear	Exotic	-
72.	*Imperata cylindrica*	Blady Grass	Grass & grasslike (GG)	-
73.	*Indigofera australis*	Australian Indigo	Shrub (SG)	-
74.	*Juncus usitatus*		Grass & grasslike (GG)	-
75.	*Lagenophora stipitata*	Common Lagenophora	Forb (FG)	-
76.	*Lantana camara*	Lantana	HTW - Manageable	-
77.	*Lepidosperma laterale*	Variable Sword-sedge	Grass & grasslike (GG)	-
78.	*Leucopogon juniperinus*	Prickly Beard-heath	Shrub (SG)	-
79.	*Lobelia purpurascens*	Whiteroot	Forb (FG)	-
80.	*Lomandra confertifolia*	Matrush	Grass & grasslike (GG)	-
81.	*Lomandra filiformis*	Wattle Matt-rush	Grass & grasslike (GG)	-
82.	*Lomandra glauca*	Pale Mat-rush	Grass & grasslike (GG)	-
83.	*Lomandra longifolia*	Spiny-headed Mat-rush	Grass & grasslike (GG)	-
84.	*Megathyrsus maximus*		Exotic	-
85.	*Melaleuca armillaris subsp. armillaris*	Bracelet Honey-myrtle	Shrub (SG)	-
86.	*Microlaena stipoides*	Weeping Grass	Grass & grasslike (GG)	-
87.	*Notelaea longifolia*	Large Mock-olive	Tree (TG)	-
88.	*Opercularia diphylla*	Stinkweed	Forb (FG)	-
89.	*Oxalis perennans*		Forb (FG)	-
90.	*Ozothamnus diosmifolius*	White Dogwood	Shrub (SG)	-
91.	*Panicum simile*	Two-colour Panic	Grass & grasslike (GG)	-
92.	*Parsonsia straminea*	Common Silkpod	Other (OG)	-
93.	*Paspalidium distans*		Grass & grasslike (GG)	-
94.	*Paspalum dilatatum*	Paspalum	HTW	-
95.	*Philydrum lanuginosum*	Frogsmouth	Forb (FG)	-

No.	Scientific Name	Common Name	BAM Growth Form*	Status
96.	*Phytolacca octandra*	Inkweed	Exotic	-
97.	*Plantago lanceolata*	Lamb's Tongues	Exotic	-
98.	*Plectranthus parviflorus*		Forb (FG)	-
99.	*Pseuderanthemum variabile*	Pastel Flower	Forb (FG)	-
100.	*Pterostylis spp.*	Greenhood	Forb (FG)	-
101.	*Pultenaea paleacea*	Chaffy Bush-pea	Shrub (SG)	-
102.	*Pultenaea retusa*		Shrub (SG)	-
103.	*Pultenaea spinosa*		Shrub (SG)	-
104.	*Pultenaea villosa*	Hairy Bush-pea	Shrub (SG)	-
105.	*Rytidosperma caespitosum*	Ringed Wallaby Grass	Grass & grasslike (GG)	-
106.	*Schoenus apogon*	Fluke Bogrush	Grass & grasslike (GG)	-
107.	*Senecio madagascariensis*	Fireweed	HTW	-
108.	*Senna pendula var. glabrata*		HTW - Manageable	-
109.	*Setaria parviflora*		Exotic	-
110.	*Setaria sphacelata*	South African Pigeon Grass	Exotic	-
111.	*Sida rhombifolia*	Paddy's Lucerne	Exotic	-
112.	*Solanum mauritianum*	Wild Tobacco Bush	Exotic	-
113.	*Solanum nigrum*	Black-berry Nightshade	Exotic	-
114.	*Solanum prinophyllum*	Forest Nightshade	Forb (FG)	-
115.	*Sonchus asper*	Prickly Sowthistle	Exotic	-
116.	*Sphaeromorphaea australis*	Spreading Nut-heads	Forb (FG)	-
117.	*Themeda triandra*	Kangaroo Grass	Grass & grasslike (GG)	-
118.	*Triadica sebifera*	Chinese Tallowood	HTW - Manageable	-
119.	*Tricoryne elatior*	Yellow Autumn-lily	Forb (FG)	-
120.	*Typha orientalis*	Broad-leaved Cumbungi	Grass & grasslike (GG)	-
121.	*Verbena bonariensis*	Purpletop	Exotic	-
122.	*Wahlenbergia gracilis*	Sprawling Bluebell	Forb (FG)	-

APPENDIX C FAUNA SPECIES LIST

Table C1 Fauna Species List

No.	Scientific Name	Common Name	Status		Observation Type*	General Abundance within Development Site**
			BC Act	EPBC Act		
	Birds					
1.	*Acridotheres tristis*	Common Myna	-	-	VO	C
2.	*Cacatua sanguinea*	Little Corella	-	-	VO, H	UC
3.	*Corvus coronoides*	Australian Raven	-	-	H	C
4.	*Cracticus tibicen*	Australian Magpie	-	-	VO, H	C
5.	*Eolophus roseicapillus*	Galah	-	-	VO	UC
6.	*Trichoglossus haematodus*	Rainbow Lorikeet	-	-	VO	C

* Observation Type: VO (Visual Observation), H (Heard whilst on site), E (Evidence recorded inc scats, tracks or markings), C (Caught on Remote Camera), T (Trapped), R (Recorded through the use of call detectors).

** General Abundance: I (Individual record), UC (Uncommon, 2-5 records), C (Common occurrence on site >5 records). Anabat Detections are classed by confidence: Confident (C), Probable (Pr), and Possible (Po)

^ Denotes introduced species.

APPENDIX D PREDICTED AND CANDIDATE SPECIES REPOORTS

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00024274/BAAS18041/21/00025808	107 Haussman Drive	16/06/2022
Assessor Name	Report Created	BAM Data version *
Gilbert Whyte	11/08/2022	54
Assessor Number	Assessment Type	BAM Case Status
BAAS18041	Part 4 Developments (Small Area)	Finalised
Assessment Revision	BOS entry trigger	Date Finalised
0	BOS Threshold: Area clearing threshold	11/08/2022

* 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.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Diamond Firetail	Stagonopleura guttata	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Eastern False Pipistrelle	Falsistrellus tasmaniensis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Gang-gang Cockatoo	Callocephalon fimbriatum	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Glossy Black-Cockatoo	Calyptorhynchus lathami	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Greater Broad-nosed Bat	Scoteanax rueppellii	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

Grey-crowned Babbler (eastern subspecies)	Pomatostomus temporalis temporalis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Grey-headed Flying-fox	Pteropus poliocephalus	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Large Bent-winged Bat	Miniopterus orianae oceanensis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Little Bent-winged Bat	Miniopterus australis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Little Eagle	Hieraaetus morphnoides	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Little Lorikeet	Glossopsitta pusilla	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Masked Owl	Tyto novaehollandiae	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Painted Honeyeater	Grantiella picta	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Powerful Owl	Ninox strenua	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Regent Honeyeater	Anthochaera phrygia	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Scarlet Robin	Petroica boodang	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Speckled Warbler	Chthonicola sagittata	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Spotted-tailed Quoll	Dasyurus maculatus	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Square-tailed Kite	Lophoictinia isura	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Swift Parrot	Lathamus discolor	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Turquoise Parrot	Neophema pulchella	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Varied Sittella	Daphoenositta chrysoptera	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
White-bellied Sea-Eagle	Haliaeetus leucogaster	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

White-throated Needletail	Hirundapus caudacutus	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Yellow-bellied Glider	Petaurus australis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C

BAM Candidate Species Report

Proposal Details

Assessment Id 00024274/BAAS18041/21/00025808	Proposal Name 107 Haussman Drive	BAM data last updated * 16/06/2022
Assessor Name Gilbert Whyte	Report Created 11/08/2022	BAM Data version * 54
Assessor Number BAAS18041	Assessment Type Part 4 Developments (Small Area)	BAM Case Status Finalised
Assessment Revision 0	Date Finalised 11/08/2022	BOS entry trigger BOS Threshold: Area clearing threshold

* 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.

List of Species Requiring Survey

Name	Presence	Survey Months

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Brush-tailed Rock-wallaby	Petrogale penicillata	Habitat constraints
Eastern Cave Bat	Vespadelus troughtoni	Habitat constraints
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Large-eared Pied Bat	Chalinolobus dwyeri	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
North Rothbury Persoonia	Persoonia pauciflora	Refer to BAR
Regent Honeyeater	Anthochaera phrygia	Habitat constraints
Swift Parrot	Lathamus discolor	Habitat constraints

APPENDIX E BIODIVERSITY CREDIT REPORTS

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00024274/BAAS18041/21/00025808

Proposal Name
107 Haussman Drive

BAM data last updated *
16/06/2022

Assessor Name
Gilbert Whyte

Assessor Number
BAAS18041

BAM Data version *
54

Proponent Names
Sam Rowe

Report Created
11/08/2022

BAM Case Status
Finalised

Assessment Revision
0

Assessment Type
Part 4 Developments (Small Area)

Date Finalised
11/08/2022

BOS entry trigger
BOS Threshold: Area clearing threshold

* 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

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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	HBT Cr	No HBT Cr	Total credits to be retired
1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	0.8	9	11	20

BAM Biodiversity Credit Report (Like for like)

1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602	-	1592_Modified	Yes	9	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602	-	1592_Remnant	No	11	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

No Species Credit Data

BAM Biodiversity Credit Report (Like for like)

Credit Retirement Options

Like-for-like credit retirement options

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00024274/BAAS18041/21/00025808

Proposal Name
107 Haussman Drive

BAM data last updated *
16/06/2022

Assessor Name
Gilbert Whyte

Assessor Number
BAAS18041

BAM Data version *
54

Proponent Name(s)
Sam Rowe

Report Created
11/08/2022

BAM Case Status
Finalised

Assessment Revision
0

Assessment Type
Part 4 Developments (Small Area)

Date Finalised
11/08/2022

BOS entry trigger
BOS Threshold: Area clearing threshold

* 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

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

BAM Biodiversity Credit Report (Variations)

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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	HBT Cr	No HBT Cr	Total credits to be retired
1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	0.8	9	11	20.00

1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602	-	1592_Modified	Yes	9	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602	-	1592_Remnant	No	11	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher threat status	1592_Modified	Yes (including artificial)	9	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher threat status	1592_Remnant	No	11	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like options

APPENDIX F STAFF CONTRIBUTIONS

The following staff were involved in the compilation of this report.

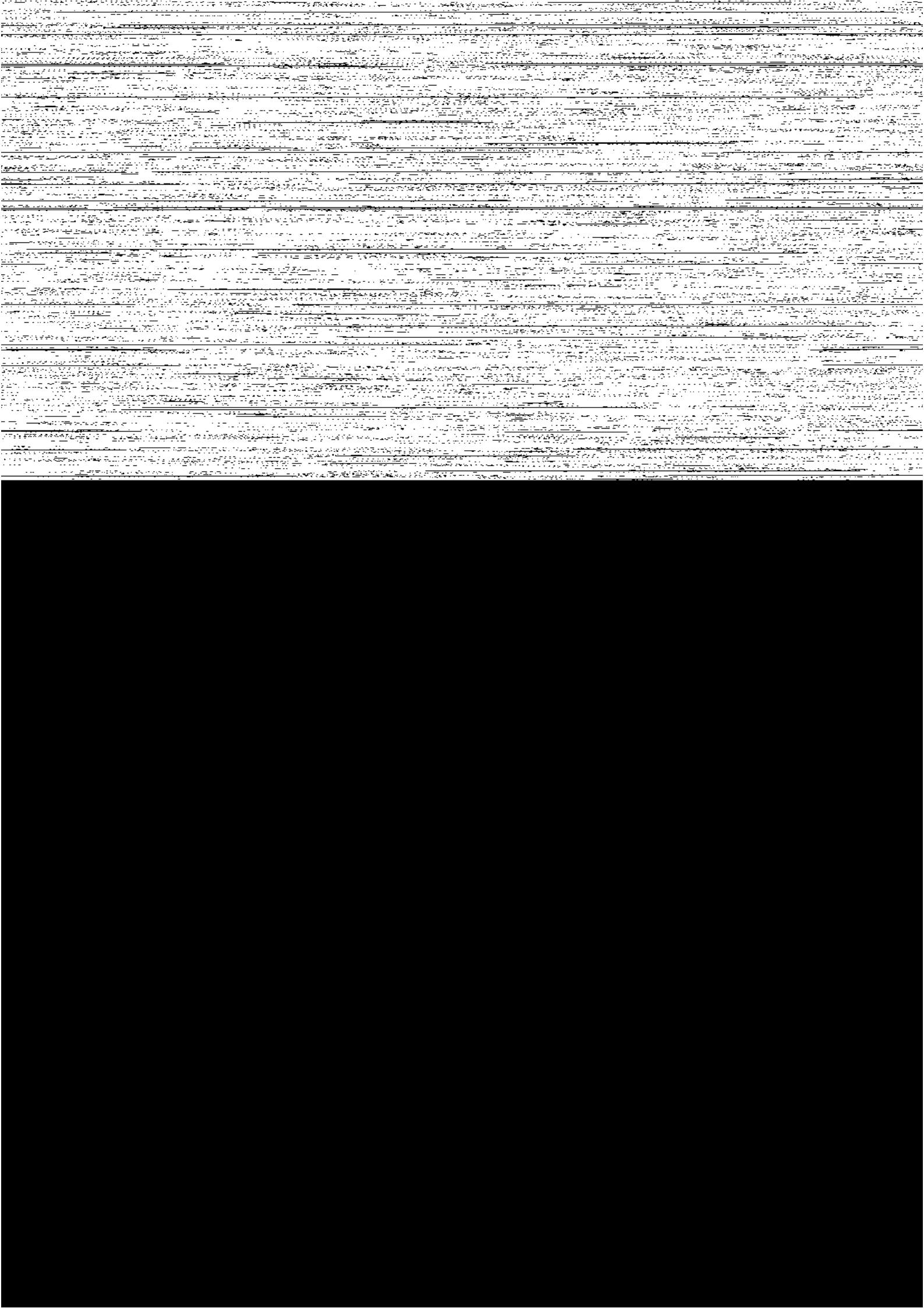
Table E1 Staff Contributions

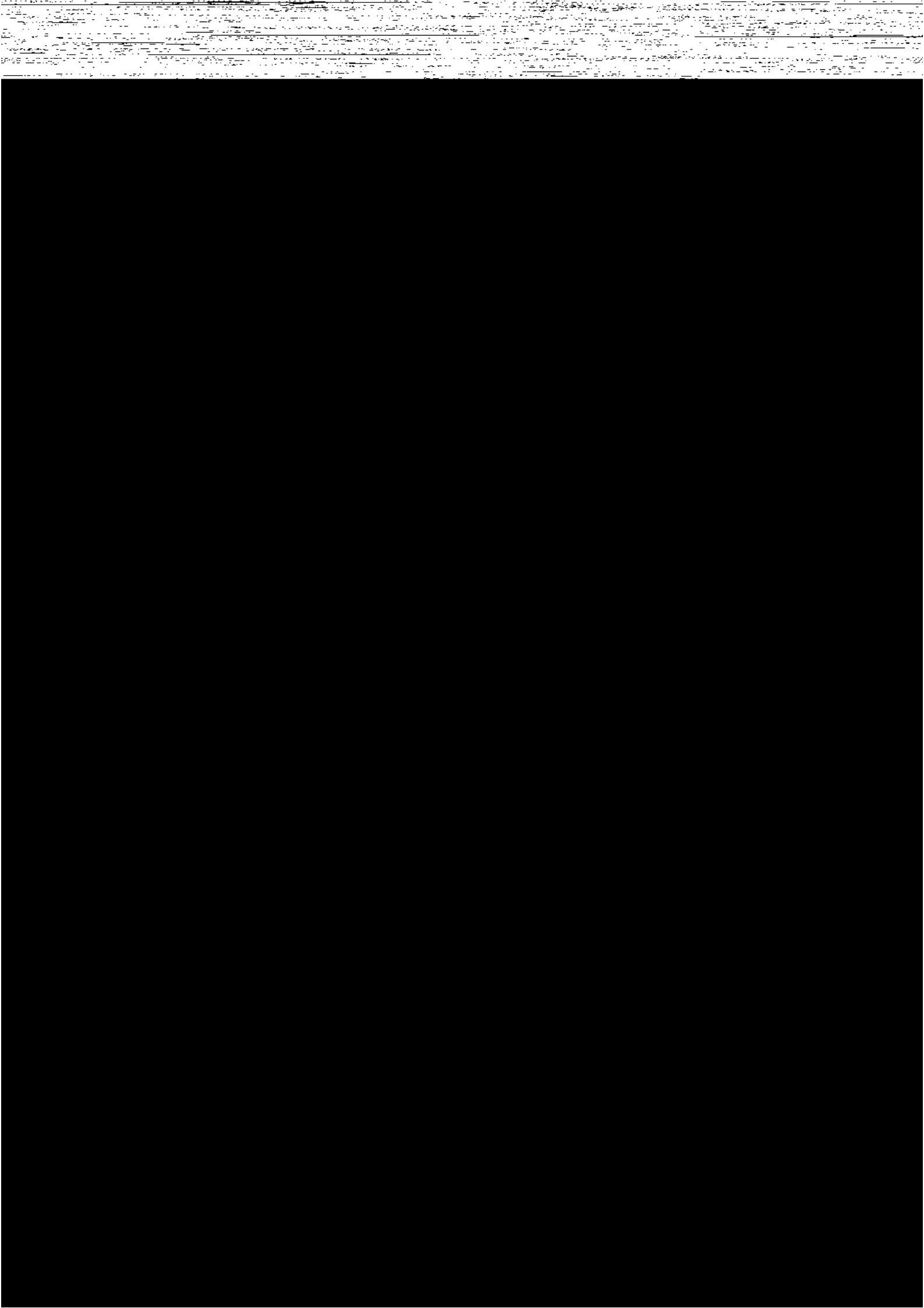
Name	Qualification	Title/Experience	Contribution
Ben Stewart	MMarSc&Mgt	Ecologist (Botanist)	Field surveys and report writing
Dr. Daniel O'Brien	B EnvMgtSc&Sc (PhD)	Senior Ecologist	Report writing and report review
Dr. Gilbert Whyte	B Sc (PhD) Accredited BAM Assessor	Senior Ecologist	Flora Surveys and report review
James Baldry	MConsBio	Graduate Ecologist	Field surveys
Gayle Joyce	B Sc (Forestry) (Hons)	GIS Specialist	GIS and figure preparation
Alan McDonaugh		GIS Specialist	GIS and figure preparation

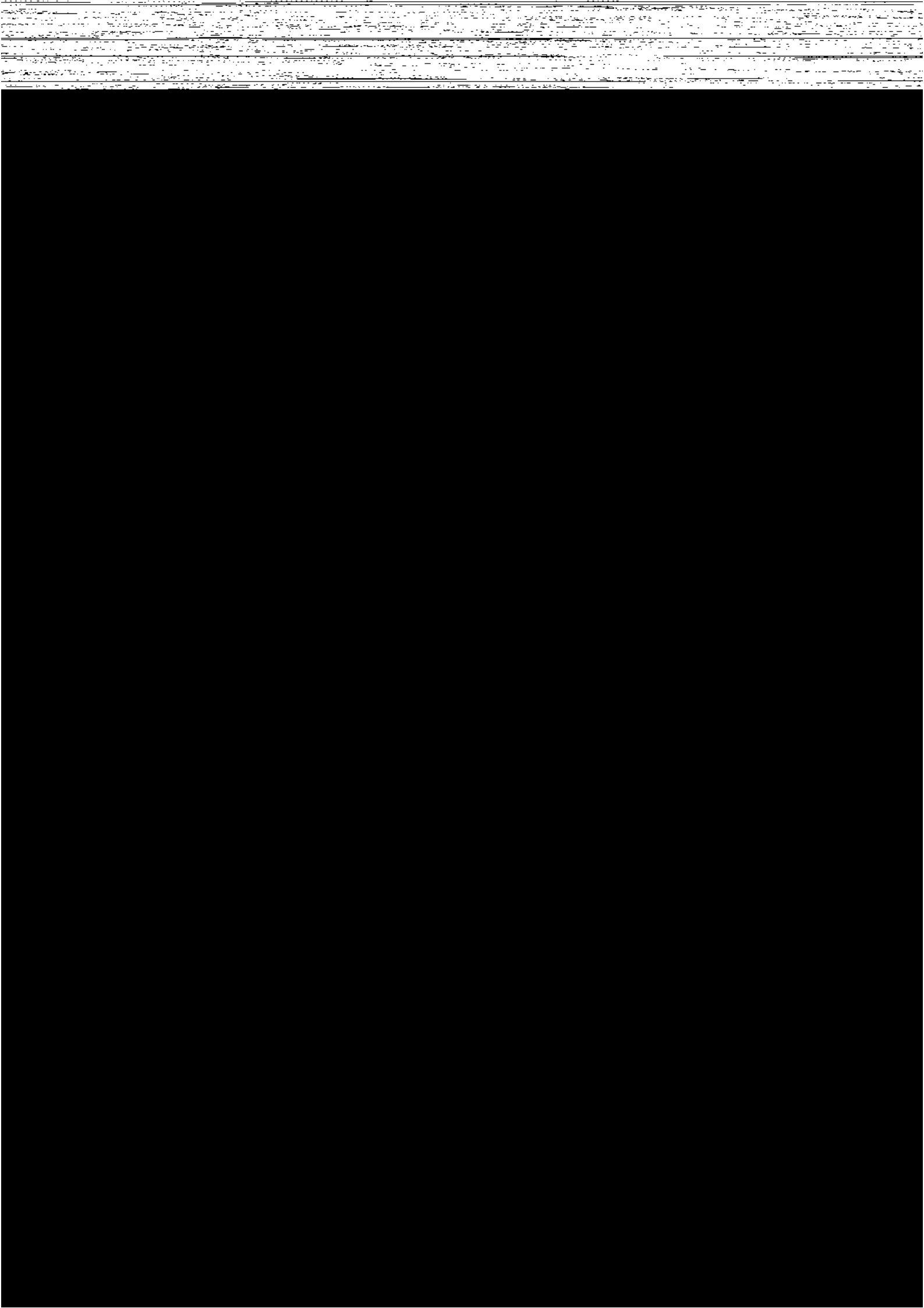
APPENDIX G LICENCING

Kleinfelder employees involved in the current study are licensed or approved under the *Biodiversity Conservation Act 2016* (License Number: SL100730, Expiry: 31 March 2023) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.

APPENDIX H BAM PLOT DATA







NSW GOVERNMENT | Planning & Environment

State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004
Certificate of Site Compatibility

I, the Executive Director, Regions, as delegate of the Secretary of the Department of Planning and Environment determine the application made by McCloy Thornton Pty Limited on 9 August 2017 by issuing this certificate under clause 25(4)(a) of the *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004*.

I certify that in my opinion:

- the site described in Schedule 1 is suitable for more intensive development;
- the development described in Schedule 1 is compatible with the surrounding environment having had regard to the criteria specified in clause 25(5)(b); and
- that development for the purposes of seniors housing of the kind proposed in the development application is compatible with the surrounding land uses only if it satisfies certain requirements specified in Schedule 2 of this certificate.

Stephen Murray
Executive Director, Regions
Planning Services

Date certificate issued: 4 October 2017

Please note: This certificate will remain current for 24 months from the date of this certificate (clause 25(9)).

SCHEDULE 1

Site description: Lot 2, DP 1145348, 107 Haussman Drive, Thornton

Project description: 161 serviced self-contained dwellings, community facilities and associated road works.

SCHEDULE 2

Application made by: McCloy Thornton Pty Limited.

Requirements imposed on determination:
The final design and number of self-care seniors living dwellings in the proposed seniors housing development will be subject to the resolution of issues relating to:

- demonstrate that vegetation modification to support bushfire mitigation and access is balanced against maintaining the ecological values of the EEC on site;
- address health and safety standards for residential development near an electrical substation facility;

- address compliance with clause 26 of the *SEPP (Housing for Seniors or People with a Disability) 2004*; and
- include evidence of compliance with clause 42 of the *SEPP (Housing for Seniors or People with a Disability) 2004*.

Any development application for the proposed development must include the following:

- Traffic Impact Assessment;
- Stormwater Management Plan;
- Contamination Report;
- Flora and Fauna Report;
- Geotechnical investigation; and
- Bushfire Hazard Report.

Department of Planning and Environment

Gateway Determination

***Planning proposal (Department Ref: PP-2021-2820)**:* To enable residential development at 107 Haussman Drive, Thornton

I, the Director, Central Coast and Hunter at the Department of Planning and Environment, as delegate of the Minister for Planning and Homes, have determined under section 3.34(2) of the *Environmental Planning and Assessment Act 1979* (the Act) that an amendment to the *Maitland Local Environmental Plan 2011* to enable residential development at 107 Haussman Drive, Thornton should be resubmitted:

1. The resubmitted planning proposal must be updated to include:
   (a) a biodiversity assessment report prepared in accordance with the NSW Biodiversity Assessment Method;
   (a) confirmation from Subsidence Advisory NSW regarding proposed grouting to resolve stability issues and that the rezoning can proceed based on current remediation; and
   (b) confirmation from NSW Rural Fire Services on need for a secondary access to the site to manage evacuation in the event of a bushfire. Should a secondary access be located on land outside of the planning proposal, confirmation and/or support from adjoining landowners is required.

2. The timeframe to resubmit the planning proposal is by 26 August 2023.

Dated 26th day of August 2022.

Dan Simpkins
Director, Central Coast and Hunter
Department of Planning and Environment

Delegate of the Minister for Planning and Homes

Our ref: PP-2022-4101

Mr Jeff Smith
General Manager
Maitland City Council
PO Box 220
MAITLAND NSW 2320

Dear Mr Smith

Planning proposal PP-2022-4101–107 Haussman Drive, Thornton

I refer to your submission relating to planning proposal PP-2022-4101 to rezone land at 107 Haussman Drive, Thornton to R1 General Residential and E2 Environmental Conservation.

At this stage, I have determined the planning proposal is not yet adequate for consideration for a Gateway determination in accordance with section 3.34(2) of the *Environmental Planning and Assessment Act 1979*.

PP-2021-2820 - Gateway Determination

The Department previously issued a Gateway determination, on 26 August 2022, for PP-2021-2820 which set out issues that were required to be included as part of a resubmitted planning proposal.

Condition 1(a)

I note a biodiversity assessment report has been provided as part of the planning proposal. This addresses condition 1(a) in the Gateway determination. Consultation with Biodiversity Conservation Division will be required and this can be addressed as a result of any Gateway determination for PP-2022-4101 to proceed.

Condition 1(b)

I note Subsidence Advisory NSW advised on 13 September 2022 that a grout/remediation proposal should be prepared by a geotechnical consultant with experience in mine subsidence assessments. After grouting, the geotechnical consultant should undertake sufficient verification boreholes to ensure that the intent of the grout plan has been met and that the risk of pothole subsidence has been effectively eliminated.

It is requested the remediation proposal be provided to facilitate ongoing support or advice from Subsidence Advisory NSW.

Condition 1(c)

I am advised attempts have been made to contact the NSW Rural Fire Services as part of the resubmission of the planning proposal. It is also noted a bushfire threat assessment has been prepared and the adjoining landowners (of 480 Raymond Terrace Road,

Thornton) have provided in-principle support for a secondary access to occur across their site.

Given the best endeavours to seeking confirmation of NSW Rural Fire Services and the in-principle support from the adjoining landowners, I am satisfied condition 1(c) has been satisfied. Consultation with NSW Rural Fire Services will be required and this can be addressed as a result of any Gateway determination for PP-2022-4101 to proceed.

Hunter Regional Plan 2041

The *Hunter Regional Plan 2041* was published in December 2022 and the planning proposal needs to demonstrate consistency with this plan.

Further assessment is required to demonstrate consistency with the *Hunter Regional Plan 2041*. In particular, how the planning proposal is consistent with:

- Strategies 3.1, 5.3, 6.3, 6.4, 7.5, 9.1 or their relevant performance outcomes
- Greater Newcastle District Planning Priority 4
- Place strategy outcomes for Thornton within the National Pinch Point Regionally Significant Growth Area.

The regional plan recognises that in order to achieve the many public interest intentions of the draft plan, new developments will have to be different. There needs to be greater diversity of housing to improve affordability.

The site is well-positioned to a range of day-to-day needs and services, along with public transport. Furthermore, there is an active planning proposal (PP-2022-1187) opposite the site which seeks a range of employment uses. This will further reinforce accessibility for future residents to local employment opportunities without the need to commute by private vehicle.

Given the proposed opportunities for a 15-minute neighbourhood outlined above, a density of only 8 dwellings/ha will remain a significant missed opportunity and substantially below an optimum density for the site.

Section 9.1 Ministerial directions

5.1 Integrating Land Use and Transport

I note an updated traffic impact assessment was provided with the planning proposal. Further consultation with Transport for NSW (TfNSW) will be required to ascertain whether this assessment and the planning proposal aligns with the planned network changes and assumptions in the current modelling work. This consultation can occur as a result of any Gateway determination for PP-2022-4101 to proceed.

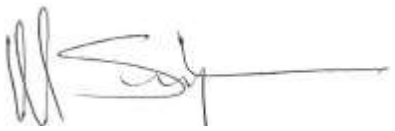
Consistency of the planning proposal across documentation

As the planning proposal has been modified over time, the proposals and recommendations within the documentation have become inconsistent. It is understood the final development footprint is yet to be determined, however, the package for consideration should reflect the same proposed footprint and development description.

The Gateway determination for PP-2021-2820 set out a timeframe of 26 August 2023 for the planning proposal to be resubmitted. We note that PP-2022-4101 was lodged with the Department on 23 May 2023. Given the need for further information to be provided to adequately address the above matters, an extension until 30 October 2023 will be granted to resubmit the planning proposal.

Should you have any enquiries about this matter, I have arranged for Ms Kylie Dorsett, Senior Planning Officer, Central Coast and Hunter to assist you. Ms Dorsett can be contacted on 9995 6666.

Yours sincerely



7 September 2023
Dan Simpkins
Director, Central Coast and Hunter
Local and Regional Planning

Attachment 1: Assessment of Hunter Regional Plan 2041 Strategies

OBJECTIVE 1: Diversify the Hunter's mining, energy and industrial capacity

Strategy 1.1 Planning proposals for mine or power station sites identified as regionally significant growth areas will be supported by a place strategy which demonstrates how the proposal will	Compliance
• maximise employment generation or will attract visitors to the region.	N/A
• make use of voids and/or site infrastructure such as rail loops, hard stand areas, power, water and road access.	N/A
• support the growth of adjoining industrial areas or settlement areas.	N/A
• enhance corridors within the landscape such as biodiversity corridors or disused infrastructure corridors.	N/A
• complement areas with special amenity value such as critical industry clusters, open space, villages and residential areas	N/A
• have considered the existing and likely future uses of adjoining land and avoid land use conflict.	N/A
• align with any specific guidance in the district planning priorities section of this plan	N/A
Strategy 1.4 Planning proposals for new employment lands will demonstrate they:	**Compliance**
• are located in areas which will not result in land use conflict.	N/A
• can be adequately serviced and any biodiversity impacts are manageable	N/A
• respond to the employment land needs identified for that local government area.	N/A
Performance outcomes	**Compliance**
1. Power stations and coal mines facilitate diverse job opportunities on their land either during operation or following closure, with land uses responsive to the characteristics of the locality.	N/A
2. Employment lands provide a variety of employment uses and diversify the employment base.	N/A
3. Employment lands close to inter-regional links support freight, logistics and industries which benefit from connections to inter-regional or global markets.	N/A
4. Employment lands close to renewable energy zones support manufacturing related to renewables and energy intensive industries and clustering of business which supports those activities.	N/A
5. Circular economy industries and facilities are in appropriate sites.	N/A
6. New employment lands are serviced, manage biodiversity impacts and are situated to avoid land use conflict.	N/A
7. Employment lands are retained and safeguarded by limiting the encroachment of sensitive land uses.	N/A

Council response:

Although, the subject site has historically been used as a quarry to extract resources. It has been disused for several years with associated infrastructure being removed. The site is now able to be adaptively reused, remediated, and developed into a future residential subdivision.

OBJECTIVE 2: Support the right of Aboriginal residents to economic self-determination

Council response:

No applicable to this application. Nevertheless, the proposal does offer housing choice and supply to the Aboriginal community via the private market.

OBJECTIVE 3: Create 15-minute neighbourhoods to support mixed, multi-modal, inclusive and vibrant communities

Strategy 3.1 Planning proposals that propose a residential, local centre or commercial centre zone will not prohibit the following land uses within urban core, general urban, inner suburban and general suburban contexts:	**Compliance**
business premises	Yes
restaurants or cafes	Yes
take-away food and drink premises	Yes
neighbourhood shops and supermarkets	Yes
educational establishments	Yes
early education and care facilities	Yes
health services facilities	Yes
markets	Yes
community facilities	Yes
recreation areas	Yes

Strategy 3.2 Planning proposals will incorporate:

• a small neighbourhood centre if the proposed residential yield exceeds 1,500 dwellings or	N/A
• a large neighbourhood centre if the proposed residential yield exceeds 4,000 dwellings.	N/A
The neighbourhood centre will: • support a floor area informed by a local retail demand analysis	N/A
• have enough developable area to accommodate the uses over one level with at grade parking to reduce costs	N/A
• be located to maximise its convenience for the vast majority of residents of which it serves	N/A
• be located in a high profile location (i.e. main arterial road or precinct with strong pedestrian traffic)	N/A
• be supported by a walkable catchment and pedestrian friendly environment.	N/A
Performance outcomes:	**Compliance**
1. Urban settlement patterns maximise the use of existing infrastructure and reduce travel demand, especially by car.	Yes
2. Neighbourhoods maximise mobility independence and active and public transport opportunities.	Yes
3. Neighbourhoods provide local access to education, jobs, services, open space and community activities.	Yes
4. Neighbourhoods encourage healthy lifestyles with opportunities to experience and engage in the cultural, entertainment, sport and recreation, and educational and activities.	Yes

5. Neighbourhoods establish or reinforce local identity.	Yes
6. Public spaces are designed to invite community interactions and economic, social and cultural activity. They enable a sense of social inclusion, wellbeing, comfort and belonging.	Yes
7. Places are designed to be greener to support the regeneration of and connection to the natural environment.	Yes

Council response:

The proposal does not seek to develop a neighbourhood centre as the dwelling yield estimation is well below 1,500 homes and will be a density of 10-11 dwellings per hectare, and is categorised as 'General Suburban', within the HRP 2041, which seeks an aspiration target of 30 dwellings per hectare. As stated above in this proposal, the site's constraints and characteristics limits the number of lots; however, the flexibility of the proposed R1 zone and ability for landholders to undertake a diversity of denser development will likely increase this estimated density.

The proposal is consistent with several performance outcome. The proposal is a unique and somewhat isolated site surrounded by remnant vegetation, which not only will contribute to the enhancement of the Thorton biodiversity corridor, but also provide a unique local identity for this neighbourhood. The proposal will also contain a public open space to encourage healthy lifestyles with opportunities to experience and engage in the cultural, entertainment, sport and recreation, and educational and activities. While providing a 15-minute neighbourhood with walkable access to jobs and services to the employment precinct within the adjoining Brickworks Road site, which will reduce the need for vehicle travel to these services. The area will also be serviced by public transport and active transport linkages for residents to access surrounding schools, such as those located in Chisholm, Metford and Thorton.

OBJECTIVE 4: An inter-connected and globally-focused Hunter without car dependent communities

Strategy 4.10 Planning proposals will:	**Compliance**
• align with the growth of defence, aeronautics, aerospace, freight and logistics capacity at Williamtown and the Port of Newcastle, taking into consideration the Port of Newcastle Port Master Plan 2040;	N/A
• maximise opportunities to increase capacity to manage freight through the ports/airports and provide access to new markets; and	N/A
• protect ports and airports via assessment of the impacts of development on the port/airport to avoid land limiting their future growth.	N/A
Strategy 4.11 Planning proposals must not undermine the long-term capacity of inter-regional connections to meet future freight and logistics movements.	N/A
Strategy 4.13 Planning proposals will not allow incompatible land uses that could affect the long-term growth of defence -related assets, key strategic links and training areas.	N/A

Performance outcomes	**Compliance**
1. Access is provided to housing, jobs and services by walking, cycling and public transport.	Yes
2. Urban areas and densities support the efficient and viable operation of public transport services.	Yes
3. Key transit corridors provide for the efficient movement of freight.	N/A
4. Access to global gateways is maintained or enhanced and their operation is unimpeded by new development.	N/A
5. A robust digital infrastructure network to service business and social interaction.	N/A

Council response:

The proposal is consistent with several performance outcomes. The site will be designed with an active transport network connecting local roads with, to be developed, and existing active transport networks along Raymond Terrace Road, Haussman Drive and Brickworks Road. These active transport networks, along with existing public transport services will enable a 15-minute neighbourhood from future residents' homes to surrounding jobs and services, such as the to the adjoining future employment precinct at Brickworks Road.

The proposal is estimated to contain a density of 10-11 dwellings per hectare, and is categorised as 'General Suburban' within the HRP 2041, which seeks an aspiration target of 30 dwellings per hectare. As stated above, in this proposal, the site's constraints and characteristics limits the number of lots; however, the flexibility of the proposed R1 zone and ability for landholders to undertake a diversity of denser development will likely increase this estimated density. Regardless the Thorton, Chilsom and Metford areas are either well established urban areas or are undergoing considerable housing development. The area already is serviced by a number of bus and train public transportation systems and with the additional housing from the proposal will further induce the demand for additional public transportation services.

OBJECTIVE 5: Plan for 'nimble neighbourhoods', diverse housing and sequenced development

Strategy 5.3 Planning proposals will not prohibit the following housing typologies within residential zones that apply to urban core, general urban, inner suburban and general suburban contexts:	**Compliance**
attached dwellings	Yes
boarding houses	Yes
dual occupancies	Yes
group homes	Yes
multi dwelling housing	Yes
secondary dwellings	Yes
semi-detached dwellings.	Yes
Performance outcomes	**Compliance**
1. Efficient use of existing infrastructure and services.	Yes
2. Appropriate access to employment, goods, services and infrastructure.	Yes
3. A variety and choice of housing types for existing and future housing needs.	Yes
4. Densities support local business and public transport services.	Yes
5. Protection of agricultural, environmental, resource and industrial lands.	Yes
6. Maintains scenic and recreational values of natural, rural and coastal landscapes.	Yes
7. A diversity of housing provides for choice, independence and affordability to match the specific needs of different communities.	Yes

Council response:

The proposed R1 General Residential zoning will enable the greatest extent of flexibility to permit almost all residential accommodation types. This will result in a variety of housing choice, densities (i.e. secondary dwellings, dial occupancies etc.) and affordable price ranges due to the varying size of lots or future infill development.

The subject site will use efficient use of surrounding existing infrastructure and services to activate the site, while providing additional infrastructure such as public open space, detention basin and active transport network.

Although the subject site will be part reasoned to a R1 General Residential, measure have been taken to ensure the existing remnant vegetation that services as the Thorton biodiversity corridor is preserved and rezoned to C3 Environmental Management. The current RU2 Rural Landscape zone footprint is characterised by the historic

quarry and is highly disturbed, containing no vegetation or agricultural value. Additionally, the scenic landscape will largely be maintained and enhanced via the future construction of the residential development which will include public street trees.

OBJECTIVE 6: Conserve heritage, landscapes, environmentally sensitive areas, waterways and drinking water catchments

	Compliance
Strategy 6.3 Planning proposals will ensure the biodiversity network is protected within an appropriate conservation zone unless an alternate zone is justified following application of the avoid, minimise, offset hierarchy.	Yes
Strategy 6.4 Planning proposals should promote enterprises, housing and other uses that complement the biodiversity, scenic and water quality outcomes of biodiversity corridors. Particularly, where they can help safeguard and care for natural areas on privately owned land.	Yes
Strategy 6.11 Planning proposals will demonstrate that development within a drinking water catchment or sensitive receiving water catchment will achieve a neutral or beneficial effect on water quality.	Yes
Performance outcomes	**Compliance**
1. Areas of high environmental value are protected to contribute to a sustainable region.	Yes
2. The biodiversity network is sustainably managed and provide social, environmental, health, cultural and economic benefits.	Yes
3. Development outcomes maintain or improve the environmental value or viability of the biodiversity network.	Yes
4. Connection with Country is at the core of designing and planning new projects and places.	Yes
5. Aboriginal cultural heritage is recognised and celebrated as living and dynamic and not dealt with statically through harm prevention and protection alone.	Yes
6. Items, areas, objects and places of heritage significance are conserved.	Yes
7. Water management uses innovative approaches in urban, rural and natural areas to enhance and protect the health of waterways, wetlands, coast and bays.	Yes
8. Water quality in drinking water catchments is protected.	Yes

Council response:

Although the proposal does seek to clear part of the remanent vegetation of the subject site to satisfy APZ requirements under the Planning for Bushfire Guideline (refer to Section 8 or Attachment 5), much of the critical biodiversity and biodiversity connectivity of the Thorton biodiversity corridor is sought to be maintained, where possible (refer Section 8, Attachment 1). Council is currently working with the proponents of this proposal, and the adjoining properties to resolve ecological issues at a precinct scale. Independent advice is being commissioned to determine ecological principles for viable corridor widths.

The proposal is also generally consistent with the *Thorton North Masterplan Plan 2003 (pg.15).* The Plan, at the time, did not see a use for the site other than for a quarry purpose. However, indicated where vegetation should be maintained to ensure biodiversity connectivity and function. This corridor is almost identical to the proposed zoning and development footprint, with much of the development occurring in the footprint of the historic mining site (refer Figure 1).

Figure 1: Open space and vegetation map from North Thorton Masterplan 2003

The proposal has also undertaken an Aboriginal Due Diligence report (Section 8, or Attachment 6) which has identified items or objects relating to Aboriginal heritage surround the outskirts of the site, but are not within the development footprint, therefore there will be no impact to Aboriginal heritage.

The proposal has also undertaken both contamination (Section 8, or Attachment 7) and surface water assessments (Section 8, or Attachment 8) due to the site's historic extractive resource quarrying use, and location of a watercourse that traverses the south-eastern boundary. Both assessments found that the subject site was suited for residential development and that environmental measures such as the proposed detention basin could manage the surface water from infill development, while coincidingly creating a greater amenity for the proposed development by combining the detention basin with the public open space and vegetation surrounding the future housing. Measures would also be put in place to improve water quality over time.

OBJECTIVE 7: Reach net zero and increase resilience and sustainable infrastructure

Strategy 7.5 Planning proposals will: protect sensitive land uses from sources of air pollution, such as major roads, railway lines and designated freight routes, using appropriate planning and development controls and design solutions to prevent and mitigate exposure and detrimental impacts on human health and wellbeing.	Yes
Performance outcomes	**Compliance**
1. Communities are designed and equipped to be safe, hazard-resilient places.	Yes
2. Neighbourhoods have inbuilt flexibility and adaptability to accommodate new uses and users in the long-term.	Yes
3. The effects of climate change are managed to optimise safety and resilience for communities and the natural environment.	Yes
4. Development is located away from high-risk areas to avoid community exposure to natural hazards as far as is practical.	Yes
5. Places are designed to support the goal of net zero emissions by 2050 and opportunities for mitigation and adaptation to a changing climate and environment.	Yes

Council response:

The proposal has undertaken a number of environmental hazard assessments to ensure the future residential development can be resilient and respondent to a number of threats such as bushfire, urban heat,

electrotechnology infrastructure and surrounding roads etc. The subject site is unique, in that it is characterised by remnant vegetation surrounding the boundary of the site creating a natural buffer from the impacts of noise, odour, and pollution from roads, rail, electrical substation infrastructure and future employment lands. The historic quarry has also created a footprint that reduces the risk of bushfire threat, with a secondary access being incorporated to ensure emergency evacuation.

The future residential development will incorporate public street trees, public open space, and a detention basin to reduce the impacts of urban heat. Additionally the preliminary concept subdivision layout (**Figure 1**) has orientated housing to be adaptable to solar orientation, installing future solar and other renewable energy infrastructure and be constructed to the standard of BASIX, therefore accommodating any advance in climate change impact.

OBJECTIVE 8: Plan for businesses and services at the heart of healthy, prosperous and innovative communities

	Compliance
Strategy 8.2 Planning proposals will accommodate new commercial activity in existing centres and main streets unless it forms part of a proposed new community or is an activity that supports a 15-minute neighbourhood.	N/A
Strategy 8.6 Planning proposals to facilitate tourism activities will:	
• demonstrate that the scale and type of tourism land use proposed can be supported by the transport network and complements the landscape setting	N/A
• be compatible with the characteristics of the site and existing and likely future land uses in the vicinity of the site	N/A
• demonstrate that the tourism land use would support the function of nearby tourism gateways or nodes	N/A
• be supported by an assessment prepared in accordance with the Department of Primary Industries' Land Use Conflict Risk Assessment Guide if the use is proposed on or in the vicinity of rural zoned lands.	N/A
Performance outcomes	**Compliance**
1. The function and vitality of centres, and main streets is strengthened, and urban renewal responds to heritage and local character	N/A
2. Centres and main streets provide a diverse array of land uses and activities.	N/A
3. New centres or main streets support the existing network and do not undermine its function or future growth.	N/A
4. Centres and main streets adapt to the demands of a transitioning economy, serve the current and future economic and social needs of the community and business, and drives productivity, collaboration and economic growth.	N/A
5. Knowledge clusters are globally and nationally connected vibrant, collaborative places that drive innovation and creativity in the market, attract investment and enhance human capital.	N/A
6. Tourism activities support domestic and international visitors, providing diverse and sophisticated tourism experiences, and complement the landscape setting and avoid land use conflict.	N/A

Council response:

Not applicable. The proposal does not propose to develop a centre as it is below the dwelling threshold.

OBJECTIVE 9: Sustain and balance productive rural landscapes

	Compliance
Strategy 9.1 Planning proposals will consider the location of mineral and energy resources, mines and quarries and ensure sensitive land uses would not encroach on those operations. A noise study may be	Yes

	Compliance
required to demonstrate impacts on the operations can be avoided or mitigated.	
Strategy 9.6 Planning proposals to expand rural town and village growth boundaries will be supported by an assessment prepared in accordance with the Department of Primary Industries' Land Use Conflict Risk Assessment Guide to limit or avoid conflicts between residential uses and agricultural activities.	N/A
Strategy 9.4 Planning proposals for lands within or near critical industry cluster land will demonstrate they are	
• compatible with equine and viticultural activities and:	N/A
• complements scenic values, visual amenity and local character	N/A
• provides suitable separation distances for sensitive uses, like tourist accommodation, having regard to spray, noise, and lighting considerations	N/A
• considers existing and likely future agricultural and rural uses of adjoining lands and the cumulative impact of similar proposals on the locality.	Yes
Performance outcomes	**Compliance**
1. Mines, quarries and irrigated or important agricultural lands are protected from encroachment by sensitive uses.	Yes
2. Food and fibre processing facilities, service and value-adding industries related to agriculture and primary industry production are increased.	N/A
3. Dispersed rural settlement is prevented to protect agricultural production and avoid unreasonable or uneconomic demands for public infrastructure or services.	N/A
4. Existing towns and villages in and around the equine and viticulture clusters are strengthened by orienting residential growth toward these locations.	N/A
5. The productive capacity and resource base for agriculture is recognised and managed for long-term agricultural production, particularly for irrigated or important agricultural land.	N/A

Council response:

The subject site will utilise a disused quarry which has not been in operation for over a decade. The quarry infrastructure has long been removed and site has remained mainly cleared with unsealed access to the site. As the quarry is not in operation it does not require ongoing protection, additionally, the site has been identified as a *Residential Investigation Area* within the superseded MUSS since 2001 and in the currently adopted LSPS.

The proposal also does not require any noise study to demonstrate impacts on operations, as the quarry is not in operation.

The subject site is also not identified to contain irrigation or important agricultural lands under its RU2 zoning, as stated above due to the historic use of the quarry.

PART 3 DISTRICT AND GROWTH AREAS: PLANNING PRIORITY 4: Grow Maitland's strategic centres along the New England Highway

Planning Priority 4: Desired future outcome for the proposed site and surrounds	Compliance
Maitland is a growing metropolitan area, with strategic centres servicing the hinterland and rural areas of Dungog, several large urban release areas, centres undergoing revitalisation and historic rural villages. Given the challenges in servicing this number of development fronts and increasing dwelling density near centres, transport nodes, the NSW	Yes

Planning Priority 4: Desired future outcome for the proposed site and surrounds	Compliance
Government and Maitland City Council will coordinate services and infrastructure to enable the provision of new housing and employment. East Maitland, as an emerging strategic centre for health and retail, will accommodate economic, housing and services growth. The health precinct around the new Maitland Hospital will provide modern healthcare facilities and be a place of innovation and high-quality healthcare for decades. The Greenhills precinct will remain a place for modern retail, dining and entertainment, together with diverse housing options. It is expected to house more than 30,000 people over the next 20 years and critical industrial and specialised retail precincts. Challenges include providing infrastructure and services, ensuring connectivity along the New England Highway into Maitland, maintaining important vistas, and enhancing biodiversity corridors. These development fronts form the New England Growth Corridor, with each area enjoying its own distinct character. A holistic and coordinated planning approach will ensure each area achieves its potential.	

Council response:

The proposal aligns and complements the with the desired future outcome and planning priority as follows:

The subject site has been identified as a Residential Investigation Area since MUSS 2001, and LSPS. This will enable additional housing within the wider East Maitland Catalyst Area an be in close proximity to future services and jobs. This proposal will also complement the work currently being undertaken for the EMCA Place Strategy which will aspire for greater density, infrastructure sequencing and delivering and creating healthier and better wellbeing communities anchored by the Maitland Hospital, Greenhills regional shopping centre and future Brickworks employment precinct.

The site has been included in the development contribution boundary and schedule for works within the North Thorton Development Contribution Plan, as such it's development will assist in funding and delivering needed future infrastructure to deal with the increase in population for this brownfield site.

Due to the short-term timeframe of developing the Brickworks Road and subject site, upgrades are currently underway to improve the capacity and safety of the Government Road and Raymond Terrace Road intersection.

PART 3 DISTRICT AND GROWTH AREAS: National Pinch Point regionally significant growth area

	Compliance
Place Strategy Outcomes: 3 Thorton	Yes
• Reinforce business and light industrial uses to service the surrounding residential community and to complement services offered at Thornton local centre.	N/A
• Create a continuous green corridor linking land south of the rail line through to land north of Raymond Terrace Road.	N/A
• Encourage development of the former brickworks site on the corner of Haussman Drive and Raymond Terrace Road into a new employment precinct.	Yes

Council response:

The separate proposal Brickworks Road Employment Precinct (PP-2022-1187) was recently adopted by Council for endorsement for finalisation. Therefore, this Place Strategy outcome has been achieved. The subject site will contribute to this employment precinct by increasing the residential population catchment who will be 400m away from accessing these services and obtaining potential future jobs.

Apart from this Place Strategy Outcome, the subject site is identified as being zoned for ‘residential land’ which is consistent with this proposal.

BUSHFIRE THREAT ASSESSMENT

FOR
A PLANNING PROPOSAL TO REZONE LAND FOR A RESIDENTIAL SUBDIVISION AT

NO.107 HAUSSMAN DRIVE THORNTON

NSW 2322

Prepared by:

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Site Details:	107 Haussman Drive, Thornton NSW 2322
Prepared by:	***Sarah Jones B.Env.Sc.,G.Dip.DBPA (Design in Bushfire Prone Areas)*** ***Firebird ecoSultants Pty Ltd*** **A**BN – 16 105 985 993 PO Box 354, Newcastle NSW 2300 M: 0414 465 990 Email: sarah@firebirdeco.com.au T: 02 4910 3939 Fax: 02 4929 2727
Prepared for:	McCloy Group
Reference No.	107 Haussman Drive – McCloy Group – July 2024
Document Status & Date:	17/07/2024
Author:	Azmina Shafie
First Reviewer:	Liv Page
Second Reviewer:	Sarah Jones

Disclaimer

Not withstanding the precautions adopted within this report, it should always be remembered that bushfires burn under a wide range of conditions. An element of risk, no matter how small always remains, and although the standard is designed to improve the performance of such buildings, there can be no guarantee, because of the variable nature of bushfires, that any one building will withstand bushfire attack on every occasion.

Executive Summary

A Bushfire Threat Assessment Report (BTA) has been prepared by Firebird ecoSultants Pty Ltd at the request of McCloy Group for a proposed residential subdivision at 107 Haussman Drive, Thornton NSW 2322**.** The report forms part of the supporting documentation for a Planning Proposal to be submitted to Maitland City Council (MCC).

The report demonstrates compliance with Planning for Bushfire Protection 2019 (NSW RFS, 2019), AS3959-2018 Construction of Buildings in Bush Fire Prone Areas. This assessment aims to consider and assess the bushfire hazard and associated potential threats relevant to the proposal. Recommendations are provided with regard to fuel management, access, provision of emergency services, building protection and construction standards to facilitate an acceptable level of bushfire protection.

In summary, the following is recommended to enable the proposal to meet the relevant legislative requirements for the proposed subdivision:

1. **Asset Protection Zone (APZ) - The APZ provides space and reduced fuel loads to ensure radiant heat levels at the buildings are below critical limits and to prevent direct flame contact.**

   Assessment in accordance with PBP 2019 has shown that future dwellings within the lots will be able to achieve BAL-29 or less. In any case, future dwellings within the site will be assessed under Section 4.14 of EP&A Act for each individual dwelling upon application.

   The APZ distances are to be managed as described under 'Planning for Bushfire Protection (Appendix 4 – Asset Protect Zone Requirements)' and the document titled 'Standards for Asset Protection Zones'.

2. **Roads - Access standards provide for emergency evacuation and firefighting operations**

   - The perimeter roads identified on the subdivision plan comply with the following criteria:
     - Are two-way sealed roads;
     - Minimum 8m carriageway width kerb to kerb;
     - Parking is provided outside the carriageway width;
     - Hydrants are located clear of parking areas;
     - Are through roads and these are linked to the internal road system at an interval of no greater than 500m;
     - Curves of roads have a minimum inner radius of 6m;
     - The maximum grade road is 15 degrees and average grade of not more than 10 degrees;
     - The road crossfall does not exceed 3 degrees; and
     - A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.

- The non-perimeter roads identified on the subdivision plan comply with the following criteria:
  - Minimum 5.5m carriageway width kerb to kerb;
  - Parking is provided outside the carriageway width;
  - Hydrants are located clear of parking areas;
  - Are through roads and these are linked to the internal road system at an interval of no greater than 500m;
  - Curves of roads have a minimum inner radius of 6m;
  - The road crossfall does not exceed 3 degrees; and
  - A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.

3. Construction Standards – Construction standards seek to increase the protection of the habitable buildings from bushfire. The shorter the APZ (distance between the external wall of the habitable building and the unmanaged vegetation), then the higher the construction standard, which is referred to as the BAL

Any future dwelling in the proposed building envelope will be able to achieve BAL-29 or less. In any case, any future dwellings within the site will be assessed under Section 4.14 of the EP&A Act for each individual dwelling upon application.

4. Water supply and utilities

Reticulated water is extended into the site. The development will be linked to the water pressure mains and the proposed internal fire hydrant spacing, sizing and pressures are to comply with AS 2419.1-2005 Fire Hydrant Installations – System design, installation and commissioning (2005).

5. Landscaping – The type, location and ongoing maintenance of landscaping is considered a necessary BPM

- The identified APZs are to be managed in accordance with accordance with PBP (Appendix 4);
- A clear area of low-cut lawn or pavement is maintained adjacent to the dwellings; and
- Fencing details in accordance with PBP (7.6 – Fences and gates)

I certify the development conforms to the relevant specifications and requirements of Planning for Bushfire Protection 2019

Sarah Jones
B.Env.Sc., G.Dip.DBPA (Design for Bushfire Prone Areas)
FPA BPAD-A Certified Practitioner (Certification Number BPD-PA-26512)
Ecologist / Bushfire Planner

Terms & Abbreviations

Abbreviation	Meaning
APZ	Asset Protection Zone
AS2419 -2005	Australian Standard – Fire Hydrant Installations
AS3959-2018	Australian Standard – Construction of Buildings in Bush Fire Prone Areas
BCA	Building Code of Australia
BPA	Bush Fire Prone Area (Also Bushfire Prone Land)
BFPL Map	Bush Fire Prone Land Map
BPMs	Bush Fire Protection Measures
BFSA	Bush Fire Safety Authority
CC	Construction Certificate
MCC	Maitland City Council
EPA Act	*NSW Environmental Planning and Assessment Act 1979*
FFDI	Forest Fire Danger Index
FMP	Fuel Management Plan
ha	hectare
IPA	Inner Protection Area
LGA	Local Government Area
OPA	Outer Protection Area
PBP	Planning for Bushfire Protection 2019
PoM	Plan of Management
RF Act	Rural Fires Act 1997
RF Regulation	Rural Fires Regulation

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1 INTRODUCTION

A Bushfire Threat Assessment Report (BTA) has been prepared by Firebird ecoSultants Pty Ltd at the request of McCloy Group for a proposed residential subdivision at 107 Haussman Drive, Thornton, hereafter referred to as the "site" (refer to Figure 1-1 for site locality).

This BTA is suitable for submission with a Planning Proposal and provides information on measures that will enable the development to comply with 'Planning for Bushfire Protection' (NSW RFS, 2019), hereafter referred to as PBP (RFS, 2019).

This assessment aims to consider and assess the bushfire hazard and associated potential threats relevant to such a proposal, and to outline the minimum mitigative measures which would be required in accordance with the provisions of the Environmental Planning and Assessment Amendment (Planning for Bushfire Protection) Regulation 2007 and the Rural Fires Amendment Regulation 2007 (RF Amendment Regulation 2007).

1.1 Site Particulars

Locality: 107 Haussman Drive, Thornton NSW 2322

LGA: Maitland City Council

Current Land Use: Vacant lot

Forest Danger Index: 100 FFDI

Note:
Boundaries are not survey accurate.
Although all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

FIGURE 1-1: SITE MAP

Ref No 2025 S

CLIENT	Client
SITE DETAILS	No.107 Haussman Drive Thornton
DATE	18 July 2024

NORTH

0 50 100 150

SCALE 3000 @ A3

Firebird ecoSultants Pty Ltd
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1.2 Description of the Proposal

This Planning Proposal relates to the proposal for a residential subdivision.

1.3 Legislative Requirements

The Site has been mapped as Bush Fire Prone Land Map (BFPLM) by MCC.

This report forms part of the supporting documentation for a Planning Proposal to be submitted to MCC.

This BTA has been prepared using current legislative requirements and associated guidelines for assessment of bushfire protection, these being:

- PBP (RFS, 2019);
- AS3959-2018 Construction of Buildings in Bushfire Prone Area; and

1.4 Objectives of Assessment

This report has been prepared to address the requirements of Clause 44 of the Rural Fires Regulation. This BTA also addresses the six key Bush Fire Protection Measures (BFRMs) in a development assessment context being:

- The provision of clear separation of buildings and bush fire hazards, in the form of fuel-reduced APZ (and their components being Inner Protection Areas (IPA's) and Outer Protection Areas (OPA's);
- Sitting and design of the proposal;
- Construction standards;
- Appropriate access standards for residents, fire-fighters, emergency workers and those involved in evacuation;
- Adequate water supply and pressure, and utility services; and
- Suitable landscaping, to limit fire spreading to a building.

Figure 1-2: Bushfire Prone Land Map

2 METHODOLOGY

2.1 Vegetation Assessment

Vegetation surveys and vegetation mapping carried out on the site has been undertaken as follows:

- Aerial Photograph Interpretation to map vegetation cover and extent
- Confirmation of the vegetation assemblage typology present.

2.2 Slope Assessment

Slope assessment has been undertaken as follows:

- Aerial Photograph Interpretation in conjunction with analysis of electronic contour maps with a contour interval of 10m.

3 SITE ASSESSMENT

The following assessment has been undertaken in accordance with the requirements of PBP (RFS, 2019).

3.1 Vegetation & Slope Assessment

In accordance with PBP (RFS 2019), an assessment of the vegetation over a distance of 140m in all directions from the site was undertaken. Vegetation that may be considered a bushfire hazard was identified in all directions from the site. This assessment is depicted in Table 3-1 and Figure 3-1 that shows the vegetation post development.

In accordance with PBP (RFS 2019), an assessment of the slope that the vegetation considered a bushfire hazard was undertaken and the results are presented in Table 3.1 below.

Table 3-1: Vegetation Classification

Proposed Residential Subdivision		
Direction	**Vegetation Type**	**Slope**
North	Forest	Upslope
Northwest	Remnant vegetation[1]	Upslope
East	Forest	Downslope 0-5°
South	Forest	Cross-slope
Southwest	Forest	Upslope

[1] Vegetation has been assessed as remnant in accordance with Section A1.11 in PBP 2019 as it provides a fire run of <50m in length.

FIGURE 3-1: VEGETATION MAP

Ref No 2025 S

CLIENT	Client
SITE DETAILS	No.107 Haussman Drive Thornton
DATE	23 July 2024

NORTH

0 50 100 150

SCALE 3000 @ A3

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4 BUSHFIRE PROTECTION ASSESSMENT

4.1 Asset Protection Zones (APZ)

The PBP (RFS, 2019) guidelines has been used to determine the widths of the APZs required for habitable buildings within the site using the vegetation and slope data identified in Section 3-1 of this report.

The site lies within Maitland Local Government Area and therefore is assessed under a FDI rating of 100. Using the results from the Site Assessment (section 3-1 of this report) the deemed to satisfy APZ requirements for the proposed buildings within the site was determined using Table A1.12.2 in PBP (RFS, 2019). Refer to Table 4-1 and Figure 5-1 for required APZs for the proposed habitable buildings.

Table 4-1: Recommended APZs for Proposed Residential Subdivision

Direction from Building Envelope	Vegetation Classification within 140m	Effective Slope (within 100m)	APZ to be Provided[1]	Width of allowable OPA[2]	Comment
North	Forest Vegetation	Upslope	An APZ of >24m will be established and maintained within the site.	10m	Acceptable solution in accordance with PBP (RFS, 2019)
Northwest	Remnant Vegetation	Upslope	An APZ of >11m will be established and maintained within the site.	N/A	Acceptable solution in accordance with PBP (RFS, 2019)
East	Forest Vegetation	Downslope 0-5°	An APZ of >29m will be established and maintained within the site.	10m	Acceptable solution in accordance with PBP (RFS, 2019)
South	Forest Vegetation	Cross-slope	An APZ of >24m will be established and maintained within the site.	10m	Acceptable solution in accordance with PBP (RFS, 2019)

Direction from Building Envelope	Vegetation Classification within 140m	Effective Slope (within 100m)	APZ to be Provided[1]	Width of allowable OPA[2]	Comment
Southwest	Forest Vegetation	Upslope	An APZ of >24m will be established and maintained within the site.	10m	Acceptable solution in accordance with PBP (RFS, 2019)

[1] APZ as per Table A1.12.2 in PBP 2019

[2] OPA; Outer Protection area as per Table A1.12.4 in PBP 2019 (See Appendix A here).

Legend

- Subject site
- 29m APZ
- 24m APZ
- 11m APZ

RAYMOND TERRACE ROAD

HAUSSMAN DRIVE

24m

29m

11m

24m

29m

24m

Note:
Boundaries are not survey accurate.
Although all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Google
Nearmap

FIGURE 1-1: ASSET PROTECTION ZONES

Ref No 2025 S

CLIENT	Client
SITE DETAILS	No.107 Haussman Drive Thornton
DATE	24 July 2024

NORTH

0 50 100 150

SCALE 3000 @ A3

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5 DWELLING DESIGN & CONSTRUCTION

Building design and the materials used for construction of future dwellings should be chosen based on the information contained within AS3959-2018, and accordingly the designer / architect should be made aware of this recommendation. It may be necessary to have dwelling plans checked by the architect involved to ensure that the proposed dwellings meet the relevant Bushfire Attack Level (BAL) as detailed in AS3959-2018.

The determinations of the appropriate BAL are based upon parameters such as weather modelling, fire-line intensity, flame length calculations, as well as vegetation and fuel load analysis. The determination of the construction level is derived by assessing the:

- Relevant FFDI = 100
- Flame temperature
- Slope
- Vegetation classification; and
- Building location.

The following BAL, based on heat flux exposure thresholds, are used in the standard:

(a) **BAL – LOW** The risk is considered to be **VERY LOW**

There is insufficient risk to warrant any specific construction requirements but there are still some risks.

(b) **BAL – 12.5** The risk is considered to be **LOW**

There is a risk of ember attack.

The construction elements are expected to be exposed to a heat flux not greater than 12.5 k/m2.

(c) **BAL – 19** The risk is considered to be **MODERATE**

There is a risk of ember attack and burning debris ignited by wind borne embers and a likelihood of exposure to radiant heat.

The construction elements are expected to be exposed to a heat flux not greater than 19 kW/m2.

(d) **BAL-29** The risk is considered to be **HIGH**

There is an increased risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to an increased level of radiant heat.

The construction elements are expected to be exposed to a heat flux no greater than 29 kW/m2.

(e) **BAL-40** The risk is considered to be **VERY HIGH**

There is much increased risk of ember attack and burning debris ignited by windborne embers, a likelihood of exposure to a high level of radiant heat and some likelihood of direct exposure to flames from the fire front.

The construction elements are expected to be exposed to a heat flux no greater than 40 kW/m^2.

(f) **BAL-FZ** The risk is considered to be **EXTREME**

There is an extremely high risk of ember attack and burning debris ignited by windborne embers, a likelihood of exposure to an extreme level of radiant heat and direct exposure to flames from the fire front.

The construction elements are expected to be exposed to a heat flux greater than 40 kW/m^2.

5.1 Determination of Bushfire Attack Levels

Using a FFDI of 100, the information relating to vegetation, slope and according to Table A1.12.5 of PBP 2019 that determined the appropriate BAL. The results from this bush fire risk assessment are detailed below in Table 4-1–Bush Fire Attack Assessment.

Table 5-1: Determination of BALs for Future Dwellings within Site

Vegetation Type & Direction	Separation Distance from vegetation	Bushfire Attack Level (BAL)	Construction Section
Forest to the North	24-<33m	BAL-29	Sect 3 & 7 of AS3959
	33-<45m	BAL-19	Sect 3 & 6 of AS3959
	45-<100	BAL-12.5	Sect 3 & 5 of AS3959
	>100m	BAL-LOW	No construction requirements
Remnant to the Northwest	11-<16m	BAL-29	Sect 3 & 7 of AS3959
	16-<23m	BAL-19	Sect 3 & 6 of AS3959
	23-<100	BAL-12.5	Sect 3 & 5 of AS3959

Vegetation Type & Direction	Separation Distance from vegetation	Bushfire Attack Level (BAL)	Construction Section
	>100m	BAL-LOW	No construction requirements
Forest to the East	29-<40m	BAL-29	Sect 3 & 7 of AS3959
	40-<54m	BAL-19	Sect 3 & 6 of AS3959
	54-<100m	BAL-12.5	Sect 3 & 5 of AS3959
	>100m	BAL-LOW	No construction requirements
Forest to the South	24-<33m	BAL-29	Sect 3 & 7 of AS3959
	33-<45m	BAL-19	Sect 3 & 6 of AS3959
	45-<100	BAL-12.5	Sect 3 & 5 of AS3959
	>100m	BAL-LOW	No construction requirements
Forest to the Southwest	24-<33m	BAL-29	Sect 3 & 7 of AS3959
	33-<45m	BAL-19	Sect 3 & 6 of AS3959
	45-<100	BAL-12.5	Sect 3 & 5 of AS3959
	>100m	BAL-LOW	No construction requirements

Given, the information in Table 5-1 above any future dwellings within the lots will be able to comply with AS3959-2018. These will be subject to further assessment under Section 4.14 of the EP&A Act depending on location of future dwellings and retained vegetation within the site.

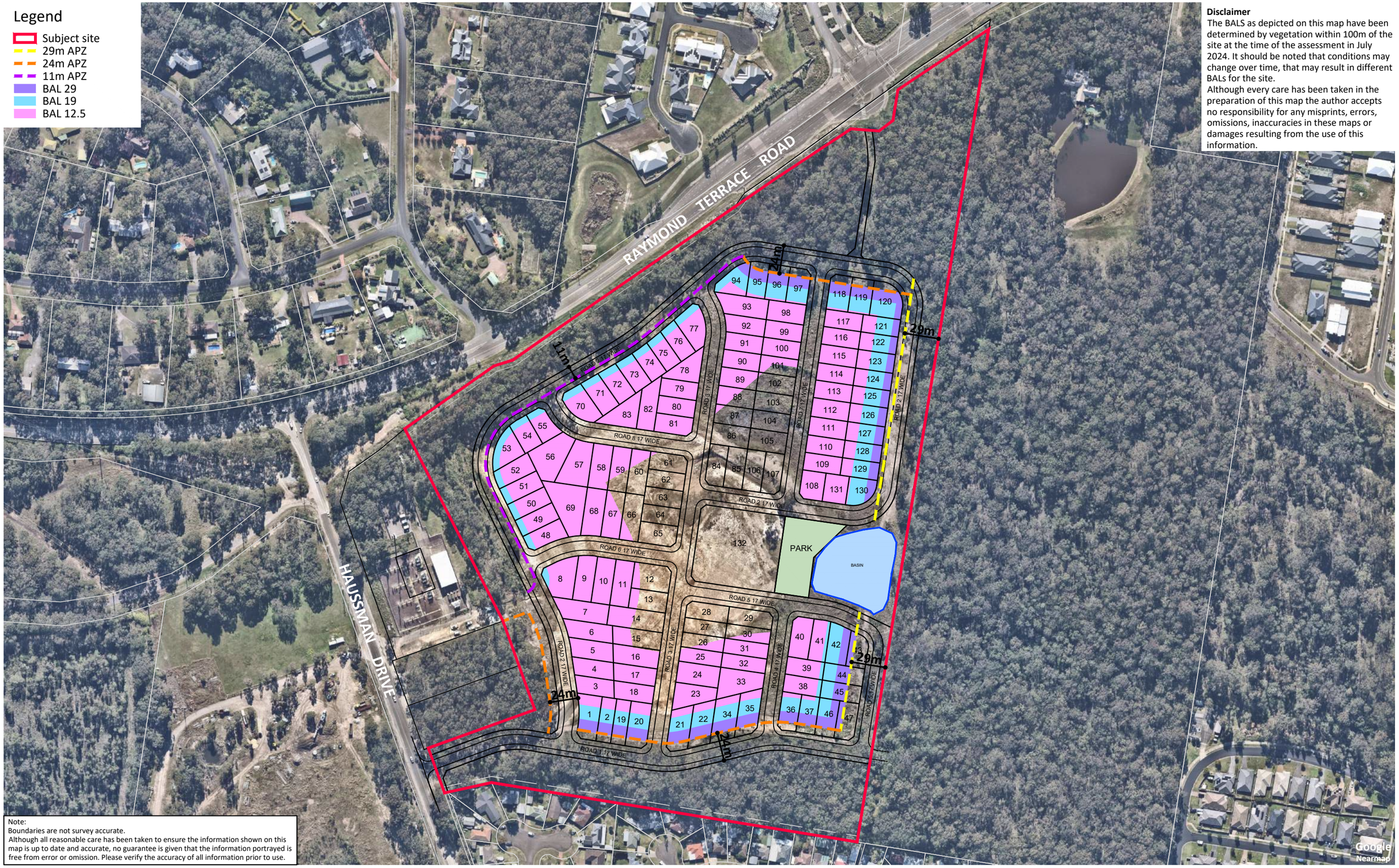
Legend

- Subject site
- 29m APZ
- 24m APZ
- 11m APZ
- BAL 29
- BAL 19
- BAL 12.5

Disclaimer

The BALS as depicted on this map have been determined by vegetation within 100m of the site at the time of the assessment in July 2024. It should be noted that conditions may change over time, that may result in different BALs for the site.

Although every care has been taken in the preparation of this map the author accepts no responsibility for any misprints, errors, omissions, inaccuracies in these maps or damages resulting from the use of this information.



Note:
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FIGURE 5-1: BUSHFIRE ATTACK LEVELS

Ref No 2025 S

CLIENT	Client
SITE DETAILS	No.107 Haussman Drive Thornton
DATE	24 July 2024

NORTH

0 50 100 150

SCALE 3000 @ A3

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6 COMPLIANCE

The proposal is for a residential subdivision and therefore development standards apply. Table 5-1 details the proposed compliance with Development Standards for Residential and Rural Residential Subdivisions.

Table 6-1: Proposed Compliance with Development Standards

Acceptable Solutions	Performance Criteria	Compliance with Performance Criteria
Asset Protection Zones		
〉 APZs are provided in accordance with Tables A1.12.2 and A1.12.3 based on the FFDI.	potential building footprints must not be exposed to radiant heat levels exceeding 29 kW/m² on each proposed lot.	**Complies with Acceptable Solution –** APZs for the site have been provided in accordance with A1.12.2.
〉 APZs are managed in accordance with the requirements of Appendix 4.	APZs are managed and maintained to prevent the spread of a fire towards the building.	**Complies with Acceptable Solution –** APZs on site are to be managed in accordance with Appendix 4 of the PBP 2019.
〉 APZs are wholly within the boundaries of the development site	the APZs is provided in perpetuity	**Complies with Acceptable Solution –** APZs on site occur entirely within the site's boundary.
〉 APZs are located on lands with a slope less than 18 degrees.	APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised.	**Complies with Acceptable Solution –** APZs on site occur over maximum 5° slopes.
Landscaping		
〉 landscaping is in accordance with Appendix 4; and fencing is constructed in accordance with section 7.6.	landscaping is designed and managed to minimise flame contact and radiant	**Complies with Acceptable Solution –** All landscaping within the site will meet the requirements of the acceptable solution.

	heat to buildings, and the potential for wind-driven embers to cause ignitions.	
Access (General Requirements)		
〉 property access roads are two-wheel drive, all -weather roads; 〉 perimeter roads are provided for residential subdivisions of three or more allotments; 〉 subdivisions of three or more allotments have more than one access in and out of the development; 〉 traffic management devices are constructed to not prohibit access by emergency services vehicles; 〉 maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient; 〉 all roads are through roads; 〉 dead end roads are not recommended, but if unavoidable, are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end; 〉 where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road;	firefighting vehicles are provided with safe, all-weather access to structures.	**Complies with Acceptable Solution –** All roads within the site are designed to meet the requirements of the acceptable solution.

〉 where access/egress can only be achieved through forest, woodland and heath vegetation, secondary access shall be provided to an alternate point on the existing public road system; and 〉 one way only public access roads are no less than 3.5 metres wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression.		
〉 the capacity of perimeter and non-perimeter road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges/ 〉 causeways are to clearly indicate load rating.	the capacity of access roads is adequate for firefighting vehicles.	**Complies with Acceptable Solution –** All roads within the site are designed to meet the requirements of the acceptable solution.
〉 hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression; 〉 hydrants are provided in accordance with the relevant clauses of AS 2419.1:2005 - Fire hydrant installations System design, installation and commissioning; and 〉 there is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.	there is appropriate access to water supply.	**Complies with Acceptable Solution –** Hydrants are to be positions appropriately across the site.

Perimeter Roads		
〉 are two-way sealed roads; 〉 minimum 8m carriageway width kerb to kerb; 〉 parking is provided outside of the carriageway width; 〉 hydrants are located clear of parking areas; 〉 are through roads, and these are linked to the internal road system at an interval of no greater than 500m; 〉 curves of roads have a minimum inner radius of 6m; 〉 the maximum grade road is 15 degrees and average grade of not more than 10 degrees; 〉 the road crossfall does not exceed 3 degrees; and 〉 a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.	access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface.	**Complies with Acceptable Solution –** All access roads to the site are designed to meet the requirements of the acceptable solution.
Non-Perimeter Roads		
〉 minimum 5.5m carriageway width kerb to kerb; 〉 parking is provided outside of the carriageway width; 〉 hydrants are located clear of parking areas;	access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating.	**Complies with Acceptable Solution –** All roads within the site are designed to meet the requirements of the acceptable solution.

〉 roads are through roads, and these are linked to the internal road system at an interval of no greater than 500m; 〉 curves of roads have a minimum inner radius of 6m; 〉 the road crossfall does not exceed 3 degrees; and 〉 a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.		
Property Access		
〉 There are no specific access requirements in an urban area where an unobstructed path (no greater than 70m) is provided between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles. **In circumstances where this cannot occur, the following requirements apply:** 〉 minimum 4m carriageway width; 〉 in forest, woodland and heath situations, rural property access roads have passing bays every 200m that are 20m long by 2m wide,	firefighting vehicles can access the dwelling and exit the property safely.	**Complies with Acceptable Solution –** All future lots are to be connected to a public road by a driveway <70m

making a minimum trafficable width of 6m at the passing bay; 〉 a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches; 〉 provide a suitable turning area in accordance with Appendix 3; 〉 curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress; 〉 the minimum distance between inner and outer curves is 6m; 〉 the crossfall is not more than 10 degrees; 〉 maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads; and 〉 a development comprising more than three dwellings has access by dedication of a road and not by right of way. **Note: Some short constrictions in the access may be accepted where they are not less than 3.5m wide, extend for no more than 30m and where the obstruction cannot be reasonably avoided or removed. The gradients applicable to public roads also apply to community style development**		

property access roads in addition to the above.		
Water Supplies		
〉 reticulated water is to be provided to the development where available; 〉 a static water and hydrant supply is provided for non-reticulated developments or where reticulated water supply cannot be guaranteed; and 〉 static water supplies shall comply with Table 5.3d.	adequate water supplies are provided for firefighting purposes.	**Complies with Acceptable Solution –** All lots are to be connected to reticulated water.
〉 fire hydrant, spacing, design and sizing complies with the relevant clauses of Australian Standard AS 2419.1:2005; 〉 hydrants are not located within any road carriageway; and 〉 reticulated water supply to urban subdivisions uses a ring main system for areas with perimeter roads.	Water supplies are located at regular intervals; and the water supply is accessible and reliable for firefighting operations.	**Can Comply with Acceptable Solution –** Hydrants are to be positioned appropriately across the site.
〉 fire hydrant flows and pressures comply with the relevant clauses of AS 2419.1:2005.	flows and pressure are appropriate.	**Complies with Acceptable Solution –** Flows and pressure assumed compliant

〉 all above-ground water service pipes are metal, including and up to any taps; and 〉 above-ground water storage tanks shall be of concrete or metal.	the integrity of the water supply is maintained.	**Complies with Acceptable Solution –** All above ground water service pipes will meet the requirements.
Electricity Services		
〉 where practicable, electrical transmission lines are underground; 〉 where overhead, electrical transmission 〉 lines are proposed as follows: lines are installed with short pole spacing of 30m, unless crossing gullies, gorges or riparian areas; and 〉 no part of a tree is closer to a power line than the distance set out in ISSC3 Guideline for Managing Vegetation Near Power Lines.	location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings.	**Complies with Acceptable Solution –** All future dwelling are able to meet the requirements for electricity services.
Gas Services		
〉 reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 - The storage and handling of LP Gas, the requirements of relevant authorities, and metal piping is used; 〉 all fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side;	location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	**Can Complies with Acceptable Solution –** All future dwelling are able to meet the requirements for gas services

〉 connections to and from gas cylinders are metal; 〉 polymer-sheathed flexible gas supply lines are not used; and 〉 above-ground gas service pipes are metal, including and up to any outlets.		

7 CONCLUSION & RECOMMENDATIONS

In summary, a Bushfire Risk Assessment has been undertaken for a proposed residential subdivision at 107 Haussman Drive, Thornton NSW 2322. The report forms part of the supporting documentation for a Planning Proposal to be submitted to MCC.

If the recommendations contained within this report are duly considered and incorporated, it is considered that the fire hazard present is containable to a level necessary to provide an adequate level of protection to life and property on the subdivision. In summary, the following is recommended to enable the proposal to meet the relevant legislative requirements for the proposed subdivision:

1. **Asset Protection Zone (APZ) - The APZ provides space and reduced fuel loads to ensure radiant heat levels at the buildings are below critical limits and to prevent direct flame contact.**

   Assessment in accordance with PBP 2019 has shown that future dwellings within the lots will be able to achieve BAL-29 or less. In any case, future dwellings within the site will be assessed under Section 4.14 of EP&A Act for each individual dwelling upon application.

   These distances are to be managed as described under 'Planning for Bushfire Protection (Appendix 4 – Asset Protect Zone Requirements)' and the document titled 'Standards for Asset Protection Zones'.

2. **Roads - Access standards provide for emergency evacuation and firefighting operations**

   - The perimeter roads identified on the subdivision plan comply with the following criteria:
     - Are two-way sealed roads;
     - Minimum 8m carriageway width kerb to kerb;
     - Parking is provided outside the carriageway width;
     - Hydrants are located clear of parking areas;
     - Are through roads and these are linked to the internal road system at an interval of no greater than 500m;
     - Curves of roads have a minimum inner radius of 6m;
     - The maximum grade road is 15 degrees and average grade of not more than 10 degrees;
     - The road crossfall does not exceed 3 degrees; and
     - A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.

   - The non-perimeter roads identified on the subdivision plan comply with the following criteria:
     - Minimum 5.5m carriageway width kerb to kerb;
     - Parking is provided outside the carriageway width;
     - Hydrants are located clear of parking areas;

- Are through roads and these are linked to the internal road system at an interval of no greater than 500m;
- Curves of roads have a minimum inner radius of 6m;
- The road crossfall does not exceed 3 degrees; and
- A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.

3. Construction Standards – Construction standards seek to increase the protection of the habitable buildings from bushfire. The shorter the APZ (distance between the external wall of the habitable building and the unmanaged vegetation), then the higher the construction standard, which is referred to as the BAL

Any future dwelling in the proposed building envelope will be able to achieve BAL-29 or less. In any case, any future dwellings within the site will be assessed under Section 4.14 of the EP&A Act for each individual dwelling upon application.

4. Water supply and utilities

Reticulated water is extended into the site. The development will be linked to the water pressure mains and the proposed internal fire hydrant spacing, sizing and pressures are to comply with AS 2419.1-2005 Fire Hydrant Installations – System design, installation and commissioning (2005).

5. Landscaping – The type, location and ongoing maintenance of landscaping is considered a necessary BPM

- The identified APZs are to be managed in accordance with accordance with PBP (Appendix 4);
- A clear area of low-cut lawn or pavement is maintained adjacent to the dwellings; and
- Fencing details in accordance with PBP (7.6 – Fences and gates)

Provided the recommendations stated above are implemented in full Firebird ecoSultants Pty Ltd is of the opinion that the proposed development is able to meet the aims and objectives of PBP (RFS, 2019).

8 BIBLIOGRAPHY

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NSW Rural Fire Service (2019). *Planning for Bushfire Protection – A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners.*

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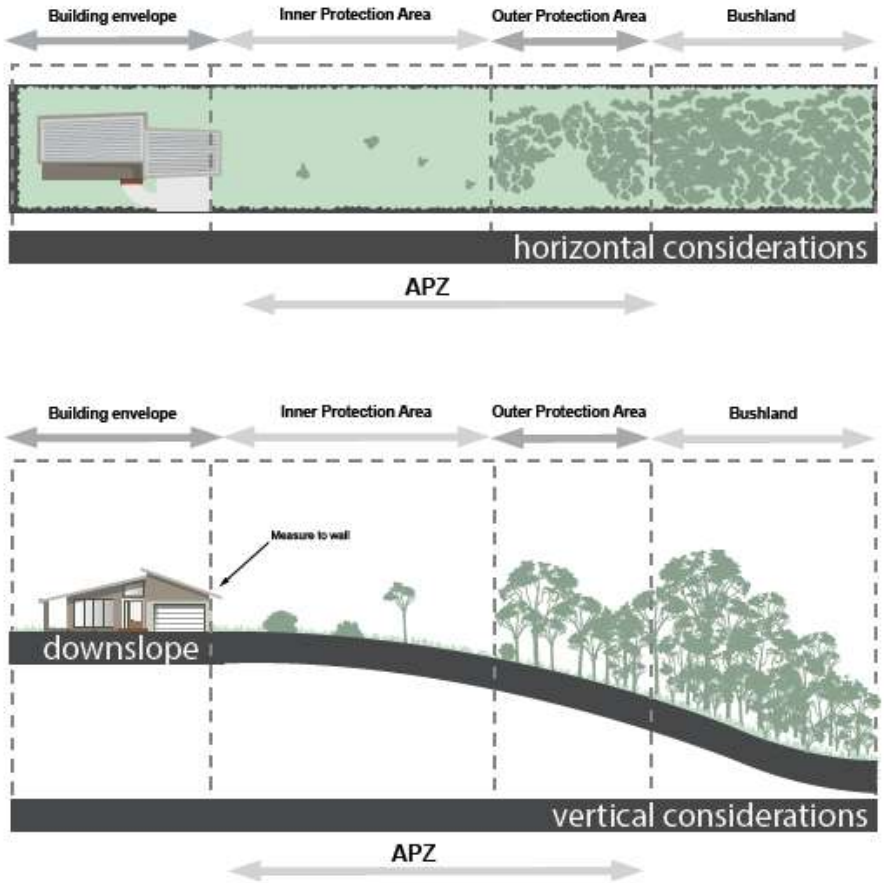
Standards Australia (2018). *AS 3959 – 2018: Construction of Buildings in Bushfire-prone Areas.*

APPENDIX A ASSET PROTECTION ZONES

An Asset Protection Zone (APZ) is an area surrounding a development that is managed to reduce the bushfire hazard to an acceptable level to mitigate the risk to life and property (refer to Figure B-1 below). The required width of the APZ varies with slope and the type of hazard. An APZ can consist of both an Inner Protection Area (IPA) and an Outer Protection Area (OPA). An APZ can include the following:

- Lawns;
- Discontinuous gardens;
- Swimming pools;
- Driveways;
- Unattached non-combustible garages with suitable separation from the Dwelling;
- Open space / parkland; and
- Car parking.

Figure 1: Components of an APZ (PBP 2019)



Inner Protection Area

The Inner Protection Area (IPA) extends from the edge of the OPA to the development. The IPA aims to ensure that the presence of fuels which could contribute to a fire event / intensity, are minimised close to the development. The performance of the IPA must be such that:

- There is minimal fine fuel at ground level which could be set alight by a bushfire; and
- Any vegetation in the IPA does not provide a path for the transfer of fire to the development – that is, the fuels are discontinuous.

The presence of a few shrubs or trees in the IPA is acceptable provided that they:

- Do not touch or overhang any buildings;
- Are well spread out and do not form a continuous canopy;
- Are not species that retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period; and
- Are located far enough away from any Dwelling so that they will not ignite the Dwelling by direct flame contact or radiant heat emission.
- Woodpiles, wooden sheds, combustible material storage areas, large areas / quantities of garden mulch, stacked flammable building materials etc are not permitted in the IPA

Outer Protection Area

The Outer Protection Area (OPA) is located adjacent to the hazard. Within the OPA any trees and shrubs should be maintained in a manner such that the vegetation is not continuous. Fine fuel loadings should be kept to a level where the fire intensity expected will not impact on adjacent developments.

Attn: Andrew Donald Barr Property & Planning 92 Young St, Carrington NSW 2294 ADonald@barrpandp.com.au	HERITAGE NOW VALUING OUR PAST - CREATING OUR FUTURE PO Box 114, Belmont NSW 2280 E: tessa@heritagenow.com.au T: 0425 250 310 W: www.heritagenow.com.au Project Number: HN000126-A

2/10/2020

Dear Andrew,

RE: 107 Haussman Drive, Thornton

Introduction

Heritage Now have been engaged by Barr Property and Planning on behalf of the McCloy Group to provide a desktop assessment as an update to a previous site inspection and Aboriginal due diligence assessment[1]. This assessment has undertaken an updated AHIMS search and analysis of previous findings.

Project Area

The Project area is located at Lot 2 DP1145348 Haussman Drive, Thornton North. The proposal is to rezone the land, which was previously used as a quarry, for residential use. The less disturbed areas are proposed to be rezoned into an E2 Zone. The impact area is almost identical to the previous impact area with the detention basin, a 200m x 60m portion along the north and the north access way.

AHIMS Search

An updated Aboriginal Heritage Information System (AHIMS) was undertaken on 4 September 2020 from latitude -32.7867 to -32.7501 and longitude 151.6074 to 151.6551. The search produced a result of 116 sites. These sites were plotted based on the coordinates provided in the AHIMS search (Figure 1, Attachment A).

There is one Aboriginal site that was registered in the Project Area, registered as AHIMS #38-4-0399 (there is also a duplicate recording of this site listed as AHIMS #38-4-0355). The site has been salvaged/destroyed and is no longer present (Figure 1).

There is one site registered on AHIMS 15 metres east of the boundary of the Project Area, AHIMS #38-4-2001 and comprised an artefact scatter of 14 silcrete stone artefacts (Attachment B). According to the site card (Attachment B) this site extends 12 metres and has low scientific significance with the artefact types and materials being represented elsewhere in the locality; however, it has also been nominated for test excavation under the Code of Practice[2]. However, the AHIMS coordinates for this site differ from the map included in the site card and it is likely that this site is located 450 metres to the east. Numerous attempts were made to contact the archaeologist who recorded the site to clarify its location, but as yet, no further information has been received.

[1] Mary Dallas Consulting Archaeologists, "Due Diligence Aboriginal Heritage Assessment for a Senior Living Development at 107 Haussman Drive, Thornton," 2018.

[2] DECCW, *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water, 2010).

There is a narrow strip of vegetation that appears not to have been previously disturbed by the quarry activity (Figure 2) and while AHIMS #38-4-2001 the first order drainage lines in this area are associated with numerous Aboriginal sites.

The most common site type in the area are surface artefact sites accounting for 89% of all sites. This includes isolated finds and artefact scatters. Where the number of artefacts was not specified in the AHIMS search, the label artefact/s has been given.

Other site types in the area include Potential Archaeological Deposits (PAD). PADs have also been found in association with artefacts, however this is a rarer site type, accounting for only 4% of sites in the area. The site types identified in the AHIMS search are summarised in Table 1.

Table 1 Site Types

Site types	Number	Per cent
Artefact/s	64	55.17%
Isolated Find	22	18.97%
Artefact Scatter	17	14.66%
PAD	8	6.90%
Artefact/s + PAD	5	4.31%
Total	116	100.00%

Of the sites identified 18.10% of sites have been salvaged/destroyed and 1.72% have been partially salvaged/destroyed, meaning that they have been subject to an Aboriginal Heritage Impact Permit. Majority of the sites affected have been surface artefact sites with only one Artefact + PAD site being salvaged/destroyed and one other being partially destroyed. Further details are provided in Table 2. Additional information on the environmental and heritage context is provided in Attachment C.

Table 2 Site Status

Site types	Salvaged/Destroyed	Partially Salvaged /Destroyed	Valid
Artefact/s	13	1	50
Isolated Find	5		17
Artefact Scatter	2		15
PAD			8
Artefact/s + PAD	1	1	3
Total	**21**	**2**	**93**
Per cent	**18.10%**	**1.72%**	**80.17%**

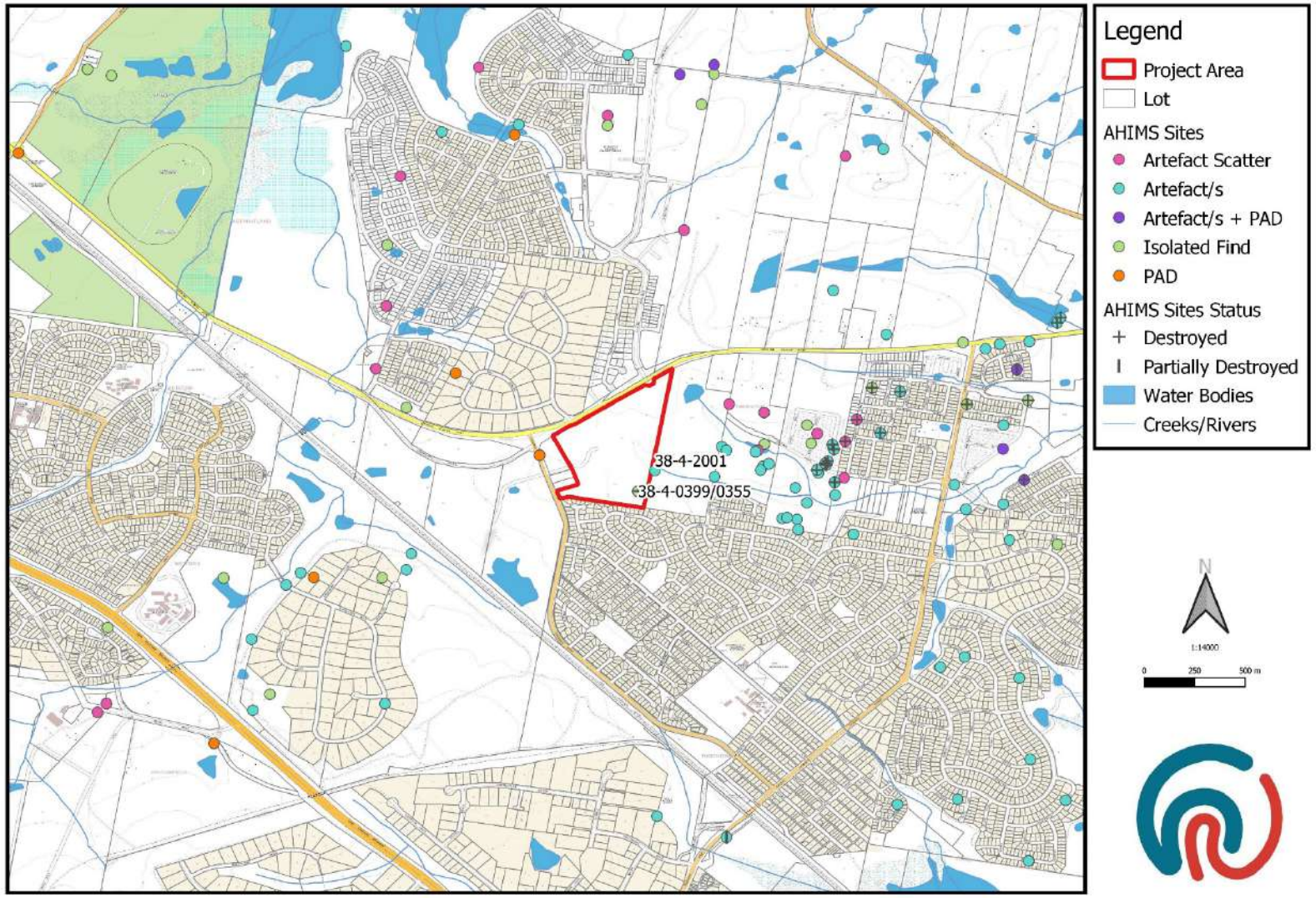


Figure 1 Updated AHIMS Search Results

Figure 2 Close-up of AHIMS site #38-4-2001

Analysis and Review

The Project Area has previously been subject to an Aboriginal Due Diligence Assessment by Mary Dallas Consulting Archaeologists[3] which included a site inspection and Aboriginal consultation. The current impact area is almost identical to the previous, except for the detention basin, a 200m x 60m portion along the north and the north access way. It is noted that this previous assessment addressed the same block of land (Lot 2, DP11453348). The previous assessment included the environmental and heritage context, undertook predictive modelling and Aboriginal consultation, as well as impact assessment and recommendations, thus the report meets the requirements under the Due Diligence Code[4].

The visual inspection was undertaken with a member of the Mindaribba Local Aboriginal Land Council (Jason Brown). No previously unidentified Aboriginal sites were observed, and the area was found to be highly disturbed and modified.

The previous report recommended that no further heritage works were required, but that works were to cease and protocols followed if Aboriginal objects or bones suspected of being human were uncovered.

Since the previous report, artefacts have been identified along the first order creekline which meets the Project Area in the east in an area that does not appear to have been previously impacted by the quarry, as such it is possible that there are additional artefacts associated with this site in the current impact area related to the detention basis. As such, a visual inspection in the vicinity in this area is warranted on the basis of the sensitivity of the landform and apparent lack of disturbance in this portion of the Project Area.

Conclusions

This desktop assessment has updated the AHIMS search and reviewed the previous Aboriginal Due Diligence Assessment. The previous assessment meets the requirements of the Due Diligence Code[5]. However, subsequent to this assessment Aboriginal artefacts have been identified along the first order creeklines in the area and there is a narrow strip of vegetation within the Project Area which appears to have not been disturbed and thus may have Aboriginal artefacts present.

A visual inspection in the vicinity of the AHIMS recorded location of AHIMS #38-4-2001 is needed if this vegetated area is to be impacted and this should be undertaken as part of the detailed design for the Development Application.

The protocols for outlined in the previous report are also to be followed if Aboriginal objects or bones suspected of being human were uncovered.

[3] Mary Dallas Consulting Archaeologists, "Due Diligence Aboriginal Heritage Assessment for a Senior Living Development at 107 Haussman Drive, Thornton."
[4] DECCW, "Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales" (Sydney, NSW: Department of Environment, Climate Change and Water, 2010).
[5] DECCW.

Attachment A AHIMS Search

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : HN126-A Thornton

Client Service ID : 533190

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-0342	Four Mile Creek 1;	AGD	56	370510	6372100	Open site	Valid	Artefact : -	Open Camp Site	2742,100988
	Contact	**Recorders**	Noeleen Curran					**Permits**	2592,2809,2810,3011	
38-4-0345	Thornton 1;	AGD	56	373900	6371700	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0346	Thornton 2;	AGD	56	373750	6371900	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0347	Thornton 3;	AGD	56	373450	6371700	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0348	Thornton 4;	AGD	56	373200	6371670	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718	
38-4-0349	Thornton 5;	AGD	56	373370	6372350	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0352	Thornton 8;	AGD	56	373850	6372960	Open site	Valid	Artefact : -	Isolated Find	100924
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0353	Thornton 9;	AGD	56	373650	6372980	Open site	Valid	Artefact : -	Open Camp Site	100924
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718	
38-4-0354	Thornton 10;	AGD	56	373470	6372400	Open site	Valid	Artefact : -	Open Camp Site	100924,102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0355	T 1; (Duplicate of 38-4-0399)	AGD	56	372100	6373200	Open site	Destroyed	Artefact : -	Isolated Find	103954
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists (MDCA),Noeleen Curran,Ms.Lucinda O'Conn					**Permits**		
38-4-0356	T 2 Beresfield	AGD	56	372500	6373200	Open site	Destroyed	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Noeleen Curran,Ms.Penny Mccardle					**Permits**		
38-4-0360	Thornton 12;	AGD	56	373750	6371400	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**		
38-4-0361	Thornton 11;	AGD	56	373700	6372300	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**		
38-4-0363	Tenambit_2;	AGD	56	369780	6375250	Open site	Valid	Artefact : -	Isolated Find	
	Contact	**Recorders**	Ms.Jill Ruig					**Permits**		
38-4-0364	Tenambit 3;	AGD	56	369880	6375220	Open site	Valid	Artefact : -	Isolated Find	
	Contact	**Recorders**	Ms.Jill Ruig					**Permits**		
38-4-0365	Thornton 11;	AGD	56	373700	6372300	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0366	Thornton 11;	AGD	56	373750	6371400	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	

Report generated by AHIMS Web Service on 04/09/2020 for Tessa Boer-Mah for the following area at Lat, Long From : -32.7867, 151.6074 - Lat, Long To : -32.7501, 151.6551 with a Buffer of 0 meters. Additional Info : Assessment. Number of Aboriginal sites and Aboriginal objects found is 116

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : HN126-A Thornton

Client Service ID : 533190

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-0426	FMC3;	AGD	56	370500	6372450	Open site	Valid	Artefact : -	Open Camp Site	100512,100988
	Contact	**Recorders**	Liam Dagg					**Permits**	2592,2809,2810,3011	
38-4-0429	ASH-1;	AGD	56	369900	6372500	Open site	Valid	Artefact : -	Isolated Find	
	Contact	**Recorders**	Ms.Claire Everett					**Permits**		
38-4-0431	FMC 2;	AGD	56	370640	6372720	Open site	Valid	Artefact : -	Open Camp Site	100512,100988
	Contact	**Recorders**	Liam Dagg					**Permits**	2592,2809,2810,3011	
38-4-0432	FMC 4;	AGD	56	370700	6372780	Open site	Valid	Artefact : -	Open Camp Site	100512,100988
	Contact	**Recorders**	Liam Dagg					**Permits**	889,2592,2809,2810,3011	
38-4-0433	FMC 5;	AGD	56	371160	6372880	Open site	Valid	Artefact : -	Open Camp Site	100512
	Contact	**Recorders**	Liam Dagg					**Permits**	889	
38-4-0434	FMC 6;	AGD	56	371140	6372800	Open site	Valid	Artefact : -	Open Camp Site	100512
	Contact	**Recorders**	Liam Dagg					**Permits**	889	
38-4-0435	FMC 7;	AGD	56	371040	6372760	Open site	Valid	Artefact : -	Isolated Find	100512
	Contact	**Recorders**	Liam Dagg					**Permits**	889	
38-4-0436	FMC 8;	AGD	56	371060	6372140	Open site	Valid	Artefact : -	Open Camp Site	100512
	Contact	**Recorders**	Liam Dagg					**Permits**	889	
38-4-0437	FMC 9;	AGD	56	370580	6372180	Open site	Valid	Artefact : -	Isolated Find	100512
	Contact	**Recorders**	Liam Dagg					**Permits**		
38-4-0395	T2; Beresfield	AGD	56	372500	6373200	Open site	Destroyed	Artefact : -	Open Camp Site	2880
	Contact	**Recorders**	Noeleen Curran,Ms.Penny Mccardle					**Permits**		
38-4-0399	T1;.	AGD	56	372100	6373200	Open site	Destroyed	Artefact : -	Isolated Find	2880,103954
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists (MDCA),Noeleen Curran,Ms.Lucinda O'Conn					**Permits**		
38-4-0401	Thorn-1;	AGD	56	372200	6371600	Open site	Valid	Artefact : -	Open Camp Site	3060,99973,102568,102615
	Contact	**Recorders**	Iain Stuart					**Permits**		
38-4-0416	FMC 2;	AGD	56	370380	6372750	Open site	Valid	Artefact : -	Isolated Find	100512
	Contact	**Recorders**	Liam Dagg					**Permits**	859	
38-4-0121	None Specified	AGD	56	373000	6373000	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	P Jones					**Permits**		
38-4-0123	None Specified	AGD	56	373100	6374900	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	P Jones					**Permits**		
38-4-0125	None Specified	AGD	56	372900	6374200	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	P Jones					**Permits**		

Report generated by AHIMS Web Service on 04/09/2020 for Tessa Boer-Mah for the following area at Lat, Long From : -32.7867, 151.6074 - Lat, Long To : -32.7501, 151.6551 with a Buffer of 0 meters. Additional Info : Assessment. Number of Aboriginal sites and Aboriginal objects found is 116

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-0625	Thornton 3 (T3)	AGD	56	371688	6373373	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	MCH - McCardle Cultural Heritage Pty Ltd					**Permits**	2141	
38-4-0626	Thornton Substation PAD1	AGD	56	371688	6373373	Open site	Valid	Potential Archaeological Deposit (PAD) : 0		
	Contact	**Recorders**	MCH - McCardle Cultural Heritage Pty Ltd					**Permits**	1389	
38-4-0688	Metford Road PAD	AGD	56	369498	6374833	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Ms.Meaghan Russell					**Permits**	1679,1971,2004	
38-4-0779	PAD1 Four Mile Creek South	AGD	56	369900	6372125	Open site	Valid	Potential Archaeological Deposit (PAD) : -		99960
	Contact	**Recorders**	Umwelt (Australia) Pty Limited - Individual users					**Permits**	2022	
38-4-0780	PAD2 Four Mile Creek Tributary	AGD	56	370350	6371935	Open site	Valid	Potential Archaeological Deposit (PAD) : -		99960
	Contact	**Recorders**	Umwelt (Australia) Pty Limited - Individual users					**Permits**	2022	
38-4-0781	Four Mile Creek South	AGD	56	369863	6372082	Open site	Valid	Artefact : 2		
	Contact	**Recorders**	Umwelt (Australia) Pty Limited - Individual users					**Permits**	2809,3011	
38-4-0803	Thornton North 8 - TN 8	AGD	56	372030	6375350	Open site	Valid	Artefact : -		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2113,2509,2880,2881,3341	
38-4-0804	Thornton North 9 - TN9	AGD	56	371580	6375000	Open site	Valid	Artefact : -		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2113,2509,2880,2881,3341	
38-4-0833	Four Mile Creek PAD	AGD	56	371333	6373772	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact T Russell	**Recorders**	AECOM Australia Pty Ltd - Sydney					**Permits**	2140	
38-4-0886	Thornton Beechwood 15	AGD	56	372390	6375260	Open site	Valid	Artefact : 1		103380
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	3875	
38-4-0887	Thornton Beechwood 11	AGD	56	372340	6375110	Open site	Valid	Artefact : 1		103380
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	3875	
38-4-0888	Thornton Beechwood 6	AGD	56	372275	6374489	Open site	Valid	Artefact : 2		103380
	Contact T Russell	**Recorders**	Mr.Peter Kuskie,Mr.Peter Kuskie					**Permits**	2816,2817,3875	
38-4-0889	Thornton North 27 (TN27)	AGD	56	371130	6373600	Open site	Valid	Artefact : 1		100988
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2809,3011,3642	
38-4-0890	Thornton North 1	AGD	56	373125	6373986	Open site	Valid	Artefact : -		

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	2592,2819	
38-4-0891	Thornton North 3	AGD	56	373185	6373705	Open site	Destroyed	Artefact : -		
	Contact T Russell	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**	2592,2819,3189,3745	
38-4-0892	Thornton North Site 2	AGD	56	373444	6373951	Open site	Valid	Artefact : 1		
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	2592,2819	
38-4-0893	Thornton North 4	AGD	56	373105	6373500	Open site	Destroyed	Artefact : -		
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	2592,2819,3189	
38-4-0849	PAD1 Four mile creek south-2	AGD	56	369900	6372125	Open site	Valid	Artefact : 2		
	Contact Searle	**Recorders**	Janice Wilson					**Permits**	2592,2809,2810,3011	
38-4-0850	PAD2 Four Mile Creek Tributary -2	AGD	56	370350	6371935	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		100988
	Contact Searle	**Recorders**	Janice Wilson					**Permits**	2592,2809,2810	
38-4-0927	Thornton North Site 1 - Lot 20	AGD	56	372943	6374863	Open site	Valid	Artefact : 6		
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**		
38-4-0928	Thornton North Site 2 - Lot 20	AGD	56	373068	6373723	Open site	Destroyed	Artefact : 1		
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	3745,4359	
38-4-0929	Thornton North Site 3 - Lot 20	AGD	56	373007	6373565	Open site	Destroyed	Artefact : 2		104167
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	3745,4359	
38-4-0930	Thornton North Site 4- Lot 1	AGD	56	372623	6373439	Open site	Valid	Artefact : 1		
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	4531	
38-4-0931	Thornton North Site 1 Lot 1	AGD	56	372597	6373409	Open site	Valid	Artefact : 3		
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	4531	
38-4-0932	Thornton North Site 2 Lot 1	AGD	56	372474	6373634	Open site	Valid	Artefact : 2		
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	4531	
38-4-0933	Thornton North Site 3 Lot 1	AGD	56	372620	6373595	Open site	Valid	Artefact : 2		
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	4531	
38-4-0934	Thornton North Site 4 - Lot 20	AGD	56	372620	6373595	Open site	Valid	Artefact : 3		104167
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	4359	
38-4-0935	Thornton North Site 5 - Lot 20	AGD	56	372960	6373457	Open site	Destroyed	Artefact : 2		104167
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	4359	
38-4-0936	Thornton North Site 6 - Lot 20	AGD	56	372958	6373278	Open site	Valid	Artefact : 40		104167
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**		
38-4-0937	Thornton North Site 7 - Lot 20	AGD	56	372818	6373445	Open site	Valid	Artefact : 1		104167
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**		

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-0938	Thornton North Site 8 - Lot 20	AGD	56	372843	6373494	Open site	Valid	Artefact : 2		104167
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**		
38-4-0939	Thornton North Site 9 - Lot 20	AGD	56	372800	6373535	Open site	Valid	Artefact : 1		104167
	Contact T Russell	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**		
38-4-0942	Thornton North 7 (TN7)	AGD	56	371410	6375280	Open site	Valid	Artefact : 20		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2509,2880,2881,3341	
38-4-0943	Thornton North 3 (TN3)	AGD	56	371950	6375050	Open site	Valid	Artefact : 3		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2880,2881,3341	
38-4-0944	Thornton North 13 (TN13)	AGD	56	371090	6374740	Open site	Valid	Artefact : 18		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2468,2592,2880,2881,3341,3642	
38-4-0945	Thornton North 12 (TN12)	AGD	56	371260	6374960	Open site	Valid	Artefact : -		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2880,2881,3341	
38-4-0881	Thornton North 26 (TN26)	AGD	56	371000	6373790	Open site	Valid	Artefact : 5		
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2468,2592,3642	
38-4-0882	Thornton North 21 (TN21)	AGD	56	371040	6374100	Open site	Valid	Artefact : 6		
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2468,2592,3642	
38-4-0883	Thornton North 20 (TN20)	AGD	56	371040	6374400	Open site	Valid	Artefact : 1		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2880,2881,3341,3642	
38-4-0884	Thornton North 2 (TN2)	AGD	56	371950	6375000	Open site	Valid	Artefact : 1		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2880,2881,3341	
38-4-0978	Thornton North PAD 1	AGD	56	371564	6374950	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact Searle	**Recorders**	Ms.Penny Mccardle					**Permits**	2509	
38-4-1028	Segment B PAD	AGD	56	370755	6372758	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact Searle	**Recorders**	AECOM Australia Pty Ltd - Sydney					**Permits**	2592,2809,2810,3011	
38-4-0124	Parkwood;	AGD	56	372850	6373300	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	P Jones					**Permits**		
38-4-1292	Thornton Bridge 1	GDA	56	372595	6371690	Open site	Partially Destroyed	Artefact : -		102615,103391
	Contact	**Recorders**	Umwelt (Australia) Pty Limited - Individual users,Niche Environment and Heritage					**Permits**	3398,3944	
38-4-1643	Lot 2 Govt Road Thornton	GDA	56	373775	6374010	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Mr.Giles (dup ID#12832) Hamm					**Permits**	3725	

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-1754	VALAIRE LAND 1/A	GDA	56	373723	6373735	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Peter Kuskie					Permits	3899	
38-4-1755	VALAIRE LAND 2/A	GDA	56	373522	6373438	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Peter Kuskie					Permits	3899	
38-4-1756	VALAIRE LAND 2/B	GDA	56	373722	6373618	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	South East Archaeology					Permits	3899	
38-4-1757	VALAIRE LAND 4/A	GDA	56	373727	6373345	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Peter Kuskie					Permits	3899	
38-4-1758	VALAIRE LAND 5/A	GDA	56	373571	6373318	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Peter Kuskie					Permits	3899	
38-4-1759	RPS Thornton AS1	GDA	56	373569	6373835	Open site	Destroyed	Artefact : 1		
	Contact	Recorders	RPS Australia East Pty Ltd - Hamilton					Permits		
38-4-1760	RPS Thornton AS2	GDA	56	373823	6373858	Open site	Destroyed	Artefact : 1		
	Contact	Recorders	RPS Australia East Pty Ltd - Hamilton					Permits		
38-4-1733	TB16	GDA	56	372495	6375495	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Mr.Jason Barr					Permits	3875	
38-4-1734	TB14	GDA	56	372353	6375445	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Mr.Peter Kuskie,South East Archaeology					Permits	3875	
38-4-1789	RPS JN 2	GDA	56	373940	6374242	Open site	Destroyed	Artefact : -		
	Contact	Recorders	RPS Australia East Pty Ltd - Hamilton,RPS Australia East Pty Ltd - Hamilton,Ms.Jo N					Permits	4157	
38-4-1788	RPS JN 1	GDA	56	373954	6374267	Open site	Destroyed	Artefact : -		
	Contact	Recorders	RPS Australia East Pty Ltd - Hamilton,RPS Australia East Pty Ltd - Hamilton,Ms.Jo N					Permits	4157	
38-4-1844	MET/1	GDA	56	370960	6375567	Open site	Valid	Artefact : -		
	Contact	Recorders	MCH - McCardle Cultural Heritage Pty Ltd,Ms.Penny Mccardle					Permits	4389	
38-4-1995	Lot 131 Site 1 Thornton	GDA	56	372551	6373614	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Giles Hamm					Permits	4531	
38-4-1996	Lot 131 Site 3 Thornton	GDA	56	372570	6373596	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Giles Hamm					Permits	4531	
38-4-2009	Lot 131 Site 9 Thornton	GDA	56	372692	6373590	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Giles Hamm					Permits	4531	

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-1976	RTRD03	GDA	56	372860	6373415	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**		
38-4-1977	RTRD14	GDA	56	372807	6373263	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**		
38-4-1978	RTRD01	GDA	56	372949	6373504	Open site	Destroyed	Artefact : -		104167
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**	4359	
38-4-1979	RTRD04	GDA	56	372988	6373530	Open site	Destroyed	Artefact : -		104167
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**	4359	
38-4-1980	RTRD05	GDA	56	372993	6373548	Open site	Destroyed	Artefact : -		104167
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**	4359	
38-4-1981	RTRD13	GDA	56	372869	6373260	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**		
38-4-1982	RTRD12	GDA	56	372827	6373268	Open site	Valid	Artefact : -		104167
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**		
38-4-1983	RTRD11	GDA	56	372874	6373209	Open site	Valid	Artefact : -		104167
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**		
38-4-1984	RTRD10	GDA	56	373023	6373444	Open site	Destroyed	Artefact : -		
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**	4359	
38-4-1985	RTRD09	GDA	56	373026	6373381	Open site	Valid	Artefact : -		104167
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**		
38-4-1986	RTRD08	GDA	56	372982	6373537	Open site	Destroyed	Artefact : -		104167
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**	4359	
38-4-1987	RTRD07	GDA	56	373011	6373630	Open site	Destroyed	Artefact : -		104167
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**	4359	
38-4-1988	RTRD06	GDA	56	373018	6373607	Open site	Destroyed	Artefact : -		104167
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**	4359	
38-4-1989	RTRD02	GDA	56	372909	6373342	Open site	Valid	Artefact : -		104167
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**	4359	
38-4-1966	Valaire Land 6/A	GDA	56	373812	6373466	Open site	Destroyed	Artefact : 1, Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Mr.Peter Kuskie,South East Archaeology					**Permits**		
38-4-1999	Lot 131 Site 4 Thornton	GDA	56	372724	6373519	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Giles Hamm					**Permits**	4531	
38-4-2000	Lot 131 Site 5	GDA	56	372748	6373532	Open site	Valid	Artefact : -		

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : HN126-A Thornton

Client Service ID : 533190

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	Mr.Giles Hamm					**Permits**	4531	
38-4-2001	Lot 131 Site 6 Thornton	GDA	56	372274	6373493	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Giles Hamm					**Permits**	4531	
38-4-2002	Lot 131 Site 7 Thornton	GDA	56	372714	6373500	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Giles Hamm					**Permits**	4531	
38-4-2003	Lot 131 Site 8 Thornton	GDA	56	372523	6373465	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Giles Hamm					**Permits**	4531	
38-4-2033	Raymond Terrace Road IF	GDA	56	373643	6374110	Open site	Valid	Artefact : -		
	Contact	**Recorders**	RPS Australia East Pty Ltd - York Street Sydney ,Mrs.Amanda Crick					**Permits**		
38-4-2031	Raymond Terrace Road IF2	GDA	56	373825	6374148	Open site	Valid	Artefact : -		
	Contact	**Recorders**	RPS Australia East Pty Ltd - York Street Sydney ,Mrs.Amanda Crick					**Permits**		
38-4-2032	Raymond Terrace Road IF1	GDA	56	373702	6374134	Open site	Valid	Artefact : -		
	Contact	**Recorders**	RPS Australia East Pty Ltd - York Street Sydney ,Mrs.Amanda Crick					**Permits**		

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Aboriginal Site Recording Form

Office Use Only

Site number 38-4-2001

Date received / / Date entered into system / / Date catalogued / /

Entered by (I.D.)

Information access

☐ Gender/male ☐ Gender/female ☐ Location restriction ☐ General restriction ☐ No access

Office Use Only

For further information contact:

☑ **Nominated Trustee**

Title	Surname	First name	Initials
MR	STAMMER	ERIC	

Organisation: STANNIC SECURITIES PTY LTD

Address: PO BOX 240 GORDON NSW 2072

Phone number: 0294115155 Fax:

Client on system ☐

☑ **Knowledge holder**

Title	Surname	First name	Initials
MR	MILLER	TOMMY	

Organisation: LOWER WONNARUA COUNCIL

Address: 51 BOWDEN ST HEDDON GRETA

Phone number: 0402636521 Fax:

Client on system ☐

Aboriginal Heritage Unit or Cultural Heritage Division Contacts

OEH HUNTER-CENTRAL COAST

Geographic location

Site Name: Lot 1 31 Site 6 Thornton

Easting: 372274 Northing: 6373493 AGD/GDA: GDA

Mapsheet: BERESFIELD 1:25000

Zone 56 Location method: Non-Differential GPS

Other registration:

Primary recorder

Title	Surname	First name	Initials
DR	HAMM	GILES	

Organisation: ARAS PTY LTD

Address: PO BOX 67 KATOOMBA NSW 2780

Phone number: 0438 757606 Fax:

Date recorded: 15/09/2018

Client on system ☐

Aboriginal site recording form - site information

Open/close site Open Site

Site context

Landform

- [ ] Mountainous
- [ ] Plain
- [ ] Rolling hills
- [ ] Steep hills
- [x] Undulating plain

Landform unit

- [ ] Beach
- [ ] Coastal rock platform
- [ ] Dune
- [ ] Intertidal flat
- [ ] Lagoon
- [ ] Tidal creek
- [ ] Tidal flat
- [ ] Cliff
- [x] Crest
- [ ] Flat
- [ ] Lower slope
- [ ] Mid slope
- [ ] Upper slope
- [ ] Plain
- [ ] Ridge
- [ ] Tor
- [ ] Valley flat
- [ ] Levy
- [ ] Stream bank
- [ ] Stream channel
- [ ] Swamp
- [ ] Terrace
- [ ] Terrace flat

Slope

[ ] degrees

Vegetation

- [ ] Closed forest
- [ ] Grasslands
- [ ] Isolated clumps of trees
- [ ] Open forest
- [x] Open woodland
- [ ] Scrub
- [ ] Woodland
- [x] Cleared
- [ ] Revegetated
- [ ] N/A

Land use

- [ ] Conservation
- [ ] Established urban
- [ ] Farming-intensive
- [ ] Farming-low intensity
- [ ] Forestry
- [ ] Industrial
- [ ] Mining
- [x] Pastoral/grazing
- [ ] Recreation
- [ ] Semi-rural
- [x] Service corridor
- [ ] Transport corridor
- [ ] Urban expansion
- [ ] Residential

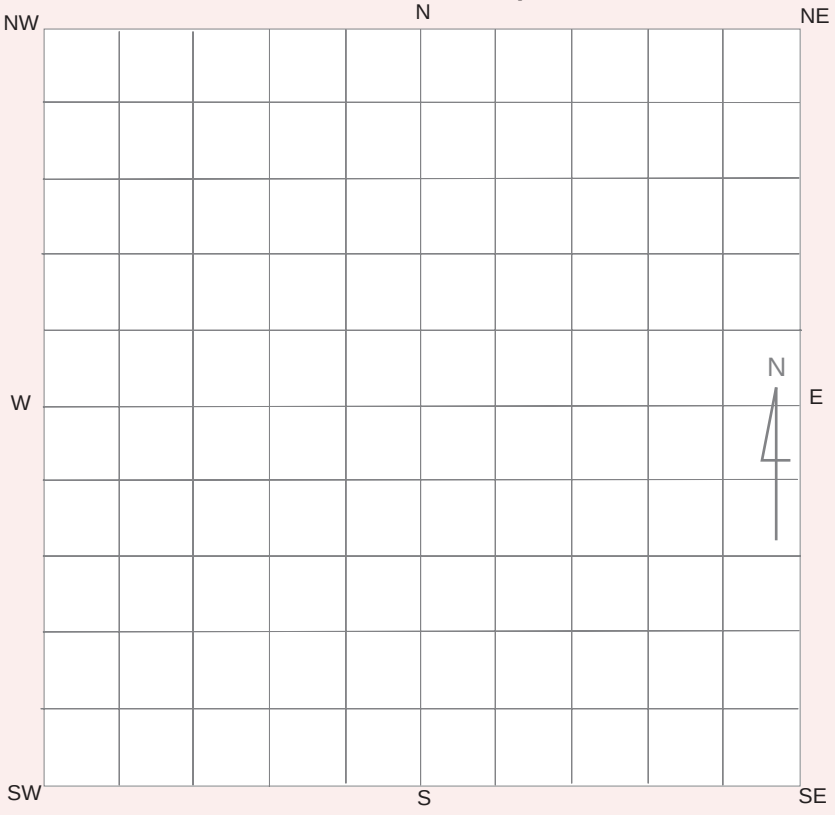
Water

Distance to permanent water source	1000 metres
Distance to temporary water source	metres
Name of nearest permanent water source	Four Mile Creek
Name of nearest temporary water	

Directions for location

Site is located at 508 Raymond Terrace Road Thornton access along Raymond Terrace Road. Site can be reached driving south into paddock and stopping near the northen boundary of Lot 131.

Site location map



Current land tenure

- [ ] Public — National park/government department
- [x] Private

Primary report **I.D.** [ ] (I.D. Office Use only)

Aboriginal site recording form - site information

General site information

Closed site

Shelter/cave formation

- [ ] Boulder
- [ ] Wind erosion
- [ ] Water erosion
- [ ] Rock collapse

Rock surface condition

- [ ] Boulder
- [ ] Sandstone platform
- [ ] Silica gloss
- [ ] Tessellated
- [ ] Weathered
- [ ] Other platform

Condition of Ceiling

- [ ] Boulder
- [ ] Sandstone platform
- [ ] Silica gloss
- [ ] Tessellated
- [ ] Weathered
- [ ] Other platform

Shelter Aspect

- [ ] North
- [ ] North East
- [ ] East
- [ ] South East
- [ ] South
- [ ] South West
- [ ] West
- [ ] North West

Open site

Site orientation

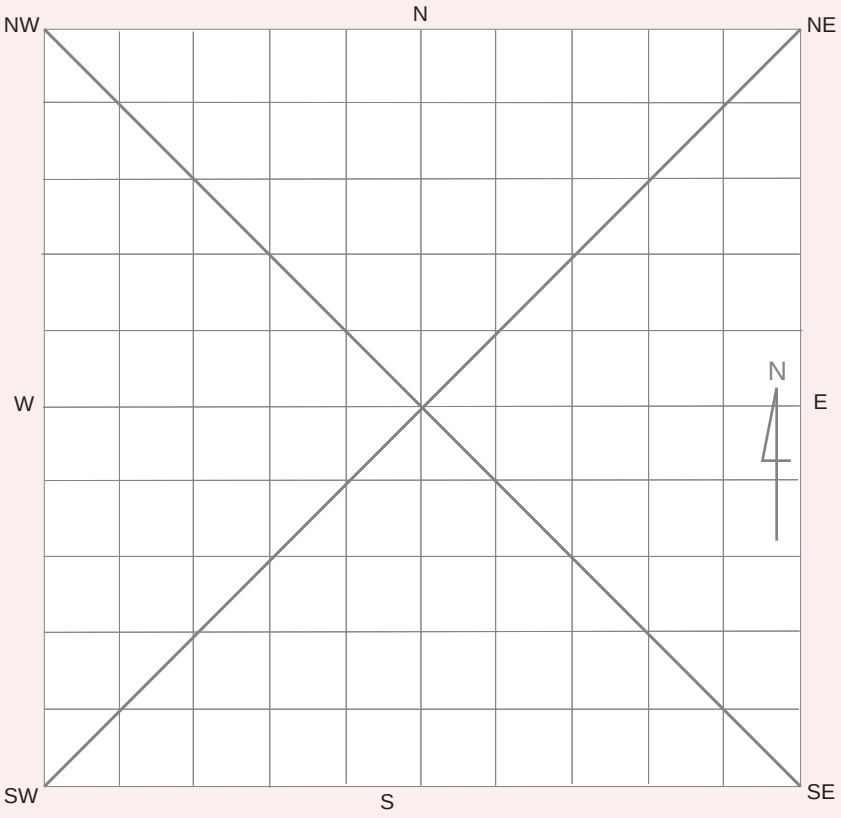
- [ ] N-S
- [ ] NE-SW
- [ ] E-W
- [ ] SE-NW
- [x] N/A

Features

- [ ] 1. Aboriginal ceremony and dreaming
- [ ] 2. Aboriginal resource and gathering
- [ ] 3. Art
- [x] 4. Artefact
- [ ] 5. Burial
- [ ] 6. Ceremonial ring
- [ ] 7. Conflict
- [ ] 8. Earth mound
- [ ] 9. Fish trap
- [ ] 10. Grinding groove
- [ ] 11. Habitation structure
- [ ] 12. Hearth
- [ ] 13. Non human bone & organic material
- [ ] 14. Ochre quarry
- [ ] 15. Potential archaeological deposit
- [ ] 16. Stone quarry
- [ ] 17. Shell
- [ ] 18. Stone arrangement
- [ ] 19. Modified tree
- [ ] 20. Water hole

Site plan

Indicate scale, boundaries of site, features



Site dimensions

Closed site dimensions (m)

- [ ] Internal length
- [ ] Internal width
- [ ] Shelter height
- [ ] Shelter floor area

Open site dimensions (m)

- [12 m] Total length of visible site
- [12 m] Average width of visible site
- [ ] Estimated area of visible site
- [ ] Length of assessed site area

Aboriginal community interpretation and management recommendations

Site was recorded as part of a due dligence assessment for Lot 131 DP 1223790 for a proposed sewer-line installation assessment. The site will be subject to a Code of Practice Test Excavation process and as a result of the proposed sewer-line development will be managed through an Aboriginal Heritage Impact Permit approval under section 90 of the NPW Act 1974. Two Wonnarua traditional owners Gordon Griffiths and George Sampson were part of the survey assessment.

Preliminary site assessment

Site cultural and scientific analysis and preliminary management recommendations

The site has been assessed to be of low scientific and archaeological significance. Sixteen Aboriginal objects have been identified as part of the site's overall surface survey assessment. The stone artefacts recorded are considered to be commonly represented in the local area and are not considered rare or unique.

This section should only be filled in by the endorsees

Endorsed by: ☑ Knowledge holder ☐ Nominated trustee ☐ Native Title holder ☐ Community consensus

Title	Surname	First name	Initials
MR	Sampson	George	

Organisation: Cacutua Culture

Address: 22 Ibis Pd Woodberry 2322

Phone number: 0434870716 Fax:

Attachments (No.)

- ☑ A4 location map
- ☐ B/W photographs
- ☐ Colour photographs
- ☐ Slides
- ☐ Aerial photographs
- ☐ Site plans, drawings
- ☐ Recording tables
- ☐ Other
- ☐ Feature inserts-No. ☐

Comments

see survey map attachment

Feature recording form - artefact

Site I.D.

Site name: Lot 131 (DP 1223790) Site 6 Thornton

Importance: Contributes to secondary site imp

First recorded date: 15/09/2018

No. of instances: 1

Recorded by: ARAS PTY

	Yes	No
Stone artefacts only		No
Artefacts collected (A permit is required to collect artefacts)		No

Percentage of non-stone artefacts to percentage of stone artefacts

0-9% | 10-19% | 20-29% | 30-39% | 40-49% | 50-59% | 60-69% | 70-79% | 80-89% | 90-100%

0-9%

Feature context and condition

Scatter No. 1

Easting: 372744

Northing: 6373493

Density (Artefact count per square metre): 1

Dimensions

12 Length (m) | 12 Width (m) | Depth (m)

	Yes	No
In situ		No
Stratified		No

Feature condition

- [ ] Very good
- [ ] Good
- [x] Poor

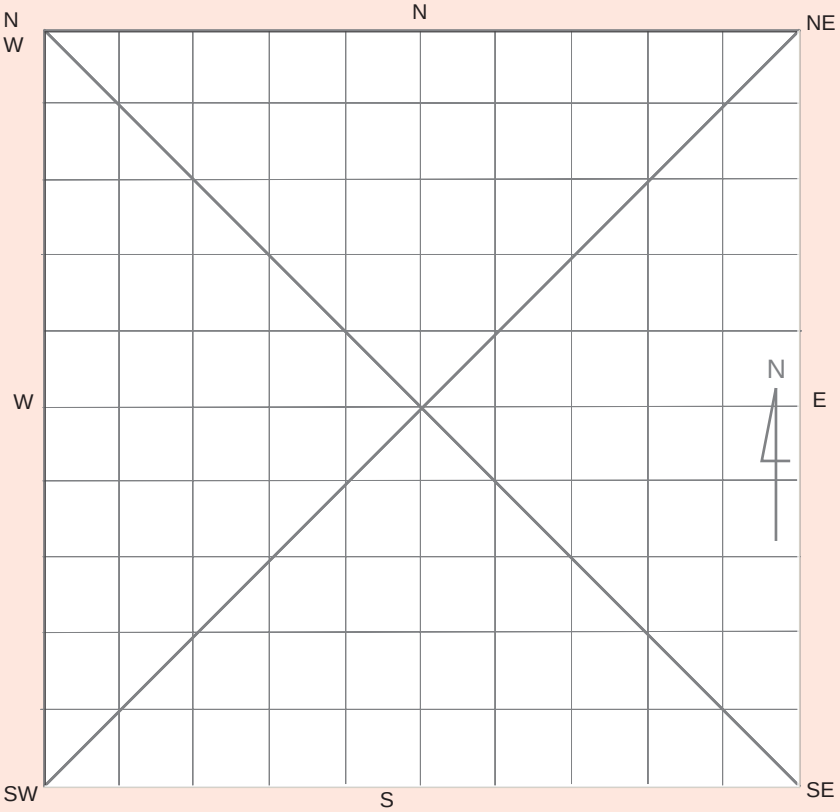
General condition

- [ ] Weathered
- [ ] Vehicle damage
- [x] Surface water wash
- [ ] Fire damage
- [x] Erosion
- [ ] Stock damage
- [ ] Exposed archaeological material

Recommended action

- [ ] Boardwalk
- [ ] Fencing
- [ ] Closure to public
- [ ] Continued inspection
- [ ] Fire hazard reduction
- [ ] Expert assessment
- [ ] Meeting with land manager
- [x] Revegetation
- [ ] Signage
- [ ] Soil erosion control
- [ ] Track closure/re-routing
- [ ] Additional recording

Feature plan (Indicate scale, location of instances)



Feature environment

(Complete when *feature* environment differs to *site* environment, use attributes from cover card, p. 2)

Crest — Land form

Land form unit

Gentle — Slope

Cleared — Vegetation

Conservation — Land use

Water

Distance to permanent water source: 1000 metres

Distance to temporary water source: metres

Name of nearest permanent water source: East of Four Mile Creek

Name of nearest temporary water

Feature recording table - artefact

Stone artefact

Instance no.	Recording date	Artefact material	Artefact type	Platform surface	Platform type	Termination	Cross section	Length (mm)	Width (mm)	Thickness (mm)
1	2018	Silcrete	Distal Fragmer	Cortex	N/A	Step	N/A	12	9	3
2	2018	Silcrete	Flake	Cortex	Wide	Feather	High/Weak	23	17	7
3	2018	Silcrete	Distal Fragmer	Cortex	N/A	Feather	N/A	21	18	9
4	2018	Silcrete	Flake	Flake scar	Focal	Feather	N/A	32	22	9
5	2018	Silcrete	Flaked Piece	N/A	N/A	N/A	N/A	17	14	6
6	2018	Silcrete	Distal Fragmer	N/A	N/A	Feather	N/A	22	16	8
7	2018	Silcrete	Medial BF	N/A	N/A	N/A	N/A	16	8	4

Other artefact type

Instance no.	Recording date	Artefact material	Artefact type	Description	Length (mm)	Width (mm)	Thickness (mm)
8	2018	Silcrete	Medial BF	Focal platform no cortex	35	15	8
9	2018	Silcrete	Medial BF	No cortex	30	15	9
10	2018	Silcrete	Flaked Piece	No cortex	28	16	10
11	2018	Silcrete	Medial BF	No cortex	18	12	6
12	2018	Silcrete	Medial BF	No cortex	16	10	4
13	2018	Silcrete	Medial BF	No cortex	28	17	11
14	2018	Silcrete	Complete Flake	Wide Platform, Feather termination	30	28	10

Material

Basalt
Chert
Fine grained siliceous
Granite
Quartz
Quartzite
Sandstone
Silcrete
Green glass
Amber glass
Amethyst glass
Clear glass
Ceramic
Porcelain
Tin can
Wire
Nail
Button
Shell
Bone
Wood
Resin

Artefact description

Adze
Anvil
Axe
Backed blade
Blade
Core
Core tool
Cyclon
Distal fragment
Eloura
Flake
Flake tool
Flaked piece
Hammerstone
Manuport
Milling slab
Mortar
Muller
Nuclear tool
Pirri
Proximal fragment
Tula
Other diagnostic type
Modified
Unworked

Platform surface

Cortex
Flake scar
More than one flake scar
Faceted
Ground
Indeterminate
Bipolar

Termination

Feather
Hinge
Step
Outrepasse
Bipolar

Platform type

Cross section

High/strong
High/weak
Low/weak
Irregular

Comments:

Feature recording form - modified tree

Site I.D.

Site name

First recorded date

Importance

Aboriginal information recorded?

No. of instances

Recorded by

Feature description

Easting

Northing

No. of scars

No. of carved panels

Feature condition

- Very good
- Good
- Poor

Condition

- Weathered
- Ringbarked
- Fire damage
- Vehicle damage
- Insects/termites
- Rot
- Limb fall
- Stock damage

Recommended action

- Fencing
- Closure to public
- Continued inspection
- Expert assessment
- Fire hazard reduction
- Insect removal
- Meeting with land manager
- Rubbish removal
- Signage
- Tree health assessment
- Track closure/re-routing
- Additional recording

Feature environment

(Complete when *feature* environment differs to *site* environment, use attributes from cover card, page 2)

- Land form
- Land form unit
- Slope
- Vegetation
- Land use

Water

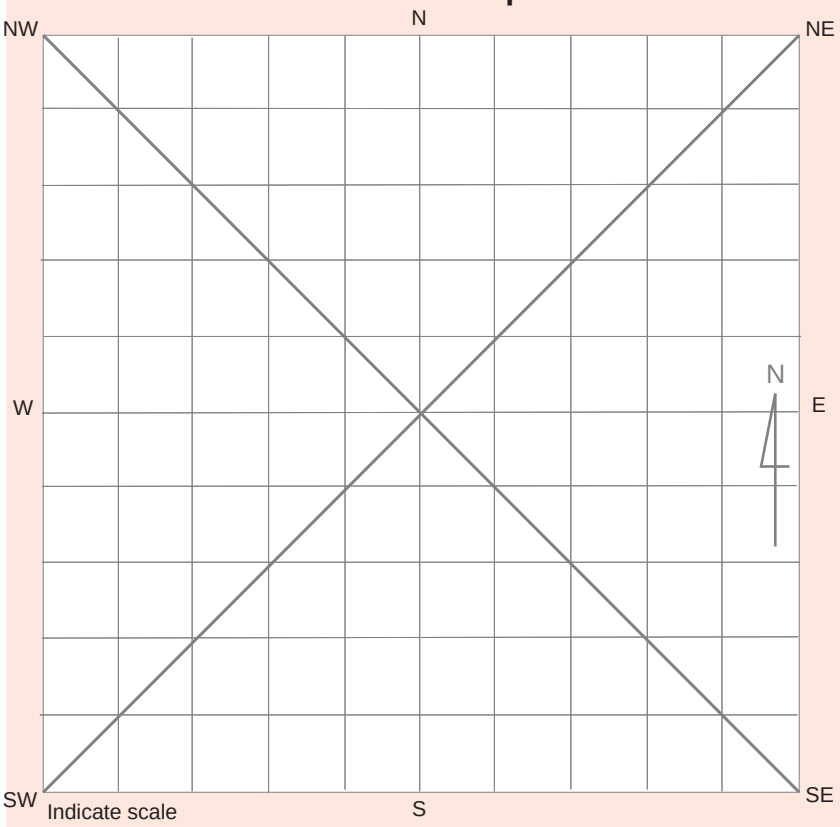
Distance to permanent water source — metres

Distance to temporary water source — metres

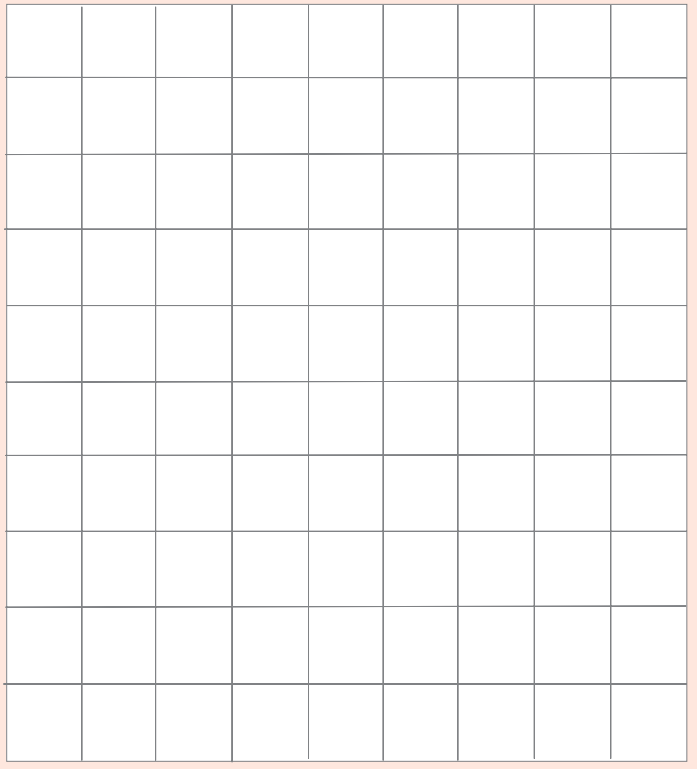
Name of nearest permanent water source

Name of nearest temporary water

Feature location plan



Scar/carved panel drawing



Attach additional drawings

Feature recording table - modified tree

Instance No.	Recording Date	Type	Species	Living Status	Tree Status	Regrowth	Length of Scar	Width of Scar	Depth	Height Above Ground	No. of Scars	Shape	No. of Carved Panels	Carving Type	Orientation	Axe Marks

Type of tree
Carved tree
Scarred tree
Carved/scarred tree

Tree species
Eucalypt
Red Gum
Angoth

Living status
Dead
Alive
Dyin

Tree Status
Standing
Lying down
Partially felled
Subject to salinity
Not *in situ*

Regrowth
Yes
No

Scar shape
Oval
Rectangular
Square
Round
Other

Carving type
Linear
Geometric
Pictorial

Axe marks
Metal
Stone
Indeterminate

Orientation
North East
East
South East
South
South West
West
North West
North

Comments:

Feature recording form - groove

Site I.D.

Site name

First recorded date / /

Importance

Aboriginal information recorded?

No. of instances

Recorded by

Feature description

Type of grinding feature

- Broad
- Narrow/point
- Hollow
- Flat

Seed species present

Recording date / /

Groove function

Profile shape

- 'U' shaped
- 'V' shaped
- Flat

Dimensions

	Smallest	Largest	
Length (mm)			Groove count
Width (mm)			Cluster count
Depth (mm)			

Feature context and condition

Easting

Northing

Dimensions of whole feature Length (m) Width (m)

Feature condition

- Very good
- Good
- Poor

General condition

- Weathered
- Vandalised

General condition ctd.

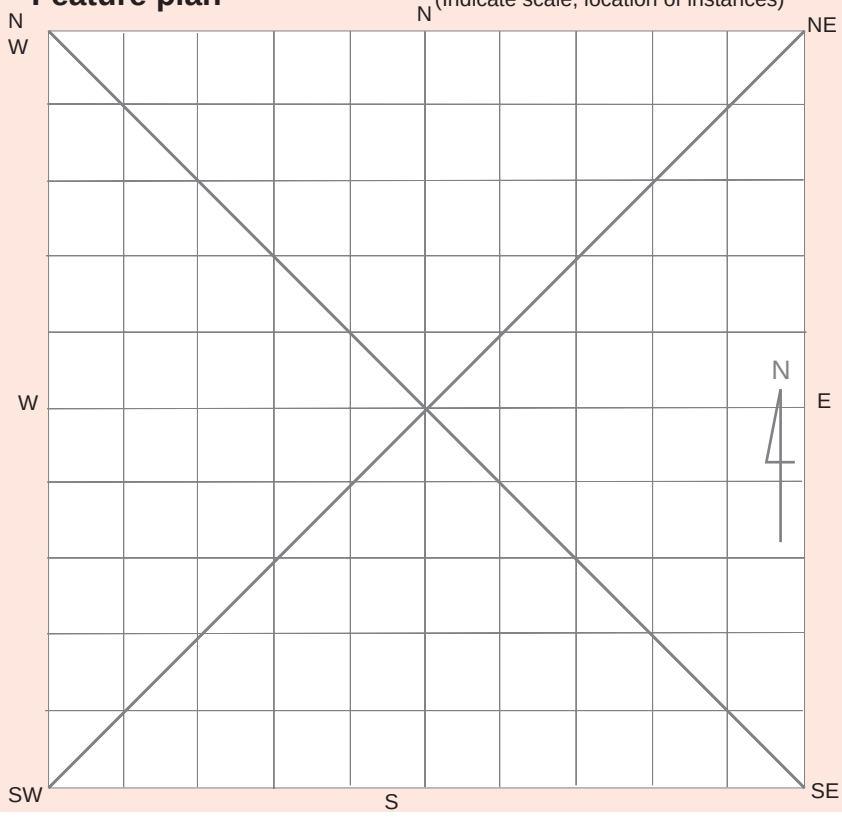
- Fire damage
- Surface water wash
- Graffiti
- Vehicle damage
- Erosion
- Stock damage

Recommended action

- Boardwalk
- Cage/barrier/fencing
- Closure to public
- Continued inspection
- Expert assessment
- Graffiti removal
- Meeting with land manager
- Revegetation
- Rubbish removal
- Signage
- Erosion control
- Track closure/re-routing
- Additional recording

Feature plan

(Indicate scale, location of instances)



Feature environment

(Complete when *feature* environment differs to *site* environment, use attributes from cover card, p. 2)

- Land form
- Land form unit
- Slope
- Vegetation
- Land use

Water

Distance to permanent water source metres

Distance to temporary water source metres

Name of nearest permanent water source

Name of nearest temporary water

Feature recording form - art

Site I.D. ____ Site name ____

First recorded date ____/____/____ **Importance** ____ **Aboriginal information recorded?** ____

No. of instances ____

Recorded by ____

Feature context and condition

Easting ____ Northing ____

Pigment ☐ Engraved ☐ Super-impositioning ☐

Artwork condition

- ☐ Very good
- ☐ Good
- ☐ Poor

General condition

- ☐ Weathered
- ☐ Vandalised
- ☐ Surface water wash
- ☐ Mineralisation
- ☐ Graffiti
- ☐ Fire damage
- ☐ Insects/termites
- ☐ Erosion
- ☐ Stock
- ☐ Unstable structure

Recommended action

- ☐ Boardwalk
- ☐ Cage/barrier/fencing
- ☐ Closure to public
- ☐ Continued inspection
- ☐ Dripline
- ☐ Expert assessment
- ☐ Fire hazard removal
- ☐ Graffiti removal
- ☐ Insect/bird nest removal
- ☐ Meeting with land manager
- ☐ Rubbish removal
- ☐ Signage
- ☐ Erosion control
- ☐ Track closure/re-routing
- ☐ Additional recording

Feature environment

(Complete when *feature* environment differs to *site* environment, use attributes from cover card, p. 2)

- ____ Land form
- ____ Land form unit
- ____ Slope
- ____ Vegetation
- ____ Land use

Water

Distance to permanent water source ____ metres

Distance to temporary water source ____ metres

Name of nearest permanent water source ____

Name of nearest temporary water ____

Art sketch plan

Sketch and number motif groups

Feature recording table - art motif

Instance	Recording date	Motif	Application technique	Form	Main colour	Location	Condition

Motif

Anthropomorphic
Bird
Bird Track
Canoe
Circle
Contact material culture
Duck
Eel
Emu
Emu track
European figure
Female
Fish
Foot
Hand
Jellyfish
Kangaroo
Line
Lizard
Macropod
Macropod Track
Male
Marine-Other
Other
Pattern
Quadruped
Reptile
Rifle
Shield
Ship
Snake
Spear
Wallaby

Application technique

Abraded
Drawn
Other
Painted
Pecked
Pigment & Engraved
Stencilled

Form

Fill
Line
Line+ Fill
Other
Pattern

Main colour

Black
Mauve *
N/A
Orange *
Other
Red *
White *
Yellow *

Art location

All over shelter surfaces
ceiling
Floor
Mostly near largest sheltered space
Mostly on out of the way surfaces
Other
Wall

Condition

Faded
Stained
Mineralisation Evident
V brant Colours
Unweathered
Weathered

Comments:

Feature recording form - shell

Site I.D. ____ Site name ____

First recorded date ____/____/____ **Importance** ____ **Aboriginal information recorded?** ____

No. of instances ____

Recorded by ____

Feature context and condition

Easting ____ Northing ____

Dimensions of whole feature

____ Length (m) ____ Width (m) ____ Depth (m)

shell distribution

- ☐ Surface scatter
- ☐ Stratified deposit
- ☐ Mounded

____ Distance to high water mark (m)

Feature condition

- ☐ Very good
- ☐ Good
- ☐ Poor

General condition

- ☐ Weathered
- ☐ Vandalised
- ☐ Surface water wash
- ☐ Mineralisation
- ☐ Graffiti

General condition ctd

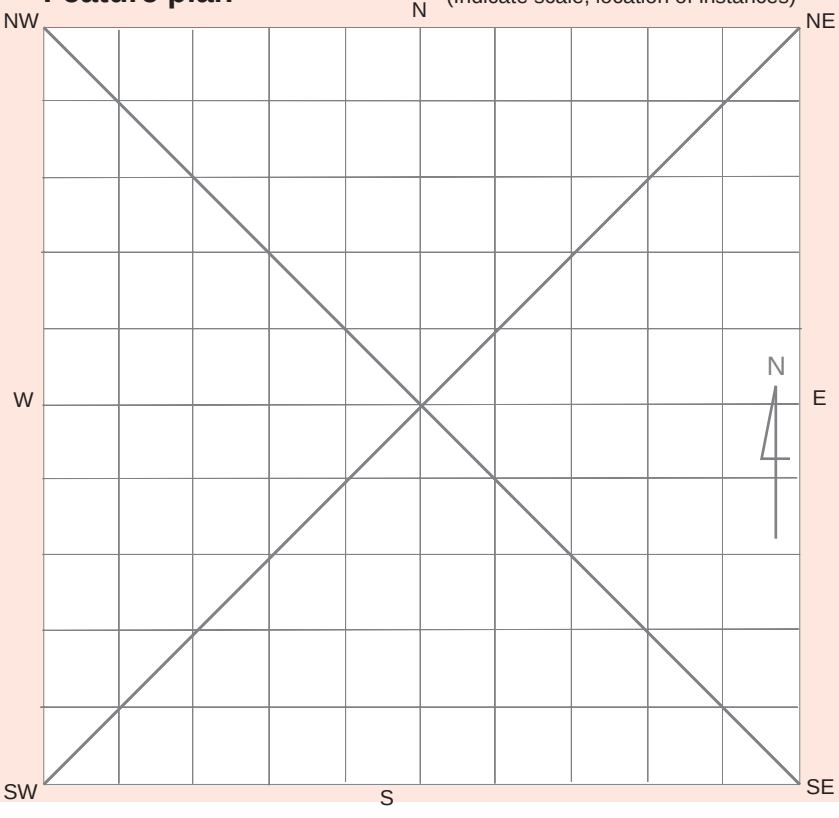
- ☐ Fire damage
- ☐ Vehicle damage
- ☐ Insects/termites
- ☐ Erosion
- ☐ Stock damage
- ☐ Unstable structure
- ☐ Exposed bone material
- ☐ Exposed archaeological material

Recommended action

- ☐ Boardwalk
- ☐ Cage/barrier/fencing
- ☐ Closure to public
- ☐ Continued inspection
- ☐ Expert assessment
- ☐ Fire hazard removal
- ☐ Graffiti removal
- ☐ Meeting with land manager
- ☐ Insect/bird nest removal
- ☐ Revegetation
- ☐ Rubbish removal
- ☐ Signage
- ☐ Erosion control
- ☐ Track closure/re-routing
- ☐ Additional recording

Feature plan

(Indicate scale, location of instances)



Feature environment

(Complete when *feature* environment differs to *site* environment, use attributes from cover card, p. 2)

____ Land form

____ Land form unit

____ Slope

____ Vegetation

____ Land use

Water

Distance to permanent water source ____ metres

Distance to temporary water source ____ metres

Name of nearest permanent water source ____

Name of nearest temporary water ____

Feature recording table - shell

Instance no.	Recording date	Shell species	% of this species shell to % total of other shell

Species

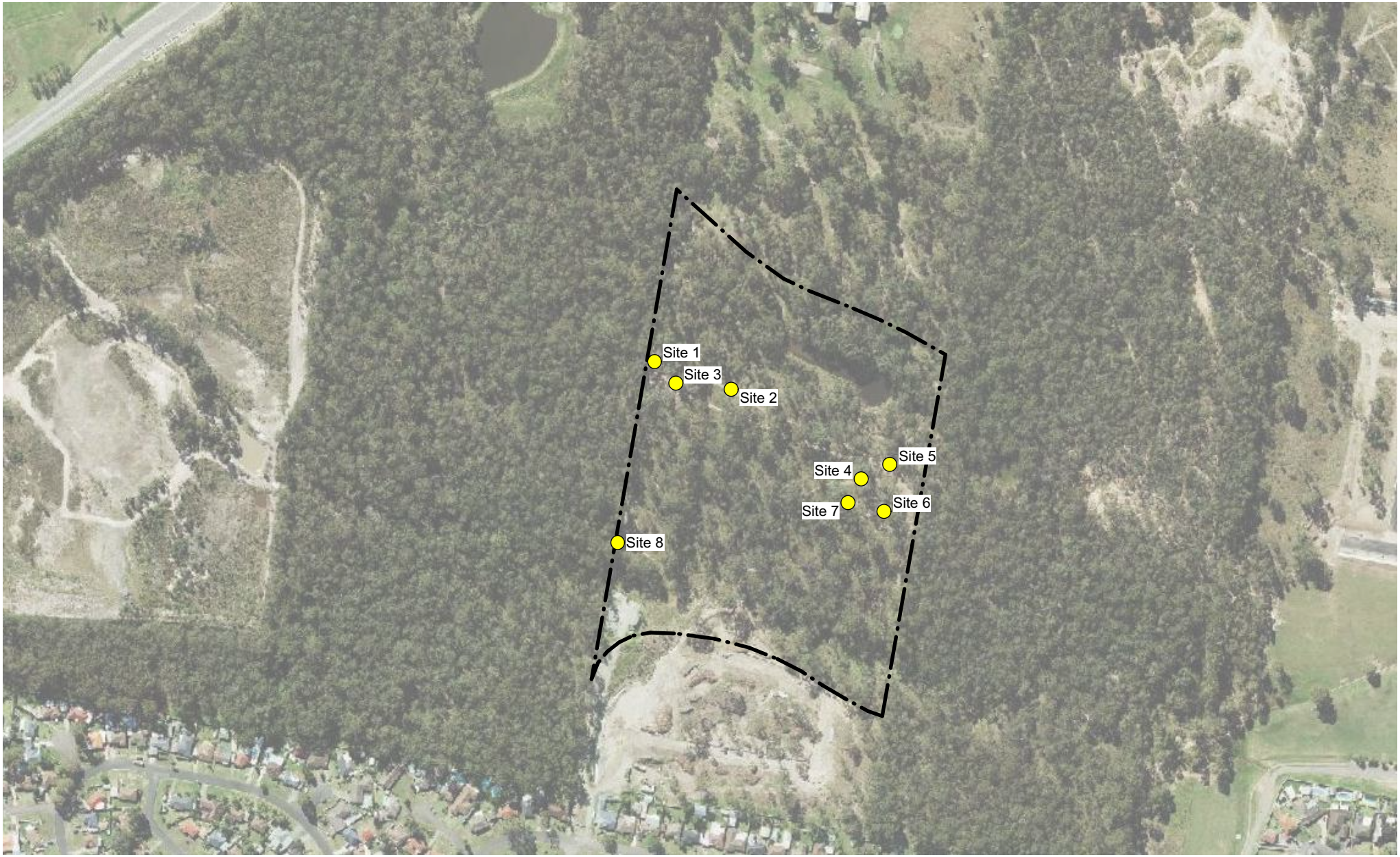
Anadara
Bimbala
Chiton
Cowrie
Dog Cockle
Duck Bill
Limpit
Mud oyster
Mutton Fish
Nerita
Ocean Snail
Periwinkle
Pipi
Ribbed Cockle
Rock Oyster
Whiad
Triton
Turban (large)

Percentage of this species shell to percentage total of other shell

0 – 9%
10 – 19%
20 – 29%
30 – 39%
40 – 49%
50 – 59%
60 – 69%
70 – 79%
80 – 89%
90 – 100%

Comments:

Office of Environment and Heritage, 59 Goulburn Street, Sydney South NSW 2000. Phone: 1300 361 967 (OEH and national parks enquiries); email: info@environment.nsw.gov.au; Website: www.environment.nsw.gov.au. OEH 2018/0307; June 2018.



Thornton - Lot 131 with Aboriginal Sites from 2018 survey

Scale

0 50 100 150 200m

Legend

Lot Boundary - Lot 131, DP 1223790

2018 Recorded Site

arcas archaeological risk assessment services

N W E S

Attachment B Previous Due Diligence Report

HERITAGE ARCHAEOLOGY HISTORY ▾ ASSESSMENT MANAGEMENT INTERPRETATION

6th July 2018

Shane Boslem
Senior Project Director
McCloy Group
Suite 2, Ground Floor
317 Hunter Street
Newcastle NSW 2300

Dear Mr Boslem,

RE: DUE DILIGENCE ABORIGINAL HERITAGE ASSESSMENT FOR A SENIOR LIVING DEVELOPMENT AT 107 HAUSSMAN DRIVE, THORNTON NSW

This report has been prepared by MDCA [Mary Dallas Consulting Archaeologists] at your request in relation to a proposed senior living development at 107 Haussman Drive (Lot 2 in DP 11453348) at Thornton, between Raymond Terrace Road and Woodberry Swamp in the south-eastern suburbs of Maitland (**Figure 1**). This report presents the results of a Due Diligence Aboriginal Heritage Assessment to meet the requirements of Due Diligence as per the OEH 2010 *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*, including a determination of whether further archaeological investigation may be required in relation to the current proposal. It has been prepared by MDCA archaeologists, Tamika Goward and Lucinda O'Connor.

Contextual Information

The subject land

The subject land is situated within the Hunter Region, approximately 8km south-east of Maitland and 22km north-west of Newcastle (**Figure 1**). It comprises a total approximate area of 18.96ha. The subject land is located within the Maitland Local Government Area, Parish of Alnwick and lies within the Office of Environment and Heritage North East Region. The subject land is bound to the north by Raymond Terrace Road, to the south by residential lots, to the west by a substation and rural lands, and to the east by vacant rural bushland. The subject land is currently extant as a large open disused quarry (**Figure 2**).

Figure 1. The subject land (orange outline) in its topographic context.

Figure 2. The subject land (orange outline).

[source: Google Earth 2007]

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Figure 3. Layout of the proposed senior living development.

[Note the blue dashed line indicates the Inner and Outer Protection Areas]

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The subject land is proposed for development as senior living inclusive of road construction, a detention basin, carpark, recreation areas and green spaces as indicated in **Figure 3**. Note that the maximum development envelope is restricted to the Outer Protection Area (OPA) and that no impacts will occur outside of this area. The land outside of the OPA will be an Environmental Asset Zone and vegetation here will be retained. Impacts from this development would include remediation of the current quarry and land modification (cut and fill) to facilitate house construction and the installation of relevant infrastructure inclusive of roads, sewer and electricity. In areas proposed for development this could be expected to impact any physical remains of past Aboriginal use on or immediately below the current ground surface.

The subject land lies on the south facing mid to lower slopes of a ridgeline that forms the watershed between Woodberry Swamp approximately 2.5km to the south-east and Four Mile Creek approximately 1.2km to the west. It is situated 50m west of a first order tributary of Francis Greenway Creek which flows east into the Hunter River some 6km south-east of the subject land.

The subject land is underlain by the Permian sediments of the East Maitland Hills region (Matthei 1995). These sediments comprise the residual soils of the Beresfield Soil Landscape. The Beresfield soil landscape is characterised by undulating low hills and rises with local relief at 10-50m (Matthei 1995). In contexts like the current subject land, intact soil profiles on side slopes can consist of up to 5-10cm of friable brownish black loam A1 (topsoil) horizon overlying 10-30cm of hard-setting dull yellowish brown sandy loam A2 horizon, on Pedal brown plastic mottled clay subsoil. Archaeological deposits in these soils are however likely to be restricted to the A horizon and are vulnerable to natural erosion and historical disturbance. Where disturbance occurs the A1 horizon is commonly absent, exposing the A2 horizon or subsoils at the surface. There is no outcropping bedrock present within the subject land.

Historically, the subject land has been cleared of its original vegetation. Prior to clearing, the subject land is likely to have supported tall open forest characterised by spotted gum (E. maculata), broad-leaved ironbark (E. fibrosa), grey gum (E. punctata), narrow-leaved stringybark (E. oblonga), thin-leaved stringybark (E. eugenioides) and grey ironbark (E. paniculata). The understory comprised paperbark, wattle and blackthorn (Matthei 1995). The creeks and intervening forest environments would have supplied Aboriginal people with a range of foods and raw materials.

Historic impacts to the subject land have included vegetation clearance and agricultural use. The subject land began being used as a brickworks in 1882. It was then purchased by CSR in 1969 after which large-scale land modifications associated with the PGH Clay Bricks and Pavers quarry took place and shaped the highly disturbed landscape, which is present today. Activities related to the use of this quarry, including a mineshaft in the northern portion, has resulted in the removal of the majority of the original soil profile. The quarry ceased activities in 2006 and has lay dormant ever since. Various portions of the quarry have since been remediated. The mineshaft has been removed and

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much vegetation rehabilitation implemented. These historical and more recent impacts could be expected to have significantly disturbed the natural soil horizons across much of the subject land.

Background research

For the current assessment, the Office of Environment and Heritage ('OEH') Aboriginal Heritage Information Management System ('the AHIMS Register') and Catalogue of Archaeological Reports was consulted. An online search of the AHIMS Register of a 4km x 4km area centred on the subject land revealed that 84 Aboriginal sites had been previously recorded in the search area[1] (**see Attachment 1**, see also **Figure 4**). One of these previously recorded sites is erroneously stated to be located within the subject land.

This site is an isolated find in a disturbed context known as *T1;* (AHIMS #38-4-0399/ 38-4-0355). It is a broken tuff flake found on a vehicle track that was recorded during survey for a then proposed extension of the clay extraction pit (Resource Planning1993). This site has two AHIMS numbers due to a duplicate recording. It should be noted that while this site is registered within the current subject, the details on the original site card and report specify that the site is located within the adjacent property to the east (Lot 182 DP792071). During the 1993 assessment, the isolated find has been collected and deposited at Mindarriba LALC (Resource Planning 1993). The site has therefore been destroyed.

Another two sites have been registered on the adjacent property to the west. These sites are *Thornton 3 (T3)* (AHIMS #38-4-0625), an artefact scatter, and *Thornton Substation PAD 1* (AHIMS #38-4-0626), a Potential Archaeological Deposit. *Thornton 3 (T3)* comprises four silcrete and one mudstone artefact within 15m of one anther. Both sites were recorded in the road reserve to the west of the substation along Haussman Drive by McCardle Cultural Heritage in 2002 during an archaeological survey for the substation. Both these sites have been managed under AHIPs prior to the construction of the substation.

Overall, the majority of sites in the search area comprise open artefact scatters, isolated finds and potential archaeological deposits, and are located along watercourses. Site locations are also strongly associated with the focus of archaeological investigation in the area, particularly in connection with areas where residential subdivision has occurred over the last few decades. The mapping of the AHIMS register data in **Figure 4** consequently demonstrates this pattern of recent investigation rather than a pattern of past Aboriginal land use. The sites within the search area are summarised in **Table 1**.

[1] Report generated by AHIMS Web Service on 4/6/2018.

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Table 1: Summary of sites registered within the search area.

Site Type	Number of Sites	Percentage of Sites
Artefact Scatter	53	63%
PAD	11	13%
Isolated Find	7	8%
No site type listed	13	16%
Total	84	100%

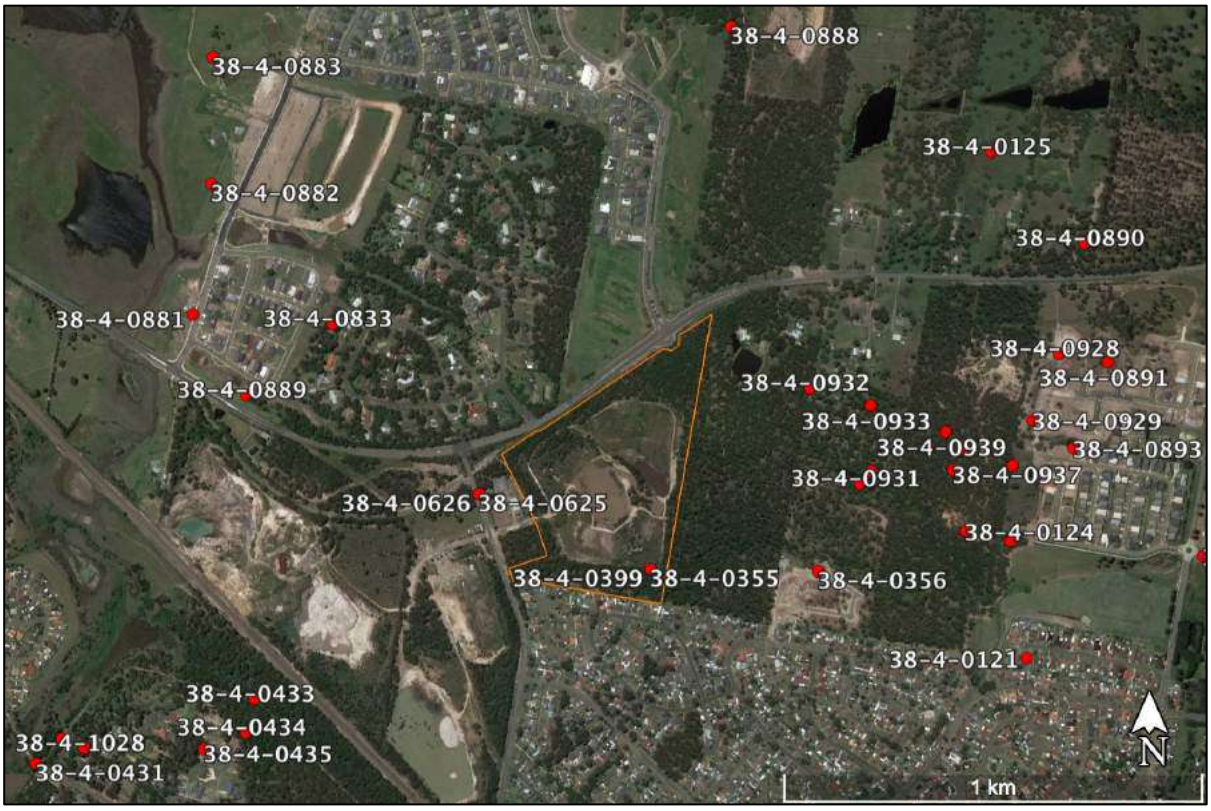

Figure 4. Aboriginal sites registered on AHIMS within the vicinity of the subject land (orange outline).

[Note that #38-4-0355/38-4-0399 is located further east, outside of the current subject land]

In addition to the AHIMS Register search, updated online searches of several other repositories were undertaken on 18/6/2018 to determine whether any Aboriginal sites or areas of potential have been identified within or adjacent to the subject lands. The results of these searches can be summarised as follows:

- A search of the Australian Heritage Database (incorporating the Register of the National Estate) was undertaken for Aboriginal heritage items within the Maitland Local Government Area. No items are listed for their Aboriginal heritage values within or adjacent to the subject land.
- The NSW State Heritage Inventory (incorporating the NSW State Heritage Register) was searched for Aboriginal heritage items within the Maitland Local Government Area. No items on

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either register within close proximity to the subject lands appear to be listed for their Aboriginal heritage values.

Local Archaeological Context

The current subject land has been partially investigated in the past through field survey (see Resource Planning Pty Ltd 1994). Several Aboriginal archaeological studies have also considered surrounding areas. These past studies provide a perspective of the local archaeological context of the Thornton area.

- Of most relevance to the current assessment are investigations conducted by Resource Planning Pty Ltd (1994a) for the proposed clay extraction pit immediately adjacent to the current subject land. Their study area comprised Lot 1742, which was then the eastern half of the current subject land and part of lot 182, with approximately a 100m buffer. Part of the survey was conducted in the eastern and south-eastern portions of the current subject land. Ms. Ricki-Jo Griffiths from Mindaribba LALC participated in this survey. During the 1993 survey two Aboriginal sites were recorded, an open artefact scatter and an isolated find. The isolated find, *T1;* (AHIMS #38-4-0399/38-4-0355) is located in the property to the east of the current subject land (see **Figure 4**). It is a snapped flake of Nobby's tuff, located in Lot 182, in a disturbed context, on a vehicle track. The artefact was not insitu and was collected and placed at Mindaribba LALC office. The open artefact scatter, *T2;* (AHIMS #38-4-0395) was found insitu approximately 1-2m from a creek line. This artefact scatter comprised 25-30 silcrete and chert artefacts. Due to the absence of archaeological sites and potential within their study area, it was recommended that development proceed as planned.
- In 1994 Resource Planning conducted a survey for a residential subdivision, immediately northeast of the current subject land. The study area was noted to have low surface visibility and no Aboriginal sites or areas of potential were identified (Resource Planning 1994b).
- Immediately northwest of current subject land, Brayshaw (1984a) surveyed an area for rural residential subdivision. Brayshaw noted low visibility due to dense grass cover across the 50ha property. The study area was not in close proximity to any major watercourses and no Aboriginal sites or areas of potential were identified.
- In 2009 a preliminary assessment was prepared by Kuskie for the Thornton North Stage 2 study area, located North of Raymond Terrace Rd, and west of McFarlanes Rd. The 349ha study area was located immediately northeast of the current subject land. Within the Stage 2 study area, 15 Aboriginal sites had been previously recorded, all of which are stone artefacts (Kuskie 2009). It was found that high potential for stone artefacts occurred in varying density across the study area, in particular within 300 metres of the former Hunter River wetlands (Kuskie 2009). Higher density of evidence was also found to occur along low gradient crests of major ridges and spurs.

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- In 1999 test excavations were carried out by Umwelt prior to works for a proposed light industrial estate on the eastern side of Thornton Rd, approximately 2km southeast of the current subject land. Testing recovered 268 artefacts across the subject area, which borders Woodberry Swamp. Artefacts were largely classified as 'flaked pieces' on raw materials including silcrete, tuff, chert and acid volcanic stone. Further excavation resulted in the recovery of 959 artefacts. It was recommended a small conservation zone be established for the area around archaeological excavation unit A360, with Section 90 consent going forward. A two-week salvage excavation followed that was undertaken by Umwelt in an unspecified area of their subject area which yielded 1246 artefacts (Umwelt 1999b).
- In 1994 Kuskie conducted a survey and excavation at Somerset Park subdivision adjacent to Woodberry Swamp, approximately 2km southeast of the current subject land. The initial survey area was across two broad low ridge spurs that descended onto the Woodberry Swamp wetlands. A total of 12 artefact scatters were recorded, consisting of 1234 artefacts, with a range of 2 to 32 artefacts per site. Artefact density occurred notably on simple slopes and basal slopes, and occurred closer to the wetlands. The dominant raw material was silcrete, with flaked pieces and flakes being the main artefact types (Kuskie 1994). In consultation with Mindaribba LALC, it was recommended that an application for a Section 90 be made for the remaining evidence (Kuskie 1994).
- Kuskie (2004a) conducted a survey for the Somerset Park subdivision extension on Raymond Terrace Rd, 1.4km southeast of current subject land. Nine Aboriginal sites were recorded and a total of 33 lithic items identified. Also identified was a Pleistocene age terrace adjacent to Woodberry Swamp, where a silcrete core fragment and a large brown tuff flake was present. Subsequent test excavations were undertaken on the terrace in 2005 by Kuskie and Clarke (2006a). A total of 263 artefacts were recovered from these excavations, with a low-density distribution of artefacts across the terrace (Kuskie and Clarke 2006a). A Section 90 Consent with salvage for the development impact area was recommended.
- Kuskie (2004b) surveyed an area for a proposed rezoning and residential development on Raymond Terrace Road, Thornton, northwest of current subject land. Seven Archaeological sites were identified, including two microlith implements, a silcrete bondi point and a tuff geometric point. Subsequent test excavations here (Kuskie & Clarke 2006b) recovered a total of 262 artefacts. It was assessed that although some depositional mixing may have occurred, some evidence is relatively insitu. Of the raw materials, silcrete was the most common, other materials included tuff, rhyolite, quartz and other volcanics. Microlith and microblades manufacture was noted to be of higher intensity in proximity to wetlands (within 300m), on simple slopes and drainage depressions. Recommendations suggested a Section 90 Consent be sought, which allowed for salvage excavations and surface collection (Kuskie & Clarke 2006b).
- In 2005 an archaeological assessment was conducted by Indigenous Outcomes for the

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rezoning of 14.2ha of land on the corner of Government Road and Raymond Terrace Road. The study area is approximately 1.5km east of the current subject land. Two isolated finds were identified within the floodplain outside of the area proposed for rezoning (Indigenous Outcomes 2005).

- More recently several archaeological test and salvage excavations have occurred across the Thornton region. These include salvage excavations at both Waterford County residential subdivision at Thornton North as well as RTA's Thornton Road Bridge Upgrade. The results of these investigations have not been included here but are forthcoming.

In summary, many previous studies have been undertaken within and in the vicinity of the subject land. Sites appear to be generally associated with major creek lines or wetland areas, elevated crests and major ridges, as well as lower slopes and drainage depressions near waterways. Previous studies within the subject land have not identified any Aboriginal sites or areas of archaeological potential. Generally, few Aboriginal objects have been recorded on landforms similar to that of the current subject land (mid slopes). The survival and degree of intactness of archaeological evidence in the area is also related strongly to levels of historical disturbance. Although other Aboriginal sites have been recorded nearby, they are generally in eroded, disturbed contexts with no associated subsurface archaeological potential. On review of the above information, the subject land has a low likelihood of retaining archaeological sensitivity.

Predictive Modeling

The distribution of Aboriginal sites in the East Maitland Hills region is strongly related to bedrock geology and local topographic features, including elevation and the presence of water resources, including swamps. In general, the Thornton area appears to most commonly manifest archaeological evidence as stone artefacts in open surface and subsurface contexts. The absence of sandstone in the subject land precludes the presence of axe grinding groove or shelter sites.

Significant resource zones occur several kilometres to the north and south of the subject land, these being Woodberry and Hexham Swamp as well as the Hunter River. It is likely that these resource areas were focal points for habitation and activity and that the intermediate environments, which include the subject land, were used to supplement resources between these preferred zones but are unlikely to have been as intensively used.

The survival and degree of intactness of archaeological evidence is also related strongly to levels of recent non-Aboriginal activity in any given area. The subject land has been heavily impacted by activities associated with the clay quarry. Large-scale land modification has occurred across the majority of the subject land and in these areas, it can be expected that no archaeological potential survives here. Surviving archaeological evidence in the vicinity of the subject land varies according to levels of historical disturbance, and is often of a low-density and partially disturbed nature, and this

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could also be expected to be the case within the portions of the subject land which have been less disturbed by the quarry. Specifically, the following types of archaeological evidence may be anticipated.

- Open campsites are stone artefact scatters and may occur almost anywhere that Aboriginal people lived and travelled in the past. The cultural activity represented by these sites may be associated with hunting or gathering activities, domestic camps, or the manufacture and maintenance of stone tools.
- Isolated artefacts can occur without any associated evidence for Aboriginal activity or occupation. Isolated finds can occur anywhere in the landscape and may represent the random loss, deliberate discard or abandonment of artefacts, or the remains of dispersed artefact scatters. This may also include manuports which are items consisting of raw materials of stone that do not naturally occur within the soil profiles of a given region. Transported onto a site by Aboriginal people from sources elsewhere, these items will have subsequently been discarded before use as flaked or ground stone tools.

Aboriginal Community Consultation

For the purposes of the current Aboriginal Heritage Die Diligence Assessment, consultation was undertaken with the Mindarribba Local Aboriginal Land Council (MLALC) to provide an Aboriginal community perspective on the assessment, particularly in relation to any cultural/historical associations with the subject land. The MLALC has a statutory responsibility "to promote the protection of Aboriginal culture and the heritage of Aboriginal persons"[2] within its boundaries, which includes the current subject land.

A representative of MLALC (Jason Brown) participated in a site inspection on 7th June 2018. MLALC was asked to comment on both the site inspection as well as any cultural/historical associations with the area considered pertinent to the assessment. The MLALC was in support of the recommendations presented in the current document. The MLALC comment is included as **Attachment 2**.

Site Inspection

An archaeological inspection of the subject land was undertaken in fine weather on Thursday 7th June 2018 by MDCA principal archaeologist Mary Dallas, and MDCA archaeologists Lucinda O'Connor and Tamika Goward in conjunction with MLALC representative, Jason Brown. The entirety of the subject

[2] Aboriginal Land Rights Act 1983, s52(1)(m).

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land was inspected and in combination with the background information reviewed above, provided sufficient information to adequately characterise its archaeological sensitivity and potential.

In general terms, the subject land is situated on a south-east moderate slope near the upper reaches of Francis Greenway Creek. It has been entirely cleared and used intensively as a clay quarry. Regrowth vegetation is extant along the perimeter but there are no mature trees within the subject land. Visibility in the highly vegetated areas is low due to thick low scrub and leaf litter.

The north-western side of the subject land is elevated, while the south-eastern portion is low lying and comprises a drainage depression which feeds into the first order tributary of Francis Greenway Creek on the adjacent property. The low-lying area contains two dams and the vehicle tracks here are raised up by at least 2m (**Figure 5**). The southern perimeter is densely vegetated with regrowth and lantana. This area is also extremely low-lying and flood prone (**Figure 6**). Water pooling could be seen here in cut drainage lines as well as in pitting of the surface.

The quarry comprises a large excavated pit with steep side slopes (**Figure 7**). Various internal haul roads and vehicle tracks are extant around and into the pit. Exposed within the pit and on all vehicle tracks, are clay and shale subsoils (**Figure 8**). Blue metal gravels and introduced sands have been placed along tracks to stabilise them. The current access road is immediately south of the substation along Haussman Drive (**Figure 9**). Evidence of a previous access road, which was relocated due to resident complaints, is present in the highly vegetated south-west corner of the property in the form of bulldozed, uneven, and banked up earth.

A large bund wall surrounds the quarry pit. The bund wall appears to comprise coarse, gravelly subsoils with large introduced sandstone pieces. It is very high where it parallels Raymond Terrace Road to the north and residential land to the south (**Figures 10 & 11**). Regrowth vegetation is established atop the bund walls. In various areas, a drainage ditch runs along the outer portion of the bund wall.

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Figure 5. The low-lying drainage area containing two dams in the south-eastern portion of the subject land.

Figure 6. Water pooling in low-lying area along the southern perimeter.

Figure 7. The quarry pit and internal haul roads. View north.

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Figure 8. Examples of exposed subsoils and introduced stabilising materials on the internal roads.

Figure 9. Access road from the substation along Haussman Drive. View east toward the quarry pit.

Figure 10. Bund wall which parallels Raymond Terrace Road in the northern portion of the subject land.

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Figure 11. Bund wall along the southern side of the quarry.

Figure 12. The furrows in the surface of the south-western portion of the subject land. View north-west.

Conclusions

The current assessment has involved a consideration of the environmental, historical and archaeological context of the subject land, and the results of field inspection, to determine whether any further Aboriginal heritage investigations are warranted in relation to the current proposed development. The subject land has been historically impacted, most notably by the clay quarry, and does not retain subsurface archaeological potential within the area proposed for development. No further Aboriginal archaeological sites or areas of Aboriginal archaeological sensitivity or potential were located within the subject land.

In conclusion, Lot 2 in DP 11453348, has been found to contain no evidence of past Aboriginal use, and very low likelihood for surviving deposits of Aboriginal stone artefacts. With the exception of the recommended actions below, no further archaeological investigations are considered warranted within the subject land in relation to the current proposal.

Recommendations

The following recommendations are based upon:

- the legal requirements and automatic statutory protection provided to items of Aboriginal heritage under the terms of the *National Parks and Wildlife Act 1974* (as amended), where it is an offence to knowingly or unknowingly harm an Aboriginal object;
- the results of the current study which are documented in this report and;
- the views and concerns expressed by the Mindaribba Local Aboriginal Land Council as outlined in this report and in the appended correspondence.

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It is recommended that:

1. This report is considered sufficient for the purpose of determining development approval for the proposed development of Lot 2 in DP 11453348.
2. There are no further Aboriginal archaeological management requirements in relation to the current proposed development of the subject land.
3. If any Aboriginal objects or bones suspected of being human are identified during construction, site workers must:
    a. Not further disturb or move these remains.
    b. Immediately cease all work at the particular location.
    c. In the case of suspected human remains only, notify NSW Police. In the case of Aboriginal objects, notify The Office of Environment & Heritage Environment Line on 131 555 as soon as practicable and provide available details of the objects or remains and their location. The Mindaribba Local Aboriginal Land Council should also be notified to assist in the determination of appropriate management for the objects or remains.
    d. Not recommence any work at the particular location unless authorised in writing by the Office of Environment & Heritage.
4. One copy of this report should be forwarded to the Mindaribba Local Aboriginal Land Council.
5. One copy of this report should be forwarded to:

    The Manager
    Aboriginal Heritage Information Management System
    NSW Office of Environment and Heritage
    P.O. Box 1967
    Hurstville NSW 2770

If you require any further information, please do not hesitate to contact us.

Yours sincerely,

Tamika Goward
Archaeologist
Mary Dallas Consulting Archaeologists

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Attachment 1

AHIMS Online Search Records

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Thornton

Client Service ID : 349065

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-0625	Thornton 3 (T3)	AGD	56	371688	6373373	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	MCH - McCardle Cultural Heritage Pty Ltd					**Permits**	2141	
38-4-0626	Thornton Substation PAD1	AGD	56	371688	6373373	Open site	Valid	Potential Archaeological Deposit (PAD) : 0		
	Contact	**Recorders**	MCH - McCardle Cultural Heritage Pty Ltd					**Permits**	1389	
38-4-0779	PAD1 Four Mile Creek South	AGD	56	369900	6372125	Open site	Valid	Potential Archaeological Deposit (PAD) : -		99960
	Contact	**Recorders**	Umwelt (Australia) Pty Limited					**Permits**	2022	
38-4-0780	PAD2 Four Mile Creek Tributary	AGD	56	370350	6371935	Open site	Valid	Potential Archaeological Deposit (PAD) : -		99960
	Contact	**Recorders**	Umwelt (Australia) Pty Limited					**Permits**	2022	
38-4-1028	Segment B PAD	AGD	56	370755	6372758	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact Searle	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Envirosciences)					**Permits**	2592,2809,2810,3011	
38-4-1292	Thornton Bridge 1	GDA	56	372595	6371690	Open site	Partially Destroyed	Artefact : -		102615,103391
	Contact	**Recorders**	Umwelt (Australia) Pty Limited,Niche Environment and Heritage,Mr.Jamie Reeves,I					**Permits**	3398,3944	
38-4-1754	VALAIRE LAND 1/A	GDA	56	373723	6373735	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	3899	
38-4-1755	VALAIRE LAND 2/A	GDA	56	373522	6373438	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	3899	
38-4-1756	VALAIRE LAND 2/B	GDA	56	373722	6373618	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	South East Archaeology					**Permits**	3899	
38-4-1757	VALAIRE LAND 4/A	GDA	56	373727	6373345	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	3899	
38-4-1758	VALAIRE LAND 5/A	GDA	56	373571	6373318	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	3899	
38-4-1759	RPS Thornton AS1	GDA	56	373569	6373835	Open site	Destroyed	Artefact : 1		
	Contact	**Recorders**	RPS Australia East Pty Ltd -Hamilton					**Permits**		
38-4-1760	RPS Thornton AS2	GDA	56	373823	6373858	Open site	Destroyed	Artefact : 1		
	Contact	**Recorders**	RPS Australia East Pty Ltd -Hamilton					**Permits**		

Report generated by AHIMS Web Service on 04/06/2018 for Tamika Goward for the following area at Datum :GDA, Zone : 56, Eastings : 370000 - 374000, Northings : 6371500 - 6375500 with a Buffer of 0 meters. Additional Info : Assessment. Number of Aboriginal sites and Aboriginal objects found is 84

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Thornton

Client Service ID : 349065

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-1733	TB16	GDA	56	372495	6375495	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Mr.Jason Barr					**Permits**	3875	
38-4-1734	TB14	GDA	56	372353	6375445	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Mr.Peter Kuskie,South East Archaeology					**Permits**	3875	
38-4-1789	RPS JN 2	GDA	56	373940	6374242	Open site	Destroyed	Artefact : -		
	Contact	**Recorders**	RPS Australia East Pty Ltd -Hamilton,RPS Australia East Pty Ltd -Hamilton,Ms.Jo Ne					**Permits**	4157	
38-4-1788	RPS JN 1	GDA	56	373954	6374267	Open site	Destroyed	Artefact : -		
	Contact	**Recorders**	RPS Australia East Pty Ltd -Hamilton,RPS Australia East Pty Ltd -Hamilton,Ms.Jo Ne					**Permits**	4157	
38-4-0804	Thornton North 9 - TN9	AGD	56	371580	6375000	Open site	Valid	Artefact : -		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2113,2509,2880,2881,3341	
38-4-0833	Four Mile Creek PAD	AGD	56	371333	6373772	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact T Russell	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Envirosciences)					**Permits**	2140	
38-4-0124	Parkwood;	AGD	56	372850	6373300	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	P Jones					**Permits**		
38-4-1954	RMS Thornton Bridge Excavation Reburial	GDA	56	372505	6371535	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Umwelt (Australia) Pty Limited,Ms.Alison Lamond					**Permits**		
38-4-0342	Four Mile Creek 1;	AGD	56	370510	6372100	Open site	Valid	Artefact : -	Open Camp Site	2742,100988
	Contact	**Recorders**	Noeleen Curran					**Permits**	2592,2809,2810,3011	
38-4-0346	Thornton 2;	AGD	56	373750	6371900	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0347	Thornton 3;	AGD	56	373450	6371700	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0348	Thornton 4;	AGD	56	373200	6371670	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718	
38-4-0349	Thornton 5;	AGD	56	373370	6372350	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0352	Thornton 8;	AGD	56	373850	6372960	Open site	Valid	Artefact : -	Isolated Find	100924
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0353	Thornton 9;	AGD	56	373650	6372980	Open site	Valid	Artefact : -	Open Camp Site	100924
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718	

Report generated by AHIMS Web Service on 04/06/2018 for Tamika Goward for the following area at Datum :GDA, Zone : 56, Eastings : 370000 - 374000, Northings : 6371500 - 6375500 with a Buffer of 0 meters. Additional Info : Assessment. Number of Aboriginal sites and Aboriginal objects found is 84

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-0354	Thornton 10;	AGD	56	373470	6372400	Open site	Valid	Artefact : -	Open Camp Site	100924,102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0355	T 1; (Duplicate of 38-4-0399)	AGD	56	372100	6373200	Open site	Valid	Artefact : -	Isolated Find	
	Contact	**Recorders**	Noeleen Curran					**Permits**		
38-4-0356	T 2 Beresfield	AGD	56	372500	6373200	Open site	Destroyed	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Noeleen Curran,Ms.Penny McCardle					**Permits**		
38-4-0360	Thornton 12;	AGD	56	373750	6371400	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**		
38-4-0361	Thornton 11;	AGD	56	373700	6372300	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**		
38-4-0365	Thornton 11;	AGD	56	373700	6372300	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0366	Thornton 11;	AGD	56	373750	6371400	Open site	Valid	Artefact : -	Open Camp Site	102568
	Contact	**Recorders**	Mr.Peter Kuskie					**Permits**	718,887	
38-4-0426	FMC3;	AGD	56	370500	6372450	Open site	Valid	Artefact : -	Open Camp Site	100512,100988
	Contact	**Recorders**	Liam Dagg					**Permits**	2592,2809,2810,3011	
38-4-0429	ASH-1;	AGD	56	369900	6372500	Open site	Valid	Artefact : -	Isolated Find	
	Contact	**Recorders**	Ms.Claire Everett					**Permits**		
38-4-0431	FMC 2;	AGD	56	370640	6372720	Open site	Valid	Artefact : -	Open Camp Site	100512,100988
	Contact	**Recorders**	Liam Dagg					**Permits**	2592,2809,2810,3011	
38-4-0432	FMC 4;	AGD	56	370700	6372780	Open site	Valid	Artefact : -	Open Camp Site	100512,100988
	Contact	**Recorders**	Liam Dagg					**Permits**	889,2592,2809,2810,3011	
38-4-0433	FMC 5;	AGD	56	371160	6372880	Open site	Valid	Artefact : -	Open Camp Site	100512
	Contact	**Recorders**	Liam Dagg					**Permits**	889	
38-4-0434	FMC 6;	AGD	56	371140	6372800	Open site	Valid	Artefact : -	Open Camp Site	100512
	Contact	**Recorders**	Liam Dagg					**Permits**	889	
38-4-0435	FMC 7;	AGD	56	371040	6372760	Open site	Valid	Artefact : -	Isolated Find	100512
	Contact	**Recorders**	Liam Dagg					**Permits**	889	
38-4-0436	FMC 8;	AGD	56	371060	6372140	Open site	Valid	Artefact : -	Open Camp Site	100512
	Contact	**Recorders**	Liam Dagg					**Permits**	889	
38-4-0437	FMC 9;	AGD	56	370580	6372180	Open site	Valid	Artefact : -	Isolated Find	100512
	Contact	**Recorders**	Liam Dagg					**Permits**		

Report generated by AHIMS Web Service on 04/06/2018 for Tamika Goward for the following area at Datum :GDA, Zone : 56, Eastings : 370000 - 374000, Northings : 6371500 - 6375500 with a Buffer of 0 meters. Additional Info : Assessment. Number of Aboriginal sites and Aboriginal objects found is 84

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-0395	T2; Beresfield	AGD	56	372500	6373200	Open site	Destroyed	Artefact : -	Open Camp Site	2880
	Contact	**Recorders**	Noeleen Curran,Ms.Penny McCardle					**Permits**		
38-4-0399	T1;	AGD	56	372100	6373200	Open site	Valid	Artefact : -	Isolated Find	2880
	Contact	**Recorders**	Noeleen Curran					**Permits**		
38-4-0401	Thorn-1;	AGD	56	372200	6371600	Open site	Valid	Artefact : -	Open Camp Site	3060,99973,10 2568,102615
	Contact	**Recorders**	Iain Stuart					**Permits**		
38-4-0416	FMC 2;	AGD	56	370380	6372750	Open site	Valid	Artefact : -	Isolated Find	100512
	Contact	**Recorders**	Liam Dagg					**Permits**	859	
38-4-0121	None Specified	AGD	56	373000	6373000	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	P Jones					**Permits**		
38-4-0123	None Specified	AGD	56	373100	6374900	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	P Jones					**Permits**		
38-4-0125	None Specified	AGD	56	372900	6374200	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	P Jones					**Permits**		
38-4-0886	Thornton Beechwood 15	AGD	56	372390	6375260	Open site	Valid	Artefact : 1		103380
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	3875	
38-4-0887	Thornton Beechwood 11	AGD	56	372340	6375110	Open site	Valid	Artefact : 1		103380
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	3875	
38-4-0888	Thornton Beechwood 6	AGD	56	372275	6374489	Open site	Valid	Artefact : 2		103380
	Contact T Russell	**Recorders**	Mr.Peter Kuskie,Mr.Peter Kuskie					**Permits**	2816,2817,3875	
38-4-0889	Thornton North 27 (TN27)	AGD	56	371130	6373600	Open site	Valid	Artefact : 1		100988
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2809,3011,3642	
38-4-0890	Thornton North 1	AGD	56	373125	6373986	Open site	Valid	Artefact : -		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**	2592,2819	
38-4-0891	Thornton North 3	AGD	56	373185	6373705	Open site	Destroyed	Artefact : -		
	Contact T Russell	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**	2592,2819,3189,3745	
38-4-0892	Thornton North Site 2	AGD	56	373444	6373951	Open site	Valid	Artefact : 1		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**	2592,2819	
38-4-0893	Thornton North 4	AGD	56	373105	6373500	Open site	Destroyed	Artefact : -		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**	2592,2819,3189	
38-4-0849	PAD1 Four mile creek south-2	AGD	56	369900	6372125	Open site	Valid	Artefact : 2		
	Contact Searle	**Recorders**	Janice Wilson					**Permits**	2592,2809,2810,3011	

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-0850	PAD2 Four Mile Creek Tributary -2	AGD	56	370350	6371935	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		100988
	Contact Searle	**Recorders**	Janice Wilson					**Permits**	2592,2809,2810	
38-4-0927	Thornton North Site 1 - Lot 20	AGD	56	372943	6374863	Open site	Valid	Artefact : 6		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**		
38-4-0928	Thornton North Site 2 - Lot 20	AGD	56	373068	6373723	Open site	Destroyed	Artefact : 1		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**	3745	
38-4-0929	Thornton North Site 3 - Lot 20	AGD	56	373007	6373565	Open site	Destroyed	Artefact : 2		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**	3745	
38-4-0930	Thornton North Site 4- Lot 1	AGD	56	372623	6373439	Open site	Valid	Artefact : 1		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**		
38-4-0931	Thornton North Site 1 Lot 1	AGD	56	372597	6373409	Open site	Valid	Artefact : 3		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**		
38-4-0932	Thornton North Site 2 Lot 1	AGD	56	372474	6373634	Open site	Valid	Artefact : 2		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**		
38-4-0933	Thornton North Site 3 Lot 1	AGD	56	372620	6373595	Open site	Valid	Artefact : 2		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**		
38-4-0934	Thornton North Site 4 - Lot 20	AGD	56	372620	6373595	Open site	Valid	Artefact : 3		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**		
38-4-0935	Thornton North Site 5 - Lot 20	AGD	56	372960	6373457	Open site	Valid	Artefact : 2		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**		
38-4-0936	Thornton North Site 6 - Lot 20	AGD	56	372958	6373278	Open site	Valid	Artefact : 40		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**		
38-4-0937	Thornton North Site 7 - Lot 20	AGD	56	372818	6373445	Open site	Valid	Artefact : 1		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**		
38-4-0938	Thornton North Site 8 - Lot 20	AGD	56	372843	6373494	Open site	Valid	Artefact : 2		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**		
38-4-0939	Thornton North Site 9 - Lot 20	AGD	56	372800	6373535	Open site	Valid	Artefact : 1		
	Contact T Russell	**Recorders**	Mr.Giles Hamm					**Permits**		
38-4-0942	Thornton North 7 (TN7)	AGD	56	371410	6375280	Open site	Valid	Artefact : 20		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2509,2880,2881,3341	
38-4-0943	Thornton North 3 (TN3)	AGD	56	371950	6375050	Open site	Valid	Artefact : 3		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2880,2881,3341	
38-4-0944	Thornton North 13 (TN13)	AGD	56	371090	6374740	Open site	Valid	Artefact : 18		100914

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Thornton

Client Service ID : 349065

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2468,2592,2880,2881,3341,3642	
38-4-0945	Thornton North 12 (TN12)	AGD	56	371260	6374960	Open site	Valid	Artefact : -		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2880,2881,3341	
38-4-0881	Thornton North 26 (TN26)	AGD	56	371000	6373790	Open site	Valid	Artefact : 5		
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2468,2592,3642	
38-4-0882	Thornton North 21 (TN21)	AGD	56	371040	6374100	Open site	Valid	Artefact : 6		
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2468,2592,3642	
38-4-0883	Thornton North 20 (TN20)	AGD	56	371040	6374400	Open site	Valid	Artefact : 1		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2880,2881,3341,3642	
38-4-0884	Thornton North 2 (TN2)	AGD	56	371950	6375000	Open site	Valid	Artefact : 1		100914
	Contact T Russell	**Recorders**	Mr.Peter Kuskie					**Permits**	2880,2881,3341	
38-4-0978	Thornton North PAD 1	AGD	56	371564	6374950	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact Searle	**Recorders**	Ms.Penny McCardle					**Permits**	2509	
38-4-1643	Lot 2 Govt Road Thornton	GDA	56	373775	6374010	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Mr.Giles Hamm					**Permits**	3725	

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[✓] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 585 6444

Standard Site Recording Form Revised 5/88

38-4-0399

NPWS Code

1:250,000 map sheet: NEWCASTLE (9,8)

AMG Grid reference (Full reference - please include leading digits)

250K 37 21 00 mE (25K)

250K 63 73 20 00 mN (5/6 25K)

Scale of map used for grid reference (Please use largest scale available): [✓] 25K, 50K (preferred) [ ] 100K [ ] 250K

1:25K, 50K, 100K map name: BERESFIELD

HEAD OFFICE USE ONLY:

NPWS Site no: 38-4-399

Site types: ISOLATED FIND

Accessioned by: _____ Date: _____

Data entered by: [signature] Date: 13 MAR 1995

Owner/Manager: G+J CAMP.

Address: LOT 182 RAYMOND TERRACE RD, THORNTON.

Site name: T1

Locality/property name: LOT 182 DP 792071

NPWS District: HUNTER

Region: CENTRAL

Reason for investigation

ARCHAEOLOGICAL SURVEY FOR E.I.S.

Portion no:

Parish:

Photos taken? No.

How many attached?

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)

FROM THE HOUSE, FOLLOW THE VEHICLE TRACK INTO THE SCRUB. CONTINUE, CROSS THE CREEK, FOLLOW THE RISE IN TERRAIN. THE TRACK BENDS TO THE LEFT AND IS LARGELY DISTURBED AS A RESULT OF WATER LOGGING. THE SITE IS ON THE EDGE OF THIS BEND, BEFORE YOU FOLLOW THE BEND.

Other sites in locality? NIL.

Site Types include:

Are sites in NPWS Register?

Have artefacts been removed from site? YES

When? 12 JULY 1993

By whom? RICKI-JD GRIFFITHS

Deposited where? MINDARIBBA LALC.

Is site important to local Aborigines? NO.

Give contact(s) name(s) + address(es) RICKI-JD GRIFFITHS, MINDARIBBA LALC. 420 HIGH ST, MAITLAND, 2320.

Contacted for this recording? YES.

(Attach additional information separately) If not, why not?

Verbal/written reference sources (including full title of accompanying report).

ARCHAEOLOGICAL SURVEY OF LOT 1, DP 634868 AND PART OF LOT 182 DP 792071, THORNTON, NSW.

NPWS Report Catalogue # C-2880

Checklist: surface visibility, damage/disturbance/ threat to site

Condition of site: GOOD/FAIR (SNAPPED).

Recommendations for management & protection (attach separate sheet if necessary)

ARTEFACT WAS REMOVED AND DEPOSITED AT THE LAND COUNCIL OFFICE. NO FURTHER ACTION REQ'D. NO THREAT TO SITE.

Site recorded by: N. CURRAN. Date: 12 JULY 1993.

Address/institution: RESOURCE PLANNING P/L
PO BOX 388
EAST MAITLAND 2323

SITE POSITION & ENVIRONMENT

OFFICE USE ONLY: NPWS site no: 38 - 4 - 399

1. Land form a. beach/hill slope/ridge top, etc: TERRACE b. site aspect: c. slope: 0-10°

d. mark on diagram provided or on your own sketch the position of the site:

e. Describe briefly:

SNAPPED FLAKED PIECE LOCATED ON A VEHICLE TRACK.

f. Local rock type: PERMIAN TOMAGO. g. Land use/effect: PRIVATE.

2. Distance from drinking water: 50m Source: SHALLOW CREEK.

3 Resource Zone associated with site (estuarine, riverine, forest etc): OPEN WOODLAND.

4 Vegetation: SPOTTED GUM - IRONBARK WOODLAND.

5. Edible plants noted: NIL

6 Faunal resources (include shellfish): NIL

7 Other exploitable resources (river pebbles, ochre, etc): NIL.

Site type:

ISOLATED FIND.

CHECKLIST TO HELP. length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.

DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.

ART area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving, no. of figures, sizes, patination.

BURIALS: number & condition of bone, position, age, sex, associated artefacts.

TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth.

QUARRIES rock type, debris, recognisable artefacts, percentage quarried.

OTHER SITES EG. structures (fish traps, stone arrangements, bora rings, mia mias), mythological sites, rock holes, engraved groove channels, contact sites (missions massacres cemeteries) as appropriate

DESCRIPTION OF SITE & CONTENTS.

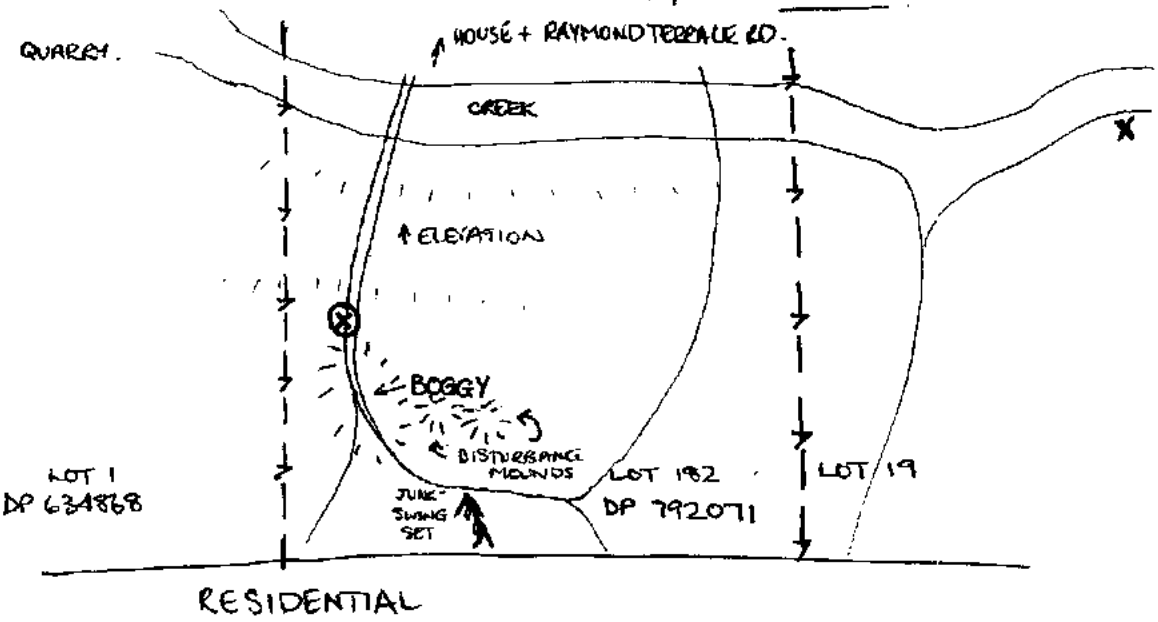
Note state of preservation of site & contents Do NOT dig, disturb, damage site or contents.

1 x snapped flaked piece 2·1cm x 1·5cm x 0·6cm (LWH)

No evidence of use wear or retouch.

Black chert (duff)

Located on a track (vehicular), not in situ

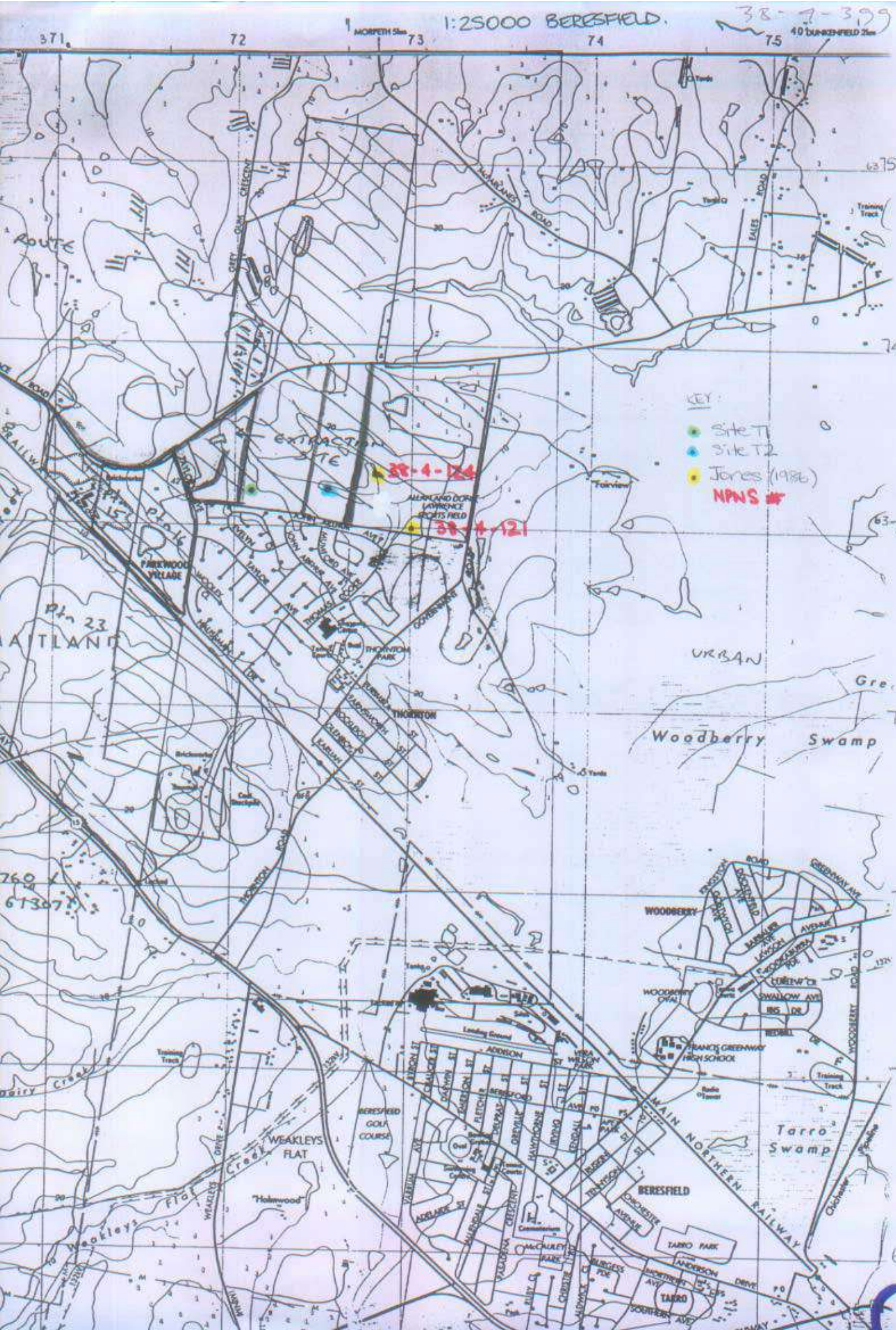


⊗ ISOLATED FIND.

X OPEN ARTEFACT SITE LOCATED (separate site card).

Attach sketches etc. eg. plan & section of shelter, show relation between site contents, indicate north, show scale.

Attach annotated photos (stereo where useful) showing scale, particularly for art sites.


1:25000 BERESFIELD.
38-1-399
71
72
73
74
75
MORPETH 5km
40 DUNGOG 25km
KEY:
Site T1
Site T2
Jones (1986)
NPWS #
38-4-124
38-4-121
EXTRACTION SITE
ALLAN CAIRD OVAL
LAWRENCE SPORTS FIELD
PARKWOOD VILLAGE
THORNTON
THORNTON PARK
URBAN
Woodberry Swamp
WOODBERRY
FRANCIS GREENWAY HIGH SCHOOL
BERESFIELD
BERESFIELD GOLF COURSE
WEAKLEYS FLAT
Tarro Swamp
TARRO
TARRO PARK
MAIN NORTHERN RAILWAY
Dairy Creek
Weakleys Flat Creek
"Holmwood"
Pt 15
Pt 16
Pt 23
63675
63673
63672
63671
63670
63669

Attachment 2

Community Consultation Record

Gmail Tamika Goward <tamika.goward@gmail.com>

draft due diligence report 107 haussman drive thorton

1 message

Jason Brown <cultureandheritage@mindaribbalalc.org> Thu, Jul 5, 2018 at 2:50 PM
To: "tamika.goward@gmail.com" <tamika.goward@gmail.com>
Cc: "tamika@mdca.com.au" <tamika@mdca.com.au>

To Tamika

Mindaribba LALC agree with the draft due diligence assessment report.

Kind Regards,

Jason Brown

Culture and Heritage | Mindaribba Local Aboriginal Land Council

1A Chelmsford Drive, Metford NSW 2323

PO Box 401, East Maitland NSW 2323

p: 02 4015 7000 | **f:** 02 4934 8544 | **e:** cultureandheritage@mindaribbalalc.org

A social, health and learning hub for our Aboriginal community.

MINDARIBBA
LOCAL ABORIGINAL LAND COUNCIL

I acknowledge and respect the traditional lands of all Aboriginal people, and I respect Elders past & present.

I ask all those that walk, work & live on traditional Aboriginal lands to be respectful of culture & traditions.

Attachment C: Additional Information

Environmental Background

The Project Area is located on sloping land. The north east corner and south west corners are at a higher elevation, forming a ridge around the north and western boundaries. The land then slopes gradually down towards the middle of the lot, possibly forming an ephemeral drainage line as this downward slope leads to a first order stream in the eastern side of the Project Area. This stream flows into the Woodberry Swamps, which is a resource rich and culturally sensitive area.

The Project Area has been previously used as a quarry. Historical images from the 1960s indicate that the landscape is relatively undisturbed, but with more recent images from the 1980s and 1990s, the area was increasingly cleared and excavated for quarrying activity. However, the southern edge and north east corner appear to have been undisturbed and are therefore more likely to retain archaeological evidence of Aboriginal occupation.

Heritage Background

Aboriginal people have been in Australia for at least 50,000 years, with potential evidence for earlier occupation. Aboriginal occupation in the region has been dated to 11,050 years before present which precedes the rise of sea levels around 6000 years before present [5].

Evidence of Aboriginal occupation in the area may take the form of artefacts, scarred trees, grinding grooves, art sites, shelters, potential archaeological deposits (PADs) and middens.

Other Related Heritage Reports

Other related heritage reports are summarised below.

Curran (1993) Archaeological Survey, Lot 1742 DP634868 and Lot182 DP 792071, Thornton, NSW

An archaeological survey was completed in the lot immediately east of the Project Area on behalf of PGH Clay Bricks and Pavers to assess the impact of a new clay extraction pit. The survey area identified two surface artefact sites; an artefact scatter (AHIMS #38-4-0395) and isolated find (AHIMS #38-4-0399). The scatter consisted of 25-30 artefacts of silcrete and chert and was located on a creek bank [6]. It was suggested that there was a possibility of further subsurface material [7]. The isolated find was not found in situ, but on an exposed piece if track. It consisted of a snapped flake made of Nobby's Tuff. There was no evidence of an intact archaeological deposit [8]. The isolated find, which plots as being within the current Project Area, was salvaged by Mindaribba Local Aboriginal Land Council [9]. The AHIMS database also indicates that the scatter, located approximately 425 east of the Project Area, has also been destroyed.

[5] Val Attenbrow, *What's Changing: Population Size or Land-Use Patterns? The Archaeology of Upper Mangrove Creek, Sydney Basin* (Canberra: Australian National University Press, 2006).
[6] Noeleen Curran, "Archaeological Survey , Lot 1742 DP634868 and Lot182 DP 792071, Thornton, NSW," Archaeological Survey Report (Metford, NSW: Resourcing Planning Pty Ltd, 1993), 11.
[7] Curran, 11.
[8] Curran, 10.
[9] Curran, 10.

Kuskie (2015) Waterford County Eastern Sector, Chisholm, Aboriginal Cultural Heritage Assessment

Archaeological test excavations were undertaken for the development of the Waterford County Estate, located opposite the Project Area on the northern side of Raymond Terrace Road. In total 220 0.5 x 0.5 m test pits were excavated. The investigation identified 12 Aboriginal sites, along with 8 surface artefacts and 242 sub-surface artefacts retrieved during excavations. The assemblage was dominated by silcrete (80.6%), but also included tuff, quartz, chert and acidic volcanic. Artefact types included flakes, flake portions, cores, backed artefacts, and retouched artefacts. The highest concentrations of artefacts were found within 300 m of the wetlands, suggesting that the proximity to wetlands was a primary factor in the nature and extent of human occupation in the area [10]. Three sites were considered of low to moderate significance (AHIMS 38-4-1727, #38-4-1728, #38-4-1729) and nine of low significance [11].

Biosis (2018) 530 Raymond Terrace Road, Thornton: Archaeological Report

Biosis conducted a field survey and test excavation for a proposed subdivision on Lot 20 DP10419, 530 Raymond Terrace Road, Thornton, approximately 650 m east of the Project Area. The survey identified 11 previously unrecorded sites including 1 PAD, 5 isolated finds and 5 artefact scatters. 10 AHIMS sites were recorded in the project area, however not all could be located in the survey. AHIMS site #38-4-0124 was found to not be in the survey area based on the site card and required an updated site location [12]. The investigation included the excavation of 37 test pits over 19 transects. Only four test pits contained artefacts, however these were able to identify the extent of three low density artefact sites. Artefact materials included silcrete, mudstone, and chert, with evidence that some pieces of mudstone and silcrete had been heat treated. The most common artefact types were flakes (44%) and cores (33%) [13]. In contrast, surface artefacts were much more likely to be angular fragments. Overall the results indicated that the potential for subsurface deposits in the area was low due to high levels of disturbance from previous land use including; quarrying recreation and erosion [14]. It was recommended that surface artefacts be salvaged and that further archaeological work is required for where sites cannot be avoided.

[10] Peter J. Kuskie, "Waterford County Eastern Sector (Part Lot 812 DP 1171131, Part Lot 7270 DP 1187087, Lot 1 DP1020710 and Lot 43 DP 1009594, Chisholm, Lower Hunter Valley, New South Wales: Aboriginal Cultural Heritage Assessment," Test Excavation (Hughes, ACT: South East Archaeology, 2015), 173.
[11] Kuskie, 184–85.
[12] Ashleigh Keevers-Eastman, Anthea Vella, and Taryn Gooley, "530 Raymond Terrace Road, Thornton: Archaeological Report," Archaeological Report (Newcastle, NSW: Biosis Pty Ltd, Report Prepared for Thornton Brentwood, 2018), 45.
[13] Keevers-Eastman, Vella, and Gooley, 89.
[14] Keevers-Eastman, Vella, and Gooley, 62.

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The Project Area is located on sloping land. The north east corner and south west corners are at a higher elevation, forming a ridge around the north and western boundaries. The land then slopes gradually down towards the middle of the lot, possibly forming an ephemeral drainage line as this downward slope leads to a first order stream in the eastern side of the Project Area. This stream flows into the Woodberry Swamps, which is a resource rich and culturally sensitive area.

The Project Area has been previously used as a quarry. Historical images from the 1960s indicate that the landscape is relatively undisturbed, but with more recent images from the 1980s and 1990s, the area was increasingly cleared and excavated for quarrying activity. However, the southern edge and north east corner appear to have been undisturbed and are therefore more likely to retain archaeological evidence of Aboriginal occupation.

Heritage Background

Aboriginal people have been in Australia for at least 50,000 years, with potential evidence for earlier occupation. Aboriginal occupation in the region has been dated to 11,050 years before present which precedes the rise of sea levels around 6000 years before present [6].

Evidence of Aboriginal occupation in the area may take the form of artefacts, scarred trees, grinding grooves, art sites, shelters, potential archaeological deposits (PADs) and middens.

Other Related Heritage Reports

Other related heritage reports are summarised below.

Curran (1993) Archaeological Survey, Lot 1742 DP634868 and Lot182 DP 792071, Thornton, NSW

An archaeological survey was completed in the lot immediately east of the Project Area on behalf of PGH Clay Bricks and Pavers to assess the impact of a new clay extraction pit. The survey area identified two surface artefact sites; an artefact scatter (AHIMS #38-4-0395) and isolated find (AHIMS #38-4-0399). The scatter consisted of 25-30 artefacts of silcrete and chert and was located on a creek bank [7]. It was suggested that there was a possibility of further subsurface material [8]. The isolated find was not found in situ, but on an exposed piece if track. It consisted of a snapped flake made of Nobby's Tuff. There was no evidence of an intact archaeological deposit [9]. The isolated find, which plots as being within the current Project Area, was salvaged by Mindaribba Local Aboriginal Land Council [10]. The AHIMS database also indicates that the scatter, located approximately 425 east of the Project Area, has also been destroyed.

[6] Val Attenbrow, *What's Changing: Population Size or Land-Use Patterns? The Archaeology of Upper Mangrove Creek, Sydney Basin* (Canberra: Australian National University Press, 2006).
[7] Noeleen Curran, "Archaeological Survey , Lot 1742 DP634868 and Lot182 DP 792071, Thornton, NSW," Archaeological Survey Report (Metford, NSW: Resourcing Planning Pty Ltd, 1993), 11.
[8] Curran, 11.
[9] Curran, 10.
[10] Curran, 10.

Kuskie (2015) Waterford County Eastern Sector, Chisholm, Aboriginal Cultural Heritage Assessment

Archaeological test excavations were undertaken for the development of the Waterford County Estate, located opposite the Project Area on the northern side of Raymond Terrace Road. In total 220 0.5 x 0.5 m test pits were excavated. The investigation identified 12 Aboriginal sites, along with 8 surface artefacts and 242 sub-surface artefacts retrieved during excavations. The assemblage was dominated by silcrete (80.6%), but also included tuff, quartz, chert and acidic volcanic. Artefact types included flakes, flake portions, cores, backed artefacts, and retouched artefacts. The highest concentrations of artefacts were found within 300 m of the wetlands, suggesting that the proximity to wetlands was a primary factor in the nature and extent of human occupation in the area [11]. Three sites were considered of low to moderate significance (AHIMS 38-4-1727, #38-4-1728, #38-4-1729) and nine of low significance [12].

Biosis (2018) 530 Raymond Terrace Road, Thornton: Archaeological Report

Biosis conducted a field survey and test excavation for a proposed subdivision on Lot 20 DP10419, 530 Raymond Terrace Road, Thornton, approximately 650 m east of the Project Area. The survey identified 11 previously unrecorded sites including 1 PAD, 5 isolated finds and 5 artefact scatters. 10 AHIMS sites were recorded in the project area, however not all could be located in the survey. AHIMS site #38-4-0124 was found to not be in the survey area based on the site card and required an updated site location [13]. The investigation included the excavation of 37 test pits over 19 transects. Only four test pits contained artefacts, however these were able to identify the extent of three low density artefact sites. Artefact materials included silcrete, mudstone, and chert, with evidence that some pieces of mudstone and silcrete had been heat treated. The most common artefact types were flakes (44%) and cores (33%) [14]. In contrast, surface artefacts were much more likely to be angular fragments. Overall the results indicated that the potential for subsurface deposits in the area was low due to high levels of disturbance from previous land use including; quarrying recreation and erosion [15]. It was recommended that surface artefacts be salvaged and that further archaeological work is required for where sites cannot be avoided.

[11] Peter J. Kuskie, "Waterford County Eastern Sector (Part Lot 812 DP 1171131, Part Lot 7270 DP 1187087, Lot 1 DP1020710 and Lot 43 DP 1009594, Chisholm, Lower Hunter Valley, New South Wales: Aboriginal Cultural Heritage Assessment," Test Excavation (Hughes, ACT: South East Archaeology, 2015), 173.
[12] Kuskie, 184–85.
[13] Ashleigh Keevers-Eastman, Anthea Vella, and Taryn Gooley, "530 Raymond Terrace Road, Thornton: Archaeological Report," Archaeological Report (Newcastle, NSW: Biosis Pty Ltd, Report Prepared for Thornton Brentwood, 2018), 45.
[14] Keevers-Eastman, Vella, and Gooley, 89.
[15] Keevers-Eastman, Vella, and Gooley, 62.

Proposed Residential Rezoning Preliminary Contamination Assessment

Lot 2 DP 1145348
107 Haussman Drive
Thornton

NEW17P-0074-AB
29 June 2017

Qualtest
LABORATORY (NSW) PTY LTD

GEOTECHNICAL I LABORATORY I EARTHWORKS I QUARRY I CONSTRUCTION MATERIAL TESTING

29 June 2017

McCloy Group,
Suite 1, Level 3, 426 King St,
Newcastle West NSW 2302

Attention: Mr Shane Boslem

Dear Shane

RE: PROPOSED REZONING - RESIDENTIAL LAND USE
LOT 2 DP 1145348 (NO. 107) HAUSSMAN DRIVE, THORNTON
PHASE 1 CONTAMINATION ASSESSMENT

Please find enclosed our Preliminary Contamination Assessment (CA) report for the proposed residential rezoning at 107 Haussman Drive, Thornton.

Based on information provided by McCloy Group, the site is proposed to be rezoned for a proposed residential development, with associated pavements, amenities, recreational areas, and park reserves.

McCloy Group required a Phase 1 CA for the Development Application for the proposed rezoning. The CA was carried out in conjunction with a preliminary geotechnical investigation also carried out by Qualtest for the site (Report Ref: NEW17P-0074-AA, dated 29 June 2017).

This report was prepared in accordance with the relevant sections of the NSW OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites.

If you have any questions regarding this report, please do not hesitate to contact Jason Lee or the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd

Emma Coleman
Senior Environmental Scientist

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Appendix A - Figures: Figure 1 - Site Location Plan
Figure 2 – Site Layout and Approximate Test Pit Locations

Appendix B - Tables: Table 1 – Soil Analytical Results

Appendix C: Groundwater Bore Search

Appendix D: Site History Documents

Appendix E: Site Photographs

Appendix F: Test Pit Logs

Appendix G: Laboratory Reports

1.0 Introduction

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present this Phase 1 Contamination Assessment (Phase 1 CA) report to McCloy Group for the proposed rezoning for residential development of Lot 2 DP 1145348, located at 107 Haussman Drive, Thornton NSW (the site). The site location is shown on Figure 1, Appendix A.

Based on the brief and lot layout plans provided in an email from McCloy dated 2 May 2017, the project is understood to comprise cutting and filling within the limits of the former quarry site, to allow for the construction of an unspecified number of residential lots, associated pavements, amenities, recreational areas and park reserves.

As part of the proposed development, cutting and filling of the site is proposed with possibly up to approximately 3m to 5m of fill anticipated in the central part of the site.

The site has previously been used as a quarry, with clay soils extracted for brick making at an off-site location. McCloy Group required a Phase 1 CA for the Development Application for the proposed development.

The Phase 1 CA was carried out in conjunction with a preliminary geotechnical investigation also carried out by Qualtest for the site (Report Ref: NEW17P-0074-AA, dated, 29 June, 2017).

2.0 Objectives

The objectives of the Phase 1 PCA were to:

- Identify potentially contaminating activities that are currently being performed on the site, and that may have been performed on the site in the past;
- Develop a preliminary conceptual site model (CSM) for the site, including assessment of Areas of Environmental Concern (AECs) and Chemicals of Potential Concern (COPC); and
- Carry out a preliminary assessment of potential contamination within fill materials on site;
- Provide recommendations for further assessment and or management, as required.

3.0 Scope of Works

In order to meet the above objectives, Qualtest carried out the following scope of works:

- Desktop study to assess past and present site uses;
- A site walkover to assess potential AECs;
- Collection of three environmental soil samples from three geotechnical test pit locations within fill materials;
- Laboratory analysis of selected environmental samples for a suite of common contaminants; and
- Preparation of a Phase 1 CA report.

4.0 Site Description

4.1 Site Identification

The site is located to the east of the Haussman Drive and is bounded by Raymond Terrace Road to the north, bushland and residential areas to the south and bushland to the east. There

is an electrical substation on the western edge of the site, as shown in Figure 2. General site information is provided below in Table 2.1.

Table 2.1: Summary of Site Details

Site location:	107 Haussman Drive, Thornton, NSW
Approximate site area:	18.72 ha
Title Identification Details:	Lot 2 DP 1145348, within the Maitland local government area.
Current Ownership:	McCloy Group.
Previous Landuse:	Former clay quarry site.
Current Landuse:	Vacant land.
Proposed Landuse:	Residential subdivision for an aged care facility.
Adjoining Site Uses:	Power substation, residential and bushland.
Site Coordinates:	32°46'6"S S 151°38'2" E

4.2 Proposed Development

The proposed development is understood to include placement of potentially up to 3m to 5m deep fill in the central part of the site, where there is currently a low-lying area which is a partially filled void from the former quarry. It is assumed the remainder of the site will be subject to some cut and fill earthworks activities to facilitate residential development. The depth of potential cut and fill is not known at this stage.

4.3 Topography and Drainage

Reference to the NSW Land and Property Information Spatial Information Exchange website (https://six.nsw.gov.au/wps/portal/) indicated the elevation of the site ranged from approximately 20m AHD in the eastern portion of the site to 40m AHD in the south western portion of the site.

A survey plan provided by McCloy Group (Delfs Lacelles Consulting Surveyors, Project No. 15327, Drawing No. 1, Rev 1) shows:

- A low lying area in the centre of the site, at an elevation of about 19m AHD;
- The western side of the site slopes up from about 19m to 20m AHD (near the site centre) to about 38m AHD;
- The southern portion of the site slopes up from about 19m to 20m AHD (near the site centre) to about 31m AHD;
- The eastern portion of the site slopes up from about 19m AHD (near the site centre) to about 21m AHD;
- The northern portion of the site slopes up from about 19m to 20m AHD (near the site centre) to about 34m to 38m AHD;

- A drainage channel has been excavated from the central low-lying part of the site to the east, where it drains to surface water ponds, and overflow from these ponds would drain offsite to the east.

During field investigations the majority of the site surface was observed to slope towards the centre of the site. The south-eastern corner of the site was observed to slope to the east.

Surface water would be expected to infiltrate into site soils, with excess surface water draining towards the centre of the site. Surface water accumulating in the centre of the site would flow down the drainage channel to the east-southeast, and from there discharge into an unnamed creek. The head of the unnamed creek is shown to be about 50m east of the site on the topographic map. The unnamed creeks appear to discharge to an unnamed wetland about 1.8km east of the site.

4.4 Regional Geology

Reference to the 1:100,000 Newcastle Coalfield Regional Geology Series Sheet 9232 indicates the site to be underlain by the Tomago Coal Measures, comprising shale, mudstone, sandstone, coal, tuff and clay. These rocks typically weather to clays and silty clays.

4.5 Hydrogeology

Groundwater beneath the site is anticipated be present in semi-confined aquifers in residual soils or weathered rock greater than 5m below ground surface (bgs) in the lower parts of the site. Groundwater flow direction from beneath the site is anticipated to follow the surface topography and flow to the east, and then to the southeast. Groundwater beneath the site would be anticipated to discharge to an unnamed creek to the east of the site which appears to discharge to an unnamed wetland about 1.8km east of the site.

It should be noted that groundwater conditions can vary due to rainfall and other influences including regional groundwater flow, temperature, permeability, recharge areas, surface condition, and subsoil drainage.

A search of the NSW Department of Primary Industries (Office of Water) registered groundwater bores located within a 500m radius of the site was undertaken. The search revealed that there are no registered bores within this radius. There were three bores located greater than 2km from the site and a copy of the search is provided in Appendix C and summaries below in Table 4.5.

Table 4.5 – Summary of Groundwater Bore Data

BORE ID	STATUS	PURPOSE	APPROXIMATE DISTANCE AND DIRECTION FROM SITE	DRILLED DEPTH (m bgs)	WATER BEARING ZONE (m bgs)
GW079948	NK	Monitoring Bore	2.15km South West	NK	NK
GW200415	Active	Monitoring Bore	2.05m West	20.1	NK
GW200414	Active	Monitoring Bore	2.08km West	10.0	NK

4.6 Acid Sulfate Soils

Reference to the Beresfield Acid Sulfate Soil Risk Map (1:25,000 scale, 1997 Edition Two, supplied by the NSW Department of Land and Water Conservation) indicates that the site is located within an area of "no known occurrence" of Acid Sulfate Soils (ASS).

5.0 Site History Review

A site history review was undertaken as part of the PCA, and included:

- A review of historical ownership of the site;
- A review of aerial photography from the past 60 years;
- A site walkover to help identify current and previous activities carried out on the site, identify surrounding land uses, and assess AECs and COPCs;
- Interviews with people familiar with the site history;
- A review of NSW EPA notices applying to the site and nearby properties.

The information provided from the above reviews is summarised in the sections below.

5.1 Historical Titles Search

A search of historical titles for the site was undertaken by Advanced Legal Searchers Pty Ltd. A list of past registered proprietors for the lot was obtained dating back to 1920. The results of the search are included in Appendix D and presented below in Table 3.1.

Table 3.1: Summary of historical titles

Date	Proprietor	Inferred Land Use
2010 - Present	CSR Building Products Limited (formerly Monier PGH Holdings Limited)	Commercial
1995 - 2010	Monier PGH Holdings Limited	Commercial
1989 - 1995	PGH Limited	Commercial
1981 - 1989	Acmil Industries Pty Ltd (with various leases)	Commercial
1975 - 1981	The Housing Commission of NSW	Commercial
1974 - 1975	Jemanapa Pty Ltd	Commercial
1963 - 1974	Ena Albertha Latter (married woman) Ada Evelyn Burns (married woman) Ernest William Green (millwright)	Private

1921 - 1963	William George Green (contractor)	Private
Prior - 1921	George William Fane De Salis (returned soldier) Rodolph Fane De Salis (esquire)	Private

The historical titles search indicated that the site was privately owned land until 1974. Post 1974 the site has been owned and operated by a number of commercial entities including a government housing agency, and building product manufacturers. It is considered likely that the clay quarrying activities commenced in the 1980's by Acmil Industries Pty Ltd.

5.2 Aerial Photograph Review

Aerial photographs of the site from 1954, 1975 and 1984 were purchased from the Department of Land and Property Information, and satellite images from Google Earth for 2007, 2010 and 2016, were assessed by a Qualtest Environmental Scientist. The results of the aerial photograph review are summarised in Table 3.2. The aerial photographs are attached in Appendix D.

Table 3.2: Aerial photograph review

Year	Site	Surrounding Land
1954	The site is comprised largely of an area of bushland with a cleared, undeveloped section of land in the central northern portion of the site. This area is grassed.	The surrounding areas appear to be a mixture of bushland to the east and south. There are areas of cleared land and bushland to north of the existing roadway bordering the northern extent of the site, as well as a large clearing to the west of the site.
1975	The site appears to be similar to the 1954 photograph. The cleared area is smaller and more regular in shape than in 1954, and remains grassed. An access road is present running southeast to northwest through the approximately the centre of the site.	A large portion of land to the south of the site has been cleared for a residential subdivision. Buildings have been constructed in the vacant block to the north of the site and further land has been cleared for industrial purposes. To the west of the site appears to be a quarry and access roads for heavy vehicle access.
1984	In the northern portion of the site there appears to be a structure or an area of cleared land (the photograph is not clear). The remainder of the site appears to be similar to the 1975 photograph.	There has been further land clearing to the south of the site, for residential subdivisions. More buildings have been constructed in the cleared land to the north. The surrounding land to the east and west appears to be similar to the previous photograph.
2007	The majority of site has been cleared,	There has been a residential property with a large dam constructed to the

Year	Site	Surrounding Land
	likely associated with the clay quarry.	north east of the site. The residential areas to the south of the site are larger. A power substation has been constructed on the western edge of the site.
2010	The site appears similar to 2007, but is becoming overgrown with vegetation.	The surrounding area appears to be similar to the 2007 google earth picture.
2016	The quarry on site appears to be un-used and vegetation re-growth is occurring.	The surrounding area appears to be similar to the 2010 google earth picture.

5.3 Site Observations

A Qualtest Environmental Scientist visited the site on 17 May 2017. Selected site photographs are presented in Appendix E.

The observations noted during the site walkover are summarised below:

- The majority of the site was bushland (see Photographs 1 and 2).
- The centre of the site was cleared and lower than the remainder of the site (see Photograph 3). The centre of the site appeared to have been subjected to some rehabilitation (filling and levelling) of the former quarry void;
- An access track is present from the site's western boundary to the central part of the site. This access track was observed to have been paved with crushed bricks (see Photograph 4). No potential Asbestos Containing Materials (ACM) were observed in this material;
- A circular access track is also present running generally around the site boundaries.
- A stockpile of bricks was located in the central region of the site (see Photograph 5), east of the lower central area and north of the access track.
- A drainage channel was observed on the eastern side of the lower central area (see Photograph 6);
- Two surface water ponds were observed in the eastern portion of the site (see Photographs 7 and 8). One of these contained water at the time of walkover, and the other was dry. The drainage channel from the centre of the site drains to these ponds. Overflow from the ponds would drain off-site to the east.

5.4 NSW EPA Records

A search of the NSW EPA database revealed that there are no properties within the proposed site in the Thornton area that are registered as having current and/or former notices. A copy of the search is provided in Appendix D.

It is noted that if a site does not appear on the record it may still be affected by contamination. For example:

- *Contamination may be present but the site has not been regulated by the EPA under the Contaminated Land Management Act 1997 or the Environmentally Hazardous Chemicals Act 1985.*

- *The EPA may be regulating contamination at the site through a licence or notice under the Protection of the Environment Operations Act 1997 (POEO Act).*
- *Contamination at the site may be being managed under the planning process.*

5.5 Anecdotal Information

The client provided the following information:

- The site was used for quarrying in the past, with clay quarried from the site used for brick production (off-site);
- They are not aware of potentially contaminating activities being carried out on site, such as re-fuelling or illegal dumping of waste;
- The central part of the site was filled, the source of the fill is not known.
- Based on anecdotal evidence, it is understood that the fill may have been placed as engineered fill in the order of 15 to 20 years ago. Despite the generally compact appearance of the material, at the time of this assessment Qualtest has not been provided with records of the placement or compaction of this material; therefore, it has been assessed to be uncontrolled fill for the purposes of this assessment.

5.6 Previous reports

No previous reports for the site have been provided to Qualtest.

5.7 Summary of site history

The information obtained from the site history review has been summarised below:

- The historical titles showed that the site was owned by a number of private entities from 1921 to 1974. The uses for the site during this time are uncertain, based on an aerial photograph from 1954, it appears that the site remained undeveloped during this time.
- From 1974 to 1981 the site was owned by a commercial entity and the Housing Commission of New South Wales. Based on an aerial photograph from 1975, it appears that the site remained undeveloped during this time.
- Since 1981 to the present the site has been owned by several commercial entities: Acmil Industries Pty Ltd, PGH Limited, Monier PGH Holdings Limited, and CSR Building Products Limited. The aerial photograph from 1984 indicates that some development may be commencing on site, and in 2007 the clay quarry appears to be in operation. Based on this is inferred that the quarry commenced in the early 1980's and continued into the 2000's.
- The aerial photograph from 2010 shows the site becoming re-vegetated and it appears the quarry is no longer in operation. By 2016 the site appears largely re-vegetated.

5.8 Gaps in the Site History

Whilst the site history is reasonably comprehensive there are some gaps identified in the review as follows:

- It is not known what activities were carried out by the private owners on the site, prior to use as a clay quarry.
- It is not known to what extent the site was rehabilitated following cessation of quarrying.

6.0 Field Investigations

Geotechnical field investigations were carried out on 17 May 2017 by an experienced Qualtest Geotechnical Engineer. The geotechnical investigation comprised 14 test pits (TP01 to TP14) spread across the site (see Figure 2, Appendix A).

Three environmental samples were collected from fill materials observed in test pits TP02, TP03 and TP04. The samples were collected at TP02 0.0-0.1m, TP03 0.3-0.4m and TP04 0.7-0.8m.

Soil samples were collected directly from the excavator bucket and a clean pair of disposable gloves was used whilst handling each new sample.

The soil samples were placed into 250mL laboratory supplied glass jars for laboratory analysis. Each soil sample was placed directly into an ice-chilled esky and remained chilled during transportation to the laboratory.

7.0 Laboratory analysis

The samples were dispatched to the NATA-accredited Eurofins MGT laboratory in Oakleigh, VIC under chain of custody conditions.

The soil samples were analysed for the following:

- Total Recoverable Hydrocarbons (TRH) – 3 primary soil samples;
- Benzene, Toluene, Ethylbenzene and Xylene (BTEX) – 3 primary soil samples;
- Polycyclic Aromatic Hydrocarbons (PAHs) – 3 primary soil samples; and,
- Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) – 3 primary soil samples.

8.0 Investigation Criteria

8.1 Health and Ecological Levels (Soil)

The health and ecological investigation levels for soil, presented in the *National Environment Protection (Assessment of Site Contamination) Measure 1999 (April 2013), NEPC 2013*, Canberra (referred to as NEPM 2013) are generally used in NSW when selecting investigation levels for chemical contaminants in soil.

The purpose of the NEPM (2013) is to *'establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry'*.

NEPM (2013) provides health and ecological investigation and screening levels for different exposure scenarios based on a proposed land use. Health and ecological investigation and screening levels are applicable to the first stage (Tier 1) of site assessment and are used to assist in the iterative development of a Conceptual Site Model (CSM). They are adopted as concentrations of a contaminant above which either further appropriate investigation and/or evaluation will be required, or development of an appropriate management strategy (including remediation).

Health Investigation Levels (HILs) and Health Screening levels (HSLs) are applicable for assessing human health risk via relevant exposure pathways.

The HILs were developed for a broad range of metals and organic substances. These are generic to all soil types.

The HSLs have been developed for selected petroleum compounds and fractions and are applicable to assessing human health risk via inhalation and direct contact with soil and groundwater. The HSLs depend on specific soil physicochemical properties, building configurations, land use scenarios and the depth that groundwater is encountered.

Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) are applicable for assessing risk to terrestrial ecosystems under residential, open space and commercial/industrial land use scenarios. They apply to the top 2m of soil, which corresponds to the root zone and habitation zone of many species.

The EILs are associated with selected metals and organic compounds. The EILs are site specific and are determined by calculating an Ambient Background Concentration (ABC) and an Added Contaminant Limit (ACL) for the site, which are added together to get the EIL. In the absence of ambient background concentration data, a generic ACL, based on the soils pH, Cation Exchange Capacity (CEC) and clay content, has been adopted.

The ESLs are associated with petroleum compounds and fractions and are dependent on specific soil physical properties (i.e. coarse and fine-grained soil).

9.0 Results

9.1 Subsurface Conditions

The typical soil types encountered during test pitting for the geotechnical investigation are summarised in Table 9.1. The test pit logs are presented in Appendix F.

Table 9.1 – Summary of Geotechnical Units and Soil Types

Unit	Soil Type	Description
1A	FILL – Topsoil / Root Affected	Sandy CLAY, Silty Sandy CLAY, CLAY – low plasticity to medium plasticity, dark brown / dark grey, fine to medium grained sand, root affected, some gravel in places.
1B	FILL - Other	Variable soil materials including: Sandy CLAY – variable plasticity, variable colours often including shades of grey and brown, fine to medium grained sand, trace / some fine to medium grained sub-angular to sub-rounded gravel. SAND – fine to medium grained, brown, some fines of low plasticity. CLAY – high plasticity, dark grey, with pockets and lenses of Gravelly Silty SAND. Gravelly Clayey SAND.
2	TOPSOIL	Sandy CLAY – low plasticity, dark grey-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel in places, root affected. Silty SAND – fine to medium grained, dark brown, fines of low plasticity, some fine to medium grained sub-angular to sub-rounded gravel in places, root affected.
3	RESIDUAL SOIL	Sandy CLAY – medium plasticity to high plasticity, grey to pale grey with some orange / dark grey to black / pale grey to white with some

Unit	Soil Type	Description
		orange, fine to medium grained sand, some fine to medium grained angular to sub-rounded gravel in places. CLAY – medium plasticity to high plasticity, dark grey to black / pale grey to grey, some orange, some fine to medium grained sand. Silty CLAY – medium to high plasticity, pale orange-grey. Silty SAND – fine to coarse grained, black, fines of medium plasticity (ORIGIN: COAL). Clayey SAND, Gravelly CLAY, Clayey Gravelly SAND with cobble sized rock fragments. With relict rock structure, extremely weathered pockets in places.
4	EXTREMELY WEATHERED (EW) ROCK with soil properties	Extremely weathered SANDSTONE with soil properties, breaks down into Sandy CLAY – medium to high plasticity, grey to pale grey with orange.
5	HIGHLY WEATHERED (HW) ROCK	SHALE, SILTSONE, COAL - estimated very low to low strength. SANDSTONE - estimated low to medium strength. Extremely to highly weathered in places.

A summary of the distribution of the geotechnical units (soil types) encountered during the geotechnical investigation are summarised in Table 9.2.

Table 9.2 – Summary of Geotechnical Units encountered at Each Test Pit Location

Location	UNIT 1A FILL-Topsoil	UNIT 1B FILL - Other	UNIT 2 Topsoil	UNIT 3 Residual Soil	UNIT 4 EW Rock	UNIT 5 HW Rock
	Depth (metres)					
TP01	0.00 - 0.10	0.10 - 0.30	-	0.30 - 1.00 2.20 - 2.30	-	1.00 - 2.20 2.30 - 3.30
TP02	0.00 - 0.20	0.20 - 0.50	-	0.50 - 0.60	0.60 - 0.80	0.80 - 0.90*
TP03	0.00 - 0.50	0.50 - 1.50	-	1.50 - 1.70	-	1.70 - 2.20
TP04	0.00 - 0.10	0.10 - 1.50	-	1.50 - 2.00	-	2.00 - 2.20
TP05	0.00 - 0.10	0.10 - 0.30	-	0.30 - 1.60	-	1.60 - 2.30
TP06	0.00 - 0.40	0.40 - 1.80	-	1.80 - 2.20	-	-
TP07	0.00 - 0.60	-	-	0.60 - 1.20	-	1.20 - 3.00
TP08	-	-	0.00 - 0.30	0.30 - 0.70	-	0.70 - 0.95*
TP09	-	0.00 - 0.60	-	0.60 - 1.50	-	1.50 - 1.60*
TP10	-	-	0.00 - 0.30	0.30 - 2.00	-	2.00 - 2.40
TP11	0.00 - 0.50	-	0.50 - 0.70	0.70 - 1.70	-	1.70 - 2.10

Location	UNIT 1A FILL-Topsoil	UNIT 1B FILL - Other	UNIT 2 Topsoil	UNIT 3 Residual Soil	UNIT 4 EW Rock	UNIT 5 HW Rock
	Depth (metres)					
TP12	-	-	0.00 - 0.30	0.30 - 0.90	-	0.90 - 0.95*
TP13	0.00 - 0.30	0.30 - 0.80	-	-	-	0.80 - 1.70*
TP14	-	-	0.00 - 0.20	0.20 - 0.50	-	0.50 - 1.60*
NOTES: * denotes refusal of excavator bucket.						

No groundwater levels or inflows were encountered in the test pits during the limited time that they remained open on the day of the field investigations.

It should be noted that groundwater conditions can vary due to rainfall and other influences including regional groundwater flow, temperature, permeability, recharge areas, surface condition, and subsoil drainage.

No odours or staining was observed during test pitting. Anthropogenic material in the form of trace amounts of brick fragments were observed in fill material between 0.0 and 0.5m in TP11.

The majority of fill materials observed appeared to be re-worked site materials. It is possible the fill observed in the central part of the site, where a former quarry void has been partially filled, and fill material observed in TP11 comprises imported fill materials.

For further information regarding the subsurface conditions observed on the site refer to the geotechnical report carried out in conjunction with this Phase 1 CA (Qualtest Report Ref: NEW17P-0074AA, dated June 2016).

9.2 Laboratory Results

Soil analytical results are summarised in Table 1, Appendix B. The laboratory analytical reports are also included in Appendix G.

Soil Analytical Results

The soil laboratory results were compared to the investigation levels, HIL A, HSL A, EIL A and ESL A, described in Section 4.0. The analytical results showed that concentrations of contaminants were reported below the adopted criteria at the three sampling locations.

10.0 Conceptual Site Model

Based on the results of the Phase 1 CA carried out on the site a conceptual site model (CSM) has been developed.

10.1 Potential Sources of Contamination

Table 10.1 (below) shows the areas of environmental concern (AECs) and associated Chemicals of Potential Concern (COPCs) identified for the site.

Table 10.1 – Potential AECs and COCs

AEC	Potentially Contaminating Activity	Potential COCs	Likelihood of Contamination	Sampling Undertaken / Comments
1. Fill used to fill the central portion of the site	Potential importation/use of fill of unknown origin and quality	Heavy Metals, TRH, BTEX, PAH, OCP, Asbestos	Low	Soil samples fromTP02, TP03, TP04No potential ACM was observed, therefore the presence of asbestos is considered unlikely.
2. Fill observed in access track and TP11, and stockpile of bricks observed.	Potential importation/use of fill of unknown origin and quality	Heavy Metals, TRH, BTEX, PAH, OCP, Asbestos	Low	No sampling was undertaken. The stockpile of bricks appeared to have been imported for use in the access roads (after crushing). The bricks in the fill in TP11 may be associated with road construction, but this is not confirmed. No potential ACM was observed, therefore the presence of asbestos is considered unlikely.
Surface water and sediment in ponds	Potential contamination from run-off from fill materials on site	Heavy Metals, TRH, PAH, OCP, pH, EC	Low	No sampling was undertaken.

10.2 Potentially Affected Media, Receptors and Exposure Pathways

Table 10.2 summarises the potentially affected media, potential receptors to contamination, and potential and complete exposure pathways.

Table 10.2 – Summary of Potentially Affected Media, Receptors and Exposure Pathways

Consideration	Information
Potentially affected media	Soil Surface water and sediments
Potential transport mechanisms & exposure pathways	Direct dermal contact with contaminated soil and/or surface water Ingestion of contaminated soil and/or surface water Leaching of soil contaminants to surface water Surface water discharge to ponds on the eastern side of the site.
Potential receptors of contamination	***Site occupants & construction/maintenance workers*** Potential exposure via dermal contact with soil and surface water, and ingestion of soil and surface water. Contact with groundwater is considered unlikely, taking into account the anticipated depth to groundwater (>5m bgs in a semi-confined aquifer), and that groundwater is not currently extracted on site for beneficial use. ***Surface water*** Contaminants could leach from soils into surface water and sediments in the ponds on the eastern side of the site. ***Groundwater*** Contaminants could leach from soils into groundwater. This is considered a lower risk as groundwater is expected to be present at depths >5m bgs within a semi-confined aquifer. ***Unnamed Creek*** Surface water is anticipated to discharge to an unnamed creek about 50m east of the site. It is considered that groundwater could discharge to the unnamed creek. Given the low risk of groundwater to be contaminated as a result of site conditions, the risk of site contamination reaching this creek via groundwater is low.

10.3 Potential and Complete Exposure Pathways

Table 10.3 (below) summarises the potential and complete exposure pathways.

Table 10.3 – Potential and Complete Exposure Pathways

Receptor/Media	Exposure Pathway	Comment
Site occupants and construction/maintenance workers	Complete	There is a potential for site users and workers to be exposed to contaminated soil. Preliminary soil sampling and analysis showed concentrations of contaminants below the adopted criteria. Based on this, the risk of potential contamination being present is considered low.
Soil	Complete	Low contaminant concentrations were reported in the samples analysed.
Surface water and sediment in onsite ponds	Complete	Excess run-off from the site would flow into these ponds. If soil contamination is present, surface water and sediments may be impacted. This is considered to be a low risk.
Surface water ecosystems	Complete	Excess runoff from the site is anticipated to flow into an unnamed creek to the eats of the site. Given that the potential for contamination to be present on the site is low, it is considered that surface water run-off would be unlikely to cause contamination of the unnamed creek.
Groundwater users	Likely to be incomplete	Groundwater is anticipated to be at depths >5m and is not considered to be contaminated, meaning a complete exposure pathway probably does not exist.

11.0 Discussion

The site history review indicated that the site has been used for quarrying of clay since the mid 1980's. Prior to this, the uses of the site are unknown, but it is anticipated the site remained undeveloped.

During the site walkover, the majority of the site was observed to be bushland (re-vegetated quarry lands). A vacant, lower lying area was present in the centre of the site, which appeared to be a partially filled quarry void. An access track was present around the perimeter of the former quarry area.

Fill materials were observed in many of the test pits to depths between 0.1m and 1.5m bgs. The majority of fill materials observed appeared to be re-worked site materials. It is possible the fill observed in the central part of the site (partially fill former quarry void), and fill material observed in TP11 comprises imported fill materials.

A stockpile of bricks was observed to the east of the central lower area, and fill containing bricks was observed on the access track providing egress to the site. Fill containing brick fragments was also observed in a test pit (TP11) on the northern side of the site. The bricks appear to have been imported to the site for forming access tracks. No obvious potential Asbestos Containing Materials (ACM) were observed in the stockpile of bricks, the access roads, or the fill in the test pits.

Three AECs were identified: AEC 1 comprises the fill in the central part of the site, AEC 2 comprises fill observed on the access track and in TP11, and AEC 3 comprised surface water and sediment in ponds on the eastern side of the site.

Three samples were collected of the fill in AEC 1, and showed concentrations of contaminants below the adopted residential land use criteria. The sampling density was not sufficient to characterise the fill. Taking into account that about 3m to 5m of fill may be placed over this area, and no observations of gross contamination (odours or staining) were observed, it is considered that further sampling and analysis in the area of AEC 1 is not required.

No samples were collected in AEC 2. The potential for contamination in AEC 2 is considered to be low based on observations of the materials. Depending on the proposed use of this material, further sampling and analysis may be required (i.e. if it is to be placed within 2m of the surface of the residential allotments).

No samples were collected in AEC 3. The potential for contamination in this AEC is low. Taking into account that excess water from AEC 3 flows off-site, assessment of potential contamination is recommended.

12.0 Conclusions and Recommendations

Based on the site history and sampling and analysis carried out to date, the site is likely to be suitable for the proposed development in its present state, provided the following recommendations are implemented:

- Due to the presence of fill materials, an Unexpected Finds Procedure should be prepared and implemented during earthworks on the site.
- Sampling and analysis of the surface water and sediments in the ponds is carried out;
- Further sampling and analysis of fill materials on the access tracks and northern portion of the site (TP11) may be required if these materials are proposed to be used within 2m of the final surface of the residential allotments.

- If material is proposed to be re-used or disposed off-site, the material will require classification in accordance with the NSW EPA (2014) Waste Classification Guidelines, or assessment in accordance with a Resource Recovery Exemption/Order under the POEO (Waste) Regulation 2014.

13.0 Limitations

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted practices and standards. To our knowledge, they represent a reasonable interpretation of the general conditions of the site.

Data and opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement by Qualtest. If this report is reproduced, it must be in full.

If you have any questions regarding this report, please do not hesitate to contact Jason Lee or the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd

Emma Coleman
Senior Environmental Scientist

14.0 References

CSIRO Soil and Landscape Grid of Australia, accessed from http://www.clw.csiro.au/aclep/soilandlandscapegrid/ViewData-KML.html on 14 June 2017

Friebel & Nadebaum (2011). *Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater* (technical paper No.10) Guidelines, CRC for Contamination Assessment and Remediation of the Environment (CRC CARE).

Hawley S.P., Glen R.A. and Baker C.J. (1995) Newcastle Coalfield Regional Geology 1:100 000, 1st edition. Geological Survey of New South Wales, Sydney.

NEPC (2013) *National Environmental Protection (Assessment of Site Contamination)* Measure 1999, as amended in 2013, National Environment Protection Council (ASC NEPM, 2013).

NSW Department of Primary Industries (Office of Water) Registered Groundwater Bore Map, accessed from http://allwaterdata.water.nsw.gov.au/water.stm, accessed on 14 June 2017.

NSW Land and Property Information, Spatial Information eXchange (SIX) Maps - Topographic Map, accessed from https://maps.six.nsw.gov.au/, accessed on 14 June 2017.

NSW Department of Land and Water Conservation (1997) Beresfield Acid Sulfate Soil Risk Map (1:25,000 scale, Edition Two)

NSW OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites.

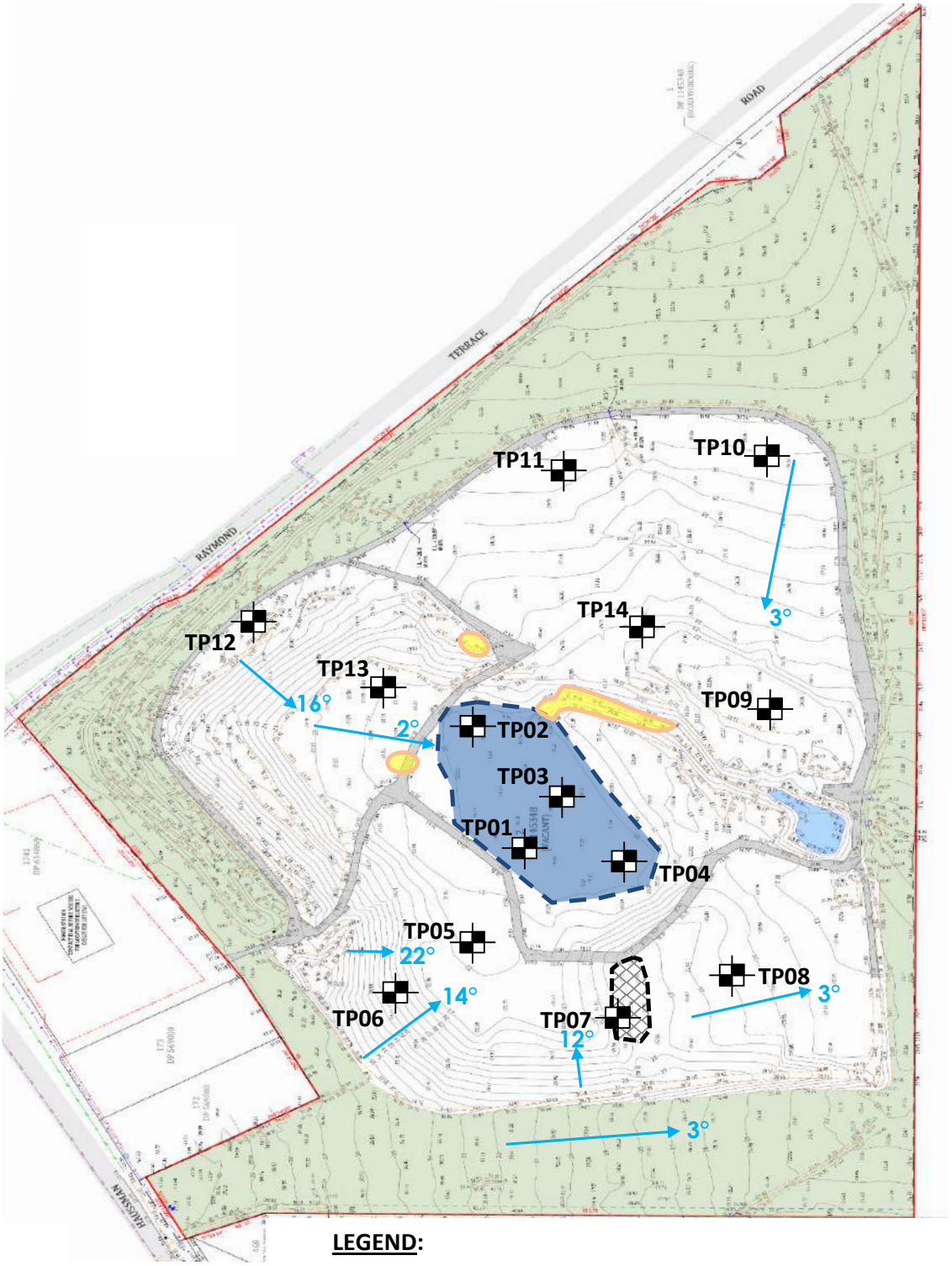
APPENDIX A:

Figures

Figure based on Sixmaps. (https://maps.six.nsw.gov.au)

Client:	McCloy Group Pty Ltd	Drawing No:	FIGURE 1
Project:	Proposed Residential Rezoning	Project No:	NEW17P-0074
Location:	107 Haussman Drive, Thornton NSW	Scale:	N.T.S.
Title:	Site Locatality Plan	Date:	21/06/2017

Qualtest LABORATORY (NSW) PTY LTD



LEGEND:

- Approximate test pit location.
- Approximate extent of filled area in base of pit.
- Approximate extent of potential topsoil fill mound.
- Approximate location of observed rock outcrop.
- 5° Approximate slope angle and direction.

Based upon contour plan prepared by Delfs Lascelles (Proj. No. 15327, Dwg No. 1, Rev. 1, dated 09/05/2017).

Qualtest LABORATORY (NEW) PTY LTD	Client:	McCLOY GROUP	Drawing No:	FIGURE 2
	Project:	PROPOSED RESIDENTIAL REZONING	Project No:	NEW17P-0074
	Location:	107 HAUSSMAN DRIVE, THORNTON	Scale:	N.T.S.
	Title:	SITE LAYOUT AND APPROXIMATE TEST PIT LOCATIONS	Date:	28/06/2017

APPENDIX B:

Tables

McCloy Group
NEW17P-0074

Table 1: Soil Analytical Results
107 Haussman Drive, Thornton

							Field ID	TP02 0.0-0.1M	TP03 0.3-0.4M	TP04 0.7-0.8M
							Date	17/05/2017	17/05/2017	17/05/2017
Analytes		Units	EQL	HIL-A [1]	HSL A [2]	EIL A/ESL A [3]				
Metals	Arsenic	mg/kg	2	100		100		4.3	5.7	25
	Cadmium	mg/kg	0.4	20				< 0.4	< 0.4	< 0.4
	Chromium	mg/kg	5	100		190*		5.1	< 5	< 5
	Copper	mg/kg	5	6000		95*		9.7	< 5	7.7
	Lead	mg/kg	5	300		1100		14	9.3	16
	Mercury	mg/kg	5	40				< 0.1	< 0.1	< 0.1
	Nickel	mg/kg	5	400		30*		< 5	< 5	< 5
	Zinc	mg/kg	5	7400		70*		19	22	36
PAHs	Acenaphthene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Acenaphthylene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Anthracene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Benz(a)anthracene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Benzo(a)pyrene	mg/kg	0.5			0.7		< 0.5	< 0.5	< 0.5
	Benzo(a)pyrene TEQ	mg/kg	0.6	3				1.2	1.2	1.2
	Benzo(b&j)fluoranthene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Benzo(g.h.i)perylene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Benzo(k)fluoranthene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Chrysene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Dibenz(a.h)anthracene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Fluoranthene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Fluorene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Indeno(1.2.3-cd)pyrene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Naphthalene	mg/kg	0.5			170		< 0.5	< 0.5	< 0.5
	Phenanthrene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Pyrene	mg/kg	0.5					< 0.5	< 0.5	< 0.5
	Total PAH	mg/kg	0.5	300				< 0.5	< 0.5	< 0.5
BTEX	Benzene	mg/kg	0.1		0.5	50		< 0.1	< 0.1	< 0.1
	Ethylbenzene	mg/kg	0.1		55	70		< 0.1	< 0.1	< 0.1
	Toluene	mg/kg	0.1		160	85		< 0.1	< 0.1	< 0.1
	Xylenes	mg/kg	0.3		40	105		< 0.3	< 0.3	< 0.3
TRH	Naphthalene	mg/kg	0.5		3			< 0.5	< 0.5	< 0.5
	TRH C6-C10	mg/kg	20			180		< 20	< 20	< 20
	TRH C6-C10 less BTEX (F1)	mg/kg	20		45			< 20	< 20	< 20
	TRH >C10-C16	mg/kg	50			120		< 50	< 50	< 50
	TRH >C10-C16 less Naphthalene (F2)	mg/kg	50		110			< 50	< 50	< 50
	TRH >C16-C34	mg/kg	100			300		< 100	< 100	< 100
	TRH >C34-C40	mg/kg	100			2800		< 100	< 100	< 100

Notes

* No site specific testing for pH and CEC was carried out, therefore conservative EILs have been adopted

Result Concentration exceeds adopted HIL A critieria

Result Concentration exceeds adopted HSL A criteria

Result Concentration exceeds adopted EIL/ESL A criteria

1 NEPC (2013) National Environmental Protection (Assessment of Site Contamination) Measure (NEPM 2013) - Table 1A(1): Health Investigation Levels (Residential A)

2 NEPC (2013) Soil Health Screening Levels for Vapour Intrusion, Residential A, Sand, 0m to <1m

3 NEPC (2013) National Environmental Protection (Assessment of Site Contamination) Measure (NEPM 2013) - Ecological Investigation and Screening Levels (Urban Residential and Public Open Space, Sand)

APPENDIX C:

Groundwater Bore Search

NSW Office of Water
Work Summary

GW079948

Licence:
Licence Status:
Authorised Purpose(s):
Intended Purpose(s):
Work Type: Bore
Work Status:
Construct.Method:
Owner Type:
Commenced Date:
Completion Date:
Final Depth:
Drilled Depth:
Contractor Name:
Driller:
Assistant Driller:
Property:
GWMA:
GW Zone:
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	GLOUC	GLOUC.049	
Licensed:			

Region: 20 - Hunter
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:
Elevation: 9.87 m (A.H.D.)
Elevation Source: Unknown
Northing: 6372613.0
Easting: 370081.0
Latitude: 32°46'36.2"S
Longitude: 151°36'46.0"E
GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

15/02/2000: Form A Remarks:
RZM MONITORING BORE SK 7653
01/12/2009: Reviewed data - nothing to update.

***** End of GW079948 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

NSW Office of Water
Work Summary

GW200414

Licence: 20BL169475 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s):

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date: **Final Depth:** 10.00 m
Completion Date: 09/09/2004 **Drilled Depth:** 10.00 m

Contractor Name:
Driller:
Assistant Driller:

Property: N/A 114 CHELMSFORD DRIVE METFORD 2323 **Standing Water Level:**
GWMA: - **Salinity:**
GW Zone: - **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.34	1/1001539
Licensed:	NORTHUMBERLAND	MAITLAND	Whole Lot 1//1001539

Region: 20 - Hunter **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6373761.0 **Latitude:** 32°45'58.9"S
Elevation Source: Unknown **Easting:** 369960.0 **Longitude:** 151°36'41.9"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Map Interpretation

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	10.00	0			Unknown

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.30	0.30	fill (silty sand, dark brown, medium grained sand, minor medium plasticity clay inclusions	Fill	

			without)		
0.30	0.50	0.20	fill (clayey sand, light brown medium grained sand, medium plasticity clay fines)	Fill	
0.50	1.30	0.80	clay (silty, light grey, orange mottling, low plasticity fines)	Clay	
1.30	2.50	1.20	sandstone (extremely weathered, fine grained, red and grey mottled)	Clay	
2.50	4.00	1.50	sandstone (very weathered, brown orange, fine to very fine grained, trends to siltstone)	Sandstone	
4.00	6.00	2.00	sandstone (moderately weathered, orange brown, fine grained)	Sandstone	
6.00	6.50	0.50	sandstone (fine grained, minor weathering, light grey)	Sandstone	
6.50	8.00	1.50	siltstone (grey, minor unweathered carbonaceous fragments, iron stained bands throughtout)	Siltstone	
8.00	8.20	0.20	coal (black, minor carbonaceous mudstone bands, moderately hard, 90-100% dull, fresh)	Invalid Code	
8.20	10.00	1.80	sandstone (light grey, fine to medium grey, moderately hard)	Sandstone	

Remarks

***** End of GW200414 *****

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NSW Office of Water
Work Summary

GW200415

Licence: 20BL169475 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s):

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date: **Final Depth:** 20.10 m
Completion Date: 10/09/2004 **Drilled Depth:** 20.10 m

Contractor Name:
Driller:
Assistant Driller:

Property: N/A 114 CHELMSFORD DRIVE METFORD 2323 **Standing Water Level:**
GWMA: - **Salinity:**
GW Zone: - **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.34	1/1001539
Licensed:	NORTHUMBERLAND	MAITLAND	Whole Lot 1//1001539

Region: 20 - Hunter **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6373738.0 **Latitude:** 32°45'59.7"S
Elevation Source: Unknown **Easting:** 369986.0 **Longitude:** 151°36'42.9"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Map Interpretation

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	20.10	0			Unknown

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.30	1.30	clay (silty, sandy, light to dark brown, low plasicity, fine to medium grained sand. Some	Clay	

			grey orange mottling)		
1.30	1.50	0.20	clay (sandy silty, orange grey mottled)	Clay	
1.50	4.00	2.50	sandstone (medium grained, light grey, moderately weathered with orange brown mottling near top)	Sandstone	
4.00	6.50	2.50	sandstone (fine to very fine grained, tends to siltstone, orange, moderately weathered)	Sandstone	
6.50	7.00	0.50	coal (black, tends to claystone in part, minor weathering)	Invalid Code	
7.00	9.00	2.00	siltstone (grey, tends to fine sandstone, minor carbonaceous traces)	Siltstone	
9.00	15.00	6.00	sandstone (light grey, white, fine to medium grained, moderately hard, not weathered, minor siltstone bands)	Sandstone	
15.00	17.00	2.00	sandstone (with siltstone, interbedded, light grey, fine to medium grained sandstone, grey siltstone, minor carbonacous)	Sandstone	
17.00	20.10	3.10	sandstone (fine to medium grained, light grey/white, fresh, hard)	Sandstone	

Remarks

***** End of GW200415 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

APPENDIX D:

Site History Documents

ADVANCE LEGAL SEARCHERS PTY LTD

(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

18th May, 2017

QUALTEST LABORATORY (NSW) PTY LTD
8 Ironbark Close,
WARABROOK NSW 2304

Attention: Emma Coleman

RE: **Hausmann Drive,**
Thornton
Job no. NEW17P-0074

Current Search

Folio Identifier 2/1145348 (title attached)
DP 1145348 (plan attached)
Dated 17th May, 2017
Registered Proprietor:
CSR BUILDING PRODUCTS LIMITED

Title Tree
Lot 2 DP 1145348

Folio Identifier 2/1145348

Folio Identifier 2/867766

Folio Identifier 1742/634868

Certificate of Title Volume 15144 Folio 152

Certificate of Title Volume 12467 Folio 13

Certificate of Title Volume 11007 Folio 116

Certificate of Title Volume 4332 Folio 26

Certificate of Title Volume 4123 Folio 36

Certificate of Title Volume 3240 Folio 25

Certificate of Title Volume 3051 Folio 79

PA 19247

****

Summary of proprietor(s)
Lot 2 DP 1145348

Year	Proprietor(s)
	(**Lot 2 DP 1145348)**
2010 – todate	CSR Building Products Limited
	(**Lot 2 DP 867766)**
2010 – 2010	CSR Building Products Limited *(formerly MonierPGH Holdings Limited)*
1997 – 2010	Monier PGH Holdings Limited
	(Lot 1742 DP 634868)
1995 – 1997	Monier PGH Holdings Limited
1989 – 1995	PGH Limited *(formerly EKI Pty Limited)*
1988 – 1989	Acmil Industries Pty. Limited.
	(Lot 1742 DP 634868 – CTVol 15144 Fol 152)
1983 – 1988	Acmil Industries Pty. Limited.
	(Lot 174 DP 569000 – CTVol 12467 Fol 13)
1981 – 1983	Acmil Industries Pty. Limited.
1975 – 1981	The Housing Commission of New South Wales
1974 – 1975	Jemanapa Pty Limited
1974 – 1974	Ena Albertha Latter, married woman Ada Evelyn Burns, married woman Ernest William Green, millwright
	(Lot 174 DP 534145 – CTVol 11007 Fol 116)
1969 – 1974	Ena Albertha Latter, married woman Ada Evelyn Burns, married woman Ernest William Green, millwright
	(Lot 17 DP 10419 – Area 54 Acres 3 Roods 23 Perches – CTVol 4332 Fol 26)
1963 – 1969	Ena Albertha Latter, married woman Ada Evelyn Burns, married woman Ernest William Green, millwright
1929 – 1963	William George Green, contractor
	(Lot 17 DP 10419 and other land – Area 224 Acres 1 Rood 18 ¼ Perches – CTVol 4123 Fol 36)
1928 – 1929	William George Green, contractor
	(Lot 17 DP 10419 and other land – Area 224 Acres 1 Rood 18 ¼ Perches – CTVol 3240 Fol 25)
1921 – 1928	William George Green, contractor
	(Portion 46 Parish Alnwick and other land – Area 2814 Acres 3 Roods 25 Perches – CTVol 3051 Fol 79
1921 – 1921	George William Irving Fane De Salis, returned soldier

1920 – 1921	Rodolph Fane De Salis, esquire

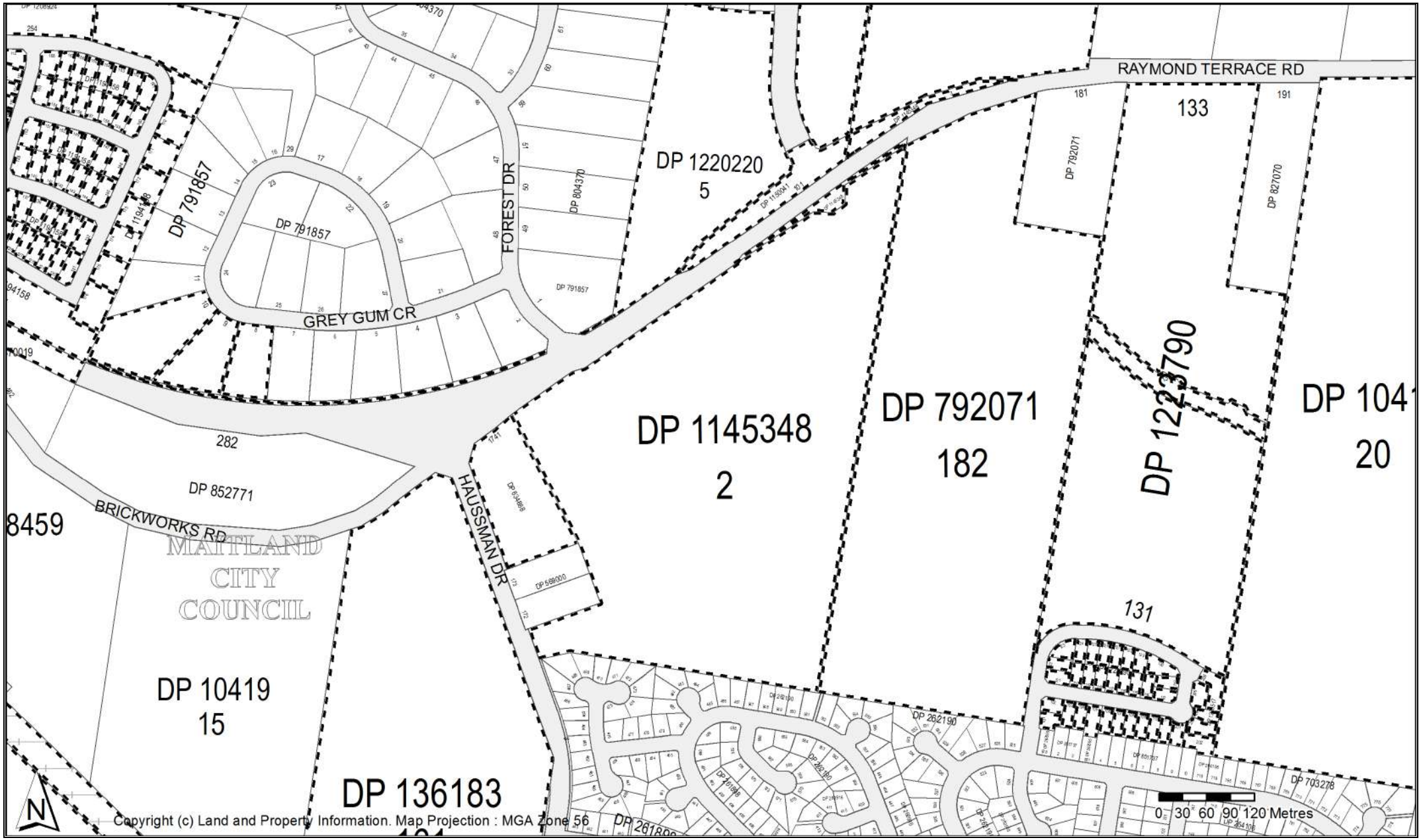
****

Cadastral Records Enquiry Report

Ref : qualtest - thornton

Requested Parcel : Lot 2 DP 1145348 **Identified Parcel :** Lot 2 DP 1145348

Locality : THORNTON **LGA :** MAITLAND **Parish :** ALNWICK **County :** NORTHUMBERLAND



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This information is provided as a searching aid only. While every endeavour is made to ensure the current cadastral pattern is accurately reflected, the Registrar General cannot guarantee the information provided. For all ACTIVITY PRIOR to SEPT 2002 you must refer to the RGs Charting and Reference Maps.

	Status	Surv/Comp	Purpose
DP10419			
Lot(s): 20			
DP269213	REGISTERED	SURVEY	EASEMENT
DP1227381	REGISTERED	SURVEY	EASEMENT
DP1228517	REGISTERED	SURVEY	SUBDIVISION
DP1230998	REGISTERED	COMPILATION	EASEMENT
DP136183			
Lot(s): 161			
DP10419	HISTORICAL	SURVEY	UNRESEARCHED
DP1128210	REGISTERED	SURVEY	EASEMENT
DP634868			
Lot(s): 1741			
DP1138708	REGISTERED	SURVEY	SURVEY INFORMATION ONLY
DP791857			
Lot(s): 8, 9, 10, 30			
DP1113732	REGISTERED	SURVEY	EASEMENT
DP792071			
Lot(s): 182			
DP269213	REGISTERED	SURVEY	EASEMENT
DP832922			
Lot(s): 1538			
DP269213	REGISTERED	SURVEY	EASEMENT
DP870019			
Lot(s): 465			
CA174812 - LOT 465 DP870019			
DP1005289			
Lot(s): 609			
DP878202	HISTORICAL	SURVEY	SUBDIVISION
DP1145348			
Lot(s): 3, 4			
DP797295	HISTORICAL	COMPILATION	DEPARTMENTAL
DP1054639	REGISTERED	SURVEY	EASEMENT
Lot(s): 1, 2			
DP269213	REGISTERED	SURVEY	EASEMENT
DP867766	HISTORICAL	SURVEY	SUBDIVISION
DP1055591	REGISTERED	COMPILATION	EASEMENT
DP1150041			
Lot(s): 101			
DP1020387	HISTORICAL	COMPILATION	LIMITED FOLIO CREATION
DP1053679	REGISTERED	SURVEY	EASEMENT
DP1108020	REGISTERED	SURVEY	SUBDIVISION
DP1126415	REGISTERED	SURVEY	REDEFINITION
DP1194158			
Lot(s): 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177			
DP651132	HISTORICAL	COMPILATION	DEPARTMENTAL
DP870019	HISTORICAL	SURVEY	SUBDIVISION
DP881116	HISTORICAL	SURVEY	SUBDIVISION
DP1090329	REGISTERED	SURVEY	SUBDIVISION
DP1113732	REGISTERED	SURVEY	EASEMENT
DP1195141	REGISTERED	SURVEY	SUBDIVISION
DP1206985			
Lot(s): 1020			
CA173940 - LOT 1020 DP1206985			
CA173965 - LOT 1021 DP1207172			

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	Status	Surv/Comp	Purpose
DP1208924			
Lot(s): 254			
DP651132	HISTORICAL	COMPILATION	DEPARTMENTAL
DP870019	HISTORICAL	SURVEY	SUBDIVISION
DP881116	HISTORICAL	SURVEY	SUBDIVISION
DP1090329	REGISTERED	SURVEY	SUBDIVISION
DP1113732	REGISTERED	SURVEY	EASEMENT
DP1194158	REGISTERED	SURVEY	SUBDIVISION
DP1195141	REGISTERED	SURVEY	SUBDIVISION
DP1219726			
Lot(s): 369			
DP651132	HISTORICAL	COMPILATION	DEPARTMENTAL
DP870019	HISTORICAL	SURVEY	SUBDIVISION
DP881116	HISTORICAL	SURVEY	SUBDIVISION
DP1090329	REGISTERED	SURVEY	SUBDIVISION
DP1113732	REGISTERED	SURVEY	EASEMENT
DP1194158	REGISTERED	SURVEY	SUBDIVISION
DP1195141	REGISTERED	SURVEY	SUBDIVISION
DP1208924	REGISTERED	SURVEY	SUBDIVISION
DP1220220			
Lot(s): 4, 5			
DP1020387	HISTORICAL	COMPILATION	LIMITED FOLIO CREATION
DP1053679	REGISTERED	SURVEY	EASEMENT
DP1108020	REGISTERED	SURVEY	SUBDIVISION
DP1126415	REGISTERED	SURVEY	REDEFINITION
DP1150041	REGISTERED	SURVEY	SUBDIVISION
DP1150600	REGISTERED	SURVEY	SUBDIVISION
DP1155695	REGISTERED	SURVEY	SUBDIVISION
DP1171131	REGISTERED	SURVEY	SUBDIVISION
DP1223790			
Lot(s): 131			
DP1227381	REGISTERED	SURVEY	EASEMENT
DP1228517	REGISTERED	SURVEY	SUBDIVISION
Lot(s): 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133			
DP269213	REGISTERED	SURVEY	EASEMENT
DP851737	HISTORICAL	SURVEY	SUBDIVISION
DP1228517			
Lot(s): 201, 202, 203, 204, 205, 206			
DP269213	REGISTERED	SURVEY	EASEMENT
DP851737	HISTORICAL	SURVEY	SUBDIVISION
DP1223790	REGISTERED	SURVEY	SUBDIVISION
DP1227381	REGISTERED	SURVEY	EASEMENT

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Requested Parcel : Lot 2 DP 1145348 **Identified Parcel :** Lot 2 DP 1145348

Locality : THORNTON **LGA :** MAITLAND **Parish :** ALNWICK **County :** NORTHUMBERLAND

Plan	Surv/Comp	Purpose
DP10419	SURVEY	UNRESEARCHED
DP136183	COMPILATION	DEPARTMENTAL
DP175278	COMPILATION	UNRESEARCHED
DP248905	SURVEY	SUBDIVISION
DP260916	SURVEY	SUBDIVISION
DP261898	SURVEY	SUBDIVISION
DP262190	SURVEY	SUBDIVISION
DP262555	SURVEY	SUBDIVISION
DP264106	SURVEY	SUBDIVISION
DP569000	SURVEY	SUBDIVISION
DP634868	SURVEY	SUBDIVISION
DP703278	SURVEY	SUBDIVISION
DP778111	SURVEY	SUBDIVISION
DP791857	SURVEY	SUBDIVISION
DP792071	SURVEY	SUBDIVISION
DP804370	SURVEY	SUBDIVISION
DP807164	SURVEY	SUBDIVISION
DP827070	SURVEY	SUBDIVISION
DP832922	SURVEY	SUBDIVISION
DP847510	SURVEY	REDEFINITION
DP851737	SURVEY	SUBDIVISION
DP852771	SURVEY	SUBDIVISION
DP870019	SURVEY	SUBDIVISION
DP1005289	SURVEY	SUBDIVISION
DP1078459	COMPILATION	DEPARTMENTAL
DP1145348	SURVEY	SUBDIVISION
DP1145348	UNRESEARCHED	SUBDIVISION
DP1150041	SURVEY	SUBDIVISION
DP1150041	UNRESEARCHED	SUBDIVISION
DP1194158	UNRESEARCHED	SUBDIVISION
DP1194158	SURVEY	SUBDIVISION
DP1194158	SURVEY	SUBDIVISION
DP1206985	COMPILATION	LIMITED FOLIO CREATION
DP1208924	SURVEY	SUBDIVISION
DP1208924	UNRESEARCHED	SUBDIVISION
DP1208924	SURVEY	SUBDIVISION
DP1219726	SURVEY	SUBDIVISION
DP1219726	UNRESEARCHED	SUBDIVISION
DP1220220	UNRESEARCHED	SUBDIVISION
DP1220220	SURVEY	SUBDIVISION
DP1223790	SURVEY	SUBDIVISION
DP1223790	UNRESEARCHED	SUBDIVISION
DP1223790	SURVEY	SUBDIVISION
DP1228517	SURVEY	SUBDIVISION

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Req:R693492 /Doc:CT 11007-116 CT /Rev:11-Jan-2011 /Sts:OK.SC /Pgs:ALL /Prt:17-May-2017 13:18 /Seq:1 of 2
Ref:ALS /Src:T

NEW SOUTH WALES

FICATE OF TITLE

ROPERTY ACT, 1900, as amended.

Application No. 19247

Prior Title Volume 4332 Folio 26

Vol. 11007 Fol. 116

EH Edition issued 13-3-1969

CANCELLED

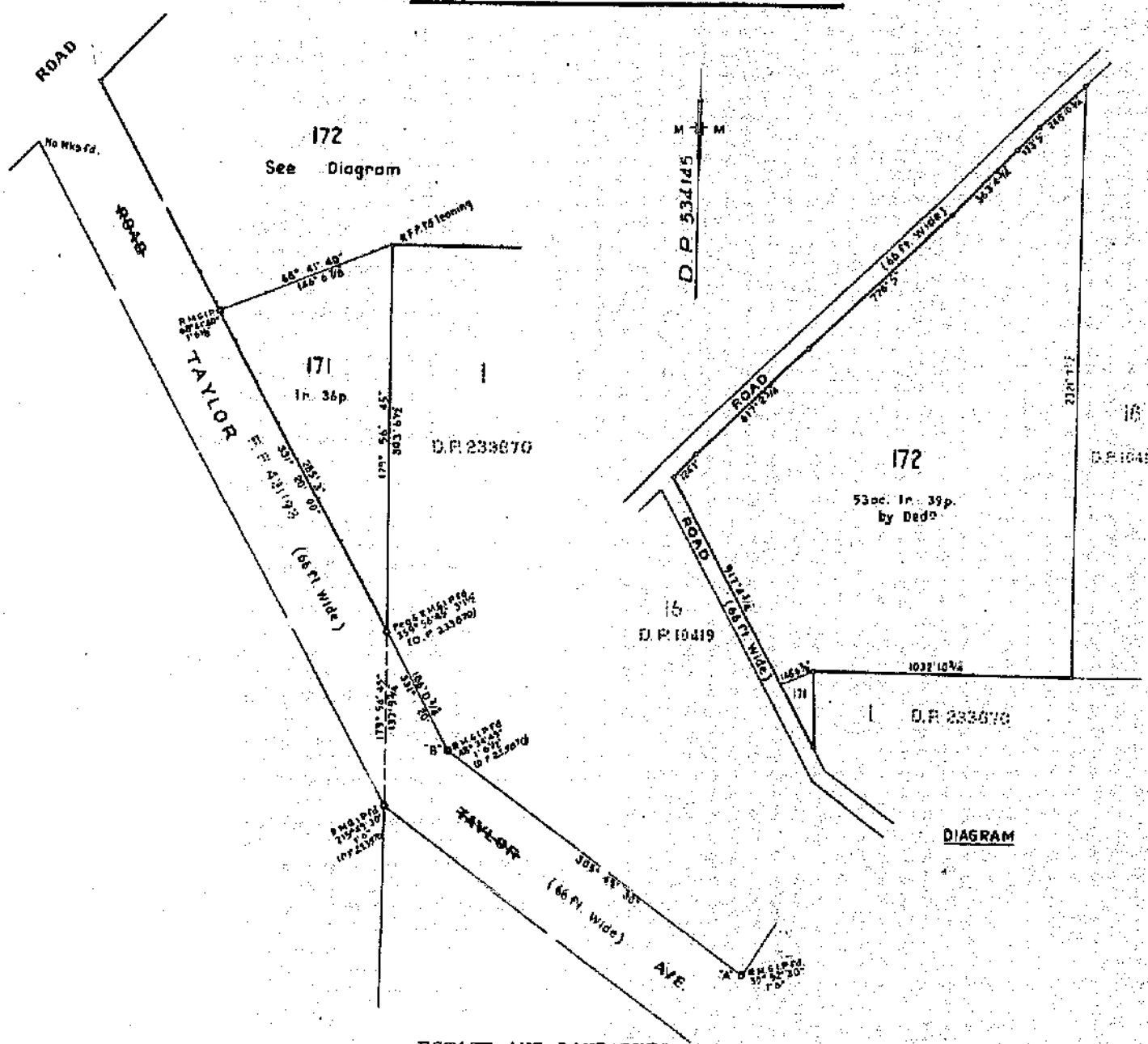
I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

Witness M.Flint

Registrar General.

(Page 1) Vol. 11007 Fol. 116

PLAN SHOWING LOCATION OF LAND



ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot 172 in Deposited Plan 534145 at Thornton in the City of Maitland Parish of Alnwick and County of Northumberland being part of Portion 46 granted to Joseph Moore on 6-6-1835.

FIRST SCHEDULE

ENA ALBERTHA LATTER, of Waratah, Married Woman, ADA EVELYN BURNS, of Broadmeadow, Married Woman and ERNEST WILLIAM GREEN, of Mayfield East, Millwright, as Joint Tenants.

SECOND SCHEDULE

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.
2. Caveat No.J446972 by the Registrar General. Entered 24-9-1963.

Registrar General.

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

Req:R693492 /Doc:CT 11007-116 CT /Rev:11-Jan-2011 /Sts:OK.SC /Pgs:ALL /Prt:17-May-2017 13:18 /Seq:2 of 2
Ref:ALS /Src:T

N373753.
Ple X.
DP 569000
6/6/74

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar-General
This deed is cancelled as to the whole New Certificates of Title have issued on 21.6.1974 for lots in Deposited Plan No. 569000 as follows:- Lots 172 to 174 Vol. 12467 Fol 11 to 13 respectively. REGISTRAR GENERAL					

SECOND SCHEDULE (continued)

INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar-General	CANCELLATION
Caveat	N373753	17-7-1973		10-8-1973		

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR-GENERAL ARE CANCELLED

Req:R693457 /Doc:CT 12467-013 CT /Rev:10-Jan-2011 /Sts:OK.SC /Pgs:ALL /Prt:17-May-2017 13:14 /Seq:1 of 2
Ref:ALS /Src:T

[redacted]ICATE OF TITLE

NEW SOUTH WALES — [redacted] PROPERTY ACT, 1900

12467013

Vol. 12467 Fol. 13

Appln No.19247

Prior Title Vol.11007 Fol.116

Edition issued 21-6-1974.

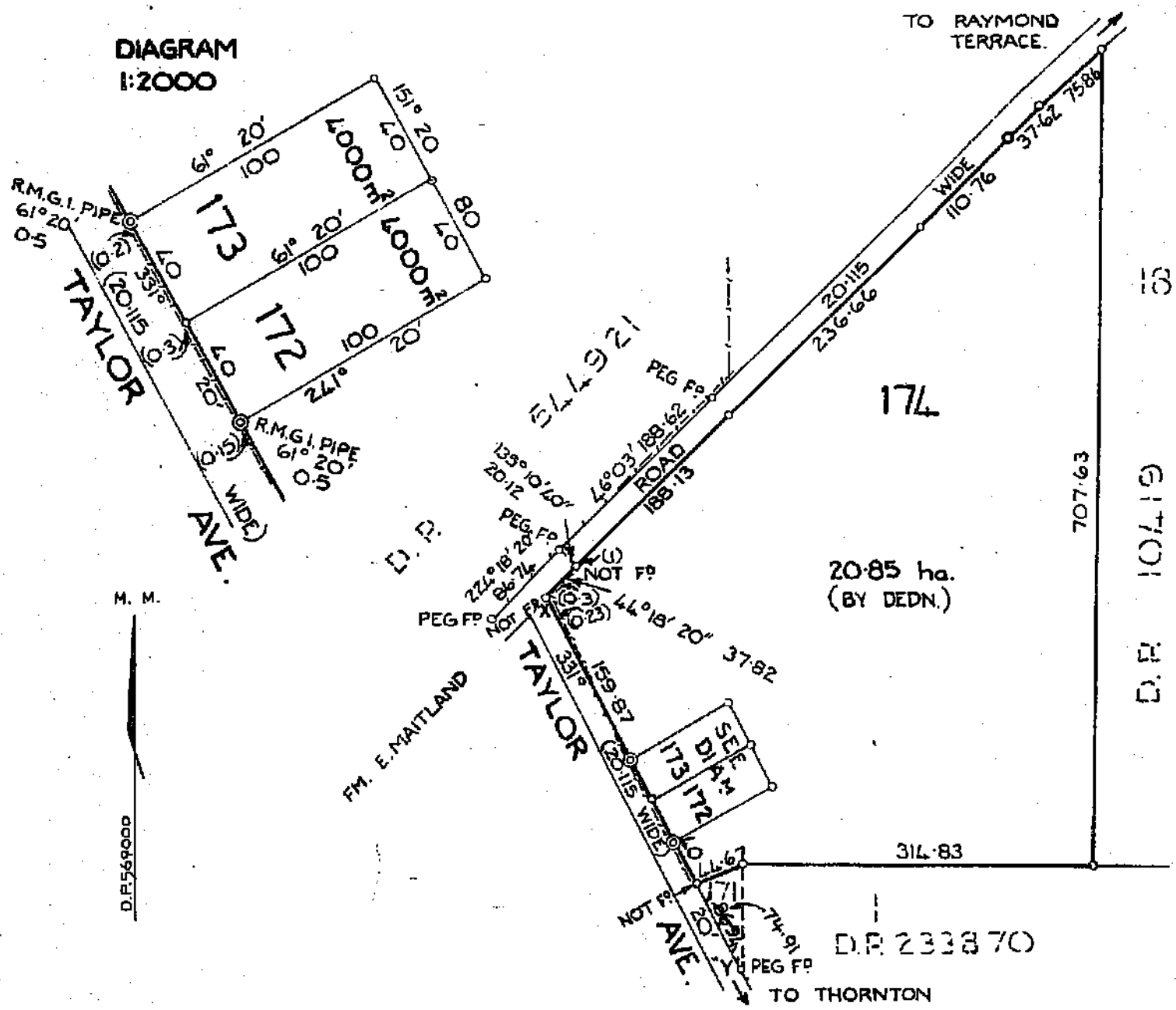
(Page 1) Vol. 12467 Fol. 13

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

Estate in Fee Simple in Lot 174 in Deposited Plan 569000 at Thornton in the City of Maitland Parish of Alnwick and County of Northumberland being part of Portion 46 granted to Joseph Moore on 6-6-1835.

FIRST SCHEDULE

~~ENA ALBERTHA LATHAM of Waratah, Married Woman, ADA EVELYN BURNS of Broadmeadow, Married Woman and ERNEST WILLIAM GREEN of Mayfield East, Millwright, as Joint Tenants.~~

SECOND SCHEDULE

GRY

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.
2. ~~Caveat No.J446975 by the Registrar General. Entered 24-9-1963.~~ Withdrawn N937235
3. ~~Caveat No.N373753. Entered 10-8-1973.~~ Withdrawn N937234

WARNING: THIS DOCUMENT MUST NOT BE REMOVED FROM THE LAND TITLES OFFICE.
PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON
NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED.

Vol. 12467 Fol. 13

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General
~~Jemanapg Pty. Limited~~	Transfer	N937235	9-7-1974	~~26-8-1974~~	
~~The Housing Commission of New South Wales~~	Transfer	P339045	------	~~30-9-1975~~	
Acmil Industries Pty. Limited by Transfer S495097. Registered 3-6-1981					
the land is cancelled as to WHOLE(ER ROAD)					
certificate of title have issued on 24-10-83					
the Plan is Deposited Plan No. 634868					
vols 1741/142 Vol. 15144 151/152					

N937234 w/d
-235 Re
N946644 (P)
P259243 Rel
P339043 Discl
044 withdrawn
045
S495097 R
D.P634868
Registered 3/10/83

SECOND SCHEDULE (continued)

INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION		
Mortgage	N946643	12-7-1974	to Custom Credit Corporation Limited	~~26-8-1974~~		Discharged	P339043	
W.d	P259243			~~11-5-1975~~		Withdrawn	P339044	
THE INTEREST OF THE COUNCIL OF THE CITY OF MAITLAND IN THE ADDITION TO EXISTING ROADS SHOWN ON DP634868				13-10-1983				
the land is first in this folio comprised								
ROAD								

(Page 2 of 2 pages)

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

Req:R693457 /Doc:CT 12467-013 CT /Rev:10-Jan-2011 /Sts:OK.SC /Pgs:ALL /Prt:17-May-2017 13:14 /Seq:2 of 2
Ref:ALS /Src:T

Req:R693434 /Doc:CT 15144-152 CT /Rev:19-Jan-2011 /Sts:OK.SC /Pgs:ALL /Prt:17-May-2017 13:13 /Seq:1 of 2
Ref:ALS /Src:T

15144152

[redacted]FICATE OF TITLE

NEW SOUTH WALES [redacted]L PROPERTY ACT, 1900

15144 152

Vol. 15144 Fol. 152

First Title : Old System

Prior Title : Vol.12467 Fol.13

EDITION ISSUED 26 10 1983

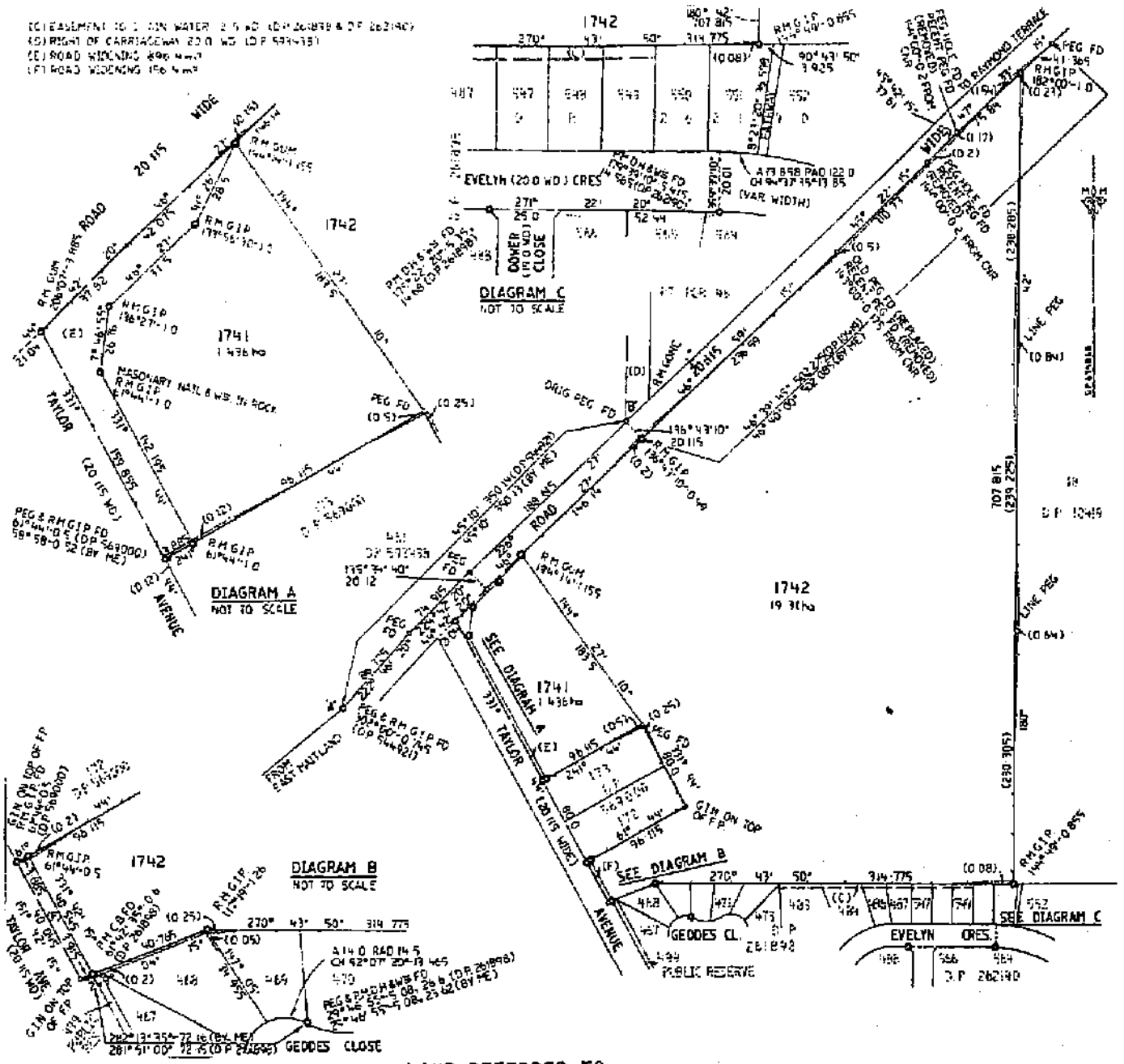
I certify that the person named in the First Schedule is the registered proprietor of an estate in fee simple (or such other estate or interest as is set out below) in the land described subject to the [redacted] appearing in the Second Schedule and to the provisions of the Real Property Act, 1900.

CANCELLED

SEE AUTO FOLIO

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



LAND REFERRED TO

Lot 1742 in Deposited Plan 634868 at Thornton in the City of Maitland Parish of Alnwick and County of Northumberland.

FIRST SCHEDULE

ACMIL INDUSTRIES PTY. LIMITED.

SECOND SCHEDULE

1. Reservations and conditions contained in the Crown Grant.

RG 2/64

PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON

(Page 1) Vol. 15144 Fol. 152

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

Vol. 15144 Fol. 152

L.O. 1066 D. West, Government Printer

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	Registrar General
CANCELLED SEE AUTO FOLIO	

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

Req:R693434 /Doc:CT 15144-152 CT /Rev:19-Jan-2011 /Sts:OK.SC /Pgs:ALL /Prt:17-May-2017 13:13 /Seq:2 of 2
Ref:ALS /Src:T

Req:R693666 /Doc:DL 0514294 /Rev:14-Jul-2008 /Sts:SC.OK /Pgs:ALL /Prt:17-May-2017 13:32 /Seq:1 of 2
Ref:qualtest - thornt /Src:T

97-01T

TRANSFER

Real Property Act, 1900

0
514294 L

Office of State Revenue use only

(11)

OFFICE OF STATE REVENUE
(N.S.W. TREASURY)
1994/95 P3
NO STAMP DUTY IS PAYABLE ON THIS INSTRUMENT 0632

(A) LAND TRANSFERRED
Show no more than 20 References to Title.
If appropriate, specify the share transferred.

FOLIO IDENTIFIERS 7/242752, 8/242752, 1742/634868, 3/232574, 16/10419, 7/239691, 67/755245, 74/755245, 1/796730, 2/796730 and VOLUME 7967 FOLIO 200 Ø
Ø NOW DEAD 1/106143

(B) LODGED BY

L.T.O. Box	Name, Address or DX and Telephone
49J 41J	MALLESONS STEPHEN JAQUES 1 FARRER PLACE SYDNEY DX 113 SYDNEY AUBCSR0001-361

Reference (max. 15 characters): ~~ALB:P104822(6)~~

(C) TRANSFEROR PGH LIMITED (ACN 003 534 870)
(formerly EKI Pty Limited)

(D) ~~acknowledges receipt of the consideration of~~ pursuant to a corporate reconstruction ~~and~~ as regards the land specified above transfers to the transferee an estate in fee simple

(E) subject to the following **ENCUMBRANCES** 1. ..... 2. ..... 3. .....

(F) TRANSFEREE T

MONIER PGH HOLDINGS LIMITED (ACN 008 631 356)

5

(G) TENANCY:

(H) We certify this dealing correct for the purposes of the Real Property Act, 1900

DATE 18 AUGUST 1995

~~Signed in my presence by the transferor who is personally~~ known to me

FOR EXECUTION CLAUSES SEE ANNEXURE

.....
Signature of Witness

.....
Name of Witness (BLOCK LETTERS)

.....
Address of Witness

.....
Signature of Transferor

Signed in my presence by the transferee who is personally known to me

.....
Signature of Witness

.....
Name of Witness (BLOCK LETTERS)

.....
Address of Witness

~~Signature of Transferee~~

1/796730, 7/239691, 67/755245, 74/755245

OFF: BA 597425
N 865043
P 384890

CHECKED BY (office use only)

Regd & Card index checked.

☛ INSTRUCTIONS FOR FILLING OUT THIS FORM ARE AVAILABLE FROM THE LAND TITLES OFFICE

H. C. MARTYN & SONS (AUST.) PTY. LTD. PH: (02) 699 2499

Req:R693666 /Doc:DL 0514294 /Rev:14-Jul-2008 /Sts:SC.OK /Pgs:ALL /Prt:17-May-2017 13:32 /Seq:2 of 2
Ref:qualtest - thornt /Src:T

This is the annexure containing execution clauses to Transfer
Between:
PGH LIMITED (as Transferor)
And:
MONIER PGH HOLDINGS LIMITED (as Transferee)

We hereby certify this dealing correct for the purposes of the Real Property Act, 1900.

DATE 18 AUGUST 1995

THE COMMON SEAL of PGH LIMITED is affixed in accordance with its articles of association in the presence of:

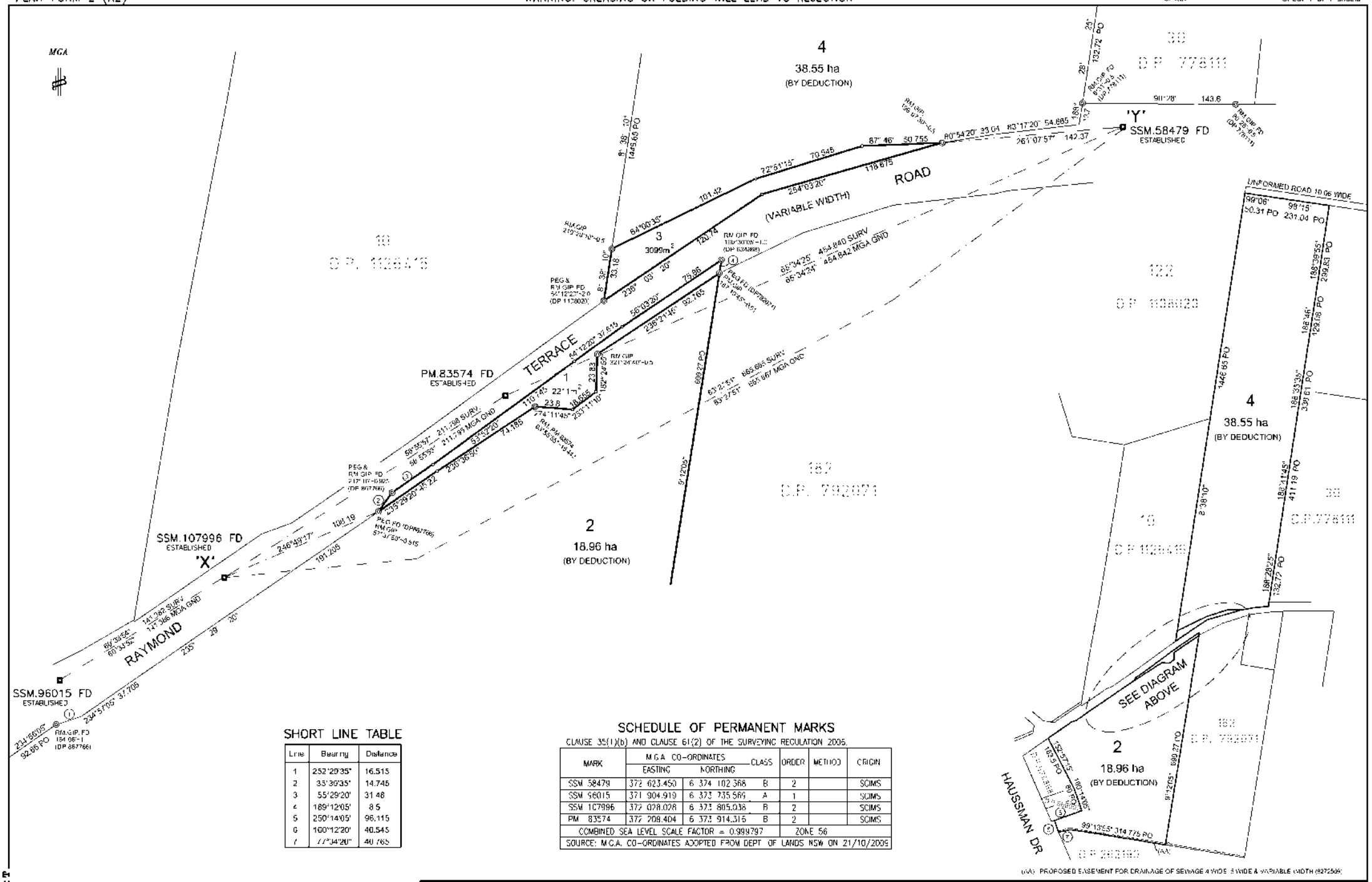
PGH LIMITED COMMON SEAL A.C.N. 003 504 870

Signature of authorised person	Signature of authorised person
DIRECTOR	SECRETARY
Office held	Office held
ANTHONY JOHN TANNER	DAVID CULLEN
Name of authorised person (block letters)	Name of authorised person (block letters)

THE COMMON SEAL of MONIER PGH HOLDINGS LIMITED is affixed in accordance with its articles of association in the presence of:

MONIER PGH HOLDINGS LIMITED A.C.N. 008 631 356 Common Seal

Signature of authorised person	Signature of authorised person
DIRECTOR	DIRECTOR
Office held	Office held
JOHN PURDIE-SMITH	DAVID CULLEN
Name of authorised person (block letters)	Name of authorised person (block letters)



SHORT LINE TABLE

Line	Bearing	Distance
1	252°29'35"	16.515
2	33°39'35"	14.745
3	55°29'20"	31.48
4	189°12'05"	8.5
5	250°14'05"	96.115
6	160°12'20"	40.545
7	77°34'20"	40.765

SCHEDULE OF PERMANENT MARKS

CLAUSE 35(1)(b) AND CLAUSE 61(2) OF THE SURVEYING REGULATION 2006.

MARK	M.G.A. CO-ORDINATES EASTING	NORTHING	CLASS	ORDER	METHOD	ORIGIN
SSM 58479	372 623.450	6 374 102.368	B	2		SCIMS
SSM 96015	371 904.919	6 373 735.569	A	1		SCIMS
SSM 107996	372 028.028	6 373 805.038	B	2		SCIMS
PM 83574	372 209.404	6 373 914.316	B	2		SCIMS
COMBINED SEA LEVEL SCALE FACTOR = 0.999797				ZONE 56		
SOURCE: M.G.A. CO-ORDINATES ADOPTED FROM DEPT. OF LANDS NSW ON 21/10/2009						

Surveyor: Jason Lee Harman Date of Survey: 28/10/2009 Surveyor's Ref: 4070-DP-RTR	PLAN OF SUBDIVISION OF LOT 1 DP 797295 & LOT 2 DP 867766	LGA: MAITLAND Locality: CHISHOLM Subdivis on No: 072980 Lengths are in metres Reduction Ratio 1 1500	Registered: 30.3 2010	DP1145348

Req:R693377 /Doc:DP 1145348 P /Rev:31-Mar-2010 /Sts:SC.OK /Pgs:ALL /Prt:17-May-2017 13:08 /Seq:1 of 3
Ref:als /Src:P

PLAN FORM 6 WARNING: Creasing or folding will lead to rejection ePlan

DEPOSITED PLAN ADMINISTRATION SHEET

Sheet 1 of 2 sheet(s)

*OFFICE USE ONLY

SIGNATURES, SEALS and STATEMENTS of intention to dedicate public roads, to create public reserves, drainage reserves, easements, restrictions on the use of land or positive covenants

IT IS INTENDED TO DEDICATE LOTS 1 & 3 TO THE PUBLIC AS PUBLIC ROAD.

Use PLAN FORM 6A
for additional certificates, signatures, seals and statements

* DP1145348

Registered: 30.3.2010 *
Title System: TORRENS
Purpose: SUBDIVISION

PLAN OF SUBDIVISION OF LOT 1 DP 797295 & LOT 2 DP 867766

L G A: MAITLAND
Locality: CHISHOLM
Parish: ALNWICK
County: NORTHUMBERLAND

Crown Lands NSW/Western Lands Office Approval

I ..... (Authorised Officer) in approving this plan certify that all necessary approvals in regard to the allocation of the land shown herein have been given

Signature: .....
Date: .....
File Number: .....
Office: .....

Subdivision Certificate

I certify that the provisions of s.109J of the Environmental Planning and Assessment Act 1979 have been satisfied in relation to:

the proposed Road Widening set out herein
* (insert 'subdivision' or 'new road')

.....
* Authorised Person/~~General Manager/Accredited Certifier~~

Consent Authority: Maitland City Council
Date of endorsement: 18.11.09
~~Accreditation no~~: .....
Subdivision Certificate no: 072980
File no: DA 07-2980

* Delete whichever is inapplicable

Surveying Regulation, 2006

I, JASON LEE HARMAN
of LAND DEVELOPMENT SOLUTIONS PTY LTD
P.O. BOX 853 THE JUNCTION, NSW 2291

a surveyor registered under the *Surveying Act, 2002*, certify that the survey represented in this plan is accurate, has been made in accordance with the *Surveying Regulation, 2006* and was completed on 28th October 2009

The survey relates to Lots 1 & 3
(specify the land actually surveyed, or specify any land shown in the plan that is not the subject of the survey)

Signature: ..... *Dated:* 20/10/2009
Surveyor registered under the Surveying Act 2002

Datum Line: X - Y
Type: ~~*Urban*~~ */ Rural*

Plans used in the preparation of survey/~~compilation.~~

DP.10419
DP.630225
DP.634868
DP.778111
DP.792071
DP.797295
DP.867766
DP.1053679
DP.1090329
DP.1108020
DP.1126415

(if insufficient space use Plan Form 6A annexure sheet)

SURVEYOR'S REFERENCE: 4070-DP-RTR (CHECKLIST)

Req:R693377 /Doc:DP 1145348 P /Rev:31-Mar-2010 /Sts:SC.OK /Pgs:ALL /Prt:17-May-2017 13:08 /Seq:3 of 3
Ref:als /Src:T
DP1145348

PLAN FORM 6A (Annexure Sheet) **WARNING:** Creasing or folding will lead to rejection ePlan

DEPOSITED PLAN ADMINISTRATION SHEET

PLAN OF SUBDIVISION OF
LOT 1 DP 797295 &
LOT 2 DP 867766

* DP1145348

Registered: 30.3.2010 *

*OFFICE USE ONLY

Subdivision Certificate No: 072980 Date of Endorsement: 18.11.09

CSR BUILDING PRODUCTS LIMITED
by its Attorneys who state that at the date of their execution hereof they have had no notice of the revocation of the Power of Attorney dated 23 February 2009 and Registered No. Book 4563 No. 191 under the authority of which they have executed this instrument.

Attorney PETER MARK McGUIGAN

Attorney CHRISTOPHER JOHN BERTUCH

SURVEYOR'S REFERENCE: 4070-DP-RTR (CHECKLIST)

Advance Legal Searchers

Advance Legal Searchers Pty Ltd hereby certifies that the information contained in this document has been provided electronically by the Registrar General.

Information provided through Tri-Search an approved LPI*NSW* Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE

17/5/2017 1:10PM

FOLIO: 2/867766

First Title(s): OLD SYSTEM
Prior Title(s): 1742/634868

Recorded	Number	Type of Instrument	C.T. Issue
27/5/1997	DP867766	DEPOSITED PLAN	FOLIO CREATED EDITION 1
26/8/1998	DP269213	DEPOSITED PLAN	
9/5/2002	8272569	TRANSFER GRANTING EASEMENT	EDITION 2
9/7/2003	DP1055591	DEPOSITED PLAN	
30/3/2010	AF394340	CHANGE OF NAME	
30/3/2010	DP1145348	DEPOSITED PLAN	FOLIO CANCELLED RESIDUE REMAINS

*** END OF SEARCH ***

ANY ENTRIES PRECEDED BY AN ASTERISK DO NOT APPEAR ON THE CURRENT EDITION OF THE CERTIFICATE OF TITLE. WARNING: THE INFORMATION APPEARING UNDER NOTATIONS HAS NOT BEEN FORMALLY RECORDED IN THE REGISTER.

Advance Legal Searchers

Advance Legal Searchers Pty Ltd hereby certifies that the information contained in this document has been provided electronically by the Registrar General.

Information provided through Tri-Search an approved LPI*NSW* Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE

17/5/2017 1:11PM

FOLIO: 1742/634868

First Title(s): SEE PRIOR TITLE(S)
Prior Title(s): VOL 15144 FOL 152

Recorded	Number	Type of Instrument	C.T. Issue
28/3/1988		TITLE AUTOMATION PROJECT	LOT RECORDED FOLIO NOT CREATED
23/9/1988		CONVERTED TO COMPUTER FOLIO	FOLIO CREATED CT NOT ISSUED
15/5/1989	Y361581	TRANSFER	EDITION 1
6/9/1995	O514294	TRANSFER	EDITION 2
27/5/1997	DP867766	DEPOSITED PLAN	FOLIO CANCELLED RESIDUE REMAINS

*** END OF SEARCH ***

ANY ENTRIES PRECEDED BY AN ASTERISK DO NOT APPEAR ON THE CURRENT EDITION OF THE CERTIFICATE OF TITLE. WARNING: THE INFORMATION APPEARING UNDER NOTATIONS HAS NOT BEEN FORMALLY RECORDED IN THE REGISTER.

Advance Legal Searchers

Advance Legal Searchers Pty Ltd hereby certifies that the information contained in this document has been provided electronically by the Registrar General in accordance with Section 96B(2) of the Real Property Act.

Information provided through Tri-Search an approved LPI*NSW* Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 2/1145348

SEARCH DATE	TIME	EDITION NO	DATE
17/5/2017	1:08 PM	1	30/3/2010

LAND

LOT 2 IN DEPOSITED PLAN 1145348
AT CHISHOLM
LOCAL GOVERNMENT AREA MAITLAND
PARISH OF ALNWICK COUNTY OF NORTHUMBERLAND
TITLE DIAGRAM DP1145348

FIRST SCHEDULE

CSR BUILDING PRODUCTS LIMITED

SECOND SCHEDULE (2 NOTIFICATIONS)

1 RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2 8272569 DRAINAGE EASEMENT AFFECTING THE LAND SHOWN AS "PROPOSED EASEMENT FOR DRAINAGE OF SEWAGE 4 WIDE, 5 WIDE & VARIABLE WIDTH" IN THE TITLE DIAGRAM

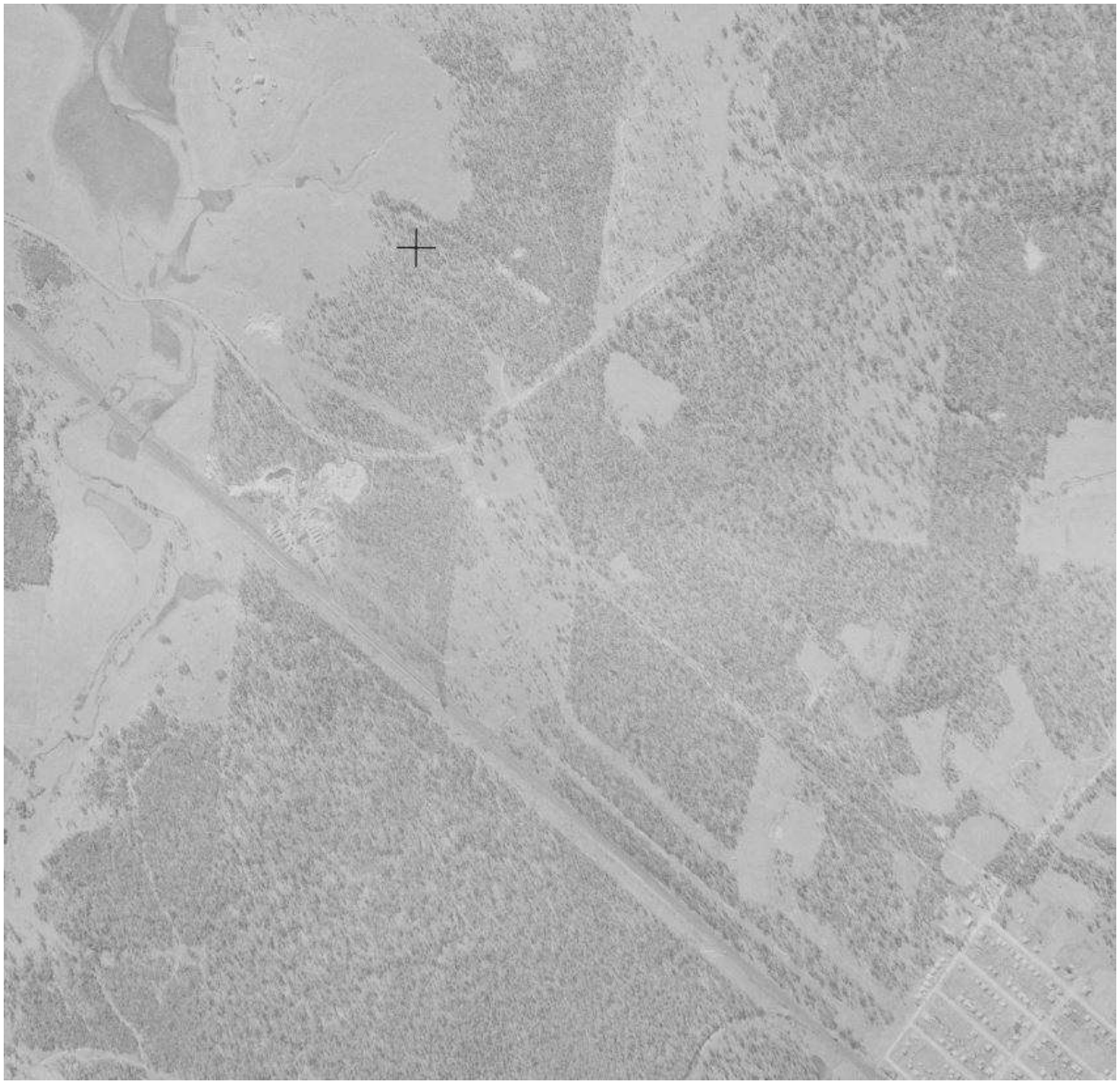
NOTATIONS

DP1055591 NOTE: PLAN OF PROPOSED EASEMENT FOR ELECTRICITY PURPOSES 5 WIDE

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

ANY ENTRIES PRECEDED BY AN ASTERISK DO NOT APPEAR ON THE CURRENT EDITION OF THE CERTIFICATE OF TITLE. WARNING: THE INFORMATION APPEARING UNDER NOTATIONS HAS NOT BEEN FORMALLY RECORDED IN THE REGISTER.



Aerial Photograph 1954

Aerial Photograph 1975

Aerial Photograph 1984

Aerial Photograph 2007

Aerial Photograph 2010

Aerial Photograph 2016

Contaminated land

+ Management of contaminated land
+ Consultants and site auditor scheme
+ Underground petroleum storage systems
Guidelines under the CLM Act
NEPM amendment
+ Further guidance
– Record of notices
About the record
Search the record
Search tips
Disclaimer
List of NSW contaminated sites notified to EPA
Frequently asked questions
Forms
+ Other contamination issues
+ Contaminated Land Management Program

Home Contaminated land Record of notices

Search results

Your search for: Suburb: THORNTON

Search Again | Refine Search

did not find any records in our database.

Search TIP

To search for a specific site, search by LGA (local government area) and carefully review all sites listed.

... more search tips

If a site does not appear on the record it may still be affected by contamination. For example:

- Contamination may be present but the site has not been regulated by the EPA under the Contaminated Land Management Act 1997 or the Environmentally Hazardous Chemicals Act 1985.
- The EPA may be regulating contamination at the site through a licence or notice under the Protection of the Environment Operations Act 1997 (POEO Act).
- Contamination at the site may be being managed under the planning process.

More information about particular sites may be available from:

- The POEO public register
- The appropriate planning authority: for example, on a planning certificate issued by the local council under section 149 of the Environmental Planning and Assessment Act.

See What's in the record and What's not in the record.

If you want to know whether a specific site has been the subject of notices issued by the EPA under the CLM Act, we suggest that you search by Local Government Area only and carefully review the sites that are listed.
This public record provides information about sites regulated by the EPA under the Contaminated Land Management Act 1997, including sites currently and previously regulated under the Environmentally Hazardous Chemicals Act 1985. Your inquiry using the above search criteria has not matched any record of current or former regulation. You should consider searching again using different criteria. The fact that a site does not appear on the record does not necessarily mean that it is not affected by contamination. The site may have been notified to the EPA but not yet assessed, or contamination may be present but the site is not yet being regulated by the EPA. Further information about particular sites may be available from the appropriate planning authority, for example, on a planning certificate issued

APPENDIX E:

Site Photographs

Photograph 1 - Overall site with vacant lower area in central portion visible

Photograph 2 - Typical photograph of site showing bushland and access track

Client:	MCCLOY GROUP PTY LTD	Photo No:	1 to 2
Project:	REZONING	Project No:	NEW17P-0062
Location:	107 HAUSSMAN DRIVE, THORNTON	Date Taken:	17/05/2017
Title:	SITE PHOTOGRAPHS	Date Compiled:	21/06/2017

Photograph 3 - Vacant lower-lying area in central portion of site

Photograph 4 - Fill material including bricks in access road on western entry to site

Client:	MCCLOY GROUP PTY LTD	Photo No:	3 to 4
Project:	REZONING	Project No:	NEW17P-0074
Location:	107 HAUSSMAN DRIVE, THORNTON	Date Taken:	17/05/2017
Title:	SITE PHOTOGRAPHS	Date Compiled:	21/06/2017

Photograph 5 - Stockpile of bricks observed on site

Photograph 6 - Surface water pond on eastern side of site, with drainage channel visible in background

Client:	MCCLOY GROUP PTY LTD	Photo No:	5 to 6
Project:	REZONING	Project No:	NEW17P-0074
Location:	107 HAUSSMAN DRIVE, THORNTON	Date Taken:	17/05/2017
Title:	SITE PHOTOGRAPHS	Date Compiled:	21/06/2017

Photograph 7 - Surface water pond on eastern side of site

Photograph 8 - Surface water pond on eastern side of site

Qualtest LABORATORY (NSW) PTY LTD	Client:	Photo No:	7 to 8
	Project:	Project No:	NEW17P-0074
	Location:	Date Taken:	17/05/2017
	Title: SITE PHOTOGRAPHS	Date Compiled:	21/06/2017

APPENDIX F:

Test Pit Logs

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP01
PAGE: 1 OF 2
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 19.5 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
E	Not Encountered		19.5	0.0		CL	0.10m FILL-TOPSOIL: CLAY - low plasticity, dark brown, some fine to medium grained sand, root affected with trace organic matter (plant debris).	M > w_P				FILL - TOPSOIL
						CI	0.30m FILL: Sandy CLAY - medium plasticity, pale grey, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel.	M ~ w_P	St / VSt	HP	200 - 300	FILL
			19.0	0.5		CH	CLAY - medium to high plasticity, dark grey to black.	M < w_P - M < w_P	H	HP	500	RESIDUAL SOIL
										HP	550	
										HP	520	
										HP	500	
										HP	>600	
			18.5	1.0			1.00m SHALE - dark grey to black with brown leaf fossils, estimated very low to low strength.					EXTREMELY TO HIGHLY WEATHERED ROCK
							1.40m COAL - black, highly fractured, some CLAY between joints, estimated very low to low strength.	D				HIGHLY WEATHERED ROCK
			18.0	1.5								
			17.5	2.0								
							2.20m					
						CH	Silty CLAY - medium to high plasticity, pale orange-grey.	M < w_P	St - VSt			RESIDUAL SOIL
							2.30m COAL - black, highly fractured, some CLAY between joints, estimated very low to low strength.					HIGHLY WEATHERED ROCK
			17.0	2.5				D				

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP01
PAGE: 2 OF 2
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 19.5 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
E							COAL - black, highly fractured, some CLAY between joints, estimated very low to low strength. *(continued)*	D				HIGHLY WEATHERED ROCK
							3.30m Hole Terminated at 3.30 m					
			16.0	3.5								
			15.5	4.0								
			15.0	4.5								
			14.5	5.0								
			14.0	5.5								

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

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

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

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1 GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP02
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 19.5 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
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	
E	Not Encountered	E 0.10m				CI	FILL-TOPSOIL: Sandy CLAY - medium plasticity, dark grey, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	M > w_P		HP	550	FILL - TOPSOIL
				0.20m		CI	FILL: Sandy CLAY - medium plasticity, grey to pale grey, fine to medium grained sand, trace fine to medium grained sub-angular to sub-rounded gravel.		St / VSt	HP	220	FILL
				0.40m		SP	FILL: SAND - fine to medium grained, brown, some fines of low plasticity.	M	MD	HP	300	
			19.0	0.5		CH	Sandy CLAY - medium to high plasticity, grey to pale grey with some orange, fine to medium grained sand.			HP	>600	RESIDUAL SOIL
				0.50m								
				0.60m		CH	Extremely Weathered SANDSTONE with soil properties; breaks down into Sandy CLAY - medium to high plasticity, grey to pale grey with some orange, fine to medium grained sand. Sand content increasing with depth.	M ~ w_P	H / VD			EXTREMELY WEATHERED ROCK
				0.80m								HIGHLY WEATHERED ROCK
				0.90m			SANDSTONE - fine to medium grained, orange to dark orange-red (ironstained), estimated low to medium strength.					
			18.5	1.0			Hole Terminated at 0.90 m Refusal					
			18.0	1.5								
			17.5	2.0								
			17.0	2.5								

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP03
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 19.4 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
E	Not Encountered	0.30m E 0.40m	19.0	0.5		CI	FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, pale brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.					FILL - ROOT AFFECTED
							0.50m FILL: CLAY - high plasticity, dark grey, with pockets and lenses of Gravelly Silty SAND - grey to brown.	M > w_P	F	HP	70 - 110	FILL
			18.5	1.0		CH				HP	50 - 90	
									S - F	HP	30 - 60	
							1.30m FILL: Sandy CLAY - medium plasticity, grey to brown, fine to medium sand, some fine to medium sub-angular to sub-rounded gravel.		St / VSt	HP	220	
			18.0	1.5		CI				HP	250	
							1.50m Silty SAND - fine to coarse grained, black, fines of medium plasticity. Residual Soil from COAL.	M	MD	HP	>600	RESIDUAL SOIL
						SM	1.60m					
						CH	Sandy CLAY - high plasticity, pale grey, fine to medium grained sand.	M < w_P	H	HP	>600	
							1.70m SHALE - pale grey-green, very low to low strength.					EXTREMELY TO HIGHLY WEATHERED ROCK
			17.5	2.0								
							2.20m Hole Terminated at 2.20 m					
			17.0	2.5								
			16.5									

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR. THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP04

CLIENT: McCLOY GROUP
PAGE: 1 OF 1
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
JOB NO: NEW17P-0074
LOCATION: 107 HAUSSMAN DRIVE, THORNTON
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
SURFACE RL: 19.7 m
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 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
E	Not Encountered	0.70m E 0.80m	19.5	0.5		CL	0.10m FILL-TOPSOIL: Sandy CLAY - low plasticity, dark grey, fine to medium sand, root affected.					FILL - TOPSOIL
							FILL: Sandy CLAY - low to medium plasticity, pale orange-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel.			HP	170	FILL
			19.0	1.0		CI	With pockets and lenses of Silty SAND - fine to medium grained, brown, fines of low plasticity.	M > w_P	St	HP	150	
			18.5	1.5		CH	1.30m FILL: Sandy CLAY - medium to high plasticity, dark grey to black, fine to medium grained sand, some fine to medium grained angular to sub-angular gravel.		F	HP	90	
			18.0	2.0		CH	1.50m Sandy CLAY - medium to high plasticity, dark grey to black, fine to medium grained sand, some fine to medium grained angular gravel.	M ~ w_P	VSt	HP	320	RESIDUAL SOIL
			17.5	2.5			2.00m SILTSTONE - pale grey to grey banded, estimated very low to low strength. 2.20m	D				EXTREMELY TO HIGHLY WEATHERED ROCK
			17.0				Hole Terminated at 2.20 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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP05
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 21.5 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
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	
E	Not Encountered		21.5	0.0		CL	0.10m FILL: Sandy CLAY - low plasticity, dark grey-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	M < w_P				FILL - ROOT AFFECTED
						CI	0.30m FILL: Sandy CLAY / Gravelly Clayey SAND - medium plasticity, grey with some orange, fine to medium grained sand, fine to medium grained sub-angular to angular gravel.		St - VSt	HP	250	FILL
			21.0	0.5		SC	Clayey SAND - fine to medium grained, pale grey with some orange, fines of medium to high plasticity.	M	D			RESIDUAL SOIL
		0.70m					0.70m					
		B 0.90m				CH	CLAY - high plasticity, grey with dark grey banding, some orange.	M < w_P	H	HP	>600	RESIDUAL SOIL WITH RELICT ROCK STRUCTURE
			20.5	1.0								
			20.0	1.5			1.60m SILTSTONE - grey and pale grey banded, estimated very low to low strength.	D				EXTREMELY TO HIGHLY WEATHERED ROCK
			19.5	2.0			2.30m					
			19.0	2.5			Hole Terminated at 2.30 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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP06
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 26.5 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
E	Not Encountered		26.5	0.0		SM	FILL-TOPSOIL: Silty SAND - fine to medium grained, dark brown, fines of low plasticity, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	D				FILL - TOPSOIL
							0.40m					
			26.0	0.5		Cl	FILL: Sandy CLAY - medium plasticity, pale grey to grey, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, some roots.		St			FILL
		0.90m					0.90m					
		B 1.10m	25.5	1.0		Cl	FILL: Sandy CLAY - medium plasticity, pale grey to grey, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel.	M ~ w_P	VSt / Fb	HP	320	FILL possibly RESIDUAL SOIL
			25.0	1.5		Cl	1.50m FILL: Sandy CLAY - medium plasticity, grey with some orange, fine to medium grained sand, some fine to medium grained sub-angular to angular gravel.			HP	360	
							1.80m			HP	350	
			24.5	2.0		CH	Gravelly CLAY - high plasticity, pale grey to white some orange, fine rounded to sub-rounded gravel, some fine to medium grained sand.		VSt - H	HP	350 - 420	RESIDUAL SOIL / EXTREMELY WEATHERED ROCK
							2.20m			HP	>600	
			24.0	2.5			Hole Terminated at 2.20 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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP07
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 27.8 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
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	
E	Not Encountered		27.5	0.5		SM	FILL-TOPSOIL: Silty SAND - fine to medium grained, dark brown, fines of low plasticity, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	D / M				FILL - MOUND CONTAINING TOPSOIL
		0.70m B 0.80m	27.0			CH	CLAY - high plasticity, pale grey to grey, some fine to medium grained sand.	M > w_P	VSt	HP HP	200 220	RESIDUAL SOIL
				1.0		CH	Sandy CLAY - high plasticity, pale grey to white some orange, fine to medium grained sand, some fine angular to sub-angular gravel.	M ~ w_P	VSt - H	HP HP	350 >600	
			26.5	1.5			SILTSTONE - pale grey to grey, estimated very low to low strength.					EXTREMELY TO HIGHLY WEATHERED ROCK
			26.0	2.0			becoming dark grey-brown	D				
			25.5	2.5								
			25.0									

0.60m
0.90m
1.20m
3.00m

Hole Terminated at 3.00 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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

TEST PIT NO: **TP08**

CLIENT: McCLOY GROUP
PAGE: 1 OF 1

PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
JOB NO: NEW17P-0074

LOCATION: 107 HAUSSMAN DRIVE, THORNTON
LOGGED BY: BB

DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
SURFACE RL: 24.0 m

TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
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	
E	Not Encountered					CL	TOPSOIL: Sandy CLAY - low plasticity, dark grey-brown, fine to medium grained sand, root affected.	M < w_P				TOPSOIL
							0.30m					
		0.40m					CLAY - high plasticity, pale grey to grey, some fine to medium grained sand, some fine grained sub-rounded to rounded gravel.					RESIDUAL SOIL
		B	23.5	0.5		CH		M > w_P	VSt	HP	250	
		0.70m								HP	320	
							0.70m					
							SILTSTONE - grey, estimated very low to low strength.	D		HP	>600	EXTREMELY TO HIGHLY WEATHERED ROCK
							0.90m					
							0.95m SANDSTONE - fine to medium grained, pale grey to orange, estimated very low to medium strength.					HIGHLY WEATHERED ROCK
			23.0	1.0			Hole Terminated at 0.95 m Refusal					
			22.5	1.5								
			22.0	2.0								
			21.5	2.5								

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

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

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

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP09
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 20.5 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
E	Not Encountered	0.70m B 0.90m	20.0	0.5		SC	FILL: Gravelly Clayey SAND - fine to medium grained, grey-brown, fine to medium grained sub-angular to sub-rounded gravel, fines of low to medium plasticity.	M / M > w_P				FILL
							0.60m					
			19.5	1.0		CH	Sandy CLAY - high plasticity, pale grey to white some orange, fine to medium grained sand, some fine to medium grained rounded to sub-rounded gravel.	M > w_P	H	HP HP	>600 >600	RESIDUAL SOIL
			19.0	1.5			1.50m					
							SHALE - pale grey-green, estimated very low to low strength.	D				HIGHLY TO MODERATELY WEATHERED ROCK
							1.60m					
							Hole Terminated at 1.60 m Refusal					
			18.5	2.0								
			18.0	2.5								

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR. THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP10
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 30.6 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
E	Not Encountered		30.5			CL	TOPSOIL: Sandy CLAY - low plasticity, dark grey-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	M < w_P				TOPSOIL
							0.30m					
		0.50m	30.0	0.5		CH	CLAY - high plasticity, dark grey with some pale orange, some fine to medium grained sand, trace fine to medium grained sub-angular to angular gravel (content increasing with depth).	M > w_P	St - VSt	HP	180	RESIDUAL SOIL possibly COLLUVIUM
		U50								HP	200	
		0.90m								HP	190	
							0.90m					
			29.5	1.0		CH	Sandy CLAY - high plasticity, pale grey to white some orange, fine to medium grained sand, some fine grained sub-angular to sub-rounded gravel.	M < w_P	VSt	HP	350	RESIDUAL SOIL
			29.0	1.5					H	HP	480	
				2.0						HP	520	
							2.00m					
			28.5				SHALE - pale grey-green, estimated very low to low strength.	D				EXTREMELY TO HIGHLY WEATHERED ROCK
							2.40m					
			28.0	2.5			Hole Terminated at 2.40 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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP11
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 30.3 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
E	Not Encountered		30.0	0.5		CH	FILL-TOPSOIL: CLAY - medium to high plasticity, dark grey-brown, some fine to medium grained sand, some fine to medium grained sub-rounded to sub-angular gravel, trace brick and plant debris, root affected.	M > w_P		HP	280	FILL - TOPSOIL
										HP	220	
				0.50m								
						SM	TOPSOIL (BURIED): Silty SAND - fine to medium grained, dark brown, fines of low plasticity, root affected.	M		HP	500	BURIED TOPSOIL
		0.70m		0.70m								
			29.5			CH	CLAY - high plasticity, pale grey to grey, some fine to medium grained sand.	M > w_P	VSt	HP	350	RESIDUAL SOIL
		U50		1.0						HP	220	
		1.10m								HP	290	
				1.10m								
			29.0			CH	Sandy CLAY - high plasticity, pale grey to white some orange, fine to medium grained sand, some fine grained rounded to sub-rounded gravel.	M ~ w_P	H	HP	450	
				1.5						HP	550	
				1.70m								
			28.5				SANDSTONE - fine to medium grained, pale grey to orange, estimated very low to medium strength.	D		HP	>600	EXTREMELY TO HIGHLY WEATHERED ROCK
				2.0								
				2.10m								
							Hole Terminated at 2.10 m					
			28.0									
				2.5								
			27.5									

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1 GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP12
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 32.8 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
E	Not Encountered	0.30m B 0.40m	32.5	0.5		CL	TOPSOIL: Sandy CLAY - low plasticity, dark grey-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	$M < w_P$				TOPSOIL
						CH	0.30m Sandy CLAY - medium to high plasticity, red-brown, fine to medium grained sand.		H	HP	>600	RESIDUAL SOIL
						SC	0.40m Clayey SAND - fine to medium grained, pale grey with some orange, fines of medium to high plasticity.	M	VD			
			32.0				Becoming extremely weathered sandstone.					
				1.0			0.90m 0.95m SANDSTONE - fine to medium grained, pale grey to orange, estimated medium strength.	D				HIGHLY WEATHERED ROCK
							Hole Terminated at 0.95 m Refusal					
			31.5	1.5								
			31.0	2.0								
			30.5	2.5								
			30.0									

LEGEND:

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

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

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1 GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP13
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 21.3 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
E	Not Encountered		21.0			CL	FILL-TOPSOIL: Sandy CLAY - low plasticity, dark grey-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	M ~ w_P				FILL - TOPSOIL
				0.5		CH	0.30m FILL: Sandy CLAY - high plasticity, grey, fine to medium grained sand, some fine grained rounded to sub-rounded gravel.	M > w_P	St - VSt	HP	150 - 250	FILL
			20.5			SC	0.50m FILL: Clayey SAND - fine to medium grained, orange, fines of medium plasticity.	M	D	HP	>600	FILL possibly RESIDUAL SOIL
		0.90m CBR 1.20m		1.0			0.80m SANDSTONE - fine to medium grained, pale grey, estimated very low to medium strength.	M - D				HIGHLY WEATHERED ROCK
			20.0	1.5			1.70m Hole Terminated at 1.70 m Refusal					
			19.5	2.0								
			19.0	2.5								
			18.5									

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1 GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP14
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 23.4 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
E	Not Encountered		23.4	0.0		SM	TOPSOIL: Silty SAND - fine to medium grained, dark brown, fines of low plasticity, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	D - M				TOPSOIL possibly FILL
				0.20m								
			23.0	0.5		SC	Clayey Gravelly SAND - fine to medium grained, red, white and orange, fine to coarse garined angular to sub angular gravel, with cobble and boulder sized rock fragments up to ~400mm dia.	M	D			RESIDUAL SOIL possibly FILL
				0.50m			SANDSTONE - fine to medium grained, orange red and white, fractured with some Clayey SAND in the joints, estimated very low to low strength.					EXTREMELY TO HIGHLY WEATHERED ROCK
			22.5	1.0				D	D			
				1.10m			SILTSTONE - dark grey-brown, estimated low to medium strength.					HIGHLY WEATHERED ROCK
			22.0	1.5								
				1.60m			Hole Terminated at 1.60 m Refusal					
			21.5	2.0								
			21.0	2.5								
			20.5									

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1 GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

APPENDIX G:

Laboratory Reports

eurofins | mgt

☐ **Sydney**
Unit F3 - 6 Building F, 16 Mars Road, Lane Cove
Phone: +612 9900 8400
Email: EnviroSampleNSW@eurofins.com.au

☐ **Brisbane**
Unit 1-21 Smallwood Place, Murrarie
Phone: +617 3902 4600
Email: EnviroSampleQLD@eurofins.com.au

☐ **Melbourne**
2 Kingston Town Close, Oakleigh, VIC 3166
Phone: +613 8564 5000 Fax: +613 8564 5090
Email: EnviroSampleVic@eurofins.com.au

CHAIN OF CUSTODY RECORD

CLIENT DETAILS

Company Name :	Qualtest	**Contact Name:**	Emma Coleman	**Purchase Order :**	**COC Number :**
Office Address :	8 Ironbark Close	**Project Manager :**	Emma Coleman	**PROJECT Number :** NEW17P-0074	**Eurofins | mgt quote ID :** 170411QUAL
	Warabrook NSW 2304	**Email for results :**	emmacoleman@qualtest.com	**PROJECT Name :** McCloy, Thornton	**Data output format:**

Special Directions & Comments :

Eurofins | mgt DI water batch number:

Analytes

	Sample ID	Date	Matrix	Suite B7	Containers: 1LP	250P	125P	1LA	40mL vial	125mL A	Jar	Bag	Sample comments:
1	TP02 0.0 - 0.1m	17/05/2017	Soil								1	1	
2	TP03 0.3 - 0.4m	17/05/2017	Soil								1	1	
3	TP03 0.8 - 0.9m	17/05/2017	Soil								1	1	
4	TP04 0.7 - 0.8m	17/05/2017	Soil								1	1	
5											1	1	
6											1	1	
7											1	1	
8											1	1	
9											1	1	
10											1	1	
11											1	1	
12											1	1	
13											1	1	
14											1	1	
15											1	1	
16											1	1	

Some common holding times (with correct preservation).
For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Relinquished By:	Emma Coleman	**Laboratory Staff** Received By:	SUE
Date & Time::	19/5/17	Date & Time:	19/5/17 2:30PM
Signature:		Signature:	

Turn around time

1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☑ 10 DAY ☐ Other: Standard

Method Of Shipment

☐ Courier
☐ Hand Delivered
☐ Postal
Courier Consignment # :

Temperature on arrival:

Report number: 547036

Jalpa Patel 22/5/17 8:49 Am

Melbourne
3-5 Kingston Town Close
Oakleigh Vic 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 18217

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name: **Qualtest**

Contact name: Emma Coleman
Project name: MCCLOY THORNTON
Project ID: NEW17P-0074
COC number: Not provided
Turn around time: 5 Day
Date/Time received: May 22, 2017 8:49 AM
Eurofins | mgt reference: **547036**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Andrew Black on Phone : (+61) 2 9900 8490 or by e.mail: AndrewBlack@eurofins.com

Results will be delivered electronically via e.mail to Emma Coleman - emmacoleman@qualtest.com.au.

Note: A copy of these results will also be delivered to the general Qualtest email address.

eurofins | mgt

Certificate of Analysis

Qualtest
8 Ironbark Close
Warabrook
NSW 2304

NATA Accredited
Accreditation Number 1261
Site Number 1254

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.

Attention: **Emma Coleman**

Report **547036-S**
Project name MCCLOY THORNTON
Project ID NEW17P-0074
Received Date May 22, 2017

Client Sample ID			**TP02 0.0-0.1M**	**TP03 0.3-0.4M**	**TP04 0.7-0.8M**
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**M17-My20607**	**M17-My20608**	**M17-My20609**
Date Sampled			**May 17, 2017**	**May 17, 2017**	**May 17, 2017**
Test/Reference	LOR	Unit			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					
TRH C6-C9	20	mg/kg	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	< 50	< 50
BTEX					
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	81	70	72
Total Recoverable Hydrocarbons - 2013 NEPM Fractions					
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50
TRH C6-C10	20	mg/kg	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20
Polycyclic Aromatic Hydrocarbons					
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	0.6	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	1.2	1.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Chrysene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5

Client Sample ID			TP02 0.0-0.1M	TP03 0.3-0.4M	TP04 0.7-0.8M
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**M17-My20607**	**M17-My20608**	**M17-My20609**
Date Sampled			**May 17, 2017**	**May 17, 2017**	**May 17, 2017**
Test/Reference	LOR	Unit			
Polycyclic Aromatic Hydrocarbons					
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Total PAH*	0.5	mg/kg	< 0.5	< 0.5	< 0.5
2-Fluorobiphenyl (surr.)	1	%	68	72	76
p-Terphenyl-d14 (surr.)	1	%	54	57	59
Total Recoverable Hydrocarbons - 2013 NEPM Fractions					
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100
Heavy Metals					
Arsenic	2	mg/kg	4.3	5.7	25
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	5.1	< 5	< 5
Copper	5	mg/kg	9.7	< 5	7.7
Lead	5	mg/kg	14	9.3	16
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	< 5	< 5	< 5
Zinc	5	mg/kg	19	22	36
% Moisture	1	%	18	19	20

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins | mgt Suite B7			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	May 22, 2017	14 Day
- Method: TRH C6-C36 - LTM-ORG-2010			
BTEX	Melbourne	May 22, 2017	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	May 22, 2017	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Polycyclic Aromatic Hydrocarbons	Melbourne	May 22, 2017	14 Day
- Method: USEPA 8270 Polycyclic Aromatic Hydrocarbons			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	May 22, 2017	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Metals M8	Melbourne	May 22, 2017	28 Days
- Method: LTM-MET-3030 by ICP-OES (hydride ICP-OES for Mercury)			
% Moisture	Melbourne	May 22, 2017	14 Day
- Method: LTM-GEN-7080 Moisture			

ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
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Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 18217

Company Name:	Qualtest	**Order No.:**		**Received:**	May 22, 2017 8:49 AM
Address:	8 Ironbark Close	**Report #:**	547036	**Due:**	May 29, 2017
	Warabrook	**Phone:**	02 4968 4468	**Priority:**	5 Day
	NSW 2304	**Fax:**	02 4960 9775	**Contact Name:**	Emma Coleman
Project Name:	MCCLOY THORNTON				
Project ID:	NEW17P-0074				

Eurofins | mgt Analytical Services Manager : Andrew Black

Sample Detail						HOLD	Moisture Set	Eurofins | mgt Suite B7
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794								
Perth Laboratory - NATA Site # 18217								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	TP02 0.0-0.1M	May 17, 2017		Soil	M17-My20607		X	X
2	TP03 0.3-0.4M	May 17, 2017		Soil	M17-My20608		X	X
3	TP04 0.7-0.8M	May 17, 2017		Soil	M17-My20609		X	X
4	TP03 0.8-0.9M	May 17, 2017		Soil	M17-My20610	X		
Test Counts						1	3	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	124			70-130	Pass	
TRH C10-C14	%	99			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	107			70-130	Pass	
Toluene	%	116			70-130	Pass	
Ethylbenzene	%	121			70-130	Pass	
m&p-Xylenes	%	121			70-130	Pass	
Xylenes - Total	%	121			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	86			70-130	Pass	
TRH C6-C10	%	117			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	87			70-130	Pass	
Acenaphthylene	%	73			70-130	Pass	
Anthracene	%	93			70-130	Pass	
Benz(a)anthracene	%	83			70-130	Pass	
Benzo(a)pyrene	%	83			70-130	Pass	
Benzo(b&j)fluoranthene	%	89			70-130	Pass	
Benzo(g.h.i)perylene	%	93			70-130	Pass	
Benzo(k)fluoranthene	%	79			70-130	Pass	
Chrysene	%	78			70-130	Pass	
Dibenz(a.h)anthracene	%	101			70-130	Pass	
Fluoranthene	%	73			70-130	Pass	
Fluorene	%	89			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	94			70-130	Pass	
Naphthalene	%	89			70-130	Pass	
Phenanthrene	%	92			70-130	Pass	
Pyrene	%	76			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	%	100			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	92			80-120	Pass	
Cadmium	%	107			80-120	Pass	
Chromium	%	94			80-120	Pass	
Copper	%	87			80-120	Pass	
Lead	%	116			80-120	Pass	
Mercury	%	88			75-125	Pass	
Nickel	%	87			80-120	Pass	
Zinc	%	94			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M17-My19630	NCP	%	93			70-130	Pass	
TRH C10-C14	A17-My19570	NCP	%	102			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M17-My19630	NCP	%	84			70-130	Pass	
Toluene	M17-My19630	NCP	%	88			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Ethylbenzene	M17-My19630	NCP	%	88			70-130	Pass	
m&p-Xylenes	M17-My19630	NCP	%	90			70-130	Pass	
o-Xylene	M17-My19630	NCP	%	91			70-130	Pass	
Xylenes - Total	M17-My19630	NCP	%	91			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M17-My19630	NCP	%	74			70-130	Pass	
TRH C6-C10	M17-My19630	NCP	%	98			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	M17-My20744	NCP	%	76			70-130	Pass	
Acenaphthylene	M17-My20744	NCP	%	74			70-130	Pass	
Anthracene	M17-My20744	NCP	%	81			70-130	Pass	
Benz(a)anthracene	M17-My20744	NCP	%	71			70-130	Pass	
Benzo(a)pyrene	M17-My20744	NCP	%	83			70-130	Pass	
Benzo(b&j)fluoranthene	M17-My20744	NCP	%	94			70-130	Pass	
Benzo(g.h.i)perylene	M17-My20744	NCP	%	80			70-130	Pass	
Benzo(k)fluoranthene	M17-My20744	NCP	%	72			70-130	Pass	
Chrysene	M17-My20744	NCP	%	72			70-130	Pass	
Dibenz(a.h)anthracene	M17-My20744	NCP	%	92			70-130	Pass	
Fluoranthene	M17-My20744	NCP	%	71			70-130	Pass	
Fluorene	M17-My20744	NCP	%	78			70-130	Pass	
Indeno(1.2.3-cd)pyrene	M17-My20744	NCP	%	85			70-130	Pass	
Naphthalene	M17-My20744	NCP	%	78			70-130	Pass	
Phenanthrene	M17-My20744	NCP	%	82			70-130	Pass	
Pyrene	M17-My20744	NCP	%	72			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	A17-My19570	NCP	%	104			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	M17-My19542	NCP	%	91			75-125	Pass	
Cadmium	M17-My19542	NCP	%	106			75-125	Pass	
Chromium	M17-My19542	NCP	%	96			75-125	Pass	
Copper	M17-My19542	NCP	%	91			75-125	Pass	
Lead	M17-My19542	NCP	%	75			75-125	Pass	
Mercury	M17-My19542	NCP	%	94			70-130	Pass	
Nickel	M17-My19542	NCP	%	90			75-125	Pass	
Zinc	M17-My19542	NCP	%	95			75-125	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M17-My20748	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	A17-My19569	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	A17-My19569	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	A17-My19569	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M17-My20748	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M17-My20748	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M17-My20748	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M17-My20748	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	M17-My20748	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	M17-My20748	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	

Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M17-My20748	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M17-My20748	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M17-My20614	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	M17-My20614	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	M17-My20614	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	M17-My20614	NCP	mg/kg	0.8	< 0.5	67	30%	Fail	Q15
Benzo(a)pyrene	M17-My20614	NCP	mg/kg	0.9	< 0.5	57	30%	Fail	Q15
Benzo(b&j)fluoranthene	M17-My20614	NCP	mg/kg	1.1	< 0.5	78	30%	Fail	Q15
Benzo(g.h.i)perylene	M17-My20614	NCP	mg/kg	0.7	0.5	33	30%	Fail	Q15
Benzo(k)fluoranthene	M17-My20614	NCP	mg/kg	0.9	< 0.5	59	30%	Fail	Q15
Chrysene	M17-My20614	NCP	mg/kg	0.8	< 0.5	54	30%	Fail	Q15
Dibenz(a.h)anthracene	M17-My20614	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	M17-My20614	NCP	mg/kg	1.7	0.6	91	30%	Fail	Q15
Fluorene	M17-My20614	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M17-My20614	NCP	mg/kg	0.7	< 0.5	58	30%	Fail	Q15
Naphthalene	M17-My20614	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	M17-My20614	NCP	mg/kg	1.0	0.8	26	30%	Pass	
Pyrene	M17-My20614	NCP	mg/kg	1.5	0.6	88	30%	Fail	Q15
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	A17-My19569	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	A17-My19569	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	A17-My19569	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	M17-My19541	NCP	mg/kg	2.8	2.6	7.0	30%	Pass	
Cadmium	M17-My19541	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	M17-My19541	NCP	mg/kg	16	15	9.0	30%	Pass	
Copper	M17-My19541	NCP	mg/kg	9.6	8.7	10	30%	Pass	
Lead	M17-My19541	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Mercury	M17-My19541	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	M17-My19541	NCP	mg/kg	12	11	9.0	30%	Pass	
Zinc	M17-My19541	NCP	mg/kg	24	24	1.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M17-My20618	NCP	%	6.4	7.1	11	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q15	The RPD reported passes Eurofins | mgt's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised By

Andrew Black	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Alex Petridis	Senior Analyst-Organic (VIC)
Harry Bacalis	Senior Analyst-Volatile (VIC)
Huong Le	Senior Analyst-Inorganic (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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12 May 2021

McCloy Group Pty Ltd
PO Box 2214
Dangar NSW 2309

Attention: Mr Sam Rowe

Dear Sam,

RE: 107 HAUSSMAN DRIVE, THORNTON NSW
SURFACE WATER & SEDIMENT ASSESSMENT

1 INTRODUCTION

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present the findings of the surface water and sediment assessment for the site located at 107 Haussman Drive, Thornton NSW (the Site).

Qualtest previously carried out a Preliminary Contamination Assessment (PCA) for the site in 2017 (Ref: NEW17P-0074-AB, dated 29 June 2017). The PCA identified ponds/dams on the site, and recommended that sampling and analysis of the water and sediment in the dams be carried out.

The PCA was submitted to Maitland City Council (MCC) as part of a re-zoning application for the site. Council have subsequently requested that the sampling and analysis recommended in the PCA is completed.

This letter provides the results of the sampling and analysis of surface water and sediment.

2 OBJECTIVES

The objective of the assessment is to assess:

- Whether the surface water and sediments in the dams pose a risk to human health or the environment; and,
- If the surface water and sediments are suitable for re-use/irrigation on site, if the dams are proposed to be backfilled.

3 SCOPE OF WORKS

In order to meet the above objectives, the following scope of works was carried out:

- Collection of surface water and sediment samples;
- Laboratory analysis of samples; and
- Data assessment and preparation of this letter report.

4 FIELD WORK

Field work was carried out on 5 May 2021. At the time of the fieldwork, three dams were observed:

- Dam 1 – located in the central eastern portion of the site. Contained water at the time of sampling;
- Dam 2 - located in the central eastern portion of the site (north of Dam 1). Dry at the time of sampling.

A surface water sample and a sediment sample were collected from Dam 1, and field water quality parameters were recorded. Dam 2 was not accessible, and therefore no sediment sample was collected.

Sediment samples were collected by hand from the edge of the dam, and surface water samples were collected using a dedicated disposable plastic bailer. The samples were placed directly into laboratory supplied jars and bottles with appropriate preservatives for the analysis. Each sample was placed directly into an ice-chilled esky and remained chilled during transportation to the laboratory.

Figure 1, attached, shows the sampling locations. Photographs of the dams are presented below.

Photograph 1 – Showing Dam 1

Photograph 2 – Showing Dam 2 (Dry)

5 ANALYTICAL SUITE

The samples were dispatched to NATA-accredited laboratory, Eurofins MGT. The samples were analysed for:

- Heavy Metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury);
- Total Recoverable Hydrocarbons (TRH);
- Benzene, Toluene, Ethylbenzene, Xylenes (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAH);
- Organochlorine Pesticides (OCP);
- Suspended Soils – water sample only; and
- pH and Electrical Conductivity.

6 ASSESSMENT CRITERIA

6.2 Sediment

The health and ecological investigation levels for soil, presented in the *National Environment Protection (Assessment of Site Contamination) Measure 1999 (April 2013), NEPC 2013*, Canberra (referred to as ASC NEPM 2013) are generally used in NSW when selecting investigation levels for chemical contaminants in soil.

The purpose of the ASC NEPM (2013) is to '*establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry*'.

ASC NEPM (2013) provides health and ecological investigation and screening levels for different exposure scenarios based on a proposed land use. Health and ecological investigation and screening levels are applicable to the first stage (Tier 1) of site assessment and are used to assist in the iterative development of a Conceptual Site Model (CSM). They are adopted as concentrations of a contaminant above which either further appropriate investigation and/or evaluation will be required, or development of an appropriate management strategy (including remediation).

Health Investigation Levels (HILs) and Health Screening levels (HSLs) are applicable for assessing human health risk via relevant exposure pathways.

The HILs were developed for a broad range of metals and organic substances. These are generic to all soil types.

The HSLs have been developed for selected petroleum compounds and fractions and are applicable to assessing human health risk via inhalation and direct contact with soil and groundwater. The HSLs depend on specific soil physicochemical properties, building configurations, land use scenarios and the depth that groundwater is encountered.

Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) are applicable for assessing risk to terrestrial ecosystems under residential, open space and commercial/industrial land use scenarios. They apply to the top 2m of soil, which corresponds to the root zone and habitation zone of many species.

The EILs are associated with selected metals and organic compounds. The EILs are site specific and are determined by calculating an Ambient Background Concentration (ABC) and an Added Contaminant Limit (ACL) for the site, which are added together to get the EIL. The EIL's for the site have been calculated using site specific pH, Cation Exchange Capacity (CEC) and clay content values.

The ESLs are associated with petroleum compounds and fractions and are dependent on specific soil physical properties (i.e. coarse and fine-grained soil).

As the proposed development is residential, the investigation levels for HIL/HSL A and EILs/ESLs for urban residential / public open space are considered applicable for the site.

6.1 Surface Water

For assessing surface water quality, it is first necessary to assess the beneficial uses of surface water for the site and down gradient of the investigation area being assessed. Potential beneficial uses are considered to include:

- Aquatic ecosystems – discharge of the dams offsite to the east to an unnamed creek located about 50m east of the eastern site boundary. The unnamed creek is anticipated to sustain freshwater ecosystem; and
- Irrigation – irrigation of the water over the site, if the dams are proposed to be backfilled.

Given the above, the potential beneficial use of surface water is considered to be sustaining aquatic ecosystems, and irrigation.

The applicable guidelines are:

- ANZECC (2000) Australian and New Zealand Guidelines on Fresh and Marine Water Quality (Primary Industries – Irrigation); and,
- ANZG (2018) Australian and New Zealand Guidelines on Fresh and Marine Water Quality.

The Default Guideline Values (DGVs) for freshwater species presented in the ANZG (2018) are considered applicable for the protection of aquatic ecosystems of the receiving waters, as overflow from the onsite dams would discharge to freshwater bodies.

ASC NEPM (2013) has adopted the trigger values for the protection of 95% of aquatic ecosystems, except where contaminants are potentially bio-accumulative in which case the trigger values for protection of 99% of species are used.

7 QUALITY ASSURANCE / QUALITY CONTOL

In order to assess field quality assurance / quality control (QA/QC) procedures, one duplicate sample (D-9.4.21), was collected and analysed with primary surface water sample DAM1. The results of the field duplicate sampling are presented in Table LR3 (attached). The RPDs were within the acceptable limit (30%), with the exception of conductivity (56%). This RPD is not considered to affect the data usability as the higher conductivity was reported for the primary sample, and was below the adopted criteria. It is noted that low concentrations exaggerate the percentage differences with respect to small total concentrations, therefore where results for primary and duplicate sample were less than 10 times the LOR, the RPDs have been disregarded.

The laboratory conducted internal quality control using laboratory duplicates, spikes and method blanks. The laboratory internal quality control showed method blank results were recorded below the laboratory limit of reporting, and spike recoveries within control limits. Laboratory duplicates were within laboratory acceptable limits, except for zinc. The laboratory quoted code Q15 which states *"The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report."*. Based on this the RPD is not considered to affect the data usability.

Based on the review of the QA/QC data, it is considered that the results are likely to be representative of conditions at the sampling locations at the time of sampling and are suitable for use in this assessment.

8 RESULTS

8.1 Surface water Field Quality Parameters

The surface quality parameters are summarised in Table 8.1 below.

Table 8.1 –Surface Water Quality Parameters

Sample Location	DAM 1
Electrical conductivity (µS/cm)	151.1
pH	6.66
Temperature (°C)	15.6
Redox Potential (mV)	61.4
Comments	Brown tinge, no odour

8.2 Laboratory Results

The laboratory results are presented in Table LR1 and LR2 (attached). The laboratory reports are also attached.

The sediment laboratory results were compared to the criteria, as outlined in Section 6.1 above. The results showed:

- Concentrations of metals, PAH's, BTEX, TRH and OCP's were below the adopted criteria;
- pH shows the sediments are neutral; and
- Conductivity shows the sediments are not saline.

The surface water laboratory results were compared to the criteria, as outlined in Section 6.2 above. The results showed:

- Concentrations of chromium were above the adopted criteria for protection of aquatic ecosystems (0.001mg/L) in sample DAM1 (0.003mg/L);
- Concentrations of copper were above the adopted criteria for protection of aquatic ecosystems (0.0014mg/L) in sample DAM1 (0.003mg/L); and,
- Concentrations of zinc were above the adopted criteria for protection of aquatic ecosystems (0.008mg/L) in sample DAM1 (0.026mg/L).

9 CONCLUSIONS

The laboratory results showed that the sediment was suitable for onsite reuse from a contamination perspective.

The surface water contained concentrations of metals (chromium, copper and zinc) above the trigger values for protection of aquatic ecosystems. Adopting the aquatic ecosystem guidelines for onsite surface water is a conservative approach, as the DGVs apply to the receiving waters. No data is available for the receiving waters (unnamed creek located 50m east of the sites eastern boundary). In addition, the surface water would only discharge to the unnamed creek during periods of high rainfall causing overflow. Based on this it is considered that the slightly elevated metals in the surface water are unlikely to have an adverse environmental impact on the unnamed creek, and therefore does not warrant remediation.

The surface water is also suitable for irrigation onsite, should the dam require dewatering for backfilling.

10 LIMITATIONS

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted practices and standards. To our knowledge, they represent a reasonable interpretation of the general conditions of the site.

Data and opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement by Qualtest. If this report is reproduced, it must be in full.

If you have any further questions regarding this report, please do not hesitate to contact the undersigned.

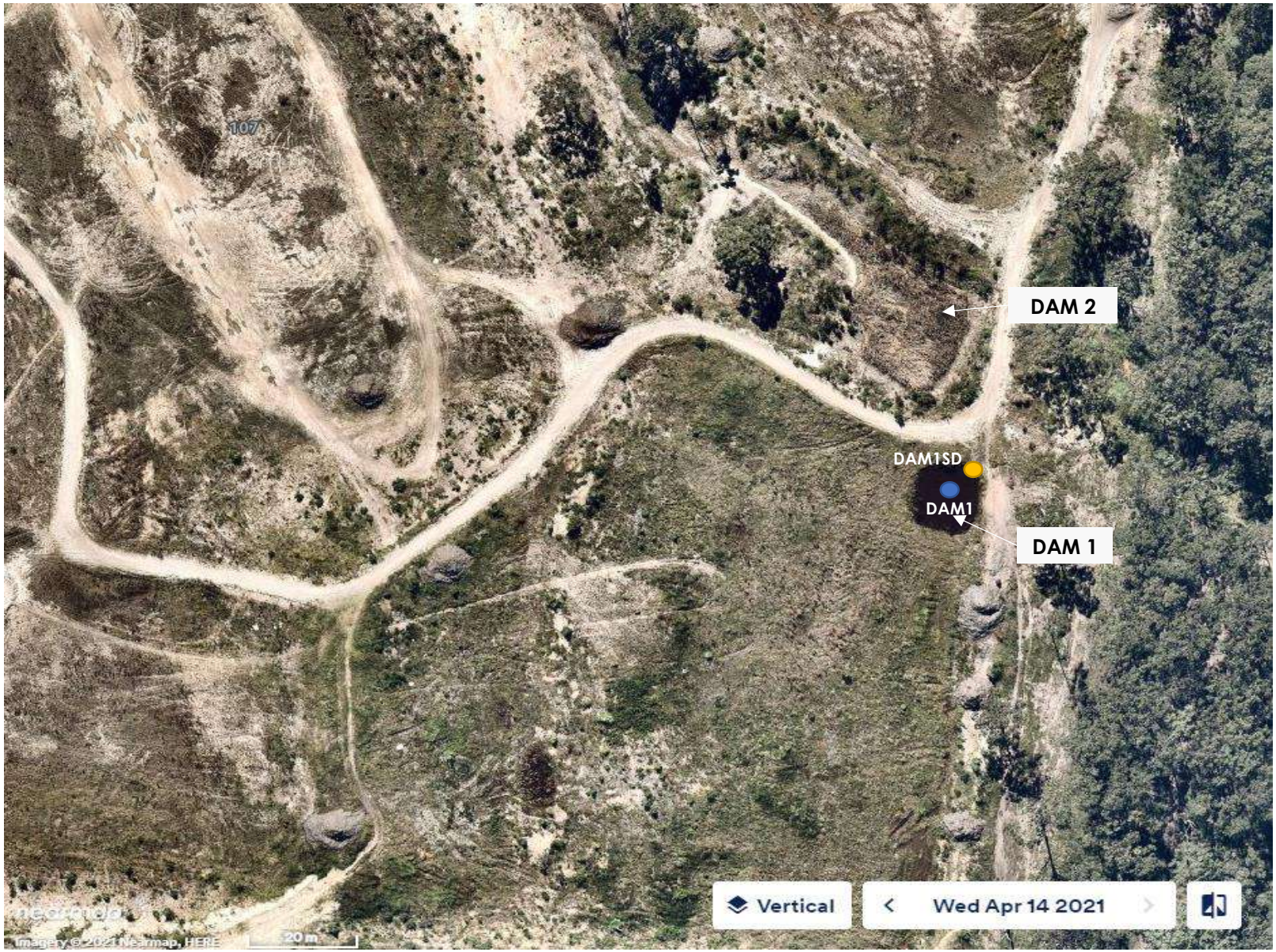
For and on behalf of Qualtest Laboratory (NSW) Pty Ltd.

Emma Coleman
Senior Environmental Scientist

Attachments:
Figure 1 – Site Location Plan
Figure 2 - Sample Location Plan
Table LR1 – Sediment Analytical Results
Table LR2 – Surface Water Analytical Results
Table LR3 – Quality Control Results
Laboratory Reports

Qualtest LABORATORY (NSW) PTY LTD

Client:	MCCLOY GROUP PTY LTD	Drawing No:	FIGURE 1
Project:	SURFACE WATER & SEDIMENT ASSESSMENT	Project No:	NEW17P-0074A
Location:	107 HAUSSMAN DRIVE THORNTON NSW	Scale:	N.T.S.
Title:	SITE LOCATION PLAN	Date:	11 MAY 2021



N

LEGEND:

- Approximate sediment sample location
- Approximate surface water sample location

Qualtest LABORATORY (NSW) PTY LTD

Client:	MCCLOY GROUP PTY LTD	Drawing No:	FIGURE 2
Project:	SURFACE WATER & SEDIMENT ASSESSMENT	Project No:	NEW17P-0074A
Location:	107 HAUSSMAN DRIVE THORNTON NSW	Scale:	N.T.S.
Title:	SAMPLE LOCATION PLAN	Date:	11 MAY 2021

NEW17P-0074A
McCloy Group

Table LR1: Sediment Analytical Results
107 Haussman Drive, Thornton NSW

					Field ID	DAM1SD
					Date	3/05/2021
Analytes		**Units**	**LOR**	**HIL-A [1,2]**	**EIL A/ESL A [3]**	
Metals	Arsenic	mg/kg	2	100	100	5.7
	Cadmium	mg/kg	0.4	20		< 0.4
	Chromium	mg/kg	5	100	410*	< 5
	Copper	mg/kg	5	6000	220*	< 5
	Lead	mg/kg	5	300	1100	13
	Mercury	mg/kg	5	40		< 0.1
	Nickel	mg/kg	5	400	170*	< 5
	Zinc	mg/kg	5	7400	520*	17
pH & EC	pH (1:5 Aqueous extract)	ph units	0.1			6.2
	Conductivity	uS/cm	0.05			32
PAHs	Acenaphthene	mg/kg	0.5			< 0.5
	Acenaphthylene	mg/kg	0.5			< 0.5
	Anthracene	mg/kg	0.5			< 0.5
	Benz(a)anthracene	mg/kg	0.5			< 0.5
	Benzo(a)pyrene	mg/kg	0.5		0.7	< 0.5
	Benzo(a)pyrene TEQ	mg/kg	0.6	3		0.6
	Benzo(b&j)fluoranthene	mg/kg	0.5			< 0.5
	Benzo(g.h.i)perylene	mg/kg	0.5			< 0.5
	Benzo(k)fluoranthene	mg/kg	0.5			< 0.5
	Chrysene	mg/kg	0.5			< 0.5
	Dibenz(a.h)anthracene	mg/kg	0.5			< 0.5
	Fluoranthene	mg/kg	0.5			< 0.5
	Fluorene	mg/kg	0.5			< 0.5
	Indeno(1.2.3-cd)pyrene	mg/kg	0.5			< 0.5
	Naphthalene	mg/kg	0.5		170	< 0.5
	Phenanthrene	mg/kg	0.5			< 0.5
	Pyrene	mg/kg	0.5			< 0.5
	Total PAH	mg/kg	0.5	300		< 0.5
BTEX	Benzene	mg/kg	0.1	0.7	50	< 0.1
	Ethylbenzene	mg/kg	0.1	NL	70	< 0.1
	Toluene	mg/kg	0.1	480	85	<0.1
	Xylenes	mg/kg	0.3	110	105	<0.3
TRH	Naphthalene	mg/kg	0.5	5	170	<0.5
	TRH C6-C10	mg/kg	20		180	<20
	TRH C6-C10 less BTEX (F1)	mg/kg	20	50		<20
	TRH >C10-C16	mg/kg	50		120	<50
	TRH >C10-C16 less Naphthalene (F2)	mg/kg	50	280		<50
	TRH >C16-C34	mg/kg	100		300	<100
	TRH >C16-C34 (silica Gel)	mg/kg	100			<100
	TRH >C34-C40	mg/kg	100		2800	<100
OCPs	4.4'-DDD	mg/kg	0.05	240		< 0.05
	4.4'-DDE	mg/kg	0.05			< 0.05
	4.4'-DDT	mg/kg	0.05		180	< 0.05
	a-BHC	mg/kg	0.05			< 0.05
	Aldrin	mg/kg	0.05	6		< 0.05
	Dieldrin	mg/kg	0.05			< 0.05
	b-BHC	mg/kg	0.05			< 0.05
	Chlordanes - Total	mg/kg	0.1	50		< 0.1
	d-BHC	mg/kg	0.05			< 0.05
	Endosulfan I	mg/kg	0.05	270		< 0.05
	Endosulfan II	mg/kg	0.05			< 0.05
	Endosulfan sulphate	mg/kg	0.05			< 0.05
	Endrin	mg/kg	0.05	10		< 0.05
	Endrin aldehyde	mg/kg	0.05			< 0.05
	Endrin ketone	mg/kg	0.05			< 0.05
	g-BHC (Lindane)	mg/kg	0.05			< 0.05
	Heptachlor	mg/kg	0.05	6		< 0.05
	Heptachlor epoxide	mg/kg	0.05			< 0.05
	Hexachlorobenzene	mg/kg	0.05			< 0.05
	Methoxychlor	mg/kg	0.05	300		< 0.2
	Toxaphene	mg/kg	1	20		< 0.1

Notes

* EIL based on pH of 6.2, CEC of 10meq/100ml, and clay content >10%.

NL Non Limiting

Result Concentration exceeds adopted human health critieria (residential)

Result Concentration exceeds adopted ecological investigation levels - Residential

1 ASC NEPM (2013) Health Investigation Levels (Residential)

2 ASC NEPM (2013) Health Screening Levels (Residential, Clay 0-1m)

3 ASC NEPM (2013) Ecological Investigation and Screening Levels (Residential, clays)

TableLR2: Surface Water Analytical Results
107 Haussman Drive, Thornton NSW

					Field ID	DAM1
					Date	3.05.21
Analytes		**Units**	**LOR**	**Aquatic Ecosystem[1]**	**Irrigation[2]**	
pH& TSS	pH (1:5 Aqueous extract)	ph units	0.1	6.5-8.0*		6.8
	Conductivity	uS/cm	10	125-2200		230
	Total Suspended Solids	mg/L	5			12
Metals	Arsenic	mg/L	5	0.013	20	0.005
	Cadmium	mg/L	0.1	0.0002	0.05	< 0.0002
	Chromium	mg/L	0.05	0.001	1	0.003
	Copper	mg/L	0.5	0.0014	5	0.003
	Lead	mg/L	0.001	0.0034	5	0.005
	Mercury	mg/L	0.001	0.00006	0.002	< 0.0001
	Nickel	mg/L	0.001	0.011	2	0.002
	Zinc	mg/L	0.005	0.008	5	0.026
OCP	4.4'-DDD	mg/L	0.0001			< 0.0001
	4.4'-DDE	mg/L	0.0001			< 0.0001
	4.4'-DDT	mg/L	0.0001	0.006		< 0.0001
	a-BHC	mg/L	0.0001			< 0.0001
	Aldrin	mg/L	0.0001			< 0.0001
	Dieldrin	mg/L	0.0001			< 0.0001
	b-BHC	mg/L	0.0001			< 0.0001
	Chlordanes - Total	mg/L	0.001	0.03		< 0.002
	d-BHC	mg/L	0.0001			< 0.0001
	Endosulfan I	mg/L	0.0001	0.03		< 0.0001
	Endosulfan II	mg/L	0.0001			< 0.0001
	Endosulfan sulphate	mg/L	0.0001			< 0.0001
	Endrin	mg/L	0.0001	0.01		< 0.0001
	Endrin aldehyde	mg/L	0.0001			< 0.0001
	Endrin ketone	mg/L	0.0001			< 0.0001
	g-BHC (Lindane)	mg/L	0.0001	0.2		< 0.0001
	Heptachlor	mg/L	0.0001	0.01		*< 0.0001*
	Heptachlor epoxide	mg/L	0.0001			*< 0.0001*
	Hexachlorobenzene	mg/L	0.0001			< 0.0001
	Methoxychlor	mg/L	0.0001			< 0.0002
	Toxaphene	mg/L	0.01	0.1		< 0.001
BTEX	Benzene	mg/L	0.001	0.95		< 0.001
	Tolune	mg/L	0.001	0.180**		< 0.001
	Ethylbenzene	mg/L	0.001	0.080**		< 0.001
	Xylenes	mg/L	0.003	0.075**		< 0.003
TRH	Naphthalene	mg/L	0.01			< 0.01
	TRH C6-C10	mg/L	0.02			< 0.02
	TRH C6-C10 less BTEX (F1)	mg/L	0.02			< 0.02
	TRH >C10-C16	mg/L	0.05			< 0.05
	TRH >C10-C16 less Naphthalene	mg/L	0.05			< 0.05
	TRH >C16-C34	mg/L	0.1			< 0.1
	TRH >C34-C40	mg/L	0.1			< 0.1
PAHs	Acenaphthene	mg/L	0.001			< 0.001
	Acenaphthylene	mg/L	0.001			< 0.001
	Anthracene	mg/L	0.001	0.00001**		*< 0.001*
	Benz(a)anthracene	mg/L	0.001			< 0.001
	Benzo(a)pyrene	mg/L	0.001	0.0001**		*< 0.001*
	Benzo(b&j)fluoranthene	mg/L	0.001			< 0.001
	Benzo(g.h.i)perylene	mg/L	0.001			< 0.001
	Benzo(k)fluoranthene	mg/L	0.001			< 0.001
	Chrysene	mg/L	0.001			< 0.001
	Dibenz(a.h)anthracene	mg/L	0.001			< 0.001
	Fluoranthene	mg/L	0.001			< 0.001
	Fluorene	mg/L	0.001			< 0.001
	Indeno(1.2.3-cd)pyrene	mg/L	0.001			< 0.001
	Naphthalene	mg/L	0.001	0.016		< 0.001
	Phenanthrene	mg/L	0.001			< 0.001
	Pyrene	mg/L	0.001			< 0.001
	Total PAH	mg/L	0.001			< 0.001

Notes:

Result — Concentration exceeds the Protection of 95-99% of species in Freshwater trigger values
Result — Concentration exceeds the Irrigation trigger values
Italics — LOR exceeds adopted criteria

^ Bio accumulative contaminants – 99% protection level
* Criteria from ANZECC (2000) Table 3.3.2, South-east Australia, Freshwater lakes and reservoirs
** Low reliability criteria
a. Conservatively assumes xylene is p-xylene.

1 ANZG (2018) Australian and New Zealand Guidelines on Fresh and Marine Water Quality - Default Guideline Values

2 ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Primary Industries - Irrigation

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NEW17P-0074A

Table LR3- Quality Control Results
107 Haussman Drive Thornton NSW

			Sample ID	DAM1	D3.5.21	RPD%
			Date	3/05/2021	3/05/2021	
			Type	Primary	Duplicate	
Analytes		Units	LOR			
pH& TSS	pH (1:5 Aqueous extract)	ph units	0.1	6.6	6.7	2
	Conductivity	uS/cm	10	**230**	**130**	**56**
Metals	Arsenic	mg/L	<0.001	0.005	0.006	18
	Cadmium	mg/L	< 0.0002	< 0.0002	< 0.0002	0
	Chromium	mg/L	< 0.001	0.003	0.003	0
	Copper	mg/L	< 0.001	0.003	0.003	0
	Lead	mg/L	< 0.001	0.005	0.004	22
	Mercury	mg/L	< 0.0001	< 0.0001	< 0.0001	0
	Nickel	mg/L	< 0.001	0.002	0.003	40
	Zinc	mg/L	0.005	0.026	0.023	12
BTEX	Benzene	mg/L	0.001	< 0.001	< 0.001	0
	Tolune	mg/L	0.001	< 0.001	< 0.001	0
	Ethylbenzene	mg/L	0.001	< 0.001	< 0.001	0
	Xylenes	mg/L	0.003	< 0.003	< 0.003	0
TRH	Naphthalene	mg/L	0.01	< 0.01	< 0.01	0
	TRH C6-C10	mg/L	0.02	< 0.02	< 0.02	0
	TRH C6-C10 less BTEX (F1)	mg/L	0.02	< 0.02	< 0.02	0
	TRH >C10-C16	mg/L	0.05	< 0.05	< 0.05	0
	TRH >C10-C16 less Naphthale	mg/L	0.05	< 0.05	< 0.05	0
	TRH >C16-C34	mg/L	0.1	< 0.1	< 0.1	0
	TRH >C34-C40	mg/L	0.1	< 0.1	< 0.1	0
PAHs	Acenaphthene	mg/L	0.001	< 0.001	< 0.001	0
	Acenaphthylene	mg/L	0.001	< 0.001	< 0.001	0
	Anthracene	mg/L	0.001	*< 0.001*	< 0.001	0
	Benz(a)anthracene	mg/L	0.001	< 0.001	< 0.005	0
	Benzo(a)pyrene	mg/L	0.001	*< 0.001*	< 0.005	0
	Benzo(b&j)fluoranthene	mg/L	0.001	< 0.001	< 0.005	0
	Benzo(g.h.i)perylene	mg/L	0.001	< 0.001	< 0.005	0
	Benzo(k)fluoranthene	mg/L	0.001	< 0.001	< 0.005	0
	Chrysene	mg/L	0.001	< 0.001	< 0.005	0
	Dibenz(a.h)anthracene	mg/L	0.001	< 0.001	< 0.005	0
	Fluoranthene	mg/L	0.001	< 0.001	< 0.001	0
	Fluorene	mg/L	0.001	< 0.001	< 0.001	0
	Indeno(1.2.3-cd)pyrene	mg/L	0.001	< 0.001	< 0.005	0
	Naphthalene	mg/L	0.001	< 0.001	< 0.001	0
	Phenanthrene	mg/L	0.001	< 0.001	< 0.001	0
	Pyrene	mg/L	0.001	< 0.001	< 0.001	0
	Total PAH	mg/L	0.001	< 0.001	< 0.005	0

Notes:
*RPDs have only been considered where a concentration is greater than 10 times the EQL.
**High RPDs are in bold (Acceptable RPD range is 30% (>10 x EQL))

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

☐ Sydney Laboratory — Unit F3 Std F, 16 Mars Road Lane Cove West NSW 2066 — 02 9900 8400 — EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory — Unit 1 21 Smallwood Place Murarrie QLD 4172 — 07 3902 4600 — EnviroSampleQLD@eurofins.com

☐ Perth Laboratory — Unit 2 91 Leach Highway Kewdale WA 6105 — 08 9251 9600 — EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory — 6 Monterey Road Dandenong South VIC 3175 — 03 8564 5000 — EnviroSampleVic@eurofins.com

Company	Qualtest	Project №	NEW17P-0074	Project Manager	Emma Coleman
Address	8 Ironbark Close Warabrook NSW 2304	Project Name	McCloy Group Thornton	EDD Format (ESdat, EQuIS etc)	Excel
Contact Name	Emma Coleman				
Phone №					
Special Directions					
Purchase Order					
Quote ID №	160622QUAN-1				

Sampler(s)	Steph Cullen				
Handed over by					
Email for Invoice	accounts@qualtest.com.au				
Email for Results	libbybetz@qualtest.com.au emmacoleman@qualtest.com.au stephcullen@qualtest.com.au billysnow@qualtest.com.au				

Analyses — Where metals are requested, please specify "Total" or "Filtered". SUITE codes must be used to attract SUITE pricing.

Containers — Change container type & size if necessary

Required Turnaround Time (TAT) — Default will be 5 days if not ticked. *Surcharge will apply

- ☐ Overnight (reporting by 9am)*
- ☐ Same day* ☐ 1 day*
- ☐ 2 days* ☐ 3 days*
- ☑ 5 days (Standard)
- ☐ Other( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Suite B7 (TRH, BTEX, PAH and Metals)	pH and EC	Suspended Solids	OCPs	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	PFAS Jar	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	DAM1	3/05/21	Water	X	X	X	X		1	1	1	2				
2	D3.5.21	3/5/21	Water	X	X				1	1	1	2				
3	DAM1 SD	3/5/21	Sediment	X	X		X							1		
4																
5																
6																
7																
8																
9																
10																
	Total Counts			3	3	1		2	2	2	4		1			

Method of Shipment: ☐ Courier (#) ☐ Hand Delivered ☐ Postal — Name — Signature — Date — Time

Laboratory Use Only									
Received By	Emma	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature	beer	Date	3/5/21	Time	3pm	Temperature	17°
Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	#792251

Submission of samples to the laboratory will be deemed its acceptance of Eurofins | Environment Testing Standard Terms and Conditions unless agreed otherwise. A copy is available on request

eurofins | Environment Testing

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IANZ # 1327

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Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Qualtest
Address: 2 Murray Dwyer Circuit
Mayfield West
NSW 2304

Project Name: MCCLOY GROUP THORNTON
Project ID: NEW17P-0074

Order No.:
Report #: 792281
Phone: 02 4968 4468
Fax: 02 4960 9775

Received: May 3, 2021 3:00 PM
Due: May 10, 2021
Priority: 5 Day
Contact Name: Emma Coleman

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Conductivity (1:5 aqueous extract at 25°C as rec.)	Conductivity (at 25°C)	pH (1:5 Aqueous extract at 25°C as rec.)	pH (at 25 °C)	Total Suspended Solids Dried at 103–105°C	Organochlorine Pesticides	Moisture Set	Eurofins Suite B7
Melbourne Laboratory - NATA Site # 1254 & 14271													
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794													
Perth Laboratory - NATA Site # 23736													
Mayfield Laboratory - NATA Site # 25079													
External Laboratory													
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**								
1	DAM1	May 03, 2021		Water	S21-My04152		X		X	X	X		X
2	D3.5.21	May 03, 2021		Water	S21-My04153		X		X				X
3	DAM1 SD	May 03, 2021		Sediment	S21-My04154	X		X			X	X	X
Test Counts						1	2	1	2	1	2	1	3

Qualtest
2 Murray Dwyer Circuit
Mayfield West
NSW 2304

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection and proficiency testing scheme providers reports.

Attention: **Emma Coleman**

Report **792281-S**
Project name MCCLOY GROUP THORNTON
Project ID NEW17P-0074
Received Date May 03, 2021

Client Sample ID			**DAM1 SD**
Sample Matrix			**Sediment**
Eurofins Sample No.			**S21-My04154**
Date Sampled			**May 03, 2021**
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons - 1999 NEPM Fractions			
TRH C6-C9	20	mg/kg	< 20
TRH C10-C14	20	mg/kg	< 20
TRH C15-C28	50	mg/kg	< 50
TRH C29-C36	50	mg/kg	< 50
TRH C10-C36 (Total)	50	mg/kg	< 50
BTEX			
Benzene	0.1	mg/kg	< 0.1
Toluene	0.1	mg/kg	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2
o-Xylene	0.1	mg/kg	< 0.1
Xylenes - Total*	0.3	mg/kg	< 0.3
4-Bromofluorobenzene (surr.)	1	%	58
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
Naphthalene[N02]	0.5	mg/kg	< 0.5
TRH C6-C10	20	mg/kg	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20
TRH >C10-C16	50	mg/kg	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50
TRH >C16-C34	100	mg/kg	< 100
TRH >C34-C40	100	mg/kg	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100
Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2
Acenaphthene	0.5	mg/kg	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5
Anthracene	0.5	mg/kg	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5
Chrysene	0.5	mg/kg	< 0.5

Client Sample ID			DAM1 SD
Sample Matrix			Sediment
Eurofins Sample No.			S21-My04154
Date Sampled			May 03, 2021
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5
Fluorene	0.5	mg/kg	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5
Naphthalene	0.5	mg/kg	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5
Pyrene	0.5	mg/kg	< 0.5
Total PAH*	0.5	mg/kg	< 0.5
2-Fluorobiphenyl (surr.)	1	%	95
p-Terphenyl-d14 (surr.)	1	%	99
Organochlorine Pesticides			
Chlordanes - Total	0.1	mg/kg	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05
a-BHC	0.05	mg/kg	< 0.05
Aldrin	0.05	mg/kg	< 0.05
b-BHC	0.05	mg/kg	< 0.05
d-BHC	0.05	mg/kg	< 0.05
Dieldrin	0.05	mg/kg	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05
Endrin	0.05	mg/kg	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05
g-BHC (Lindane)	0.05	mg/kg	< 0.05
Heptachlor	0.05	mg/kg	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05
Methoxychlor	0.2	mg/kg	< 0.2
Toxaphene	0.1	mg/kg	< 0.1
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.2
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.2
Dibutylchlorendate (surr.)	1	%	102
Tetrachloro-m-xylene (surr.)	1	%	94
Conductivity (1:5 aqueous extract at 25°C as rec.)	10	uS/cm	32
pH (1:5 Aqueous extract at 25°C as rec.)	0.1	pH Units	6.2
% Moisture	1	%	25
Heavy Metals			
Arsenic	2	mg/kg	5.7
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	< 5
Copper	5	mg/kg	< 5
Lead	5	mg/kg	13
Mercury	0.1	mg/kg	< 0.1

Client Sample ID			DAM1 SD
Sample Matrix			Sediment
Eurofins Sample No.			S21-My04154
Date Sampled			May 03, 2021
Test/Reference	LOR	Unit	
Heavy Metals			
Nickel	5	mg/kg	< 5
Zinc	5	mg/kg	17

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	May 06, 2021	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Sydney	May 06, 2021	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	May 06, 2021	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	May 06, 2021	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons	Sydney	May 06, 2021	14 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Metals M8	Sydney	May 06, 2021	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Organochlorine Pesticides	Sydney	May 06, 2021	14 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water			
Conductivity (1:5 aqueous extract at 25°C as rec.)	Sydney	May 06, 2021	7 Days
- Method: LTM-INO-4030 Conductivity			
pH (1:5 Aqueous extract at 25°C as rec.)	Sydney	May 06, 2021	7 Days
- Method: LTM-GEN-7090 pH in soil by ISE			
% Moisture	Sydney	May 04, 2021	14 Days
- Method: LTM-GEN-7080 Moisture			

eurofins | Environment Testing

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Company Name: Qualtest
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Mayfield West
NSW 2304

Project Name: MCCLOY GROUP THORNTON
Project ID: NEW17P-0074

Order No.:
Report #: 792281
Phone: 02 4968 4468
Fax: 02 4960 9775

Received: May 3, 2021 3:00 PM
Due: May 10, 2021
Priority: 5 Day
Contact Name: Emma Coleman

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Conductivity (1:5 aqueous extract at 25°C as rec.)	Conductivity (at 25°C)	pH (1:5 Aqueous extract at 25°C as rec.)	pH (at 25 °C)	Total Suspended Solids Dried at 103–105°C	Organochlorine Pesticides	Moisture Set	Eurofins Suite B7
Melbourne Laboratory - NATA Site # 1254 & 14271													
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794													
Perth Laboratory - NATA Site # 23736													
Mayfield Laboratory - NATA Site # 25079													
External Laboratory													
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**								
1	DAM1	May 03, 2021		Water	S21-My04152		X		X	X	X		X
2	D3.5.21	May 03, 2021		Water	S21-My04153		X		X				X
3	DAM1 SD	May 03, 2021		Sediment	S21-My04154	X		X			X	X	X
Test Counts						1	2	1	2	1	2	1	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total*	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Organochlorine Pesticides							
Chlordanes - Total	mg/kg	< 0.1			0.1	Pass	
4.4'-DDD	mg/kg	< 0.05			0.05	Pass	
4.4'-DDE	mg/kg	< 0.05			0.05	Pass	
4.4'-DDT	mg/kg	< 0.05			0.05	Pass	
a-BHC	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-BHC	mg/kg	< 0.05			0.05	Pass	
d-BHC	mg/kg	< 0.05			0.05	Pass	
Dieldrin	mg/kg	< 0.05			0.05	Pass	
Endosulfan I	mg/kg	< 0.05			0.05	Pass	
Endosulfan II	mg/kg	< 0.05			0.05	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endosulfan sulphate	mg/kg	< 0.05			0.05	Pass	
Endrin	mg/kg	< 0.05			0.05	Pass	
Endrin aldehyde	mg/kg	< 0.05			0.05	Pass	
Endrin ketone	mg/kg	< 0.05			0.05	Pass	
g-BHC (Lindane)	mg/kg	< 0.05			0.05	Pass	
Heptachlor	mg/kg	< 0.05			0.05	Pass	
Heptachlor epoxide	mg/kg	< 0.05			0.05	Pass	
Hexachlorobenzene	mg/kg	< 0.05			0.05	Pass	
Methoxychlor	mg/kg	< 0.2			0.2	Pass	
Toxaphene	mg/kg	< 0.1			0.1	Pass	
Method Blank							
Conductivity (1:5 aqueous extract at 25°C as rec.)	uS/cm	< 10			10	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	86			70-130	Pass	
TRH C10-C14	%	117			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	95			70-130	Pass	
Toluene	%	96			70-130	Pass	
Ethylbenzene	%	95			70-130	Pass	
m&p-Xylenes	%	98			70-130	Pass	
o-Xylene	%	93			70-130	Pass	
Xylenes - Total*	%	96			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	99			70-130	Pass	
TRH C6-C10	%	82			70-130	Pass	
TRH >C10-C16	%	117			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	95			70-130	Pass	
Acenaphthylene	%	91			70-130	Pass	
Anthracene	%	92			70-130	Pass	
Benz(a)anthracene	%	83			70-130	Pass	
Benzo(a)pyrene	%	97			70-130	Pass	
Benzo(b&j)fluoranthene	%	83			70-130	Pass	
Benzo(g.h.i)perylene	%	101			70-130	Pass	
Benzo(k)fluoranthene	%	98			70-130	Pass	
Chrysene	%	92			70-130	Pass	
Dibenz(a.h)anthracene	%	84			70-130	Pass	
Fluoranthene	%	80			70-130	Pass	
Fluorene	%	105			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	85			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Naphthalene	%	87			70-130	Pass	
Phenanthrene	%	84			70-130	Pass	
Pyrene	%	102			70-130	Pass	
LCS - % Recovery							
Organochlorine Pesticides							
Chlordanes - Total	%	79			70-130	Pass	
4.4'-DDD	%	94			70-130	Pass	
4.4'-DDE	%	82			70-130	Pass	
4.4'-DDT	%	75			70-130	Pass	
a-BHC	%	90			70-130	Pass	
Aldrin	%	75			70-130	Pass	
b-BHC	%	110			70-130	Pass	
d-BHC	%	93			70-130	Pass	
Dieldrin	%	93			70-130	Pass	
Endosulfan I	%	110			70-130	Pass	
Endosulfan II	%	86			70-130	Pass	
Endrin	%	107			70-130	Pass	
Endrin aldehyde	%	74			70-130	Pass	
g-BHC (Lindane)	%	115			70-130	Pass	
Heptachlor	%	100			70-130	Pass	
Heptachlor epoxide	%	80			70-130	Pass	
Methoxychlor	%	105			70-130	Pass	
LCS - % Recovery							
Conductivity (1:5 aqueous extract at 25°C as rec.)	%	85			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	100			80-120	Pass	
Cadmium	%	111			80-120	Pass	
Chromium	%	115			80-120	Pass	
Copper	%	113			80-120	Pass	
Lead	%	116			80-120	Pass	
Mercury	%	120			80-120	Pass	
Nickel	%	111			80-120	Pass	
Zinc	%	111			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	S21-My03124	NCP	%	77			70-130	Pass	
TRH C10-C14	S21-My03114	NCP	%	107			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	S21-My03124	NCP	%	98			70-130	Pass	
Toluene	S21-My03124	NCP	%	94			70-130	Pass	
Ethylbenzene	S21-My03124	NCP	%	102			70-130	Pass	
m&p-Xylenes	S21-My03124	NCP	%	99			70-130	Pass	
o-Xylene	S21-My03124	NCP	%	98			70-130	Pass	
Xylenes - Total*	S21-My03124	NCP	%	99			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	S21-My03124	NCP	%	113			70-130	Pass	
TRH C6-C10	S21-My03124	NCP	%	78			70-130	Pass	
TRH >C10-C16	S21-My03114	NCP	%	107			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Acenaphthene	S21-My01268	NCP	%	118			70-130	Pass	
Acenaphthylene	S21-My01268	NCP	%	92			70-130	Pass	
Anthracene	S21-My01268	NCP	%	124			70-130	Pass	
Benz(a)anthracene	S21-My01268	NCP	%	116			70-130	Pass	
Benzo(a)pyrene	S21-My01268	NCP	%	112			70-130	Pass	
Benzo(b&j)fluoranthene	S21-My01268	NCP	%	107			70-130	Pass	
Benzo(g.h.i)perylene	S21-Ap57264	NCP	%	120			70-130	Pass	
Benzo(k)fluoranthene	S21-My01268	NCP	%	111			70-130	Pass	
Chrysene	S21-My13256	NCP	%	75			70-130	Pass	
Dibenz(a.h)anthracene	S21-My01268	NCP	%	94			70-130	Pass	
Fluoranthene	S21-My01268	NCP	%	119			70-130	Pass	
Fluorene	S21-My01268	NCP	%	121			70-130	Pass	
Indeno(1.2.3-cd)pyrene	S21-My01268	NCP	%	87			70-130	Pass	
Naphthalene	S21-My01268	NCP	%	107			70-130	Pass	
Phenanthrene	S21-My01268	NCP	%	125			70-130	Pass	
Pyrene	S21-My01268	NCP	%	123			70-130	Pass	
Spike - % Recovery									
Organochlorine Pesticides				Result 1					
Chlordanes - Total	S21-My13256	NCP	%	71			70-130	Pass	
4.4'-DDD	S21-My13256	NCP	%	70			70-130	Pass	
4.4'-DDE	S21-My13256	NCP	%	74			70-130	Pass	
4.4'-DDT	S21-My13256	NCP	%	87			70-130	Pass	
a-BHC	S21-My13256	NCP	%	73			70-130	Pass	
Aldrin	S21-My13256	NCP	%	70			70-130	Pass	
b-BHC	S21-My13256	NCP	%	89			70-130	Pass	
d-BHC	S21-Ap57264	NCP	%	86			70-130	Pass	
Dieldrin	S21-My13256	NCP	%	76			70-130	Pass	
Endosulfan I	S21-Ap57264	NCP	%	91			70-130	Pass	
Endosulfan II	S21-My13256	NCP	%	72			70-130	Pass	
Endosulfan sulphate	S21-Ap58043	NCP	%	88			70-130	Pass	
Endrin	S21-My13256	NCP	%	91			70-130	Pass	
Endrin ketone	S21-Ap58043	NCP	%	105			70-130	Pass	
g-BHC (Lindane)	S21-My13256	NCP	%	89			70-130	Pass	
Heptachlor	S21-My13256	NCP	%	114			70-130	Pass	
Heptachlor epoxide	S21-My13256	NCP	%	74			70-130	Pass	
Hexachlorobenzene	S21-My13256	NCP	%	72			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S21-My04571	NCP	%	112			75-125	Pass	
Cadmium	S21-My04571	NCP	%	119			75-125	Pass	
Chromium	S21-My08210	NCP	%	109			75-125	Pass	
Copper	S21-My08210	NCP	%	109			75-125	Pass	
Lead	S21-My08230	NCP	%	91			75-125	Pass	
Mercury	S21-My08210	NCP	%	114			75-125	Pass	
Nickel	S21-My08210	NCP	%	114			75-125	Pass	
Zinc	S21-My04571	NCP	%	124			75-125	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	S21-My08210	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	S21-My03113	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	S21-My03113	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	S21-My03113	NCP	mg/kg	< 50	82	76	30%	Fail	Q15

Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S21-My08210	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	S21-My08210	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	S21-My08210	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	S21-My08210	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	S21-My08210	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total*	S21-My08210	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	S21-My08210	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	S21-My08210	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	S21-My03113	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	S21-My03113	NCP	mg/kg	< 100	110	70	30%	Fail	Q15
TRH >C34-C40	S21-My03113	NCP	mg/kg	< 100	100	68	30%	Fail	Q15
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	S21-My04379	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	S21-My04379	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
4.4'-DDD	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-BHC	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-BHC	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-BHC	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-BHC (Lindane)	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	S21-My04379	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	S21-My04379	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	

Duplicate									
				Result 1	Result 2	RPD			
Conductivity (1:5 aqueous extract at 25°C as rec.)	S21-My04154	CP	uS/cm	32	27	17	30%	Pass	
pH (1:5 Aqueous extract at 25°C as rec.)	S21-My04154	CP	pH Units	6.2	6.2	<1	30%	Pass	
% Moisture	S21-My04180	NCP	%	23	21	7.0	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S21-My04182	NCP	mg/kg	9.3	11	18	30%	Pass	
Cadmium	S21-My04182	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	S21-My04182	NCP	mg/kg	26	23	11	30%	Pass	
Copper	S21-My04182	NCP	mg/kg	38	29	27	30%	Pass	
Lead	S21-My04182	NCP	mg/kg	79	94	18	30%	Pass	
Mercury	S21-My04182	NCP	mg/kg	0.2	0.2	10	30%	Pass	
Nickel	S21-My04182	NCP	mg/kg	17	13	24	30%	Pass	
Zinc	S21-My04182	NCP	mg/kg	120	97	25	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Andrew Black	Analytical Services Manager
Andrew Sullivan	Senior Analyst-Organic (NSW)
Charl Du Preez	Senior Analyst-Inorganic (NSW)
John Nguyen	Senior Analyst-Metal (NSW)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Qualtest
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Mayfield West
NSW 2304

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection and proficiency testing scheme providers reports.

Attention: **Emma Coleman**

Report **792281-W**
Project name MCCLOY GROUP THORNTON
Project ID NEW17P-0074
Received Date May 03, 2021

Client Sample ID			**DAM1**	**D3.5.21**
Sample Matrix			**Water**	**Water**
Eurofins Sample No.			**S21-My04152**	**S21-My04153**
Date Sampled			**May 03, 2021**	**May 03, 2021**
Test/Reference	LOR	Unit		
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1
BTEX				
Benzene	0.001	mg/L	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	107	109
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	0.001	mg/L	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.005
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.005
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.005
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.005
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.005
Chrysene	0.001	mg/L	< 0.001	< 0.005
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.005
Fluoranthene	0.001	mg/L	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001

Client Sample ID			DAM1	D3.5.21
Sample Matrix			Water	Water
Eurofins Sample No.			S21-My04152	S21-My04153
Date Sampled			May 03, 2021	May 03, 2021
Test/Reference	LOR	Unit		
Polycyclic Aromatic Hydrocarbons				
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.005
Naphthalene	0.001	mg/L	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.005
2-Fluorobiphenyl (surr.)	1	%	61	95
p-Terphenyl-d14 (surr.)	1	%	62	INT
Organochlorine Pesticides				
Chlordanes - Total	0.002	mg/L	< 0.002	-
4.4'-DDD	0.0001	mg/L	< 0.0001	-
4.4'-DDE	0.0001	mg/L	< 0.0001	-
4.4'-DDT	0.0001	mg/L	< 0.0001	-
a-BHC	0.0001	mg/L	< 0.0001	-
Aldrin	0.0001	mg/L	< 0.0001	-
b-BHC	0.0001	mg/L	< 0.0001	-
d-BHC	0.0001	mg/L	< 0.0001	-
Dieldrin	0.0001	mg/L	< 0.0001	-
Endosulfan I	0.0001	mg/L	< 0.0001	-
Endosulfan II	0.0001	mg/L	< 0.0001	-
Endosulfan sulphate	0.0001	mg/L	< 0.0001	-
Endrin	0.0001	mg/L	< 0.0001	-
Endrin aldehyde	0.0001	mg/L	< 0.0001	-
Endrin ketone	0.0001	mg/L	< 0.0001	-
g-BHC (Lindane)	0.0001	mg/L	< 0.0001	-
Heptachlor	0.0001	mg/L	< 0.0001	-
Heptachlor epoxide	0.0001	mg/L	< 0.0001	-
Hexachlorobenzene	0.0001	mg/L	< 0.0001	-
Methoxychlor	0.0002	mg/L	< 0.0002	-
Toxaphene	0.001	mg/L	< 0.001	-
Aldrin and Dieldrin (Total)*	0.0002	mg/L	< 0.0002	-
DDT + DDE + DDD (Total)*	0.0002	mg/L	< 0.0002	-
Vic EPA IWRG 621 OCP (Total)*	0.002	mg/L	< 0.002	-
Vic EPA IWRG 621 Other OCP (Total)*	0.002	mg/L	< 0.002	-
Dibutylchlorendate (surr.)	1	%	INT	-
Tetrachloro-m-xylene (surr.)	1	%	61	-
Conductivity (at 25°C)	10	uS/cm	230	130
pH (at 25 °C)	0.1	pH Units	6.8	6.7
Total Suspended Solids Dried at 103–105°C	5	mg/L	12	-
Heavy Metals				
Arsenic	0.001	mg/L	0.005	0.006
Cadmium	0.0002	mg/L	< 0.0002	< 0.0002
Chromium	0.001	mg/L	0.003	0.003
Copper	0.001	mg/L	0.003	0.003
Lead	0.001	mg/L	0.005	0.004
Mercury	0.0001	mg/L	< 0.0001	< 0.0001
Nickel	0.001	mg/L	0.002	0.003
Zinc	0.005	mg/L	0.026	0.023

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	May 04, 2021	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Sydney	May 04, 2021	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	May 04, 2021	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	May 04, 2021	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons	Sydney	May 04, 2021	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Metals M8	Sydney	May 10, 2021	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Organochlorine Pesticides	Sydney	May 04, 2021	7 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water			
Conductivity (at 25°C)	Sydney	May 05, 2021	28 Days
- Method: LTM-INO-4030 Conductivity			
pH (at 25 °C)	Sydney	May 05, 2021	1 Days
- Method: LTM-GEN-7090 pH in water by ISE			
Total Suspended Solids Dried at 103–105°C	Sydney	May 05, 2021	7 Days
- Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry			

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Company Name: Qualtest
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Mayfield West
NSW 2304

Project Name: MCCLOY GROUP THORNTON
Project ID: NEW17P-0074

Order No.:
Report #: 792281
Phone: 02 4968 4468
Fax: 02 4960 9775

Received: May 3, 2021 3:00 PM
Due: May 10, 2021
Priority: 5 Day
Contact Name: Emma Coleman

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Conductivity (1:5 aqueous extract at 25°C as rec.)	Conductivity (at 25°C)	pH (1:5 Aqueous extract at 25°C as rec.)	pH (at 25 °C)	Total Suspended Solids Dried at 103–105°C	Organochlorine Pesticides	Moisture Set	Eurofins Suite B7
Melbourne Laboratory - NATA Site # 1254 & 14271													
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794													
Perth Laboratory - NATA Site # 23736													
Mayfield Laboratory - NATA Site # 25079													
External Laboratory													
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**								
1	DAM1	May 03, 2021		Water	S21-My04152		X		X	X	X		X
2	D3.5.21	May 03, 2021		Water	S21-My04153		X		X				X
3	DAM1 SD	May 03, 2021		Sediment	S21-My04154	X		X			X	X	X
Test Counts						1	2	1	2	1	2	1	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
Organochlorine Pesticides							
Chlordanes - Total	mg/L	< 0.002			0.002	Pass	
4.4'-DDD	mg/L	< 0.0001			0.0001	Pass	
4.4'-DDE	mg/L	< 0.0001			0.0001	Pass	
4.4'-DDT	mg/L	< 0.0001			0.0001	Pass	
a-BHC	mg/L	< 0.0001			0.0001	Pass	
Aldrin	mg/L	< 0.0001			0.0001	Pass	
b-BHC	mg/L	< 0.0001			0.0001	Pass	
d-BHC	mg/L	< 0.0001			0.0001	Pass	
Dieldrin	mg/L	< 0.0001			0.0001	Pass	
Endosulfan I	mg/L	< 0.0001			0.0001	Pass	
Endosulfan II	mg/L	< 0.0001			0.0001	Pass	
Endosulfan sulphate	mg/L	< 0.0001			0.0001	Pass	
Endrin	mg/L	< 0.0001			0.0001	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endrin aldehyde	mg/L	< 0.0001			0.0001	Pass	
Endrin ketone	mg/L	< 0.0001			0.0001	Pass	
g-BHC (Lindane)	mg/L	< 0.0001			0.0001	Pass	
Heptachlor	mg/L	< 0.0001			0.0001	Pass	
Heptachlor epoxide	mg/L	< 0.0001			0.0001	Pass	
Hexachlorobenzene	mg/L	< 0.0001			0.0001	Pass	
Methoxychlor	mg/L	< 0.0002			0.0002	Pass	
Toxaphene	mg/L	< 0.001			0.001	Pass	
Method Blank							
Conductivity (at 25°C)	uS/cm	< 10			10	Pass	
Total Suspended Solids Dried at 103–105°C	mg/L	< 5			5	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/L	< 0.001			0.001	Pass	
Cadmium	mg/L	< 0.0002			0.0002	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	103			70-130	Pass	
TRH C10-C14	%	70			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	112			70-130	Pass	
Toluene	%	107			70-130	Pass	
Ethylbenzene	%	109			70-130	Pass	
m&p-Xylenes	%	119			70-130	Pass	
o-Xylene	%	112			70-130	Pass	
Xylenes - Total*	%	117			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	113			70-130	Pass	
TRH C6-C10	%	105			70-130	Pass	
TRH >C10-C16	%	72			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	71			70-130	Pass	
Acenaphthylene	%	75			70-130	Pass	
Anthracene	%	80			70-130	Pass	
Benz(a)anthracene	%	87			70-130	Pass	
Benzo(a)pyrene	%	88			70-130	Pass	
Benzo(b&j)fluoranthene	%	92			70-130	Pass	
Benzo(g.h.i)perylene	%	76			70-130	Pass	
Benzo(k)fluoranthene	%	103			70-130	Pass	
Chrysene	%	87			70-130	Pass	
Dibenz(a.h)anthracene	%	85			70-130	Pass	
Fluoranthene	%	84			70-130	Pass	
Fluorene	%	73			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	72			70-130	Pass	
Naphthalene	%	81			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Phenanthrene	%	73			70-130	Pass	
Pyrene	%	85			70-130	Pass	
LCS - % Recovery							
Organochlorine Pesticides							
Chlordanes - Total	%	101			70-130	Pass	
4.4'-DDD	%	102			70-130	Pass	
4.4'-DDE	%	93			70-130	Pass	
4.4'-DDT	%	121			70-130	Pass	
a-BHC	%	95			70-130	Pass	
Aldrin	%	91			70-130	Pass	
b-BHC	%	100			70-130	Pass	
d-BHC	%	97			70-130	Pass	
Dieldrin	%	96			70-130	Pass	
Endosulfan I	%	100			70-130	Pass	
Endosulfan II	%	96			70-130	Pass	
Endosulfan sulphate	%	105			70-130	Pass	
Endrin aldehyde	%	129			70-130	Pass	
Endrin ketone	%	113			70-130	Pass	
g-BHC (Lindane)	%	103			70-130	Pass	
Heptachlor	%	130			70-130	Pass	
Heptachlor epoxide	%	104			70-130	Pass	
Hexachlorobenzene	%	88			70-130	Pass	
Methoxychlor	%	128			70-130	Pass	
LCS - % Recovery							
Conductivity (at 25°C)	%	102			70-130	Pass	
Total Suspended Solids Dried at 103–105°C	%	89			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	104			80-120	Pass	
Cadmium	%	100			80-120	Pass	
Chromium	%	88			80-120	Pass	
Copper	%	88			80-120	Pass	
Lead	%	90			80-120	Pass	
Mercury	%	92			80-120	Pass	
Nickel	%	89			80-120	Pass	
Zinc	%	94			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Total Suspended Solids Dried at 103–105°C	S21-My11902	NCP	%	85			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S21-My08075	NCP	%	107			75-125	Pass	
Chromium	S21-My08075	NCP	%	94			75-125	Pass	
Copper	S21-My08075	NCP	%	90			75-125	Pass	
Lead	S21-My08075	NCP	%	86			75-125	Pass	
Mercury	S21-My08075	NCP	%	90			75-125	Pass	
Nickel	S21-My08075	NCP	%	94			75-125	Pass	
Zinc	S21-My08075	NCP	%	91			75-125	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	S21-Ap57930	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	S21-Ap57930	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	S21-Ap57930	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	S21-Ap57930	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C16-C34	S21-Ap57930	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH >C34-C40	S21-Ap57930	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Conductivity (at 25°C)	S21-My01628	NCP	uS/cm	310	280	10	30%	Pass	
Total Suspended Solids Dried at 103–105°C	S21-My11902	NCP	mg/L	8.8	8.6	2.0	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S21-My08074	NCP	mg/L	0.003	0.003	3.0	30%	Pass	
Cadmium	S21-My08074	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium	S21-My08074	NCP	mg/L	0.027	0.026	3.0	30%	Pass	
Copper	S21-My08074	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Lead	S21-My08074	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury	S21-My08074	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel	S21-My08074	NCP	mg/L	0.002	0.001	65	30%	Fail	Q15
Zinc	S21-My08074	NCP	mg/L	0.030	0.028	6.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Andrew Black	Analytical Services Manager
Andrew Sullivan	Senior Analyst-Organic (NSW)
Charl Du Preez	Senior Analyst-Inorganic (NSW)
John Nguyen	Senior Analyst-Metal (NSW)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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GHD Tower, Level 3, 24 Honeysuckle Drive
Newcastle, New South Wales 2300
Australia
www.ghd.com

Your ref: [0000]
Our ref: 12626983

15 November 2023

Sam Rowe
Project Director
McCloy Group Pty Ltd
Suite 2, Ground Floor,
317 Hunter Street, NSW 2300

107 Haussman Drive, Thornton North – proposed rezoning for residential development
Review of 2015 mine subsidence report for proposed new residential development

1. Introduction

This letter provides advice on the relevance of the attached GHD 2015 report with respect to the proposed rezoning of 107 Haussman Drive Thornton to R1 General Residential and the proposed new residential development shown on the drawing provided by McCloy Group (Ref. HD03 Rev.16, 10/10/2023), reproduced below as Figure 1.

Figure 1 Proposed new residential development (Ref. HD03 Rev.16, 10/10/2023)

2. Relevance of GHD 2015 report

The GHD 2015 report (attached) was for a different residential development being proposed by McCloy Group on the same site. The report discusses that the site is not within a Mine Subsidence District and as such, the Mine Subsidence Board (MSB) is not an approval authority for development applications. However, Maitland City Council may consult the MSB and place similar conditions on development.

The site remains outside a Mine Subsidence District. The Mine Subsidence Board (MSB) has been replaced by Subsidence Advisory NSW (SA NSW) which retains the same functions under the Coal Mine Compensation Act 2017. The 2017 amendments to the Act do not alter our advice from 2015.

We understand Maitland City Council consulted with SA NSW regarding the previously proposed development and that SA NSW indicated that investigation of mine workings and elimination of mine subsidence risk should be required. GHD expect that SA NSW advice regarding the proposed new development would be the same.

Following the recommended geotechnical investigations, it may be appropriate to place a limit on the depth of cover to which elimination of risk (e.g. mine grouting) is required. For example, 30 or 40 m depth of cover. However, this would depend on the findings of the investigations and so no update to the 2015 report can be provided at this stage.

Section 4 of the GHD 2015 report presents a discussion on mine subsidence hazards and consequences and makes reference to MSB Graduated Design Guidelines for Residential Construction.

The Graduated Design Guidelines for Residential Construction have been replaced by SA NSW Surface Development Guidelines (numbered 1 through to 8 and with the recent addition of 1A and 3A guidelines). As the site is not within a Mine Subsidence District, it has not been assigned a guideline. However, if it were, it would almost certainly be assigned Guideline 7 – On Application with subdivision applications or development applications (not rezoning) to be considered under SA NSWs Merit Assessment Policy. As previously stated, GHD expect SA NSW advice would be the elimination of subsidence hazards at least to 20 to 30 m depth, and this would also be the case under the Merit Assessment Policy.

Section 5 of the GHD 2015 report presents assumed risk reduction scope and a preliminary cost estimate.

The assumed scope of works (tasks listed in Table 1 of the report) are considered appropriate for the new development for the purposed of a preliminary cost estimate. However, the cost estimate is now outdated and may not be appropriate. A revised cost estimate would be expected to be higher.

3. Conclusions

Other than the preliminary cost estimate, the mine subsidence advice presented in the GHD 2015 report is appropriate for the proposed rezoning of 107 Haussman Drive Thornton to R1 General Residential and the proposed residential development shown in Figure 1.

Aspects discussed in Section 2 relating to MSB, SA NSW and Surface Development Guidelines are not expected to impact the development as the site remains outside a Mine Subsidence District.

Regards

Sam Mackenzie
Technical Director - Geotechnical Engineer

0455 865 377
sam.mackenzie@ghd.com

Attachment 1

GHD 2015 report: *Proposed residential development – Thornton North, Mine subsidence constraints*. GHD Ref. 2218155/111687, 4 December 2015

04 December 2015

Shane Boslem
McCloy Group
Suite 1, Level 3 426 King Street
NEWCASTLE WEST NSW 2300

Our ref: 22/18155/00 111687
Your ref:

Dear Shane

Proposed residential development - Thornton North
Mine subsidence constraints

1 Introduction

This letter presents advice relating to mine subsidence constraints to proposed residential development at a CSR site near the corner of Haussman Drive and Raymond Terrace Road, Thornton North.

As the site is not within a Mine Subsidence District, the Mine Subsidence Board (MSB) is not an approval authority for development applications. However, Maitland City Council may consult the MSB and place similar conditions on development. For the purpose of this assessment, we have assumed Council will place conditions that are comparable to those expected from the MSB.

We understand the MSB advised the site is undermined by abandoned coal mine workings. The MSB have concerns that future subsidence may damage proposed dwellings as well as create a hazard to the public generally. In order for development to occur, the MSB advised CSR that the risk of subsidence would need to be eliminated by grouting and/or excavation.

This letter should be read in conjunction with the attached General Notes.

2 Methodology and key assumptions

GHD undertook a desktop study and interpreted the mine's location and cover depth (which is, the vertical distance from the ground surface to the top of the workings). We then developed an assumed scope of risk reduction work and estimated an indicative cost to complete these works based on the following key assumptions:

- Council will place conditions on development that are comparable to that expressed by the MSB and generally in line with the MSB Graduated Design Guidelines for Residential Construction (NSW)
- The location and orientation of the workings not only are approximate (as shown in the attached Figure 1: note that this interpreted location is different to that shown on the MSB plan provided) but also represent a poorly defined layout at a particular time. This mine layout may not represent the actual extent or shape of the workings at the time of abandonment
- The finished ground surface level will be not more than 1 m below the ground surface shown on the 2012 CSR borehole location plan provided
- Filling of mine voids with up to a cover depth of 20 m will be acceptable to Council as a means of eliminating the risk of future mine subsidence
- Not filling mine voids greater than 20 m cover depth will not preclude residential development, although Council may impose conditions on dwelling size and materials

- The two shafts and two tunnel entries will be located by excavation and backfilled with fill rather than capped with reinforced concrete slabs
- The scope of risk reduction work, quantities and cost rates are as presented in Section 5.

2.1 Desktop study

The desktop study comprised review of the following:

- historical information including mine record tracing RT 292, newspaper articles and NSW Department of Mines annual reports
- MSB plans provided
- historical and modern geological maps
- recent aerial photographs
- information provided by CSR including photos, a video, survey plans and logs of six 'U' series boreholes

A list of references is attached.

2.2 Site visit

The site visit on 20 November 2015 allowed observation of surface conditions, particularly where CSR reported a subsidence hole was filled in 2011 and 'U' series boreholes were drilled in August 2012.

No evidence of mine subsidence features such as shafts, tunnels, potholes or cracks was observed during the site visits. However, this does not confirm their absence as grass cover and general site disturbance may have obscured such features.

The location of the '2011 hole' and 'U' series boreholes are shown in Figure 1 attached.

3 Description of mining

3.1 Geology and mined seam

The reviewed geology maps show the site is located to the east of the Thornton syncline in sedimentary rocks belonging to the Tomago Coal Measures. The stratum dips generally toward the west to south-west at 10° to 22° to the horizontal. A localised seam dip of approximately 20° toward the west-south-west has been interpreted from review of the 1902 geology map, CSR borehole data, positioning of the mine workings relative to borehole locations and the 2011 subsidence hole location.

The 1902 geology map indicates the coal seam mined was known as the Morpeth Seam.

Neither the thickness of the seam or mining interval (thickness of coal mined) is shown on the record tracing or mentioned in the other references reviewed. Based on the U6 borehole log provided, the seam thickness appears to be approximately 1.8 m. The mining height is generally less than the geological seam thickness as beds within coal seams are frequently of a quality that was not worth extracting.

3.2 Groundwater

The U series borehole logs do not indicate a static groundwater level and it appears these boreholes were not sufficiently deep to intersect the groundwater table.

Aerial photographs of the quarry show ponded water at about RL 20 m AHD. As the mine workings (with the exception of the tunnel entries and shafts) are below this level, all of the workings are expected to be currently flooded.

3.3 Glenvale Colliery

General

A plan of the abandoned coal mine workings is shown on record tracing RT 292. The mine was known as "Glenvale" or "Glen Vale" Colliery and operated episodically between 1927 and 1952. Being a very small mine, there is little mention of Glenvale Colliery in departmental annual reports and newspapers. The following summarises what was ascertained.

1927 opening of "Glen Vale" colliery noted in the Greta Field. 4 people employed.

1928 notice of discontinuance of "Glenvale" colliery.

1929 17 people employed at "Glenvale" colliery. 14 of which were below ground.

1930 28 October. Henry Sharpe, manager of "Glen Vale Colliery, a small coal mine on the Raymond Terrace road near East Maitland" charged with having failed on 8 September to use clay or other non-combustible material for stemming.

1931 no mention in annual report

1932 no mention in annual report. Last date on record tracing RT 292 is 20/12/32.

1933 to 1950 no mention in annual reports

1951 notice of discontinuance and recommencement of "Glenvale" colliery.

1952 notice of abandonment of "Glenvale" colliery

The mining method was bord and pillar workings with access through two tunnel entries. Air was provided via a furnace shaft originally and later by a "new shaft" adjacent to the "furnace shaft". The creation of the new shaft coincided with a new in-seam drive of 3 yard width through a single pillar. A note on the record tracing indicates this new drive was required as the tunnels were impassable beyond this due to "intense floor heave".

This intense floor heave is expected to be due to swelling of expansive claystone forming the floor of the workings rather than a bearing capacity failure of the pillars. However, the latter is possible (although unlikely beneath loaded pillars) if the claystone floor became sufficient weak as it absorbed water, swelled and softened. In either case, the result is a reduction in remaining mine void volume. Record tracing RT 292 includes the reference "Vide papers M^S 52/1972" to additional information on the floor heave. Further investigation of these mine workings should include an attempt to source these papers.

The tunnel entries appear to be close to the sub-crop of the mined coal seam and are interpreted as being "in-seam". That is, the miners followed the seam down dip from the surface to a depth where the coal was of a quality worth mining. At this point, the first bord was mined perpendicular to the main tunnel and hence approximately along the strike of the seam.

Pillars were not extracted although a hatched area on the record tracing indicates where a bord was widened on 20 December 1932, the last date on the record tracing.

Extent of mine workings

The mining activity between 1932 and 1952 is unknown and the record tracing (RT 292) is not marked as a ‘plan of abandonment’ and not signed by a mine surveyor. RT 292 includes dates of extraction in red and shows ‘open ended’ bords or headings. Image 1 below shows a portion of RT 292 illustrating these features.

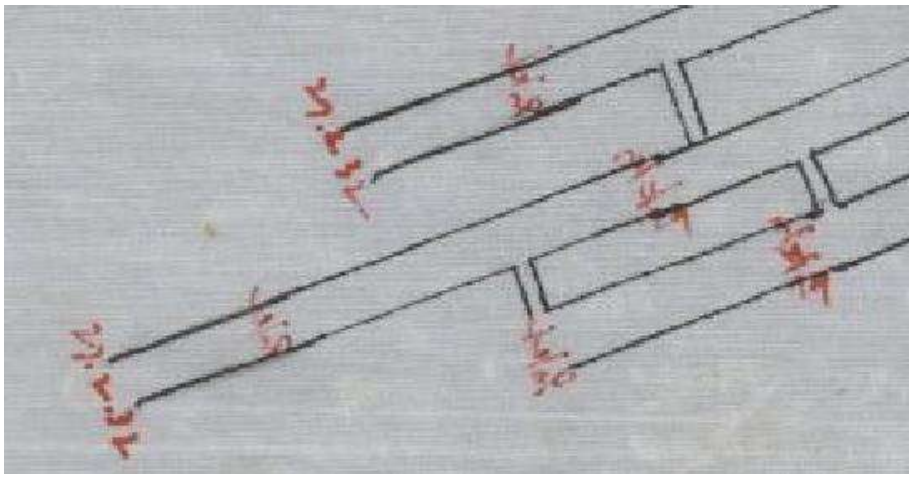


Image 1 Portion of record tracing RT 292 illustrating ‘open ended’ bords and dates

The ‘open ended’ bords and lack of certified plan of abandonment suggest that the actual mine workings may be more extensive than shown on RT 292. This possibility would need to be investigated by borehole drilling.

In the period between 1932 and abandonment in 1952, the only mention of Glenvale or Glen Vale Colliery found in the annual reports is in 1951. Here the annual report simply provides notice that Glenvale Colliery was discontinued and recommenced. Given the mine was abandoned in the following year, the volume of additional coal mined, if any, is likely to be very little and record tracing RT 292 is likely to present a reasonable representation of the extent of mining.

Position of mine

The position of the Glenvale Colliery workings has been interpreted from the location of the 2011 subsidence hole (as shown on the 2012 plan of surface contours and boreholes) as well as cadastre boundaries on the record tracing and positions of the U series boreholes. The interpreted location as shown on the attached Figure 1 is approximately 25 m east-north-east of where the MSB plan indicates.

The position of the mine workings is an important aspect of determining cover depth as the ground surface is lower to the west and south west. If the workings are further west, the cover depths will also be less that currently estimated.

Cover depth

Cover depth to the top of the mined seam have been estimated from the following:

- Inferred position of the workings as shown in Figure 1
- Ground surface contours from the 2012 CSR Housing Commission Proposed Drilling plan
- Inferred seam dip and dip direction of approximately 20° to the west-sou-west.

Resulting cover ranges are shown on Figure 1. Overall, cover is judged to vary from about 9 to 36 m, not including the tunnel entries which will be shallower.

4 Subsidence hazards and risk reduction

Broadly, subsidence hazards associated with mine workings relate to the following mechanisms:

- Pothole subsidence – where the roof of the mine, particularly at the intersections of mine headings, collapses and migrates toward the ground surface to form a depression or hole
- Collapse of shafts – where material settles or washes out such that the shaft re-appears as a hole
- Collapse of tunnels – where the roof of a tunnel entry collapses or the material used to fill the tunnel settles or washes out such that the tunnel re-appears as a hole or depression
- Trough subsidence – where an area of the mine roof converges over a region of several pillars due to lack of support from the mine pillars or complete removal of pillars during mining, or progressive deterioration of pillars since mining finished, resulting in surface cracking, compression ridges and typically broad depressions.

For the Glenvale Colliery workings as depicted on the record tracing, trough subsidence is not expected to be a mechanism of concern. This is due to the relatively large dimensions of the pillars shown to remain, their expected height of less than 1.8 m and the depth of cover being relatively shallow. Note that this assessment is based on the validity of the record tracing which may not be a reasonable representation of the mine workings.

Potholes, shafts and tunnel subsidence events occurring in residential areas can present one or a combination of the following consequences:

- Damage to houses, driveways, pools, sheds and the like - in some cases resulting in houses being unsafe and requiring demolition
- Damage to infrastructure such as roads, footpaths and utilities
- Injury or loss life.

Typically, the MSB require mine subsidence hazards to be eliminated where the cover depth to the workings is less than 20 m. This is usually achieved by injection of cementitious grout into the mine voids via boreholes or excavation of the workings and backfilling where the workings are very shallow (typically less than 10 m below the ground surface).

For workings at greater than 20 m cover depth, the MSB may also require grouting. However, in our experience the risk of subsidence associated with residential development is often acceptable without the need for grouting at greater than 20 m cover. Typically, in such circumstances, the MSB would place conditions on development in line with their Graduated Design Guidelines for Residential Construction. For example, where workings remain at 20 to 40 m cover depth, approval conditions may comprise single storey light weight construction, possibly with a requirement for pothole footings where in ground concrete beams extend beyond the footprint to span over a nominal diameter void.

Old mine entries such as shafts and tunnels generally need to be located by excavation, surveyed and backfilled. The nature of backfilling will depend on the final land use. In some cases, reinforced concrete slabs are required to cap shafts to mine closure guidelines.

5 Assumed risk reduction and preliminary cost estimate

To develop an preliminary cost estimate for works associated with mine subsidence assessment and risk reduction, an assumed scope of work has been developed. This is based on the preliminary assessment of mine workings presented herein and expected Council conditions placed on development.

The assumed scope is presented in Table 1 together with an indicative cost estimate and basis.

Table 1 Assumed scope and preliminary cost estimate

Item	Description	Basis / assumptions	Preliminary cost estimate	
			low	high
Geotechnical consulting services	Investigation of mine workings (including location, downhole identification and survey of shafts and tunnels), assessment of risk, risk mitigation strategy and grouting specification, remediation QA and reporting	Estimated from projects of similar nature and not determined through detailed scoping and cost estimating	$ 100,000	$ 150,000
Tunnels and shafts	Engineering filling of excavated shafts and tunnels over approximately 300 m² area to average of 2 m depth	No concrete slab capping required	Cost assumed to be included in site regrade earthworks for subdivision	
Grout plant mobilisation and demobilisation	Set up plant and access, demobilisation following completion of grouting		$ 15,000 [A]	$ 25,000 [A]
Drilling and **plug** grouting	Low mobility gravel and grout to plug workings at about 20 m cover in 7 locations (headings)	14 boreholes to 20 m with gravel and grout plugs ~200 m² area x 1 to 1.5 m depth at $200/m³ [B]	1 m avg. void height $ 40,000	1.5 m avg. void height $ 60,000
Drilling and **infill** grouting	Filling of mine voids shallower than 20 m with higher mobility cementitious grout	~2,400 m² area x 1 to 1.5 m depth at $150/m³ [A]	1 m avg. void height $ 360,000	1.5 m avg. void height $ 540,000
		Preliminary cost estimate (excluding GST)	**$ 415,100**	**$ 645,130**

A: Based on indicative rates for a similar project provided by a grouting contractor recently

B: Additional $50/m³ included over base rate for grouting and drilling to allow for more complex and time consuming plug grouting

The preliminary cost estimates presented in Table 1 do not include any additional contingency or allowance for rate rises. We recommend a contingency be applied to the above estimates, particularly for the cost of grouting which is difficult to predict due to the unknown volume of void to be filled.

As a guide, a contingency allowance of 30% for the drilling and grouting work is suggested at this stage.

6 Limitations

6.1 General

This report has been prepared by GHD for McCloy Group and may only be used and relied on by McCloy Group for the purpose agreed between GHD and the McCloy Group as set out in this report.

GHD otherwise disclaims responsibility to any person other than McCloy Group arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

6.2 Preliminary cost estimate

GHD has prepared the preliminary cost estimate set out in Section 5 of this Report ("Cost Estimate") using information reasonably available to the GHD employee(s) who prepared this Report; and based on assumptions and judgments made by GHD as set out in the Report.

The Cost Estimate has been prepared for the purpose of indicating likely costs associated with mitigating mine subsidence hazards prior to purchase of the land and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this Report, no detailed quotation has been obtained for actions identified in this Report. GHD does not represent, warrant or guarantee that the works can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

Regards
GHD Pty Ltd

Sam Mackenzie
Principal Geotechnical Engineer
(02) 4979 9983, 0455 865 377

Attachments:

References
General Notes
Figure 1 – Preliminary plan of mine workings

References

Sorted by date: earliest to latest

Map: Geological Map of part of the Maitland Coal Field. T.W.E. David, Department of Mines and Agriculture, NSW. 1902.

Report: 1927 Annual Report. NSW Department of Mines. P89.

Report: 1928 Annual Report. NSW Department of Mines. P86.

Report: 1929 Annual Report. NSW Department of Mines. P70.

Article: “Clay Not Used – Mine Manager Fined”. Newcastle Morning Herald and Miners’ Advocate. Tuesday 28 October 1930, p4.

Report: 1951 Annual Report. NSW Department of Mines. P62.

Report: 1952 Annual Report. NSW Department of Mines. P65.

Record tracing: RT 292 “Glenvale Colliery”. Scale 2 chains to 1 inch. Unsigned and undated. Department of Industry, Skills and Regional Development (DOI) ref. R10000287.

Map: Newcastle Coalfield Regional Geology. 1:100 000 scale, Sheet 9231 Ed. 1, 1995. NSW Department of Mineral Resources.

MSB files FN99-00826N0: showing plan of cadastre and mine workings within Lot 2 DP 867766. Newcastle District Office, 01/05/2008

CSR files: mine inspectors notice “Notice of Prohibition, Restriction, Evacuation or Closure of a Mine” NSW Mine Inspectorate, No. 10003, 25/10/2011. Provided by VGT Pty Ltd on 24 November 2015.

CSR files: 1 video and 21 photographs of clearing, excavation and filling associated with remediation of a subsidence feature in November 2011. Provided by VGT Pty Ltd on 24 November 2015.

CSR files: plan of surface contours and boreholes “Housing Commission Proposed Drilling” Figure 4, 8/10/2012. Provided by VGT Pty Ltd on 24 November 2015.

CSR files: cross section of U series boreholes “Housing Commission Cross Section” Figure 3, 8/10/2012. Provided by VGT Pty Ltd on 24 November 2015.

CSR files: borehole logs of U series boreholes. Drill Hole Number: U1, U2, U3, U4, U5, U6. Total Drilling Pty Ltd, August 2012. Provided by VGT Pty Ltd on 24 November 2015.

McCloy Group: Plan of proposed subdivision of Lot 2 DP 1145348. Project HD34, drawing HD05 Rev 3, 23/10/2015.

Emails: between MSB and McCloy regarding proposed development and MSB requirements, dated 4/11/2015, 10/11/2015, 11/11/2015.

Aerial photographs 2001 to 2015: Accessed from Google Earth and NSW Department of Lands during November 2015.

MSB Graduated Design Guidelines for Residential Construction (NSW). www.minesub.nsw.gov.au accessed 02/12/2015

GENERAL NOTES

GHD GEOTECHNICS
Specialist Services in Geotechnical Engineering,
Geology, Field/Laboratory Testing and Hydrogeology
www.ghd.com.au/ghdgeotechnics

The report contains the results of a geotechnical investigation conducted for a specific purpose and client. The results should not be used by other parties, or for other purposes, as they may contain neither adequate nor appropriate information. In particular, the investigation does not cover contamination issues unless specifically required to do so by the client.

TEST HOLE LOGGING

The information on the test hole logs (boreholes, test pits, exposures etc.) is based on a visual and tactile assessment, except at the discrete locations where test information is available (field and/or laboratory results). The test hole logs include both factual data and inferred information. Moreover, the location of test holes should be considered approximate, unless noted otherwise (refer report). Reference should also be made to the relevant standard sheets for the explanation of logging procedures (Soil and Rock Descriptions, Core Log Sheet Notes etc.).

GROUNDWATER

Unless otherwise indicated, the water levels presented on the test hole logs are the levels of free water or seepage in the test hole recorded at the given time of measuring. The actual groundwater level may differ from this recorded level depending on material permeabilities (i.e. depending on response time of the measuring instrument). Further, variations of this level could occur with time due to such effects as seasonal, environmental and tidal fluctuations or construction activities. Confirmation of groundwater levels, phreatic surfaces or piezometric pressures can only be made by appropriate instrumentation techniques and monitoring programmes.

Ref: DS5.5.1 Issue 1.6 Date: 28/07/2009

INTERPRETATION OF RESULTS

The discussion or recommendations contained within this report normally are based on a site evaluation from discrete test hole data, often with only approximate locations (e.g. GPS). Generalised, idealised or inferred subsurface conditions (including any geotechnical cross-sections) have been assumed or prepared by interpolation and/or extrapolation of these data. As such these conditions are an interpretation and must be considered as a guide only.

CHANGE IN CONDITIONS

Local variations or anomalies in the generalised ground conditions do occur in the natural environment, particularly between discrete test hole locations. Additionally, certain design or construction procedures may have been assumed in assessing the soil-structure interaction behaviour of the site. Furthermore, conditions may change at the site from those encountered at the time of the geotechnical investigation through construction activities and constantly changing natural forces.

Any change in design, in construction methods, or in ground conditions as noted during construction, from those assumed or reported should be referred to this firm for appropriate assessment and comment.

GEOTECHNICAL VERIFICATION

Verification of the geotechnical assumptions and/or model is an integral part of the design process - investigation, construction verification, and performance monitoring. Variability is a feature of the natural environment and, in many instances, verification of soil or rock quality, or foundation levels, is required. There may be a requirement to extend foundation depths, to modify a foundation system and/or to conduct monitoring as a result of this natural variability. Allowance for verification by appropriate geotechnical personnel must be recognised and programmed for construction.

FOUNDATIONS

Where referred to in the report, the soil or rock quality, or the recommended depth of any foundation (piles, caissons, footings etc.) is an engineering estimate. The estimate is influenced, and perhaps limited, by the fieldwork method and testing carried out in connection with the site investigation, and other pertinent information as has been made available. The material quality and/or foundation depth remains, however, an estimate and therefore liable to variation. Foundation drawings, designs and specifications should provide for variations in the final depth, depending upon the ground conditions at each point of support, and allow for geotechnical verification.

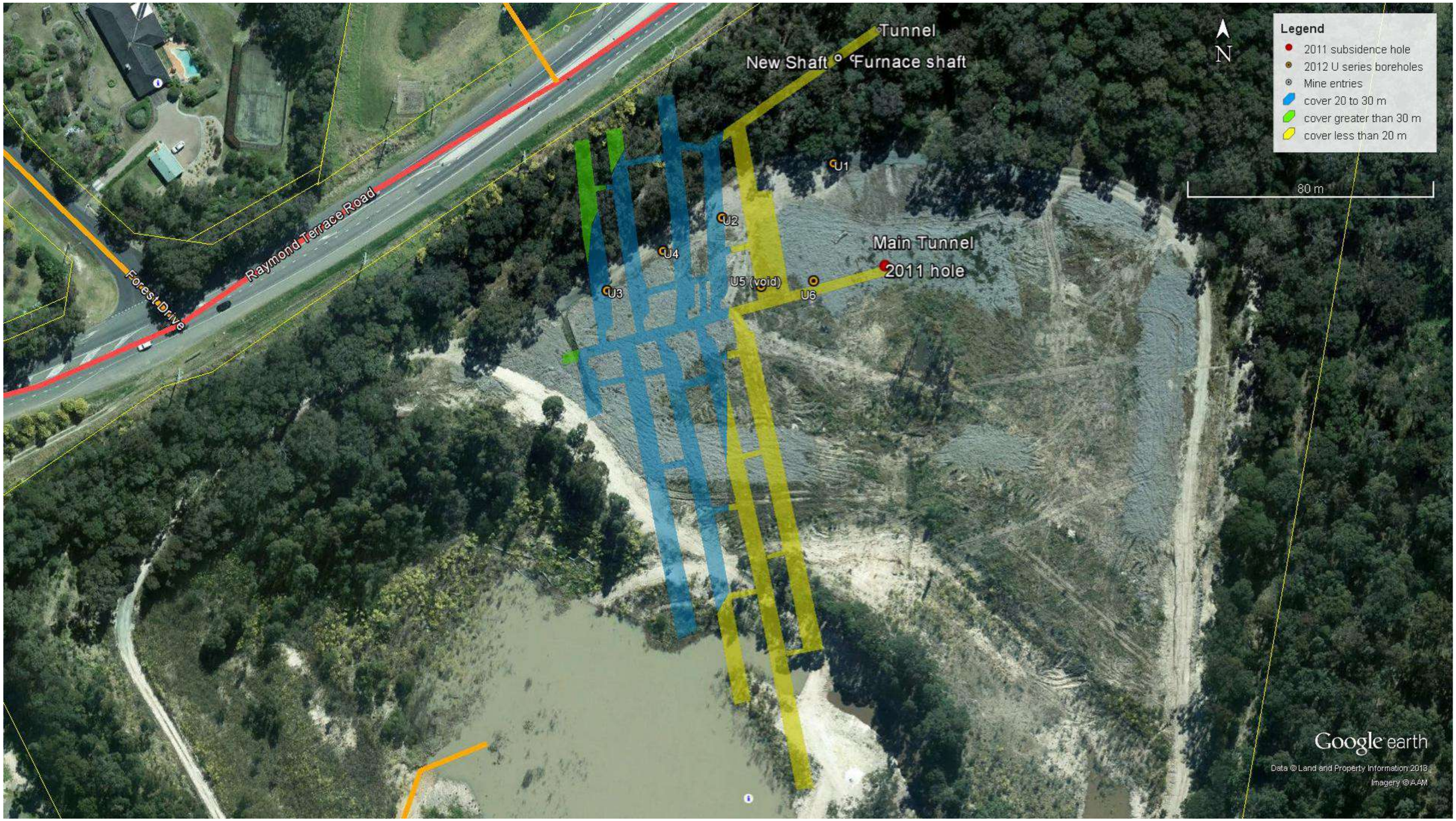
CLIMATE CHANGE

GHD Geotechnics acknowledges the occurrence of ongoing climate change. Cognisance is given to climate change issues as may be applicable to specific geotechnical investigations and assessments.

REPRODUCTION OF REPORTS

Where it is desired to reproduce the information contained in our geotechnical report, or other technical information, for the inclusion in contract documents or engineering specification of the subject development, such reproductions must include at least all of the relevant test hole and test data, together with the appropriate Standard Description sheets and remarks made in the written report of a factual or descriptive nature.

Reports are the subject of copyright and shall not be reproduced either totally or in part without the express permission of GHD.



McCloy Group

Proposed Residential Development – Thornton North

Preliminary plan of mine workings

scale | As shown date | December 2015

job no | 22-18155

file ref | 22-18155_FIG1.ppt

Figure 1

©

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Proposed Seniors Living Development Preliminary Geotechnical Assessment

Lot 2 DP 1145348,
107 Haussman Drive,
Thornton

NEW17P-0074-AA
29 June 2017

Qualtest
LABORATORY (NSW) PTY LTD

GEOTECHNICAL I LABORATORY I EARTHWORKS I QUARRY I CONSTRUCTION MATERIAL TESTING

29 June 2017

McCloy Group,
Suite 1, Level 3, 426 King St,
Newcastle West NSW 2302

Attention: Mr Shane Boslem

Dear Shane,

RE: PROPOSED SENIORS LIVING DEVELOPMENT
LOT 2 DP 1145348 (NO. 107) HAUSSMAN DRIVE, THORNTON
PRELIMINARY GEOTECHNICAL ASSESSMENT

Please find enclosed our Preliminary Geotechnical Assessment report for the proposed seniors living development, to be located at 107 Haussman Drive, Thornton.

The report includes preliminary geotechnical recommendations for urban development including earthworks procedures, batter slopes, and preliminary site classification in accordance with AS2870-2011, "*Residential Slabs and Footings*".

If you have any further questions regarding this report, please do not hesitate to contact Shannon Kelly or the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd

Jason Lee
Principal Geotechnical Engineer

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Figure AA1: Site Layout and Approximate Test Pit Locations

Appendix A: Results of Field Investigations

Appendix B: Results of Laboratory Testing

Appendix C: CSIRO Sheet BTF 18

1.0 Introduction

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present this report on behalf of McCloy Group Pty Ltd (McCloy), for the proposed seniors living development located at Lot 2 DP 1145348, No. 107 Haussman Drive, Thornton.

Based on the brief and lot layout plans provided in an email from McCloy dated 2 May 2017, the project is understood to comprise cutting and filling within the limits of the former quarry site, to allow for the construction of an unspecified number of senior's living residential units, associated pavements, amenities, recreational areas and park reserves.

The scope of work for the geotechnical investigation included providing discussion and recommendations on the following:

- Site capability assessment - Assessing the suitability of the site for proposed development from a geotechnical perspective, including geotechnical constraints for development;
- Preliminary site classification to AS2870-2011, "*Residential Slabs and Footings*";
- Recommendations for earthworks including site preparation, excavation conditions, batters and benching, the suitability of the site soils for use as fill, and fill construction procedures.

This report presents the results of the field work investigations and laboratory testing, and provides recommendations for the scope outlined above.

2.0 Field Work

Field work investigations were carried out on 17 May, 2017 and comprised of:

- DBYD search of proposed test locations was undertaken to check proposed test locations for the presence of underground services;
- Site walkover to make observations of surface features at the property and in the immediate surrounding area;
- Excavation of 14 test pits (TP01 to TP14) using a 14 tonne rubber tracked excavator equipped with a 1100mm wide bucket to depths of between 0.90m and 3.30m. Dynamic Cone Penetrometer tests (DCP's) were undertaken adjacent to the test pit locations TP01 to TP04;
- Undisturbed samples (U50 tubes) and bulk disturbed samples were taken for subsequent laboratory testing;
- Test pits were backfilled with the excavation spoil and compacted using the excavator bucket and tracks.

Investigations were carried out by an experienced Geotechnical Engineer from Qualtest who located the test pits, carried out the testing and sampling, produced field logs of the test pits, and made observations of the site surface conditions.

Engineering logs of the test pits are presented in Appendix A.

Approximate test pit locations are shown on the attached Figure AA1. Test pits were located in the field by handheld GPS and relative to existing site features including topographic features, lot boundaries, existing developments and trees.

Approximate reduced levels of the test pits have been interpolated from the survey plan provided by the client, (Drawing Ref: Project No. 15327, Drawing No. 1, Revision 1, dated 09/05/2017, prepared by Delfs Lascelles Consulting Surveys), on which Figure AA1 is based.

3.0 Site Description

3.1 Surface Conditions

The site is located at Lot 2 DP1145348, No. 107 Haussman Drive, Thornton, which is an irregular shaped allotment with a total plan area of about 39ha, which is the location of a disused clay quarry. The lot is bounded to the northwest by Raymond Terrace Road, to the east by undeveloped bushlands, to the south by residential lots, and to the west by an electricity sub-station and Haussman Drive.

The proposed area of development is understood to be generally limited to the zone containing most previous disturbance and vegetation clearing shown as the unshaded area visible on Figure AA. This area and is generally bounded by an unsealed access track on most sides, and by the crest of the quarry pit to the south and southeast.

The site is situated within an area of gently to moderately undulating topography, occupying the upper catchment of a local ephemeral creek which drains to the east from the eastern boundary of the site.

Based upon the survey plan provided by the client, ground levels are understood to range from about RL18m within the creek on the eastern boundary, up to about RL40 (AHD) near the western boundary in the vicinity of Haussman Drive.

The topography of the site has been modified during previous site use as a clay quarry. The main area of extraction was from the south-western side of the quarry pit, leaving batters along the southern to north-western edges of the pit, with a maximum height of about 12m along the western edge.

These batters generally drain towards a lower area of the quarry pit which has previously been levelled by filling, positioned near the centre of the site in the vicinity of TP01 to TP04. Based upon fill depth observed in these test pits, the fill is judged to mostly be of depths in the order of 1.5m or shallower.

A drainage channel is connected to the northern edge of the levelled fill area, draining through a cutting into bedrock towards the east-southeast into a detention basin (dam). A culvert is located beneath the access road on the eastern side of the dam, draining into the natural gully / creek near the eastern boundary of the site.

The northern area of the quarry pit generally slopes to the south towards the drainage channel and dam.

Existing development at the site includes the unsealed access roads mapped on the survey plan. Swale drains are present in several areas outside the quarry pit. No significant structures were observed at the site.

The site of proposed development is generally vegetated by established grass cover and a sparse to moderate cover of bushes and established trees. The coverage of bushes and established trees was denser on the outer perimeter of the site, while the fill at the approximate centre of the site was covered by short grass.

Photographs of the site taken on the day of the site investigations are shown below.

Photograph 1: From access road on southern area of site to the south of the filled area, facing west.

Photograph 2: From access road on southern area of site to the south of the filled area, facing north.

Photograph 3: From access road on western side of filled area, facing north.

Photograph 4: From access road on western side of filled area, facing southeast.

Photograph 5: Possible topsoil /fill mound at location of TP07, facing south.

Photograph 6: Drainage channel connecting to northern side of filled area, facing east. Rock outcropping visible in sides.

Photograph 7: Dam on eastern side of site, facing west.

Photograph 8: Facing southeast towards culvert outlet from dam into gully / creek on eastern boundary.

Photograph 9: View from access road south of dam, facing south.

Photograph 10: View of cleared area north of dam, facing north-west towards TP09 location.

Photograph 11: From access road along northwest edge of site, facing east.

Photograph 12: From access road along northwest edge of site, facing southeast.

3.2 Subsurface Conditions

Reference to the 1:100,000 Newcastle Regional Geology Series Sheet 9232 indicates the site to be underlain by the Tomago Coal Measures, comprising shale, mudstone, sandstone, coal, tuff and clay.

The typical soil types encountered at test pit locations during the field investigation have been divided into geotechnical units as summarised in Table 1.

TABLE 1 – SUMMARY OF GEOTECHNICAL UNITS AND SOIL TYPES

Unit	Soil Type	Description
1A	FILL – Topsoil / Root Affected	Sandy CLAY, Silty Sandy CLAY, CLAY – low plasticity to medium plasticity, dark brown / dark grey, fine to medium grained sand, root affected, some gravel in places.
1B	FILL - Other	Variable soil materials including: Sandy CLAY – variable plasticity, variable colours often including shades of grey and brown, fine to medium grained sand, trace / some fine to medium grained sub-angular to sub-rounded gravel. SAND – fine to medium grained, brown, some fines of low plasticity. CLAY – high plasticity, dark grey, with pockets and lenses of Gravelly Silty SAND. Gravelly Clayey SAND.
2	TOPSOIL	Sandy CLAY – low plasticity, dark grey-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel in places, root affected. Silty SAND – fine to medium grained, dark brown, fines of low plasticity, some fine to medium grained sub-angular to sub-rounded gravel in places, root affected.
3	RESIDUAL SOIL	Sandy CLAY – medium plasticity to high plasticity, grey to pale grey with some orange / dark grey to black / pale grey to white with some orange, fine to medium grained sand, some fine to medium grained angular to sub-rounded gravel in places. CLAY – medium plasticity to high plasticity, dark grey to black / pale grey to grey, some orange, some fine to medium grained sand. Silty CLAY – medium to high plasticity, pale orange-grey. Silty SAND – fine to coarse grained, black, fines of medium plasticity (ORIGIN: COAL). Clayey SAND, Gravelly CLAY, Clayey Gravelly SAND with cobble sized rock fragments. With relict rock structure, extremely weathered pockets in places.
4	EXTREMELY WEATHERED (EW) ROCK with soil properties	Extremely weathered SANDSTONE with soil properties, breaks down into Sandy CLAY – medium to high plasticity, grey to pale grey with orange.
5	HIGHLY WEATHERED (HW) ROCK	SHALE, SILTSONE, COAL - estimated very low to low strength. SANDSTONE - estimated low to medium strength. Extremely to highly weathered in places.

Table 2 contains a summary of the distribution of the above units at the test pit locations.

TABLE 2 – SUMMARY OF GEOTECHNICAL UNITS ENCOUNTERED AT EACH TEST LOCATION

Location	UNIT 1A FILL-Topsoil	UNIT 1B FILL - Other	UNIT 2 Topsoil	UNIT 3 Residual Soil	UNIT 4 EW Rock	UNIT 5 HW Rock
	Depth (metres)					
TP01	0.00 - 0.10	0.10 - 0.30	-	0.30 - 1.00 2.20 - 2.30	-	1.00 - 2.20 2.30 - 3.30
TP02	0.00 - 0.20	0.20 - 0.50	-	0.50 - 0.60	0.60 - 0.80	0.80 - 0.90*
TP03	0.00 - 0.50	0.50 - 1.50	-	1.50 - 1.70	-	1.70 - 2.20
TP04	0.00 - 0.10	0.10 - 1.50	-	1.50 - 2.00	-	2.00 - 2.20
TP05	0.00 - 0.10	0.10 - 0.30	-	0.30 - 1.60	-	1.60 - 2.30
TP06	0.00 - 0.40	0.40 - 1.80	-	1.80 - 2.20	-	-
TP07	0.00 - 0.60	-	-	0.60 - 1.20	-	1.20 - 3.00
TP08	-	-	0.00 - 0.30	0.30 - 0.70	-	0.70 - 0.95*
TP09	-	0.00 - 0.60	-	0.60 - 1.50	-	1.50 - 1.60*
TP10	-	-	0.00 - 0.30	0.30 - 2.00	-	2.00 - 2.40
TP11	0.00 - 0.50	-	0.50 - 0.70	0.70 - 1.70	-	1.70 - 2.10
TP12	-	-	0.00 - 0.30	0.30 - 0.90	-	0.90 - 0.95*
TP13	0.00 - 0.30	0.30 - 0.80	-	-	-	0.80 - 1.70*
TP14	-	-	0.00 - 0.20	0.20 - 0.50	-	0.50 - 1.60*
NOTES: * denotes practical refusal of 14 tonne excavator bucket.						

No groundwater levels or inflows were encountered in the test pits during the limited time that they remained open on the day of the field investigations.

It should be noted that groundwater conditions can vary due to rainfall and other influences including regional groundwater flow, temperature, permeability, recharge areas, surface condition, and subsoil drainage.

4.0 Laboratory Testing

Samples collected during the field investigations were returned to our NATA accredited Warabrook Laboratory for testing which comprised of:

- (7 no.) Atterberg tests;
- (1 no.) Four day soaked California Bearing Ratio (CBR) test and Standard Compaction.

Results of the laboratory testing are presented in Appendix B, with a summary of the results presented in Table 3 & Table 4.

Proposed Shrink/Swell tests were replaced with Atterberg Limits tests due to the typically friable nature of the site soils.

TABLE 3 – SUMMARY OF ATTERBERG LIMITS TESTING RESULTS

Location	Depth (m)	Material Description	Liquid Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
TP05	0.7 – 0.9	(CH) CLAY	43	24	7.0
TP06	0.9 – 1.1	FILL (CI) Sandy CLAY	38	19	7.0
TP07	0.7 – 0.8	(CH) CLAY	55	33	10.5
TP08	0.4 – 0.7	(CH) CLAY	57	39	11.0
TP09	0.7 – 0.9	(CH) Sandy CLAY	71	40	14.5
TP10	0.5 – 0.9	(CH) CLAY	47	31	10.0
TP12	0.3 – 0.4	(CH) Sandy CLAY	71	47	7.5

TABLE 4 – SUMMARY OF CBR TESTING RESULTS

Location	Sample Depth (m)	Field Moisture Content (%)	Optimum Moisture Content (%)	Relationship of Field MC to OMC (%)	CBR (%)
TP13	0.9 – 1.2	13.2	17.2	4.0 dry	25

5.0 Discussion and Recommendations

5.1 General Suitability of the Site for the Proposed Development

The main geotechnical issues affecting urban capability identified at the site include:

- The presence of relatively steep slopes (in the order of 12° to 22°) in some areas of the site, including at the southern and western edges of the existing quarry pit. The likelihood of slope instability events may be higher in these areas than flatter areas if sound engineering and good hillside practice is not undertaken. This is likely to include stripping of existing uncontrolled fill, and flattening of batters where appropriate for the proposed development.
- The presence or inferred presence of uncontrolled fill affecting the majority of the existing quarry footprint. The existing fill has been assessed to be uncontrolled fill for the purposes of assessing preliminary site classifications, and footing should not be founded on the uncontrolled fill in its current state.

Based on the results of field investigations the site is considered suitable for the proposed development from a geotechnical viewpoint provided that development is carried out in accordance with sound engineering principles and good hillside practice, and with respect to the constraints and recommendations of this report, including geotechnical input during the design and construction phase.

Further geotechnical investigation and advice should be carried out during detailed design phase for earthworks/retention design, site classification to AS2870-2011 and pavement design as required.

In areas of previous filling, detailed geotechnical investigation at future stages of the development is recommended to delineate the extent, depth and properties of the fill.

Preliminary investigation of the roughly level filled area in the base of the pit, (as shown in Figure AA), indicates filling to be in the order of up to 1.5m depth. Based on anecdotal evidence, it is understood that the fill may have been placed as engineered fill I in the order of 15 to 20 years ago. Despite the generally compact appearance of the material, at the time of this assessment Qualtest has not been provided with records of the placement or compaction of this material; therefore, it has been assessed to be uncontrolled fill for the purposes of this assessment.

Based upon results of hand penetrometer and DCP testing at discrete locations, it is judged that a significant proportion of the filled area in the base of the pit may be of inadequate bearing capacity for support of residential footings. This may have been caused or contributed to by slower drainage in this lower lying position of the site, and resulting high moisture content of some of the fill materials.

Based upon the available information, it is recommended that allowance be made to remove and replace the existing fill materials as controlled fill. Subject to moisture conditioning (drying back), the majority of existing fill is anticipated to be suitable for re-use as general fill for engineering purposes; however, near surface topsoil and root affected material is likely to be suitable for landscaping purposes only.

In areas where proposed depth of controlled filling exceeds 2m (above existing site levels), and site preparation results in a suitable subgrade foundation for placement of controlled fill, the option of leaving existing fill materials in place may be considered. This may involve site preparation including stripping of topsoil, reworking and compaction of the upper fill surface, and proof roll assessment to identify any soft or deflecting areas requiring removal and replacement with approved controlled fill.

The option of leaving the fill in place (in its current condition) may carry a larger risk than would normally be accepted for low risk residential construction that settlements may exceed normal limits. It is recommended that further engineering assessment and advice is sought if this option is proposed in terms of remediation requirements for the filled areas.

Alternatively settlement sensitive structures may be supported on piers founded in bedrock beneath all uncontrolled fill, designed in accordance with sound engineering principles.

5.2 Preliminary Site Classification to AS2870-2011

Based on the results of the field work and laboratory testing, the site of the proposed seniors living development located at Lot 2 DP1145348, No. 107 Haussman Drive, Thornton, as shown on Figure AA1, is preliminary classified in its current condition in accordance with AS2870-2011 *'Residential Slabs and Footings'*, as **Class 'P'**.

The site is classified as **Class 'P'** due to the presence or inferred presence of fill to depths of greater than 0.4m in many locations. The fill includes variable depths and types of soil materials understood to remain from previous quarry activities at the site. As there are no records of placement or compaction of the fill available, the existing fill has been assessed to be uncontrolled fill for the purposes of assessing preliminary site classifications.

The underlying natural soil profiles are anticipated to be classified as **Class 'M'** or potentially **Class 'H1'**, dependent on depth and reactivity of residual clay overlying weathered rock.

If site re-grading works involving cutting or filling are performed after the date of this assessment, the classification may change and further advice should be sought.

Based upon discussions with the client, it is understood that significant earthworks are proposed at the site including reshaping batters and filling deeper areas of the quarry pit, likely to depths of several metres.

As a preliminary guide, if cutting is carried out to remove all uncontrolled fill, exposing residual soil or weathered rock, or if the site is filled with site won residual soil, weathered rock or similar material, carried out to 'Level 1' criteria as defined in Clause 8.2 – Section 8, of AS3798-2007, lots are likely to be classified as **Class 'M'** or **Class 'H1'**.

With engineering input and measures such as providing a sufficiently thick (about 0.2m to 0.3m depth) topsoil layer of very low to non-reactive soil, and using fill with Iss of about 2.0% or less, it is envisaged that site classification of **Class 'M'** could be achievable in most cases. However, this would need to be confirmed at the time of bulk earthworks once the type of fill and level of filling is confirmed. For higher reactivity fill material (of Iss greater than about 2.0%), filled areas may potentially be classified **Class 'H1' to Class 'E'**, depending upon the source and Iss of the fill.

Final site classification will be dependent on a number of factors, including depth of topsoil, depth of fill and residual soil, reactivity of the natural soil and any fill material placed, and the level of supervision carried out. Re-classification of lots should be confirmed by the geotechnical authority at the time of construction following any site re-grade works.

Footings for the proposed development should be designed and constructed in accordance with the requirements of AS2870-2011.

The classification presented above assumes that:

- All footings are founded in controlled fill (if applicable) or in the residual clayey soils or rock below all non-controlled fill, topsoil material and root zones, and fill under slab panels meets the requirements of AS2870-2011, in particular, the root zone must be removed prior to the placement of fill materials beneath slabs;
- The performance expectations set out in Appendix B of AS2870-2011 are acceptable, and that site foundation maintenance is undertaken to avoid extremes of wetting and drying;
- Footings are to be founded outside of or below all zones of influence resulting from existing or future service trenches;
- The constructional and architectural requirements for reactive clay sites set out in AS2870-2011 are followed;
- Adherence to the detailing requirement outlined in Section 5 of AS2870-2011 '*Residential Slabs and Footings*' is essential, in particular Section 5.6, '*Additional requirements for Classes M, H1, H2 and E sites*' including architectural restrictions, plumbing and drainage requirements;
- Site maintenance complies with the provisions of CSIRO Sheet BTF 18, "*Foundation Maintenance and Footing Performance: A Homeowner's Guide*", a copy of which is attached in Appendix C.

All structural elements on all lots should be supported on footings founded beneath all uncontrolled fill, layers of inadequate bearing capacity, soft/loose, wet or other potentially deleterious material.

If any localised areas of uncontrolled fill of depths greater than 0.4m are encountered during construction, footings should be designed in accordance with engineering principles for Class 'P' sites.

The classification provided is preliminary based on broadly spaced investigations and limited surface observations, and should be confirmed prior to design of foundations. It is recommended that targeted investigations be carried out once a concept design including proposed cut/fill earthworks is developed, and that the extent of existing fill is further investigated prior to or during earthworks construction.

5.3 Excavation Conditions and Depth to Rock

The depths of fill, topsoil, colluvium, residual soils and weathered rock, together with depths of practical refusal of the 14 tonne excavator where encountered are summarised in Table 2.

In terms of excavation conditions, site materials can generally be divided into:

- Clayey and Granular Soils (Units 1, 2 & 3). It is anticipated that these materials could be excavated by a conventional excavator or backhoe bucket;
- Weathered Rock (Unit 4 & 5). Rippability is dependent on rock strength, depth, degree of weathering and number of defects within the rock mass which can vary significantly.

It is anticipated that the Weathered Rock (Unit 4 & 5) material encountered could be excavated by conventional 14 tonne excavator or equivalent at least to the depths indicated on the appended test pit logs.

It is expected that material below the depth of 14 tonne excavator bucket refusal will be excavatable by ripping to some greater depth, although this has not been assessed as part of the current investigation.

It is recommended that targeted investigations (e.g. cored boreholes) are carried out if significant excavations are proposed where bedrock depth or excavatability is important to design or construction.

Care should be taken not to disturb or destabilise existing underground services or structures.

Slow water inflow is likely from the topsoil if earthworks are carried out following wet weather. It is also possible that groundwater could exist at localised areas of the site such as from water perched above the residual clay / bedrock profile, or in areas of existing depressions / dams.

5.4 Batter Slope Recommendations

Site materials should be supported by properly designed and constructed retaining walls or else battered in accordance with the recommended batter slopes summarised in Table 5, and protected against erosion.

Selection of batter slopes should consider future maintenance activities, such as operation of mowing equipment where necessary, requiring batters of about 1V:4H or flatter.

Temporary excavations to depths of up to 1.2m in competent compact material with sufficient cohesion, such as clay of stiff consistency or better may be battered vertically, subject to inspection during excavation by the geotechnical authority. Deeper excavations may be supported by means of temporary shoring.

Temporary earthworks in any wet or granular soils are likely to require shallow batters or shoring to prevent slumping and/or collapse.

Visual assessment for signs of instability should be made prior to carrying out any work in the excavation. If any deflection or excavation instability is observed, the excavation should be backfilled and further geotechnical advice sought.

The safe working procedures of Work Cover NSW *Excavation work code of practice*, dated July 2014 should be followed.

Recommended batter slopes for each inferred geotechnical unit are summarised in Table 5.

TABLE 5 - RECOMMENDED BATTER SLOPES

GEOTECHNICAL UNIT	MATERIAL TYPE	MAXIMUM SLOPE OF EXCAVATED UNSUPPORTED BATTER	
		Temporary Excavations *	Permanent Excavations
UNIT 1 & 2	Existing Fill & Topsoil	1V:1.5H	1V:3H
UNIT 3	Residual Soil (& Controlled Fill)	1V:1H	1V:2H
UNIT 4	Extremely Weathered Rock	1V:0.5H	1V:1.5H
UNIT 5	Highly Weathered Rock	1V:0.5H	1V:1H

NOTE: * Subject to inspection during excavation to check for water inflow, lack of soil cohesion, adversely orientated defects or other conditions that could affect stability of the slope.

Areas which may be subject to inundation should have flattened batters (approximately 1V:3.5H or flatter depending upon specific assessment).

Excavations should be designed for surcharge loading from slopes, retaining walls, structures and other improvements in the vicinity of the excavation.

Surcharge loads such as stockpiles of excavated soils and vehicle traffic should not be applied within a 1V:1.5H projection from the toe of any excavations or embankments, or within a 1m offset from the crest of the excavation or embankments, unless specific assessment is undertaken.

Drainage measures should be implemented above and behind all temporary and permanent batter slopes to avoid concentrated water flows on the face or infiltration into the soil/rock profile behind the face. Surface water flows from upslope areas should be diverted away from the face.

5.5 Design Subgrade CBR for Pavement Design

Based on the results of the field work, laboratory testing, and previous experience in the surrounding area, indicative California Bearing Ratio (CBR) values are provided below for preliminary purposes:

- CBR ≤ 3.0% Possible localised sections or poor / wet subgrade;
- CBR = 3% to 5% Unit 3 – Residual Soils and Controlled Fill (cohesive materials);
- CBR = 8% to 10% Unit 4 & 5 – Extremely to Highly Weathered Rock.

Earthworks including a large amount of filling are expected to occur prior to pavement construction. Therefore values of design subgrade CBR will be largely dependent upon the materials used for filling. It is expected that most areas of poor / wet subgrade will be remediated during the bulk earthworks phase.

The design CBR values for pavement thickness design should be assessed by laboratory testing when pavement layout and subgrade levels / conditions are known.

Subgrade should be prepared in accordance with the site preparation requirements presented in below.

5.6 Site Preparation

Site preparation and earthworks suitable for pavement support should consist of:

- Following any bulk excavation to proposed subgrade level, all areas of proposed pavement construction or site re-grading should be stripped to remove all existing uncontrolled fill, vegetation, topsoil, root affected or other potentially deleterious materials.
- Stripping depths are expected to be variable due to variable depths of existing fill.
- Following stripping, the exposed subgrade should be proof rolled (minimum 10 tonne static roller), to identify any wet or excessively deflecting material. Any such areas should be over excavated and backfilled with an approved select material.
- The moisture content of the subgrade materials and therefore the need for moisture conditioning or over-excavation and replacement, will be largely dependent on pre-existing and prevailing weather conditions at the time of construction;
- Protect the area after subgrade preparation to maintain moisture content as far as practicable. The placement of subbase gravel would normally provide adequate protection.
- Site preparation should include provision of drainage and erosion control as required as well as sedimentation control measures.

It should be anticipated that some moisture conditioning of the subgrade may be necessary prior to compaction and placement of fill materials.

The required time period to prepare the subgrade is likely to be dependent on the prevailing weather conditions at the time of construction.

If over wet subgrades exist at the time of construction or deleterious fill materials are encountered at subgrade level, these materials should be over-excavated and be replaced with a minimum depth of 250mm of well graded granular select material with CBR of 15% or greater. The requirement for, and extent of subgrade replacement / select filling, should be confirmed by the geotechnical authority at the time of construction.

Site preparation should include stripping of any over-wet or deleterious materials from any dams / detention basins and backfilling in accordance with the procedures in Section 5.7.

5.7 Fill Construction Procedures

Earthworks for pavement construction or support of foundations should consist of the following measures:

- Approved fill beneath pavements should be compacted in layers not exceeding 300mm loose thickness to a minimum density ratio of 95% Standard Compaction within ±2% of OMC in cohesive soils;

- The top 300mm of natural subgrade below pavements or the final 300mm of road subgrade fill should be compacted to a minimum density ratio of 98% Standard Compaction within the moisture range of 60% to 90% of Optimum Moisture Content (OMC).
- Site fill beneath structures should be compacted to a minimum density ratio of 98% Standard Compaction within ±2% of OMC in cohesive soils;
- All fill should be supported by properly designed and constructed retaining walls or else battered at 1V:2H or flatter and protected against erosion;
- Where fill is to be placed on slopes in excess of 1V:8H (7°), a prepared surface should be benched or stepped into the natural slope;
- Earthworks should be carried out in accordance with the recommendations outlined in AS3798-2007 'Guidelines for Earthworks for Commercial and Residential Developments'.

5.8 Suitability of Site Materials for Re-Use as Fill

The following comments are made with respect to suitability of site materials for re-use as fill:

- Units 1A & 2 – Topsoil-Fill & Topsoil materials are generally expected to be suitable for re-use for landscaping purposes only;
- Unit 1B – Fill materials may be variable. If fill material is not affected by roots, vegetation or other deleterious material, it may be suitable for re-use as general fill for engineering purposes. These materials will likely require some moisture conditioning, with materials excavated from lower lying areas more likely to require drying back. Suitability for re-use should be confirmed prior to, or at the time of construction;
- Unit 3 – Residual Soils are generally expected to be suitable for re-use as general fill for engineering purposes. These materials will likely require some moisture conditioning;
- Unit 4 & 5 – Extremely to Highly Weathered Rock materials are generally expected to be suitable for re-use as general fill, and possibly select fill in places. These materials may require some moisture conditioning.

Final selection of fill materials should consider properties such as reactivity which is typically moderate for site won Unit 3 Residual Soils, and likely to be lower for site won Unit 4 & 5 weathered rock.

The suitability of material for re-use should be assessed and confirmed by the geotechnical authority at the time of construction.

5.9 Management of Soil Erosion

The need for erosion protection of the site should be addressed during design. Depending upon the detailed design including expected flow rates, measures of protection may include constructing and maintaining appropriate batter slopes, established vegetation using suitably compacted soils, implementing storm water drainage measures to prevent concentrated flows on the slope, rip-rap, geosynthetic and nails, gabion / terramesh walls or concrete lining.

Levels of soil erosion should be able to be maintained within normally acceptable levels by adopting good soil erosion and sedimentation control practices, including:

- Minimise the area and duration of soil exposure by staged development and controlled clearing;
- Stockpile stripped soil for reuse and protect from erosion;

- Control storm water run-off by diverting clean run-off from denuded areas, minimising slope gradient, length and run-off velocities;
- Trap soil and water pollutants using silt traps, sediment basins, perimeter banks, silt fences and nutrient traps as appropriate;
- Re-vegetate as soon as is practicable.

5.10 Drainage

Adequate surface and storm water drainage should be installed and maintained on the building site in accordance with local government requirements.

All collected storm water run-off should be piped into the street drainage system or discharged into existing storm water drain or watercourses in a controlled manner that limits erosion. Surface and sub-soil drains may be required to improve drainage. Septic wastes should be connected to the reticulated disposal system.

If backfilling depressions within the lower lying areas of the existing quarry pit, it is likely to be necessary to divert drainage flows and/or provide dedicated sump and pump areas to prevent water ponding in areas of proposed fill placement.

6.0 Limitations

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted geotechnical design practices and standards. To our knowledge, they represent a reasonable interpretation of the general conditions of the site.

The extent of testing associated with this assessment is limited to discrete test pit locations. It should be noted that subsurface conditions between and away from the test pit locations may be different to those observed during the field work and used as the basis of the recommendations contained in this report.

If subsurface conditions encountered during construction differ from those given in this report, further advice should be sought without delay.

Data and opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement by Qualtest. If this report is reproduced, it must be in full.

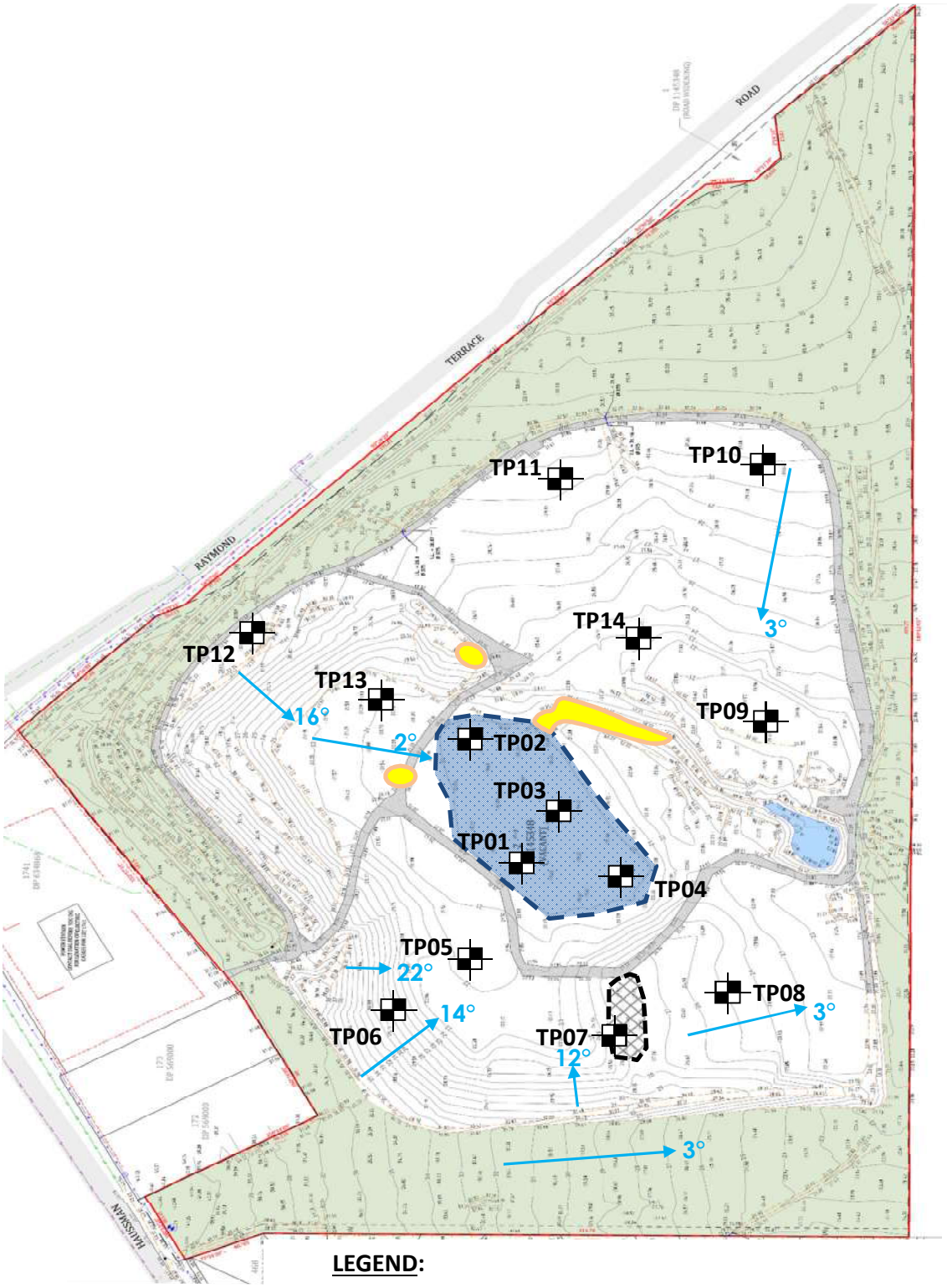
If you have any further questions regarding this report, please do not hesitate to contact Shannon Kelly or the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd.

Jason Lee
Principal Geotechnical Engineer

FIGURE AA1:

Site Layout and Approximate Test Pit Locations



LEGEND:

- Approximate test pit location.
- Approximate extent of filled area in base of pit.
- Approximate extent of potential topsoil fill mound.
- Approximate location of observed rock outcrop.
- 5° Approximate slope angle and direction.

Based upon contour plan prepared by Delfs Lascelles (Proj. No. 15327, Dwg No. 1, Rev. 1, dated 09/05/2017).

Qualtest LABORATORY (NSW) PTY LTD	Client:	McCLOY GROUP	Drawing No:	FIGURE AA1
	Project:	PROPOSED SENIORS LIVING DEVELOPMENT	Project No:	NEW17P-0074
	Location:	107 HAUSSMAN DRIVE, THORNTON	Scale:	N.T.S.
	Title:	SITE LAYOUT AND APPROXIMATE TEST PIT LOCATIONS	Date:	28/06/2017

APPENDIX A:

Results of Field Investigations

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP01
PAGE: 1 OF 2
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 19.5 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
E	Not Encountered		19.5	0.0		CL	0.10m FILL-TOPSOIL: CLAY - low plasticity, dark brown, some fine to medium grained sand, root affected with trace organic matter (plant debris).	M > w_P				FILL - TOPSOIL
						CI	0.30m FILL: Sandy CLAY - medium plasticity, pale grey, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel.	M ~ w_P	St / VSt	HP	200 - 300	FILL
			19.0	0.5		CH	CLAY - medium to high plasticity, dark grey to black.	M < w_P - M < w_P	H	HP	500	RESIDUAL SOIL
										HP	550	
										HP	520	
										HP	500	
										HP	>600	
			18.5	1.0			1.00m SHALE - dark grey to black with brown leaf fossils, estimated very low to low strength.					EXTREMELY TO HIGHLY WEATHERED ROCK
							1.40m COAL - black, highly fractured, some CLAY between joints, estimated very low to low strength.	D				HIGHLY WEATHERED ROCK
			18.0	1.5								
			17.5	2.0								
							2.20m					
						CH	Silty CLAY - medium to high plasticity, pale orange-grey.	M < w_P	St - VSt			RESIDUAL SOIL
							2.30m COAL - black, highly fractured, some CLAY between joints, estimated very low to low strength.					HIGHLY WEATHERED ROCK
			17.0	2.5				D				

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP01
PAGE: 2 OF 2
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 19.5 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
E							COAL - black, highly fractured, some CLAY between joints, estimated very low to low strength. *(continued)*	D				HIGHLY WEATHERED ROCK
							3.30m Hole Terminated at 3.30 m					
			16.0	3.5								
			15.5	4.0								
			15.0	4.5								
			14.5	5.0								
			14.0	5.5								

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

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

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

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1 GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP02
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 19.5 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
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	
E	Not Encountered	E 0.10m				CI	FILL-TOPSOIL: Sandy CLAY - medium plasticity, dark grey, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	M > w_P		HP	550	FILL - TOPSOIL
				0.20m		CI	FILL: Sandy CLAY - medium plasticity, grey to pale grey, fine to medium grained sand, trace fine to medium grained sub-angular to sub-rounded gravel.		St / VSt	HP	220	FILL
				0.40m		SP	FILL: SAND - fine to medium grained, brown, some fines of low plasticity.	M	MD	HP	300	
			19.0	0.5		CH	Sandy CLAY - medium to high plasticity, grey to pale grey with some orange, fine to medium grained sand.			HP	>600	RESIDUAL SOIL
				0.50m								
				0.60m		CH	Extremely Weathered SANDSTONE with soil properties; breaks down into Sandy CLAY - medium to high plasticity, grey to pale grey with some orange, fine to medium grained sand. Sand content increasing with depth.	M ~ w_P	H / VD			EXTREMELY WEATHERED ROCK
				0.80m								HIGHLY WEATHERED ROCK
				0.90m			SANDSTONE - fine to medium grained, orange to dark orange-red (ironstained), estimated low to medium strength.					
			18.5	1.0			Hole Terminated at 0.90 m Refusal					
			18.0	1.5								
			17.5	2.0								
			17.0	2.5								

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP03
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 19.4 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
E	Not Encountered	0.30m E 0.40m	19.0	0.5		CI	FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, pale brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.					FILL - ROOT AFFECTED
							0.50m FILL: CLAY - high plasticity, dark grey, with pockets and lenses of Gravelly Silty SAND - grey to brown.	M > w_P	F	HP	70 - 110	FILL
			18.5	1.0		CH				HP	50 - 90	
									S - F	HP	30 - 60	
							1.30m FILL: Sandy CLAY - medium plasticity, grey to brown, fine to medium sand, some fine to medium sub-angular to sub-rounded gravel.		St / VSt	HP	220	
			18.0	1.5		CI				HP	250	
							1.50m Silty SAND - fine to coarse grained, black, fines of medium plasticity. Residual Soil from COAL.	M	MD	HP	>600	RESIDUAL SOIL
						SM	1.60m					
						CH	Sandy CLAY - high plasticity, pale grey, fine to medium grained sand.	M < w_P	H	HP	>600	
							1.70m SHALE - pale grey-green, very low to low strength.					EXTREMELY TO HIGHLY WEATHERED ROCK
			17.5	2.0								
							2.20m Hole Terminated at 2.20 m					
			17.0	2.5								
			16.5									

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR. THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP04

CLIENT: McCLOY GROUP
PAGE: 1 OF 1
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
JOB NO: NEW17P-0074
LOCATION: 107 HAUSSMAN DRIVE, THORNTON
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
SURFACE RL: 19.7 m
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 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
E	Not Encountered	0.70m E 0.80m	19.5	0.5		CL	0.10m FILL-TOPSOIL: Sandy CLAY - low plasticity, dark grey, fine to medium sand, root affected.					FILL - TOPSOIL
							FILL: Sandy CLAY - low to medium plasticity, pale orange-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel.			HP	170	FILL
			19.0	1.0		CI	With pockets and lenses of Silty SAND - fine to medium grained, brown, fines of low plasticity.	M > w_P	St	HP	150	
			18.5	1.5		CH	1.30m FILL: Sandy CLAY - medium to high plasticity, dark grey to black, fine to medium grained sand, some fine to medium grained angular to sub-angular gravel.		F	HP	90	
			18.0	2.0		CH	1.50m Sandy CLAY - medium to high plasticity, dark grey to black, fine to medium grained sand, some fine to medium grained angular gravel.	M ~ w_P	VSt	HP	320	RESIDUAL SOIL
			17.5	2.5			2.00m SILTSTONE - pale grey to grey banded, estimated very low to low strength. 2.20m	D				EXTREMELY TO HIGHLY WEATHERED ROCK
			17.0				Hole Terminated at 2.20 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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP05
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 21.5 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
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	
E	Not Encountered		21.5	0.0		CL	0.10m FILL: Sandy CLAY - low plasticity, dark grey-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	M < w_P				FILL - ROOT AFFECTED
						CI	0.30m FILL: Sandy CLAY / Gravelly Clayey SAND - medium plasticity, grey with some orange, fine to medium grained sand, fine to medium grained sub-angular to angular gravel.		St - VSt	HP	250	FILL
			21.0	0.5		SC	Clayey SAND - fine to medium grained, pale grey with some orange, fines of medium to high plasticity.	M	D			RESIDUAL SOIL
		0.70m					0.70m					
		B 0.90m				CH	CLAY - high plasticity, grey with dark grey banding, some orange.	M < w_P	H	HP	>600	RESIDUAL SOIL WITH RELICT ROCK STRUCTURE
			20.5	1.0								
			20.0	1.5			1.60m SILTSTONE - grey and pale grey banded, estimated very low to low strength.	D				EXTREMELY TO HIGHLY WEATHERED ROCK
			19.5	2.0			2.30m					
			19.0	2.5			Hole Terminated at 2.30 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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP06
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 26.5 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
E	Not Encountered		26.5	0.0		SM	FILL-TOPSOIL: Silty SAND - fine to medium grained, dark brown, fines of low plasticity, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	D				FILL - TOPSOIL
							0.40m					
			26.0	0.5		Cl	FILL: Sandy CLAY - medium plasticity, pale grey to grey, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, some roots.		St			FILL
		0.90m					0.90m					
		B 1.10m	25.5	1.0		Cl	FILL: Sandy CLAY - medium plasticity, pale grey to grey, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel.	M ~ w_P	VSt / Fb	HP	320	FILL possibly RESIDUAL SOIL
			25.0	1.5		Cl	1.50m FILL: Sandy CLAY - medium plasticity, grey with some orange, fine to medium grained sand, some fine to medium grained sub-angular to angular gravel.			HP	360	
							1.80m			HP	350	
			24.5	2.0		CH	Gravelly CLAY - high plasticity, pale grey to white some orange, fine rounded to sub-rounded gravel, some fine to medium grained sand.		VSt - H	HP	350 - 420	RESIDUAL SOIL / EXTREMELY WEATHERED ROCK
							2.20m			HP	>600	
			24.0	2.5			Hole Terminated at 2.20 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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP07
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 27.8 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
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	
E	Not Encountered		27.5	0.5		SM	FILL-TOPSOIL: Silty SAND - fine to medium grained, dark brown, fines of low plasticity, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	D / M				FILL - MOUND CONTAINING TOPSOIL
		0.70m B 0.80m	27.0			CH	CLAY - high plasticity, pale grey to grey, some fine to medium grained sand.	M > w_P	VSt	HP HP	200 220	RESIDUAL SOIL
				1.0		CH	Sandy CLAY - high plasticity, pale grey to white some orange, fine to medium grained sand, some fine angular to sub-angular gravel.	M ~ w_P	VSt - H	HP HP	350 >600	
			26.5	1.5			SILTSTONE - pale grey to grey, estimated very low to low strength.					EXTREMELY TO HIGHLY WEATHERED ROCK
			26.0	2.0			becoming dark grey-brown	D				
			25.5	2.5								
			25.0									

0.60m
0.90m
1.20m
3.00m

Hole Terminated at 3.00 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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

TEST PIT NO: **TP08**

CLIENT: McCLOY GROUP
PAGE: 1 OF 1

PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
JOB NO: NEW17P-0074

LOCATION: 107 HAUSSMAN DRIVE, THORNTON
LOGGED BY: BB

DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
SURFACE RL: 24.0 m

TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
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	
E	Not Encountered					CL	TOPSOIL: Sandy CLAY - low plasticity, dark grey-brown, fine to medium grained sand, root affected.	M < w_P				TOPSOIL
							0.30m					
		0.40m					CLAY - high plasticity, pale grey to grey, some fine to medium grained sand, some fine grained sub-rounded to rounded gravel.					RESIDUAL SOIL
		B	23.5	0.5		CH		M > w_P	VSt	HP	250	
		0.70m								HP	320	
							0.70m					
							SILTSTONE - grey, estimated very low to low strength.	D		HP	>600	EXTREMELY TO HIGHLY WEATHERED ROCK
							0.90m					
							0.95m SANDSTONE - fine to medium grained, pale grey to orange, estimated very low to medium strength.					HIGHLY WEATHERED ROCK
			23.0	1.0			Hole Terminated at 0.95 m Refusal					
			22.5	1.5								
			22.0	2.0								
			21.5	2.5								

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

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

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

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP09
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 20.5 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
E	Not Encountered	0.70m B 0.90m	20.0	0.5		SC	FILL: Gravelly Clayey SAND - fine to medium grained, grey-brown, fine to medium grained sub-angular to sub-rounded gravel, fines of low to medium plasticity.	M / M > w_P				FILL
							0.60m					
			19.5	1.0		CH	Sandy CLAY - high plasticity, pale grey to white some orange, fine to medium grained sand, some fine to medium grained rounded to sub-rounded gravel.	M > w_P	H	HP HP	>600 >600	RESIDUAL SOIL
			19.0	1.5			1.50m					
							SHALE - pale grey-green, estimated very low to low strength.	D				HIGHLY TO MODERATELY WEATHERED ROCK
							1.60m					
							Hole Terminated at 1.60 m Refusal					
			18.5	2.0								
			18.0	2.5								

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR. THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP10
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 30.6 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
E	Not Encountered		30.5			CL	TOPSOIL: Sandy CLAY - low plasticity, dark grey-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	M < w_P				TOPSOIL
							0.30m					
		0.50m	30.0	0.5		CH	CLAY - high plasticity, dark grey with some pale orange, some fine to medium grained sand, trace fine to medium grained sub-angular to angular gravel (content increasing with depth).	M > w_P	St - VSt	HP	180	RESIDUAL SOIL possibly COLLUVIUM
		U50								HP	200	
		0.90m								HP	190	
							0.90m					
			29.5	1.0		CH	Sandy CLAY - high plasticity, pale grey to white some orange, fine to medium grained sand, some fine grained sub-angular to sub-rounded gravel.	M < w_P	VSt	HP	350	RESIDUAL SOIL
			29.0	1.5					H	HP	480	
				2.0						HP	520	
							2.00m					
			28.5				SHALE - pale grey-green, estimated very low to low strength.	D				EXTREMELY TO HIGHLY WEATHERED ROCK
							2.40m					
			28.0	2.5			Hole Terminated at 2.40 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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP11
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 30.3 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
E	Not Encountered		30.0	0.5		CH	FILL-TOPSOIL: CLAY - medium to high plasticity, dark grey-brown, some fine to medium grained sand, some fine to medium grained sub-rounded to sub-angular gravel, trace brick and plant debris, root affected.	M > w_P		HP	280	FILL - TOPSOIL
										HP	220	
				0.50m								
						SM	TOPSOIL (BURIED): Silty SAND - fine to medium grained, dark brown, fines of low plasticity, root affected.	M		HP	500	BURIED TOPSOIL
		0.70m		0.70m								
			29.5			CH	CLAY - high plasticity, pale grey to grey, some fine to medium grained sand.	M > w_P	VSt	HP	350	RESIDUAL SOIL
		U50		1.0						HP	220	
		1.10m								HP	290	
				1.10m								
			29.0			CH	Sandy CLAY - high plasticity, pale grey to white some orange, fine to medium grained sand, some fine grained rounded to sub-rounded gravel.	M ~ w_P	H	HP	450	
				1.5						HP	550	
				1.70m								
			28.5				SANDSTONE - fine to medium grained, pale grey to orange, estimated very low to medium strength.	D		HP	>600	EXTREMELY TO HIGHLY WEATHERED ROCK
				2.0								
				2.10m								
							Hole Terminated at 2.10 m					
			28.0									
				2.5								
			27.5									

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1 GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP12
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 32.8 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
E	Not Encountered	0.30m B 0.40m	32.5	0.5		CL	TOPSOIL: Sandy CLAY - low plasticity, dark grey-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	$M < w_P$				TOPSOIL
						CH	0.30m Sandy CLAY - medium to high plasticity, red-brown, fine to medium grained sand.		H	HP	>600	RESIDUAL SOIL
						SC	0.40m Clayey SAND - fine to medium grained, pale grey with some orange, fines of medium to high plasticity.	M	VD			
			32.0				Becoming extremely weathered sandstone.					
				1.0			0.90m 0.95m SANDSTONE - fine to medium grained, pale grey to orange, estimated medium strength.	D				HIGHLY WEATHERED ROCK
							Hole Terminated at 0.95 m Refusal					
			31.5	1.5								
			31.0	2.0								
			30.5	2.5								
			30.0									

LEGEND:

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

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

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1 GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP13
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 21.3 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
E	Not Encountered		21.0			CL	FILL-TOPSOIL: Sandy CLAY - low plasticity, dark grey-brown, fine to medium grained sand, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	M ~ w_P				FILL - TOPSOIL
				0.5		CH	0.30m FILL: Sandy CLAY - high plasticity, grey, fine to medium grained sand, some fine grained rounded to sub-rounded gravel.	M > w_P	St - VSt	HP	150 - 250	FILL
			20.5			SC	0.50m FILL: Clayey SAND - fine to medium grained, orange, fines of medium plasticity.	M	D	HP	>600	FILL possibly RESIDUAL SOIL
		0.90m CBR 1.20m		1.0			0.80m SANDSTONE - fine to medium grained, pale grey, estimated very low to medium strength.	M - D				HIGHLY WEATHERED ROCK
			20.0	1.5			1.70m Hole Terminated at 1.70 m Refusal					
			19.5	2.0								
			19.0	2.5								
			18.5									

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1 GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

ENGINEERING LOG - TEST PIT

CLIENT: McCLOY GROUP
PROJECT: PROPOSED RESIDENTIAL SUBDIVISION
LOCATION: 107 HAUSSMAN DRIVE, THORNTON

TEST PIT NO: TP14
PAGE: 1 OF 1
JOB NO: NEW17P-0074
LOGGED BY: BB
DATE: 17/5/17

EQUIPMENT TYPE: 14 TONNE EXCAVATOR
TEST PIT LENGTH: 3.0 m **WIDTH:** 1.1 m
SURFACE RL: 23.4 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
E	Not Encountered		23.4	0.0		SM	TOPSOIL: Silty SAND - fine to medium grained, dark brown, fines of low plasticity, some fine to medium grained sub-angular to sub-rounded gravel, root affected.	D - M				TOPSOIL possibly FILL
				0.20m								
			23.0	0.5		SC	Clayey Gravelly SAND - fine to medium grained, red, white and orange, fine to coarse garined angular to sub angular gravel, with cobble and boulder sized rock fragments up to ~400mm dia.	M	D			RESIDUAL SOIL possibly FILL
				0.50m			SANDSTONE - fine to medium grained, orange red and white, fractured with some Clayey SAND in the joints, estimated very low to low strength.					EXTREMELY TO HIGHLY WEATHERED ROCK
			22.5	1.0				D	D			
				1.10m			SILTSTONE - dark grey-brown, estimated low to medium strength.					HIGHLY WEATHERED ROCK
			22.0	1.5								
				1.60m			Hole Terminated at 1.60 m Refusal					
			21.5	2.0								
			21.0	2.5								
			20.5									

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 (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

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

Consistency

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

QT LIB 1.1 GLB Log NON-CORED BOREHOLE - TEST PIT NEW17P-0074 HAUSSMAN DR, THORNTON.GPJ <<DrawingFile>> 28/06/2017 14:36 8.30.003 Datgel Lab and In Situ Tool

Qualtest
LABORATORY (NSW) PTY LTD

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

DYNAMIC CONE PENETROMETER - TEST REPORT

Client: MCCLOY GROUP
Principal:
Project: PROPOSED SENIORS LIVING DEVELOPMENT
Location: 107 HAUSSMAN DR, THORNTON

Project Number: *NEW17P-0074*
Sheet No: *1 of 1*
Test Date: 15/05/2017
Tested By: BB

Test Method: AS1289 6.3.2 ☑ Cone Tip
Drop Height: 510 ± 5mm ☐ Blunt Tip

Depth Below Surface (mm)	Test Number								Test Location / Comments
	TP01	TP02	TP03	TP04					
150	3	2	4	4					DCP locations are as shown on Figure AA1.
300	2	3	4	5					
450	7	5	4	4					R = Refusal, hammer bouncing.
600	24	7	5	3					
750		13	4	3					
900		R	2	2					
1050			2	3					
1200			4	2					
1350			8	6					
1500			9	11					
1650			R	6					
1800				10					
1950				13					
2100				R					
2250									
2400									
2550									
2700									
2850									
3000									
3150									
3300									
3450									
3600									
3750									
3900									
4050									
4200									
4350									
4500									

Comments: Readings recorded in blows per 150mm increments.

APPENDIX B:

Results of Laboratory Testing

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
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E: admin@qualtest.com.au
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ABN: 98 153 268 896

Report No: MAT:NEW17W-1887--S01
Issue No: 1

Material Test Report

Client: McCLOY GROUP
Suite 1, Level 3, 426 King Street
Newcastle West NSW 2300

Principal:
Project No.: NEW17P-0074
Project Name: Proposed Seniors Living Development

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 7/06/2017

Sample Details

Sample ID:	NEW17W-1887--S01
Sampling Method:	AS1289.1.2.1 cl 6.5
Date Sampled:	17/05/2017
Source:	On-Site
Material:	Sandy Clay
Specification:	No Specification
Project Location:	Lot 2 DP 1145348 - Haussman Drive, Thornton
Sample Location:	TP05 - (0.7 - 0.9m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	43	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	19	
Plasticity Index (%)	AS 1289.3.3.1	24	

Comments

N/A

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QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
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E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: MAT:NEW17W-1887--S02
Issue No: 1

Material Test Report

Client: McCLOY GROUP
Suite 1, Level 3, 426 King Street
Newcastle West NSW 2300

Principal:
Project No.: NEW17P-0074
Project Name: Proposed Seniors Living Development

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 7/06/2017

Sample Details

Sample ID:	NEW17W-1887--S02
Sampling Method:	AS1289.1.2.1 cl 6.5
Date Sampled:	17/05/2017
Source:	On-Site
Material:	Sandy Clay
Specification:	No Specification
Project Location:	Lot 2 DP 1145348 - Haussman Drive, Thornton
Sample Location:	TP06 - (0.9 - 1.1m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	38	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	19	
Plasticity Index (%)	AS 1289.3.3.1	19	

Comments

N/A

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QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
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ABN: 98 153 268 896

Report No: MAT:NEW17W-1887--S03
Issue No: 1

Material Test Report

Client: McCLOY GROUP
Suite 1, Level 3, 426 King Street
Newcastle West NSW 2300

Principal:
Project No.: NEW17P-0074
Project Name: Proposed Seniors Living Development

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The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 30/05/2017

Sample Details

Sample ID:	NEW17W-1887--S03
Sampling Method:	AS1289.1.2.1 cl 6.5
Date Sampled:	17/05/2017
Source:	On-Site
Material:	Sandy Clay
Specification:	No Specification
Project Location:	Lot 2 DP 1145348 - Haussman Drive, Thornton
Sample Location:	TP07 - (0.7 - 0.8m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	10.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	55	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	22	
Plasticity Index (%)	AS 1289.3.3.1	33	

Comments

N/A

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QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
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E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: MAT:NEW17W-1887--S04
Issue No: 1

Material Test Report

Client: McCLOY GROUP
Suite 1, Level 3, 426 King Street
Newcastle West NSW 2300

Principal:
Project No.: NEW17P-0074
Project Name: Proposed Seniors Living Development

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 7/06/2017

Sample Details

Sample ID:	NEW17W-1887--S04
Sampling Method:	AS1289.1.2.1 cl 6.5
Date Sampled:	17/05/2017
Source:	On-Site
Material:	Sandy Clay
Specification:	No Specification
Project Location:	Lot 2 DP 1145348 - Haussman Drive, Thornton
Sample Location:	TP08 - (0.4 - 0.7m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	11.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	57	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	18	
Plasticity Index (%)	AS 1289.3.3.1	39	

Comments

N/A

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Report No: MAT:NEW17W-1887--S05
Issue No: 1

Material Test Report

Client: McCLOY GROUP
Suite 1, Level 3, 426 King Street
Newcastle West NSW 2300

Principal:
Project No.: NEW17P-0074
Project Name: Proposed Seniors Living Development

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 7/06/2017

Sample Details

Sample ID: NEW17W-1887--S05
Sampling Method: AS1289.1.2.1 cl 6.5
Date Sampled: 17/05/2017
Source: On-Site
Material: Sandy Clay
Specification: No Specification
Project Location: Lot 2 DP 1145348 - Haussman Drive, Thornton
Sample Location: TP09 - (0.7 - 0.9m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	14.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	71	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	31	
Plasticity Index (%)	AS 1289.3.3.1	40	

Comments

N/A

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Report No: MAT:NEW17W-1887--S06
Issue No: 1

Material Test Report

Client: McCLOY GROUP
Suite 1, Level 3, 426 King Street
Newcastle West NSW 2300

Principal:
Project No.: NEW17P-0074
Project Name: Proposed Seniors Living Development

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 7/06/2017

Sample Details

Sample ID:	NEW17W-1887--S06
Sampling Method:	AS1289.1.2.1 cl 6.5
Date Sampled:	17/05/2017
Source:	On-Site
Material:	Sandy Clay
Specification:	No Specification
Project Location:	Lot 2 DP 1145348 - Haussman Drive, Thornton
Sample Location:	TP10 - (0.5 - 0.9m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	10.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	47	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	16	
Plasticity Index (%)	AS 1289.3.3.1	31	

Comments

N/A

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Report No: MAT:NEW17W-1887--S08
Issue No: 1

Material Test Report

Client: McCLOY GROUP
Suite 1, Level 3, 426 King Street
Newcastle West NSW 2300

Principal:
Project No.: NEW17P-0074
Project Name: Proposed Seniors Living Development

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 30/05/2017

Sample Details

Sample ID:	NEW17W-1887--S08
Sampling Method:	AS1289.1.2.1 cl 6.5
Date Sampled:	17/05/2017
Source:	On-Site
Material:	Sandy Clay
Specification:	No Specification
Project Location:	Lot 2 DP 1145348 - Haussman Drive, Thornton
Sample Location:	TP12 - (0.3 - 0.4m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	71	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	24	
Plasticity Index (%)	AS 1289.3.3.1	47	

Comments

N/A

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California Bearing Ratio Test Report

Report No: CBR:NEW17W-1887--S09
Issue No: 1

Client: McCLOY GROUP
Suite 1, Level 3, 426 King Street
Newcastle West NSW 2300

Principal:
Project No.: NEW17P-0074
Project Name: Proposed Seniors Living Development

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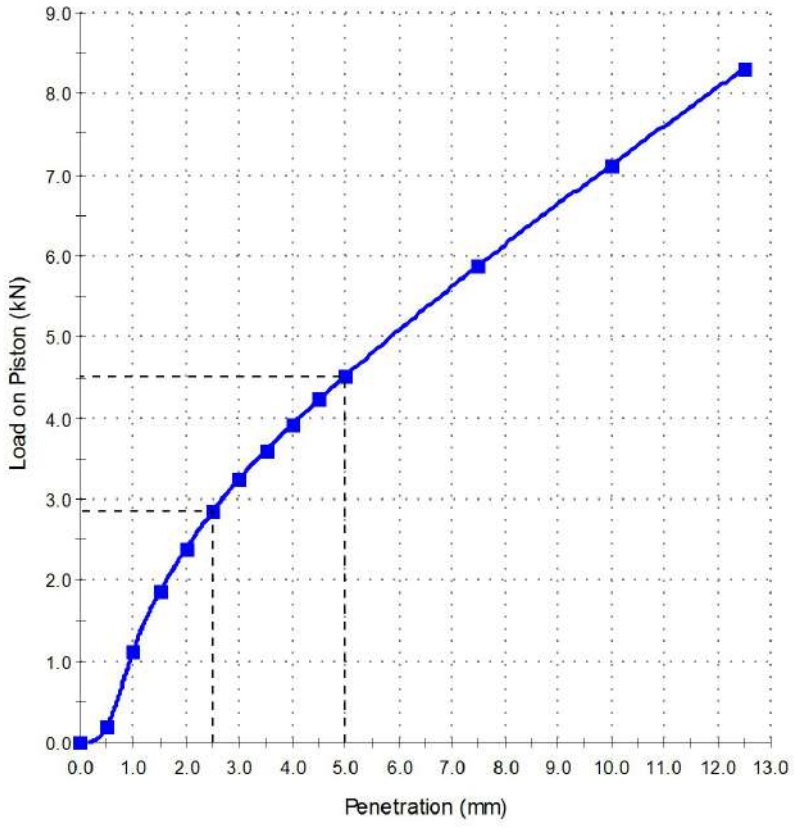
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 30/05/2017

Sample Details

Sample ID:	NEW17W-1887--S09	Date Sampled:	17/05/2017
Sampling Method:	AS1289.1.2.1 cl 6.5		
Specification:	No Specification	Source:	On-Site
Location:	TP13 - (0.9 - 1.2m)	Material:	Sandy Clay
Project Location:	Lot 2 DP 1145348 - Haussman Drive, Thornton		

Load vs Penetration



Test Results

AS 1289.6.1.1

CBR At 5.0mm (%):	25
Maximum Dry Density (t/m³):	1.73
Optimum Moisture Content (%):	17.2
Dry Density before Soaking (t/m³):	1.73
Density Ratio before Soaking (%):	100
Moisture Content before Soaking (%):	16.9
Moisture Ratio before Soaking (%):	98
Dry Density after Soaking (t/m³):	1.74
Density Ratio after Soaking (%):	100
Swell (%):	0.0
Moisture Content of Top 30mm (%):	20.4
Moisture Content of Remaining Depth (%):	17.5
Compactive Effort:	Standard
Surcharge Mass (kg):	9.00
Period of Soaking (Days):	4
Oversize Material (%):	0.0

Moisture Content

Field Moisture Content (%):	13.2

Comments

Moisture Content Method Performed as Per AS1289.2.1.1.
Laboratory Moisture Ratio (LMR): 98.0% Laboratory Density Ratio (LDR): 100.0%

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APPENDIX C:

CSIRO Sheet BTF 18

Foundation Maintenance and Footing Performance: A Homeowner's Guide

Foundation Maintenance and Footing Performance:
A Homeowner's Guide

CSIRO

BTF 18 replaces Information Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction
There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion
All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation
This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil
All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure
This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth
Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation
Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay
Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage

As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots
In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself
Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures
Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures
Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures
Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.
Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing
Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage
In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

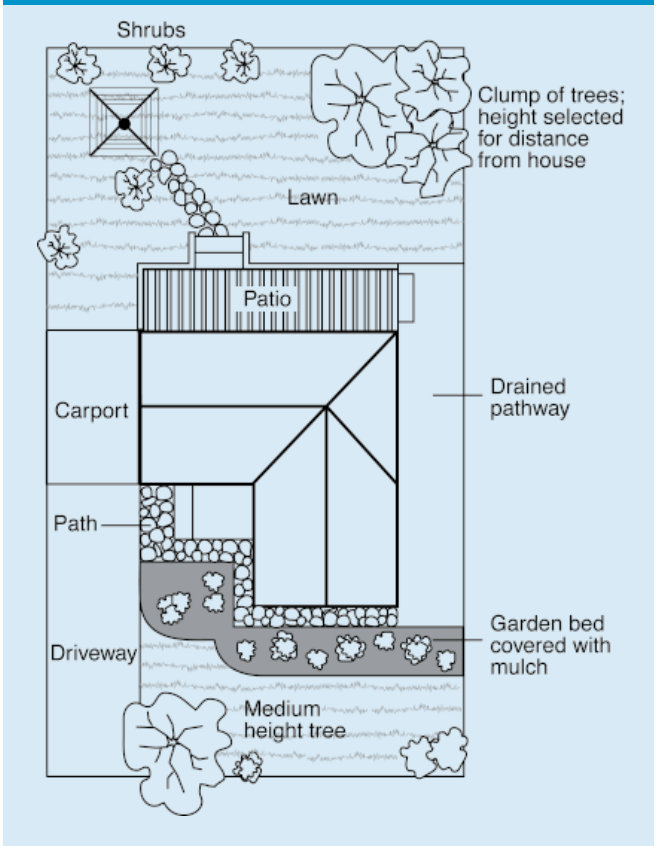
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15–25 mm but also depend on number of cracks	4

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

The information in this and other issues in the series was derived from various sources and was believed to be correct when published.

The information is advisory. It is provided in good faith and not claimed to be an exhaustive treatment of the relevant subject.

Further professional advice needs to be obtained before taking any action based on the information provided.

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sam@mccloygroup.com.au

Dear Sam

RESPONSE TO SUBDIVISION/REZONING ENQUIRY – 107 HAUSMANN DRIVE THORNTON – EOTH22-00297

Thank you for the opportunity to provide comment on the above proposal.

In accordance with the Mine Subsidence Compensation Act (2017), Subsidence Advisory NSW regulates development within mine subsidence districts to help protect homes, buildings and infrastructure from potential subsidence damage.

The site is not within a declared mine subsidence district. Subsidence Advisory NSW does not have legislative power to make determinations on development that is not within a district.

However, the site is known to be undermined by the abandoned Glenvale Colliery which feature shallow workings and several mine entry features. These workings may present a risk to surface development and public safety.

Using the Subsidence Advisory subdivision assessment policy as a guide, the site would be considered at high risk of shallow/pothole subsidence. This would necessitate the removal of the risk by a suitable means such as grouting under all lots, road and public spaces where a sinkhole risk exists. A grout/remediation proposal should be prepared by a geotechnical consultant with experience in mine subsidence assessments. After grouting, the geotechnical consultant should undertake sufficient verification boreholes to ensure that the intent of the grout plan has been met and that the risk of pothole subsidence has been effectively eliminated.

Where a trough subsidence risk exists, the geotechnical consultant should provide estimated subsidence impact parameters. All infrastructure associated with the subdivision works should be designed to accommodate the estimated parameters.

Construction over mine entries or shafts should not be permitted unless the risk has been eliminated.

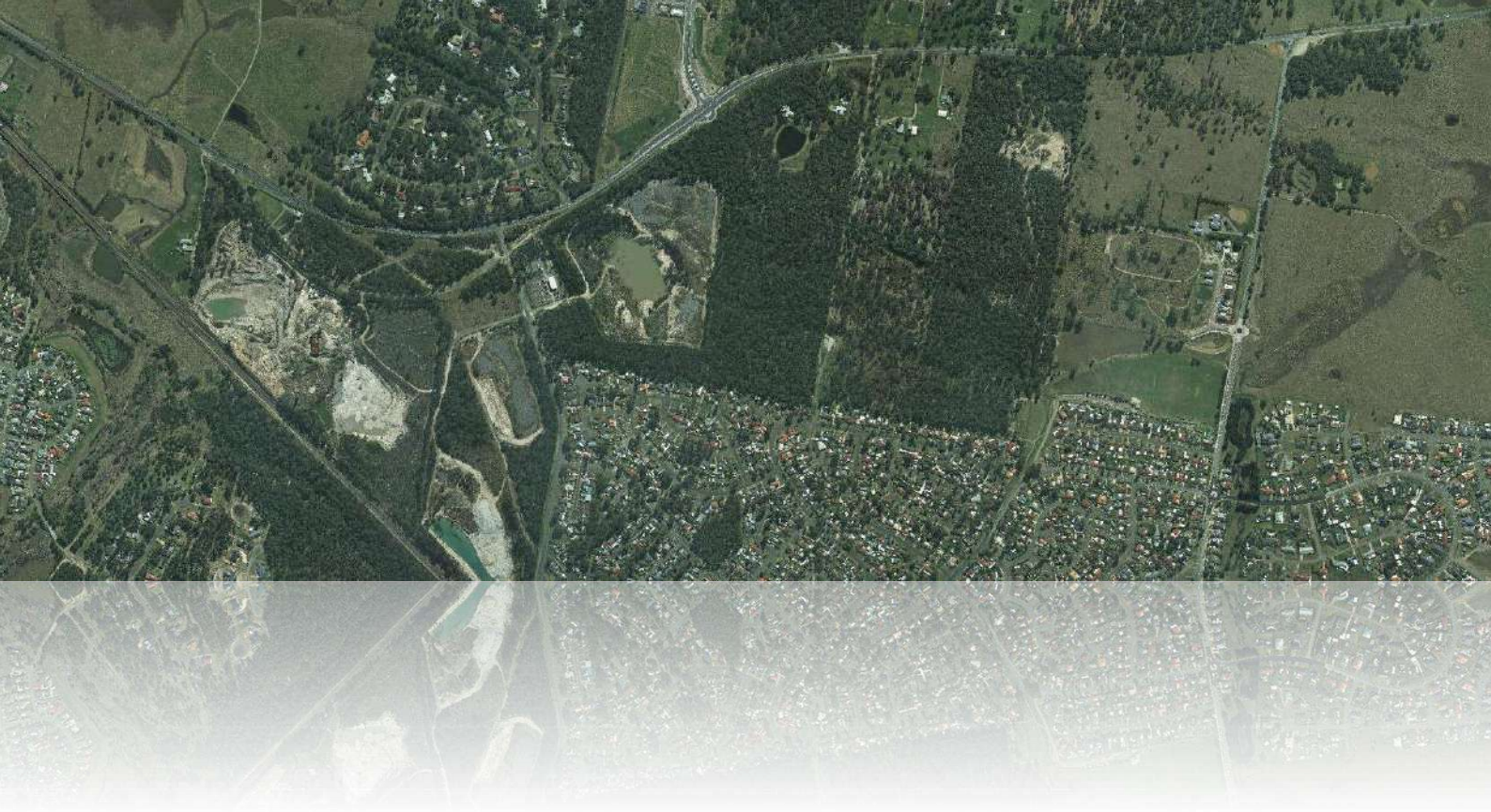
Subsidence Advisory NSW would be happy to review reports and provide advice to you or Council regarding the adequacy of any geotechnical investigation or remediation strategy prepared for the site.

If you have any queries concerning this matter, please contact Senior Risk Engineer, Melanie Fityus via e-mail subsidencedevelopment@customerservice.nsw.gov.au or 4908 4300.

Yours faithfully,

Melanie Fityus
Senior Risk Engineer

13 September 2022



TRAFFIC AND PARKING IMPACT ASSESSMENT

OF THE PROPOSED RESIDENTIAL SUBDIVISION

AT 107 HAUSSMAN DRIVE, THORNTON

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Transport Planning, Traffic Impact Assessments, Road Safety Audits, Expert Witness

200695.01FA - 8th October 2020

Development Type: **Residential Subdivision**

Site Address: **107 Haussman Drive, Thornton**

Prepared for: **McCloy Group**

Document reference: **200695.01FA**

Status	Issue	Prepared By	Checked By	Date
Draft	A	AT	TS	8th October 2020
Final	A	AT		8th October 2020

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1 INTRODUCTION

M^CLaren Traffic Engineering (MTE) was commissioned by *McCloy Group* to provide a Traffic and Parking Impact Assessment of the proposed Residential Subdivision of Lot 2 DP 1145348 with address 107 Haussman Drive, Thornton.

1.1 Description and Scale of Development

The proposed development, as depicted in the plans in **Annexure A**, includes the construction of the infrastructure and other works required to facilitate a future residential subdivision consisting of approximately **160 dwellings**. The proposed development has a total area of 18.96ha and will have the following features:

- Development of the majority of Lot 2 DP 1145348 into approximately 160 residential lots;
- The construction of new internal roads to facilitate access to the residential lots;
- Construction of a new primary access road from a new intersection with Haussman Drive, with access two options considered within this report:
    - **Scenario A:** Right-turn IN permitted
    - **Scenario B**: Right-turn IN prohibited.

The preliminary design of the Haussman Drive upgrade with respect to the location of the proposed primary access road for the subdivision is provided in **Annexure B**.

This proposed subdivision is part of the Thornton North Urban Release Area (Maitland Council DCP Part F7). The Maitland Development Control Plan outlines an indicative design for the general structure of Thornton North but does not specify specific road layouts for individual land releases and includes only a general collector road layout.

1.2 State Environmental Planning Policy (Infrastructure) 2007

The proposed development is on land that has a frontage to a classified road (Raymond Terrace Road) and does qualify under Clause 101 of the *SEPP (Infrastructure) 2007*. Accordingly, safe and practical vehicular access is provided by a road other than the Raymond Terrace Road and the safety, efficiency and ongoing operation of the Raymond Terrace Road will not be adversely affected by the development.

The proposed development does not qualify as a traffic generating development with relevant size and/or capacity under Clause 104 of the *SEPP (Infrastructure) 2007*. Accordingly, formal referral to the Roads and Maritime Services (RMS) is not required and Maitland City Council officers can determine this proposal accordingly.

1.3 Site Description

1.3.1 Existing Conditions

The subject site is situated at 107 Haussman Drive, Thornton NSW 2322 and is legally identified as Lot 2 in DP 1145348. The site can be classified as an existing rural residential property which housed a clay quarry, which is no longer in use. Vehicular access to the site is currently made from Haussman Drive via gravel driveway which measures 6m wide within the property with a 14m wide crossing at Haussman Drive.

The site is adjacent to current residential dwellings to the south and a rural property to the east. The site is also bordered by Huassman Drive to the west and Raymond Terrace Road to the north. In between the site and Haussman Drive is a High Voltage Transformer Station. More residential subdivisions are proposed to the east and north of the site in line with the *Maitland Council DCP*. Major arterial and sub-arterial roads surrounding the site include Raymond Terrace Road to the north and the New England Highway to the South.

1.3.2 Zoning

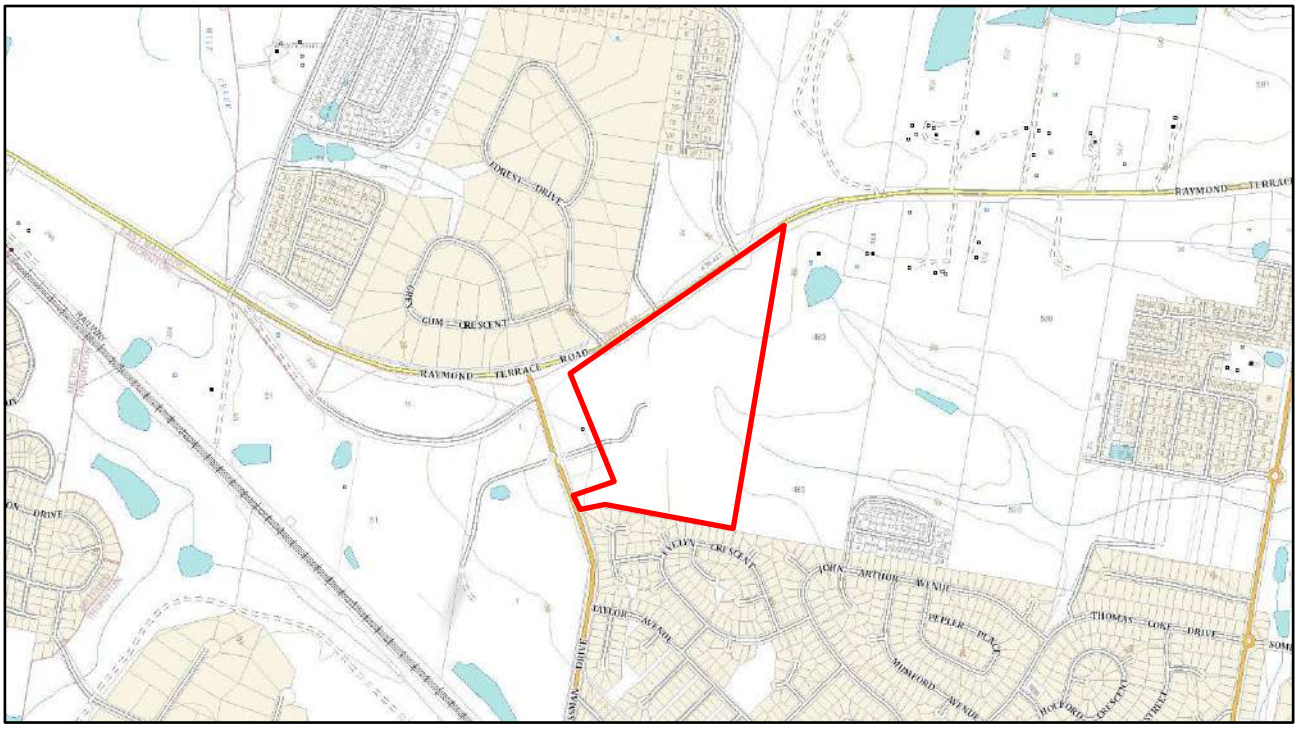
The subject site is currently zoned RU2 – Rural Landscape under the *Maitland City Council Local Environment Plan 2011*.

1.4 Site Context

The site location is depicted in **Figure 1 & Figure 2** below.

Site Location

FIGURE 1: SITE CONTEXT – AERIAL PHOTO



Site Location

FIGURE 2: SITE CONTEXT – STREET MAP

2 EXISTING TRAFFIC AND PARKING CONDITIONS

2.1 Road Hierarchy

The existing road network surrounding the site has the following characteristics:

Haussman Drive

- Unclassified LOCAL Road;
- Approximately 8.0 m wide sealed carriageway facilitating two lanes (one in each direction) and unsealed shoulders on both sides of the road (i.e. no formal kerb);
- Signposted 60km/h carriageway;
- No kerbside parking permitted;
- Haussmann Drive meets Raymond Terrace Road with a T-Intersection 300m to the north of the proposed site access road;
- Brickworks Road also meets Haussmann Road with a T-Intersection 70m to the south of Raymond Terrace Road, and 230m to the north of the proposed site access road.

Raymond Terrace Road

- Classified STATE Road (Road No. 104);
- Approximately 16.0m wide sealed carriageway facilitating two lanes of traffic (one in each direction) as well as turning lanes;
- Unsealed shoulders are present on both sides of the road (i.e. no formal kerb), except on approach to the Settlers Boulevard Intersection;
- Signposted 80km/h carriageway;
- No kerbside parking permitted.

Settlers Boulevard

- Unclassified LOCAL Road;
- Approximately 23.0m wide sealed carriageway facilitating four lanes of traffic (two in each direction) in the proximity to the junction with Raymond Terrace Road. 8m median separates the two directions. Becomes one lane each way 200m away from intersection;
- Signposted 50km/h carriageway;
- No kerbside parking permitted.

2.2 Existing Traffic and Parking Environment

Traffic counts were completed at the intersection of Haussman Drive / Raymond Terrace Road on three consecutive days on Thursday 11th, Friday 12th and Saturday 13th of May 2017, representing a typical weekday and weekend conditions and are reproduced in **Annexure C** for reference.

To account for expected increase in traffic volumes between 2017 and 2020, a linear growth factor of 2% p.a. over 3 years has been applied to all approaches of the May 2017 traffic volumes. The application of a 2% growth factor is a standard approach for adapting historical count data in the absence of more localised traffic growth rates and is considered a conservative approach for these specific intersections.

2.2.1 Intersection Performance

Existing intersection performances have been assessed using SIDRA INTERSECTION 8. The results of the analysis are summarised in **Table 1** below with detailed SIDRA outputs shown in **Annexure D**. It should be noted that as three consecutive survey days were undertaken, the worst-case day will be assessed, that is Friday the 12th of May, with a 2% p.a. growth rate over 3-years applied to all movements.

TABLE 1: INTERSECTION PERFORMANCES (SIDRA INTERSECTION 8)

Intersection	Peak Hour	Degree of Saturation(1)	Average Delay(2) (sec/vehicle)	Level of Service(3)	Control Type	Worst Movement
EXISTING PERFORMANCE						
Haussman Drive / Raymond Terrace Road	AM	0.95	13.1 (Worst: 41.8)	**N/A** (Worst: C)	Priority	RT from Haussman Drive
	PM	1.01	25.2 (Worst: >70)	**N/A** (Worst: F)		RT from Haussman Drive

SIDRA INTERSECTION modelling provides an overall Level of Service (LoS) of N/A, as SIDRA does not provide a good representation of the operation of the intersection of Haussman Drive / Raymond Terrace due to free flow assumptions along major road movements, that is the near zero delays associated with major road through movements. A more appropriate indication for the overall operation of the intersection is the LoS and average delays associated with the minor road movements.

The worst turn movements of Haussman Drive (RT from Haussman Drive) are operating at LoS “C” during the peak AM period and LoS “F” during the peak PM period. While the LoS of “C” indicates the movement is operating satisfactorily during the AM, during the PM the right turn movement from Haussman Drive is operating at capacity and intersection upgrades are required. These upgrades are already planned and discussed in **Section 2.3** below.

2.3 Future Road and Infrastructure Upgrades

From *Maitland City Councils Development Application Tracker* and website, it appears that there are future planned road changes which will affect existing traffic conditions within the vicinity of the subject site.

Roadworks include upgrades and new intersections along Raymond Terrace Road in line with the planned layout of the Thornton North Urban Release Area. In addition, new public residential roads will be built to facilitate the residential development of the area, also changing the traffic conditions experienced.

As part of those works, upgrades to Haussman Drive are currently underway with the design of Stage 2 of this project currently being completed for the section from Raymond Terrace Road to Taylor Avenue. According to the *Maitland City Council* website the following is stated with regard to the Stage 2 upgrades.

> *Haussman Drive uprade from Raymond Terrace Road to Taylor Avenue including both intersections:*
>
> - *Relocation of power poles and other utility services*
> - *Upgrade to a signalised intersection at Raymond Terrace Road and Haussman Drive*
> - *Construction of a roundabout at Haussman Drive and Taylor Avenue intersection*
> - *Reconstruction and widening of the road pavement in both Railway Avenue and Haussman Drive.*
> - *Construction of a shared path along Haussman Drive.*

The proposed upgrade of the Raymond Terrace Road / Haussman Drive intersection to a signalised intersection will greatly increase the intersections capacity beyond the existing priority channelised right turn arrangement. The existing worst movement as identified above in **Section 2.2.1**, being the right hand turn movement from Haussman Drive, is expected to be provided with additional capacity increasing the operating performance of this movement at this intersection.

The exact details of these proposed upgrades have not yet been released by Council or the TfNSW and cannot be assessed in detail within this report. Considering the upgrades are in-line with several locally planned residential subdivisions throughout the Thornton North Urban Release area, it is expected that the intersection design will have already accounted for the traffic generation from this proposed subdivision amongst others.

Preliminary plans for the duplication of Haussman Drive at the site location are provided in **Annexure B**.

2.4 Public Transport

The subject site has access to existing bus route 182 provided by Hunter Buses Network which the 182 from Haussman Drive onto Taylor Avenue. The nearest bus stop on Haussman Drive (Stop ID. 2322136) is located approximately 500m from the majority of the site. These bus routes provide access to Thornton Train Station Stockland Green Hills Shopping Centre and Maitland. Thornton Station is 2kms from the Subdivision and provides access to Maitland and Newcastle, as well as the extended NSW TrainLink Network.

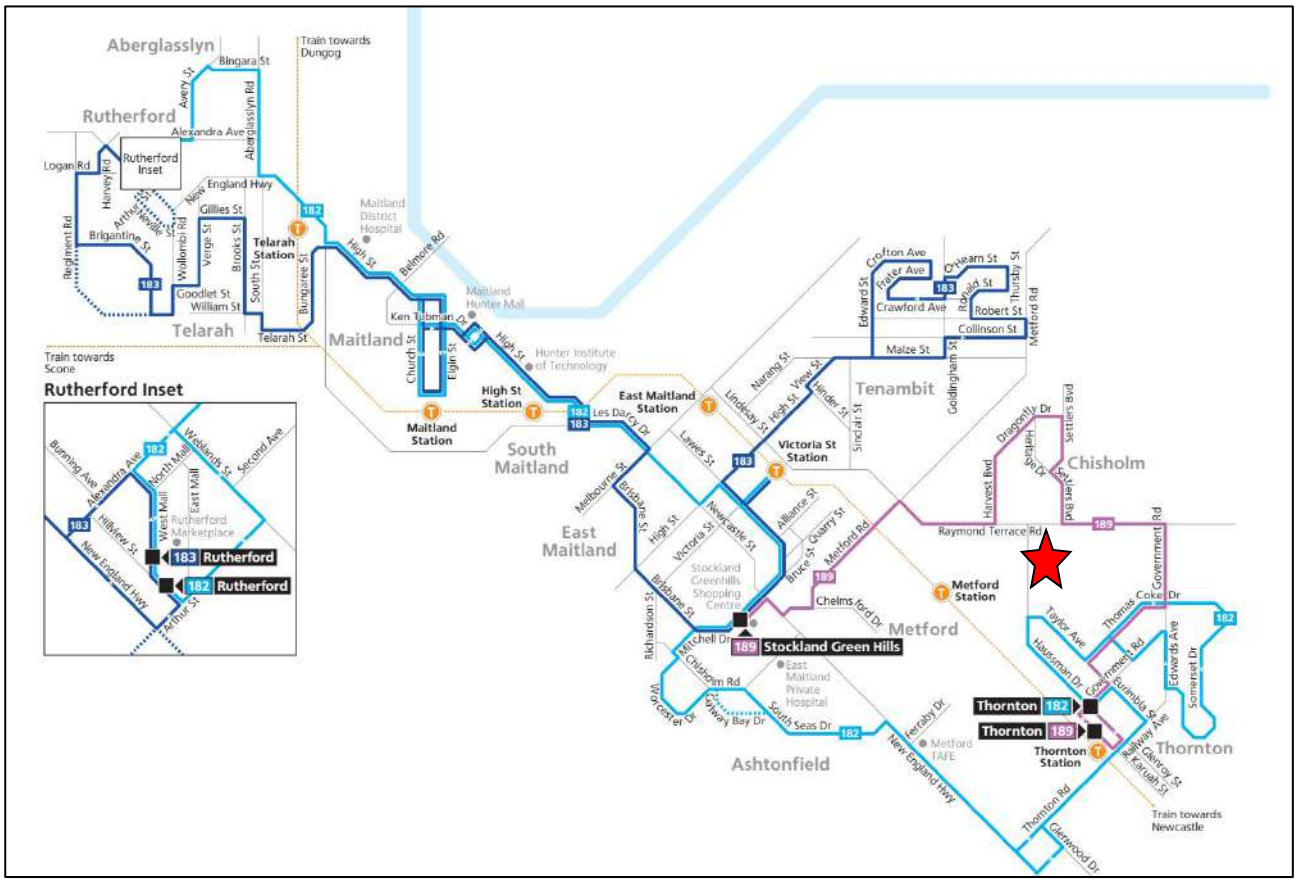


FIGURE 3: BUS ROUTES

3 PARKING ASSESSMENT

3.1 Council Parking Requirement

Reference is made to the *Maitland Development Control Plan 2011 – Part C – Design Guidelines – Appendix A* which designates the following in regard to parking:

> *Dwelling Houses*
> *Minimum of 1 space*
> *This space is to be located behind the building line as set by Council.*

The residential lots will have sufficient space for a minimum of 1 car parking space per dwelling. Further assessment of this provision will be conducted during the individual development applications for each residential dwelling within the subdivision.

4 TRAFFIC ASSESSMENT

The impact of the expected traffic generation levels associated with the subject proposal is discussed in the following sub-sections.

4.1 Traffic Generation

The estimated traffic generation level for the residential subdivision for 160 proposed lots is based upon the RMS *Guide to Traffic Generating Developments October 2002* and more recent supplements. The RMS publicised updated low density residential dwellings traffic generation rates within the *Technical Direction TDT 2013/04a,* and these rates will be applied to this subdivision development. The expected traffic generation is summarised in **Table 2** below.

TABLE 2: PEAK HOUR TRAFFIC GENERATION

Development Type	Scale	Peak Period	Rate	Peak Traffic Generation	Trip Assignment(1)
Dwelling Houses	160	AM	0.71 trips per dwelling	114	23 IN; 91 OUT
		PM	0.78 trips per dwelling	125	100 IN; 25 OUT

Note (1): Assumes 20% inbound & 80% outbound during AM peak (shown above). Vice versa for PM.

As shown above, the traffic generated by the site equates to **114** and **125** vehicle trips in both the AM (23 IN; 91 OUT) and PM (100 IN; 25 OUT) peak periods, respectively.

The traffic assignment and likely impact of these additional vehicle trips on the existing road network are analysed in the following sub-sections.

4.2 Traffic Assignment

Given the surrounding road network and the available routes to / from the site the following two traffic assignments have been considered, based weather or not right-turns into the subdivision access road are permitted. Both traffic assignment scenarios assume that the proposed subdivision is only accessible via one future intersection with Haussman Drive, where right-turn movements from the access road into Haussman Drive will be prohibited.

Right-Turn IN Permitted (Scenario A)

During the AM and PM period, the following traffic distribution is adopted:

- **Inbound:**
    - 50% from the north along Haussman Drive:
        - 40% along Raymond Terrace Road from the Maitland area;
        - 10% along Raymond Terrace Road from the Raymond Terrace area;

- 50% from the south along Haussman Drive.

- **Outbound:**
  - 50% to the north along Haussman Drive, after completing a U-turn at the future Haussman Drive / Taylor Avenue roundabout:
    - 40% along Raymond Terrace Road towards Maitland;
    - 10% along Raymond Terrace Road towards Raymond Terrace;
  - 50% to the south along Haussman Drive.

Right-Turn IN Prohibited (Scenario B)

During the AM and PM period, the following traffic distribution is adopted:

- **Inbound:**
  - 50% from the north along Haussman Drive:
    - 40% along Raymond Terrace Road from the Maitland area;
    - 10% along Raymond Terrace Road from the Raymond Terrace area;
  - 50% from the south;
    - 30% along Haussman Drive, turning right onto Raymond Terrace Road before completing at U-Turn at the signalised intersection of Raymond Terrace Road / Settlers Boulevard and turning left into Haussman Drive;
    - 20% along Government Road and Raymond Terrace Road turning left into Haussman Drive.

- **Outbound:**
  - 50% northbound along Haussman Drive, after completing a U-turn at the future Haussman Drive / Taylor Avenue intersection:
    - 40% along Raymond Terrace Road towards Maitland;
    - 10% along Raymond Terrace Road towards Raymond Terrace;
  - 50% southbound along Haussman Drive.

4.3 Traffic Impact

The additional traffic specified in **Section 4.1** and **4.2** above has been added to the existing intersections. The following sub-sections outline the results of the future performance under each scenario explored within this report.

4.3.1 Haussman Drive / Raymond Terrace Road

The future SIDRA INTERSECTION performance of the Haussman Drive / Raymond Terrace Road intersection under Scenarios A and B are summarised in **Table 3** below, with detailed SIDRA outputs reproduced in **Annexure D** for reference.

TABLE 3: INTERSECTION PERFORMANCES (SIDRA INTERSECTION 7)

Intersection	Peak Hour	Degree of Saturation[1]	Average Delay[2] (sec/vehicle)	Level of Service[3]	Control Type	Worst Movement
EXISTING PERFORMANCE						
Haussman Drive / Raymond Terrace Road	AM	0.95	13.1 (Worst: 41.8)	**N/A** (Worst: C)	Priority	RT from Haussman Drive
	PM	1.01	25.2 (Worst: >70)	**NA** (Worst: F)		RT from Haussman Drive
FUTURE PERFORMANCE – Scenario A – RHT IN Permitted						
Haussman Drive / Raymond Terrace Road	AM	0.96	15.2 (Worst: 47.4)	**N/A** (Worst: D)	Priority	RT from Haussman Drive
	PM	1.11	34.4 (Worst: >70)	**N/A** (Worst: F)		RT from Haussman Drive
FUTURE PERFORMANCE – Scenario B – RHT IN Prohibited						
Haussman Drive / Raymond Terrace Road	AM	0.99	17.2 (Worst: 54.6)	**N/A** (Worst: D)	Priority	RT from Haussman Drive
	PM	1.38	61.5 (Worst: >70)	**N/A** (Worst: F)		RT from Haussman Drive

As shown above the worst turn movement (RT from Haussman Drive) of the intersection of Haussman Drive / Raymond Terrace Road remains unchanged in the future scenario for the PM peak period and reduces from a LoS “C” to a LoS “D” in the future scenarios for the AM peak period. This result indicates that the right turn movement from Haussman Drive is essentially at capacity within this intersection under its existing arrangements, especially in the PM peak period.

The proposed signalised upgrade of the Haussman Drive / Raymond Terrace Road intersection, which is currently undergoing design by Council and TfNSW will result in a significant increase in the intersections capacity, especially the capacity of the heavily utilised right turn movements both from Raymond Terrace Road and Haussman Drive. Detailed concept designs of the proposed intersection upgrade have not been provided for this analysis, but considering the existing performance of the intersection, it is expected there will be a significant increase in the intersections overall capacity which will cater for both this proposed subdivision development and the other residential subdivisions currently planned within the Thornton North Urban Release Area.

4.3.2 Haussman Drive / Subdivision Access Road

A number of options have been considered for the design of the Haussman Drive / Subdivision Access Road intersection, with consideration made to the upgrades to Haussman Drive to a dual carriageway in both directions as outlined in **Annexure B**. Two scenarios have been considered, with both scenarios assuming that right-turn movements from the Access Road into Haussman Drive will be prohibited. The two scenarios assessed below are:

- **Scenario A** – Right-Turn IN Permitted
- **Scenario B** – Right Turn IN Prohibited

The future SIDRA INTERSECTION performance of the Haussman Drive / Subdivision Access Road intersection under Scenarios A and B are summarised in **Table 3** below, with detailed SIDRA outputs reproduced in **Annexure D** for reference.

TABLE 4: INTERSECTION PERFORMANCES (SIDRA INTERSECTION 7)

Intersection	Peak Hour	Degree of Saturation[1]	Average Delay[2] (sec/vehicle)	Level of Service[3]	Control Type	Worst Movement	95th Percentile Queue
FUTURE PERFORMANCE – Scenario A – RHT IN Permitted							
Haussman Drive / Access Road	AM	0.22	0.6 (Worst: 11.5)	**N/A** (Worst: A)	Priority	RT from Haussman Drive	0.3 veh (2.1m) Haussman Drive
	PM	0.24	1 (Worst: 11.5)	**NA** (Worst: A)		RT from Haussman Drive	1.2 veh (8.2m) Haussman Drive
FUTURE PERFORMANCE – Scenario B – RHT IN Prohibited							
Haussman Drive / Access Road	AM	0.18	0.7 (Worst: 7)	**N/A** (Worst: A)	Priority	LT from Access Road	0.4 veh (2.5m) Access Road
	PM	0.18	0.6 (Worst: 6.5)	**N/A** (Worst: A)		LT from Access Road	0.3 veh (2.1m) Access Road

As shown above the worst turning movements operate at LoS “A” during both the AM and PM peak periods. This represents acceptable delays and additional spare capacity maintained under both scenarios.

SIDRA outputs provide an indication of the average queue length associated with individual turning movements. When right turns are permitted from Haussman Drive into the Access Road, a 95th percentile queue length of 8.2m (1.2 veh) in the PM peak period will be present along Haussman Drive. As a dual carriageway, the intersection will effectively operate as a basic right-turn (BAR) treatment, facilitating following vehicles to negotiate around a right turning vehicle in an instance when they would be queued at the intersection. This outcome is considered acceptable from a traffic flow perspective, through an additional sightline assessment would be required to ensure the minimum sightline requirements are met under this scenario.

The alternative option considered, which is prohibiting a right-turn movement into the access road from Haussman Drive (Scenario B), will have a marginal reduction on the average intersection delay, due to removal of the right-turn. Comparatively, for this proposed intersection there is no significant benefit gained from prohibiting right-turn movements which can easily be accommodated within the dual carriageway. It should be noted that limited data is available on the expected increase to the Haussman Drive two-way traffic flows with respect to the completion of the entire Thornton North urban release area.

The provision of an additional eastern access point to the subdivision, potentially to Honeymyrtle Street, will likely change the traffic flow dynamics of this intersection. While further traffic modelling would be required to quantify the impact, it is expected that both the number of right and left turn movements into the Access Road would increase. Residents in the existing residential streets within the northern side of Thornton such as John Arthur Avenue and Mahogany Crescent would be expected to utilise the new intersection for access, as an alternative to Taylor Avenue. This has the potential to create residential amenity impacts within these local streets due to an increase in through traffic. The Haussman Drive / Access Road intersection is expected to have sufficient capacity to accommodate this additional traffic flow, subject to further intersection modelling of this specific scenario.

Based on the analysis above, the provision of a right-turn from Haussman Drive into the subdivision access road will not have a detrimental impact on the performance of Haussman Drive.

5 CONCLUSION

In view of the foregoing, the proposed residential subdivision (as depicted in **Annexure A**) is fully supportable in terms of its traffic and parking impacts. The following outcomes of this traffic impact assessment are relevant to note:

- The subdivision lot layout does not provide concept plans for the dwellings set out of each lot, however there is ample site area in each lot to provide the required number of car parking spaces.

- Detailed compliance of the internal road design within the proposed subdivision in accordance with AMCORD and the Council requirements will be required at a later stage of this proposal. A road safety evaluation will also follow at the detailed design stage to ensure that lots can be adequately served in terms of potential individual driveway locations and service vehicle circulation.

- The traffic generated by the site equates to **114** and **125** vehicles trips in the AM (23 IN; 91 OUT) and PM (100 IN; 25 OUT) peak periods, respectively. The traffic generated by the proposed development will be of a low order and will not detrimentally impact the ongoing operation of the existing road network.

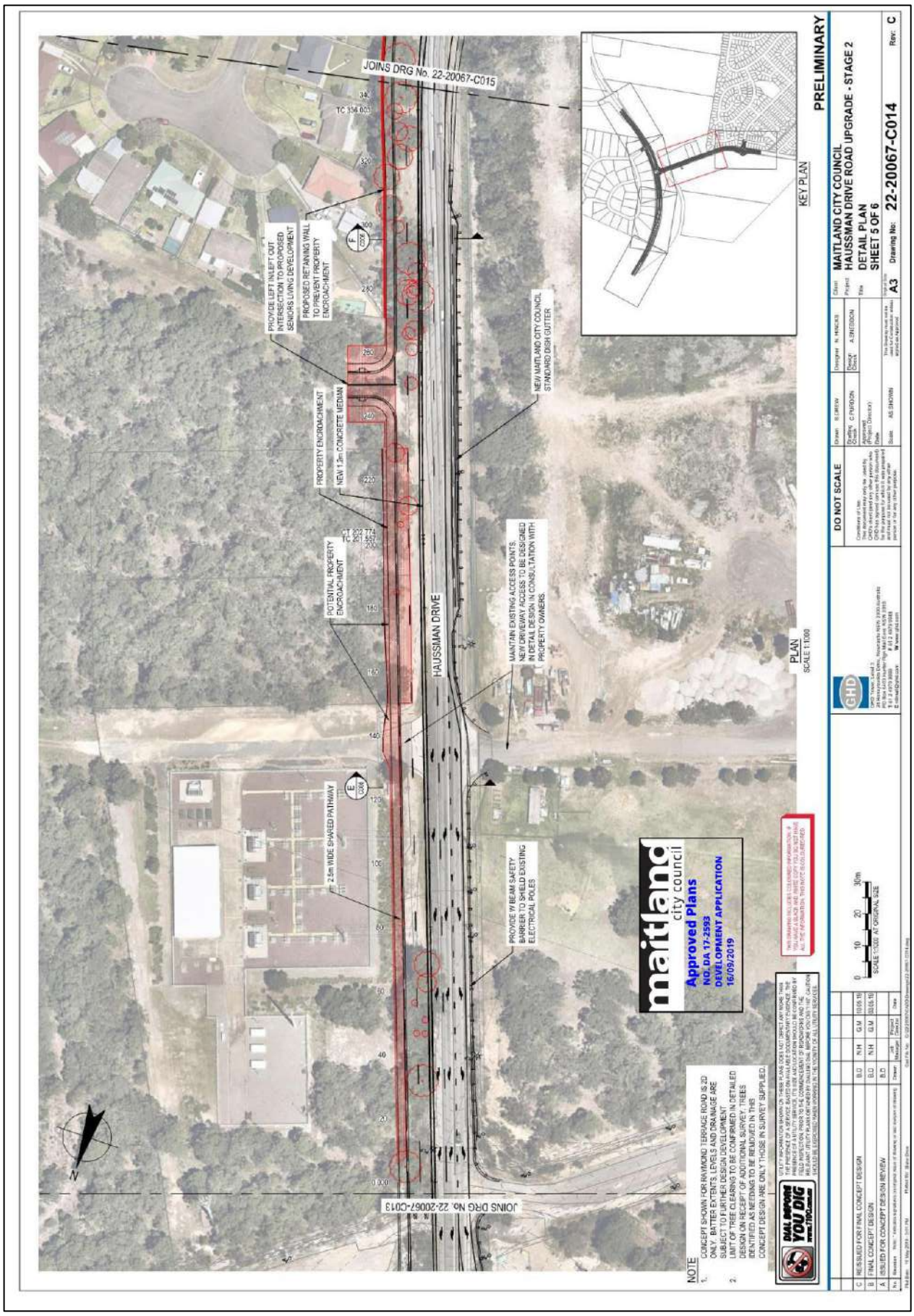
- The provision of a right-turn movement from Haussman Drive into the subdivision access road is supportable and can currently be provided without the provision of a channelised right-turn. The 95th percentile queue of 8.2m (1.2 vehicles) is minimal with an average delay of 11.5 seconds.

- The impact of providing an additional eastern access road to Honeymyrtle Street has not been assessed, but this option is expected to increase the through traffic using the subdivision to access Haussman Drive, potentially creating residential amenity issues within the proposed subdivision. Further detailed analysis of this scenario would be required including its impact on the Haussman Drive / Access Road intersection.

- The intersection of Haussman Drive / Raymond Terrace Road intersection is already operating at capacity, though it is expected that the proposed upgrades to this intersection by Council will provide significant additional capacity to the intersection to support both existing traffic flows and future traffic flows generated by the completion of the Thornton North Urban Release area. A concept design of this intersection upgrade has not been provided and hence could not be assessed in detail.

ANNEXURE A: CONCEPT SITE PLANS

ANNEXURE B: HAUSSMAN DRIVE / SUBDIVISION ACCESS ROAD CONCEPT



ANNEXURE C: TRAFFIC SURVEY RESULTS

(Sheet 1 of 3)

BVY TRAFFIC SURVEY — Quality data services proven since 2000

QUALITY ENDORSED COMPANY BY AS/NZS ISO 9001:2008
OH&S SYSTEM CERTIFIED TO AS/NZS ISO 4801:2001

TURNING MOVEMENT SURVEY
Intersection of Hausmann Dr and Raymond Tarrace Rd, Thornton

Date:	Thu 11/05/17
Weather:	Overcast
Suburban	Thornton
Custome	BTF

North:	N/A
East:	Raymond Tarrace Rd
South:	Hausmann Dr
West:	Raymond Tarrace Rd

Survey Start	AM:	7:00	PM:	15:00
Vehicular Peakhour		Pedestrians Peakhour		
AM:	7:45 AM-8:45 AM	AM:	N/A	
PM:	4:15 PM-5:15 PM	PM:	N/A	

All Vehicles

Time		pproach Raymond Tarr			th Approach Hausman			pproach Raymond Tarr			Hourly Total	
eriod Star	Period End	U	WB	L	U	R	L	U	R	EB	Hour	Peak
7:00	7:15	0	48	25	0	12	38	0	44	53	1205	
7:15	7:30	0	69	34	0	10	39	0	52	60	1385	
7:30	7:45	0	120	51	0	12	46	0	50	62	1530	
7:45	8:00	0	143	34	0	17	55	0	60	71	1632	Peak
8:00	8:15	0	151	31	0	20	57	0	61	80	1613	
8:15	8:30	0	147	39	0	25	56	0	61	81	1545	
8:30	8:45	0	164	40	0	23	65	0	57	94	1441	
8:45	9:00	0	108	20	0	19	68	0	63	83	1293	
9:00	9:15	0	74	21	0	17	67	0	71	82	1201	
9:15	9:30	0	68	17	0	11	72	0	61	76		
9:30	9:45	0	74	17	0	13	72	0	54	65		
9:45	10:00	0	76	11	0	14	53	0	52	63		
15:00	15:15	0	110	34	0	23	91	0	62	79	1722	
15:15	15:30	0	95	16	0	26	87	0	69	111	1765	
15:30	15:45	0	110	24	0	22	98	0	94	128	1796	
15:45	16:00	0	108	19	0	23	79	0	85	129	1776	
16:00	16:15	0	97	21	0	19	81	0	91	133	1776	
16:15	16:30	0	102	21	0	23	83	0	72	134	1801	Peak
16:30	16:45	0	115	21	0	37	83	1	66	133	1775	
16:45	17:00	0	120	18	0	29	98	0	59	119	1711	
17:00	17:15	0	125	20	0	32	105	0	72	113	1613	
17:15	17:30	0	96	19	0	39	102	0	61	92	1451	
17:30	17:45	0	86	23	0	40	96	0	63	84	1270	
17:45	18:00	0	80	16	0	29	89	0	52	79	1059	
18:00	18:15	0	86	11	0	20	73	0	42	73	908	
18:15	18:30	0	58	10	0	18	50	0	37	55		
18:30	18:45	0	41	15	0	12	37	0	25	51		
18:45	19:00	0	50	7	0	19	38	0	32	48		

Peak Time		pproach Raymond Tarr			th Approach Hausman			pproach Raymond Tarr			Peak
eriod Star	Period End	U	WB	L	U	R	L	U	R	EB	total
7:45	8:45	0	605	144	0	85	233	0	239	326	1632
16:15	17:15	0	462	80	0	121	369	1	269	499	1801

ANNEXURE C: TRAFFIC SURVEY RESULTS

(Sheet 2 of 3)

BVY TRAFFIC SURVEY
Quality data services proven since 2000

QUALITY ENDORSED COMPANY BY AS/NZS ISO 9001:2008
OH&S SYSTEM CERTIFIED TO AS/NZS ISO 4801:2001

TURNING MOVEMENT SURVEY

Intersection of Hausmann Dr and Raymond Tarrace Rd, Thornton

Date:	Fri 12/05/17	*North:*	N/A	Survey Start	AM:	7:00	PM: 15:00
Weather:	Overcast	*East:*	Raymond Tarrace Rd	Vehicular Peakhour		Pedestrians Peakhour	
Suburban	Thornton	*South:*	Hausmann Dr	AM:	8:00 AM-9:00 AM	AM:	N/A
Custome	BTF	*West:*	Raymond Tarrace Rd	PM:	4:30 PM-5:30 PM	PM:	N/A

All Vehicles

Time		pproach Raymond Tarr			th Approach Hausman			pproach Raymond Tarr			Hourly Total	
eriod Star	Period End	U	WB	L	U	R	L	U	R	EB	Hour	Peak
7:00	7:15	0	65	19	0	11	36	0	46	43	1198	
7:15	7:30	0	66	40	0	12	43	0	55	59	1396	
7:30	7:45	0	131	39	0	17	46	0	83	44	1578	
7:45	8:00	0	133	23	0	10	53	0	83	41	1722	
8:00	8:15	0	161	27	0	18	56	0	91	65	1771	Peak
8:15	8:30	0	147	36	0	9	75	0	117	73	1667	
8:30	8:45	0	150	47	0	7	84	0	137	79	1485	
8:45	9:00	0	108	33	0	17	69	0	107	58	1241	
9:00	9:15	1	85	16	0	16	63	0	82	51	1106	
9:15	9:30	0	82	14	0	9	60	0	68	42		
9:30	9:45	0	78	6	0	9	63	0	59	45		
9:45	10:00	0	66	13	0	8	57	0	65	48		
15:00	15:15	0	108	27	0	22	75	0	92	66	1685	
15:15	15:30	0	109	20	0	24	99	0	103	64	1729	
15:30	15:45	0	97	22	0	26	96	0	114	84	1750	
15:45	16:00	0	107	13	0	24	107	0	104	82	1770	
16:00	16:15	0	110	17	0	17	109	0	103	78	1823	
16:15	16:30	0	111	22	0	27	101	0	110	69	1884	
16:30	16:45	0	105	18	0	31	105	0	123	77	1888	Peak
16:45	17:00	0	124	21	0	41	110	0	111	83	1862	
17:00	17:15	0	135	18	0	38	104	0	121	79	1727	
17:15	17:30	0	116	14	0	40	98	0	104	72	1529	
17:30	17:45	0	117	19	0	38	96	0	101	62	1325	
17:45	18:00	0	98	20	0	25	79	0	74	59	1094	
18:00	18:15	0	86	13	0	19	73	0	61	45	914	
18:15	18:30	0	61	11	0	9	55	0	61	43		
18:30	18:45	0	50	9	0	11	52	0	53	27		
18:45	19:00	0	51	11	0	19	37	0	34	23		

Peak Time		pproach Raymond Tarr			th Approach Hausman			pproach Raymond Tarr			Peak
eriod Star	Period End	U	WB	L	U	R	L	U	R	EB	total
8:00	9:00	0	566	143	0	51	284	0	452	275	1771
16:30	17:30	0	480	71	0	150	417	0	459	311	1888

ANNEXURE C: TRAFFIC SURVEY RESULTS

(Sheet 3 of 3)

BVY TRAFFIC SURVEY
ABN 18 434 865 435
3 Hepburn Way * Caroline Springs * Victoria * 3023 * Australia
Quality data services proven since 2000
Phone: 1300 883 936 * Fax: 1300 882 932

QUALITY ENDORSED COMPANY BY AS/NZS ISO 9001:2008
OH&S SYSTEM CERTIFIED TO AS/NZS ISO 4801:2001

TURNING MOVEMENT SURVEY
Intersection of Hausmann Dr and Raymond Tarrace Rd, Thornton

Date:	Sat 13/05/17
Weather:	Overcast
Suburban	Thornton
Customer:	BTF

North:	N/A
East:	Raymond Tarrace Rd
South:	Hausmann Dr
West:	Raymond Tarrace Rd

Survey Start	AM:	9:00	PM:	12:00
Vehicular Peakhour		Pedestrians Peakhour		
AM:	11:00 AM-12:00 P	AM:	N/A	
PM:	12:45 PM-1:45 PM	PM:	N/A	

All Vehicles

Time		Approach Raymond Tarra			uth Approach Hausmann			Approach Raymond Tarra			Hourly Total	
Period Star	Period End	U	WB	L	U	R	L	U	R	EB	Hour	Peak
9:00	9:15	0	68	10	0	5	57	0	41	58	1167	
9:15	9:30	0	87	21	0	17	79	0	48	69	1249	
9:30	9:45	0	94	23	0	9	64	0	46	63	1274	
9:45	10:00	0	86	16	0	11	66	0	68	61	1337	
10:00	10:15	0	90	10	0	12	59	0	82	68	1372	
10:15	10:30	0	99	8	0	17	63	0	78	81	1438	
10:30	10:45	0	104	11	0	17	77	0	68	85	1474	
10:45	11:00	0	101	13	0	8	71	0	71	79	1509	
11:00	11:15	0	105	21	0	13	77	0	85	86	1558	Peak
11:15	11:30	0	101	17	0	17	71	0	93	83		
11:30	11:45	0	110	19	0	15	71	0	95	87		
11:45	12:00	0	98	16	0	19	91	0	79	89		
12:00	12:15	0	97	14	0	18	62	0	70	100	1397	
12:15	12:30	0	91	10	0	11	59	0	68	85	1406	
12:30	12:45	0	95	12	0	19	62	0	74	79	1433	
12:45	13:00	0	99	15	0	13	80	0	75	89	1434	Peak
13:00	13:15	0	95	14	0	10	90	0	62	99	1412	
13:15	13:30	0	103	10	0	13	75	0	60	90	1387	
13:30	13:45	0	95	16	0	21	69	0	56	85	1372	
13:45	14:00	0	91	12	0	16	74	0	63	93	1344	
14:00	14:15	0	81	16	0	21	72	0	61	94	1334	
14:15	14:30	0	98	7	0	19	62	0	67	83		
14:30	14:45	0	93	10	0	17	54	0	59	81		
14:45	15:00	0	85	10	0	19	65	0	71	89		

Peak Time		Approach Raymond Tarra			uth Approach Hausmann			Approach Raymond Tarra			Peak
Period Star	Period End	U	WB	L	U	R	L	U	R	EB	total
11:00	12:00	0	414	73	0	64	310	0	352	345	1558
12:45	13:45	0	392	55	0	57	314	0	253	363	1434

ANNEXURE D: SIDRA MODELLING RESULTS

(10 SHEETS)

MOVEMENT SUMMARY

Site: 01 [01EXAM - Raymond Terrace Drive / Haussman Drive]

Raymond Terrace Drive / Haussman Drive
Thornton, NSW (Job Ref: 200695)
EXISTING AM
Site Category: (None)
Giveway / Yield (Two-Way)

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: Haussman Drive (S)												
1	L2	317	1.3	0.172	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	54.9
3	R2	57	5.6	0.440	41.8	LOS C	1.5	10.9	0.93	1.03	1.18	34.8
Approach		374	2.0	0.440	11.1	LOS A	1.5	10.9	0.14	0.60	0.18	50.5
East: Raymond Terrace Drive (E)												
4	L2	160	4.6	0.089	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.4
5	T1	632	1.8	0.328	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		792	2.4	0.328	1.2	NA	0.0	0.0	0.00	0.12	0.00	58.5
West: Raymond Terrace Drive (W)												
11	T1	307	2.1	0.161	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
12	R2	504	4.6	0.953	41.2	LOS C	17.2	124.9	0.97	2.11	4.68	35.1
Approach		812	3.6	0.953	25.6	NA	17.2	124.9	0.60	1.31	2.91	41.7
All Vehicles		1977	2.8	0.953	13.1	NA	17.2	124.9	0.27	0.70	1.23	48.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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 SUMMARY

Site: 01 [01EXPM - Raymond Terrace Drive / Haussman Drive]

Raymond Terrace Drive / Haussman Drive
Thornton, NSW (Job Ref: 200695)
EXISTING PM
Site Category: (None)
Giveway / Yield (Two-Way)

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: Haussman Drive (S)												
1	L2	465	1.6	0.720	55.7	LOS D	23.1	164.1	0.97	0.01	2.97	31.5
3	R2	167	3.8	1.006	111.6	LOS F	10.6	76.5	1.00	1.82	4.33	20.9
Approach		633	2.2	1.006	70.5	LOS F	23.1	164.1	0.98	0.49	3.33	27.8
East: Raymond Terrace Drive (E)												
4	L2	79	2.7	0.043	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.5
5	T1	536	2.2	0.279	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		615	2.2	0.279	0.7	NA	0.0	0.0	0.00	0.07	0.00	59.0
West: Raymond Terrace Drive (W)												
11	T1	347	2.7	0.182	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
12	R2	513	1.8	0.730	15.6	LOS B	7.0	49.6	0.79	1.23	1.75	46.7
Approach		860	2.2	0.730	9.3	NA	7.0	49.6	0.47	0.73	1.04	51.3
All Vehicles		2107	2.2	1.006	25.2	NA	23.1	164.1	0.49	0.47	1.43	42.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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 SUMMARY

Site: 01 [01(A)FUAM - Raymond Terrace Drive / Haussman Drive]

Raymond Terrace Drive / Haussman Drive
Thornton, NSW (Job Ref: 200695)
FUTURE AM - Scenario A
Site Category: (None)
Giveway / Yield (Two-Way)

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: Haussman Drive (S)												
1	L2	355	1.2	0.193	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	54.9
3	R2	66	4.8	0.516	45.1	LOS D	1.8	13.3	0.94	1.05	1.27	33.7
Approach		421	1.8	0.516	11.9	LOS A	1.8	13.3	0.15	0.61	0.20	50.0
East: Raymond Terrace Drive (E)												
4	L2	162	4.5	0.090	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.4
5	T1	632	1.8	0.328	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		794	2.4	0.328	1.2	NA	0.0	0.0	0.00	0.12	0.00	58.5
West: Raymond Terrace Drive (W)												
11	T1	307	2.1	0.346	2.2	LOS A	2.0	14.3	0.64	0.00	0.65	57.2
12	R2	514	4.5	0.973	47.4	LOS D	19.8	144.1	0.98	2.28	5.24	33.2
Approach		821	3.6	0.973	30.5	NA	19.8	144.1	0.86	1.43	3.52	39.3
All Vehicles		2036	2.7	0.973	15.2	NA	19.8	144.1	0.38	0.75	1.46	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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 SUMMARY

Site: 01 [01(A)FUPM - Raymond Terrace Drive / Haussman Drive]

Raymond Terrace Drive / Haussman Drive
Thornton, NSW (Job Ref: 200695)
FUTURE PM - Scenario A
Site Category: (None)
Giveway / Yield (Two-Way)

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: Haussman Drive (S)												
1	L2	476	1.5	0.782	71.4	LOS F	29.9	212.4	1.00	0.00	3.54	27.8
3	R2	171	3.7	1.110	177.8	LOS F	17.6	127.3	1.00	2.25	6.15	15.0
Approach		646	2.1	1.110	99.4	LOS F	29.9	212.4	1.00	0.59	4.23	22.8
East: Raymond Terrace Drive (E)												
4	L2	82	2.6	0.045	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.5
5	T1	536	2.2	0.279	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		618	2.2	0.279	0.8	NA	0.0	0.0	0.00	0.08	0.00	59.0
West: Raymond Terrace Drive (W)												
11	T1	347	2.7	0.182	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
12	R2	555	1.7	0.792	17.6	LOS B	8.9	63.3	0.83	1.36	2.13	45.5
Approach		902	2.1	0.792	10.8	NA	8.9	63.3	0.51	0.84	1.31	50.2
All Vehicles		2166	2.1	1.110	34.4	NA	29.9	212.4	0.51	0.55	1.81	38.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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 SUMMARY

Site: 01 [01(B)FUAM - Raymond Terrace Drive / Haussman Drive]

Raymond Terrace Drive / Haussman Drive
Thornton, NSW (Job Ref: 200695)
FUTURE AM - Scenario B
Site Category: (None)
Giveway / Yield (Two-Way)

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: Haussman Drive (S)												
1	L2	355	1.2	0.193	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	54.9
3	R2	74	4.3	0.576	48.3	LOS D	2.1	15.3	0.95	1.07	1.35	32.8
Approach		428	1.7	0.576	13.0	LOS A	2.1	15.3	0.16	0.62	0.23	49.3
East: Raymond Terrace Drive (E)												
4	L2	175	4.2	0.097	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.4
5	T1	632	1.8	0.328	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		806	2.3	0.328	1.2	NA	0.0	0.0	0.00	0.12	0.00	58.4
West: Raymond Terrace Drive (W)												
11	T1	307	2.1	0.351	2.3	LOS A	2.1	14.7	0.65	0.00	0.66	57.2
12	R2	514	4.5	0.990	54.6	LOS D	22.2	161.7	0.99	2.44	5.78	31.1
Approach		821	3.6	0.990	35.0	NA	22.2	161.7	0.86	1.53	3.87	37.5
All Vehicles		2056	2.7	0.990	17.2	NA	22.2	161.7	0.38	0.79	1.59	46.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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 SUMMARY

Site: 01 [01(B)FUPM - Raymond Terrace Drive / Haussman Drive]

Raymond Terrace Drive / Haussman Drive
Thornton, NSW (Job Ref: 200695)
FUTURE PM - Scenario B
Site Category: (None)
Giveway / Yield (Two-Way)

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: Haussman Drive (S)												
1	L2	476	1.5	0.892	99.1	LOS F	38.1	270.3	1.00	0.00	4.45	23.0
3	R2	202	3.1	1.377	389.2	LOS F	40.6	291.6	1.00	3.36	10.80	7.9
Approach		678	2.0	1.377	185.6	LOS F	40.6	291.6	1.00	1.00	6.34	14.8
East: Raymond Terrace Drive (E)												
4	L2	142	1.5	0.077	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	536	2.2	0.279	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		678	2.0	0.279	1.2	NA	0.0	0.0	0.00	0.12	0.00	58.5
West: Raymond Terrace Drive (W)												
11	T1	347	2.7	0.183	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
12	R2	555	1.7	0.854	22.0	LOS B	11.1	79.0	0.89	1.56	2.77	43.2
Approach		902	2.1	0.854	13.5	NA	11.1	79.0	0.55	0.96	1.70	48.4
All Vehicles		2258	2.1	1.377	61.5	NA	40.6	291.6	0.52	0.72	2.59	29.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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 SUMMARY

Site: 02A [02(A)FUAM - Haussman Drive / Access Road - RHT IN]

Huassman Drive / Access Road - Scenario A
Thornton, NSW (Job Ref: 200695)
FUTURE AM - Scenario A
Site Category: (None)
Giveway / Yield (Two-Way)

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: Haussman Drive (S)												
2	T1	459	1.6	0.130	0.4	LOS A	0.3	2.1	0.06	0.02	0.06	59.3
3	R2	13	0.0	0.130	11.5	LOS A	0.3	2.1	0.13	0.04	0.13	56.8
Approach		472	1.6	0.130	0.7	NA	0.3	2.1	0.06	0.02	0.06	59.3
East: Access Road (E)												
4	L2	48	0.0	0.055	7.4	LOS A	0.2	1.4	0.43	0.66	0.43	52.2
Approach		48	0.0	0.055	7.4	LOS A	0.2	1.4	0.43	0.66	0.43	52.2
North: Huassman Dirve (N)												
7	L2	13	0.0	0.217	5.6	LOS A	0.0	0.0	0.00	0.02	0.00	58.2
8	T1	815	3.7	0.217	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.9
Approach		827	3.7	0.217	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles		1347	2.8	0.217	0.6	NA	0.3	2.1	0.04	0.04	0.04	59.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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 SUMMARY

Site: 02A [02(A)FUPM - Haussman Drive / Access Road - RHT IN]

Huassman Drive / Access Road - Scenario A
Thornton, NSW (Job Ref: 200695)
FUTURE PM - Scenario A
Site Category: (None)
Giveway / Yield (Two-Way)

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: Haussman Drive (S)												
2	T1	776	1.8	0.243	0.8	LOS A	1.2	8.2	0.12	0.04	0.13	58.7
3	R2	53	0.0	0.243	11.5	LOS A	1.2	8.2	0.31	0.11	0.34	55.1
Approach		828	1.7	0.243	1.5	NA	1.2	8.2	0.14	0.05	0.15	58.4
East: Access Road (E)												
4	L2	14	0.0	0.014	6.9	LOS A	0.0	0.3	0.38	0.59	0.38	52.4
Approach		14	0.0	0.014	6.9	LOS A	0.0	0.3	0.38	0.59	0.38	52.4
North: Huassman Dirve (N)												
7	L2	53	0.0	0.202	5.6	LOS A	0.0	0.0	0.00	0.08	0.00	57.6
8	T1	725	1.6	0.202	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.6
Approach		778	1.5	0.202	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.5
All Vehicles		1620	1.6	0.243	1.0	NA	1.2	8.2	0.07	0.05	0.08	58.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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 SUMMARY

Site: 02B [02(B)FUAM - Haussman Drive / Access Road - No RHT IN]

Huassman Drive / Access Road - Scenario B
Thornton, NSW (Job Ref: 200695)
FUTURE AM - Scenario B
Site Category: (None)
Giveway / Yield (Two-Way)

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: Haussman Drive (S)												
2	T1	429	1.7	0.111	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		429	1.7	0.111	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
East: Access Road (E)												
4	L2	96	0.0	0.100	7.0	LOS A	0.4	2.5	0.39	0.64	0.39	52.4
Approach		96	0.0	0.100	7.0	LOS A	0.4	2.5	0.39	0.64	0.39	52.4
North: Huassman Dirve (N)												
7	L2	24	0.0	0.182	5.6	LOS A	0.0	0.0	0.00	0.04	0.00	58.0
8	T1	664	4.6	0.182	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	59.8
Approach		688	4.4	0.182	0.2	NA	0.0	0.0	0.00	0.02	0.00	59.7
All Vehicles		1214	3.1	0.182	0.7	NA	0.4	2.5	0.03	0.06	0.03	59.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

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MOVEMENT SUMMARY

Site: 02B [02(B)FUPM - Haussman Drive / Access Road - No RHT IN]

Huassman Drive / Access Road - Scenario B
Thornton, NSW (Job Ref: 200695)
FUTURE PM - Scenario B
Site Category: (None)
Giveway / Yield (Two-Way)

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: Haussman Drive (S)												
2	T1	678	2.0	0.176	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		678	2.0	0.176	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
East: Access Road (E)												
4	L2	26	0.0	0.025	6.5	LOS A	0.1	0.6	0.32	0.58	0.32	52.6
Approach		26	0.0	0.025	6.5	LOS A	0.1	0.6	0.32	0.58	0.32	52.6
North: Huassman Dirve (N)												
7	L2	105	0.0	0.182	5.6	LOS A	0.0	0.0	0.00	0.18	0.00	56.8
8	T1	592	2.0	0.182	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	59.3
Approach		697	1.7	0.182	0.9	NA	0.0	0.0	0.00	0.09	0.00	58.9
All Vehicles		1401	1.8	0.182	0.6	NA	0.1	0.6	0.01	0.06	0.01	59.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

M^CLAREN TRAFFIC ENGINEERING

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Email: admin@mclarentraffic.com.au

Division of RAMTRANS Australia ABN: 45067491678 RPEQ: 19457

Transport Planning, Traffic Impact Assessments, Road Safety Audits, Expert Witness

24 November 2022 Reference: 220798.01FA

McCloy Group
Suite 2, Ground Floor,
317 Hunter Street, Newcastle
NSW 2300
Attention: Sam Rowe

SUPPLEMENTARY TRAFFIC IMPACT ASSESSMENT FOR RESIDENTIAL SUBDIVISION AT 107 HAUSSMAN DRIVE, THORNTON

Dear Sam,

Reference is made to your request to provide a supplementary traffic impact assessment of the proposed residential subdivision at 107 Haussman Drive, Thornton. This report should be read as a supplement to the traffic and parking impact assessment report by M^CLaren Traffic Engineering dated 8 October 2020 (MTE Report) (reference 200695.01FA).

Taking into consideration the comments provided by the Department of Planning and Environment (as reproduced in **Annexure A** for reference), additional traffic modelling has been undertaken, including the planned road network changes in the immediate vicinity of the site. The modelling has been undertaken using an Aimsun microsimulation model provided by TfNSW.

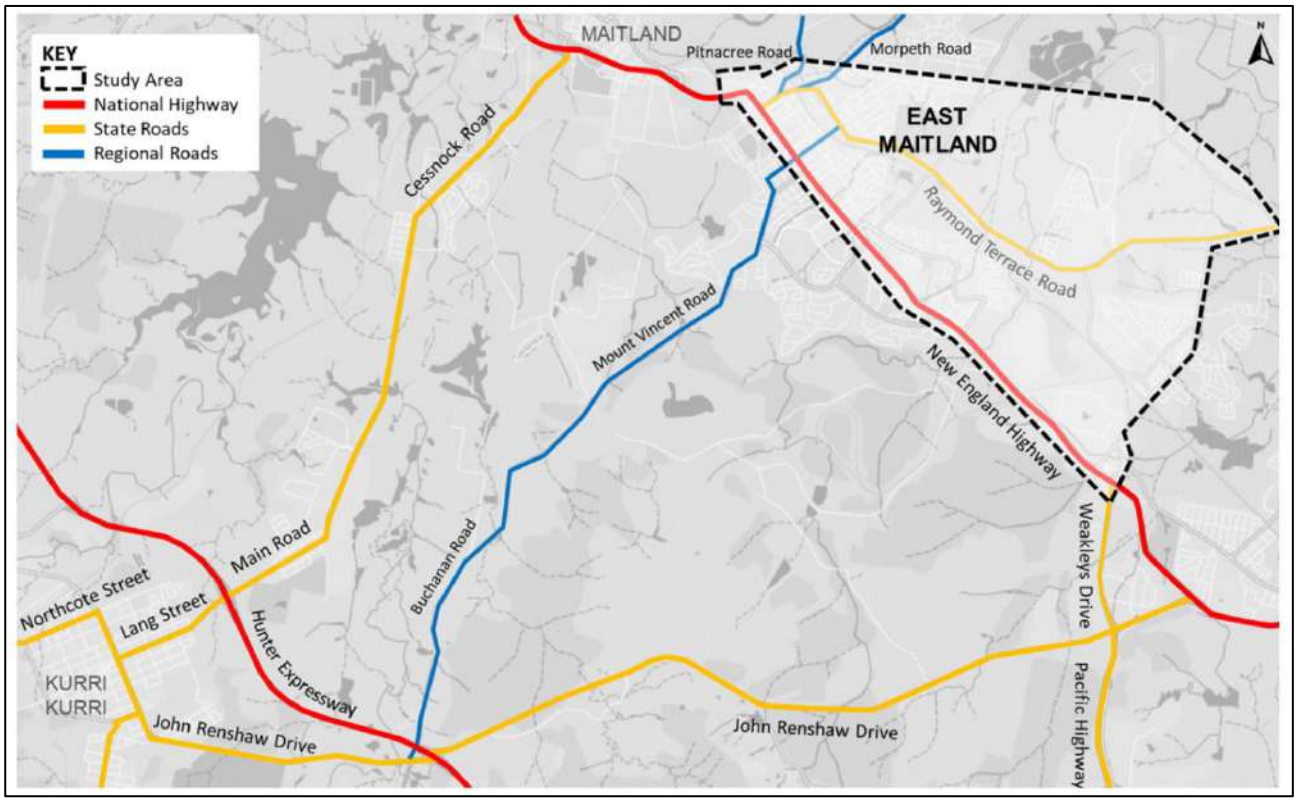
The assumptions with regards to traffic generation and traffic distribution provided in the MTE Report have been retained for the purpose of this supplementary modelling and reference should be made to that report if further details regarding the application are sought.

1 Modelling Methodology

To reflect the impacts of the development on the roads surrounding the site and to assess the impacts of two possible access arrangements, modelling has been undertaken using an Aimsun microsimulation model provided by TfNSW. The results reflected by this model is detailed in **Section 2**.

1.1 Aimsun Base Model

The base model provided by TfNSW is a base model to assist with the assessment of the road network performance in East Maitland. It was prepared by Arcadis and includes the area as indicated in **Figure 1**.



Arcadis 2022

FIGURE 1: SCOPE OF BASE MICROSIMULATION MODEL

The model includes volumes for the AM (7 AM – 9 AM) and PM (3 PM – 5 PM) peaks and has been calibrated and validated by Arcadis to meet the requirements of the TfNSW Traffic Modelling Guidelines. The base configuration of the roads surrounding the site in the model is depicted in **Figure 2**.

As shown, the layout of the model does not include any of the upgrades planned in the near future by Maitland Council as outlined in **Annexure B**.

FIGURE 2: BASE MODEL CONFIGURATION

1.2 Model Adaptation

1.2.1 Road Network Adjustments

To provide an assessment of the performance of the road network surrounding the site and noting that the upgrades planned by Maitland Council will be completed prior to the occupation of any development on the site, modifications were made to the base model including:

- Duplication of Haussman Drive between Taylor Avenue and Raymond Terrace Road;
- Upgrade of Taylor Avenue / Haussman Drive intersection to a dual-lane roundabout;
- Upgrade of Raymond Terrace / Haussman Drive intersection to signal control, including extra lanes;
- Duplication of Raymond Terrace Road between Haussman Drive and Harvest Boulevarde.

The road layout implemented in the model including the upgrades is depicted in **Figure 4**.

1.2.2 Scope of Model Used for Assessment

To examine the area most relevant to the site and the access option testing, the scope of the model was reduced to encompass only the area outlined in **Figure 3**. The volumes in the reduced model were based on subpath volumes from the base model (including Council Road upgrades) such that there was no difference between the models when considering the reduced area only.

FIGURE 3: REDUCED SCOPE OF MODEL USED FOR ASSESSMENT

FIGURE 4: MODEL INCLUDING LOCALISED UPGRADES

2 Modelling of Existing, Future and Development Traffic Volumes

2.1 Existing Traffic Environment

The existing traffic environment has been modelled as a base point of comparison for the future traffic environment. The existing traffic environment has been assessed using the base traffic volumes as adapted from the base model provided by TfNSW. All modelling has been based on the upgraded road network as discussed in **Section 1.2**. The results of the base model assessment are summarised in **Table 1**.

TABLE 1: EXISTING INTERSECTION PERFORMANCE
AIMSUN

BASE + LOCAL UPGRADES					
Intersection	**Control**	**Peak Period**	**Average Delay (worst)**	**Level of Service (worst)**	**Maximum Average Vehicle Queue (Approach)**
Haussman Drive / Taylor Avenue	Roundabout	AM	7.1 (8.6) (East RT)	A (A)	0.2 (East LT)
		PM	3.8 (5) (South RT)	A (A)	0.1 (East LT)
Haussman Drive / Raymond Terrace Road	Signals	AM	14.5 (22.7) (South RT)	B (B)	1.4 (East T)
		PM	7.6 (13) (West RT)	A (A)	1.5 (East T)

2.2 Growth Traffic Environment

The performance of the future road network based on 2% growth volumes per annum and with the local road upgrades implemented in the model as outlined in **Section 1.2** is summarised in **Table 2**.
.

TABLE 2: EXISTING PLUS GROWTH INTERSECTION PERFORMANCE
AIMSUN

BASE + LOCAL UPGRADES					
Intersection	**Control**	**Peak Period**	**Average Delay (worst)**	**Level of Service (worst)**	**Maximum Average Vehicle Queue (Approach)**
Haussman Drive / Taylor Avenue	Roundabout	AM	7.1 (8.6) (East RT)	A (A)	0.2 (East LT)
		PM	3.6 (6) (South RT)	A (A)	0.1 (East LT)
Haussman Drive / Raymond Terrace Road	Signals	AM	14.6 (26.4) (South RT)	B (B)	1.3 (East T)
		PM	7.4 (12) (West RT)	A (A)	2.2 (West RT)

2.3 Traffic Impacts of Development

Using the traffic distribution as outlined in the MTE Report, the Aimsun model was adapted to include two configurations for testing as follows:

A. Site access restricted to left-in, left-out from Haussman Drive (**Figure 5**);

B. Site access restricted to left-in, right-in, left-out from Haussman Drive (**Figure 6**).

For this assessment, the traffic volumes associated with the development were added to the "base plus 10-year growth" volumes in the Aimsun model to reflect the performance of the road network at a 10-year design horizon.

The results of this assessment are reflected in **Table 9**.

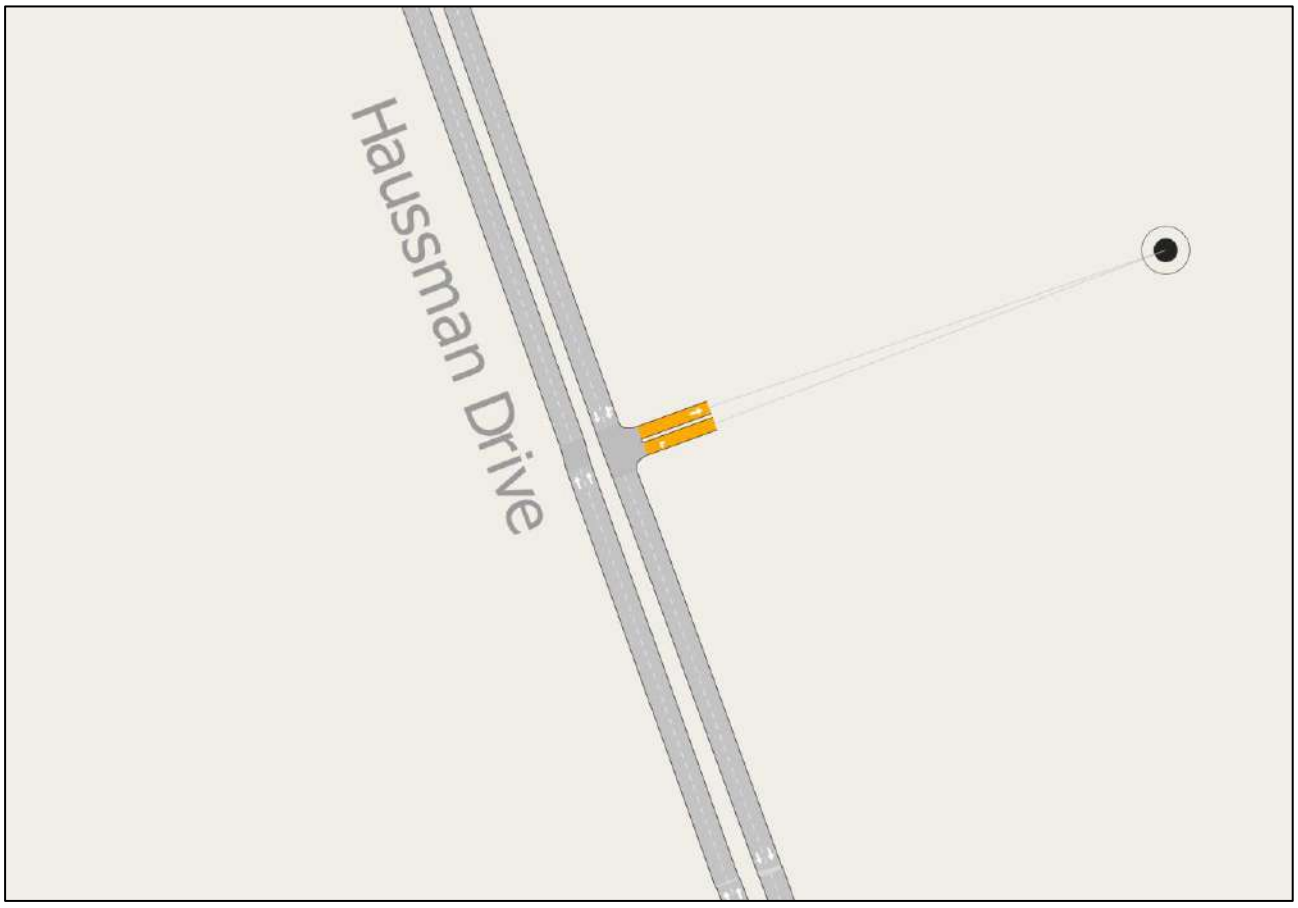


FIGURE 5: HAUSSMAN DRIVE LEFT-IN / LEFT-OUT DEVELOPMENT ACCESS OPTION – MODEL SNAPSHOT

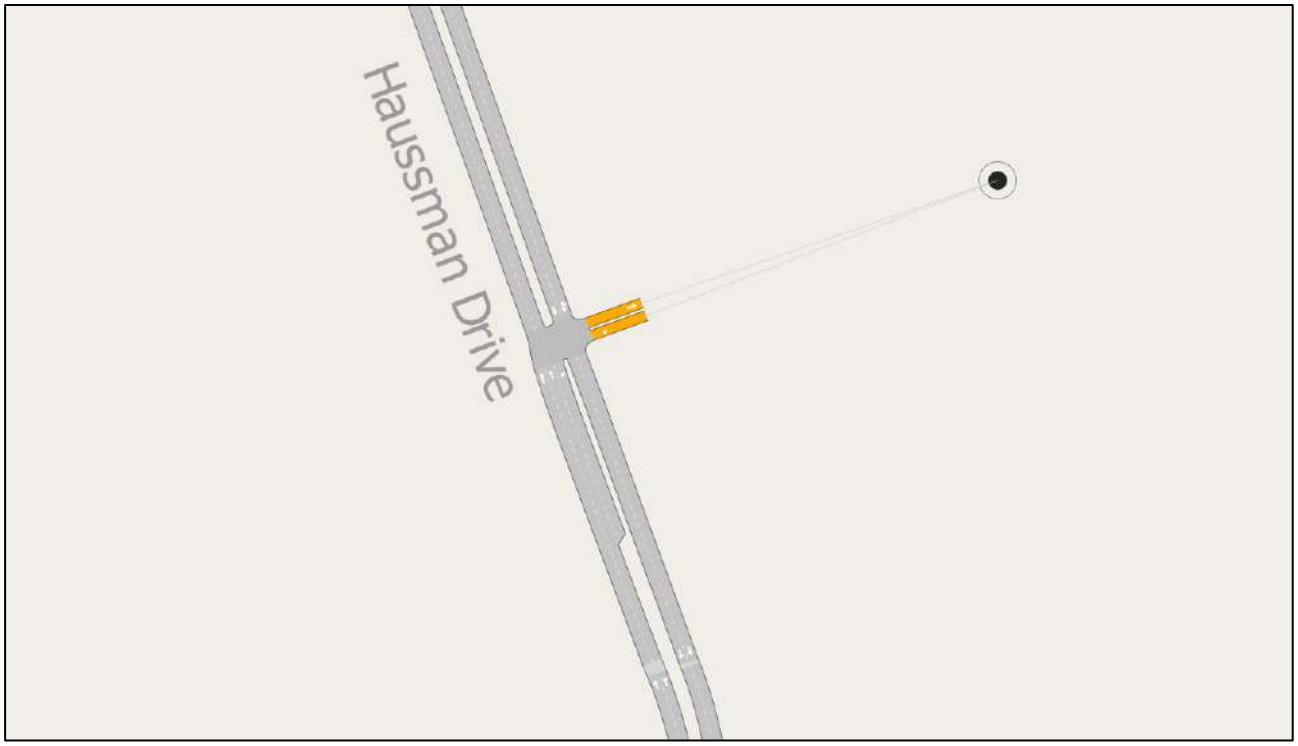


FIGURE 6: HAUSSMAN DRIVE LEFT-IN / RIGHT IN / LEFT-OUT DEVELOPMENT ROAD DEVELOPMENT ACCESS OPTION – MODEL SNAPSHOT

TABLE 3: INTERSECTION PERFORMANCES (AIMSUN)
EXISTING PLUS GROWTH PLUS DEVELOPMENT

Left-In Left-Out					
Intersection	**Control**	**Peak Period**	**Average Delay (worst)**	**Level of Service (worst)**	**Maximum Average Vehicle Queue (Approach)**
Haussman Drive / Taylor Avenue	Roundabout	AM	10.9 (48.2) (North T)	A (D)	0.2 (East LT)
		PM	10.2 (42) (North T)	A (C)	0.2 (East LT)
Haussman Drive / Raymond Terrace Road	Signals	AM	15.5 (43.3) (South RT)	B (D)	1 (East LT)
		PM	12.3 (26) (West RT)	A (B)	1.3 (West RT)
Site Entry	Give-Way	AM	1.9 (5.2) (North LT)	A (A)	0 (North LT)
		PM	0.9 (4) (North LT)	A (A)	0 (North LT)
Right-In Permitted					
Intersection	**Control**	**Peak Period**	**Average Delay (worst)**	**Level of Service (worst)**	**Maximum Average Vehicle Queue (Approach)**
Haussman Drive / Taylor Avenue	Roundabout	AM	10.8 (47.8) (North T)	A (D)	0.2 (East LT)
		PM	10.1 (42) (North T)	A (C)	0.2 (East LT)
Haussman Drive / Raymond Terrace Road	Signals	AM	13 (26.4) (West RT)	A (B)	1 (East LT)
		PM	12.5 (26) (West RT)	A (B)	1.4 (West RT)
Site Entry	Give-Way	AM	2 (4.9) (North LT)	A (A)	0.1 (North T)
		PM	0.9 (4) (North LT)	A (A)	0 (North LT)

As shown, under both development scenarios, the surrounding intersections will retain levels of service of “A” or “B”, indicating that the proposed development will have little to no noticeable effect on the performance of the road network in the surrounds of the site.

Whilst the traffic model provided by TfNSW includes a much larger scope than just these intersections, the impact on any intersections further afield will be less than that at those modelled and there is no need to provide results for other intersections.

3 Conclusions

The traffic impacts of the subject residential subdivision at 107 Haussman Drive, Thornton have been assessed, with the following conclusions drawn:

- The traffic generation associated with a 160-lot residential subdivision will have little to no noticeable effect on the performance of the road network.
- Both access options assessed (left-in / left-out and left-in / right-in / left-out) perform acceptably and there is no clear difference in the performance of the road network based on the options assessment.
- It is likely that a right-turn into the site would provide for a superior level of amenity for residents and, considering that the modelling demonstrates that it will have no adverse impact on the road network, it is the superior option for access to the site.

Please contact the undersigned on 9521 7199 should you require further information or assistance.

Yours faithfully,

McLaren Traffic Engineering

Tom Steal
Senior Traffic Engineer
BE Civil AMAITPM MIEAust
RMS Accredited Level 2 Road Safety Auditor

ANNEXURE A: DPIE COMMENTS

(2 SHEETS)

Department of Planning and Environment

Mr David Evans
General Manager
Maitland City Council
PO Box 220
MAITLAND NSW 2320

Our ref: IRF22/2059

Attn: Leonie Bryson

Dear Mr Evans,

Planning proposal PP-2021-2820 to amend Maitland Local Environmental Plan 2011

I am writing in response to the planning proposal forwarded to the Minister under section 3.34(1) of the *Environmental Planning and Assessment Act 1979* (the Act) seeking to enable residential development at 107 Haussman Drive, Thornton.

The planning proposal has not sufficiently demonstrated how the boundary of the R1 General Residential zone avoids or minimises the impacts on vegetation or environmental values. The NSW Biodiversity Assessment Method (BAM) is the pathway to determine if areas of environmental value should be avoided or conserved. This assessment needs to be undertaken before the planning proposal can progress.

This may also have implications for the bushfire report and the advice of NSW Rural Fire Service regarding compliance with Planning for Bushfire Protection. Confirmation from the agency is required on the need for secondary access to the site, and for landowner support if this is required to be located on adjoining properties.

Confirmation from Subsidence Advisory NSW is also required to determine consistency with section 9.1 Ministerial direction 4.6 and whether additional studies or measures, including grouting, are required to support future residential uses.

The above matters were not appropriately addressed in the planning proposal submitted to the Department of Planning and Environment. As delegate of the Minister for Planning and Homes, I have determined the planning proposal should be resubmitted after matters outlined in the enclosed Gateway Determination have been addressed.

If the planning proposal is not resubmitted and considered adequate before the timeframe specified in the enclosed Gateway determination, a decision will be made to not proceed with the planning proposal under section 3.32(2(d) of the Act.

While not a final plan, the Department has done an assessment of the planning proposal against the draft Hunter Regional Plan 2041. In particular, assessing the merits against the objectives to create a 15-minute region and nimble neighbourhoods of diverse housing.

The site is well-positioned to a range of day-to-day needs and services, along with public transport. Furthermore, there is an active planning proposal (PP-2022-1187) opposite the site which seeks a range of employment uses. This will further reinforce accessibility for future residents to local employment opportunities without the need to commute by private vehicle.

The draft regional plan recognises that in order to achieve the many public interest intentions of the draft plan, new developments will have to be different. There needs to be greater diversity of housing to improve affordability. As the proposed minimum lot size of 450m^2 is the same as the adjoining R1 General Residential zoned areas, it is not consistent with this strategy or objective.

Given the proposed opportunities for a 15-minute neighbourhood outlined above, a density of only 8 dwellings/ha will be a significant missed opportunity and substantially below an optimum density for the site.

In our assessment of the planning proposal, the following matters were identified as likely to be required to be addressed prior to public exhibition (unless addressed beforehand):

- a revised transport assessment that considers Transport for NSW's road and intersection planning for the area; and
- advice from Hunter Water Corporation on the location and capacity of sewer and water in relation to the site.

These above matters could be further considered as part of the resubmitted planning proposal. However, they are not required or been conditioned in the Gateway determination.

The Department offers its assistance in resolving these matters and recommends Council seeks pre-lodgement advice to confirm the matters listed in the Gateway resubmit have been adequately addressed.

As you would be aware the Department of Planning and Environment is committed to reducing the time taken to complete planning proposals and is taking an active management approach to align planning proposals with the timeframes outlined in the *Local Environmental Plan Making Guideline* (December 2021).

Should you have any enquiries about this matter, I have arranged for Mr Thomas Holmes, Senior Planning Officer, Central Coast and Hunter to assist you. Mr Holmes can be contacted on 9860 1583.

Yours sincerely

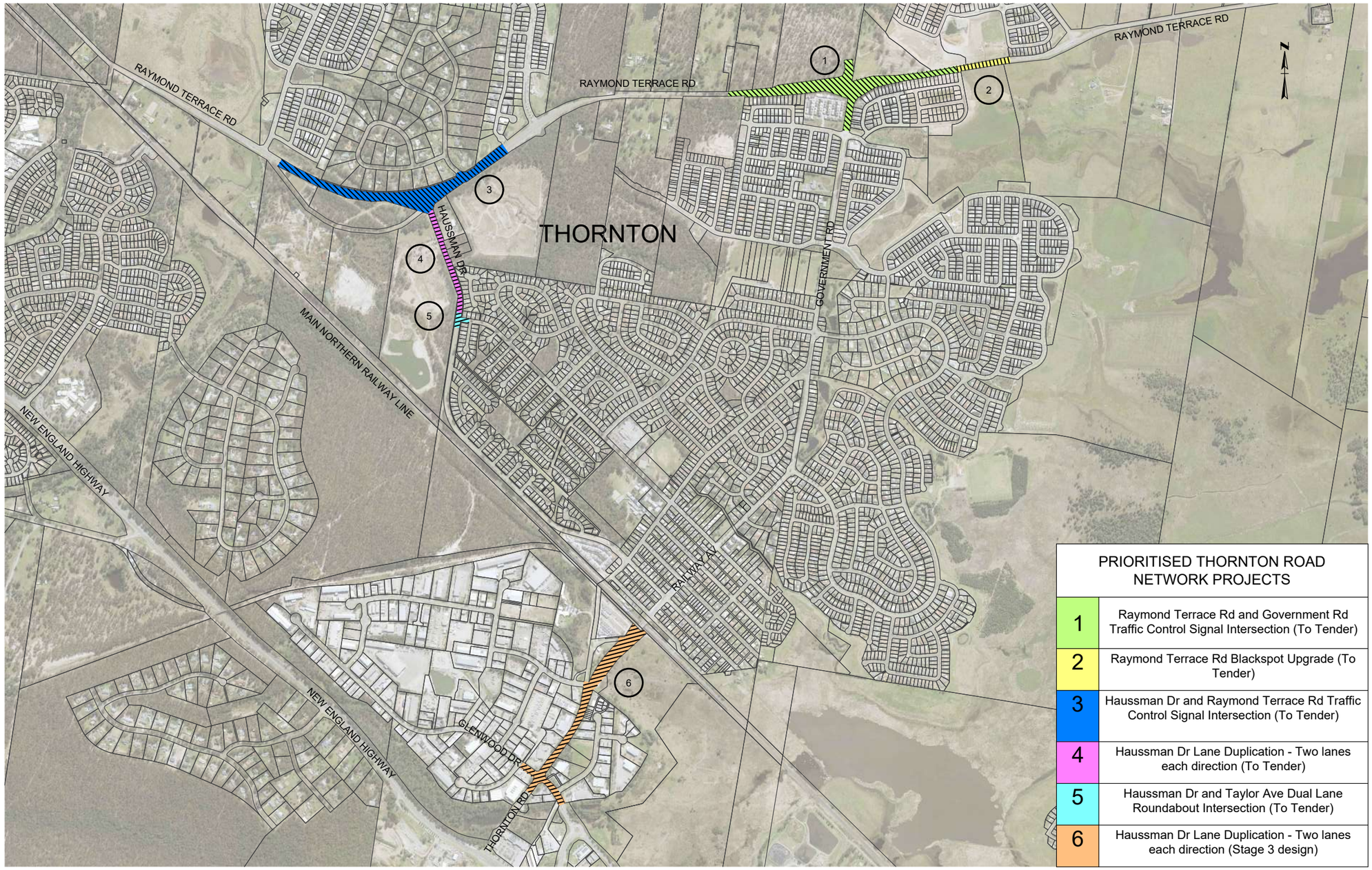
26/08/2022
Dan Simpkins
Director, Central Coast and Hunter Region
Planning and Land Use Strategy

Encl: Gateway determination

ANNEXURE B: MAP OF UPGRADES FROM COUNCIL MEETING MINUTES

(1 SHEET)

BRINGING FORWARD CONSTRUCTION OF HAUSSMAN DRIVE & RAYMOND TERRACE ROAD - UPDATE (Cont.)



PRIORITISED THORNTON ROAD NETWORK PROJECTS	
1	Raymond Terrace Rd and Government Rd Traffic Control Signal Intersection (To Tender)
2	Raymond Terrace Rd Blackspot Upgrade (To Tender)
3	Haussman Dr and Raymond Terrace Rd Traffic Control Signal Intersection (To Tender)
4	Haussman Dr Lane Duplication - Two lanes each direction (To Tender)
5	Haussman Dr and Taylor Ave Dual Lane Roundabout Intersection (To Tender)
6	Haussman Dr Lane Duplication - Two lanes each direction (Stage 3 design)

P:\Task Folders 1819\Govt and RT Rd Thornton Inters - 3615\02 DESIGN\11 Overview\3615-11A.dwg

A	ORIGINAL ISSUE	C.P.	03/05/2022
	SHEET REVISION	BY	DATE

Plotted: 3/05/2022 12:47:33 PM By: CI

CONCEPT PLAN - NOT FOR CONSTRUCTION

RATIO @A3
Horizontal Ratio:1:15 000
Vertical Ratio:

SURVEYOR	DATUM
N/A	A.H.D.
DESIGNER	DATE OF PLAN
C. Pinchen	03/05/2022

MAITLAND CITY COUNCIL
INFRASTRUCTURE & WORKS
285-287 HIGH STREET
P.O. BOX 220
MAITLAND 2320
PHONE: (02) 49349700
FAX (02) 49333209
DX 21613 MAITLAND

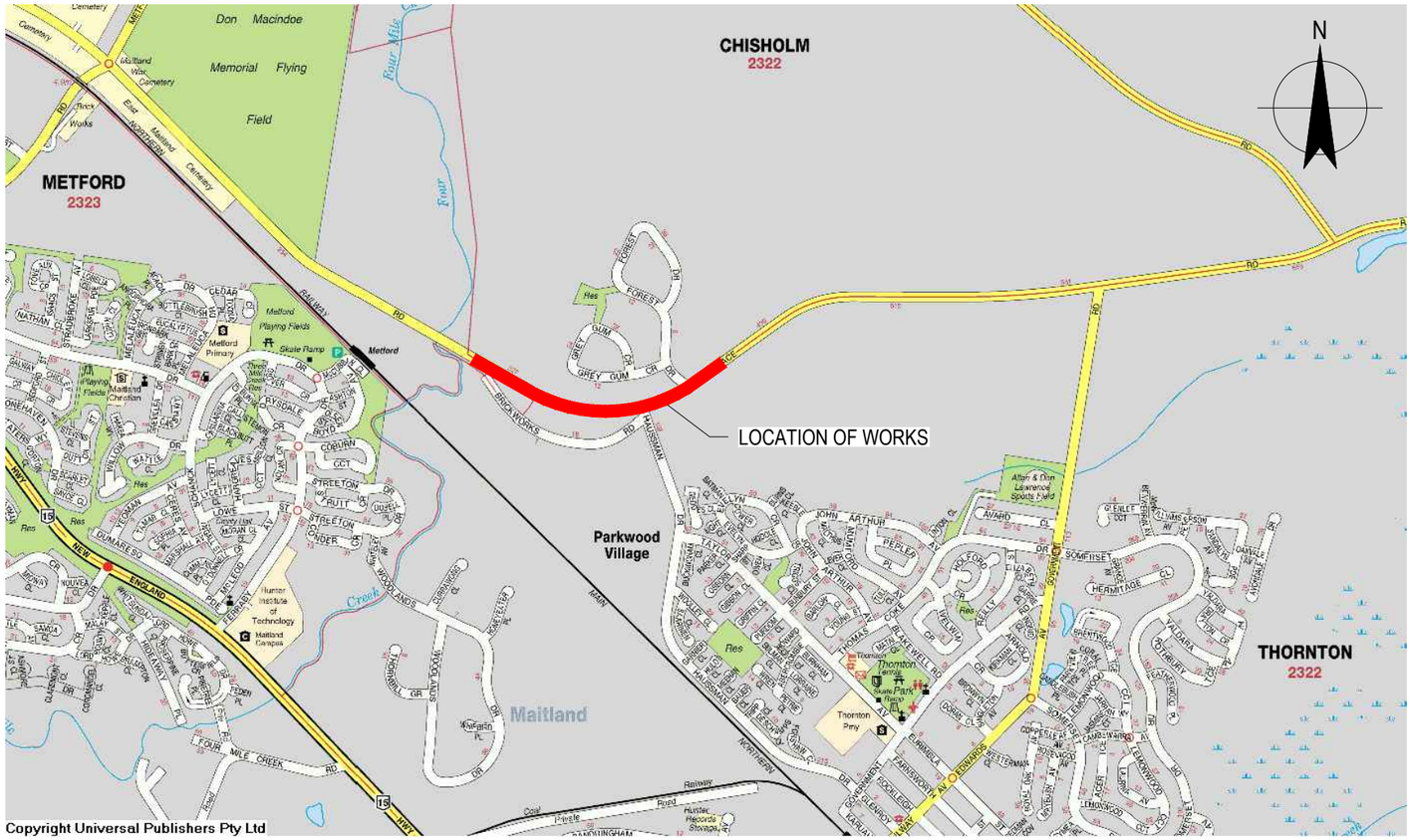
THORNTON ROAD NETWORK
Tender Projects
Thornton
PRIORITISED THORNTON ROAD NETWORK PROJECTS

PLAN No. 3615-11A
Sheet 1 of 1

ANNEXURE C: ROAD UPGRADE PLANS PROVIDED BY COUNCIL

(19 SHEETS)

MAITLAND CITY COUNCIL
HAUSSMAN DRIVE - STAGE 2
RAYMOND TERRACE ROAD - DETAILED DESIGN
22-12542622



LOCALITY PLAN
N.T.S

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	30% DETAIL DESIGN	BD	GM	AS	30.07.21

maitland city council

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Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE - STAGE 2
Title COVER SHEET AND LOCALITY PLAN

Original Size **A3** Drawing No: **22-12542622-C2001** Rev: **A**

Plot Date: 30 July 2021 - 3:50 PM Plotted By: Blake Drew Cad File No: C:\12d\SW\data\P-00-12D-001\22-12542622 - MCC - Haussman Drive, Stage 2 - Detailed Design_1219\CADD\Drawings\22-12542622-C2000.dwg

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0 50 100 150m
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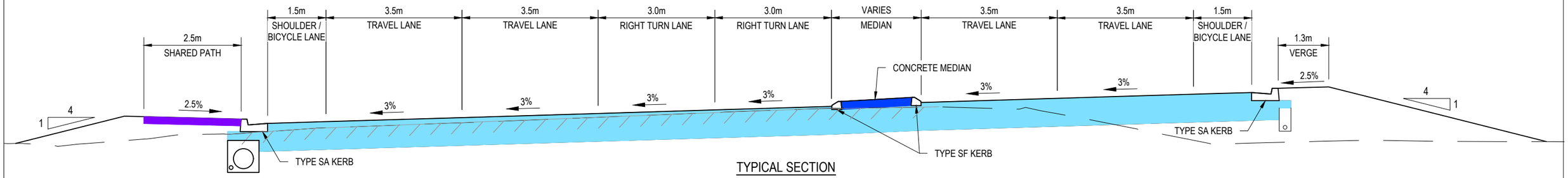
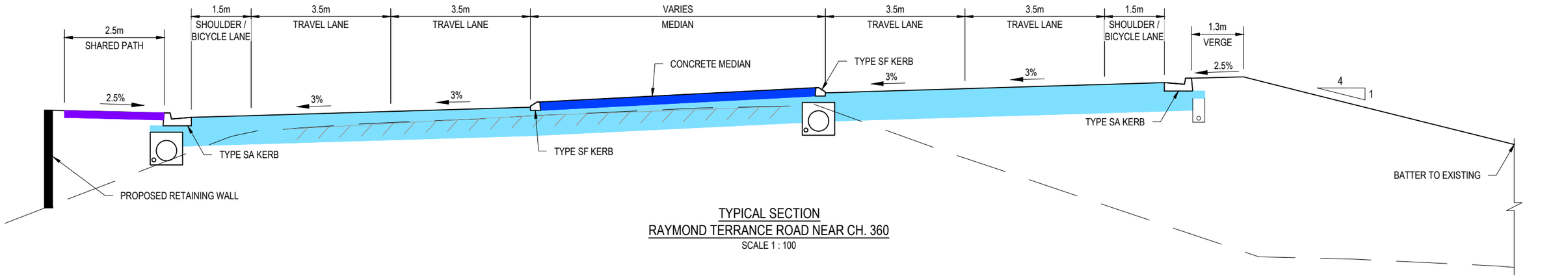
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE - STAGE 2
Title GENERAL ARRANGENMENT

Original Size **A3** Drawing No: **22-12542622-C2031** Rev: **A**

Plot Date: 30 July 2021 - 3:51 PM Plotted By: Blake Drew Cad File No: C:\12d\SW\data\P-00-12D-001\22-12542622 - MCC - Haussman Drive, Stage 2 - Detailed Design_1219\CADD\Drawings\22-12542622-C2030.dwg



TYPICAL SECTION
RAYMOND TERRANCE ROAD NEAR CH. 540
SCALE 1 : 100



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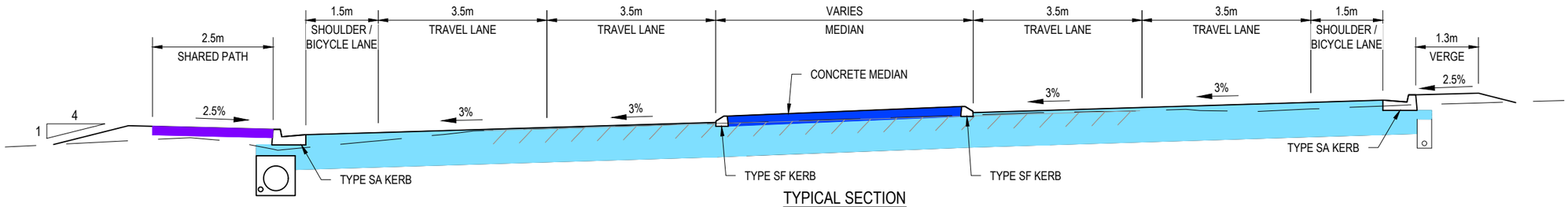
SCALE 1 : 100



TYPICAL SECTION
RAYMOND TERRANCE ROAD NEAR CH. 160
SCALE 1 : 100

NOTES

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2. SUBSURFACE DRAINAGE TO BE IN ACCORDANCE WITH TFNSW STANDARD DRAWINGS 0000.000.PT.0009 TO 0000.000.PT.0014
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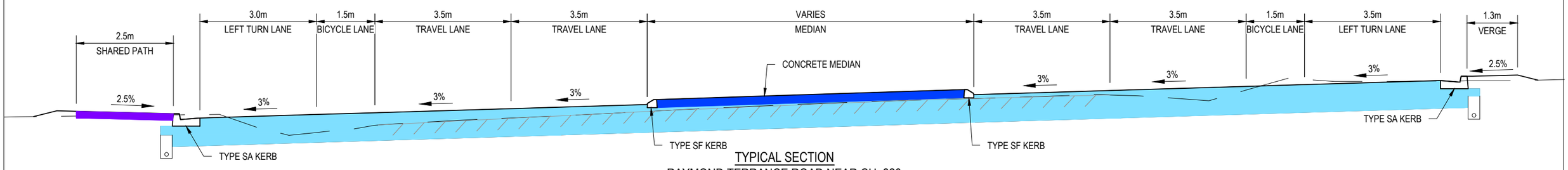
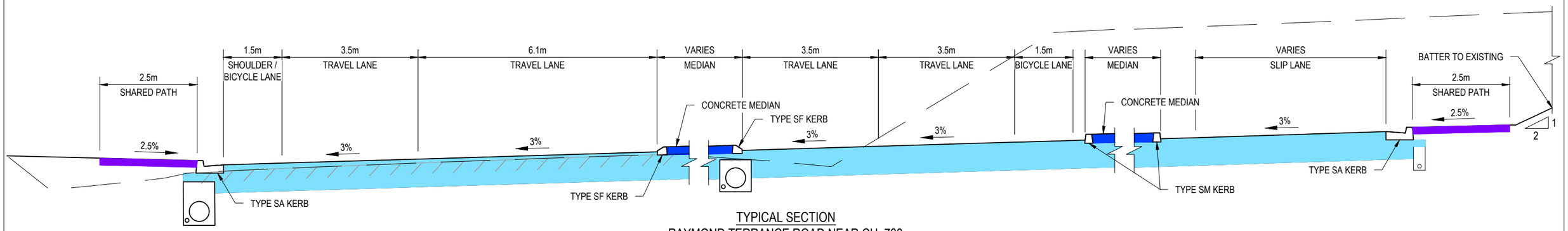
Project HAUSSMAN DRIVE - STAGE 2
Title TYPICAL SECTIONS
SHEET 1 OF 2

Original Size **A3** Drawing No: **22-12542622-C2051** Rev: **A**

Plot Date: 30 July 2021 - 3:51 PM Plotted By: Blake Drew Cad File No: C:\12d\SW\data\P-00-12D-001\22-12542622 - MCC - Haussman Drive, Stage 2 - Detailed Design_1219\CADD\Drawings\22-12542622-C2050.dwg



TYPICAL SECTION
RAYMOND TERRANCE ROAD NEAR CH. 820
SCALE 1 : 100



TYPICAL SECTION
RAYMOND TERRANCE ROAD NEAR CH. 700
SCALE 1 : 100

NOTES

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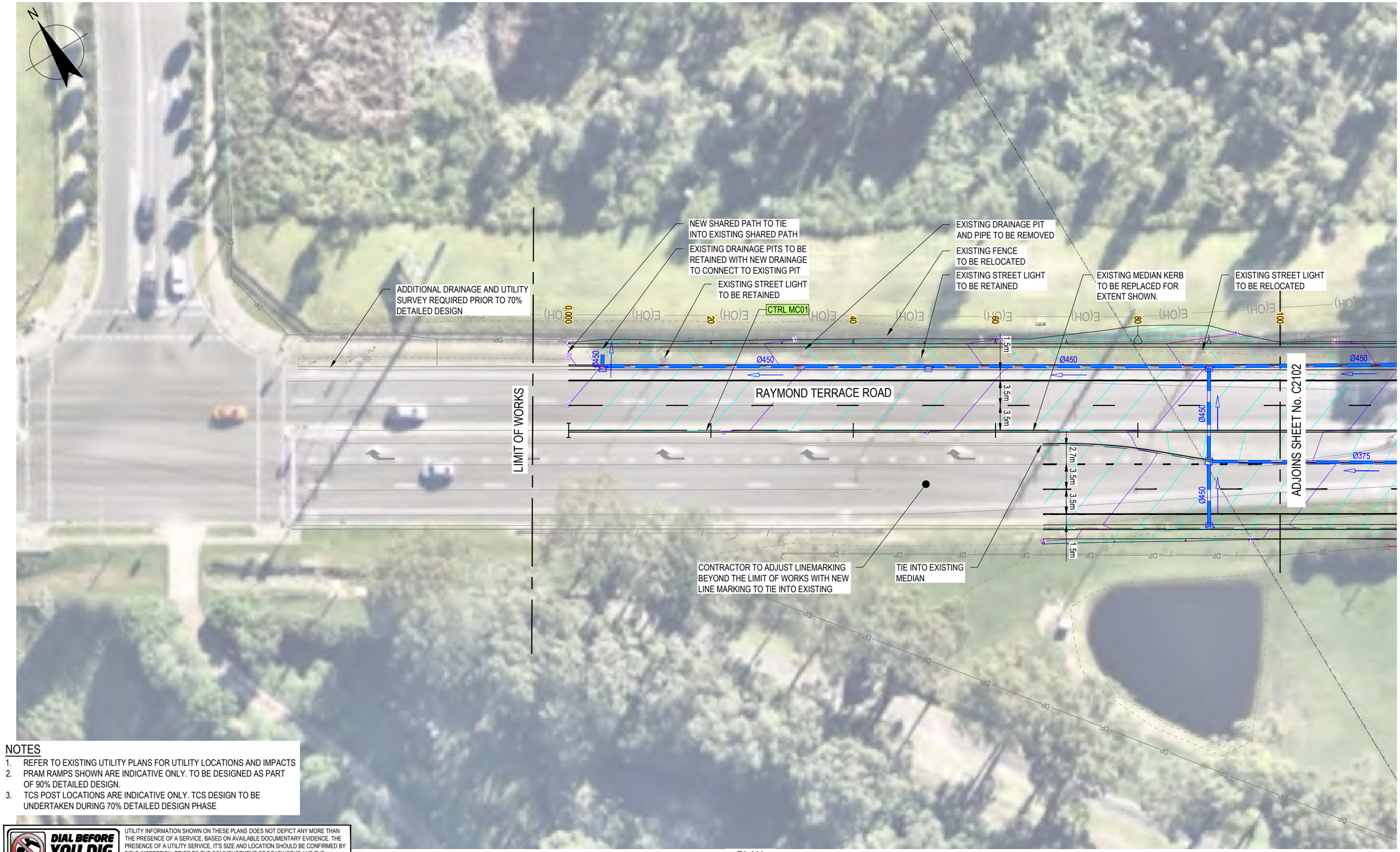
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE - STAGE 2
Title TYPICAL SECTIONS
SHEET 2 OF 2

Original Size **A3** Drawing No: **22-12542622-C2052** Rev: **A**

Plot Date: 30 July 2021 - 3:51 PM Plotted By: Blake Drew Cad File No: C:\12d\SW\data\P-00-12D-001\22-12542622 - MCC - Haussman Drive, Stage 2 - Detailed Design_1219\CADD\Drawings\22-12542622-C2050.dwg



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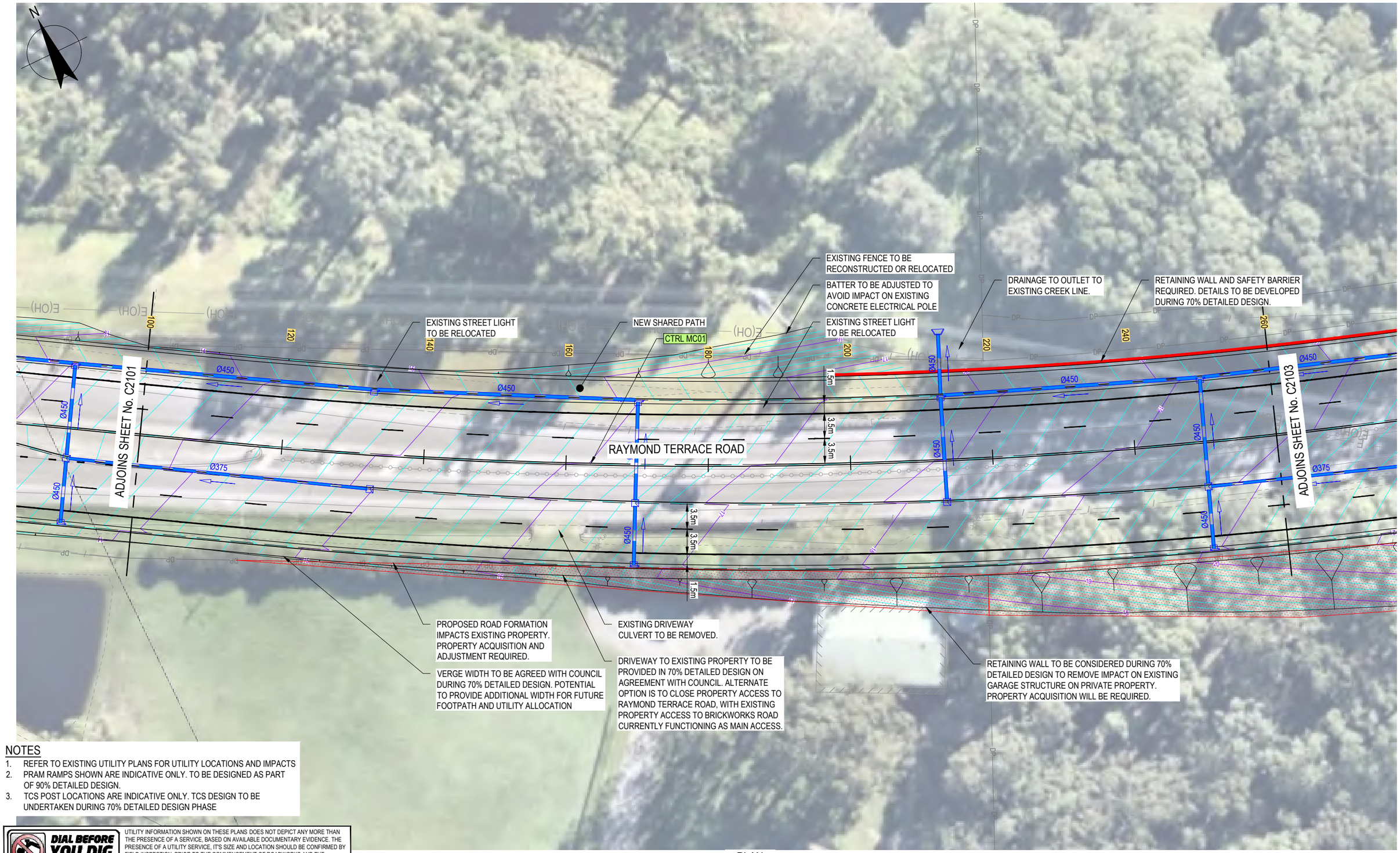
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE - STAGE 2
Title DETAIL PLAN
SHEET 1 OF 8

Original Size A3
Drawing No: 22-12542622-C2101
Rev: A

Plot Date: 30 July 2021 - 3:51 PM Plotted By: Blake Drew
Cad File No: C:\12d\SW\data\P-00-12D-001\22-12542622 - MCC - Haussman Drive, Stage 2 - Detailed Design_1219\CADD\Drawings\22-12542622-C2100.dwg



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Client: MAITLAND CITY COUNCIL
Project: HAUSSMAN DRIVE - STAGE 2
Title: DETAIL PLAN SHEET 2 OF 8

Original Size: A3
Drawing No: 22-12542622-C2102
Rev: A

Plot Date: 30 July 2021 - 3:51 PM
Plotted By: Blake Drew
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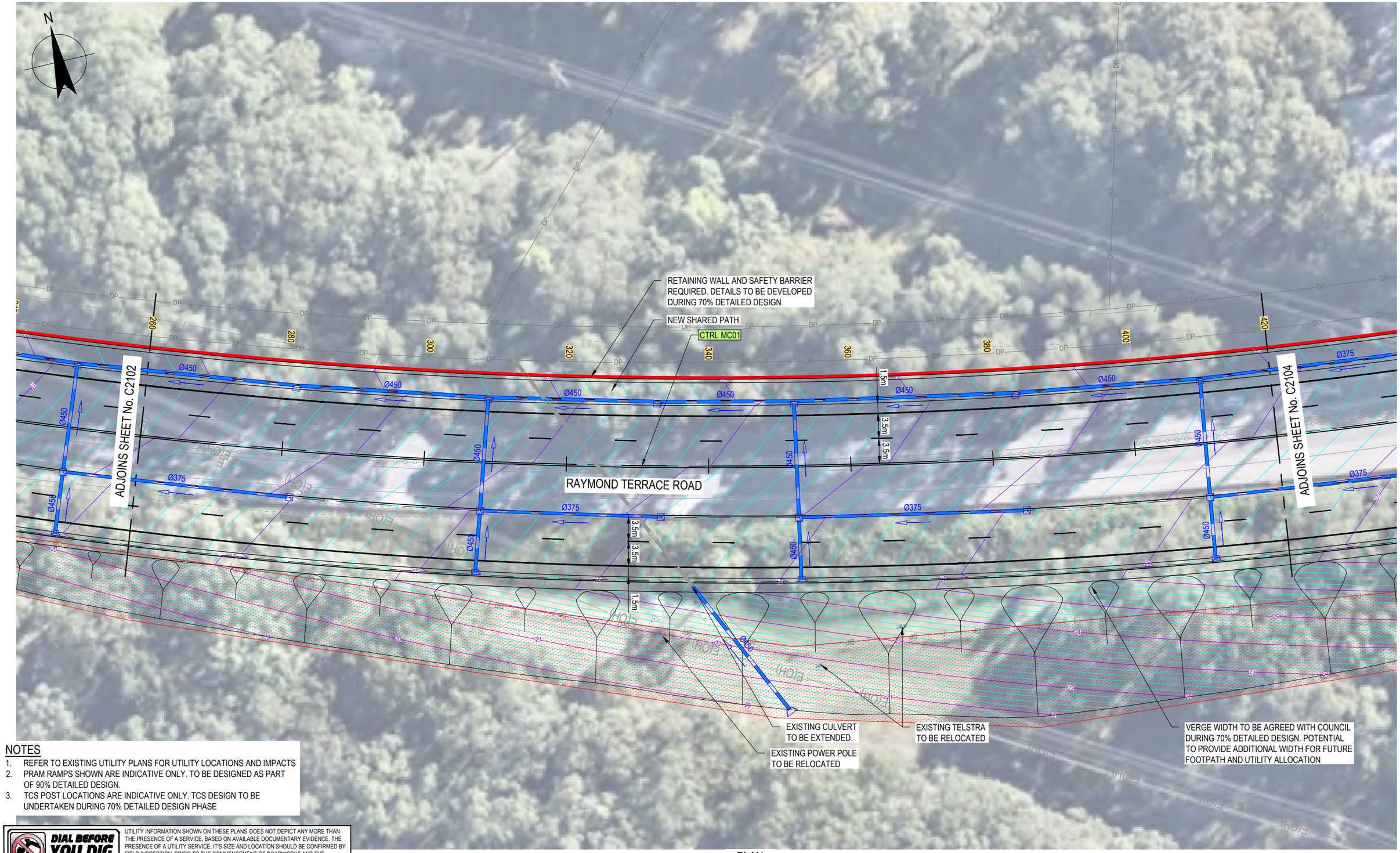

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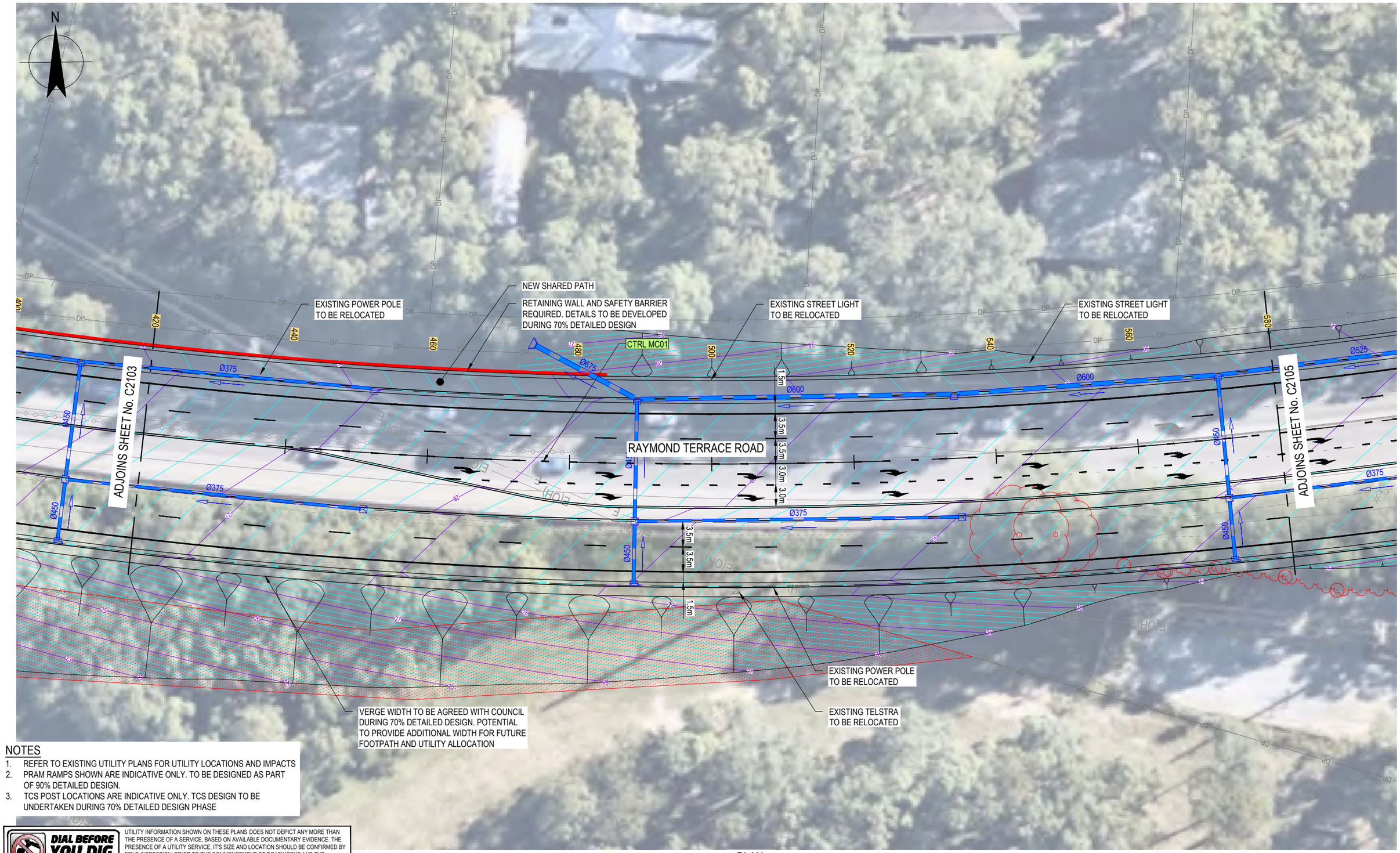
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE - STAGE 2
Title DETAIL PLAN
SHEET 3 OF 8

Original Size A3
Drawing No: 22-12542622-C2103
Rev: A

Plot Date: 30 July 2021 - 3:51 PM
Plotted By: Blake Drew
Cad File No: C:\12d\SW\data\P-00-12D-001\22-12542622 - MCC - Haussman Drive, Stage 2 - Detailed Design_1219\CADD\Drawings\22-12542622-C2100.dwg



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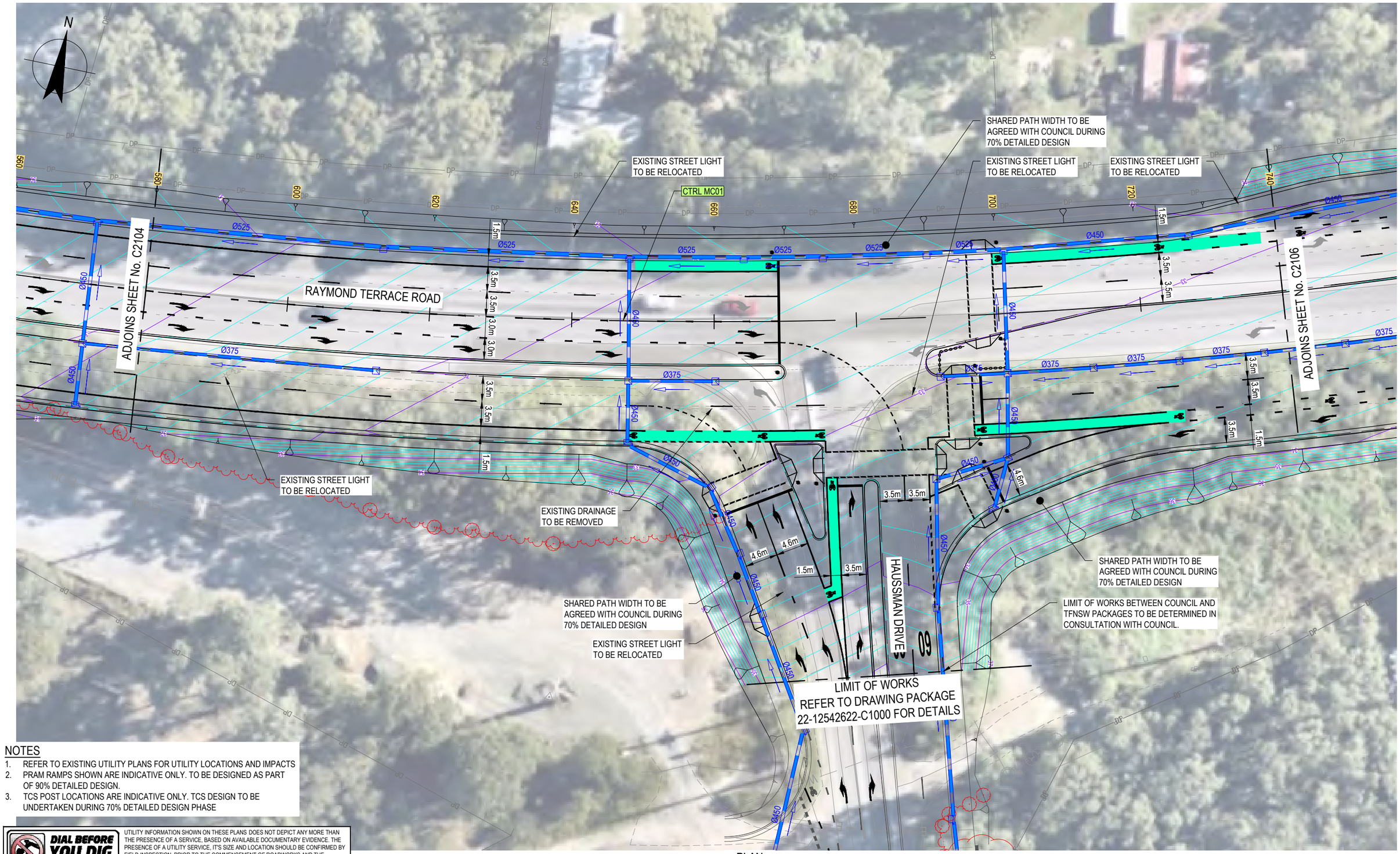
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE - STAGE 2
Title DETAIL PLAN
SHEET 4 OF 8

Original Size A3
Drawing No: 22-12542622-C2104
Rev: A

Plot Date: 30 July 2021 - 3:52 PM
Plotted By: Blake Drew
Cad File No: C:\12d\SW\data\P-00-12D-001\22-12542622 - MCC - Haussman Drive, Stage 2 - Detailed Design_1219\CADD\Drawings\22-12542622-C2100.dwg



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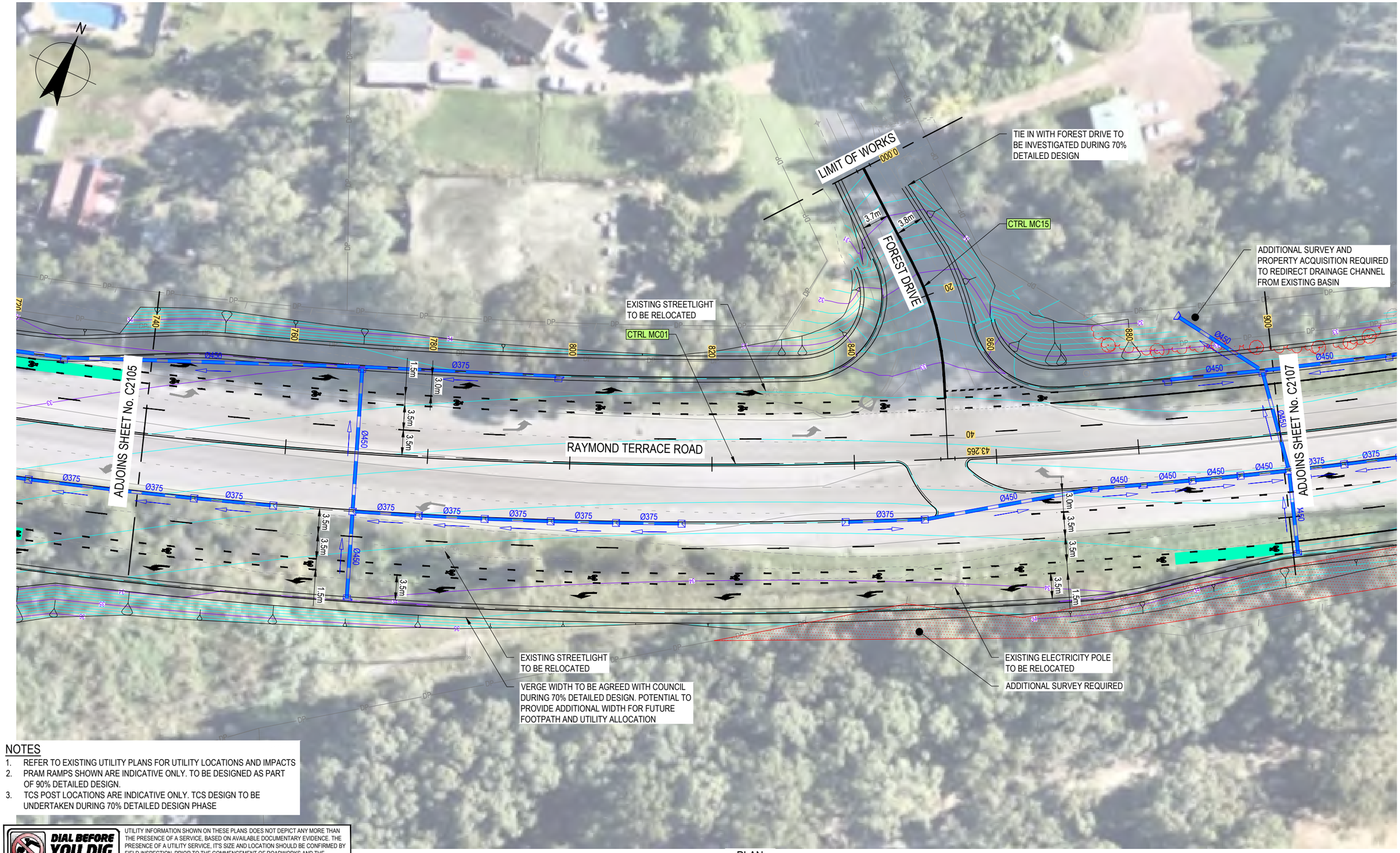
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE - STAGE 2
Title DETAIL PLAN
SHEET 5 OF 8

Original Size A3 Drawing No: 22-12542622-C2105 Rev: A

Plot Date: 30 July 2021 - 3:52 PM Plotted By: Blake Drew Cad File No: C:\12d\SW\data\P-00-12D-001\22-12542622 - MCC - Haussman Drive, Stage 2 - Detailed Design_1219\CADD\Drawings\22-12542622-C2100.dwg



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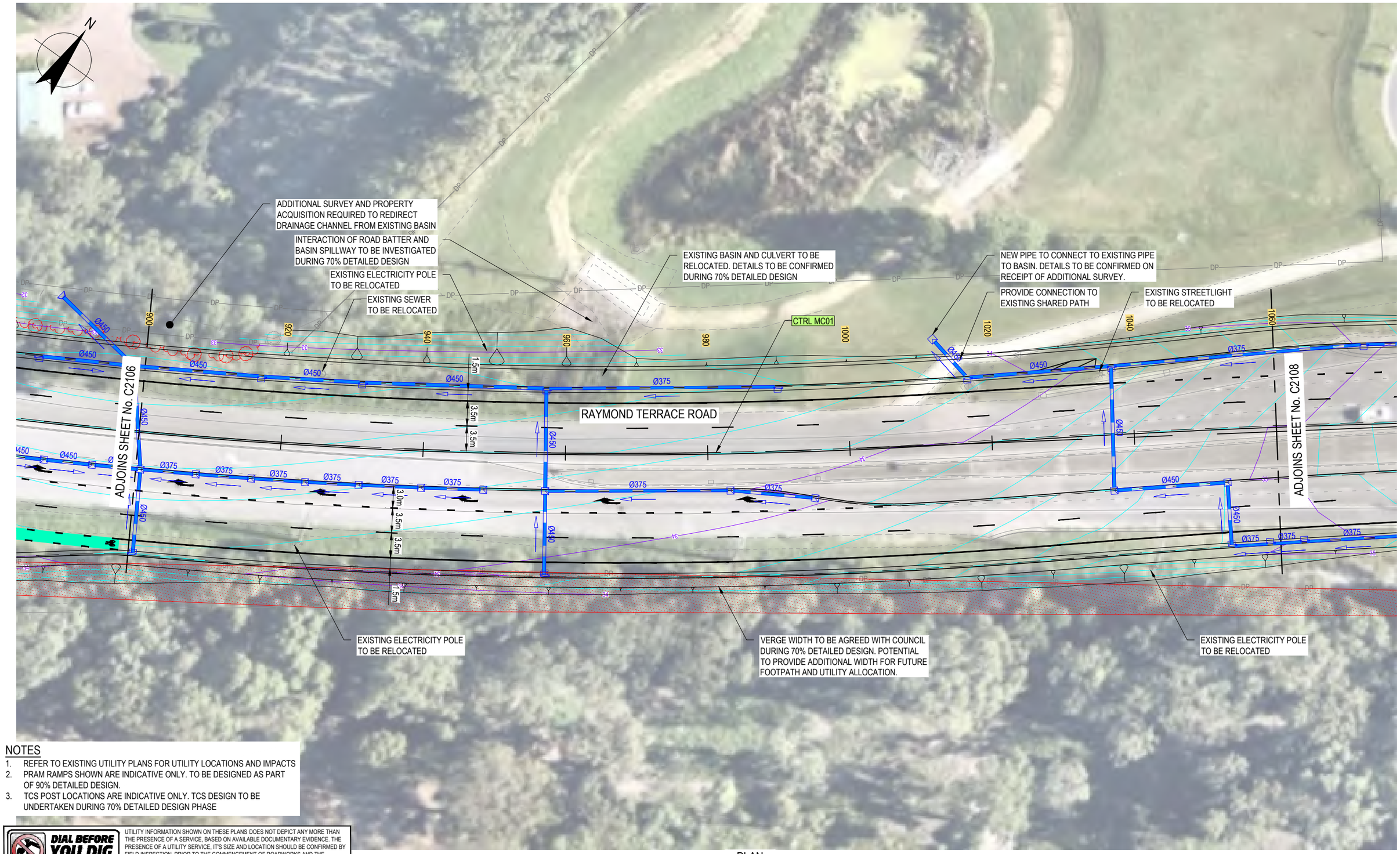
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE - STAGE 2
Title DETAIL PLAN
SHEET 6 OF 8

Original Size A3
Drawing No: 22-12542622-C2106
Rev: A

Plot Date: 30 July 2021 - 3:52 PM Plotted By: Blake Drew Cad File No: C:\12d\SW\data\P-00-12D-001\22-12542622 - MCC - Haussman Drive, Stage 2 - Detailed Design_1219\CADD\Drawings\22-12542622-C2100.dwg



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SCALE 1:500

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	30% DETAIL DESIGN	BD	GM	AS	30.07.21

Note: * indicates signatures on original issue of drawing or last revision of drawing

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SCALE 1:500 AT ORIGINAL SIZE

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Newcastle NSW 2300 Australia
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Date			
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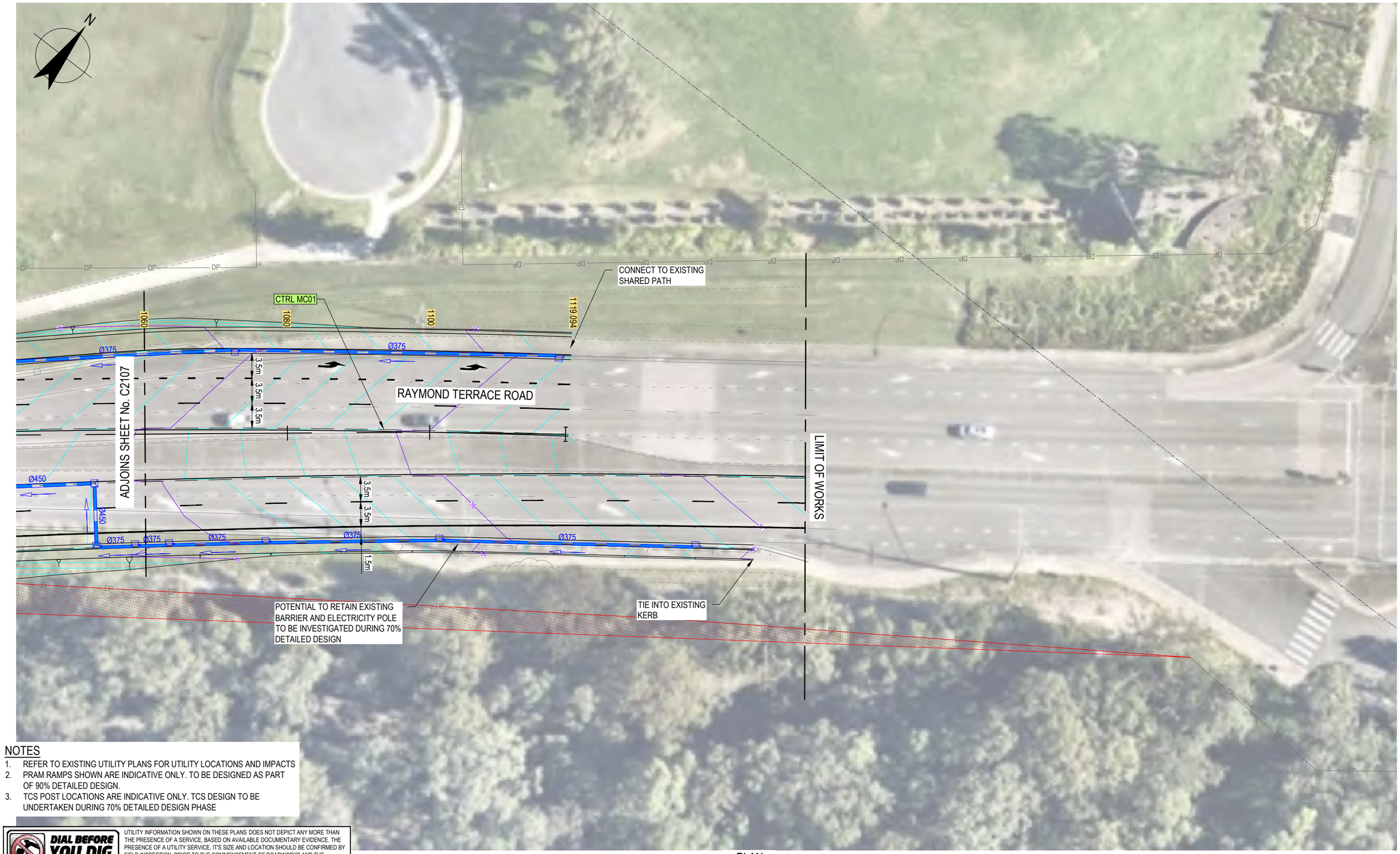
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE - STAGE 2
Title DETAIL PLAN
SHEET 7 OF 8

Original Size A3
Drawing No: 22-12542622-C2107
Rev: A

Plot Date: 30 July 2021 - 3:52 PM Plotted By: Blake Drew Cad File No: C:\12d\SW\data\P-00-12D-001\22-12542622 - MCC - Haussman Drive, Stage 2 - Detailed Design_1219\CADD\Drawings\22-12542622-C2100.dwg



NOTES

1. REFER TO EXISTING UTILITY PLANS FOR UTILITY LOCATIONS AND IMPACTS
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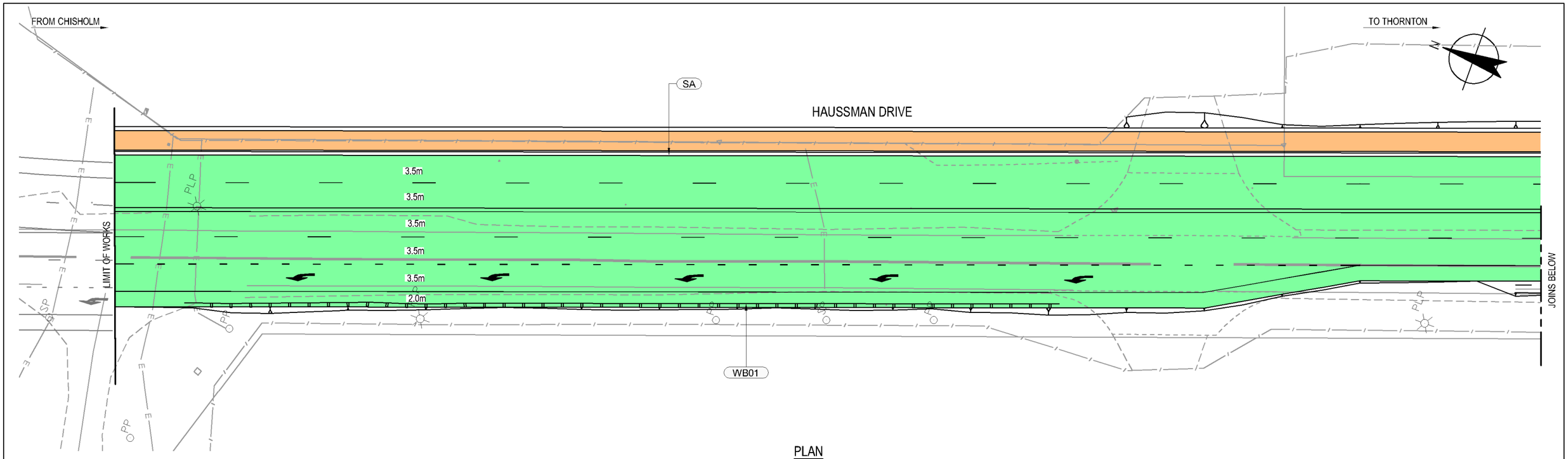
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE - STAGE 2
Title DETAIL PLAN
SHEET 8 OF 8

Original Size A3
Drawing No: 22-12542622-C2108
Rev: A

Plot Date: 30 July 2021 - 3:52 PM
Plotted By: Blake Drew
Cad File No: C:\12d\SW\data\P-00-12D-001\22-12542622 - MCC - Haussman Drive, Stage 2 - Detailed Design_1219\CADD\Drawings\22-12542622-C2100.dwg



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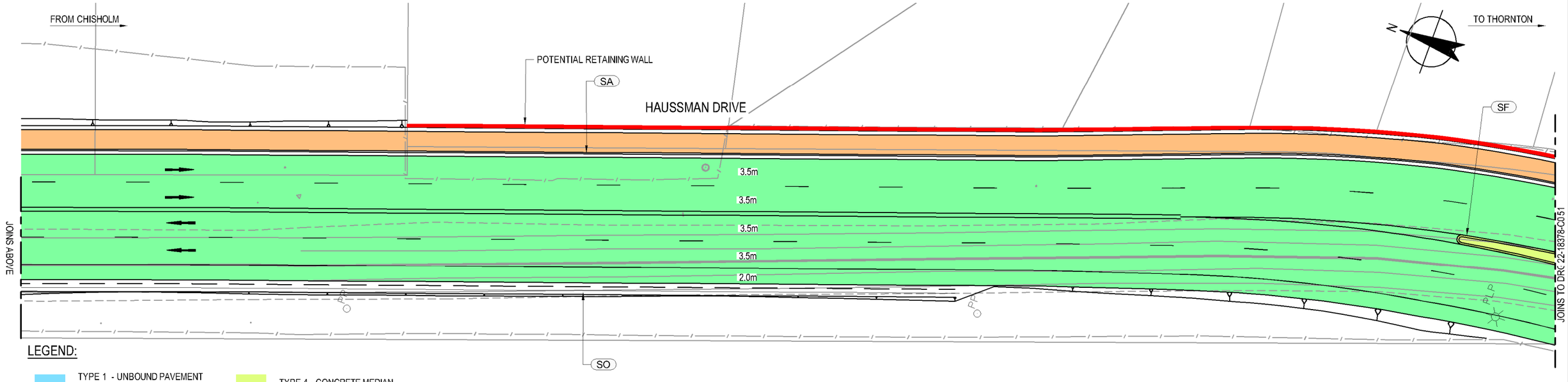

LEGEND:

- TYPE 1 - UNBOUND PAVEMENT WITH AC
- TYPE 2 - UNBOUND PAVEMENT WITH 2 COAT SEAL
- TYPE 3 - CONCRETE ROUNDABOUT PAVEMENT
- TYPE 4 - CONCRETE MEDIAN
- TYPE 5 - SHARED PATHWAY

PLAN
SCALE 1:500

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
C	FINAL CONCEPT DESIGN	RJC	GM	AS	06.10.17
B	FINAL CONCEPT DESIGN	C.B	G.M	A.S	15.09.17
A	ISSUED FOR REVIEW	C.B	G.M	A.S	13.07.17

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Approved (Project Director)			
Date			
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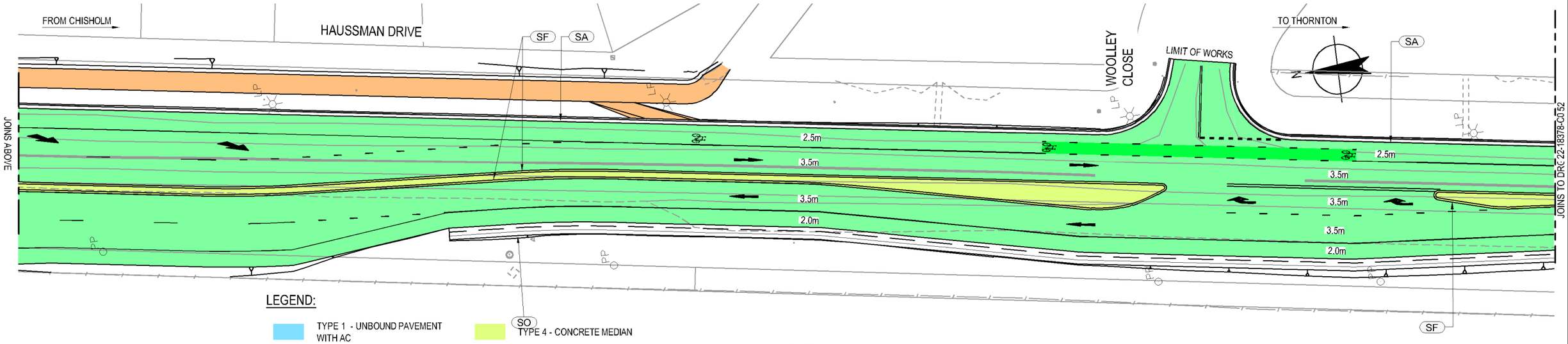
Client: MAITLAND CITY COUNCIL
Project: HAUSSMAN DRIVE ROAD UPGRADE
Title: PAVEMENT PLAN SHEET 1 OF 7

Original Size: A3
Drawing No: 22-18378-C050
Rev: C

Plot Date: 6 October 2017 - 5:06 PM Plotted By: Bec Cocks Cad File No: G:\22\18378\CADD\Drawings\22-18378-C050.dwg



LEGEND:

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- TYPE 4 - CONCRETE MEDIAN
- TYPE 5 - SHARED PATHWAY

PRELIMINARY

No	Revision (Note: * indicates signatures on original issue of drawing or last revision of drawing)	Drawn	Job Manager	Project Director	Date
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A	ISSUED FOR REVIEW	C.B	G.M	A.S	13.07.17

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Drafting Check | Design Check
Approved (Project Director)
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Scale AS SHOWN
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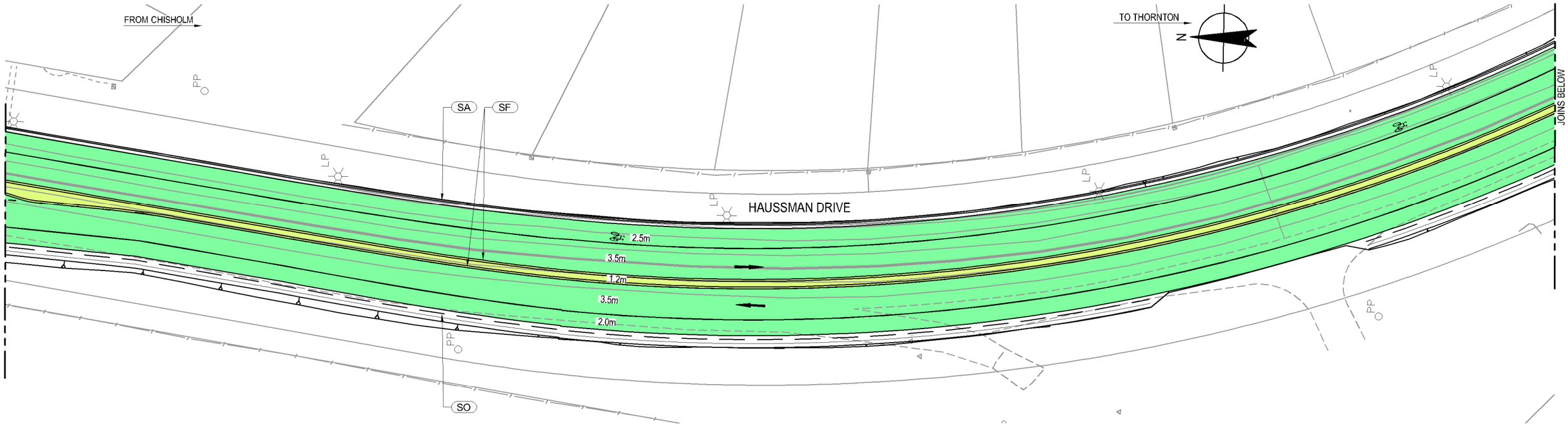
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE ROAD UPGRADE
Title PAVEMENT PLAN SHEET 2 OF 7

Original Size A3 | Drawing No: 22-18378-C051 | Rev: C

Plot Date: 6 October 2017 - 5:06 PM | Plotted By: Bec Cocks | Cad File No: G:\22\18378\CADD\Drawings\22-18378-C050.dwg



PLAN
SCALE 1:500

PLAN
SCALE 1:500

LEGEND:

- TYPE 1 - UNBOUND PAVEMENT WITH AC
- TYPE 2 - UNBOUND PAVEMENT WITH 2 COAT SEAL
- TYPE 3 - CONCRETE ROUNDABOUT PAVEMENT
- TYPE 4 - CONCRETE MEDIAN
- TYPE 5 - SHARED PATHWAY

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
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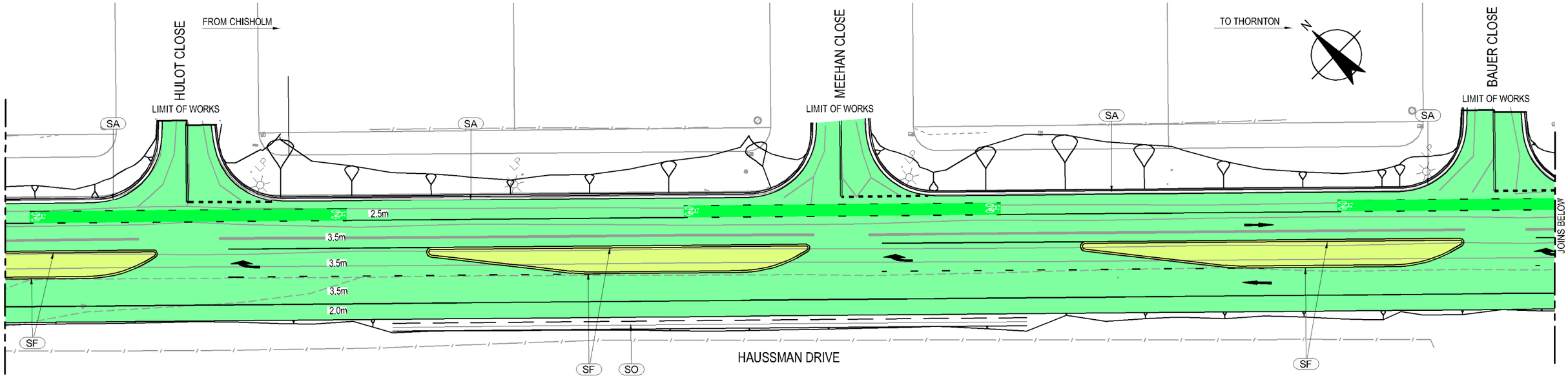
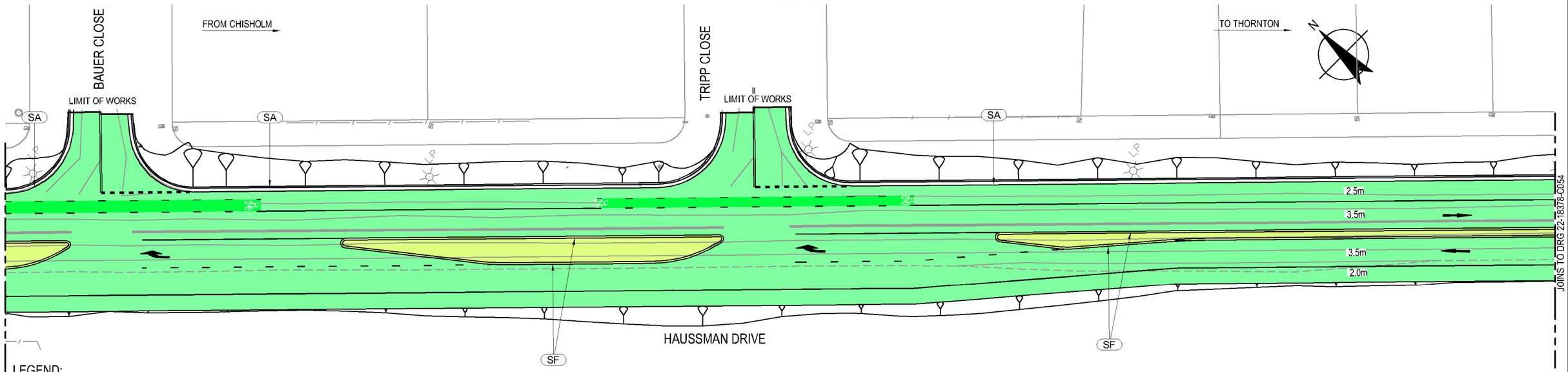
Client: MAITLAND CITY COUNCIL
Project: HAUSSMAN DRIVE ROAD UPGRADE
Title: PAVEMENT PLAN SHEET 3 OF 7

Original Size: A3
Drawing No: 22-18378-C052
Rev: C

Plot Date: 6 October 2017 - 5:06 PM Plotted By: Bec Cocks Cad File No: G:\22\18378\CADD\Drawings\22-18378-C050.dwg



PLAN
SCALE 1:500



LEGEND:

- TYPE 1 - UNBOUND PAVEMENT WITH AC
- TYPE 2 - UNBOUND PAVEMENT WITH 2 COAT SEAL
- TYPE 3 - CONCRETE ROUNDABOUT PAVEMENT
- TYPE 4 - CONCRETE MEDIAN
- TYPE 5 - SHARED PATHWAY

PLAN
SCALE 1:500

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
C	FINAL CONCEPT DESIGN	RJC	GM	AS	06.10.17
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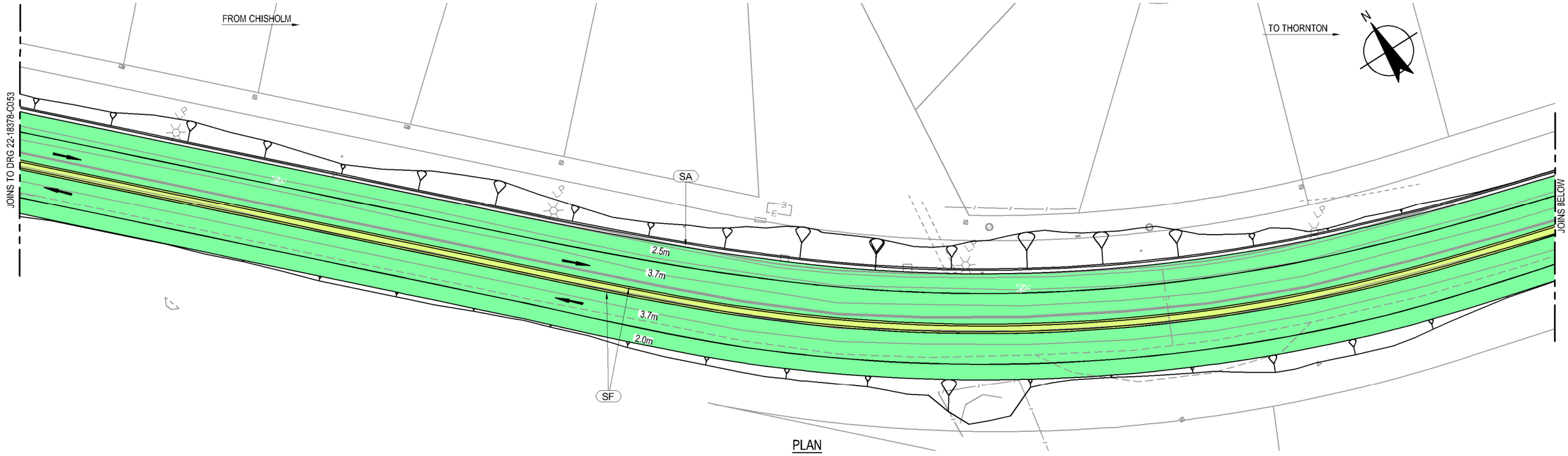
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE ROAD UPGRADE
Title PAVEMENT PLAN
SHEET 4 OF 7

Original Size A3
Drawing No: 22-18378-C053
Rev: C

Plot Date: 6 October 2017 - 5:06 PM
Plotted By: Bec Cocks
Cad File No: G:\22\18378\CADD\Drawings\22-18378-C050.dwg



PLAN
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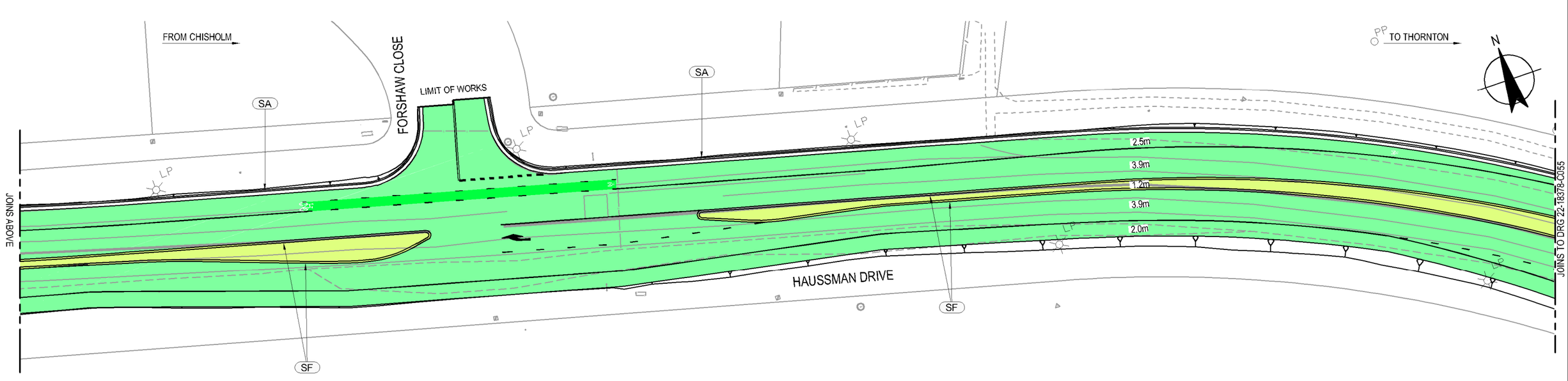

PLAN
SCALE 1:500

LEGEND:

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PRELIMINARY

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Approved (Project Director)			
Date			
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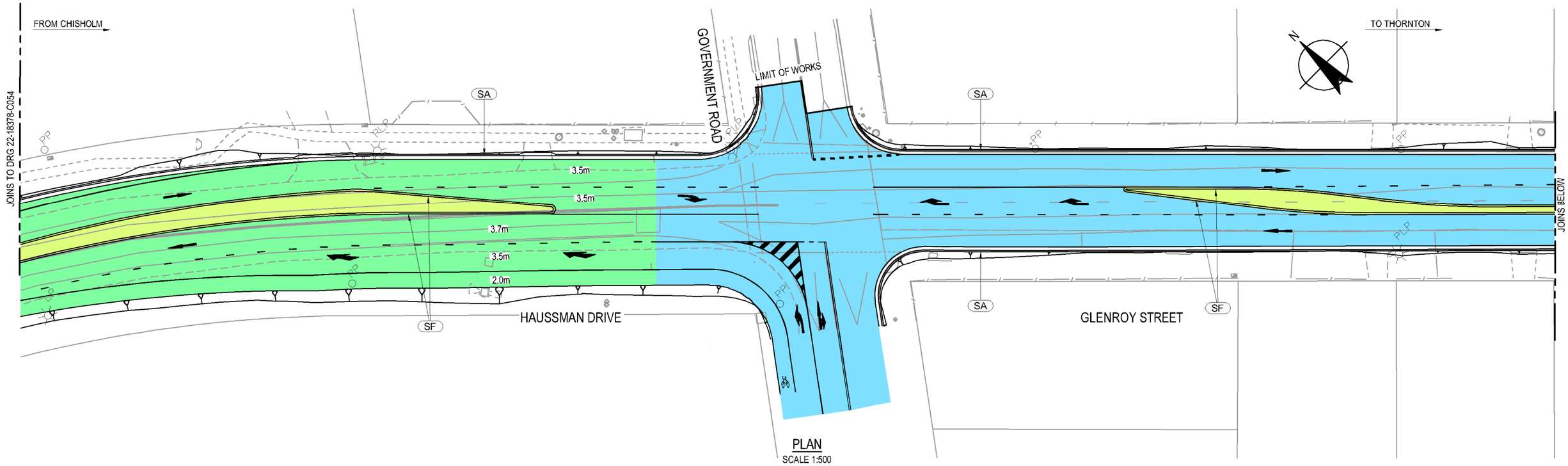
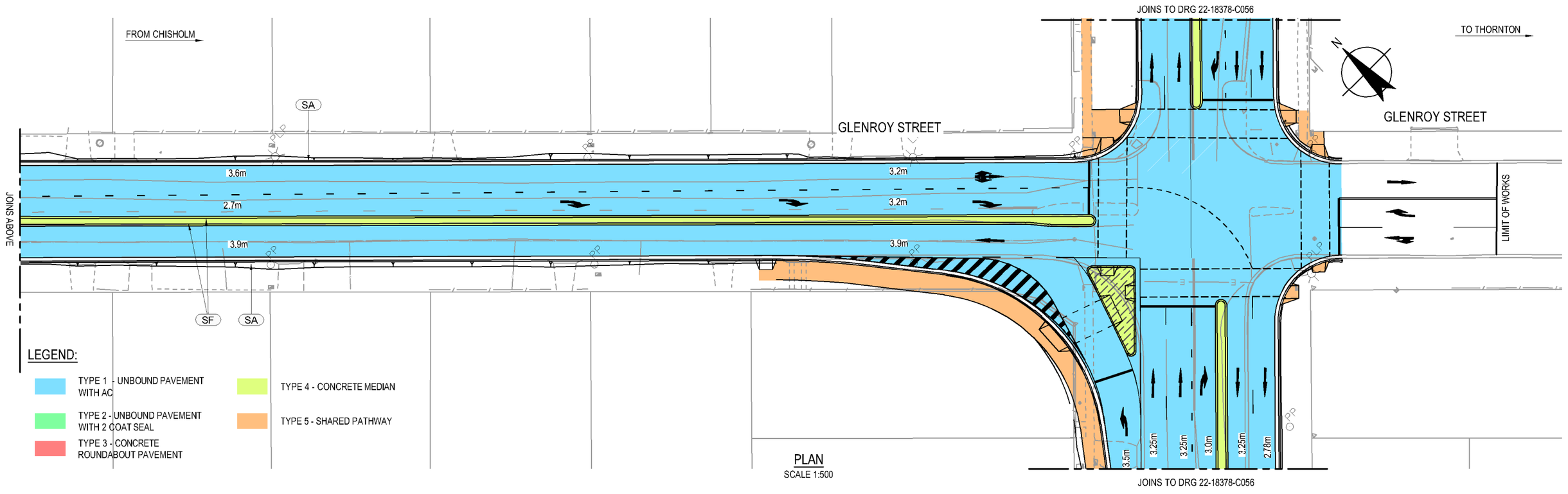
Client MAITLAND CITY COUNCIL
Project HAUSSMAN DRIVE ROAD UPGRADE
Title PAVEMENT PLAN
SHEET 5 OF 7

Original Size A3 Drawing No: **22-18378-C054** Rev: C

Plot Date: 6 October 2017 - 5:06 PM Plotted By: Bec Cocks Cad File No: G:\22\18378\CADD\Drawings\22-18378-C050.dwg





PRELIMINARY

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Approved (Project Director)			
Date			
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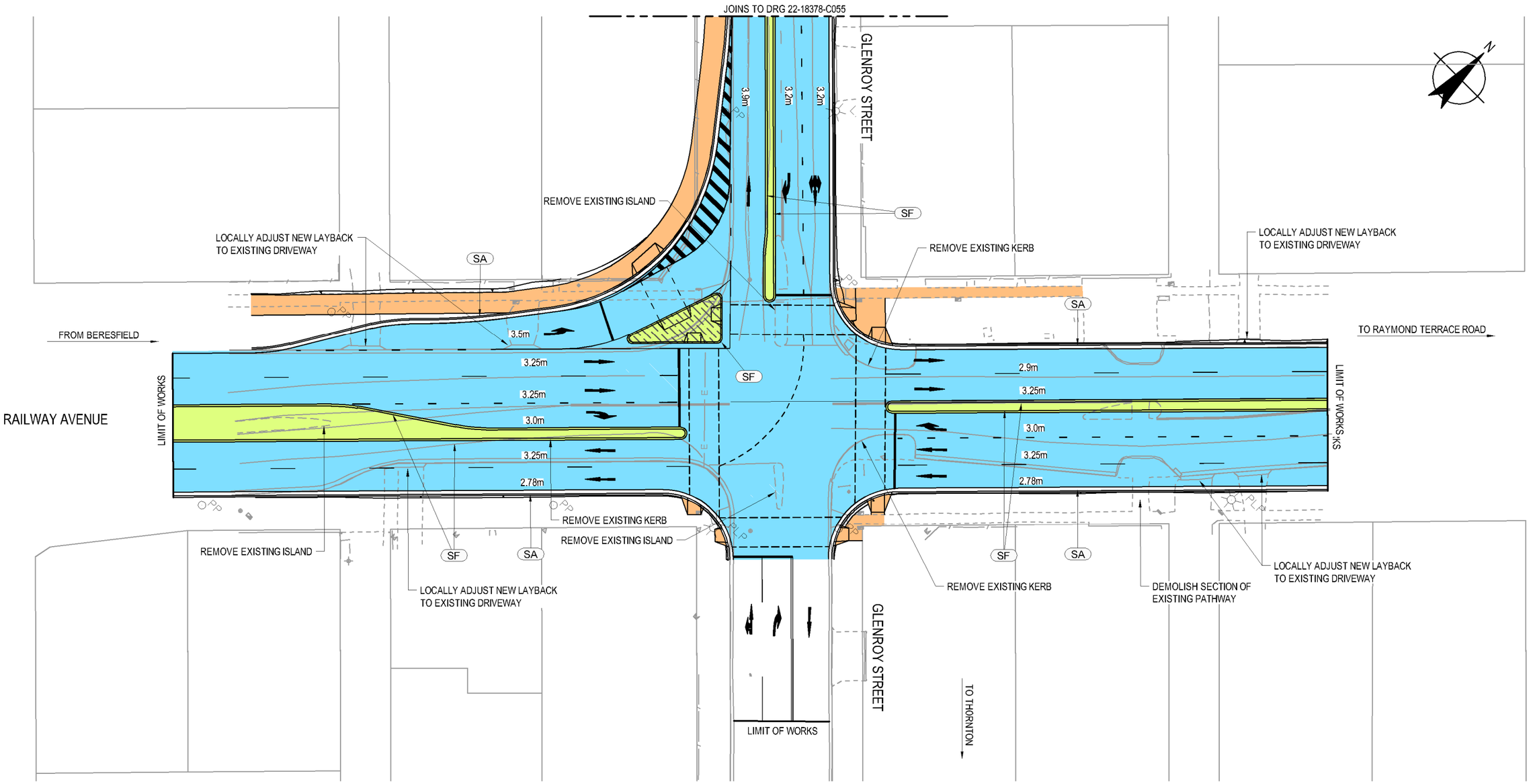
Client: MAITLAND CITY COUNCIL
Project: HAUSSMAN DRIVE ROAD UPGRADE
Title: PAVEMENT PLAN
SHEET 6 OF 7

Original Size: A3
Drawing No: 22-18378-C055
Rev: C

Plot Date: 6 October 2017 - 5:06 PM Plotted By: Bec Cocks Cad File No: G:\22\18378\CADD\Drawings\22-18378-C050.dwg



PLAN
SCALE 1:500

LEGEND:

- TYPE 1 - UNBOUND PAVEMENT WITH AC
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- TYPE 5 - SHARED PATHWAY

PRELIMINARY

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Drafting Check		Design Check	
Approved (Project Director)			
Date			
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Client: MAITLAND CITY COUNCIL
Project: HAUSSMAN DRIVE ROAD UPGRADE
Title: PAVEMENT PLAN
SHEET 7 OF 7

Original Size A3
Drawing No: 22-18378-C056
Rev: C

Plot Date: 6 October 2017 - 5:06 PM Plotted By: Bec Cocks Cad File No: G:\22\18378\CADD\Drawings\22-18378-C050.dwg

Hunter Water Corporation
ABN 46 228 513 446

PO Box 5171
HRMC NSW 2310
36 Honeysuckle Drive
NEWCASTLE NSW 2300
1300 657 657 (T)
(02) 4979 9468 (F)
enquiries@hunterwater.com.au
hunterwater.com.au

11 November 2015

Our Ref: 2015-1302/2.002

McCloy Thornton Pty Ltd
PO Box 2214
DANGAR NSW 2309

17 NOV 2015

Attention: Sam Rowe

Dear Sam

PRELIMINARY SERVICING ADVICE FOR PROPOSED DEVELOPMENT

Thank you for your request for Hunter Water's preliminary servicing advice for the provision of water and sewer services to the proposed rezoning of land from Rural Landscape to Residential at Lot 2 DP 1145348, 107 Haussman Drive, Thornton.

General information on water and sewer issues relevant to the proposal is included in this correspondence. This information is based on Hunter Water's knowledge of its system performance and other potential development in the area at the present time.

Preliminary servicing advice is not a commitment by Hunter Water and may be subject to significant change prior to the development proceeding. General information on the provision of Hunter Water funded and delivered infrastructure may also be provided. This advice may also change substantially due to a range of factors. In particular, you should note that water and sewer systems are dynamic by nature and, as such, capacity availability and system performance varies over time. As a consequence, the advice provided herein regarding servicing availability is indicative only. A detailed analysis of available capacity will be undertaken upon lodgement of an application for a Notice of Formal Requirements.

If you proceed with a development application you will need to lodge a further application with Hunter Water to then determine the formal requirements that shall apply. Hunter Water will then issue a **Notice of Formal Requirements**. You will need to comply with each of the requirements in this Notice for the issue of a Section 50 Compliance Certificate for the specific development.

Hunter Water anticipates that the development will place an additional demand of approximately 150 Equivalent Tenements (ET) on the water supply and wastewater systems and has reviewed system capacity and performance on this basis. As a result, Hunter Water's preliminary advice is as follows:

Water

The property has frontage to a DN300mm water main along Haussman Drive, Thornton. The location of the water main is shown in Figure 1. The height of the connection point is at approximately RL 40m AHD.

There is currently sufficient capacity available in these mains to serve the proposed development, however, you should note that capacity availability and system performance varies over time. A detailed analysis will be undertaken upon lodgement of an application for a Notice of Formal Requirements.

Security of Supply

As the proposed development is greater than 100 lots, security of supply needs to be addressed. The developer will be required to submit a water concept plan to demonstrate a dual water supply to the development.

Wastewater Transportation

The site of the proposed subdivision is located in the Thornton 1 Wastewater Pumping Station (WWPS) catchment area, which pumps into the Berry Park 1 WWPS and is within the Morpeth Wastewater Treatment Works (WWTW) catchment.

The nearest sewer connection point to service this development is at access chamber J1519, located to the south-east of the development (as shown in Figure 2). The developer will need to determine whether the proposed development can gravitate to this connection point or if pumping will be required. A sewer servicing report will need to be prepared to demonstrate the servicing requirements for this development.

There is currently sufficient capacity within Thornton 1 WWPS for this development. However, as noted elsewhere in this correspondence, capacity availability and system performance varies over time. A detailed analysis will be undertaken upon lodgement of a Notice of Formal Requirements.

Wastewater Treatment

The proposed development falls within the Morpeth WWTW catchment. Whilst this development was not included in growth projections for the WWTW, Hunter Water's treatment facilities are continually reviewed and upgraded over time to meet demand from growth, and future capacity upgrades can be brought forward if required.

Abandoned Assets

There are two DICL sewer mains traversing the southern part of the site (as shown in Figure 3). These mains have been abandoned in-ground and are no longer required.

Potential Land Disposal

There are two parcels of land facing Haussman Drive that may be available for purchase (as shown hatched in blue on Figure 4). Should you wish to pursue this matter, you should discuss the long term need for this land with Hunter Water.

Financial Contribution

Dependent on the connection points and utilisation of infrastructure, it may be necessary to pay a reimbursement towards capacity uptake in infrastructure assets constructed by other developers. Hunter Water administers reimbursements for a maximum period of 15 years following hand over to Hunter Water.

It is not possible to calculate reimbursement values at this time due to the tentative nature of information, connection points etc, and accordingly such calculations are usually deferred until definitive information is available.

Environmental Assessment

Please note that a Review of Environmental Factors will be required for any works external to a particular development site, or where the service design includes infrastructure or activities that may have environmental impacts that would not have been specifically addressed in the consent authorities assessment and determination of the proposed development. Examples

may be the construction of new or augmented water and sewer pump stations, sewer vents, trunk mains, reservoirs, development in a Wastewater Treatment Plant buffer zone, or development in a water reserve. Furthermore, a Controlled Activity Approval will be required from the NSW Office of Water for any excavation within 40m of a water body or should groundwater be present.

Prior to commencement of environmental assessment please contact the Hunter Water Developer Services Group to confirm the scope and need for such an assessment. It is recommended to meet and agree these matters prior to the developer engaging the services of a design or environmental consultant. In addition, please refer to the Hunter Water Review of Environmental Factors Guidance Notes, located in the Building & Development section of the Hunter Water website. The document provides the minimum requirements and an example template for the preparation of a REF.

Should you require further clarification or assistance please do not hesitate to contact me on 4979 9545.

Yours Sincerely

11.11.15

Malcolm Withers
Senior Developer Services Engineer

Figure 1 – Proposed water connection point

Figure 2 - Location of the assessed sewer connection point.

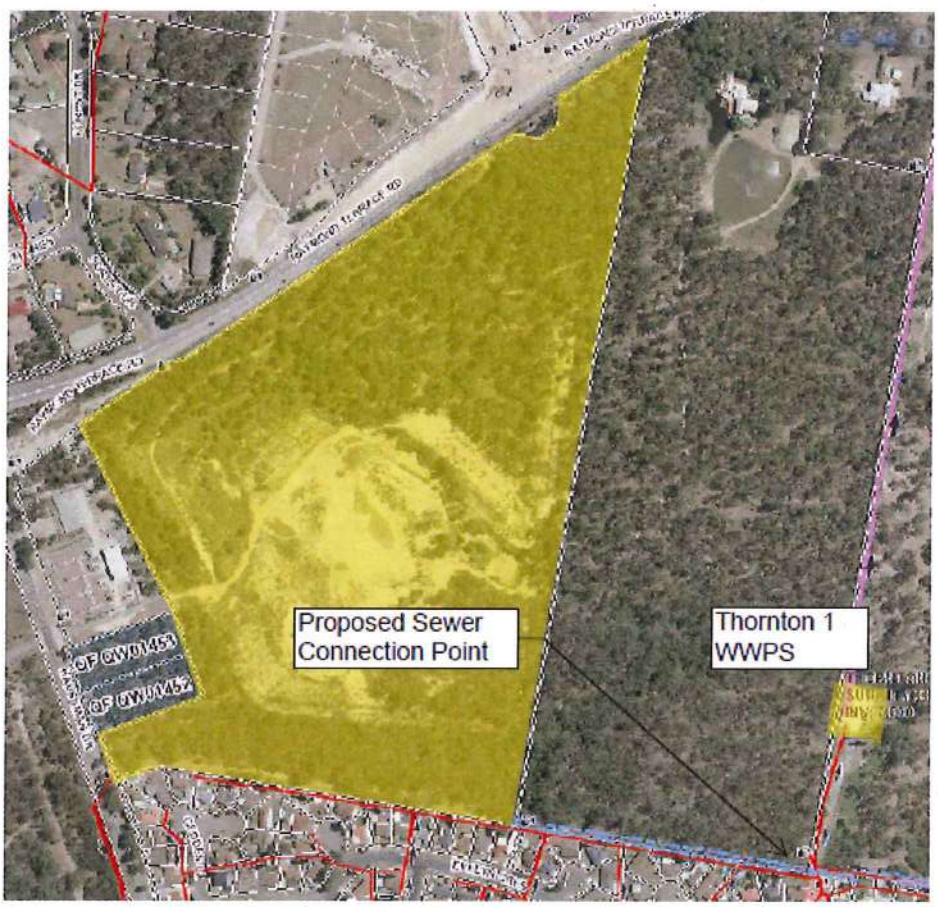

Figure 3 – Location of abandoned assets

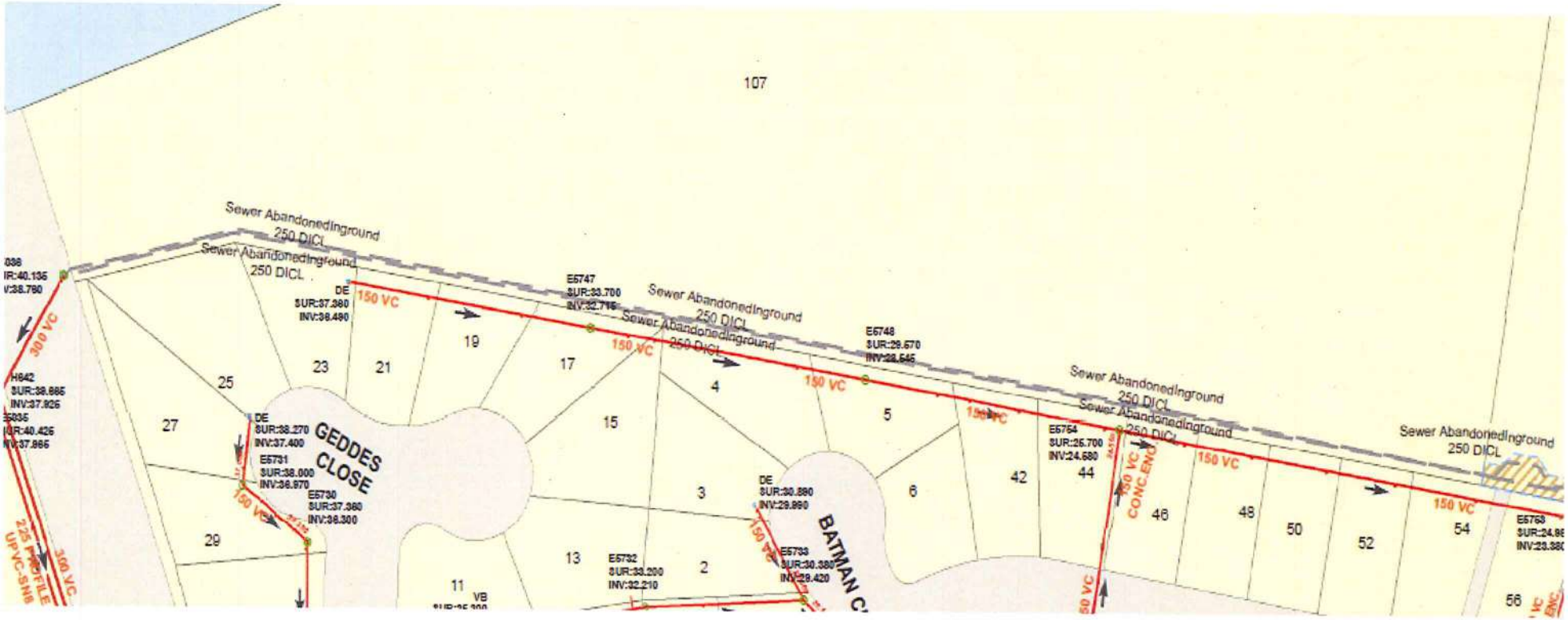

Figure 4 – Potential land disposal

Department of Planning, Housing and Infrastructure

Ref: IRF24/71
Your Ref: RZ21002

Mr Jeff Smith
General Manager
Maitland City Council
PO Box 220
MAITLAND NSW 2320

Via Email: info@maitland.nsw.gov.au

07 May 2024

Subject: Planning Proposal PP-2023-2323 to amend Maitland Local Environmental Plan 2011

Dear Mr Smith,

I am writing in response to the planning proposal you have forwarded to the Minister under section 3.34(1) of the Environmental Planning and Assessment Act 1979 (the Act) in respect of the planning proposal to the rezone 107 Haussman Drive, Thornton for residential and conservation purposes and to amend the minimum lot size.

As delegate of the Minister for Planning and Public Spaces, I have determined the planning proposal should proceed subject to the conditions in the enclosed gateway determination.

I have agreed, as delegate of the Secretary, the inconsistency of the planning proposal with applicable directions of the Minister under section 9.1 of the Act, Directions 1.1 Implementation of Regional Plans, 3.1 Conservation Zones, 3.2 Heritage Conservation, 4.5 Acid Sulfate Soils, 9.1 Rural Zones and 9.2 Rural Lands is justified in accordance with the terms of the directions. No further approval is required in relation to the directions.

Council may still need to obtain the agreement of the Secretary to comply with the requirements of relevant applicable directions of the Minister under section 9.1 of the Act: 4.3 Planning for Bushfire Protection, 4.4 Remediation of Contaminated Land and 4.6 Mine Subsidence and Unstable Land.

The proposed local environmental plan (LEP) is to be finalised on or before 12 months of the Gateway determination. Council should aim to commence the exhibition of the planning proposal as soon as possible. Should council seek to make a proposed LEP, the request to draft the LEP should be made directly to Parliamentary Counsel's Office well in advance of the date the LEP is projected to be made. A copy of the request should be forwarded to the Department of Planning, Housing and Infrastructure.

The NSW Government has committed to reduce the time taken to complete LEPs. To meet these commitments, the Minister may appoint an alternate planning proposal authority if Council does not meet the timeframes outlined in the gateway determination.

The Department's categorisation of planning proposals in the Local Environmental Plan Making Guideline (Department of Planning and Environment, 2023) is supported by category specific timeframes for satisfaction of conditions and authority and Government agency referrals, consultation, and responses. Compliance with milestones will be monitored by the Department to ensure planning proposals are progressing as required.

Should you have any enquiries about this matter, I have arranged for Ms Sandra Bush at the Department to assist you. Ms Bush can be contacted on 02 5778 1409.

Yours sincerely,

07/05/24

Jeremy Gray
Director Hunter and Northern Region
Local Planning and Council Support

Department of Planning, Housing and Infrastructure

Gateway Determination

Planning proposal (Department Ref: PP-2023-2323): *Rezone Lot 2 DP 1145348, 107 Haussman Drive, Thornton, for residential and conservation purposes and amend the minimum lot size.*

I, the Director at the Department of Planning, Housing and Infrastructure, as delegate of the Minister for Planning and Public Spaces, have determined under section 3.34(2) of the *Environmental Planning and Assessment Act 1979* (the Act) that an amendment to the Maitland Local Environmental Plan 2011 to rezone land at Lot 2 DP 1145348, 107 Haussman Drive, Thornton for residential and conservation purposes and amend the minimum lot size should proceed subject to the following Gateway conditions.

The Council as planning proposal authority planning proposal authority is authorised to exercise the functions of the local plan-making authority under section 3.36(2) of the EP&A Act subject to the following:

(a) the planning proposal authority has satisfied all the conditions of the gateway determination;

(b) the planning proposal is consistent with applicable directions of the Minister under section 9.1 of the EP&A Act or the Secretary has agreed that any inconsistencies are justified; and

(c) there are no outstanding written objections from public authorities.

The LEP should be completed on or before 12 months of the Gateway determination date.

Gateway Conditions

1. Prior to agency and community consultation, the proposal is to be amended to ensure a consistent development footprint between the planning proposal and all the supporting studies.
2. Public exhibition is required under section 3.34(2)(c) and clause 4 of Schedule 1 to the Act as follows:

   (a) the planning proposal is categorised as standard as described in the *Local Environmental Plan Making Guidelines* (Department of Planning and Environment, 2021) and must be made publicly available for a minimum of 20 days; and

   (b) the planning proposal authority must comply with the notice requirements for public exhibition of planning proposals and the specifications for material that must be made publicly available along with planning proposals as identified in *Local Environmental Plan Making Guidelines* (Department of Planning and Environment, 2021).

3. Consultation is required with the following public authorities and government agencies under section 3.34(2)(d) of the Act and/or to comply with the requirements of applicable directions of the Minister under section 9 of the EP&A Act:

   - Biodiversity Conservation and Science Group (BCS) – Biodiversity
   - Transport for NSW (TfNSW)
   - NSW Rural Fire Service (RFS)
   - Subsidence Advisory NSW (SA NSW)
   - Hunter Water Corporation (HWC)
   - Mindaribba Local Aboriginal Land Council (LALC)
   - NSW Heritage
   - Environment Protection Authority

   Each public authority is to be provided with a copy of the planning proposal and any relevant supporting material via the NSW Planning Portal and given at least 30 days to comment on the proposal.

4. A public hearing is not required to be held into the matter by any person or body under section 3.34(2)(e) of the EP&A Act. This does not discharge Council from any obligation it may otherwise have to conduct a public hearing (for example, in response to a submission or if reclassifying land).

Dated 07 day of May 2024.

07/05/24

Jeremy Gray
Director, Hunter and Northern Region
Local Planning and Council Support
Department of Planning, Housing and Infrastructure

Delegate of the Minister for Planning and Public Spaces

Department of Planning, Housing and Infrastructure

Our ref: IRF25/1035

Mr Jeff Smith
General Manager
Maitland City Council
PO Box 220
MAITLAND NSW 2320

By email: info@maitland.nsw.gov.au
Adam.Kennedy@maitland.nsw.gov.au

Dear Mr Smith

Planning proposal PP-2023-2323 – Alteration of Gateway Determination

I refer to your letter requesting an extension of time to complete planning proposal PP-2023-2323 which seeks to rezone Lot 2 DP 1145348, 107 Haussman Drive, Thornton, for residential and conservation purposes and amend the minimum lot size.

I have determined as the delegate of the Minister, in accordance with section 3.34(7) of the *Environmental Planning and Assessment Act 1979*, to alter the Gateway determination dated 7 May 2024 for PP-2023-2323. The Alteration of Gateway determination is enclosed.

I note the factors that have prevented completion of the LEP to date. However, given the period of time since the Gateway determination was issued, it should be noted that:

- further extensions of time to complete the proposal will not be supported; and
- if completion of the proposal is unlikely within the extended timeframe, Council should withdraw and re-submit the proposal when it is ready to proceed.

If you have any questions in relation to this matter, I have arranged for Sandra Bush to assist you. Sandra can be contacted on 5778 1409.

Yours sincerely

21 May 2025

Lucy Walker
Acting Director, Hunter and Northern Region
Local Planning & Council Support

Encl: Alteration of Gateway Determination

Department of Planning, Housing and Infrastructure

Alteration of Gateway Determination

Planning proposal (Department Ref: PP-2023-2323)

I, Acting Director, Hunter and Northern Region, Local Planning and Council Support at the Department of Planning, Housing and Infrastructure, as delegate of the Minister for Planning and Public Spaces, have determined under section 3.34(7) of the *Environmental Planning and Assessment Act 1979* to alter the Gateway determination dated 7 May 2024 for the proposed amendment to the Maitland Local Environmental Plan 2011 as follows:

1. Delete from the Gateway description text:

   "The LEP should be completed on or before 12 months of the Gateway determination date."

   and replace with:

   "The LEP should be completed on or before 29 August 2025."

Dated 21 day of May 2025.

Lucy Walker
Acting Director, Hunter and Northern Region
Local Planning & Council Support
Department of Planning, Housing and Infrastructure

Delegate of the Minister for Planning and Public Spaces

VARA
CONSULTING

18 December 2024

Mr. Jeff Smith
General Manager
Maitland City Council
PO Box 220
MAITLAND NSW 2320

Att: Mr Adam Kennedy

Dear Adam,

RE: Progression of Planning Proposal - 107 Haussman Drive, Thornton (PP-2023-2323)

I refer to Maitland City Council's letter dated 27 November 2024, and our subsequent meeting on 12 December 2024 regarding the above Planning Proposal. On behalf of the current owner of the site, Tracey Ann McCloy, I am writing to confirm that we wish to continue to progress with the proposal.

Please feel free to contact me if you have any questions.

Regards,

Vara Consulting
Jason McIntosh
Director
0417 689 270

VARA
CONSULTING

14 April 2025

Mr. Jeff Smith
General Manager
Maitland City Council
PO Box 220
MAITLAND NSW 2320

Att: Mr Adam Kennedy

Dear Adam,

RE: Progression of Planning Proposal - 107 Haussman Drive, Thornton (PP-2023-2323)

I refer to the letter from NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) dated 29 August 2024, which was also referenced in Maitland City Council's letter dated 27 November 2024.

One of the matters raised for consideration by DCCEEW was document consistency, as follows:

It is unclear if the BDAR, for example Figures 2 and 4 and Table 9, have considered Asset Protection Zone impacts as shown in Figure 1.1 of the Bushfire Threat Assessment.

Recommended action:
Consider improving consistency between documents, to ensure areas of high environmental value are protected and impacts are accurately identified and offset.

Figures 2 and 4 of the BDAR are included under Annexure A of this letter.

Since the change of ownership in the land, we have been unable to properly engage with the original bushfire consultant for the project. We have therefore engaged Bushfire Planning Australia to prepare supplementary information that supports consistency between required APZ's and the BDAR mapping. The required APZ's determined under AS3959-2018 are shown under Annexure B of this letter. It should be noted that the figure under Annexure B demonstrates that APZ's can be achieved within the impacted footprint shown in the BDAR.

Please feel free to contact me if you have any questions.

Regards,

Vara Consulting
Jason McIntosh
Director
0417 689 270

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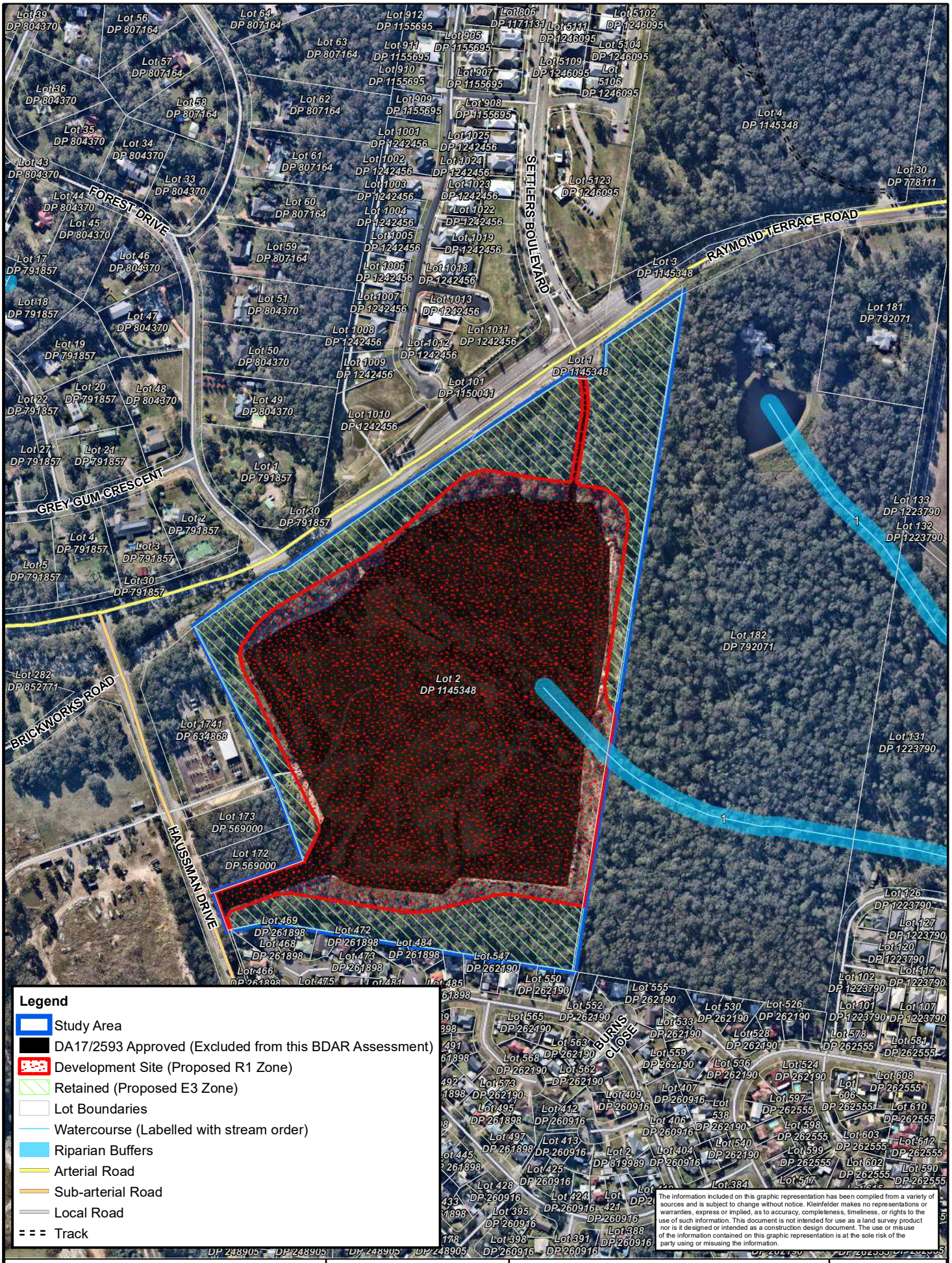
CONSULTING

Appendix A – Figures 2 and 4 of the BDAR



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PROJECT REFERENCE: 20220611

DATE DRAWN: 8/9/2022 10:17 Version 1

DRAWN BY: AMcDonaugh

DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2021

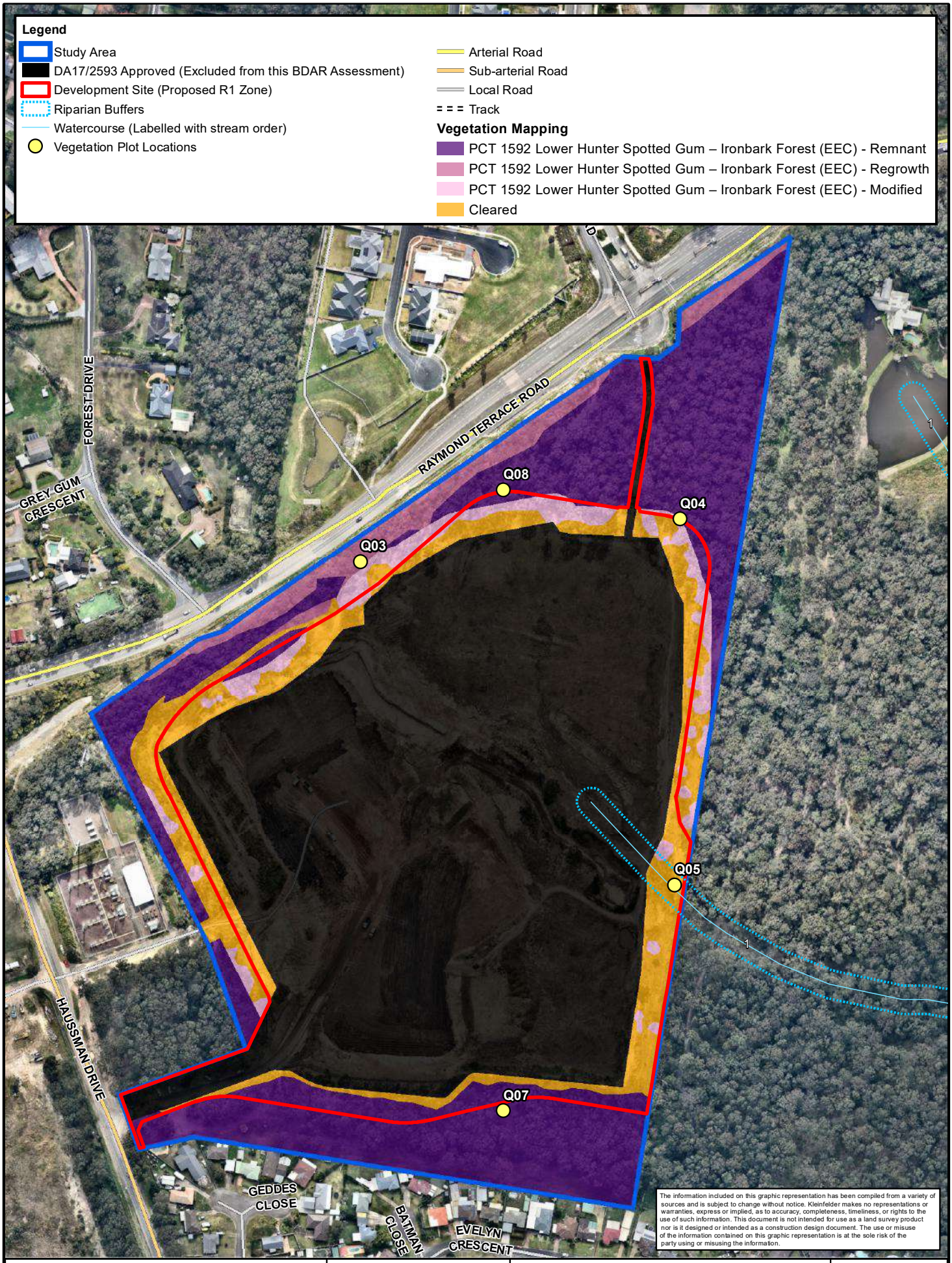
Study Area and Development Site

McCloy Group
Biodiversity Development Assessment Report
Lot 2 DP 1145348
Haussman Drive, Thornton NSW

FIGURE:

2

J:\00 CLIENT FILES\127490_McCloy_Group\20220611_BDAR_HaussmanDrive_May2021\Mapping\20220729_BDAR_Fig02_StudyArea_DevelopmentSite.mxd



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PROJECT REFERENCE: 20220611
DATE DRAWN: 8/29/2022 09:46 Version 1
DRAWN BY: AMcDonaugh
DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2021

Vegetation Communities

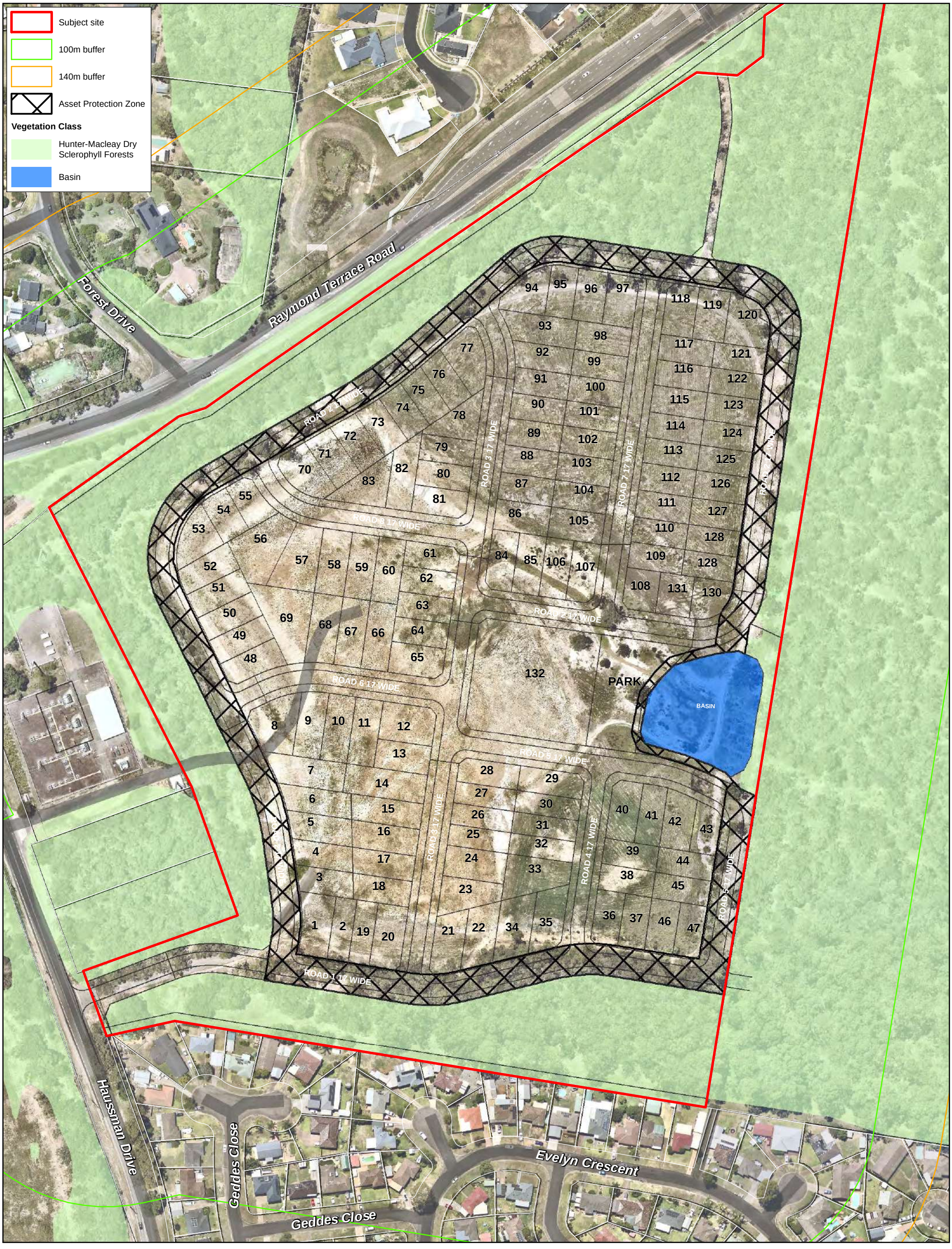
McCloy Group
Biodiversity Development Assessment Report
Lot 2 DP 1145348
Haussman Drive, Thornton NSW

FIGURE:
4

J:\00 CLIENT FILES\127490_McCloy_Group\20220611_BDAR_HaussmanDrive_May2021\Mapping\20220729_BDAR_Fig04_VegetationCommunities.mxd

VARA
CONSULTING

Appendix B – Proposed APZ's under AS3959-2018



BUSHFIRE PLANNING AUSTRALIA

Source:	Cadastral Boundary: NSW Department of Finance, Services and Innovation 2025 Aerial photo: Nearmap 26/01/2025 Vegetation: Bushfire Planning Australia 2025, based on NSW SVTM © State Government of NSW and Department of Planning and Environment 2024
Disclaimer:	No warranty is given in relation to the data (including accuracy, reliability, completeness, currency or suitability) and no liability is accepted (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.
File:	File: 2535-Thornton-FigZ-AssetProtectionZone-Method2-250411 Date: 11/04/2025

0 25 50 75
Meters

A3 Scale: 1:2,000

Coordinate System: GDA 1994 MGA Zone 56

Project: Thornton Strategic Bushfire Study
Job No: 2535

Figure:
Asset Protection Zone - Performance Solution (Method 2 - AS3959-2018)

M^CLAREN TRAFFIC ENGINEERING

Address: Shop 7, 720 Old Princes Highway Sutherland NSW 2232
Postal: P.O Box 66 Sutherland NSW 1499

Telephone: +61 2 8355 2440
Fax: +61 2 9521 7199
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Email: admin@mclarentraffic.com.au

Division of RAMTRANS Australia ABN: 45067491678 RPEQ: 19457

Transport Planning, Traffic Impact Assessments, Road Safety Audits, Expert Witness

11 February 2025 Reference: 241074.01DB

Vara Consulting
Suite 9A,
172 - 178 Pacific Highway,
Swansea NSW 2281
Attention: Jason McIntosh

SUPPLEMENTARY TRAFFIC IMPACT ASSESSMENT FOR RESIDENTIAL SUBDIVISION AT 107 HAUSSMAN DRIVE, THORNTON

Dear Jason,

Reference is made to your request to provide a supplementary traffic impact assessment of the proposed residential subdivision at 107 Haussman Drive, Thornton. This report should be read as a supplement to the traffic and parking impact assessment report by M^CLaren Traffic Engineering dated 8 October 2020 (MTE Report) (reference 200695.01FA) and the Supplementary Traffic Assessment dated 24 November 2022 (reference 220798.01FA).

Comments have been provided by TfNSW regarding the traffic and transport impacts of the proposal as follows:

> *"Further information to support the Planning Proposal is required to identify how the traffic and transport impacts of the proposal can be appropriately mitigated in the absence of any funded project (projects listed in dot points below). The modelling and subsequent recommendations from the TPIA and TIA are contingent upon the following transport infrastructure improvements, which are not funded for delivery:*
>
> *Duplication of Haussman Drive between Taylor Avenue and Raymond Terrace Road;*
>
> *Upgrade of Taylor Avenue / Haussman Drive intersection to a dual-lane roundabout;*
>
> *Upgrade of Raymond Terrace / Haussman Drive intersection to signal control, including extra lanes; and*
>
> *Duplication of Raymond Terrace Road between Haussman Drive and Harvest Boulevarde.*

At this time, TfNSW is unable to provide a final response to the agency consultation due to the uncertainty regarding the timeline for delivering these necessary transport infrastructure improvements, which are being relied on to mitigate the impacts of the proposal and facilitate the subsequent release of land."

To address the matters raised, the Aimsun model has been re-run using base and development traffic volumes to examine the performance of the traffic network without the planned upgrades. The modelling methodology adopted is consistent with that described in the Supplementary Traffic Assessment. Two access scenarios were considered, being:

- All vehicles are required to turn left into and out of the site.
- Right turns are permitted into the site, left turns are permitted into the site and left turns are permitted out of the site.

The results of the assessment are outlined in **Table 1**.

In addition to the modelling of the proposed scale of development under the Planning Proposal, the traffic volumes associated with the approved development (DA17/2593), which included a total of 156 Independent Living Units (ILUs), were modelled. Access to the approved ILU development was restricted to left turns in and left turns out only and was modelled accordingly.

The results of the modelling indicate the following outcomes:

- There is no change in level of service at any of the intersections surrounding the site as a result of the proposed development, regardless of whether right turns into the site are permitted.
- The intersection of the proposed site access driveway and Haussman Drive is expected to perform at a Level of Service of A in both peak hours, regardless of whether right turns into the site are permitted.

Whilst the traffic model provided by TfNSW includes a much larger scope than just these intersections, the impact on any intersections further afield will be less than that at those modelled and there is no need to provide results for other intersections.

Considering the results of the modelling, the same conclusions as the Supplementary Traffic Advice dated 24 November 2022 are maintained, being that:

- The traffic generation associated with a 160-lot residential subdivision will have little to no noticeable effect on the performance of the road network.
- Both access options assessed (left-in / left-out and left-in / right-in / left-out) perform acceptably and there is no clear difference in the performance of the road network based on the options assessment.
- It is likely that a right-turn into the site would provide for a superior level of amenity for residents and, considering that the modelling demonstrates that it will have no adverse impact on the road network, it is the superior option for access to the site.

Please contact the undersigned on 9521 7199 should you require further information or assistance.

Yours faithfully,

McLaren Traffic Engineering

Tom Steal
Associate
BE Civil MIEAust
RMS Accredited Level 3 Road Safety Auditor

TABLE 1: RESULTS OF MODELLING

Intersection	Control	Peak Period	Average Delay (worst)	Level of Service (worst)	Maximum Average Vehicle Queue (Approach)
BASE CASE					
Raymond Terrace Road / Harvest Boulevard	Signals	AM	34.2 (43.5) (North RT)	C (D)	2.5 (North RT)
		PM	33 (40) (East RT)	C (C)	2.7 (West LT)
Haussman Drive / Raymond Terrace Road	Give Way	AM	7.5 (21.7) (South RT)	A (B)	0.4 (South RT)
		PM	8.8 (26) (South RT)	A (B)	0.5 (South RT)
Raymond Terrace Road / Settlers Blvd	Signals	AM	21.5 (50) (West UT)	B (D)	1 (North LT)
		PM	14.7 (42) (West UT)	B (C)	1 (East T)
Site Access	Give Way	AM	3.6 (5.6) (South T)	A (A)	0 (North LT)
		PM	2.7 (4) (South T)	A (A)	0 (North LT)
NO RIGHT TURN IN					
Raymond Terrace Road / Harvest Boulevard	Signals	AM	33.7 (45.9) (North RT)	C (D)	2.6 (North RT)
		PM	34.6 (39) (North RT)	C (C)	3.1 (West LT)
Haussman Drive / Raymond Terrace Road	Give Way	AM	7.6 (22.6) (South RT)	A (B)	0.5 (South RT)
		PM	9.2 (30) (South RT)	A (C)	0.6 (South RT)
Raymond Terrace Road / Settlers Blvd	Signals	AM	21 (34.6) (East RT)	B (C)	0.9 (North LT)
		PM	15.4 (26) (East RT)	B (B)	1.3 (East T)
Site Access	Give Way	AM	3.7 (5.2) (South T)	A (A)	0.1 (East LT)
		PM	2.5 (6) (South RT)	A (A)	0.1 (South RT)
RIGHT TURN IN PERMITTED					
Raymond Terrace Road / Harvest Boulevard	Signals	AM	30 (35.1) (North RT)	C (C)	1.9 (North RT)
		PM	37 (41) (North LT)	C (C)	3 (West LT)
Haussman Drive / Raymond Terrace Road	Give Way	AM	7.6 (23.4) (South RT)	A (B)	0.5 (South RT)
		PM	13 (38) (South RT)	A (C)	1.1 (South RT)
Raymond Terrace Road / Settlers Blvd	Signals	AM	23.2 (38.5) (West UT)	B (C)	1 (North LT)
		PM	17.9 (29) (West UT)	B (C)	1.3 (East T)
Site Access	Give Way	AM	1.9 (7.4) (South RT)	A (A)	0.1 (East LT)
		PM	6 (10) (South T)	A (A)	0.1 (East LT)
APPROVED 156 ILU DEVELOPMENT					
Raymond Terrace Road / Harvest Boulevard	Signals	AM	34.4 (43.4) (North RT)	C (D)	2.5 (North RT)
		PM	34.6 (40) (East RT)	C (C)	2.9 (West LT)
Haussman Drive / Raymond Terrace Road	Give Way	AM	7.6 (22.4) (South RT)	A (B)	0.5 (South RT)
		PM	9.4 (27) (South RT)	A (B)	0.6 (South RT)
Raymond Terrace Road / Settlers Blvd	Signals	AM	21.2 (34.2) (East RT)	B (C)	1.1 (North LT)
		PM	16 (35) (East RT)	B (C)	1.1 (East T)
Site Access	Give Way	AM	3.8 (5.8) (South T)	A (A)	0.1 (East LT)
		PM	3.5 (6) (East LT)	A (A)	0.1 (East LT)

107 Haussman Drive, Thornton
Biodiversity Development Assessment Report

107 Haussman Drive (Lot 2 DP1145348), Thornton NSW 2322 20220611

09 September 2022

KLEINFELDER
Bright People. Right Solutions.

Suite 3, 240-244 Pacific Highway,
Charlestown, NSW 2290

Phone: +61 2 4949 5200

107 Haussman Drive, Thornton
Biodiversity Development Assessment Report

107 Haussman Drive (Lot 2 DP1145348), Thornton NSW 2322

Kleinfelder Project: 20220611

Kleinfelder Document: NCA22R125923

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Prepared for: McCloy Group

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Prepared by: Ben Stewart

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Document Control:

Version	Description	Date
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2.0	Final	09 September 2022
Prepared	Reviewed	Endorsed
Ben Stewart	Dan O'Brien	Dallas Milburn

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1 INTRODUCTION

1.1 SCOPE

Kleinfelder Australia Pty Ltd (Kleinfelder) was engaged by McCloy Group, to prepare a streamline Biodiversity Development Assessment Report (streamline BDAR) to identify constraints associated with the rezoning of Lot 2 DP 1145348 from RU2 – Rural Landscape to R1 General Residential and E2 – Environmental Conservation (Figure 1). The following terms are used throughout this report to describe particular geographical areas:

- Study Area (19 ha) – Lot 2 DP1145348 (107 Haussman Drive, Thornton NSW 2322) (**Figure 2**)
- Development Site – proposed R1 Zone (**Figure 2**)
- Retained – proposed E3 Zone (**Figure 2**)
- Locality – land within a 5 km radius of the Study Area (**Figure 1**).

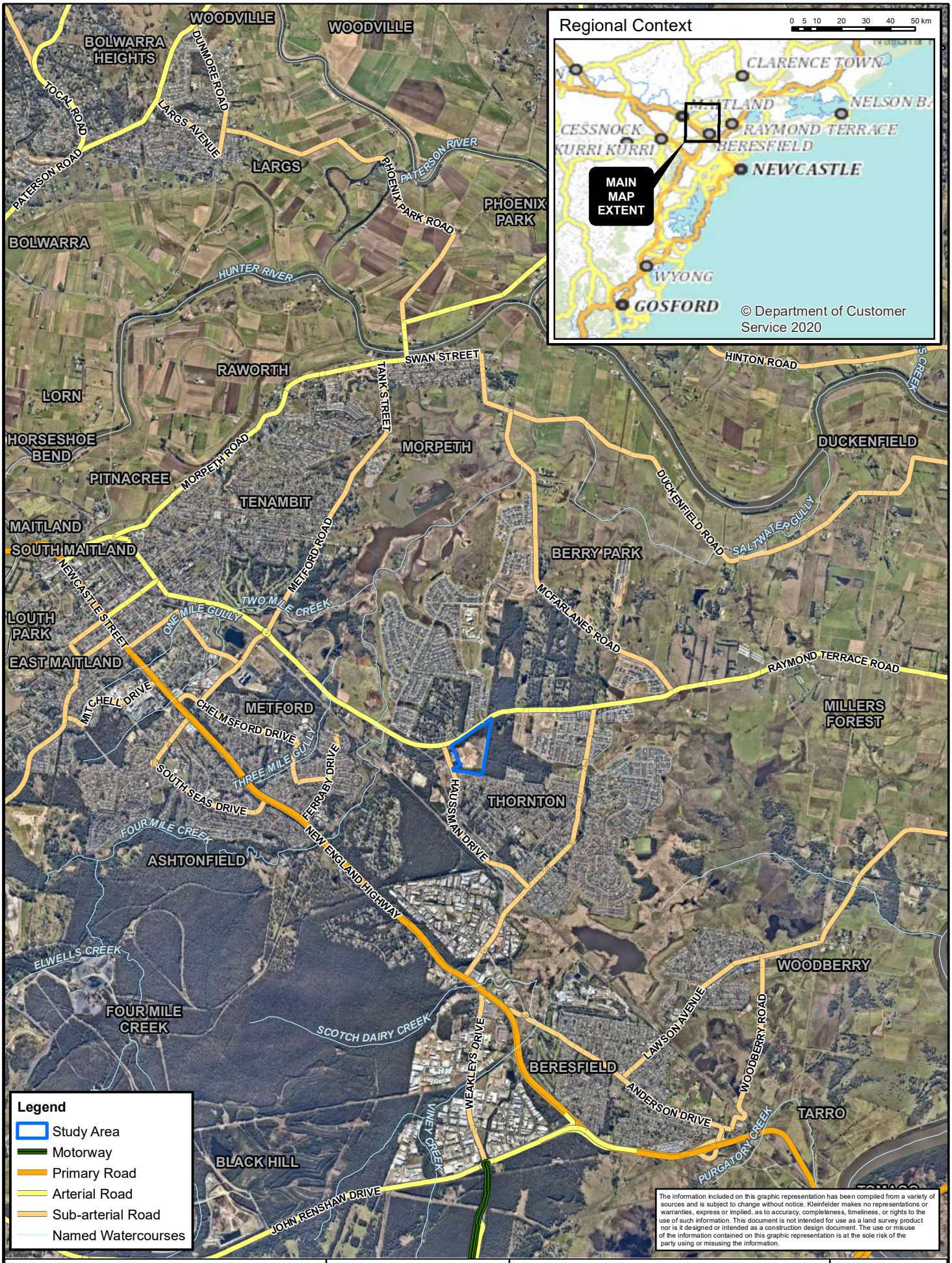
1.2 LOCAL CONTEXT

The study area is approximately 19 hectares (ha) and is legally defined as Lot 2 DP 1145348. The Study Area is located in the Maitland City Council (MCC) Local Government Area (LGA) and is zoned RU2 – Rural Landscape under the Maitland Local Environmental Plan 2011 (Maitland LEP 2011).

The study area adjoins Rural lands (RU2) to the east and west, General Residential lands (R1) to the north and south, and Large Lot Residential lands (R5) to the north-west. It is located generally on the south-eastern corner where Haussman Drive intersects with Raymond Terrace Road. Lands zoned E3 – Environmental Management are located further to the east, and also further to the south-west on the southern side of the train line. It is understood that a rezoning/subdivision is proposed on the adjacent land to the east (480 Raymond Terrace Road, Lot 182 DP 792071). The site is mapped as Category 1 land in the Maitland Urban Settlement Strategy.

1.3 PROPOSED REZONING

Kleinfelder understands that large part of the site is subject to an approved development (DA17/2593). The extent of the approved development is shown on Figure 2. The approved development also includes an Asset Protection Zone (APZ) which extends beyond the extent of the approved DA boundary as shown on Figure 2. The proposed rezoning of the central portion of the site to R1 – General Residential includes the area of approved development and a narrow band around the extent of the approved DA (mostly cleared). The remaining areas of the site are proposed to be rezoned E3 – Environmental Management.



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DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2021

Locality

McCloy Group
Biodiversity Development Assessment Report
Lot 2 DP 1145348
Haussman Drive, Thornton NSW

FIGURE:

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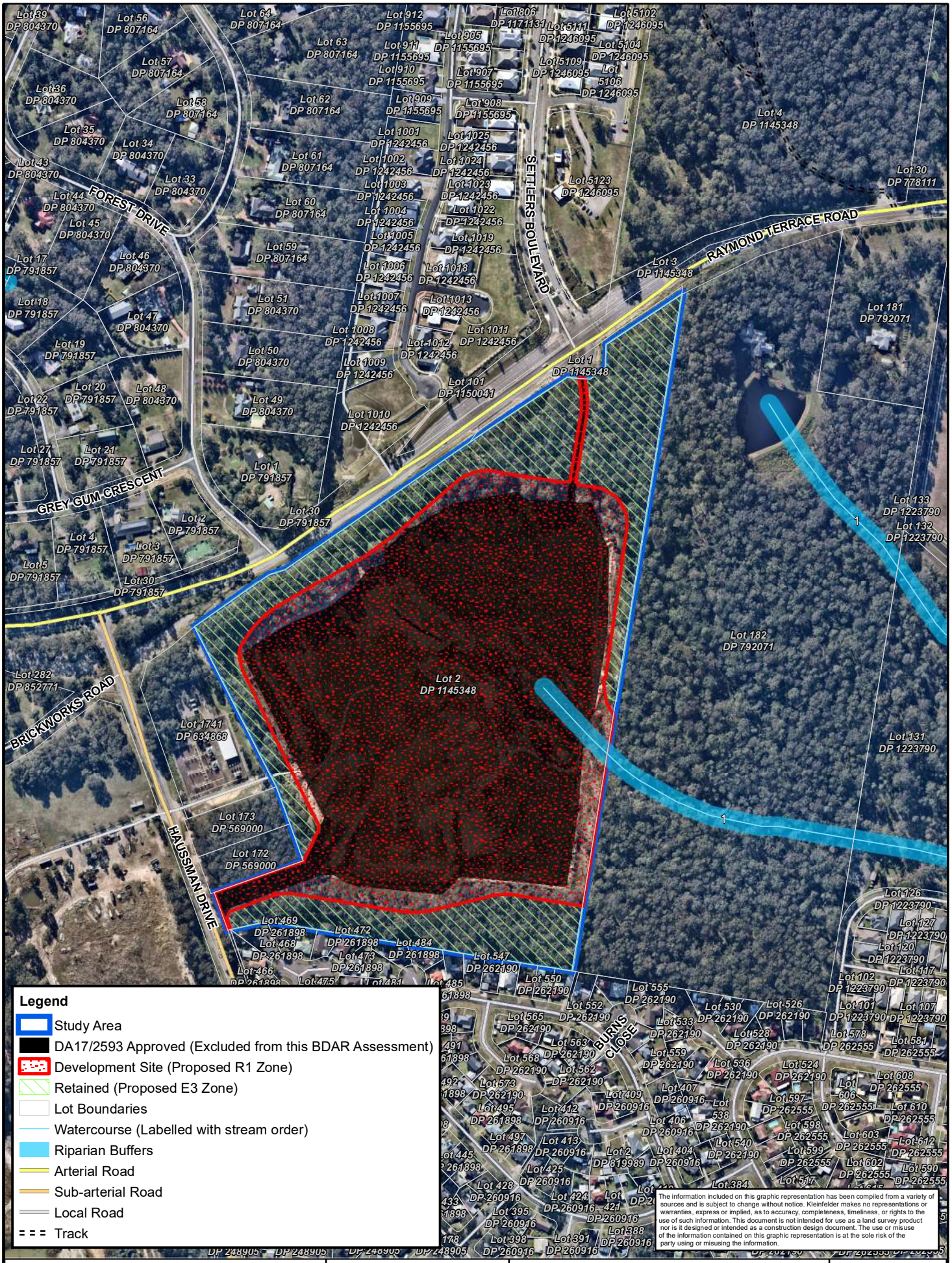

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1.4 INFORMATION SOURCES

The following information sources were utilised to inform the biodiversity development assessment which provided knowledge of existing literature pertaining to the Development Site and broader locality:

- The NSW DPE BioNet Vegetation Classification (formerly known as the NSW Vegetation Information System Classification Database) (DPE, 2022a).
- The NSW DPE Threatened Biodiversity Data Collection (formerly known as the Threatened Species Profile Database) (DPE, 2022b).
- The NSW DPE BioNet Atlas of NSW (formerly known as the NSW Wildlife Atlas) (DPE, 2022c).
- The Commonwealth Department of the Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES) (DAWE, 2022a).
- The Commonwealth DAWE *Species Profile and Threats Database* (SPRAT) (DAWE, 2022b).
- Relevant published literature.

1.5 LEGISLATIVE CONTEXT

Assessment of the proposed development was undertaken in accordance with and in consideration of the following Acts and Policies:

- Commonwealth:
  - *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- State:
  - *Biodiversity Assessment Method (DPIE, 2020a)*
  - *Biodiversity Conservation Act 2016* (NSW) (BC Act)
  - *Biodiversity Conservation Regulation 2017* (NSW) (BC Regulation)
  - *Environmental Planning and Assessment Act 1979* (EP&A Act)
  - *Biodiversity Conservation (Savings and Transitional) Regulation 2017*
  - *Biosecurity Act 2015*
  - *State Environmental Planning Policy (Biodiversity and Conservation) 2021 – Chapter 3 (Koala Habitat Protection) 2020.*
- Local:
  - Maitland Local Environmental Plan 2011 (MLEP 2011)
  - Maitland Development Control Plan 2011 (MDCP 2011).

1.5.1 Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

Under the EPBC Act assessment, an approval is required for actions that are likely to have a significant impact on matters of national environmental significance (MNES). An action includes a project, development, undertaking, activity, or series of activities. When a person proposes to take an action, they believe may need approval under the EPBC Act, they must refer the proposed development to the Australian Government Minister for the Environment. The Act identifies nine MNES:

1. World Heritage properties;
2. National heritage places;
3. Wetlands of international importance (Ramsar Convention);
4. Listed threatened species and communities;
5. Migratory species listed under international agreements;
6. Great Barrier Reef Marine Park;
7. Commonwealth marine areas;

8. Nuclear actions; and
9. Water resources in respect to Coal Seam Gas and large coal mines.

While this BDAR is not required to address MNES, the proponent is required to address the EPBC Act as part of their development application. Items 3, 4 and 5 are relevant to the current proposed development.

1.5.2 Biodiversity Conservation Act 2016 (NSW)

Biodiversity Assessment Pathway

As per Part 7.7 of the BC Act, all applications for development consent under Part 4 of the EP&A Act are to be accompanied by a BDAR[1] unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values. Part 7.2 of the BC Act states that a development is *likely to significantly affect threatened species* if it:

- Is carried out within an area of Outstanding Biodiversity Value, or
- Exceeds the Biodiversity Offset Scheme (BOS) thresholds, which includes:
    - Clearing of native vegetation, or undertaking a prescribed activity, on land mapped on the NSW Biodiversity Vales Map (BV Map), or
    - Clearing of native vegetation of an area declared by clause 7.2 of the BC Regulation as exceeding the threshold.
- Is likely to significantly affect threatened species or ecological communities, or their habitat, according to the test in section 7.3 (5-part test).

The proposed development does not occur within an area of Outstanding Biodiversity Value (AOBV).

The NSW biodiversity values map was reviewed, and there are no areas of biodiversity value mapped within the Study Area.

Under clause 7.2 of the BC Regulation, the area of native vegetation clearing threshold for the proposed development is 1 ha or more, as the minimum lot size of the Development Site is 40 ha. However, it is understood that the minimum lot size following rezoning (prior to subdivision/development) will be reduced to <1ha, such that the vegetation clearing threshold for entry into the BOS will be 0.25 ha. If this minimum lot size was applied, a streamline BDAR (small area module) could be undertaken if the vegetation clearing is equal to, or less than, 1 ha. The proposed development will directly impact on approximately 0.82 ha of native vegetation. As such, the proposed development exceeds the native vegetation clearing threshold set out in the BC Regulation, and a BDAR is required for the proposed development.

Biodiversity Assessment Method

Section 2.2 of the BAM (DPIE, 2020a) summarises the streamlined assessment modules that may be used by an assessor. These streamlined assessment modules may be used where the proposed development impacts on:

a) scattered trees (Appendix B of the BAM).
b) a small area (Appendix C of the BAM).

[1] With the exception of:
(a) an application for development consent for State significant development, or
(b) an application for a complying development certificate.

c) planted native vegetation, where the planted native vegetation was planted for purposes such as street trees and other roadside plantings, windbreaks, landscaping in parks and gardens, and revegetation for environmental rehabilitation (Appendix D of the BAM).

Appendices B, C and D of the BAM set out the circumstances where each of the streamlined assessment modules can be used to assess a proposal and the specific assessment requirements. Streamlined assessment modules cannot be used to assess clearing within areas mapped by the Biodiversity Values Map.

The proposed rezoning of land to residential comprises 0.82 ha of native vegetation. Any development within the future residential zoned land will have the potential to impact 0.82 ha of native vegetation. Given the minimum lot size of 1 ha, the small area module of the BAM (streamline BDAR) is applicable to the project.

The Biodiversity Accredited Assessor System (BAAS) Case number for the project is 00024274. The BAM Calculator number for the project is 00024274/BAAS18041/21/00025808.

1.5.3 Biosecurity Act 2015

Under the *Biosecurity Act 2015* all plants are regulated with a general biosecurity duty *"to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable."* Under the Act, a biosecurity impact is *"an adverse effect on the economy, environment, or the community that arises, or has the potential to arise, from a biosecurity matter."*

All matters of biosecurity identified during the assessment, including High Threat Weeds (HTW) and Weeds of National Significance (WoNS) have been considered within this report.

1.5.4 State Environmental Planning Policy (Biodiversity and Conservation) 2021

The State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Biodiversity and Conservation SEPP) consolidates, transfers and repeals the provisions of eleven (11) SEPPs into a single environmental planning instrument. The Biodiversity and Conservation SEPP aims to promote the protection and improvement of key environmental assets for their intrinsic value and the social and economic benefits they provide. Relevant chapters of the Biodiversity and Conservation SEPP are considered below:

Chapter 3 - Koala Habitat Protection State Environmental Planning Policy (SEPP 2020)

This Chapter of the Biodiversity and Conservation SEPP incorporates the provisions of the now repealed Koala Habitat Protection SEPP 2020 (Koala SEPP 2020) and the Koala Habitat Protection SEPP 2021. The Koala Habitat Protection SEPP 2021 was made and commenced on 17 March 2021. The Koala SEPP 2021 reinstates the policy framework of SEPP Koala Habitat Protection 2019 to 83 Local Government Areas (LGA) in NSW; however, for all RU1, RU2 and RU3 zoned land outside of the Sydney Metropolitan Area and the Central Coast, Koala SEPP 2020 continues to apply.

The Koala SEPP aims to encourage the conservation and management of areas of natural vegetation that provide habitat for Koalas to support a permanent free-living population over their present range and reverse the current trend of Koala population decline. The Koala SEPP 2021 applies to each Local Government Area listed in Schedule 1 of the SEPP. However, for all RU1, RU2 and RU3 zoned land outside of the Sydney Metropolitan Area and the Central Coast, Koala SEPP 2020 continues to apply.

The Study Area is zoned RU2 – Rural Landscape under the Maitland LEP 2011, as such, the provisions of the Koala SEPP 2020 apply. See Section **4.1.1.** for a summary of the Koala habitat assessment.

2 LANDSCAPE CONTEXT

2.1 LANDSCAPE FEATURES

The landscape features and site context detailed in Section 3 of the BAM (DPIE, 2020a) are described in **Table 1**. These landscape features are also shown in **Figure 3**.

Table 1 Landscape context of Subject Site (107 Haussman Drive, Thornton).

Landscape Feature	Development Site
IBRA bioregion	Sydney Basin IBRA Region
IBRA subregion	Hunter IBRA Sub-region
LGA	City of Maitland
Mitchell Landscapes	**Newcastle Coastal Ramp** This landscape occurs on undulating lowlands and low to steep hills on complex patterns of faulted and gently folded Carboniferous conglomerate, lithic sandstone, felspathic sandstone, and mudstone. General elevation 50 to 275m, local relief 40 to 150m. Stony red texture-contrast soils on steep slopes, yellow and brown texture-contrast soils on lower slopes and deep dark clay loams along streams (Mitchell, 2002).
Rivers, streams and estuaries	One first order stream starts within the Study Area and flows to the west, outside of the Study Area (**Figure 3**). The current development design of the Subject Site impacts the head of the stream.
Wetlands	The closest mapped wetlands are the Woodberry Swamp (Approx. 1.3km from the Development Site) and Tarro Swamp (Approx. 4.3km from the Development Site), which are mapped under the SEPP Coastal Management Act 2018 as Coastal Wetlands. Additionally, the Hunter Wetlands National Park, listed as a RAMSAR Wetland, occurs approximately 11.5km from the Development Site.
Connectivity of different areas of habitat	The Development Site occurs within the Thornton north residential area that has majority cleared of wooded vegetation. Limited connectivity to other areas of wooded vegetation exists due to the intersection of Raymond Terrace Road to the north, Haussman Drive to the south-west and high-density residential areas to the south-east. Large areas of wooded vegetation occur to the south-west of the Development Site, however, these areas have limiting connectivity to the Development Site due to Haussman Drive, the Railway corridor adjacent to Haussman Drive, and the New England Highway further to the south-west.
Areas of geological significance and soil hazard features	The Development Site occurs on Class 5 land as mapped under the Maitland Local Environmental Plan 2011, and therefore has a low risk of acid sulfate soils occurring within the site. Class 2 Acid Sulfate Soils are mapped approximately 1km away to the south-east of the Development Site.
Areas of outstanding biodiversity value	The Development Site does not occur on an area mapped as Outstanding Biodiversity Value, or within proximity to an area mapped as Outstanding Biodiversity Value.

2.2 SITE CONTEXT

Details of the landscape assessment for the Development Site, according to the BAM (DPIE, 2020a) using the site-based assessment methodology and determined by remote sensing and GIS are detailed below.

2.2.1 Native Vegetation Cover

Native vegetation cover estimated to remain in the landscape proximal to the Development Site has been calculated within a 1,500 m site buffer. The 1,500 m site buffer area has a total area of 1022 ha, of which 329 ha is native vegetation. This equates to 32% native vegetation cover (**Figure 3**).

2.3 GEOLOGY AND SOILS

The Study Area is mapped as occurring on the Beresfield soil landscape (DPE, 2022f). The Beresfield soil landscape is described as occurring on undulating low hills and rises on Permian sediments in the East Maitland Hills region. Soils are typically moderately deep (<120 cm) Podzolic soils. The dominant materials are described as fine sandy-clay or silty loams. These soils are prone to water erosion and localised seasonal waterlogging in low lying areas can occur.

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Legend

- Study Area
- DA17/2593 Approved (Excluded from this BDAR Assessment)
- Landscape Assessment - 1500m Buffer
- Landscape Assessment - Native Vegetation

Biodiversity Values (V11.4)

- Coastal Management Act - Wetlands
- Protected Riparian Land
- IBRA Sub-region Boundary (V7)
- Mitchell Landscapes Boundary (V3)
- Watercourse (Labelled with stream order)
- Riparian Buffers

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DATA SOURCE:
NSW DFSI - 2020
NSW EOH - 2020
Nearmap - 2020

Site Location - Landscape Context

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Biodiversity Development Assessment Report
Lot 2 DP 1145348
Haussman Drive, Thornton NSW

FIGURE:

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3 NATIVE VEGETATION

3.1 METHODOLOGY

Native vegetation (**Figure 3**) at the Development Site was assessed in accordance with Section 4.2 of the BAM (DPIE, 2020a).

3.1.1 Data Review

Previous vegetation mapping within Lot 2 DP 1145348, completed as part of the Flora and Fauna Assessment Report (Kleinfelder, 2017) for a senior housing development, was reviewed in conjunction with plot-based surveys conducted as part of the current assessment.

3.1.2 Vegetation Mapping Surveys

Vegetation Mapping and Surveys

Detailed vegetation surveys were conducted across the Study Area on 12 and 26 May 2021. Areas of vegetation to be impacted by the amended development design were mapped during this period.

The ecotonal boundaries of each PCT within the development footprint were validated through ground-truthed surveys using a combination of rapid data points (RDPs) and vegetation boundary polygons. These attributes were collected in the field using a hand-held Trimble™ GPS unit. Additionally, aerial photographic interpretation (API) was used to aid in determining boundaries of PCTs within the Study Area.

Plant Community Type Determination

Each vegetation community identified within the Study Area was assigned to the closest equivalent PCT from those listed in the BioNet Vegetation Classification database (DPIE, 2020b). This was based on field data confirming dominant species present and floristic structure and composition within those vegetation communities. Other diagnostic features to aid in PCT classification included landscape position, soil type and descriptive attributes for those communities.

Relevant attributes of each PCT, such as floristic composition and structure, regional location, dominant species, etc, were assessed to determine if the vegetation within the Study Area is commensurate with known Threatened Ecological Communities (TECs) as defined by NSW (BC Act) and Commonwealth (EPBC Act) legislation.

Vegetation Zones

Vegetation zones were identified and delineated on the Development Site in accordance with Section 4.3 of the BAM (DPIE, 2020a). A vegetation zone is defined in the BAM as a relatively homogenous area that is the same vegetation type and broad condition. Vegetation zones identified within the Development Site are presented in Section 3.2.

Assessing Vegetation Integrity (Vegetation Condition)

Following stratification of the Development Site into vegetation zones, plots/transects were undertaken to collect site condition data for the composition, structure and function attributes listed in **Table 2** in accordance with Section 4.3 of the BAM (DPIE, 2020a). The location of the plots/transects were selected through stratified random sampling to provide a representative sample of the variation in vegetation composition and condition within each vegetation zone.

Table 2 Growth form groups and condition attributes used to assess the composition, structure and function components of vegetation integrity.

Condition attributes used to assess composition	Condition attributes used to assess structure	Attributes used to assess function
Tree richness	Tree cover	Number of large trees
Shrub richness	Shrub cover	Tree regeneration
Grass and Grass-like richness	Grass and Grass-like cover	Tree stem size classes
Forb richness	Forb cover	Total length of fallen logs
Fern richness	Fern cover	Litter cover
Other richness	Other r cover	High threat weed cover

Five (5) vegetation integrity plots were undertaken across the Development Site (**Figure 3**) which meets the minimum number of plots/transects required for each vegetation zone, based on their area, as detailed in Section 4.3.4, Table 3 of the BAM (DPIE, 2020a).

Floristic Identification and Nomenclature

Floristic identification and nomenclature were based on Harden (1992, 1993, 2000 and 2002) with subsequent revisions as published on PlantNet (http://plantnet.rbgsyd.nsw.gov.au).

3.2 Assessment Results

3.2.1 Vegetation within the Development Site

Vegetation Description

One PCT was identified within the Study Area (**Figure 4**); 1592 -Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter.

Table 3 Plant Community Types (PCTs) identified within the proposed R1 and E3 Zones.

Vegetation Zone	Vegetation Formation	Vegetation Class	PCT	Condition	R1 Area (ha)	E3 Area (ha)
1	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	1592 -Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Regrowth Meets EEC determination	0.00	0.58
2	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	1592 -Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Remnant - Moderate Meets EEC determination	0.50	4.23

Vegetation Zone	Vegetation Formation	Vegetation Class	PCT	Condition	R1 Area (ha)	E3 Area (ha)
3	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	1592 -Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Modified Meets EEC determination	0.32	0.27
				Subtotal	0.82	5.08
	-	-	Cleared	-	1.30	0.47
			Approved DA	-	11.27	0.00
				Total	13.39	5.55

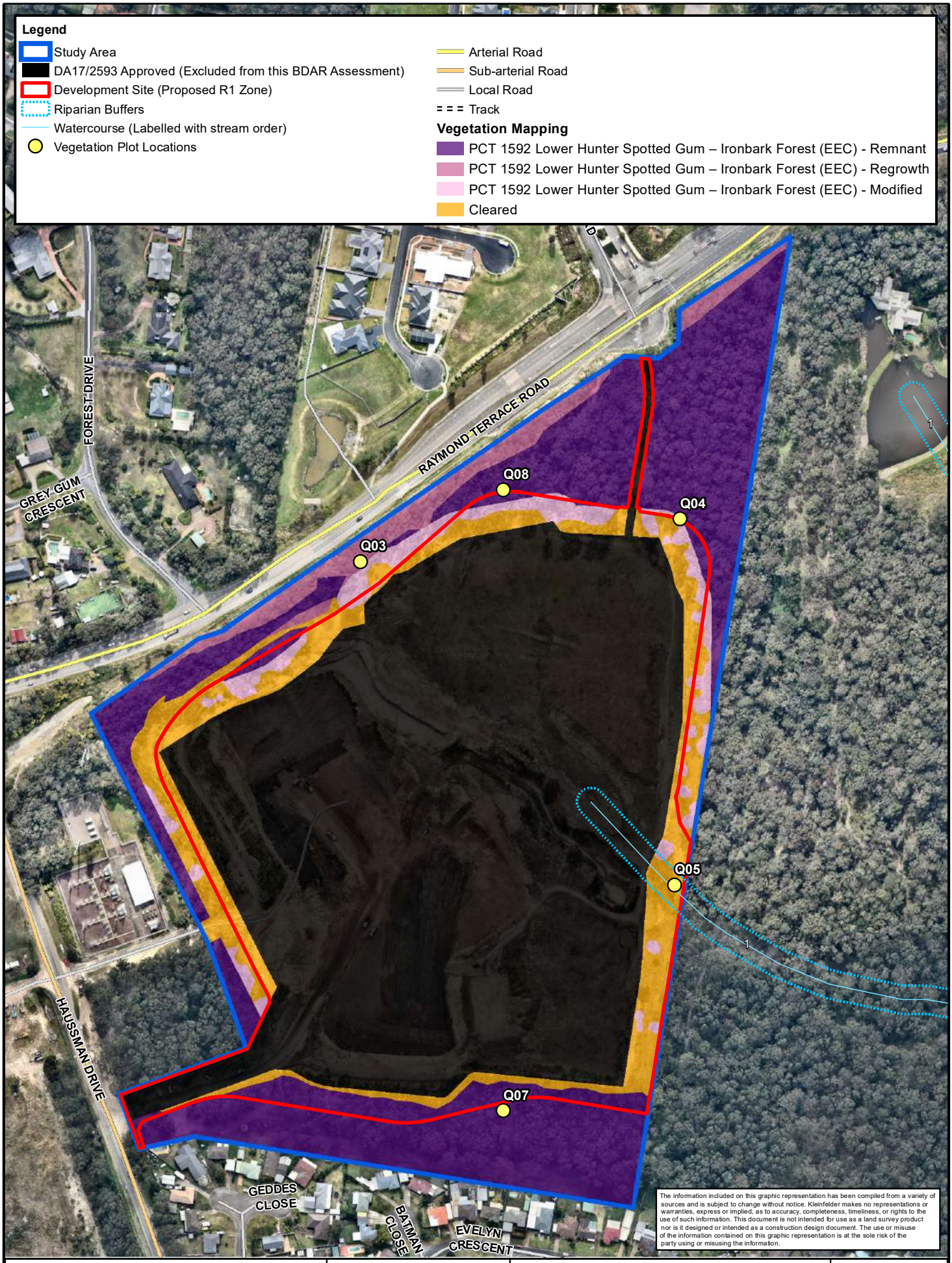
Threatened Ecological Communities (TECs)

Within the Development Site, Vegetation Zone 2 and 3 (0.82ha) is commensurate with the vegetation assemblage of one Endangered Ecological Community (EEC); *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions* (hereafter referred to as Lower Hunter Spotted Gum Ironbark Forest) (**Figure 4**). Lower Hunter Spotted Gum Ironbark Forest occurs within the Sydney Basin IBRA region and typically occurs on Permian geology. The EEC is characterised by a dominant canopy stratum of *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Red Ironbark), with a *Eucalyptus punctata* (Grey Gum) influence.

Vegetation Zones

The Plant Community Type within the Study Area is comprised of three (3) vegetation zones (**Figure 4**). Vegetation Zone 1 (zone 1) is considered to exist in a low/degraded condition within some evidence of regrowth occurring within the north-western strip of the Study Area. Vegetation Zone 2 (Zone 2) is considered to be in a moderate condition and occurs within the northern and southern portions of the Study Area. Vegetation Zone 3 (zone 3) is considered to be in a modified/managed condition due to APZ vegetation management associated with the approved DA.

Details on the vegetation zone (including condition class, area, patch size, survey effort and vegetation integrity score) are outlined in **Table 3** and full descriptions of each vegetation zone is provided in the following sub-sections **Figure 4** shows the distribution of vegetation zone within the Development Site. Plot data is provided in **Appendix H**.



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DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2021

Vegetation Communities

McCloy Group
Biodiversity Development Assessment Report
Lot 2 DP 1145348
Haussman Drive, Thornton NSW

FIGURE:
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3.2.1.1 Vegetation Zone 1

Plate 1 Vegetation Zone 1

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Regrowth condition)	
Vegetation Formation and Class	Dry Sclerophyll Forests (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests
Area within Development Site	0.00
Survey Effort	**Required:** 1 plots/transects
	Conducted: 1 plots/transects (Q03)

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Regrowth condition)	
Floristic description	This community occurs as an open forest with the mixture of canopy species. The most dominant species within this vegetation zone include *Eucalyptus punctata* (Grey Gum), *Eucalyptus siderophloia* (Grey Ironbark) and *Eucalyptus globoidea* (White Stringybark). The shrub layer is generally sparse within this community. Species such as *Ozothamnus diosmifolius* (White Dogwood), *Acacia fimbriata* (Fringed Wattle), *Breynia oblongifolia* (Coffee bush) and *Bursaria spinosa* (Native Blackthorn) were present throughout. The ground stratum varies within the area but is generally dominated by grasses such as *Themeda australis* (Kangaroo Grass), *Microlaena stipoides* (Weeping Grass) and *Entolasia stricta* (Wiry Panic). Forbs such as *Lobelia purpurascens* (Whiteroot), *Dichondra repens* (Kidney Weed), *Oxalis perennans* were also common.
Condition within Development Site	Vegetation within this zone is considered to be in degraded condition due to previous clearing and weed incursion. Regrowth is evident.
Justification for PCT selection	Although the canopy structure is slightly different to that of the moderate condition vegetation zone of PCT 1592, shrub species and ground cover species are commensurate with the PCT 1592. Therefore, PCT 1592 is considered the most appropriate PCT for this vegetation zone.
Status	**BC Act Listed – Endangered** *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*. The vegetation assemblage within this zone is commensurate with vegetation characteristic of this EEC. The Development Site is commensurate with descriptive attributes of this EEC, i.e., regional location, soil type and geology. **EPBC Act - Not Listed.**
SAII	No
PCT % Cleared	44 % (obtained from NSW BioNet Vegetation Classification)

3.2.1.2 Vegetation Zone 2

Plate 2: Vegetation Zone 2

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Remnant - Moderate condition)	
Vegetation Formation and Class	Dry Sclerophyll Forests (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests
Area within Development Site	0.50
Survey Effort	**Required:** 2 plots/transects
	Conducted: 2 plots/transects (Q07 & Q08)

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Remnant - Moderate condition)	
Floristic description	This community occurs as an open forest with the canopy stratum dominated by *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Red Ironbark). *Eucalyptus punctata* (Grey Gum, *Eucalyptus siderophloia* (Grey Ironbark) and *Eucalyptus umbra* (Broad-leaved White Mahogany) are co-dominant species, depending on the area within the Development Site. Commonly encountered shrubs within this vegetation zone include *Ozothamnus diosmifolius* (White Dogwood), *Acacia fimbriata* (Fringed Wattle), *Acacia elongata* (Swamp Wattle) and *Bursaria spinosa* (Native Blackthorn) with minor occurrences of *Acacia falcata, Daviesia ulicifolia* (Gorse Bitter Pea) and *Pultenaea villosa* (Hairy Bush Pea). The ground stratum varies within the area but is generally dominated by grasses such as *Themeda australis* (Kangaroo Grass), *Microlaena stipoides* (Weeping Grass), *Entolasia stricta* (Wiry Panic). Forbs such as *Gonocarpus teucrioides* (Raspwort), *Lobelia purpurascens* (Whiteroot) and *Dichondra repens* (Kidney Weed) were also common. *Cheilanthes sieberi* (Poison Rock Fern) was common in certain areas.
Condition within Development Site	Vegetation within this zone is considered to be in moderate condition.
Justification for PCT selection	PCT 1592 is considered the most appropriate PCT for the community present within the Development Site based on the dominant canopy species, *Eucalyptus fibrosa* (Red Ironbark) and *Corymbia maculata* (Spotted Gum) with an influence of *Eucalyptus punctata* (Grey Gum).
Status	**BC Act Listed – Endangered** *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*. The vegetation assemblage within this zone is commensurate with vegetation characteristic of this EEC. The Development Site is commensurate with descriptive attributes of this EEC, i.e., regional location, soil type and geology. **EPBC Act - Not Listed.**
SAII	No
PCT % Cleared	44 % (obtained from NSW BioNet Vegetation Classification)

3.2.1.3 Vegetation Zone 3

Plate 3 Vegetation Zone 3

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Modified/Managed condition)	
Vegetation Formation and Class	Dry Sclerophyll Forests (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests
Area within Development Site	0.32
Survey Effort	**Required:** 2 plots/transects
	Conducted: 2 plots/transects (Q04 & Q05)

1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Modified/Managed condition)	
Floristic description	This community occurs as an open forest with the mixture of canopy species. The most dominant species within this vegetation zone include *Corymbia maculata* (Spotted Gum) *Eucalyptus punctata* (Grey Gum), *Eucalyptus fibrosa* (Red Ironbark). The shrub layer is generally sparse within this community. Species such as *Breynia oblongifolia* (Coffee bush) and *Bursaria spinosa* (Native Blackthorn) were present throughout. Scattered occurrences of *Ozothamnus diosmifolius* (White Dogwood) was evident within this community. The ground stratum varies within the area but is generally dominated by grasses such as *Microlaena stipoides* (Weeping Grass) and *Entolasia stricta* (Wiry Panic). An influence of *Themeda triandra* (Kangaroo Grass), *Imperata cylindrica* (Blady Grass) and *Aristida vagans* (Three-awn Spear grass) was present. Forbs such as *Lobelia purpurascens* (Whiteroot) and *Arthropodium milleflorum* (Pale Vanilla-lily) and the fern *Cheilanthes sieberi* were also evident throughout.
Condition within Development Site	Vegetation within this zone is considered to be in moderate condition due to previous clearing and weed incursion.
Justification for PCT selection	PCT 1592 is considered the most appropriate PCT for the community present within the Development Site based on the dominant canopy species, *Eucalyptus fibrosa* (Red Ironbark) and *Corymbia maculata* (Spotted Gum) with an influence of *Eucalyptus punctata* (Grey Gum).
Status	**BC Act Listed – Endangered** *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*. The vegetation assemblage within this zone is commensurate with vegetation characteristic of this EEC. The Development Site is commensurate with descriptive attributes of this EEC, i.e. regional location, soil type and geology. **EPBC Act - Not Listed.**
SAII	No
PCT % Cleared	44 % (obtained from NSW BioNet Vegetation Classification)

Assessment of Patch Size

The patch size for Vegetation Zone 1, 2 and 3 were assessed as >100 ha as this zone is connected to large intact areas of native vegetation extending to the east, south and west, any gaps in the vegetation patch are less than 100 m.

Vegetation Integrity Score

The current vegetation integrity score of the vegetation zones is outlined in **Table 4**.

Table 4 Condition scores and current Vegetation Integrity (VI) scores of each vegetation zone within the development footprint (proposed R1 Zone).

Zone	PCT	Condition Class	Area (ha)	Condition scores (Current Score)			Vegetation Integrity Score
				Composition	Structure	Function	
1	1592	Regrowth	0.00	72.8	39.2	49	51.9
2	1592	Remnant	0.5	81.4	22.7	44.8	43.6
3	1592	Modified	0.32	84.1	43.5	44.5	54.6

3.2.2 Vegetation within the Study Area

The vegetation within the Study Area is floristically consistent with *PCT 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter*. A large portion of the Study Area consists of previously cleared vegetation, pertaining to an approved DA. This vegetation within this area occurs as a managed form of PCT 1592. Species observed within these areas that differ from the current Subject Site consist of *Andropogon virginicus* (Whisky Grass), *Gonocarpus tetragynus* (Raspwort), *Dillwynia retorta, Pultenaea spinosa, Leucopogon juniperinus* (Prickly Beard-heath), *Goodenia paniculata, Acacia irrorata* (Green Wattle), *Acacia parvipinnula* (Silver-stemmed Wattle), *Casuarina glauca* (Swamp She-oak) and *Typha orientalis* (Broad-leaved Cumbungi). The main floristic difference within this part of the Study Area in comparison to the Subject Site is the limited overstorey vegetation and large areas dominated by Whisky Grass. **Plate 4** and **Plate 5** displays the vegetation condition within this part of the Study Area.

Plate 4 **Condition of vegetation within cleared sections of the Study Area.**

Plate 5 **Patches of Whisky Grass (*Andropogon virginicus*) dominating parts of the Study Area.**

4 THREATENED SPECIES

4.1 ASSESSING HABITAT SUITABILITY

To help inform the assessment of suitable habitat for threatened species and populations within the Study Area, a database search of the NSW Department of Planning and Environment (DPE) BioNet Atlas and the Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) were conducted. Results are provided in **Appendix A**. A site-based survey assessing the suitability of threatened flora and fauna species habitat was undertaken on 12 and 26 May 2021. This assessment id detailed in the Section 4.1.1.

4.1.1 Habitat Assessment

Flora

A BioNet Atlas search of the area returned five (5) threatened flora species recorded within the locality, of which, one species, *Callistemon linearifolius* (Netted Bottled Brush), was considered to have a moderate likelihood of occurring within the Study Area. Based on the findings of the previous Flora and Fauna Assessment Report (Kleinfelder, 2017) and the site surveys, undertaken on 12 and 26 May 2021, no threatened species were identified to occur within the Development Site. Therefore, the vegetation within the Development Site is unlikely to support habitat for threatened flora species.

Fauna

Habitat Assessment

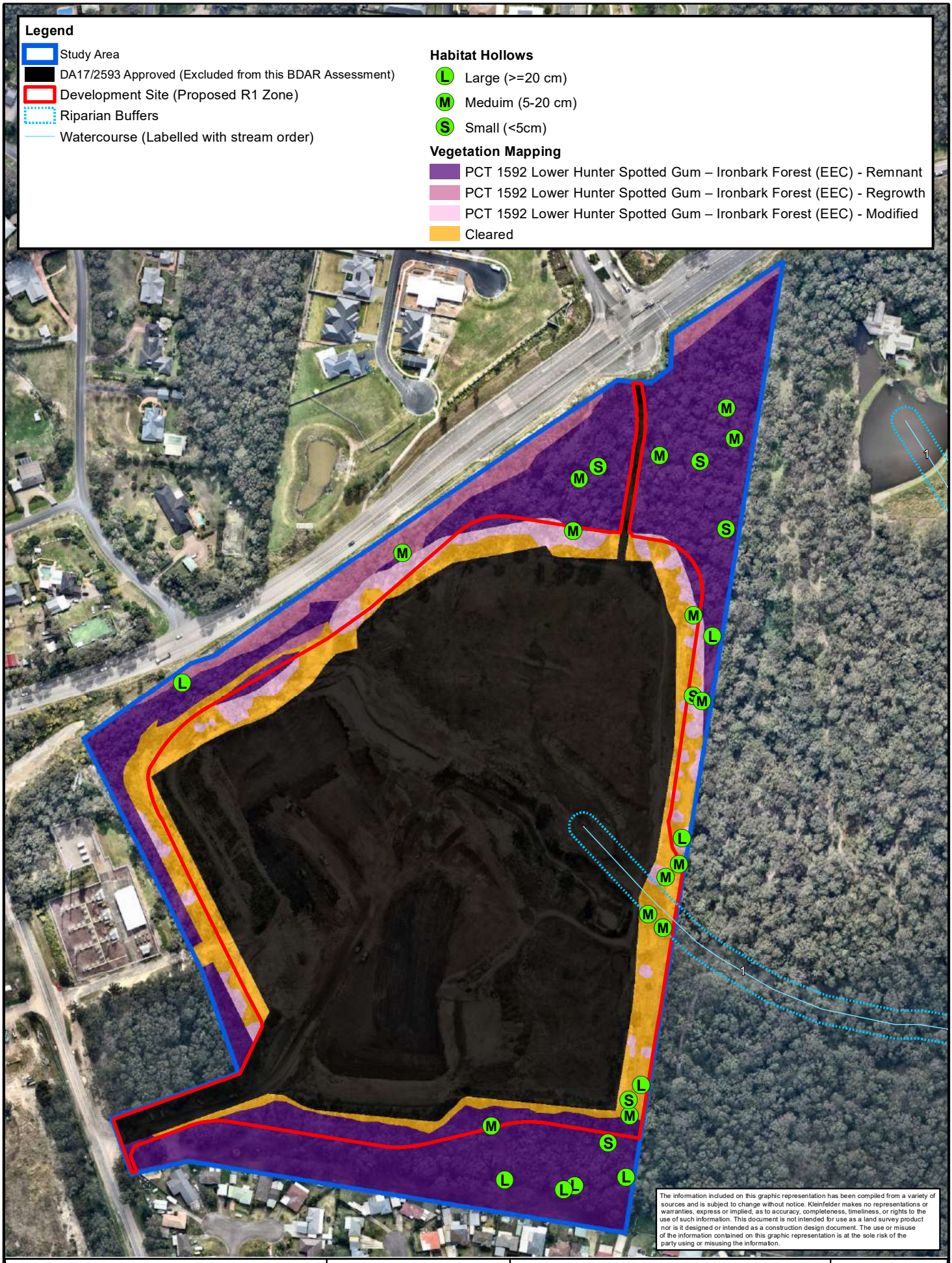
A BioNet Atlas search, applying a 5-kilometre buffer to the Development Site, returned 53 threatened fauna species within the locality. Based on site surveys conducted on 12 and 26 May 2021, and previous records of threatened fauna species (Kleinfelder, 2017), the Development Site is likely to contain suitable habitat for the following fauna species:

- Little Lorikeet (*Glossopsitta pusilla*)
- Grey-crowned Babbler (eastern sub-species) (*Pomatostomus temporalis temporalis*)
- Squirrel Glider (*Pteropus norfolkensis*)
- Brush-tailed Phascogale (*Phascogale tapoatafa*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)

Habitat Tree Survey

A ground-based survey of habitat trees within the Study Area was undertaken on 26 May 2021 to validate the number and size of hollows previously identified in 2017 (Kleinfelder, 2017) and identify additional hollow-bearing trees, dead standing stags and trees containing nests. The results of the habitat tree survey are used to determine the suitability of hollows for hollow-dependent threatened fauna species likely to occur within the Study Area.

A total of 26 hollow-bearing trees are located within the Study Area with ten (10) being located within the proposed R1 Zone. Within the proposed R1 Zone, there is one (1) hollow-bearing tree containing a large hollow and nine (9) containing medium-sized hollows (**Figure 5**).



Metres
0 25 50 100 150 200
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PROJECT REFERENCE: 20220611
DATE DRAWN: 8/29/2022 09:50 Version 1
DRAWN BY: AMcDonaugh
DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2021

Habitat Features

McCloy Group
Biodiversity Development Assessment Report
Lot 2 DP 1145348
Haussman Drive, Thornton NSW

FIGURE:
5

J:\00 CLIENT FILES\127490_McCloy_Group\20220611_BDAR_HaussmanDrive_May2021\Mapping\20220729_BDAR_Fig05_HabitatFeatures.mxd

Koala Habitat

Vegetation within the Study Area and Subject Site does not meet the definition of 'Potential' Koala habitat as defined by SEPP 2020, due to a lack of listed Koala feed tree species (according to Schedule 2 of the SEPP 2020). *Eucalyptus punctata* comprised less than 15% total cover of species. In addition, there are no BioNet atlas records of Koalas within 2.5 kilometres of the Study Area within the last 18 years indicating that the area lacks a resident Koala population. As such, the vegetation within the Study Area does not meet the definition of 'Core' Koala habitat under the Koala SEPP 2020.

4.1.2 Ecosystem Credit Species

The following assessment of habitat suitability for ecosystem credit species was conducted in accordance with Section 5.2 of the BAM. Ecosystem credits represent threatened species that can be predicted to be present by the type and condition of vegetation at the Subject Site. Targeted survey is not required for ecosystem credit species.

Step 1: Identify threatened species for assessment.

A list of predicted ecosystem credit species for the Subject Site was reviewed in the BAM calculator, according to PCTs present on the subject land.

Step 2: Assessment of the habitat constraints and vagrant species on the subject land

The potential for identified ecosystem credit species to occur on the Subject Site was assessed according to species specific habitat requirements, as detailed in **Table 5**.

Table 5 Assessment of ecosystem credit species within the Subject Site.

Scientific Name	Common Name	Confirmed predicted species	Justification
Anthochaera phrygia	Regent Honeyeater	Yes	-
Callocephalon fimbriatum	Gang-gang Cockatoo	Yes	-
Calyptorhynchus lathami	Glossy Black-cockatoo (foraging)	Yes	-
Chthonicola sagittata	Speckled Warbler	Yes	-
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Yes	-
Daphoenositta chrysoptera	Varied Sittella	Yes	-
Dasyurus maculatus	Spot-tailed Quoll	Yes	-
Falsistrellus tasmaniensis	Eastern False Pioistrelle	Yes	-
Glossopsitta pusilla	Little Loriket	Yes	-
Grantiella picta	Painted Honeyeater	Yes	-

Scientific Name	Common Name	Confirmed predicted species	Justification
Haliaeetus leucogaster	White-bellied Sea-eagle	Yes	-
Hieraaetus morphnoides	Little Eagle	Yes	-
Lathamus discolor	Swift Parrot	Yes	-
Lophoictinia isura	Square-tailed Kite	Yes	-
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Yes	-
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Yes	-
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Yes	-
Miniopterus australis	Little Bent-winged Bat	Yes	-
Miniopterus orianae oceanensis	Large Bent-winged Bat	Yes	-
Neophema pulchella	Turquoise Parrot	Yes	-
Ninox connivens	Barking Owl	Yes	-
Ninox strenua	Powerful Owl	Yes	-
Petaurus australis	Yellow-bellied Glider	Yes	-
Petroica boodang	Scarlet Robin	Yes	-
Phascolarctos cinereus	Koala (foraging)	Yes	-
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Yes	-
Pteropus poliocephalus	Grey-headed Flying-fox	Yes	-
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Yes	-
Scoteanax rueppellii	Greater Broad-nosed Bat	Yes	-
Stagonopleura guttata	Diamond Firetail	Yes	-
Tyto novaehollandiae	Masked Owl (foraging)	Yes	-

4.1.3 Species Credit Species

Step 1: Identify threatened species for assessment.

A list of predicted Species Credit Species for the Development Site was reviewed in the BAM calculator. Species credits pertain to threatened species that cannot be predicted by the vegetation present within the Subject Site.

Step 2: Assessment of the habitat constraints and vagrant species on the subject land; and

Step 3: Identify Candidate Species Credit species for further assessment.

The potential for identified Species Credit Species to occur on the Development Site was assessed according to species specific habitat requirements, as detailed in **Table 6**. Where woodland habitat features were not present due to the degraded condition of the site vegetation, Species Credit Species were determined to not be candidate species and no further assessment was required (**Table 6**).

No candidate species were identified as potential entities for a Serious and Irreversible Impact (SAII).

Table 6 Species Credit Species identified as Candidate Species.

Scientific Name	Common Name	Confirmed Candidate Species	Justification
Anthochaera phrygia	Regent Honeyeater	**No**	**Vegetation within the Subject site not mapped as important habitat for this species.**
Chalinolobus dwyeri	Large-eared Pied Bat	**No**	**Subject Site not within 2km of caves, cliffs, overhangs, escarpments or tunnels**
Lathamus discolor	Swift Parrot	**No**	**Vegetation within the Subject Site not mapped as important habitat for this species.**
Miniopterus australis	Little Bent-winged Bat	**No**	**No caves, tunnels, mines or culverts within the Subject Site or Study Area.**
Miniopterus orianae oceanensis	Large Bent-winged Bat	**No**	**No caves, tunnels, mines or culverts within the Subject Site or Study Area.**
Persoonia pauciflora	North Rothbury Persoonia	**No**	**Subject Site not within 10km of North Rothbury.**
Petrogale penicillata	Brush-tailed Rock-wallaby	**No**	**Subject Site not within 1km of rocky outcrops, gorges or escarpments.**

Scientific Name	Common Name	Confirmed Candidate Species	Justification
Vespadelus troughtoni	Eastern Cave Bat	**No**	**Subject Site not within 2km of caves, cliffs, overhangs, escarpments or tunnels**

4.1.4 Threatened Flora and Fauna Survey Results

No threatened flora or fauna species were identified within the Subject Site during the site assessment. A list of species identified during the surveys is provided in **Appendix 2**.

Weather Data

Weather data for the survey period is summarised per month in **Table 7**. Temperature rainfall data retrieved from Maitland Airport AWS (061428).

Table 7 Weather data experienced during the site assessment. Weather data collected from Maitland Airport AWS (Station 061428).

Date	Temps.		Rain	9am				3pm			
	Min.	Max.		Temp.	RH	Dir.	Spd.	Temp.	RH	Dir	Spd.
	°C	°C	(mm)	°C	%	Km/h		°C	%	Km/h	
12/05	11.8	22.0	8.2	14.8	80	WNW	8	20.9	71	S	11
26/05	7.4	23.0	0	15.8	70	NNW	4	22.5	46	WNW	17

5 AVOID AND MINIMISE IMPACTS ON BIODIVERSITY VALUES

5.1 AVOIDING AND MINIMISING IMPACTS DURING PROJECT PALNNING

5.1.1 Avoid and Minimise Impacts on Native Vegetation and Habitat

The proposed Residential (R1) zoning largely encompasses areas subject to an existing approved DA, including APZs. The vast majority (4.23 ha or 89%) of higher-quality remnant Lower Hunter Spotted Gum – Ironbark Forest (EEC) is being retained and is proposed to be zoned Environmental Management (E3). These areas support higher quality habitats suitable for threatened species. In addition, sixteen hollow-bearing trees (62%) of all hollow-bearing trees within the Study Area are to be located within the proposed E3 zone.

The extent of the proposed R1 zone has undergone multiple iterations to ensure ecological connectivity is maintained within the site and to adjacent land. Specifically, an assessment of the importance of various corridors through the site was undertaken (RPS 2020). This assessment showed that, while connectivity around the western and northern boundary of the Study Area serves as a valuable ecological corridor, the strip of vegetation along the southern boundary of the Study Area was likely to be of greater importance to maintain fauna movement from land in the south-west to land in the east/north-east. Subsequently, a wider strip of intact bushland has been retained along the southern boundary (to be zoned E3), in addition to retained areas of bushland around the western, northern and eastern extents (also to be zoned E3). The retention of the areas will ensure that connectivity internally and externally to the site will be maintained.

The site is mapped as Category 1 land in the Maitland Urban Settlement Strategy. The site is considered to have high strategic merit and strong site specific merit for rezoning for residential purposes. Rezoning and development of the site for residential purposes reflects the highest and best use of land already highly disturbed due to its previous use as a quarry.

5.2 ASSESSMENT OF IMPACTS

5.2.1 Impacts on Native Vegetation and Habitat

5.2.1.1 Direct Impacts

The proposed rezoning will have the potential to impact all vegetation within the Development Site (proposed R1 Zone). The area of native vegetation within the proposed R1 totals 0.82 ha. Each vegetation zone equates to one management zone, and the future value of each attribute (composition, structure, and function) and the vegetation integrity score for all management zones will be zero.

5.2.1.2 Indirect Impacts

The proposed development has the potential for indirect impacts on the E3 Zone surrounding the proposed R1 Zone. Potential indirect impacts include:

- Increased weed invasion and potential spread or introduction of pathogens from the site to nearby vegetation
- Erosion and sedimentation into nearby vegetation
- Reduced viability of adjoining habitats due to increased noise, dust or light spill during operational phase
- Increase in rubbish dumping in adjoining habitats
- Accidental clearing

- Predation/exclusion of native fauna by domestic animals.

Provided appropriate mitigation measures and management plans are adhered to, it is unlikely to have a significant long-term effect on threatened species, ecological communities and their habitats.

5.2.2 Prescribed Impacts

The proposed development is not considered to have the potential to impact on any prescribed impacts.

5.3 Mitigating and Managing Impacts on Biodiversity Values

The measures outlined in **Table 8** should be adhered to prior and during vegetation clearing to ensure that impacts are minimised.

Table 8: Summary of direct, prescribed and indirect impacts of the proposed development.

Impact	Action and Outcome	Responsibility	Timing
• Direct impact / prescribed impact			
Clearing of native vegetation	• Clearing boundaries (R1/E3 Zone) should be clearly marked prior to clearing works (i.e., no-go exclusion fencing and signage). Permanent fencing is to be installed following vegetation clearing. • Ensure vehicle and equipment parking areas and stockpile areas are identified and positioned to avoid areas containing ecological value. • Identify and communicate the location of any 'no go zones' in site inductions.	Construction site manager	Prior to and during vegetation clearing
Vehicle collision with fauna	• Speed limits within the Development Site should be limited to 40 km/hr. • Driving during dawn and dusk to be avoided where practicable.	Construction site manager	During vegetation clearing and construction
Indirect Impact			
Transfer of weeds and pathogens to and from site	• The fungal pathogens *Phytophora cinnamomi* and Myrtle Rust (*Puccinia psidii*) are known to occur in the LGA however, it is unknown if they occur within the Development Site. These pathogens can have devastating impacts on native plant communities and inhabiting fauna if not properly managed. • Vehicle movements restricted to bitumen road and a haul road through the site. • All soil and seed material from site to be disposed of at landfill (no dumping in adjacent areas).	Construction site manager	During vegetation clearing and construction
Increase in dust, light and noise during clearing works	• Impacts from operational activities, such as disturbance to an animal's normal behaviour patterns due to noise, vibration, lighting or dust may cause surrounding areas of previously suitable habitat to become sub-optimal and may cause fauna species to vacate areas of previously suitable habitat.	Construction site manager	During vegetation clearing and construction

Impact	Action and Outcome	Responsibility	Timing
	• Construction works to be limited to daylight hours. • Reduce machinery noise where possible during clearing. • Dust suppression measures such as water to be utilised as necessary.		
Erosion and sedimentation	• Erosion and sedimentation mitigation measures to be put in place prior to commencement clearing works to prevent sedimentation into off site areas (e.g., bunds or sediment fencing).	Construction site manager	Prior to commencement of works.
Waste	• Waste management procedures to be identified prior to commencement of works. • Spill Response Procedures to be in place and spill kits to be present during clearing works. • All general waste to be removed from site.	Construction site manager	Prior to and during tree clearing.
Accidental Clearing	• Permanent fencing along R1/E3 boundary	Construction site manager	Prior to and during tree clearing.
Disturbance by domestic animals	• Permanent fencing along R1/E3 boundary	Construction site manager	Prior to and during tree clearing.

6 IMPACT SUMMARY

6.1 SERIOUS AND IRREVERSIBLE IMPACTS

No species at risk of Serious and Irreversible Impact (SAII) were identified during the study.

6.2 IDENTIFICATION OF IMPACTS REQUIRING OFFSETS

This section provides an assessment of the impacts requiring offsetting in accordance with Section 10.1 of the BAM (DPIE, 2020a).

6.2.1 Impacts on Native Vegetation

A summary of the impacts on native vegetation and the required ecosystem credit is provided in Table 9. The vegetation integrity score threshold is >17, therefore impacts to vegetation Zone 1 are required to be offset.

Table 9: Summary of ecosystem credit requirements

Vegetation Zone	Vegetation Zone Name	Area (ha)	Current Vegetation Integrity Score	Future Vegetation Integrity Score	Credits Required
1	VZ1 - 1592_regrowth	0.00	51.9	51.9	0
2	VZ2 – 1592 remnant	0.50	43.6	0	9
3	VZ3 – 1592 modified	0.32	54.6	0	11
				Total Credit Requirement	**20**

The Biodiversity Credit Reports (like-for-like and variation options) is provided in **Appendix E**.

7 ASSESSMENT OF OTHER BIODIVERSITY LEGISLATION

7.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

A database search of relevant threatened species databases and an assessment of the likelihood of occurrence of threatened and migratory species is provided in **Appendix A**. No threatened or migratory species, or ecological communities listed under the EPBC Act were identified within the Development Site. One species, Grey-headed Flying-fox, was assessed as having a moderate likelihood of occurrence due to suitable foraging habitat within the site. No breeding camps are located in proximity to the site. As the proposed rezoning only has the potential to impact a small area of foraging habitat for this highly mobile species, it is unlikely there will be a significant impact on these species. As such, a referral to the Commonwealth Minister for the Environment is not considered necessary.

7.2 BIOSECURITY ACT 2015

Species which require control prior to and post construction to ensure they are not spread due to works, include the high threat species listed in **Table 10**.

Table 10: Weed species requiring control within the Development Site

Scientific Name	Common Name	Weeds of National Significance (WONS)	Priority weeds of the Maitland LGA (Biosecurity Act)	High Threat Weeds (BAM)
Andropogon virginicus	Whisky Grass	-	-	✓
Asparagus aethiopicus	Asparagus Fern	✓	✓	✓
Bidens pilosa	Cobbler's Pegs	-	-	✓
Chloris gayana	Rhodes Grass	-	-	✓
Cortaderia selloana	Pampas Grass	-	✓	✓
Cyperus eragrostis	Umbrella Sedge	-	-	✓
Lantana camara	Lantana	✓	✓	✓
Paspalum dilatatum	Paspalum	-	-	✓
Senecio madagascariensis	Fireweed	✓	✓	✓
Senna pendula var. glabrata		-	-	✓
Triadica sebifera	Chinese Tallowood	-	-	✓

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APPENDIX A THREATENED SPECIES DATABASE SEARCH

THREATENED SPECIES DATABASE SEARCH

A list of threatened species, populations and ecological communities that have been reported or modelled to occur from within a five-kilometre radius of the Study Area was obtained from the following databases:

- NSW Department of Planning and Environment (DPE) BioNet Atlas: (http://www.bionet.nsw.gov.au/).
- Protected matter database search tool (https://www.environment.gov.au/epbc/protected-matters-search-tool)

An assessment was then made of the likelihood of the threatened species, populations, and / or ecological communities reported or modelled to occur in the locality occurring within the Study Area or using the habitat within the Study Area as an essential part of a foraging range.

The table below summarises the likelihood of threatened species and EPBC Act listed migratory species occurring within the Study Area based on the habitat requirements of each species. A brief definition of the likelihood of occurrence criteria is provided below:

- Known – species identified within the site during surveys.
- High – species known from the area (DPIE Wildlife Atlas records), suitable habitat (such as roosting and foraging habitat) present within the site.
- Moderate – species may be known from the area, potential habitat is present within the site.
- Low – species not known from the area and/or marginal habitat is present within the site.
- Nil – habitat requirements not met for this species within the site.

Note: Marine species identified within the desktop assessment i.e. marine bird species, have been excluded from the list based on obvious habitat constraints. However, indirect impacts on these species and ecological communities have been considered.

Table A1 'Likelihood of Occurrence' table

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
Flora								
1.	*Acacia bynoeana* Bynoe's Wattle	E	V	0	PMST	The species is endemic to central eastern NSW, currently known from only 30 locations, many of only 1-5 plants. Grows mainly in heath/ dry sclerophyll forest on sandy soils, prefers open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches.	Low	Marginally suitable habitat within the Study Area. No known records within the locality.
2.	*Angophora inopina* Charmhaven Apple	V	V	0	PMST	This species is endemic to the central coast region of NSW and is known to occur in four main vegetation communities: *Eucalyptus haemastoma / Corymbia gummifera / Angophora inopina* woodland / forest; *Hakea teretifolia / Banksia oblongifolia* wet heath; *Eucalyptus resinifera / Melaleuca sieberi / Angophora inopina* sedge / woodland; and *Eucalyptus capitellata / Corymbia gummifera / Angophora inopin*a woodland / forest elegans. Flowering generally poor and sporadic.	Not present	This species was not identified during the assessment.
3.	*Arthraxon hispidus* Hairy-joint Grass	V	V	0	PMST	The species has been recorded from scattered locations throughout Queensland and on the northern tablelands and north coast of NSW. Hairy-joint Grass is found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps as well as woodland.	Nil	Habitat not suitable within the Study Area. No known records within the locality.
4.	*Asperula asthenes* Trailing Woodruff	V	V	0	PMST	This small herb occurs only in NSW. It is found in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens/Wallis Lakes area. Occurs in damp sites, often along river banks.	Nil	No suitable habitat within the Study Area. No known records within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
5.	*Caladenia tessellata* Thick Lip Spider Orchid	E	V	0	PMST	In NSW this species is found sporadically on the coast from Swansea and extends onto the Tablelands further south. *Caladenia tessellata* is normally found on clay or sandy soils in grassy sclerophyll woodlands, although it has been recorded on stony soil. The species is now known with certainty from only two populations on the NSW Southern Tablelands.	Nil	Marginally suitable habitat within the Study Area. No known records within the locality.
6.	*Callistemon linearifolius* Netted Bottlebrush	V	-	253	BioNet	This shrub grows up to 3-4 m tall, with red flowers that are clustered into the typical "bottlebrushes". The species grows in dry sclerophyll forest on the coast and adjacent ranges.	**Moderate**	Potentially suitable habitat within the Study Area, however, species was not identified during the assessment. No records in proximity to the Study Area.
7.	*Commersonia prostrata* Dwarf Kerrang	E	E	0	PMST	Occurs on sandy, sometimes peaty soils in a wide variety of habitats: Snow Gum (*Eucalyptus pauciflora*) Woodland and Ephemeral Wetland floor at Rowes Lagoon; Blue leaved Stringybark (*E. agglomerata*) Open Forest at Tallong; and in Brittle Gum (*E. mannifera*) Low Open Woodland at Penrose; Scribbly Gum (*E. haemostoma*)/ Swamp Mahogany (*E. robusta*) Ecotonal Forest at Tomago.	Nil	No suitable habitat within the Study Area. No known records within the locality
8.	*Cryptostylis hunteriana* Leafless Tongue-orchid	V	V	0	PMST	In New South Wales the species occupies a variety of habitats. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*). The species grows most often on the flat plains close to the coast, favouring moist soils.	Nil	No suitable habitat within the Study Area.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
9.	*Cynanchum elegans* White - flowered Wax Plant	E	E	0	PMST	Occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; *Leptospermum laevigatum* (Coastal Tea-tree) – *Banksia integrifolia* subsp. *integrifolia* (Coastal Banksia) coastal scrub; *Eucalyptus tereticornis* (Forest Red Gum) aligned open forest and woodland; *Corymbia maculata* (Spotted Gum) aligned open forest and woodland; and *Melaleuca armillaris* scrub (Bracelet Honeymyrtle) to open scrub.	Nil	No suitable habitat within the Study Area.
10.	*Dichanthium setosum*	V	V	0	PMST	Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture.	Low	Marginally suitable habitat in cleared areas of the Study Area. No known records within the locality.
11.	*Eucalyptus camaldulensis* Endangered population in the Hunter	E2	-	1	BioNet	In NSW, Eucalyptus camaldulensis occurs along the western flowing rivers but is known from only one coastal catchment, the Hunter. The western-most individuals in the Hunter are at Bylong, south of Merriwa, and the most easterly at Hinton, on the bank of the Hunter River, in the Port Stephens local government area. It has been recorded in the local government areas of Lithgow, Maitland, Mid-Western Regional, Muswellbrook, Port Stephens, Singleton and Upper Hunter.	Not present	Species not identified to occur within the Study Area during the assessment.
12.	*Eucalyptus glaucina* Slaty Red Gum	V	V	0	PMST	A medium-sized tree to 30 m tall. The bark is smooth and mottled white to slaty grey. Produces flowers that a usually white but occasionally pink. Grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils.	Not present	Species not identified during the assessment.
13.	*Eucalyptus parramattensis subsp. decadens* Earp's Gum	V	V	0	PMST	Occurs in low-lying, often swampy areas and in woodlands with associates such as *Eucalyptus racemosa* (Narrow-leaved Scribbly Gum), *E. globoidea* (White Stringybark) and *Angophora bakeri* (Narrow-leaved Apple) on poor sandy soils.	Not present	Species not identified during the assessment.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
14.	*Euphrasia arguta*	CE	CE	0	PMST	Known from Nundle State Forest and adjacent private land, in New South Wales. The species is known from three locations in two areas approximately 14 km apart. Occur in eucalypt forest with a mixed grass and shrub understorey within Nundle State Forest.	Nil	Unsuitable habitat within the Study Area.
15.	*Grevillea parviflora* subsp. *parviflora* Small-flower Grevillea	V	V	0	PMST	The species occurs in heath and shrubby woodland, in sandy or lightly clay soils usually over thin shales.	Nil	Species not identified during the assessment.
16.	*Maundia triglochinoides*	V	-	3	BioNet Atlas	Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct. Grows in swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients.	Low	No suitable habitat for this species occurs within the Development Site. Potential suitable habitat may occur within damp areas and artificial water bodies within the Study Area.
17.	*Melaleuca biconvexa* Biconvex Paperbark	V	V	0	PMST	Scattered, disjunct populations in coastal areas from Jervis Bay to Port Macquarie, with most populations in the Gosford-Wyong areas. Grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Nil	Species not identified during the assessment.
18.	*Persicaria elatior* Tall Knotweed	V	V	0	PMST	Grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Nil	Habitat not suitable within the Study Area. No records within the locality.
19.	*Phaius australis*	E	E	0	PMST	Distribution has been tentatively described as being north from Lake Cathie but mainly north of the Evans Head area to the Barron River in northeast Queensland. Commonly associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest and often where Broad-leaved Paperbark or Swamp Mahogany is found.	Nil	Habitat for this species is not present within the Study Area. No records within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
20.	*Pomaderris brunnea* Rufous Pomaderris	E	V	0	PMST	Shrub growing up to 3 m tall with distinctly hairy stems. The species occurs in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. Habitat for this species includes moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Nil	Habitat not suitable for this species within the Study Area. No records within the locality.
21.	*Prasophyllum sp. Wybong (C.Phelps ORG 5269)* (EPBC Act) / *Prasophyllum petilum* (BC Act) A Leek-orchid	V	CE	0	PMST	Known from open eucalypt woodland and grassland.	Nil	Habitat not suitable within the Study Area for this species. No records within the locality.
22.	*Pterostylis gibbosa* Illawarra Greenhood	E	E	0	PMST	In the Hunter region, this species grows in open woodland dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *E. tereticornis* (Forest Red Gum) and *Callitris endlicheri* (Black Cypress Pine).	Nil	No suitable habitat within the Study Area. No records within the locality.
23.	*Rhizanthella slateri* Underground Orchid	V	E	0	PMST	The species grows in eucalypt forest but no informative assessment of the likely preferred habitat for the species is available. Currently known only from 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra.	Low	Marginally suitable habitat within the Study Area. No known records within the locality.
24.	*Rhodamnia rubescens* Scrub Turpentine	-	E	2	BioNet Atlas	Often found in wet sclerophyll associations in rainforest transition zones and creek side riparian vegetation. The species occupies a range of volcanically derived and sedimentary soils and is also a common pioneer species in eucalypt forests.	Low	No suitable habitat present within the Study Area. Species not identified during the assessment.
25.	*Rhodomyrtus psidioides* Native Guava	E4	-	4	BioNet Atlas	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.	Low	No suitable habitat present within the Study Area. Species not recorded during the assessment.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
26.	*Rutidosis heterogama* Heath Wrinklewort	V	V	0	PMST	Grows in dry sclerophyll forests, native grasslands, grassy woodlands and heathlands.	Low	Marginally suitable habitat present within the Study Area. No known records within the locality.
27.	*Syzygium paniculatum* Magenta Lilly Pilly	E	V	0	PMST	Grows on sandy soils in subtropical and littoral rainforest near the coast from Bulahdelah to Jervis Bay.	Nil	No suitable habitat present within the Study Area. Species not recorded during the assessment.
28.	*Tetratheca juncea* Black-eyed Susan	V	V	18	BioNet Atlas, PMST	Grows in sandy, occasionally swampy heath and in dry sclerophyll forest; chiefly in coastal districts from Bulahdelah to Lake Macquarie.	Low	No suitable habitat for this species present within the Study Area. Low number of records within the locality.
29.	*Thesium austral* Austral Toadflax	V	V	0	PMST	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*).	Low	Potentially suitable habitat within grassland areas dominated by *Themeda australis*. No known records within the locality.
Birds								
1.	*Anseranas semipalmata* Magpie Goose	V	-	1	BioNet Atlas	Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW.	Low	Potentially suitable habitat are in shallow water bodies within the Study Area; however, breeding is unlikely to occur within south-east NSW. One BioNet record from 1980 within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
2.	*Anthochaera phrygia* Regent Honeyeater	E	CE	3	BioNet Atlas, PMST	Mostly recorded in box-ironbark eucalypt associations. At times of food shortage, the species also uses other woodland types and wet lowland coastal forest dominated by *Eucalyptus robusta* (Swamp Mahogany) or *Corymbia maculata* (Spotted Gum).	Low-	Potential foraging habitat within wooded vegetation of the Study Area. Low number of records within the locality, not in proximity to the Study Area. Study Area is not mapped as important habitat for this species under the BAM important habitat mapping (DPE, 2022e).
3.	*Artamus cyanopterus cyanopterus* Dusky Woodswallow	V	-	4	BioNet Atlas	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.	Low	Broadly suitable foraging habitat within the Study Area. Low number of BioNet records within the locality. No records within proximity to the Study Area.
4.	*Callocephalon fimbriatum* Gang-gang Cockatoo	V	E	2	BioNet Atlas	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. Gang-gang Cockatoos feed mainly on seeds of native and introduced trees and shrubs, with a preference for eucalypts, wattles and introduced hawthorns.	Low	Marginally suitable foraging habitat within wooded vegetation dominated by *Eucalyptus spp.* Most recent BioNet record within the locality is from 2004.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
5.	*Calyptorhynchus lathami* Glossy Black-Cockatoo	V	-	2	BioNet Atlas	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of She-oak occur. Black She-oak (*Allocasuarina littoralis*) and Forest She-oak (*A. torulosa*) are important foods. Potential nest trees contain hollows that are; (i) at least 8 m above the ground; and (ii) in stems with a diameter of at least 30 cm; and (iii) hollow diameter is at least 15 cm; and (iv) stem angle is at least 45 degrees, and may be near-vertical or vertical.	Low	No suitable foraging habitat within the Study Area. Low number of BioNet records within the locality.
6.	*Daphoenositta chrysoptera* Varied Sittella	V	-	8	BioNet Atlas	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Low - moderate	Potentially suitable foraging habitat within the Study Area. Low number of BioNet records within the locality. Two recent records within proximity to the Study Area.
7.	*Ephippiorhynchus asiaticus* Black-necked Stork	E	-	25	BioNet Atlas	Inhabits wetlands, such as floodplains of rivers with large shallow swamps and pools, and deeper permanent bodies of water. Occasionally individuals will stray into open grass, woodland areas or flooded paddocks in search of food. Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the floodplain habitat).	Low	Primarily unsuitable foraging habitat within the Study Area. No suitable breeding habitat within the Study Area. Most sightings are located within the vicinity of the Woodberry Swamp, to the south-east of the Study Area.
8.	*Erythrotriorchis radiatus* Red Goshawk	CE	V	0	PMST	Occurs in tropical and warm-temperate woodlands and forests. Mostly occurs in northern Australia with populations also occurring in the southeast of QLD and northeast of NSW.	Low	Broadly suitable foraging habitat within the Study Area. No known Records within locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
9.	*Falco hypoleucos* Grey Falcon	-	V	0	PMST	Medium-sized, compact, pale falcon with a heavy, thick-set, deep-chested appearance. The species is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	Nil	No suitable habitat present within the Study Area. No known records within the locality.
10.	*Glossopsitta pusilla* Little Lorikeet	V	-	27	BioNet Atlas	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in *Angophora, Melaleuca* and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m).	**Moderate**	Potentially suitable habitat within eucalypt dominated areas of the Study Area. Records within the locality including 2 records adjacent to the Study Area in wooded vegetation.
11.	*Haliaeetus leucogaster* White-bellied Sea-Eagle	V	M	14	BioNet Atlas	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest. This species hunts for fish, turtles and sea snakes however will feed on carrion along the waterline. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'.	Low	Primarily unsuitable foraging habitat within the Study Area. No suitable breeding habitat within the Study Area. This species may, on occasion, fly over the site.
12.	*Hamirostra melanosternon* Black-breasted Buzzard	V	-	1	BioNet Atlas	Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands.	Low	No suitable breeding or foraging habitat within the Study Area. One BioNet record within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
13.	*Hieraaetus morphnoides* Little Eagle	V	-	2	BioNet Atlas	Occupies open eucalypt forest, woodland or open woodland. She-oak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	Low	Potentially suitable habitat within the Study Area due to remnant eucalypt woodland. Only 2 BioNet records, with the most recent sighting in 2014, approx. 5kms from the Study Area.
14.	*Lathamus discolor* Swift Parrot	E	CE	2	BioNet Atlas, PMST	This migratory species has been recorded on the mainland from a variety of habitat types including dry and wet sclerophyll forest, forested wetlands, coastal swamp forests and heathlands. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Forest Red Gum (*E. tereticornis*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*). The Study Area is not mapped within important areas for this species (DPIE, 2021b).	Low	Potentially suitable foraging habitat within the Study Area when *Eucalyptus spp.* and *Corymbia spp.* are in flower. This species does not breed on the Australina mainland. The Study Area is not mapped as important habitat under BAM important habitat mapping (DPE, 2022e).
15.	*Lophoictinia isura* Square-tailed Kite	V	-	1	BioNet	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	Low	Not particularly suitable habitat for foraging or breeding within the Study Area. Only one BioNet record from 1993 within the locality.
16.	*Melithreptus gularis gularis* Black-chinned Honeyeater (eastern subspecies)	V	-	3	BioNet Atlas	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially *Eucalyptus sideroxylon* (Mugga Ironbark), *E. albens* (White Box), *E. microcarpa* (Inland Grey Box), *E. melliodora* (Yellow Box), *E. blakelyi* (Blakely's Red Gum) and *E. tereticornis* (Forest Red Gum). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river she-oaks (nesting habitat) and tea-trees.	Low	Broadly suitable foraging habitat within the Study Area. Low number of records within locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
17.	*Neophema pulchella* Turquoise Parrot	V	-	2	BioNet Atlas	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants or browsing on vegetable matter. Nests in tree hollows, logs or posts, from August to December.	Low	Marginal foraging habitat present within Study Area around eucalypt woodland. Low number of BioNet records within the locality with the most recent being 2004
18.	*Ninox connivens* Barking Owl	V	-	2	BioNet Atlas	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile riparian soils. Potential nest trees are living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.	Low	Potentially suitable foraging habitat within the Study Area. No suitable hollows for breeding within the Study Area. Low number of BioNet records.
19.	*Ninox strenua* Powerful Owl	V	-	20	BioNet Atlas	The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as *Syncarpia glomulifera* (Turpentine), *Allocasuarina littoralis* (Black She-oak), *Acacia melanoxylon* (Blackwood), *Angophora floribunda* (Rough-barked Apple), *Exocarpos cupressiformis* (Cherry Ballart) and a number of eucalypt species. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	Low	Potentially suitable foraging habitat within the Study Area due to the fragmented vegetation across the site. No suitable hollows for breeding with the Study Area. Low-moderate number of records with a recent record (2019) within 1.2kms of the Study Area.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
20.	*Oxyura australis* Blue-billed Duck	V	-	2	BioNet Atlas	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. Forages far from the shore, particularly if dense cover is available in the central parts of the wetland, on the bottom of swamps. Usually nest solitarily in Cumbungi over deep water.	Low	No water bodies within the Development Site. Water bodies within the Study Area do contain dense vegetation, however, they are shallow and not substantial enough in size for this species.
21.	*Pandion cristatus* Eastern Osprey	V	M	3	BioNet Atlas	This species favours coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Low	No suitable foraging or breeding habitat within the Study Area. Low number of BioNet records.
22.	*Petroica boodang* Scarlet Robin	V	-	1	BioNet Atlas	Occurs in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Habitat usually contains abundant logs and fallen timber. Over Autumn and Winter often lives in open grassy woodlands, and grasslands or grazed paddocks with scattered trees.	Low	Broadly suitable within the Study Area. Only one BioNet record within the locality form 1995.
23.	*Pomatostomus temporalis temporalis* Grey-crowned Babbler (eastern subspecies)	V	-	33	BioNet Atlas	Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions. Forages on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses.	**Moderate**	Potentially suitable foraging habitat within the Study Area. Records within the locality, including some within proximity to the Study Area. No nests were identified during the assessment.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
24.	*Ptilinopus magnificus* (Wompoo Fruit-Dove)	V	-	1	BioNet	Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Most often seen in mature forests, but also found in remnant and regenerating rainforest.	Low	Preferred habitat does not occur within the Study Area due to lack of rainforest and/or wet eucalypt forest. One recent BioNet record within the locality.
25.	*Stictonetta naevosa* Freckled Duck	V	-	5	BioNet	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	Low	Marginally suitable habitat around waterbodies within the Study Area that contain *Typha spp.*. Low number of BioNet records within the locality, with the most recent being 1985.
26.	*Tyto novaehollandiae* Masked Owl	V	-	13	BioNet Atlas	Lives in dry eucalypt forest and woodlands from sea level to 1100m. Optimal habitat includes an open understory and a mosaic of sparse (grassy) and dense (shrubby) ground cover on gentle terrain. Masked Owls nest in large hollow eucalypts usually with an internal diameter of 35-50cm and 12-20m high and tend to be within 100m of a creek line (LMCC, 2014). Dead stags are especially popular for roosting/breeding habitat and are a limited resource due to natural attrition.	Low	Potential foraging habitat within the Study Area. No suitably sized hollows for breeding habitat within the Study Area. Recent BioNet records within 500m of the Study Area.
27.	*Tyto tenebricosa* Sooty Owl	V	-	1	BioNet	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. This species forages on arboreal mammals. Nest trees usually consist of large trees with hollows approximately 12m high and have an internal diameter of 35-50cm and tend to occur within 100m of creek lines (LMCC, 2014).	Low	Potential foraging habitat within the Study Area. No suitable breeding hollows within the Study Area. Only one record within the locality form 2002.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
Mammals								
1.	*Chalinolobus dwyeri* Large-eared Pied Bat	V	V	2	BioNet Atlas, PMST	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Found in well-timbered areas containing gullies.	Low	Unsuitable roosting habitat within the Study Area. Low number of BioNet records
2.	*Dasyurus maculatus* Spotted-tailed Quoll	V	E	1	BioNet Atlas, PMST	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites. Mostly nocturnal, although will hunt during the day; spend most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds.	Low	Marginally suitable foraging habitat within the Study Area. Marginal breeding habitat within wooded areas containing large hollows. One record from 2004 within the locality.
3.	*Falsistrellus tasmaniensis* Eastern False Pipistrelle	*V*	-	36	BioNet Atlas	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows but has also been found under loose bark on trees or in buildings.	Low	No suitable habitat within the Study Area. Species previously recorded in 2008 to the east of the Study Area. Low-moderate number of records within the locality.
4.	*Micronomus norfolkensis* Eastern Coastal Freetail-bat	*V*	-	50	BioNet Atlas	Tall open forest, Melaleuca, dry sclerophyll forest, River Red Gum and Yellow Box woodlands and riparian open forest. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	**Known**	Previously identified within the Study Area as part of the Flora and Fauna Assessment (Kleinfelder, 2017).

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
5.	*Miniopterus australis* Little Bent-winged Bat	*V*	-	116	BioNet Atlas	Occupies moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings.	**Known**	Previously recorded within the Study Area in 2017 (Kleinfelder, 2017). No suitable breeding habitat.
6.	*Miniopterus orianae oceanensis* Large Bent-winged Bat (recently renamed from *Miniopterus schreibersii oceanensis* Eastern Bentwing-bat)	*V*	-	39	BioNet Atlas	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	**Known**	Previously recorded within the Study Area in 2017 (Kleinfelder, 2017). No suitable breeding habitat.
7.	*Myotis macropus* Southern Myotis	*V*	-	39	BioNet Atlas	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	**Known**	Previously recorded within the Study Area during the Flora and Fauna Assessment for the 107 Haussman Drive (Kleinfelder, 2017). No suitable foraging habitat.
8.	*Petauroides Volans* Greater Glider	-	V	2	BioNet Atlas, PMST	Open woodland and tall remnant forests where there is suitable eucalypt trees. Rests in hollow trees during the day and feeds at night. Presence and density of Greater Gliders is related to soil fertility, eucalypt tree species, disturbance history and density of suitable tree hollows.	Low	Marginal habitat suitability in remnant vegetation within the Study Area. Low number of records within the locality, most recent being 1998.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
9.	*Petaurus norfolcensis* Squirrel Glider	V	-	28	BioNet Atlas	Inhabits mature or old growth Box, Box-Ironbark woodlands and *Eucalyptus tereticornis* (River Red Gum) forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	**Moderate**	The Study Area may represent potential foraging and breeding habitat for this species. Records occur within the locality.
10.	*Petrogale penicillata* Brush-tailed Rock Wallaby	E	V	0	PMST	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night when foraging.	Nil	No suitable habitat present within the Study Area. No known records within the Study Area.
11.	*Phascogale tapoatafa* Brush-tailed Phascogale	*V*	-	5	BioNet Atlas	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span	**Moderate**	Potentially suitable foraging and breeding habitat within the Study Area. Low number of records within the locality. One recent (2018) record in proximity to the Study Area.
12.	*Phascolarctos cinereus* Koala	E	E	1	BioNet Atlas, PMST	Found in a variety of forest types with suitable feed tree species. Feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Low	Site contains low numbers Koala Feed Trees as listed under the Koala SEPP 2020 - *E. punctata*. Very few records within the locality.
13.	*Potorous tridactylus tridactylus* Long-nosed Potoroo (SE Mainland Population)	V	V	0	PMST	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	Low	Potentially suitable habitat within the Study Area. No known records within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
14.	*Pseudomys novaehollandiae* New Holland Mouse	-	V	0	PMST	Inhabits open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	Nil	No suitable habitat within the Study Area. No known records within the locality.
15.	*Pteropus poliocephalus* Grey-headed Flying-fox	V	V	64	BioNet Atlas, PMST	Occurs across a wide range of habitat types along the eastern seaboard of Australia, depending on food availability. Fruit from myrtaceous trees and rainforest trees form the major components of their diet.	**Moderate**	May forage within the Study Area of flowering *Eucaloyptus spp.* No Flying-fox camp within the Study Area. Closest known nationally significant camp occurs at Tenambit, East Maitland.
16.	*Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat	V	-	8	BioNet Atlas	Roosts in tree hollows and buildings. In treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees.	Low	Potential habitat within the Study Area. Low number of records within the locality.
17.	*Scoteanax rueppellii* Greater Broad-nosed Bat	V	-	26	BioNet Atlas	This species occurs in a variety of habitats including rainforest, dry and wet sclerophyll forest and eucalypt woodland.	**Moderate**	Potentially suitable habitat within the Study Area. Low-moderate amount of records within the locality, including some in proximity to the Study Area.
18.	*Vespadelus troughtoni* Eastern Cave Bat	V	-	15	BioNet Atlas	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	Low	No suitable roosting habitat within the Study Area. No records within proximity to the Study Area. No suitable breeding habitat.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
Amphibians								
1.	*Heleioporus australiacus* Giant Burrowing Frog	-	V	0	PMST	The species occurs along the coast and eastern slopes of the Great Dividing Range south from Wollemi National Park, appearing to exist as 2 populations between Jervis Bay and Eden. Habitat for the species includes sandy soils supporting heath, woodland or open forest. The species breeds in ephemeral to intermittent streams with persistent pools. Only infrequently moves to breeding sites, most commonly found on ridges away from creeks, several hundred metres from water.	Nil	No suitable habitat within the Study Area. No known records within the locality.
2.	*Litoria aurea* Green and Golden Bell Frog	E	V	1	BioNet Atlas, PMST	This species prefers open water bodies, fringed by reeds and other aquatic vegetation for breeding and foraging purposes. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Needs fallen logs and debris for shelter and over-wintering purposes.	Low	No water bodies are present within the Development Site. Water bodies within the Study Area, but outside of the Development Site contain dense *Typha orientalis* vegetation with no open water space. One BioNet record within the locality. Sighting is from 1976.
3.	*Mixophyes balbus* Stuttering Frog	-	V	0	PMST	The species occurs along the east coast of Australia. Habitat for the species includes rainforest and wet, tall, open forest, sheltering in deep leaf litter and thick understorey vegetation on the forest floor. Within Sydney Basin the species is now confined to populations in the Watagan Mountains, the southern Blue Mountains and Macquarie Pass. The species does not occur in areas where the riparian vegetation has been disturbed or where there have been significant upstream human impacts.	Nil	No suitable habitat within the Study Area. No known records within the locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
4.	*Mixophyes iteratus* Giant Barred Frog	-	E	0	PMST	Occurs on the coast and ranges from south-eastern QLD to the Hawkesbury River in NSW, particularly in Coffs Harbour - Dorrigo area. Forage and live amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest. Breed in shallow, flowing rocky streams. Within Sydney Basin, confined to small populations in tall, wet forest in the Watagan Mountains north of the Hawkesbury and the lower Blue Mountains.	Nil	No suitable habitat within the Study Area. No known records within the locality.
5.	*Uperoleia mahonyi* Mahonyi's Toadlet	E	E	0	PMST	Current observations indicate Mahony's Toadlet inhabits ephemeral and semi-permanent swamps and swales on the coastal fringe of its range. Known records occur in heath or wallum habitats almost exclusively associated with leached (highly nutrient impoverished) white sand. Commonly associated with acid paperbark swamps, Mahony's Toadlet also is known to occur in wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland.	Nil	No suitable habitat within the Study Area. No known records within the locality.
Migratory Terrestrial Species								
1.	*Calidris acuminata* Sharp-tailed Sandpiper	-	M	7	BioNet Atlas, PMST	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. Also occur in saltworks and sewage farms. Use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. Use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
2.	*Calidris melanotos* Pectoral Sandpiper	-	M	2	BioNet Atlas, PMST	Prefers shallow fresh to saline wetlands. Found in coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. Has also been recorded in swamp overgrown with lignum. Forage in shallow water or soft mud at the edge of wetlands.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
	Calidris ruficollis Red-necked Stint	-	M	1	BioNet Atlas	Mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Also occur in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats. Sometimes use flooded paddocks or damp grasslands.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
	Chlidonias leucopterus White-winged Black Tern	-	M	1	BioNet Atlas	Non-breeding visitor, inhabits fresh, brackish or saline, and coastal or subcoastal wetlands. Frequents tidal wetlands, such as harbours, bays, estuaries and lagoons, and their associated tidal sandflats and mudflats. Terrestrial wetlands, including swamps, lakes, billabongs, rivers, floodplains, reservoirs, saltworks, sewage ponds and outfalls are also inhabited.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
	Cuculus optatus Oriental Cuckoo	-	M	0	PMST	Occurs at rainforest edges, leafy trees in paddocks, river flats, roadsides and mangroves.	Nil	No suitable habitat present onsite. No known records of this species within locality.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
	Gallinago hardwickii Latham's Snipe	-	M	5	BioNet Atlas, PMST	Often recorded in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
	Gelochelidon nilotica Gull-billed Tern	-	M	2	BioNet Atlas	Found in freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
	Hirundapus caudacutus White-throated Needletail	-	M	3	BioNet Atlas, PMST	Forages in high open spaces over varied habitat types although probably recorded most often above wooded or partly wooded areas, including open forest and rainforest, and may also fly between trees or in clearings.	Low	This species may utilise areas above wooded vegetation for foraging within the Study Area. Low number of BioNet records within the locality.
	Monarcha melanopsis Black-faced Monarch	-	M	0	PMST	Found in rainforests, moist eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	Nil	Habitat not suitable for species within the Study Area
	Monarcha trivirgatus Spectacled Monarch	-	M	0	PMST	Inhabits the understorey of mountain/ lowland rainforests, thickly wooded gullies and waterside vegetation including mangroves.	Nil	
	Motacilla flava Yellow Wagtail	-	M	0	PMST	Found in a variety of habitats including short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns.	Low	Marginally suitable habitat present within the Study Area. No known records within the Study Area.
	Myiagra cyanoleuca Satin Flycatcher	-	M	0	PMST	Found in tall forests, preferring wetter habitats such as heavily forested gullies.	Nil	No suitable habitat present within the Study Area. No known records within the Study Area.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
	Rhipidura rufifrons Rufous Fantail	-	M	0	PMST	Found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground.	Nil	No suitable habitat present within the Study Area. No known records within the Study Area.
	Thalasseus bergii Crested Tern	-	M	1	BioNet Atlas	The Crested Tern is usually a strictly coastal species. They breed in colonies on small offshore islands	Low	No suitable habitat present within the Study Area. One BioNet record within the locality from 1986.
	Tringa glareola Wood Sandpiper	-	M	3	BioNet Atlas	Occupies well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. Typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially *Melaleuca* and *Eucalyptus camaldulensis* (River Red Gums) and often with fallen timber. Also frequents inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops. This species uses artificial wetlands, including open sewage ponds, reservoirs, large farm dams, and bore drains.	Low	Marginal habitat may be present around artificial waterbodies within the Study Area. Low number of BioNet records.
	Tringa nebularia Common Greenshank	-	M	4	BioNet Atlas, PMST	Found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. Uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
	Tringa stagnatilis Marsh Sandpiper	-	M	2	BioNet Atlas	Lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes.	Low	No suitable habitat present within the Study Area. Low number of BioNet records.
Threatened Ecological Communities								
1.	*Central Hunter Valley Eucalypt Forest and Woodland*	-	CE	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.
2.	*Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South Eastern Queensland ecological community*	-	E	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.
3.	*Lowland Rainforest of Subtropical Australia*	-	CE	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.
4.	*River-flat Eucalypt Forest on Coastal Floodplains of Southern New South Wales and Eastern Victoria*	-	CE	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.

	Species	Status*		Records**	Source***	Habitat	LoO	Summary
		BC	EPBC					
5.	*Subtropical and Temperate Saltmarsh*	-	V	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.
6.	*White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*	-	CE	-	PMST	Not present within the Study Area.	Absent	Vegetation on site is not consistent with Threatened Ecological Community.
7.	*Lower Hunter Spotted Gum Ironbark Forest*	E	-	-	-	Vegetation present on site is commensurate with the endangered ecological community	**Present**	**Known**

* Status. *Biodiversity Conservation Act 2016* (BC), *Environment Protection and Biodiversity Conservation Act* (EPBC), M (Migratory), V (Vulnerable), E (Endangered), CE (Critically Endangered), E3 (Endangered Ecological Community), E4B (Critically Endangered Ecological Community)

** Records. # (number of records within locality), P (Predicted), K (known to occur with the locality).

*** Source. Bionet (NSW Department of Planning, Industry and Environment (DPIE) BioNet Atlas), PMST (Protected matter database search tool).

APPENDIX B FLORA SPECIES LIST

Table B1 Flora Species List

No.	Scientific Name	Common Name	BAM Growth Form*	Status
1.	*Acacia elongata*	Swamp Wattle	Shrub (SG)	-
2.	*Acacia falcata*		Shrub (SG)	-
3.	*Acacia fimbriata*	Fringed Wattle	Shrub (SG)	-
4.	*Acacia irrorata*	Green Wattle	Shrub (SG)	-
5.	*Acacia parvipinnula*	Silver-stemmed Wattle	Shrub (SG)	-
6.	*Acacia spp.*	Wattle	Shrub (SG)	-
7.	*Ambrosia tenuifolia*	Lacy Ragweed	Exotic	-
8.	*Amyema spp.*	Mistletoe	Other (OG)	-
9.	*Andropogon virginicus*	Whisky Grass	HTW	-
10.	*Angophora costata*	Sydney Red Gum	Tree (TG)	-
11.	*Aristida vagans*	Threeawn Speargrass	Grass & grasslike (GG)	-
12.	*Arthropodium milleflorum*	Pale Vanilla-lily	Forb (FG)	-
13.	*Asparagus aethiopicus*	Asparagus Fern	HTW	-
14.	*Aster subulatus*	Wild Aster	Exotic	-
15.	*Bidens pilosa*	Cobbler's Pegs	HTW	-
16.	*Billardiera scandens*	Hairy Apple Berry	Other (OG)	-
17.	*Brachyscome multifida*	Cut-leaved Daisy	Forb (FG)	-
18.	*Breynia oblongifolia*	Coffee Bush	Shrub (SG)	-
19.	*Bursaria spinosa*	Native Blackthorn	Shrub (SG)	-
20.	*Callistemon salignus*	Willow Bottlebrush	Shrub (SG)	-
21.	*Casuarina glauca*	Swamp Oak	Tree (TG)	-
22.	*Centella asiatica*	Indian Pennywort	Forb (FG)	-
23.	*Centella cordifolia*		Forb (FG)	-
24.	*Cheilanthes sieberi*	Rock Fern	Fern (EG)	-
25.	*Chloris gayana*	Rhodes Grass	HTW	-
26.	*Cirsium vulgare*	Spear Thistle	Exotic	-
27.	*Commelina cyanea*	Native Wandering Jew	Forb (FG)	-
28.	*Conyza bonariensis*	Flaxleaf Fleabane	Exotic	-
29.	*Cortaderia selloana*	Pampas Grass	HTW - Manageable	-
30.	*Corymbia maculata*	Spotted Gum	Tree (TG)	-
31.	*Cyanthillium cinereum*	Purple Fleabane	Exotic	-

No.	Scientific Name	Common Name	BAM Growth Form*	Status
32.	*Cymbopogon refractus*	Barbed Wire Grass	Grass & grasslike (GG)	-
33.	*Cynodon dactylon*	Common Couch	Grass & grasslike (GG)	-
34.	*Cyperus eragrostis*	Umbrella Sedge	HTW	-
35.	*Cyperus spp.*		Grass & grasslike (GG)	-
36.	*Daviesia ulicifolia*	Gorse Bitter Pea	Shrub (SG)	-
37.	*Desmodium rhytidophyllum*		Forb (FG)	-
38.	*Desmodium varians*	Slender Tick-trefoil	Other (OG)	-
39.	*Dianella caerulea*	Blue Flax-lily	Forb (FG)	-
40.	*Dichelachne micrantha*	Shorthair Plumegrass	Grass & grasslike (GG)	-
41.	*Dichondra repens*	Kidney Weed	Forb (FG)	-
42.	*Digitaria parviflora*	Small-flowered Finger Grass	Grass & grasslike (GG)	-
43.	*Dillwynia retorta*		Shrub (SG)	-
44.	*Echinochloa colona*	Awnless Barnyard Grass	Grass & grasslike (GG)	-
45.	*Echinopogon caespitosus*	Bushy Hedgehog-grass	Grass & grasslike (GG)	-
46.	*Einadia nutans*	Climbing Saltbush	Forb (FG)	-
47.	*Entolasia stricta*	Wiry Panic	Grass & grasslike (GG)	-
48.	*Eragrostis brownii*	Brown's Lovegrass	Grass & grasslike (GG)	-
49.	*Eucalyptus fibrosa*	Red Ironbark	Tree (TG)	-
50.	*Eucalyptus globoidea*	White Stringybark	Tree (TG)	-
51.	*Eucalyptus moluccana*	Grey Box	Tree (TG)	-
52.	*Eucalyptus punctata*	Grey Gum	Tree (TG)	-
53.	*Eucalyptus paniculata*	Grey Ironbark	Tree (TG)	-
54.	*Eucalyptus spp.*		Tree (TG)	-
55.	*Eucalyptus umbra*	Broad-leaved White Mahogany	Tree (TG)	-
56.	*Exotic Palm seedling*		Exotic	-
57.	*Facelis retusa*		Exotic	-
58.	*Fimbristylis dichotoma*	Common Fringe-sedge	Grass & grasslike (GG)	-
59.	*Gamochaeta spp.*		Exotic	-
60.	*Geitonoplesium cymosum*	Scrambling Lily	Other (OG)	-
61.	*Glycine clandestina*	Twining glycine	Other (OG)	-
62.	*Glycine microphylla*	Small-leaf Glycine	Other (OG)	-
63.	*Glycine tabacina*	Variable Glycine	Other (OG)	-

No.	Scientific Name	Common Name	BAM Growth Form*	Status
64.	*Gonocarpus tetragynus*	Poverty Raspwort	Forb (FG)	-
65.	*Gonocarpus teucrioides*	Germander Raspwort	Forb (FG)	-
66.	*Goodenia paniculata*		Forb (FG)	-
67.	*Goodenia rotundifolia*		Forb (FG)	-
68.	*Hardenbergia violacea*	False Sarsaparilla	Other (OG)	-
69.	*Hydrocotyle laxiflora*	Stinking Pennywort	Forb (FG)	-
70.	*Hypericum gramineum*	Small St John's Wort	Forb (FG)	-
71.	*Hypochaeris radicata*	Catsear	Exotic	-
72.	*Imperata cylindrica*	Blady Grass	Grass & grasslike (GG)	-
73.	*Indigofera australis*	Australian Indigo	Shrub (SG)	-
74.	*Juncus usitatus*		Grass & grasslike (GG)	-
75.	*Lagenophora stipitata*	Common Lagenophora	Forb (FG)	-
76.	*Lantana camara*	Lantana	HTW - Manageable	-
77.	*Lepidosperma laterale*	Variable Sword-sedge	Grass & grasslike (GG)	-
78.	*Leucopogon juniperinus*	Prickly Beard-heath	Shrub (SG)	-
79.	*Lobelia purpurascens*	Whiteroot	Forb (FG)	-
80.	*Lomandra confertifolia*	Matrush	Grass & grasslike (GG)	-
81.	*Lomandra filiformis*	Wattle Matt-rush	Grass & grasslike (GG)	-
82.	*Lomandra glauca*	Pale Mat-rush	Grass & grasslike (GG)	-
83.	*Lomandra longifolia*	Spiny-headed Mat-rush	Grass & grasslike (GG)	-
84.	*Megathyrsus maximus*		Exotic	-
85.	*Melaleuca armillaris subsp. armillaris*	Bracelet Honey-myrtle	Shrub (SG)	-
86.	*Microlaena stipoides*	Weeping Grass	Grass & grasslike (GG)	-
87.	*Notelaea longifolia*	Large Mock-olive	Tree (TG)	-
88.	*Opercularia diphylla*	Stinkweed	Forb (FG)	-
89.	*Oxalis perennans*		Forb (FG)	-
90.	*Ozothamnus diosmifolius*	White Dogwood	Shrub (SG)	-
91.	*Panicum simile*	Two-colour Panic	Grass & grasslike (GG)	-
92.	*Parsonsia straminea*	Common Silkpod	Other (OG)	-
93.	*Paspalidium distans*		Grass & grasslike (GG)	-
94.	*Paspalum dilatatum*	Paspalum	HTW	-
95.	*Philydrum lanuginosum*	Frogsmouth	Forb (FG)	-

No.	Scientific Name	Common Name	BAM Growth Form*	Status
96.	*Phytolacca octandra*	Inkweed	Exotic	-
97.	*Plantago lanceolata*	Lamb's Tongues	Exotic	-
98.	*Plectranthus parviflorus*		Forb (FG)	-
99.	*Pseuderanthemum variabile*	Pastel Flower	Forb (FG)	-
100.	*Pterostylis spp.*	Greenhood	Forb (FG)	-
101.	*Pultenaea paleacea*	Chaffy Bush-pea	Shrub (SG)	-
102.	*Pultenaea retusa*		Shrub (SG)	-
103.	*Pultenaea spinosa*		Shrub (SG)	-
104.	*Pultenaea villosa*	Hairy Bush-pea	Shrub (SG)	-
105.	*Rytidosperma caespitosum*	Ringed Wallaby Grass	Grass & grasslike (GG)	-
106.	*Schoenus apogon*	Fluke Bogrush	Grass & grasslike (GG)	-
107.	*Senecio madagascariensis*	Fireweed	HTW	-
108.	*Senna pendula var. glabrata*		HTW - Manageable	-
109.	*Setaria parviflora*		Exotic	-
110.	*Setaria sphacelata*	South African Pigeon Grass	Exotic	-
111.	*Sida rhombifolia*	Paddy's Lucerne	Exotic	-
112.	*Solanum mauritianum*	Wild Tobacco Bush	Exotic	-
113.	*Solanum nigrum*	Black-berry Nightshade	Exotic	-
114.	*Solanum prinophyllum*	Forest Nightshade	Forb (FG)	-
115.	*Sonchus asper*	Prickly Sowthistle	Exotic	-
116.	*Sphaeromorphaea australis*	Spreading Nut-heads	Forb (FG)	-
117.	*Themeda triandra*	Kangaroo Grass	Grass & grasslike (GG)	-
118.	*Triadica sebifera*	Chinese Tallowood	HTW - Manageable	-
119.	*Tricoryne elatior*	Yellow Autumn-lily	Forb (FG)	-
120.	*Typha orientalis*	Broad-leaved Cumbungi	Grass & grasslike (GG)	-
121.	*Verbena bonariensis*	Purpletop	Exotic	-
122.	*Wahlenbergia gracilis*	Sprawling Bluebell	Forb (FG)	-

APPENDIX C FAUNA SPECIES LIST

Table C1 Fauna Species List

No.	Scientific Name	Common Name	Status		Observation Type*	General Abundance within Development Site**
			BC Act	EPBC Act		
	Birds					
1.	*Acridotheres tristis*	Common Myna	-	-	VO	C
2.	*Cacatua sanguinea*	Little Corella	-	-	VO, H	UC
3.	*Corvus coronoides*	Australian Raven	-	-	H	C
4.	*Cracticus tibicen*	Australian Magpie	-	-	VO, H	C
5.	*Eolophus roseicapillus*	Galah	-	-	VO	UC
6.	*Trichoglossus haematodus*	Rainbow Lorikeet	-	-	VO	C

* Observation Type: VO (Visual Observation), H (Heard whilst on site), E (Evidence recorded inc scats, tracks or markings), C (Caught on Remote Camera), T (Trapped), R (Recorded through the use of call detectors).

** General Abundance: I (Individual record), UC (Uncommon, 2-5 records), C (Common occurrence on site >5 records). Anabat Detections are classed by confidence: Confident (C), Probable (Pr), and Possible (Po)

^ Denotes introduced species.

APPENDIX D PREDICTED AND CANDIDATE SPECIES REPOORTS

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00024274/BAAS18041/21/00025808	107 Haussman Drive	16/06/2022
Assessor Name	Report Created	BAM Data version *
Gilbert Whyte	11/08/2022	54
Assessor Number	Assessment Type	BAM Case Status
BAAS18041	Part 4 Developments (Small Area)	Finalised
Assessment Revision	BOS entry trigger	Date Finalised
0	BOS Threshold: Area clearing threshold	11/08/2022

* 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.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Diamond Firetail	Stagonopleura guttata	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Eastern False Pipistrelle	Falsistrellus tasmaniensis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Gang-gang Cockatoo	Callocephalon fimbriatum	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Glossy Black-Cockatoo	Calyptorhynchus lathami	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Greater Broad-nosed Bat	Scoteanax rueppellii	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

Grey-crowned Babbler (eastern subspecies)	Pomatostomus temporalis temporalis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Grey-headed Flying-fox	Pteropus poliocephalus	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Large Bent-winged Bat	Miniopterus orianae oceanensis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Little Bent-winged Bat	Miniopterus australis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Little Eagle	Hieraaetus morphnoides	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Little Lorikeet	Glossopsitta pusilla	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Masked Owl	Tyto novaehollandiae	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Painted Honeyeater	Grantiella picta	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Powerful Owl	Ninox strenua	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Regent Honeyeater	Anthochaera phrygia	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Scarlet Robin	Petroica boodang	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Speckled Warbler	Chthonicola sagittata	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Spotted-tailed Quoll	Dasyurus maculatus	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Square-tailed Kite	Lophoictinia isura	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Swift Parrot	Lathamus discolor	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Turquoise Parrot	Neophema pulchella	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Varied Sittella	Daphoenositta chrysoptera	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
White-bellied Sea-Eagle	Haliaeetus leucogaster	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

White-throated Needletail	Hirundapus caudacutus	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Yellow-bellied Glider	Petaurus australis	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C

BAM Candidate Species Report

Proposal Details

Assessment Id 00024274/BAAS18041/21/00025808	Proposal Name 107 Haussman Drive	BAM data last updated * 16/06/2022
Assessor Name Gilbert Whyte	Report Created 11/08/2022	BAM Data version * 54
Assessor Number BAAS18041	Assessment Type Part 4 Developments (Small Area)	BAM Case Status Finalised
Assessment Revision 0	Date Finalised 11/08/2022	BOS entry trigger BOS Threshold: Area clearing threshold

* 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.

List of Species Requiring Survey

Name	Presence	Survey Months

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Brush-tailed Rock-wallaby	Petrogale penicillata	Habitat constraints
Eastern Cave Bat	Vespadelus troughtoni	Habitat constraints
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Large-eared Pied Bat	Chalinolobus dwyeri	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
North Rothbury Persoonia	Persoonia pauciflora	Refer to BAR
Regent Honeyeater	Anthochaera phrygia	Habitat constraints
Swift Parrot	Lathamus discolor	Habitat constraints

APPENDIX E BIODIVERSITY CREDIT REPORTS

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00024274/BAAS18041/21/00025808

Proposal Name
107 Haussman Drive

BAM data last updated *
16/06/2022

Assessor Name
Gilbert Whyte

Assessor Number
BAAS18041

BAM Data version *
54

Proponent Names
Sam Rowe

Report Created
11/08/2022

BAM Case Status
Finalised

Assessment Revision
0

Assessment Type
Part 4 Developments (Small Area)

Date Finalised
11/08/2022

BOS entry trigger
BOS Threshold: Area clearing threshold

* 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

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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	HBT Cr	No HBT Cr	Total credits to be retired
1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	0.8	9	11	20

BAM Biodiversity Credit Report (Like for like)

1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602	-	1592_Modified	Yes	9	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602	-	1592_Remnant	No	11	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

No Species Credit Data

BAM Biodiversity Credit Report (Like for like)

Credit Retirement Options

Like-for-like credit retirement options

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00024274/BAAS18041/21/00025808

Proposal Name
107 Haussman Drive

BAM data last updated *
16/06/2022

Assessor Name
Gilbert Whyte

Assessor Number
BAAS18041

BAM Data version *
54

Proponent Name(s)
Sam Rowe

Report Created
11/08/2022

BAM Case Status
Finalised

Assessment Revision
0

Assessment Type
Part 4 Developments (Small Area)

Date Finalised
11/08/2022

BOS entry trigger
BOS Threshold: Area clearing threshold

* 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

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

BAM Biodiversity Credit Report (Variations)

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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	HBT Cr	No HBT Cr	Total credits to be retired
1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	0.8	9	11	20.00

1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602	-	1592_Modified	Yes	9	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602	-	1592_Remnant	No	11	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher threat status	1592_Modified	Yes (including artificial)	9	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher threat status	1592_Remnant	No	11	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like options

APPENDIX F STAFF CONTRIBUTIONS

The following staff were involved in the compilation of this report.

Table E1 Staff Contributions

Name	Qualification	Title/Experience	Contribution
Ben Stewart	MMarSc&Mgt	Ecologist (Botanist)	Field surveys and report writing
Dr. Daniel O'Brien	B EnvMgtSc&Sc (PhD)	Senior Ecologist	Report writing and report review
Dr. Gilbert Whyte	B Sc (PhD) Accredited BAM Assessor	Senior Ecologist	Flora Surveys and report review
James Baldry	MConsBio	Graduate Ecologist	Field surveys
Gayle Joyce	B Sc (Forestry) (Hons)	GIS Specialist	GIS and figure preparation
Alan McDonaugh		GIS Specialist	GIS and figure preparation

APPENDIX G LICENCING

Kleinfelder employees involved in the current study are licensed or approved under the *Biodiversity Conservation Act 2016* (License Number: SL100730, Expiry: 31 March 2023) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.

APPENDIX H BAM PLOT DATA

DATE: 12-05-2021	SITE: 107 HAUSMAN DR.	PLOT ID: Q01	RECORDER: B. STEWART

Note that strata information is not the same as GF Code or N, E, HTE, which needs to be assigned to each species after field work is completed.

	C	Ab		C	Ab		C	Ab		C	Ab		C	Ab		C	Ab		C	Ab
						BURSARIA SP.	0.5	10	MIC. STIP.	50	200	CHEILANTHES S.	0.1	20	SOLANUM N.	0.1	2
						PULTEN. VIL.	1	20	THEM. TRI.	65	1000	HARDEN. VIO.	0.1	5	SENECIO MAD.	0.5	50
						EUC. UMBRA/SPARS.	1	10	PASPALIDIUM D.	0.2	10	LOMANDRA FIL.	0.1	2	BIDENS BIL.	0.1	20
						INDIGOFERA A.	0.1	1	ENTOLASIA S.	1	50	LOB. PURP.	0.1	50	PASPALUM D.	5	40
						ACACIA BINERV.	1	30	DICHELACHNE M.	5	150	GONO. TETRA.	0.2	50	VERB. BON.	0.2	5
						OZOTHAM. DIO.	0.2	5	IMP. CYLIN.	2	100	CENTELLA A.	0.2	100	CONYZA B.	0.5	50
						EUC. SPP.	0.2	2	ERAG. BROWNII	0.5	50	WAHLENBERGIA G.	0.1	5	HYPOCHAERIS R.	0.1	20
						BREYNIA OB.	0.1	2				DICH. REP.	0.1	50	SETARIA P.	0.1	5
												GOOD. PANIC.	0.2	70	CYANTHILIUM C.	0.1	10
												FIMBRIS. DICH.	0.1	1			
												LAGENOPH STIP.	0.1	20			
												GOODENIA R.	0.1	5			
												GLYCINE CLAN.	0.1	5			
												DIANELLA C.	0.1	1			
												STEROSTYLIS SP.	0.1	1			

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, 30, ... (to nearest 5%), 100. Include overhanging plants.

Ab: 1-10, 20, 50, 100, 500, 1000, 1500, 2000 etc (numbers > 20 are estimates only). If overhanging species do not occur in plot, record abundance as 1

Note: *0.1%* ≈ 63 x 63 cm, *0.5%* ≈ 1.4 x 1.4 m, *1%* ≈ 2.0 x 2.0 m, *5%* ≈ 4.0 x 5.0 m, *25%* ≈ 10 x 10 m

400 m² PLOT

DATE: 12-05-2021	SITE: 107 HAUSSMAN DR.	PLOT ID: Q02	RECORDER: B. STEWART.

Note that strata information is not the same as GF Code or N, E, HTE, which needs to be assigned to each species after field work is completed.

Overstorey Species			Midstorey Species			Ground Cover (Trees)			Ground Cover (Grasses)			Ground Cover (Other)			Other		
	C	Ab		C	Ab		C	Ab		C	Ab		C	Ab		C	Ab
						BURSARIA SP.	1	30	ENTO. STRIC.	15	300	LOMANDRA LONG.	1	20	ANDRO. VIRG.	35	500
						DILLWYNIA R.	0.2	15	ECHINO. CAES.	0.5	30	LOBELIA PURP.	0.1	50	LANTANA CAM.	0.2	2
						ACACIA ~~FALCIFORMIS~~	1	25	CYNODON DAC.	10	500	LEPIDOSP. LAT.	0.1	10	SENECIO MAD.	0.1	5
						EUC SP. / C. MAC	1	5	PANICUM MISUM.	0.2	5	SYNAEDO. AUSTRALIS SPREADING ASSOC.	1	100	PASP. DIL.	0.2	10
						PULT. SPIN.	0.2	10	RYTIDOSPERM. ~~CAES~~ SP.	0.1	10	FIMB. DICH.	0.2	20	BIDENS PIL.	0.1	2
						DAV. ~~CUCULIFOLIA~~ ACEROSAS	0.1	2	ARISTIDA V.	0.1	20	CENTELLA A.	0.1	40	HYPOCH. RAD.	0.1	2
						OZOTH. DIOS-	0.1	2	ERAG. BR.	0.5	50	GONO. TETRA.	0.2	50			
						PULT. VIL.	0.2	10	THEM. TRIA	0.2	5	JUNCUS U.	0.1	5			
						ACACIA ~~FLAVIPILOSA~~	0.1	2				SCHOENUS ~~APOGON~~ SP.	0.1	50			
						LEUCOPOGON J.	0.1	2				GOODENIA R.	0.1	5			
						PULT. ~~RETUSA~~	0.1	2				HARDENBG. V.	0.1	2			
												GLY. CLAN.	0.1	10			
												HYDROC. LAX.	0.1	50			

C (%): 0.1, 0.2, 0.3, ..., **1**, 2, 3, ..., 10, 15, 20, 25, 30, ... (to nearest 5%), 100. Include overhanging plants. **Note:** *0.1%* ≈ 63 x 63 cm, *0.5%* ≈ 1.4 x 1.4 m, *1%* ≈ 2.0 x 2.0 m, *5%* ≈ 4.0 x 5.0 m, *25%* ≈ 10 x 10 m

Ab: 1-10, 20, 50, 100, 500, 1000, 1500, 2000 etc (numbers > 20 are estimates only). If overhanging species do not occur in plot, record abundance as 1

400 m² PLOT

DATE: 12-05-2021	SITE: 107 HAUSSMAN DR	PLOT ID: Q03	RECORDER: B - STEWART.

Note that strata information is not the same as GF Code or N, E, HTE, which needs to be assigned to each species after field work is completed.

Dominant Species			Mid-story Species			Ground Cover (shrubs)			Ground Cover (grasses)			Ground Cover (herbs)			Other		
	C	Ab		C	Ab		C	Ab		C	Ab		C	Ab		C	Ab
EUC - GLOB? ~~BAMBAG~~ ?	5	5	ACACIA ~~FIMBRIATA~~	5	10	BREYNIA OB.	0.2	5	PANICUM SIM.	2	~~50~~	GLYCINE TAB.	0.2	20	PASP. DIL.	5	50
EUC. SID.	2	3	ACACIA ~~ELONGATA~~	0.5	5	BURSARIA SPIN.	0.2	5	PASPALIDIUM D.	0.1	10	HARDENBERGIA	0.5	50	CHLORIS GA.	5	50
EUC. PUNC.	5	1	MEL. ARM.?	0.5	2	OZOTHAM. DIO.	0.1	10	ENTO. STRIC.	~~50~~ 7	100	LOBELIA P.	0.2	50	SETARIA P.	0.5	10
									MICRO. STIP.	15	500	CENTELLA A.	0.1	50	SOLANUM N.	0.1	5
									CYNODON DAC.	0.5	20	CHEILANTH. SIEB.	0.1	20	LANTANA.	0.1	2
									LYTIDOSP. ~~CAES.~~	0.2	10	OXALIS ~~LER.~~	0.1	20	VERB. BON.	0.1	5
									THEMEDA TR.	15	500	GLY. CLAN.	0.5	50	HYPOCH. RADI.	0.1	5
									ARISTIDA VAR.	2	100	LOMANDRA LONG.	0.1	5	SETARIA SPH.	0.2	5
												DESMOD. VARI.	~~25~~ 1	150	SIDA RHOM.	1	70
												LOMANDRA CON.	0.2	10	SONCHUS ASP.	0.1	2
												DICHONDRA R.	0.1	50	CYANTHIL. CIN.	0.1	5
												OPERCULARIA.	0.1	10	BIDENS PIL.	0.1	5
												&			SENECIO MAD.	0.2	30
															CLAMOCHAETA	0.1	5
															AMBROSIA TEN.	0.5	50
															FACELIS RETUSA	0.1	5

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, 30, ... (to nearest 5%), 100. Include overhanging plants.

Ab: 1-10, 20, 50, 100, 500, 1000, 1500, 2000 etc (numbers > 20 are estimates only). If overhanging species do not occur in plot, record abundance as 1

Note: *0.1%* ≈ 63 x 63 cm, *0.5%* ≈ 1.4 x 1.4 m, *1%* ≈ 2.0 x 2.0 m, *5%* ≈ 4.0 x 5.0 m, *25%* ≈ 10 x 10 m

400 m² PLOT

DATE: 12-05-2021	SITE: 107 HAUSSMAN DR.	PLOT ID: Q04	RECORDER: B. STEWART.

Note that strata information is not the same as GF Code or N, E, HTE, which needs to be assigned to each species after field work is completed.

	C	Ab		C	Ab		C	Ab		C	Ab		C	Ab		C	Ab
EUC. SID.	5	1				BURSARIA SPIN.	0.5	5	ENTO-STRICT.	~~10~~	200	LOBELIA PURP.	~~0.5~~ 1	~~50~~ 500	HYPOCHAERIS	0.1	5
C. MACULATA.	20	2				ACACIA. ~~SPP.~~	0.2	5	DIGITARIA P.	~~1~~	35	HALORAGODENDRON	0.5	50	LANTANA.	0.1	5
E. GLOB?	15	6				INDIGOFERA.	0.1	2	MICRO. STIP.	~~0.5~~ 1	30	ATHEROPODIUM M.	0.1	1	PASPALUM DIL.	0.2	10
E. FIB.	3	1				ACACIA FAL.	0.1	1	ARISTIDA V.	05	25	CYPERUS S.	0.2	50	SENNA GLAB.	0.1	1
E. MOL.	2	1				DAV. ~~ULI.~~ ACIC.	0.1	3	ECHINOPOGON C.	0.1	5	PSEUDERANTH.	0.2	50			
						OZOTH. DIO.	0.1	5	~~LACHNOCHLOA~~ DICHELACH. MO	0.1	5	LOMANDRA C.	0.1	5			
						ACACIA ~~SPP.~~ FIMBRIATA	0.1	5	THEMEDA TR.	~~2~~ 3	50	DICHONDRA R.	0.1	40			
						PULT. VIL.	0.1	2.	RYTIDOSP. ~~CAES.~~	~~0.5~~ 1	60	DESMODIUM V.	0.1	10			
						PULT. ~~SPP.~~ RETUSA.	0.1	1	PANICUM SIM.	0.2	15	COMMELINA.	0.1	5			
									CYMBO. R.	0.1	1	GLYCINE TAB.	0.1	10			
												PLECTRANTHUS P.	0.1	4			
												OPERCULARIA D.	0.1	5			
												SOLANUM PRIN.	0.1	2			
												LOMANDRA FIL.	~~0.5~~ 1	~~40~~			
												BRACHYSCOME ~~SPP.~~	0.1	2			
												GOODENIA R.	0.1	10			
												DIANELLA CA.	0.1	10			
												MISTLETOE.	0.1	2			

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, 30, ... (to nearest 5%), 100. Include overhanging plants.
Ab: 1-10, 20, 50, 100, 500, 1000, 1500, 2000 etc (numbers > 20 are estimates only). If overhanging species do not occur in plot, record abundance as 1

Note: *0.1%* ≈ 63 x 63 cm, *0.5%* ≈ 1.4 x 1.4 m, *1%* ≈ 2.0 x 2.0 m, *5%* ≈ 4.0 x 5.0 m, *25%* ≈ 10 x 10 m
400 m² PLOT

DATE: 12-05-2021	SITE: 107 HAUSSMAN DR	PLOT ID: Q05	RECORDER: B. STEWART.

Note that strata information is not the same as GF Code or N, E, HTE, which needs to be assigned to each species after field work is completed.

	C	Ab		C	Ab		C	Ab		C	Ab		C	Ab		C	Ab
C. MACULATA.	10	12				BURSARIA SPIN.	0.1	5	THEMEDA.	~~20~~	500	AMYEMA SPP. MISTLETOE.	0.1	1	PASPALUM D.	1	30
E. UMBRA ✓	5	3				A. FALC.	0.1	1	ENTO. STRIC.	5.	70	FIMBR. DICH.	2	100	CYPERUS ER.	0.5	20
E. PUNC.	3	0				ACACIA SP. (SHRUB)	0.1	2	MICR. STIP.	10	150	GONO. TENU.	0.5	70	SETARIA P.	0.1	10
E. MOL.	5	2							ARISTIDA V.	~~2~~	100	LACENOPH STIP.	0.1	20	BIDENS P.	0.1	5
									PANICUM SIM.	~~5~~	100	LOB. PURP.	0.2	50	CYANTH. GN.	0.1	5
									PRAG. BROWNII	0.1	10	GOOD. R.	0.1	5	~~ASTERACEAE??~~	~~0.1~~	~~1~~
									BIGI. PARN.	~~0.5~~	40	LOMANDRA FIL.	0.1	5	VERB. BON.	0.1	5
									~~DICHEL. MICR. ARTHRO. ARIST.~~	0.1	10	GLY. TAB.	0.1	5	CYPERUS SP.	0.1	10
									RYTIDO. ~~LAES. PAT.~~	0.1	10	DIAN. CEIR.	0.1	2	SIDA RHOM.	0.1	5
									IMP. CYLIN.	0.5	50	TRICHORYN. INVOL.	0.1	3	SENECIO.	0.1	5
									CYNODON. D.	0.1	10	PSEUDERANTHEMUM	0.1	10	HYPO CHAERIS	0.1	5
									ELHIND. COLENS.	0.1	2	OPERC. D.	0.1	5	~~POA SP.~~	~~0.1~~	~~2~~
												HARDENBERGIA	0.1	2	CONYZA BON	0.1	5
												SPHAERO. AUSTRALIS STRAWLINE ASTR	0.1	10	SENNA GLAB.	0.1	2
												HYDRO LAX.	0.2	50	SOL. NIG.	0.1	1
												JUNCUS V.	0.2	20	FICUS R.	0.1	2
												CENTELLA A.	0.2	40			
												DICHONDRA R.	0.2	50			
												SOLANUM P.	0.1	2			
												WAHLENBERGIA.	0.1	1			
												ARTHROPODIUM	0.1	10			

C (%): 0.1, 0.2, 0.3, ..., **1**, 2, 3, ..., 10, 15, 20, 25, 30, ... (to nearest 5%), 100. Include overhanging plants. **Note:** *0.1%* ≈ 63 x 63 cm, *0.5%* ≈ 1.4 x 1.4 m, *1%* ≈ 2.0 x 2.0 m, *5%* ≈ 4.0 x 5.0 m, *25%* ≈ 10 x 10 m

Ab: 1-10, 20, 50, 100, 500, 1000, 1500, 2000 etc (numbers > 20 are estimates only). If overhanging species do not occur in plot, record abundance as 1

400 m² PLOT

DATE: 12-05-2021	SITE: 107 HAUSSMAN DR	PLOT ID: Q06	RECORDER: B. STEWART-

Note that strata information is not the same as GF Code or N, E, HTE, which needs to be assigned to each species after field work is completed.

Overstorey Species			Understorey Species			Shrub or Large Shrub			Ground Cover Grasses			Ground Cover Other			Litter		
	C	Ab		C	Ab		C	Ab		C	Ab		C	Ab		C	Ab
						ACACIA. SP. (GONE)	0.2	10	ARISTIDA V.	1.	50	CHEILANTHES.	0.1	10	CORTADERIA SP.	0.5	1
						BURSARIA SP.	0.5	20	MICRO. STR.	10	500	LAGENOPHORA.	0.1	20	LANTANA	0.2	10
						OZOTH. DIO.	0.5	20	ORAG. BR.	0.5	20	FIMB. DICH.	75	100	SENECIO MAD.	05	40
						DILL. RETORT.	0.2	10	THEMEDA.	0.5	20	SPHAERO. AUSTRALIS STRAWBERRY ASTER	0.5	100	ANDRO. VIRG.	10	70
						ACACIA TAL.	0.1	2	ENTO. STR.	20	500	GLY. CLAN.	0.1	10	ASTER SUB.	0.1	1
						PULT. VIL	0.2	10	PANICUM SIM	5.	100	CENTELLA.	0.2	50	SIDA RHOM.	0.2	10
						PULT. SPIN.	0.5	10	DIGI. PARV.	37	70	COM-LONG.	5	20	BIDENS PIL.	0.1	5
						EUC. SP.	0.5	2	ECHINO. CAE.	0.5	30	LOB. PURP	0.5	500	CONYZA B.	0.1	5
						DAV. ACIC.	0.1	5	DICH. PAPPAN. LACHNOGRAMOIDES	37	150	CENTELLA COR.	0.1	30	HYPO. RADI.	0.1	5
						PULT. SPECIOSA	0.1	5	IMP. CYLIN.	5	100	HARDENBERGIA	0.1	5	PASP. DIL.	2	50
						CALLIST. SAL.	0.1	1				JUNCUS J.	1	50	VERB. BON.	0.2	5
												HYDRO. RAX	0.2	50	GAMOCHAETA.	0.1	5
												GLY. MICRO.	0.1	5	CHINESE TALLOW	0.1	1
												GOOD. PAN.	05	50			
												GOOD. R.	0.1	2			
												PARSON. STRAM.	0.1	1			
												GONO TENU.	0.1	5			
												HYPERICUM G.	0.1	1			

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, 30, ... (to nearest 5%), 100. Include overhanging plants. **Note:** *0.1%* ≈ 63 x 63 cm, *0.5%* ≈ 1.4 x 1.4 m, *1%* ≈ 2.0 x 2.0 m, *5%* ≈ 4.0 x 5.0 m, *25%* ≈ 10 x 10 m

Ab: 1-10, 20, 50, 100, 500, 1000, 1500, 2000 etc (numbers > 20 are estimates only). If overhanging species do not occur in plot, record abundance as 1

400 m² PLOT

107 HAUSMAN DR. THORNTON

B. STEWART

26/05/2021

Q07

	Species	Cover	ABUN. ~~Notes~~	NOTES
41	C. MACULATA.	10 %	6	
42	E. PUNCTATA.	5 %	4	
43	E. FIBROSA.	5 %	2	
44	E. SIDEROPHILUM.	10 %	10	
45	LOBELIA PURPURASCENS.	0.2%	150	
46	HARDENBERGIA VIOLACEA	0.1%	20	
47	BURSARIA SPINOSA.	0.1%	15	
48	CHEILANTHES SIEBERI	0.1%	5	
49	MICROLAENA STIPOIDES.	10%	150	
50	ENTOLASIA STRICTA	5%	70	
51	DESMODIUM VARIANS.	0.1%	20	
52	LOMANDRA FILIFORMIS SUBSP. COROLLACEA	0%	30	
53	SENNA GLABRATA.	0.1%	4	
54	ACACIA SP.	0.1%	2	
55	PSEUDOSANTHERIUM VARIABILE	0.1%	10	
56	PANICUM SIMILE.	0.2%	10	
57	LOMANDRA GLAUCA.	0.1%	1	
58	ARTHROPODIUM MIL.	0.1%	5	
59	DESMODIUM RHYTIDOPHYLUM.	0.1%	5	
60	LANTANA CAMARA.	0.1%	3	
61	LOMANDRA ~~CYLINDRICA~~ CONFERTIFOLIA	0.1%	2	
62	GLYCINE CLANDESTINA.	0.1%	5	
63	DICHELACHNE MICRANTHA.	0.1%	5	
64	ERAGROSTIS BROWNII	0.1%	5	
65	ECHINOPOGON CAESPITOSUM.	0.2%	10	
66	ARISTIDA VAGANS.	0.2%	10	
67	HYPOCHAERIS GLABRATA.	0.1%	2	
68	IMPERATA CYLINDRICA	0.5%	50	
69	LOMANDRA LONGIFOLIA.	0.1%	5	
70	GEITONOPLESIUM CYMOSUM.	0.1%	2	
71	EXOTIC PALM SEEDLING.	0.1%	1	
72	THEMEDA AUSTRALIS.	0.5%	10	
73	GLYCINE TABACINA.	0.2%	10	
74	CYMBOPOGON REFRACTUS.	0.1%	2	
75	DIANELLA SP. CAERULEA.	0.1%	5	
76	RHYTIDOSPERMA CAESPITOSUM.	0.1%	2	
77	LEPIDOSPERMA LATERALE.	0.1%	1	
78	AMYEMA SP.	0.1%	1	(MISTLETOE)
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				

DATE: 26/05/2021	SITE: 107 KAMISSIMAN DR	PLOT ID: Q08	RECORDER: B. STEWART.

GF Code	N, E or HTE	Species Name	Voucher	C	Ab
		29. INDIGOFERA AUSTRALIS.		0.1%	2
		30. DAVEISIA ULICIFOLIA.		0.1%	2
		31. PSEUDERANTHEMUM VARIABILE.		0.1%	15
		32. DESMODIUM ~~VARIANS~~ RYTIDOPHYLLUM		0.1%	5
		33. PASPALUM DILITATUM		0.2%	5
		34. BREYNIA OBLONGIFOLIA.		0.2%	15
		35. SOLANUM PRINOPHYLLUM		0.1%	2
		36. BILLARDIERA SCANDENS		0.1%	1
		37. THEMEDA AUSTRALIS		0.2%	50
		38. LOMANDRA FILIFORMIS SUBSP. CORRIACEA.		0.2%	10
		39. ACACIA PARVIPINNULA.		0.1%	1
		40. EINADIA NUTANS.		0.1%	1
		41. PULTENAEA VILLOSA.		0.1%	2
		42. FALCELIS RENUSA.		0.1%	1
		43. SOLANUM NIGRUM.		0.1%	2
		44. ECHINOPOGON CAESPITOSUS.		0.1%	2
		45. ACACIA ELONGATA.		0.2%	1
		46. PULTENAEA PALACEA		0.1%	1
		47. NOTELAEA LONGIFOLIA.		0.1%	1
		48. AMYEMA SPP.		0.1%	1
		49.			
		50.			
		51.			
		52.			
		53.			
		54.			
		55.			
		56.			
		57.			

GF Code: fill in after field, and *circle top 3 dominant spp. in each GF*
N, E or HTE: fill in after field
C (%): 0.1, 0.2, 0.3, ..., **1**, 2, 3, ..., 10, 15, 20, 25, 30, ... (to nearest 5%), 100
C (%): includes overhanging plants
Ab: 1-10, 20, 50, 100, 500, 1000, 1500, 2000 etc (numbers > 20 are estimates only)
Ab: does not include overhanging plants unless there is a cover value in plot but no stems in the plot

Note: 0.1% ≈ 63 x 63 cm
0.5% ≈ 1.4 x 1.4 m
1% ≈ 2.0 x 2.0 m
5% ≈ 4.0 x 5.0 m
25% ≈ 10 x 10 m

DATE: 26/05/2021	SITE: 107 HAUSSMAN DR.	PLOT ID: Q08	RECORDER: B. SPENART.

400 m² PLOT

GF Code	N, E or HTE	Species Name	Voucher	C	Ab
		1. COMMBIA MACULATA.		15%	8
		2. EUCALYPTUS PANICULATA.		5%	4
		3. EUCALYANS FIBROSA.		5%	0
		4. EUCALYPTUS MOLUCANNA.		2%	1
		5. EUCALYPTUS PUNCHATA.		3%	2
		6. EUCALYPTUS UMBRA.		5%	3
		7. MICROLAENA STIPOIDES		10%	200
		8. CHEILANTHES SIEBERI		0.1%	10
		9. ENTOLASIA STRICTA.		5%	100
		10. LOMANDRA FILIFORMIS SUBSP. FILIFORMIS		0.5%	10
		11. LOBELIA PURPUASCENS.		0.2%	50
		12. OPERCULARIA DIPHYLLA		0.1%	5
		13. BURSARIA SPINOSA.		0.1%	10
		14. DESMODIUM VARIANS		0.1%	2
		15. ARISTIDA VAGANS		0.1%	~~5~~ 10
		16. ACACIA FALCATA.		0.1%	~~5~~ 2
		17. CYANTHILLIUM CINEREUM.		0.1%	~~10~~ 5
		18. GLYCINE TABACINA.		0.1%	~~10~~ 5
		19. IMPERATA CYLINDRICA.		0.1%	~~5~~ 10
		20. LANTANA CAMARA.		0.1%	~~5~~ 10
		21. HARDENBERGIA VIOLACEA.		0.1%	5
		22. PANICUM SIMILE.		0.1%	5
		23. OZOTHAMNUS DIOSMIFOLIUS.		0.1%	5
		24. RYTIDOSPERMA CAESPITOSUM		0.1%	~~10~~ 5
		25. ARTHROPODIUM MILLIFLORUM		0.1%	~~10~~ 5
		26. SENECIO MADAGASCARENSIS.		0.1%	~~5~~ 2
		27. WAHLENBERGIA GRACILIS		0.1%	2
		28. HYPOCHAERIS RADICATA.		0.1%	1

GF Code: fill in after field, and *circle top 3 dominant spp. in each GF*
N, E or HTE: fill in after field
C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, 30, ... (to nearest 5%), 100
C (%): includes overhanging plants
Ab: 1-10, 20, 50, 100, 500, 1000, 1500, 2000 etc (numbers > 20 are estimates only)
Ab: does not include overhanging plants unless there is a cover value in plot but no stems in the plot

Note: 0.1% ≈ 63 x 63 cm
0.5% ≈ 1.4 x 1.4 m
1% ≈ 2.0 x 2.0 m
5% ≈ 4.0 x 5.0 m
25% ≈ 10 x 10 m

DATE: 12-05-2021	SITE: 107 HAUSSMAN DR	PLOT ID: WALKOVER	RECORDER: B. STEWART

Note that strata information is not the same as GF Code or N, E, HTE, which needs to be assigned to each species after field work is completed.

	C	Ab		C	Ab		C	Ab		C	Ab		C	Ab		C	Ab
CIRSIUM V.																	
EINADIA N.																	
PLANTAGO L.																	
CAS. GLAUC.																	
TYPHA																	
MELIA. MAX.																	
A. COSTATA																	
ACACIA IRR.																	
PHYTOLACA. OC.																	
PHYLLRUM																	
SOLANUM MAJ.																	
ASPARAG. AC.																	

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3; ..., 10, 15, 20, 25, 30, ... (to nearest 5%), 100. Include overhanging plants.

Ab: 1-10, 20, 50, 100, 500, 1000, 1500, 2000 etc (numbers > 20 are estimates only). If overhanging species do not occur in plot, record abundance as 1

Note: *0.1%* ≈ 63 x 63 cm, *0.5%* ≈ 1.4 x 1.4 m, *1%* ≈ 2.0 x 2.0 m, *5%* ≈ 4.0 x 5.0 m, *25%* ≈ 10 x 10 m

400 m² PLOT

DATE: 12-05-2021	SITE: 107 HAUSSMAN DR.	PLOT ID: Q01	RECORDER: B. STEWART.
Record GPS coord at start & end? ✓	Photos (portrait / landscape) at start & end? ✓		Magnetic bearing: 251°
PCT:		Veg Class: HUNTER - MACLEAY DRY SCL.	

1000 m² PLOT

Tree Stem Size Class*		Eucalypt species^	Non-eucalypt species
Count of Large Trees (record DBH of each tree at 1.3 m from ground)	80+ cm	—	—
	50+ cm	—	—
All other Trees: Only record ***presence or absence*** of trees in these stem size classes	30-49 cm	—	—
	20-29 cm	—	—
	10-19 cm	—	—
	5-9 cm	—	—
Count of **Regeneration**	<5 cm	1 ✓	—

HBT†	
<20 cm	20 cm+
N/A	N/A

*Living trees only; for **multi-stemmed trees**, only largest stem is counted or recorded as present; trees with stem class size <5 cm is treated as **regeneration**.
^Includes species of *Eucalyptus, Corymbia, Angophora, Lophostemon, Syncarpia*

†Count of hollow-bearing trees and shrubs; includes living and dead; record by stem size class.

Length of logs (m) (≥ 10 cm diameter, > 50 cm in length)	0	**TOTAL LENGTH (m)**

1 m² subPLOT

	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot	5	15	5	45	15															
Average	17.																			

Litter includes leaves, seeds, twigs, branchlets and branches **less than 10 cm diameter**; also includes dead material attached to living plants, as long as they are touching ground or close enough to act as functional litter. **Rock** includes units >20mm.

Physiography + Site Features (may help in determining PCT and Management Zones

Morphological Type		Landform Element		Site Drainage	
Lithology	CLAY SOILS	Landform Pattern		Distance to nearest water and type	
Slope and Aspect	W	Soil Colour	LIGHT BROWN - GREY	Microrelief	B

Plot Disturbance:

	Severity	Age		Severity	Age
Clearing (incl. logging)	3	R	Fire damage	.	
Cultivation (incl. pasture)			Storm damage		
Soil erosion	2	R	Weediness	2-3	R.
Firewood removal			Other		
Grazing (native vs stock)					

Severity: 0 = no evidence, 1 = light, 2 = mod, 3 = severe
Age: R = (recent), NR = not recent (3-10 yrs), O = old (>10 yrs)

DATE: 12-05-2021	SITE: 107 HANSMAN	PLOT ID: Q02	RECORDER: B. STEWART
Record GPS coord at start & end? ✓	Photos (portrait / landscape) at start & end? ✓	Magnetic bearing: 059°	
PCT:	Veg Class: DRY SCLEROPHYLL		

1000 m² PLOT

Tree Stem Size Class*		Eucalypt species^	Non-eucalypt species
Count of Large Trees (record DBH of each tree at 1.3 m from ground)	80+ cm	—	—
	50+ cm	—	—
All other Trees: Only record ***presence or absence*** of trees in these stem size classes	30-49 cm	—	—
	20-29 cm	—	—
	10-19 cm	—	—
	5-9 cm	—	—
Count of **Regeneration**	<5 cm	23	—

*Living trees only; for **multi-stemmed trees**, only largest stem is counted or recorded as present; trees with stem class size <5 cm is treated as **regeneration**.
^Includes species of *Eucalyptus, Corymbia, Angophora, Lophostemon, Syncarpia*

HBT†	
<20 cm	20 cm+
N/A	N/A.

†Count of hollow-bearing trees and shrubs; includes living and dead; record by stem size class.

Length of logs (m) (≥ 10 cm diameter, > 50 cm in length)	1 + 0.5 + 1	TOTAL LENGTH (m) 2.5m.

1 m² subPLOT

	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot	5	35	35	5	15	75	30	20	40	25										
Average	19																			

Litter includes leaves, seeds, twigs, branchlets and branches **less than 10 cm diameter**; also includes dead material attached to living plants, as long as they are touching ground or close enough to act as functional litter. **Rock** includes units >20mm.

Physiography + Site Features (may help in determining PCT and Management Zones

Morphological Type		Landform Element		Site Drainage	
Lithology	SANDSTONE. CLAY/ SOIL	Landform Pattern		Distance to nearest water and type	
Slope and Aspect	FLAT	Soil Colour	LIGHT BROWN.	Microrelief	

Plot Disturbance:

	Severity	Age		Severity	Age
Clearing (incl. logging)	3	R	Fire damage		
Cultivation (incl. pasture)			Storm damage		
Soil erosion	2	R.	Weediness	3	R.
Firewood removal			Other		
Grazing (native vs stock)					

Severity: 0 = no evidence, 1 = light, 2 = mod, 3 = severe.
Age: R = (recent), NR = not recent (3-10 yrs), O = old (>10 yrs)

DATE: 12-05-2021	SITE: 107 HAUSSMAN	PLOT ID: Q03	RECORDER: B. STEWART
Record GPS coord at start & end? ✓	Photos (portrait / landscape) at start & end? ✓	Magnetic bearing: 056°	
PCT:	Veg Class: DRY SCLEROPHYLL		

1000 m² PLOT

Tree Stem Size Class*		Eucalypt species^	Non-eucalypt species
Count of Large Trees (record DBH of each tree at 1.3 m from ground)	80+ cm	1 IIII	—
	50+ cm	1	—
All other Trees: Only record ***presence or absence*** of trees in these stem size classes	30-49 cm	✓	—
	20-29 cm	—	—
	10-19 cm	✓	—
	5-9 cm	✓	—
Count of **Regeneration**	<5 cm	13	—

HBT†	
<20 cm	20 cm+
1	—
—	—
—	—
—	—
—	

*Living trees only; for **multi-stemmed trees**, only largest stem is counted or recorded as present; trees with stem class size <5 cm is treated as **regeneration**.
^Includes species of *Eucalyptus, Corymbia, Angophora, Lophostemon, Syncarpia*

†Count of hollow-bearing trees and shrubs; includes living and dead; record by stem size class.

Length of logs (m) (≥ 10 cm diameter, > 50 cm in length)	IIII 1 + 3 +	TOTAL LENGTH (m)
		4m

1 m² subPLOT

	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot	45	50	5	15	80	15	5	25	15	0										
Average	39																			

Litter includes leaves, seeds, twigs, branchlets and branches **less than 10 cm diameter**; also includes dead material attached to living plants, as long as they are touching ground or close enough to act as functional litter. **Rock** includes units >20mm.

Physiography + Site Features (may help in determining PCT and Management Zones

Morphological Type		Landform Element		Site Drainage	
Lithology	SANDSTONE CLAY SOIL	Landform Pattern		Distance to nearest water and type	
Slope and Aspect	W	Soil Colour	BROWN	Microrelief	

Plot Disturbance:

	Severity	Age		Severity	Age
Clearing (incl. logging)	2-3	R	Fire damage		
Cultivation (incl. pasture)			Storm damage		
Soil erosion	1	R	Weediness	2	R
Firewood removal			Other		
Grazing (native vs stock)					

Severity: 0 = no evidence, 1 = light, 2 = mod, 3 = severe.
Age: R = (recent), NR = not recent (3-10 yrs), O = old (>10 yrs)

DATE: 12-05-2021	SITE: 107 HAUSSMAN	PLOT ID: Q04	RECORDER: B STEWART
Record GPS coord at start & end?		Photos (portrait / landscape) at start & end?	Magnetic bearing: 165°
PCT:		Veg Class: DRY SCLEROPHYLL	

1000 m² PLOT

Tree Stem Size Class*		Eucalypt species^	Non-eucalypt species
Count of Large Trees (record DBH of each tree at 1.3 m from ground)	80+ cm	1	—
	50+ cm	—	—
All other Trees: Only record ***presence or absence*** of trees in these stem size classes	30-49 cm	✓	—
	20-29 cm	✓	—
	10-19 cm	✓	—
	5-9 cm	—	—
Count of **Regeneration**	<5 cm	9	—

*Living trees only; for **multi-stemmed trees**, only largest stem is counted or recorded as present; trees with stem class size <5 cm is treated as **regeneration**.
^Includes species of *Eucalyptus, Corymbia, Angophora, Lophostemon, Syncarpia*

HBT†	
<20 cm	20 cm+
N/A	N/A

†Count of hollow-bearing trees and shrubs; includes living and dead; record by stem size class.

Length of logs (m) (≥ 10 cm diameter, > 50 cm in length)	2 + 2 + 2 + 2	TOTAL LENGTH (m) 8m.

1 m² subPLOT

	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot	65	40	90	50	70	25	35	0	10	5										
Average	63																			

Litter includes leaves, seeds, twigs, branchlets and branches **less than 10 cm diameter**; also includes dead material attached to living plants, as long as they are touching ground or close enough to act as functional litter. **Rock** includes units >20mm.

Physiography + Site Features (may help in determining PCT and Management Zones

Morphological Type		Landform Element		Site Drainage	
Lithology	SANDSTONE CLAY SOIL.	Landform Pattern		Distance to nearest water and type	
Slope and Aspect	S	Soil Colour	LIGHT - DARK BROWN	Microrelief	

Plot Disturbance:

	Severity	Age		Severity	Age
Clearing (incl. logging)	2	R.	Fire damage		
Cultivation (incl. pasture)			Storm damage		
Soil erosion			Weediness	2	R
Firewood removal			Other		
Grazing (native vs stock)			(RECENT LANTANA CONTROL		

Severity: 0 = no evidence, 1 = light, 2 = mod, 3 = severe.
Age: R = (recent), NR = not recent (3-10 yrs), O = old (>10 yrs)

DATE: 12-05-21	SITE: 107 HAUSSMAN	PLOT ID: Q05	RECORDER: B-STENART
Record GPS coord at start & end?		Photos (portrait / landscape) at start & end?		Magnetic bearing: 011°
PCT:		Veg Class:	

1000 m² PLOT

Tree Stem Size Class*		Eucalypt species^	Non-eucalypt species
Count of Large Trees (record DBH of each tree at 1.3 m from ground)	80+ cm	—	—
	50+ cm	3	—
All other Trees: Only record ***presence or absence*** of trees in these stem size classes	30-49 cm	✓	—
	20-29 cm	—	—
	10-19 cm	✓	—
	5-9 cm	✓	—
Count of **Regeneration**	<5 cm	5	—

*Living trees only; for **multi-stemmed trees**, only largest stem is counted or recorded as present; trees with stem class size <5 cm is treated as **regeneration**.
^Includes species of *Eucalyptus, Corymbia, Angophora, Lophostemon, Syncarpia*

HBT†	
<20 cm	20 cm+
—	—
1	—
1	—
7	—
—	—
—	—
—	—

†Count of hollow-bearing trees and shrubs; includes living and dead; record by stem size class.

Length of logs (m) (≥ 10 cm diameter, > 50 cm in length)	0	TOTAL LENGTH (m)

1 m² subPLOT

	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot	30	85	10	60	10	5	10	10	0	0										
Average	39																			

Litter includes leaves, seeds, twigs, branchlets and branches **less than 10 cm diameter**; also includes dead material attached to living plants, as long as they are touching ground or close enough to act as functional litter. **Rock** includes units >20mm.

Physiography + Site Features (may help in determining PCT and Management Zones

Morphological Type		Landform Element		Site Drainage	
Lithology	SANDSTONE CLAY. SOIL	Landform Pattern		Distance to nearest water and type	
Slope and Aspect	S	Soil Colour	LIGHT BROWN	Microrelief	

Plot Disturbance:

	Severity	Age		Severity	Age
Clearing (incl. logging)	2-3	R	Fire damage		
Cultivation (incl. pasture)			Storm damage		
Soil erosion			Weediness	2	R -
Firewood removal			Other		
Grazing (native vs stock)					

Severity: 0 = no evidence, 1 = light, 2 = mod, 3 = severe.
Age: R = (recent), NR = not recent (3-10 yrs), O = old (>10 yrs)

DATE: 12-05-2021	SITE: 107 HAUSSMAN	PLOT ID: 006	RECORDER: B. STEWART
Record GPS coord at start & end? ✓	Photos (portrait / landscape) at start & end? ✓	Magnetic bearing: 112°	
PCT:	Veg Class:		

1000 m² PLOT

Tree Stem Size Class*		Eucalypt species^	Non-eucalypt species
Count of Large Trees (record DBH of each tree at 1.3 m from ground)	80+ cm	—	—
	50+ cm	—	—
All other Trees: Only record ***presence or absence*** of trees in these stem size classes	30-49 cm	—	—
	20-29 cm	—	—
	10-19 cm	—	—
	5-9 cm	—	—
Count of **Regeneration**	<5 cm	10	—

*Living trees only; for **multi-stemmed trees**, only largest stem is counted or recorded as present; trees with stem class size <5 cm is treated as **regeneration**.
^Includes species of *Eucalyptus, Corymbia, Angophora, Lophostemon, Syncarpia*

HBT†	
<20 cm	20 cm+
N/A	N/A

†Count of hollow-bearing trees and shrubs; includes living and dead; record by stem size class.

Length of logs (m) (≥ 10 cm diameter, > 50 cm in length)	0	TOTAL LENGTH (m)

1 m² subPLOT

	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot	5	15	0	50	5	5	0	0	0	5										
Average	15																			

Litter includes leaves, seeds, twigs, branchlets and branches **less than 10 cm diameter**; also includes dead material attached to living plants, as long as they are touching ground or close enough to act as functional litter. **Rock** includes units >20mm.

Physiography + Site Features (may help in determining PCT and Management Zones

Morphological Type		Landform Element		Site Drainage	
Lithology	CLAY SOIL	Landform Pattern		Distance to nearest water and type	
Slope and Aspect	E	Soil Colour	BROWN.	Microrelief	

Plot Disturbance:

	Severity	Age		Severity	Age
Clearing (incl. logging)	3	R	Fire damage		
Cultivation (incl. pasture)			Storm damage		
Soil erosion			Weediness	2-3	R.
Firewood removal			Other		
Grazing (native vs stock)					

Severity: 0 = no evidence, 1 = light, 2 = mod, 3 = severe.
Age: R = (recent), NR = not recent (3-10 yrs), O = old (>10 yrs)

-This document has not been endorsed or approved by Office of Environment and Heritage or Muddy Boots Environmental Training-

BAM Site – Field Survey Form

Site Sheet no: 1 of _____

		Survey Name	Zone ID	Recorders			
Date	26/05/24			JAMES B, BEN S.			
Zone	Datum	Plot ID	Q07	Plot dimensions	20x50	Photo #	✓
56H							
Easting	Northing	IBRA region	SYDNEY BASIN	Midline bearing from 0 m	86°E	Magnetic °	
372134	6373374						
Vegetation Class		DRY SCLEROPHYLL FOREST SHRUB/GRASS FORM.				Confidence: H M L	
Plant Community Type		HUNTER MACLAY DRY SCLEROPHYLL		EEC: tick		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm	𝍸	
20 – 29 cm	𝍸 𝍸	
10 – 19 cm	𝍸 𝍸 | |	
5 – 9 cm	𝍸 |	
< 5 cm	𝍸	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	1+	Tally space

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). 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. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	40	70	30	90	50	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	56 %																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture	Sandy	Soil Colour	Grey	Soil Depth	
Slope	Light decline	Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			evidence of previous clearing
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

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

2.5m

10

-This document has not been endorsed or approved by Office of Environment and Heritage or Muddy Boots Environmental Training-

BAM Site – Field Survey Form

Site Sheet no: 1 of _____

		Survey Name	Zone ID	Recorders			
Date	26/05/21			BEN.S , JAMES.B			
Zone 56H	Datum	Plot ID	Q08	Plot dimensions	10x100	Photo #	✓
Easting 372140	Northing 6373819	IBRA region	SYDNEY BASIN	Midline bearing from 0 m	60°	Magnetic °	
Vegetation Class						Confidence: H M L	
Plant Community Type				EEC: tick		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	𝍸	
30 – 49 cm	𝍸 |	
20 – 29 cm	𝍸 |||	
10 – 19 cm	𝍸 𝍸 𝍸 𝍸 𝍸	
5 – 9 cm	𝍸 𝍸 ||	
< 5 cm	𝍸 𝍸 𝍸 𝍸 |||	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	473+	Tally space

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). 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. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	80	90	70	50	20	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	62.1																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture	sandy.	Soil Colour	light grey	Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			evidence of select logging - cut stumps.
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

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Hunter Water Corporation
ABN 46 228 513 446

PO Box 5171
HRMC NSW 2310
36 Honeysuckle Drive
NEWCASTLE NSW 2300
1300 657 657
enquiries@hunterwater.com.au
hunterwater.com.au

3 December 2024

Hunter Water Ref: HW2017-1215/18/82
Your Ref: 3106

The General Manager
Maitland City Council

Attention: Adam Kennedy
Via: NSW Planning Portal

Dear Adam

RE: 107 HAUSSMEN DRIVE THORNTON REZONING PROPOSAL - LEP PP-2021-2820 and PP-2022-4101 (Reference number: REF-3106)

Hunter Water has no objections to amendment to the Maitland LEP 2013 by rezoning land from RU2 Rural Landscape zone to a proposed part R1 General Residential zone and C3 Environmental Management zone at 107 Haussman Drive, Thornton.

The site has been identified on Hunter Water's Maitland Growth Plan with development forecast to proceed after 10 years, however, based on this rezoning referral, Hunter Water will update our forecast to indicate future connections can be expected within 5 years. Please advise if this expectation is incorrect.

Hunter Water confirms that the proponent lodged a Preliminary Servicing Application in 2015. Although this application has expired, and Hunter Water recommends the Proponent submit a new application so we can provide updated servicing advice and indicative developer charges.

Water Supply

The site is located in the Four Mile Creek 1 Reservoir (Buttai) water supply zone and it is expected sufficient capacity will be available to service the proposed subdivision. At the time of subdivision, the developer will need to prepare a water servicing report to confirm network connections and security of supply options.

Wastewater Transportation

The site has potential to connect to various wastewater pumping station catchments. At the time of subdivision, the developer will need to prepare a sewer servicing strategy to confirm network connection points and assess the downstream network capacity and identify any developer funded network upgrades.

Developer Charges

Please note, Hunter Water has reintroduced developer charges for new connections to our water and wastewater networks. These charges are being phased in with the full charge payable in the 2026/2027 financial year.

If you require further advice or clarification regarding this submission, please contact the undersigned on 02 4081 5826 or at barry.calderwood@hunterwater.com.au.

Yours sincerely

Barry Calderwood
Account Manager Major Development

From: Tara Dever <Ceo@mindaribbalalc.org>
Sent: Friday, 27 September 2024 3:39 PM
To: Adam Kennedy
Subject: RE: Request for comment - Planning Proposal PP-2023-2323 - 107 Haussman Drive, Thornton - Rezone to residential and conservation while amending the minimum lot size

Importance: High

Good afternoon Adam,

RE: Planning Proposal PP-2023-2323 - 107 Haussman Drive, Thornton - Rezone to residential and conservation while amending the minimum lot size

The Mindaribba Local Aboriginal Land Council have reviewed all documents presented by the Maitland Council.
And the Mindaribba Local Aboriginal Land Council has *no objections* to the proposed rezoning.

Warm Regards, Tara

MINDARIBBA
LOCAL ABORIGINAL LAND COUNCIL
Tara Dever (She/Her/Hers)
Chief Executive
Mindaribba Local Aboriginal Land Council

Email: ceo@mindaribbalalc.org
Phone: 02 - 4015 7000
1A Chelmsford Drive Metford NSW 2323
55 Aberdare Rd Aberdare NSW 2325
PO Box 401 East Maitland NSW 2323

I pay my respects to all Wonnarua Elders past and present. For they are the traditional keepers, custodians and knowledge holders of all the lands, waters and skies on which I am very grateful to work, live and prosper today and everyday. *Always was, and always will be; Aboriginal Land!*

From: Tara Dever
Sent: Wednesday, 25 September 2024 3:35 PM
To: Adam Kennedy <Adam.Kennedy@maitland.nsw.gov.au>
Subject: RE: Request for comment - Planning Proposal PP-2023-2323 - 107 Haussman Drive, Thornton - Rezone to residential and conservation while amending the minimum lot size

Good afternoon Adam,

The Mindaribba LALC would like to request an extension to review ***Planning Proposal PP-2023-2323 - 107 Haussman Drive, Thornton - Rezone to residential and conservation while amending the minimum lot size.***
We would like to request an extension to submit comment until COB Friday the 27th September 2024.

Your support in this matter is greatly appreciated.

Warmest Regards, Tara

Tara Dever (She/Her/Hers)
Chief Executive
Mindaribba Local Aboriginal Land Council

Email: ceo@mindaribbalalc.org
Phone: 02 - 4015 7000
1A Chelmsford Drive Metford NSW 2323
55 Aberdare Rd Aberdare NSW 2325
PO Box 401 East Maitland NSW 2323

I pay my respects to all Wonnarua Elders past and present. For they are the traditional keepers, custodians and knowledge holders of all the lands, waters and skies on which I am very grateful to work, live and prosper today and everyday. ***Always was, and always will be; Aboriginal Land!***

From: Adam Kennedy <Adam.Kennedy@maitland.nsw.gov.au>
Sent: Wednesday, 25 September 2024 3:02 PM
To: Tara Dever <Ceo@mindaribbalalc.org>
Subject: RE: Request for comment - Planning Proposal PP-2023-2323 - 107 Haussman Drive, Thornton - Rezone to residential and conservation while amending the minimum lot size

Good afternoon,

A friendly reminder that today is the last day for comment on the abovementioned proposal.

Should you wish an extension, or wish not to comment please respond back to me.

If there is no comment by COB Friday 27 September 2024. I will consider it as no comment.

Kind regards

Adam Kennedy
Senior Strategic Planner
City Planning | Maitland City Council
t 02 4934 9642
Adam.Kennedy@maitland.nsw.gov.au

From: Adam Kennedy
Sent: Thursday, August 29, 2024 1:24 PM
To: Tara Dever <ceo@mindaribbalalc.org>
Subject: Request for comment - Planning Proposal PP-2023-2323 - 107 Haussman Drive, Thornton - Rezone to residential and conservation while amending the minimum lot size

Good afternoon,

Council has received a Gateway determination for the abovementioned planning proposal, and as prescribed within the condition requires to undertaken State agency engagement. This request had been placed through the Planning Portal; however, a technical error has resulted in the need to undertake this manually to progress the proposal.

Per the Gateway determination and regulatory requirements of the Section 9.1 Ministerial Directions, engagement is required. Linked is the planning proposal, Gateway Determination and supporting studies relevant to your Department. The proposal is to rezone the land to a residential and conservation use, while amending the minimum lot size to facilitate a range of housing types.

Comments are due 25 September 2024.

If you require any additional information, or are having technical issues accessing the linked documents please let me know.

Regards

Adam Kennedy
Senior Strategic Planner
City Planning | Maitland City Council
t 02 4934 9642
Adam.Kennedy@maitland.nsw.gov.au

****
The views expressed in this email are not necessarily those of the Maitland City Council unless otherwise stated. The organisation does not warrant that this message is free of viruses or any other defect or error. This message and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this message in error please contact the author.
****

Maitland City Council
PO Box 220
MAITLAND NSW 2320

Your reference: (REF-3104) PP-2023-2323
Our reference: SPI20240907000174

ATTENTION: Adam Kennedy

Date: Tuesday 8 October 2024

Dear Sir/Madam,

Strategic Planning Instrument
Rezoning – Planning Proposal
Rezone from the current RU2 Rural Landscape zone to a proposed part R1 General Residential zone and C3 Environmental Management zone within a disused quarry site. Amend the minimum lot size from mostly the 40ha minimum lot size to 450m² for the proposed R1 General Residential zoned land. The remainder of the C3 Environmental Management zoned land will retain the 40ha minimum lot size. This proposal continues PP-2021-2820 and PP-2022-4101 submitting requested additional information at the request of the DPE.

I refer to your correspondence dated 06/09/2024 inviting the NSW Rural Fire Service (NSW RFS) to comment on the above Strategic Planning document.

The NSW RFS has considered the information submitted and provides the following comments.

The New South Wales Rural Fire Service (NSW RFS) has reviewed the proposal with regard to Section 4.4 of the directions issued in accordance with Section 9.1 of the *Environmental Planning and Assessment Act 1979*.

The objectives of the direction are:

- *to protect life, property and the environment from bush fire hazards, by discouraging the establishment of incompatible land uses in bush fire prone areas, and*
- *to encourage sound management of bush fire prone areas.*

The direction provides that a planning proposal must:

- *have regard to Planning for Bushfire Protection 2019,*
- *introduce controls that avoid placing inappropriate developments in hazardous areas, and*
- *ensure that bushfire hazard reduction is not prohibited within the APZ.*

Based upon an assessment of the information provided, NSW RFS raises no objections to the proposal subject to a requirement that the future subdivision/development of the land complies with *Planning for Bush Fire Protection (PBP) 2019*.

With regard to these requirements, the following comments are made in relation to the submitted concept plan:

- The superlot set aside for higher density development has a direct interface with the reserve/drainage basin. The acceptable solution for a subdivision under Table 5.3b in *PBP 2019* requires a perimeter road

Postal address

NSW Rural Fire Service
Locked Bag 17
GRANVILLE NSW 2142

Street address

NSW Rural Fire Service
4 Murray Rose Ave
SYDNEY OLYMPIC PARK NSW 2127

T (02) 8741 5555
F (02) 8741 5550
www.rfs.nsw.gov.au

between the development and the vegetation. Future development must be supported by evidence, such as a Vegetation Management Plan (VMP) or Plan of Management (POM), demonstrating the managed reserve will be maintained to the required standard of an Inner Protection Area (IPA) and/or appropriate APZs are provided to demonstrate that future residential development can comply with Appendix 1 of *PBP 2019*.

- Access for the future subdivision must comply with the requirements of Table 5.3b of *PBP 2019* as follows:
- Future development must be supported by plans demonstrating compliant kerb to kerb widths for perimeter and non-perimeter roads, with parking provided outside the carriageway, in accordance with Table 5.3b of *PBP 2019*;
- The current layout of the subdivision relies on one way in and out of the subdivision via Haussman Drive until development takes place on the adjoining site to the east. As the secondary access point to the east cannot be relied upon at this stage, future development must be supported by plans demonstrating the subdivision access complies with Table 5.3b in *PBP 2019*, by providing an operational secondary access and egress road.

For any queries regarding this correspondence, please contact Elaine Chandler on 1300 NSW RFS.

Yours sincerely,

Kalpana Varghese
Supervisor Development Assessment & Plan
Built & Natural Environment

Department of Climate Change, Energy, the Environment and Water

Your ref: Your email received 29 August 2024
Our ref: DOC24/706457-23

Adam Kennedy
Senior Strategic Planner
Maitland City Council

By email: Adam.Kennedy@maitland.nsw.gov.au

Dear Adam

Planning Proposal PP-2023-2323 - 107 Haussman Drive, Thornton

Thank you for your email request dated 29 August 2024 seeking advice from the Biodiversity, Conservation and Science (BCS) Group of the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 107 Haussman Drive, Thornton NSW (PP-2023-2323).

BCS has reviewed information provided and consider that the proposed rezoning can proceed to the next stage of assessment following consideration of BCS comments provided in Attachment 1.

If you have any further questions about this issue, please contact our Hunter Central Coast Planning Team at huntercentralcoast@environment.nsw.gov.au.

Yours Sincerely

Joe Thompson
Director Hunter Central Coast
Biodiversity, Conservation and Science

26 September 2024

Enclosure Attachment 1

Attachment 1 - BCS Comments

PP-2023-2323 – 107 Haussman Drive, Thornton NSW

In preparing this advice BCS has reviewed the submitted documents including the:

- Biodiversity Development Assessment Report (BDAR) (Kleinfelder, September 2022)
- Bushfire Threat Assessment for the Planning Proposal at 107 Haussman Drive Thornton (Firebird ecoSultants Pty Ltd, July 2024).
- Planning proposal (Maitland City Council, Document Revision 13.8.2024)

Key Assessment matters for consideration

1.	***Protection of areas of High Environmental Value***	Remnant vegetation on site has been identified as being of high environmental value providing habitat for, amongst others: • the Threatened Ecological Community Lower Hunter Spotted Gum – Ironbark Forest , Little Lorikeet, Grey-crowned Babbler, Squirrel Glider, Brush-tailed Phascogale, Grey-headed Flying-fox and Greater Broad-nosed Bat • biodiversity corridor connectivity. While the proposal will avoid most of the biodiversity remaining on site, it is recommended that opportunities to strengthen protection of these avoided lands in perpetuity be considered and where possible adopted. **Recommended action(s):** • A C2 Environmental Conservation zone is recommended for areas of high environmental value. • Consider additional planning mechanisms to ensure avoided areas are protected in perpetuity.

2.	***Document consistency***	It is unclear if the BDAR, for example Figures 2 and 4 and Table 9, have considered Asset Protection Zone impacts as shown in Figure 1.1 of the Bushfire Threat Assessment. **Recommended action:** Consider improving consistency between documents, to ensure areas of high environmental value are protected and impacts are accurately identified and offset.

3.	***Consistency with BAM 2020***	Biodiversity assessment plot data does not appear to have been provided as indicated in Appendix H of the BDAR. BCS were also unable to view assessment calculations through the Biodiversity Offset and Agreements Management System (BOAMS). This has made it difficult to review the accuracy of impacts and offsets for example as provided in Table 9 of the BDAR. **Recommended action:** Biodiversity assessment plot data should be included with the BDAR and BAM 2020 calculations provided via BOAMs.

Outlook

RE: Planning Proposal PP-2023-2323 - 107 Haussman Drive, Thornton

From Liam Sultana <liam.sultana@environment.nsw.gov.au>
on behalf of
CPHR RD Hunter Central Coast Mailbox <huntercentralcoast@environment.nsw.gov.au>
Date Mon 12/05/2025 8:13 AM
To Adam Kennedy <Adam.Kennedy@maitland.nsw.gov.au>

Hi Adam,

Thank you for your email to CPHR. CPHR have no comments to make on the new proponents response.

Please let me know if you have any questions or feedback.

Kind regards,

Liam Sultana
A/Coordination and Planning Officer
Hunter Central Coast - Regional Delivery
Conservation Programs, Heritage and Regulation Group
Department of Climate Change, Energy, the Environment and Water

E liam.sultana@environment.nsw.gov.au

NSW GOVERNMENT

From: Adam Kennedy <Adam.Kennedy@maitland.nsw.gov.au>
Sent: Friday, 9 May 2025 11:07 AM
To: Louisa Bulley <louisa.bulley@environment.nsw.gov.au>; CPHR RD Hunter Central Coast Mailbox <huntercentralcoast@environment.nsw.gov.au>
Subject: Re: Planning Proposal PP-2023-2323 - 107 Haussman Drive, Thornton
Importance: High

Good morning,

I tried to call but the call rang out.

Is there a timeframe for when this response will be provided?

The Department of Planning is placing urgency on this, as an alteration request to extend the timeframe of the proposal is being determined today, and evidence is needed that this response is progressing.

Happy to chat over the phone when you receive this,
Regards

Adam Kennedy
Senior Strategic Planner

City Planning

02 4934 9642 | Adam.Kennedy@maitland.nsw.gov.au

maitland
CITY COUNCIL

We acknowledge the Wonnarua People as the Traditional Owners and Custodians of the land within the Maitland Local Government Area.

From: Adam Kennedy
Sent: 01 May 2025 3:29 PM
To: louisa.bulley@environment.nsw.gov.au <louisa.bulley@environment.nsw.gov.au>; BCS RD Hunter Central Coast Mailbox <huntercentralcoast@environment.nsw.gov.au>
Subject: Planning Proposal PP-2023-2323 - 107 Haussman Drive, Thornton

Good morning,

I refer to the abovementioned planning proposal. There has been a delay in responding to DCCEEWs original advice on 26 September 2024 due to change in ownership of the site.

Please see attached the new proponents response to your advice.

Responses to Key Assessment
Key Assessment 1:
Council has considered this advice and undertook a review of landuse within the C2 zone. It was found that the landuse of roads was a prohibited use, which would unintentionally prohibit an emergency access for the site, which was a condition required for NSW RFS. Council acknowledges the high environmental value of the surrounding remnant vegetation, however to ensure there are no unintentional consequences, Council has determined to retain the environmental land as C3 at this time. Council, in near future, will undertake a LGA wide review of C2 and C3 zones to ensure zone and landuse consistency across the City, while enabling better protection for biodiversity corridors. This will include the subject site, which will likely be rezoned to C2 during this review.

Key Assessment 2:
Please see attached the new proponents response to DCCEEW's response.

Key Assessment 3:
Please see attached the biodiversity assessment plot data that was described within Appendix H of the BDAR.

If you require any further information, please contact me.

Regards

Adam Kennedy
Senior Strategic Planner
City Planning

02 4934 9642 | Adam.Kennedy@maitland.nsw.gov.au

maitland
CITY COUNCIL

We acknowledge the Wonnarua People as the Traditional Owners and Custodians of the land within the Maitland Local Government Area.

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Any views expressed in this email are those of the individual sender except where the sender expressly and with authority states them to be the views of the NSW Office of Environment, Energy and Science.

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

Subsidence Advisory

Our Ref: EREZ24-00011
Your Ref: PP-2023-2323
20 September 2024

Adam Kennedy
Senior Strategic Planner – Maitland City Council
adam.kennedy@maitland.nsw.gov.au

Re: PLANNING PROPOSAL FOR 107 HAUSSMAN DRIVE THORNTON

Dear Adam Kennedy,

Thank you for the opportunity to provide comment on the planning proposal for a residential subdivision at 107 Haussman Drive Thornton.

In accordance with the *Coal Mine Subsidence Compensation Act (2017)*, Subsidence Advisory NSW regulates development within mine subsidence districts to help protect homes, buildings and infrastructure from potential subsidence damage.

The site is not within a declared mine subsidence district but is undermined by historical coal mine workings with several mapped mine entries that may pose a subsidence risk to surface development.

Subsidence Advisory does not have any objection to the proposed rezoning and lot size amendments.

As per the recommendations of the Report on Proposed Residential Development, Thornton North, Mine Subsidence Constraints (GHD Ref 2218155/111687, 4 December 2015) further detailed investigations should be undertaken to determine the true extent of mine workings and the risk that the workings pose to the proposed development.

Subsequent to a detailed investigation, a proposal should be developed to eliminate the risk of coal mine subsidence including the risk posed by any shafts and drifts identified.

It is recommended that all geotechnical reports and investigations relating to mine subsidence should be undertaken by a suitably qualified and experienced geotechnical practitioner in accordance with Section 4.4 of the Subsidence Advisory Merit Assessment Policy. Prior to engaging a geotechnical practitioner, the proponent or Council may seek advice directly from Subsidence Advisory to ensure that any studies are undertaken to the appropriate standard.

Subsidence Advisory would be happy to review and provide advice on any future investigations and remediation proposals prepared for the subdivision to ensure that mine entries do not pose a public safety hazard and remediation is completed to the extent that future surface development is not at risk of mine subsidence.

If you have any queries concerning this matter, please contact Senior Risk Engineer, Melanie Fityus via e-mail subsidencedevelopment@customerservice.nsw.gov.au or 4908 4300.

Sincerely,

Melanie Fityus
Senior Risk Engineer

Your Ref: 107 Haussman Dr, Thornton
Our Ref: DOC24/732093-3

The General Manager
Maitland City Council
PO Box 220
MAITLAND NSW 2320

Attention: Adam Kennedy, Senior Strategic Planner

Via the CnR Portal

Dear Adam,

Thank you for providing the NSW Environment Protection Authority (EPA) with the opportunity to comment on the draft planning proposal to rezone land at 107 Haussman Drive, Thornton NSW from RU2 Rural Landscape to R1 General Residential and E2 – Environmental Conservation.

The EPA has reviewed the provided documentation and does not consider that the proposal will impact on matters for which the EPA is the appropriate regulatory authority.

As you may be aware, there are several strategic planning initiatives that could be considered to address potential land-use conflicts or cumulative impacts associated with the proposal, including:

- Zoning land to accommodate land use whilst avoiding land-use conflict, by selecting zones that consider adjacent land uses and ways to deal with their compatibility at the zone edge.
- Using controls in land-use planning instruments such as local environmental plans, development control plans and local strategic planning statements to promote compatibility between industrial and residential zoned land developments.
- Considering the possibility that a previous land use has caused contamination of the site, as well as the potential risk to health or the environment from that contamination. Consideration of contamination at a strategic level provides an opportunity to consider contamination issues early, well in advance of statutory approvals for land use changes.

The EPA has produced guidance material that may assist with applying strategic planning initiatives for this matter, including:

- Noise Guide for Local Government (EPA, 2023) – section 5 provides information on strategic planning and examples of how it can be used by council to promote better noise outcomes.
- Local Government Air Quality Toolkit (EPA) – provides information and guidance on common air quality issues managed by council officers. *Section 6 of module 2: land use planning and appropriate site selection* outlines how planning can be used improve and protect air quality.
- Water policies, guidelines, and programs (EPA) – provides information on water management including a link to NSW Government's risk-based framework for considering waterway health outcomes in strategic land-use planning decisions.

The EPA considers that any change in land use should be supported by information demonstrating that the land is suitable for the proposed use or can be made suitable, either by remediation or by

the way the land is used (see *Managing Land Contamination Planning Guidelines SEPP 55–Remediation of Land* (EPA and Department of Urban Affairs and Planning, 1998)).

Additionally, under section 60 of the *Contaminated Land Management Act 1997*, the EPA must be notified of contamination that meets certain triggers. These are outlined in the *Guidelines on the duty to report contamination under the Contaminated Land Management Act 1997* (EPA, 2015).

If you have any further questions about this issue, please contact Claire McQueeney, Strategic Planning Unit at email environmentprotection.planning@epa.nsw.gov.au.

Yours sincerely

Gabby Sutherland
A/Unit Head – Strategic Planning Unit
Policy & Strategy

20 September 2024

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Yours sincerely

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Transport for NSW

02 October 2024

File No: NTH24/00645/001
Your Ref: PP-2023-2323

General Manager
Maitland City Council
PO Box 220
MAITLAND NSW 2320

Attention: Adam Kennedy

Raymond Terrace Road (MR104): Planning Proposal (PP-2023-2323) to amend Maitland Local Environmental Plan 2011, Lot 2 DP1145, 107 Haussman Drive Thornton

I refer to the abovementioned Planning Proposal referred to Transport for NSW (TfNSW) on 29 August 2024 seeking agency consultation in accordance with Condition 3 of the gateway determination, dated 07 May 2024.

TfNSW key interests are the safety and efficiency of the transport network, the needs of our customers and the integration of land use and transport in accordance with the *Future Transport Strategy*.

Raymond Terrace Road (MR104) is a classified State road and Haussman Drive and all other roads within the site location are local roads. Council is the roads authority for these roads and all other public roads in the area, in accordance with Section 7 of the *Roads Act 1993*.

TfNSW has reviewed the Traffic and Parking Impact Assessment (TPIA) prepared by McLaren Traffic Engineering, dated 08 October 2022; Supplementary Traffic Impact Assessment (TIA) prepared by McLaren Traffic Engineering, dated 24 November 2022 and relevant supporting documentation for the Planning Proposal.

The modelling and subsequent recommendations from the TPIA and TIA are contingent upon the following transport infrastructure improvements, which are not funded for delivery:

- Duplication of Haussman Drive between Taylor Avenue and Raymond Terrace Road;
- Upgrade of Taylor Avenue / Haussman Drive intersection to a dual-lane roundabout;
- Upgrade of Raymond Terrace / Haussman Drive intersection to signal control, including extra lanes; and
- Duplication of Raymond Terrace Road between Haussman Drive and Harvest Boulevarde.

At this time, TfNSW is unable to provide a final response to the agency consultation due to the uncertainty regarding the timeline for delivering these necessary transport infrastructure improvements, which are being relied on to mitigate the impacts of the proposal and facilitate the subsequent release of land.

Further information to support the Planning Proposal is required to identify how the traffic and transport impacts of the proposal can be appropriately mitigated by the developer, in the absence of any funded project.

TfNSW welcomes the opportunity to be involved in future discussions with Council and the proponent to ensure that suitable access arrangements on the classified road network are in place to support the proposal.

Should you require further information please contact Kate Leonard, Development Services Case Officer, on 1300 207 783 or by emailing development.north@transport.nsw.gov.au.

Yours faithfully

Liz Smith
Manager Development Services North
Community & Place
Regional & Outer Metropolitan

Transport for NSW

11 April 2025
File No: NTH24/00645/002
Your Ref: PP-2023-2323

General Manager
Maitland City Council
PO Box 220
MAITLAND NSW 2320

Attention: Adam Kennedy

Raymond Terrace Road (MR104): Planning Proposal (PP-2023-2323) to amend Maitland Local Environmental Plan 2011, Lot 2 DP1145, 107 Haussman Drive Thornton

I refer to the abovementioned Planning Proposal referred to Transport for NSW (TfNSW) on 29 August 2024 seeking agency consultation in accordance with Condition 3 of the gateway determination, dated 7 May 2024, and the Supplementary Traffic Impact Assessment (TIA) referred to TfNSW on 4 March 2025.

TfNSW key interests are the safety and efficiency of the transport network, the needs of our customers and the integration of land use and transport in accordance with the *Future Transport Strategy*.

Raymond Terrace Road (MR104) is a classified State Road and Haussman Drive and all other roads within the site location are local roads. Council is the roads authority for these roads and all other public roads in the area, in accordance with Section 7 of the *Roads Act 1993*.

TfNSW has reviewed the Traffic and Parking Impact Assessment (TPIA) prepared by McLaren Traffic Engineering, dated 08 October 2022; Supplementary Traffic Impact Assessment (TIA) prepared by McLaren Traffic Engineering, dated 24 November 2022 and relevant supporting documentation for the Planning Proposal.

TfNSW is supportive of the Planning Proposal progressing and provides the following comments for consideration:

1. Two options for access off Haussman Drive have been presented. The preferred access option would allow right turns and left turns into the site, and left turns out of the site.

2. It is acknowledged that the alternative access arrangement, being left in/left out only has not accounted for a formalised U-turn facility north of the site. It is therefore recommended that the preferred access option be captured in the future precinct wide Development Control Plan (DCP).

3. The Traffic Impact Assessment identifies existing capacity issues at the intersection of Haussman Drive/Raymond Terrace Road, and that the development will contribute to additional traffic demand.

Consideration should be given to developer contributions towards the future upgrade of this intersection to address the impacts of the proposed development.

4. It is observed that a secondary access point, intended to provide safe emergency ingress and egress, is proposed off Raymond Terrace Road. TfNSW does not support direct access to Raymond Terrace Road, however, would be supportive of this arrangement if it is only to be used in the event of emergency evacuation (e.g. is managed in consultation with the RFS to be locked unless required for evacuation purposes).

Should you require further information please contact Kate Leonard, Development Services Case Officer, on 1300 207 783 or by emailing development.north@transport.nsw.gov.au.

Yours faithfully

Holly Taylor
A/Team Leader Development Services
North Region | Community & Place
Regional & Outer Metropolitan

Our Ref: 6340/TH-01-001/2023

McCloy Project Management Pty Ltd - ACN 613 410 450

6 October 2023

Maitland City Council
285-287 High Street,
Maitland NSW 2320

By Email

Attention: Adam Kennedy

Dear Adam

Re: Planning Proposal PP-2021-2820 to amend Maitland Local Environmental Plan 2011
107 Haussman Drive Thornton

We refer to Council email correspondence dated 12th September 2023 containing the previous Gateway Determination (PP-2021-2820) and supporting Adequacy Assessment letter from the NSW Department of Planning and Environment (DP&E) dated 7th September 2023 requesting some additional information on top of the previously requested and addressed additional information.

The requested additional information from within the Gateway Determination is addressed below.

PP-2021-2820 - Gateway Determination

Condition 1(a)

Noted as satisfactorily addressed for Gateway.

Condition 1(b)

As requested in the previous response from DP&E; McCloy Project Management engaged in discussions with Subsidence Advisory NSW who have provided correspondence in relation to the necessary mitigation requirements.

As Council are aware, there is an approved Development Application (DA17/2593) for a 153 Serviced Self-Contained Dwellings and Associated Community Facilities on the subject site.

As part of that DA assessment, the attached report by GHD was provided with the DA; *Proposed Residential Development – Thornton North Mine Subsidence Constraints*. The report outlines the constraints and the processes/scope for remediation. Council were comfortable to issue approval for the development (physical structures on the site), by providing the condition of consent outlined below.

MINE WORKINGS

20. **Prior to the issue of a Construction Certificate** for Stage 2, the extent of mine workings including depth of cover are to be determined by a detailed *Site Investigation Report* for the purposes of establishing the appropriate treatment of abandoned mine workings, to permit the staged surface residential development for the purposes of this consent including the internal road network and associated utility installations.

The Site Investigation is to include conclusions and recommendations on civil design and building construction standards to ensure that the development will be designed to remain safe, serviceable and repairable in the event of mine subsidence.

The recommendations arising from this *Site Investigation Report* form part of the development consent and are to be incorporated into any relevant construction stage.

We request that Council please seek confirmation that the previous work undertaken by GHD is sufficient to address the request by DP&E for a remediation proposal. It is noted that the development currently approved by Council is far more intense than the proposed residential zoning being sought by this application, which would then be subject of further development applications for subdivision, then subsequent housing; allowing conditions such as that above to be imposed.

Condition 1(c)

Noted as satisfactorily addressed for Gateway.

Hunter Regional Plan 2041

It is understood that Council are addressing this matter. From the applicant's perspective; although our current layout is greater than 8 dwellings per/ha; we are somewhat constrained as Council have endorsed the proposed minimum lot size of 450m2.

Section 9.1 Ministerial direction

Noted as satisfactorily addressed for Gateway.

Consistency of the planning proposal across documentation

We are working on having all relevant documentation updated to reflect the current proposed zoning plan.

Upon confirmation that the supplied information is sufficient to address Condition 1(b) relating to mine subsidence, we will ensure all updated documents for consistency are provided prior to the 30th of October as specified within the letter.

I trust that the responses above are sufficient for DP&E to progress the formal Gateway Determination.

Yours sincerely,

SAM ROWE

Project Director