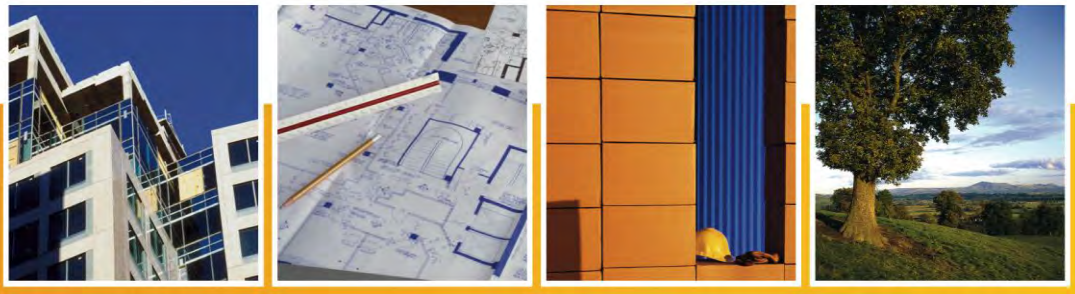
STATEMENT OF ENVIRONMENTAL EFFECTS



For

Staged Integrated Residential Tourist Development

At

Lots 2 - 4 DP 869651 and Lot 11 DP 1187663

Wine Country Drive, Rothbury

Prepared for

Capital Hunter Pty Ltd

September 2016

Report 15/029 - 2

Prepared by

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1.0 INTRODUCTION

1.1 BACKGROUND

HDB Town Planning and Design (HDB) have been engaged by *Capital Hunter Pty Ltd* to design and prepare a Statement of Environmental Effects (SEE) to accompany a Staged Development Application for an integrated residential/tourist development within Lots 2 - 4 DP 869651 and Lot 11 DP 1187663, Wine Country Drive, Rothbury.

This application is made pursuant to the provisions of the Cessnock Local Environmental Plan (LEP) 2011, the Environmental Planning and Assessment Act 1979 (EP& A Act), State Government policies and the statutory and non statutory planning guidelines of Cessnock City Council.

The subject site is situated at the gateway to Cessnock's Vineyard District and opposite 'The Vintage' golf and residential development. Due to its location and characteristics, the site has significant merits in regard to the development of tourism opportunities within the Cessnock Local Government Area. This was recognised through rezoning of the site from RU4 Primary Production Small Lots to Zone SP3 Tourist Zone in August 2014 (Gazette No. LW 22 August 2014) to provide for a variety of tourist-oriented development and activities in conjunction with residential development.

The rezoning also resulted in the nomination of the site as an urban release area under Cessnock Local Environmental Plan 2011.

This Development Application (DA) is submitted as a 'Staged Development Application' pursuant to Section 83B of the EP& A Act seeking consent for:

1 A concept Masterplan for staged development of the site for an integrated tourist/residential development within a golf course; and

2 Stage 1 of the development being Community Title subdivision of the subject site into 4 superlots to establish the boundaries for the various areas proposed on site.

As the development progresses, separate DA's with relevant details will be lodged for future stages as indicated in the Masterplan.

1.2 APPLICATION DETAILS

1.2.1 PROPOSED DEVELOPMENT SITE DESCRIPTION

The development site is described as:

- Lots 2 – 4 DP 869651
- Lot 11 DP 1187663

1.2.2 APPLICANT DETAILS

Capital Hunter Pty Ltd

C/- HDB Town Planning & Design

PO Box 40

Maitland NSW 2320

1.2.3 CONTACT DETAILS

Mathew Egan

HDB Town Planning & Design

PO Box 40

MAITLAND, NSW 2320

PH: 02 4933 6682

FX: 02 4933 6683

E: mathew@hdb.com.au

1.2.4 OWNERSHIP DETAILS

The current owner of the property is:

Capital Hunter Pty Ltd

ABN 44 550 486 790

C/- HDB Town Planning & Design

PO Box 40

Maitland NSW 2320

2.0 SITE ANALYSIS

2.1 LOCATION

Address: Lots 2 - 4 DP 869651, Lot 11 DP 1187663
Wine Country Drive

Local Government: Cessnock LGA

Locality: Rothbury

Area of site: 240 ha

Zone: SP3 Tourist Zone

Figure 1 shows the location of the subject site.

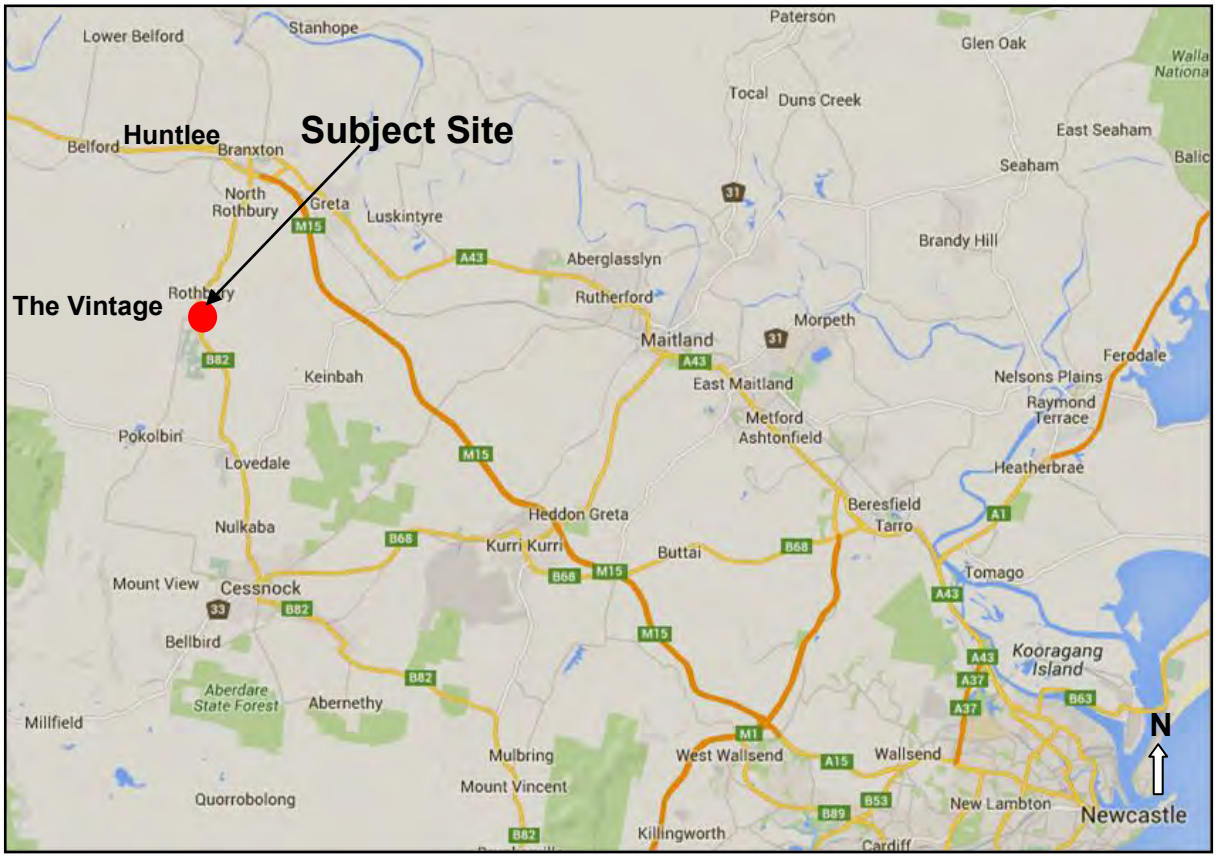


Figure 1 *- Location map*
Source: Google Maps

2.2 EXISTING SITE

The subject site is located approximately 8km south of Branxton and 14km north of Cessnock, opposite the 'The Vintage' on Wine Country Drive. The Huntlee New town development is located 7km to the north of the site.

The site is irregularly shaped with an approximate area of 240ha and is defined by Black Creek to the north and east, and MR220 (Wine Country Drive) to the west. The southern boundary is common with the rear of properties adjoining Wilderness Road.

The property is used for limited grazing. A number of farm dams and drainage lines are scattered throughout the site. The only structures on the site are a brick dwelling, two large silos and some sheds within a fenced area in the northern part of the site.

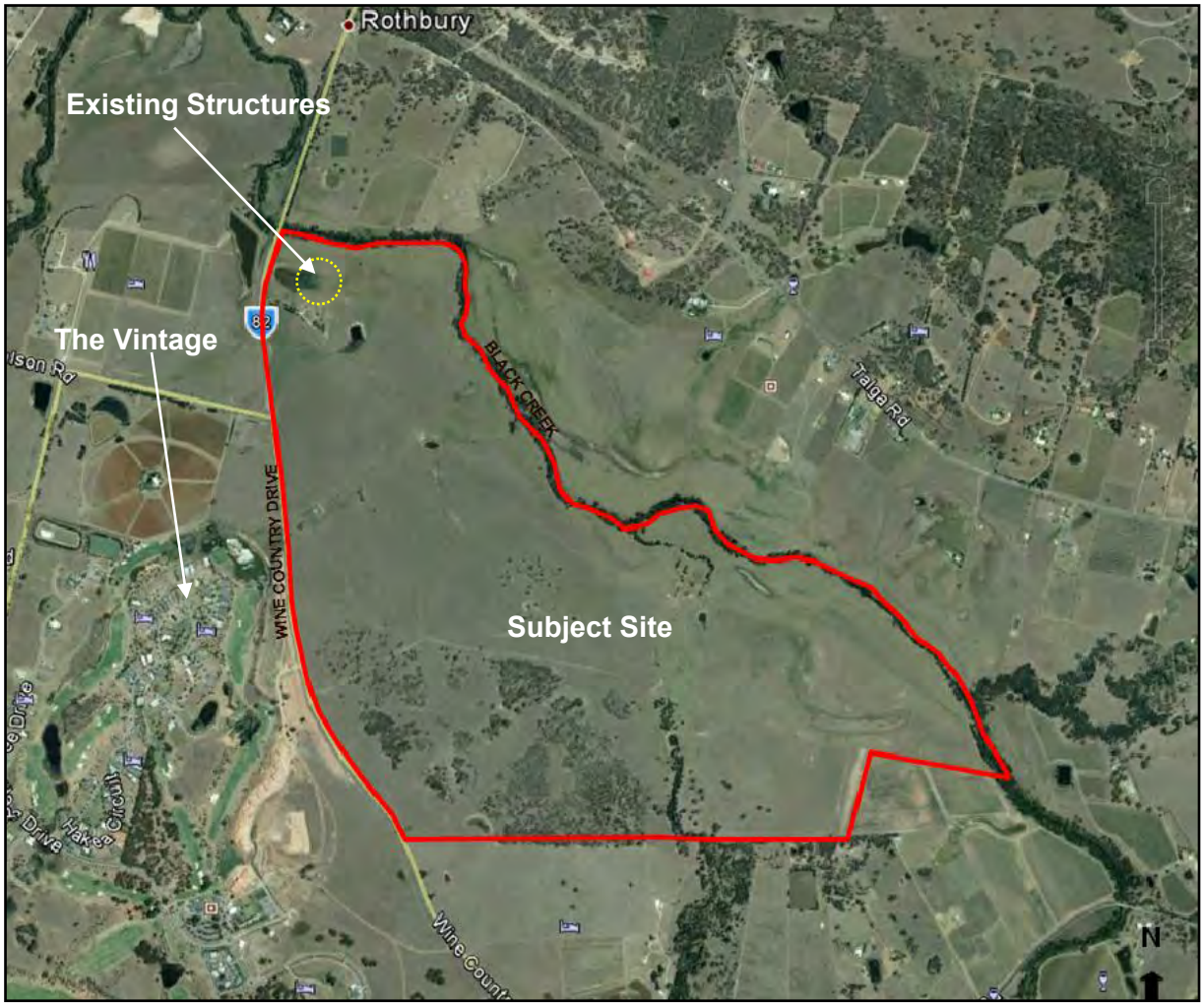


Figure 2 *- Aerial photograph of the Site*
Source: Google Maps

2.3 TOPOGRAPHY

The site largely contains flat alluvial flood plain deposits with established improved grass cover. It slopes gently (less than 4°) from south-west in a north-easterly direction towards Black Creek. The highest point of the site is at RL 62.27m AHD on its south-west boundary and the lowest is at RL 35.88m AHD in the lower reaches of the drainage line in the northern part of the site where it joins Black Creek, refer to the site survey plan in ***Appendix A***.

2.4 HYDROLOGY

The site is traversed by a 3rd order stream located approximately in the centre of the site. This drainage line flows through 'The Vintage' residential and golf course site and has been significantly altered and dammed.

The southern part of the site has a drainage path that drains into Black Creek. This would generally be considered as 3rd order. On the northern part of the site a drainage line flows under MR220 to Black Creek. This drainage line flows through The Vintage development adjoining. The site drains to Black Creek and contains a number of dams scattered throughout, refer to ***Figure 3*** showing the prominent drainage path within the site.

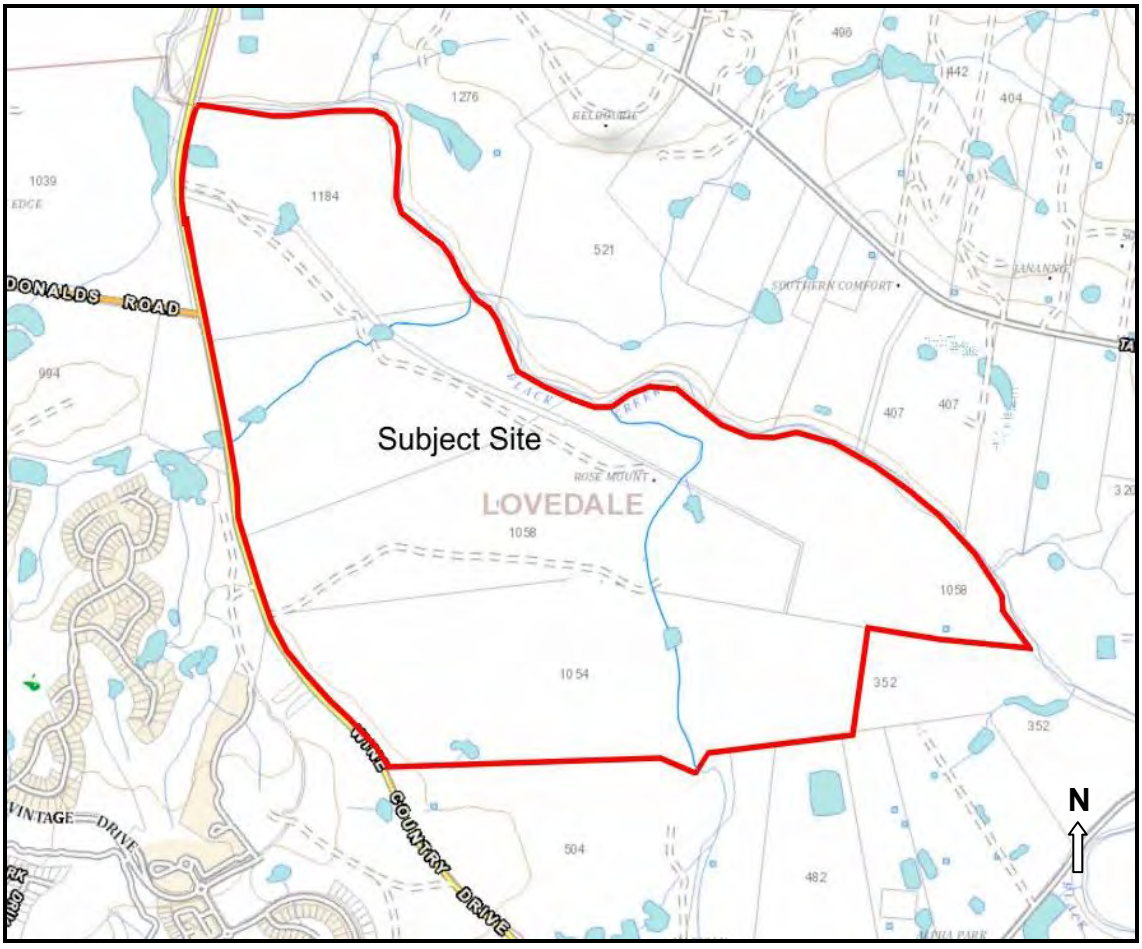


Figure 3 *- Drainage path diagram*
Source: Google Maps

2.5 TRANSPORT

Wine Country Drive is a regional road providing an important link between New England Highway/Hunter Expressway to the north and Cessnock to the south. It has a single lane of travel in each direction with a speed limit of 90 km/hr in the vicinity of the subject site. There are no kerbs or gutters along this stretch of the road. This recently widened 8m wide paved carriageway does not have any formal footpaths or cycleways along the site frontage.

There is limited access to public transport in the locality apart from school buses and those operated by wine tour companies. The closest railway station is at Branxton which is 8.5 kms from the site.

There are two access points to the site, the one to the north servicing the existing dwelling and a second entry point located further to the south.

The proposed future entry to the 'The Vintage' development is located onto Wine Country Drive approximately 100 m south of the southern entry.

2.6 FLORA & FAUNA

The site is generally cleared except for the riparian areas and the south-western part of the site containing scattered patches of native vegetation. These highly disturbed stands of remanent vegetation are largely regrowth with no connectivity to larger habitat areas.

A Flora and Fauna Assessment was undertaken by RPS at the Planning Proposal stage in 2013 which identified (4) vegetation communities, including two Endangered Ecological Communities (EECs) amongst the remanent vegetation as listed below (see ***Appendix B***):

- Central Hunter Ironbark Spotted Gum Ironbark Forest (EEC);
- Central Hunter Riparian forest (EEC);
- Casuarina glauca Woodland; and
- Open Melaleuca decora stand.

As a result of the agricultural activities in the past, these stands of vegetation were found to be in varying levels of degradation as indicated in the mapping provided by RPS in ***Figure 4*** (see ***Appendix B*** for details).

Twenty three (23) threatened fauna species and three (3) flora species listed under the Threatened Species Conservation Act 1993 were noted as having the potential to occur or have known habitat within the site. One threatened flora species, Eucalyptus glaucina was identified on site.

Five (5) threatened fauna species and two (2) threatened flora species listed under the Environmental Protection and Biodiversity Conservation Act 1999 were assessed as having the potential to occur on the site, or the site could support preferred habitat for the species.

The site was considered to have low habitat value due to lack of variably sized hollows, few understorey shrubs, limited woody debris and rocks, and grazing by cattle over an extended period.

The Flora and Fauna Assessment by RPS concluded that the proposed development was unlikely to have any impact on the flora and fauna significance of the site.

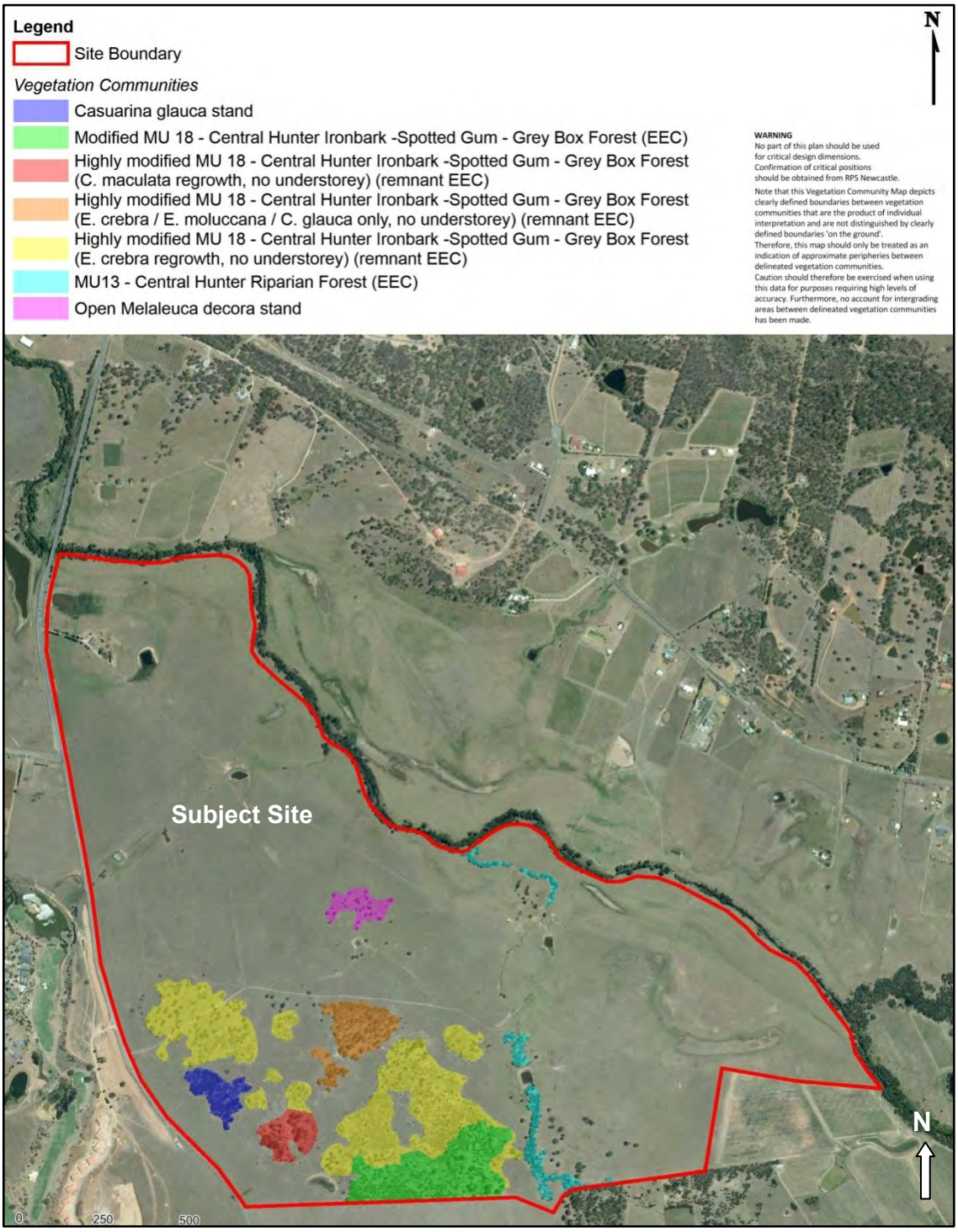


Figure 4 *- Vegetation communities on the Site*
Source: Flora and Fauna Assessment by RPS (2013)

MJD Environmental Pty Ltd (MJD) was engaged to provide an update on the earlier assessment with due regard to the changes in the concept Masterplan and the recent listings under the EPBC Act (Environmental Protection and Biodiversity Conservation Act). A copy of the ecological update is attached as ***Appendix C***.

The study generally supports the recommendations set forth in the RPS report and provides the following additional comments with regard to the proposal:

- Two additional hollow bearing trees were identified onsite which shall be retained under the revised concept plan;
- Assessment under TSC and EPBC Act determined that all additional threatened and migratory species were not likely to be impacted by the proposal. However, despite the highly modified nature of Central Hunter Valley Eucalypt Forest and Woodland on site coupled with the intended rehabilitation, the remnant patches satisfy the moderate condition criteria and therefore meet the minimum thresholds for further assessment via referral under the EPBC Act.

It should be noted that the Ecologist who carried out the survey for MJD in 2016 was the same Ecologist who prepared the original survey for RPS in 2013.

2.7 SITE IMPROVEMENTS

An unoccupied dwelling and associated infrastructure exist in the northern part of the site. The site currently has minimal grazing activities. Post and wire fencing runs along the western boundary of the site.

2.8 ARCHAEOLOGY & HERITAGE

The site has had a number of Archaeological Studies carried out on it since 2004. The Aboriginal items that have been identified are to be preserved in situ and a buffer will be created around them. In addition a transect has been established through the site from north to south in which no construction, other than roads, services and turf / golf course will take place. This will allow for further investigation as may be required in the future.

Discussion has taken place with the Office of Environment and Heritage (OEH) and Mindaribba Aboriginal Land Council to establish an agreement. A draft Management Plan to guide the future development of the site has been prepared. This is currently being finalised and as the proposed Stage 1 DA and Masterplan do not involve any planned works it is proposed to have this in place prior to Stage 2. A copy of the agreement is attached in ***Appendix D***.

2.9 SERVICES TO SITE

Electricity and gas connections can be extended to the development from existing resources in the vicinity of the site. NBN services are available in the area and arrangements will be made for its extension. The subject site is located on the periphery of Hunter Water Corporation's water supply network and has limited capacity to service the development. Similarly the site is in the catchment of Cessnock Waste Water Treatment Works but cannot be serviced from the existing infrastructure due to limited capacity. As a result servicing strategies have been developed for reticulated water and sewer which are discussed later in this report.

2.10 SURROUNDING LAND USE

To the west of the site is 'The Vintage', an integrated tourist/residential development in a similar vein to that proposed on this site. The land uses to the north, south and east are generally characterised by rural lands and vineyards interspersed with hotels and other tourism related activities. The Huntlee New Town development is located approximately 7km to the north of the site.

2.11 FLOODING

The eastern part of the site being along the bank of Black Creek is affected by flooding. The recent Flood Study by Council lead to a change in the 1in 100 year flood levels on the property, mainly increasing flood extent areas in the northern and south-eastern parts of the site.

The Masterplan has been revised from that proposed in the rezoning to ensure all habitable spaces are able to meet Council's flood planning levels. Correspondence with Council on this matter is attached in ***Appendix E***. ***Figure 5*** shows the peak flood levels and depths on the property during a 1% AEP event.

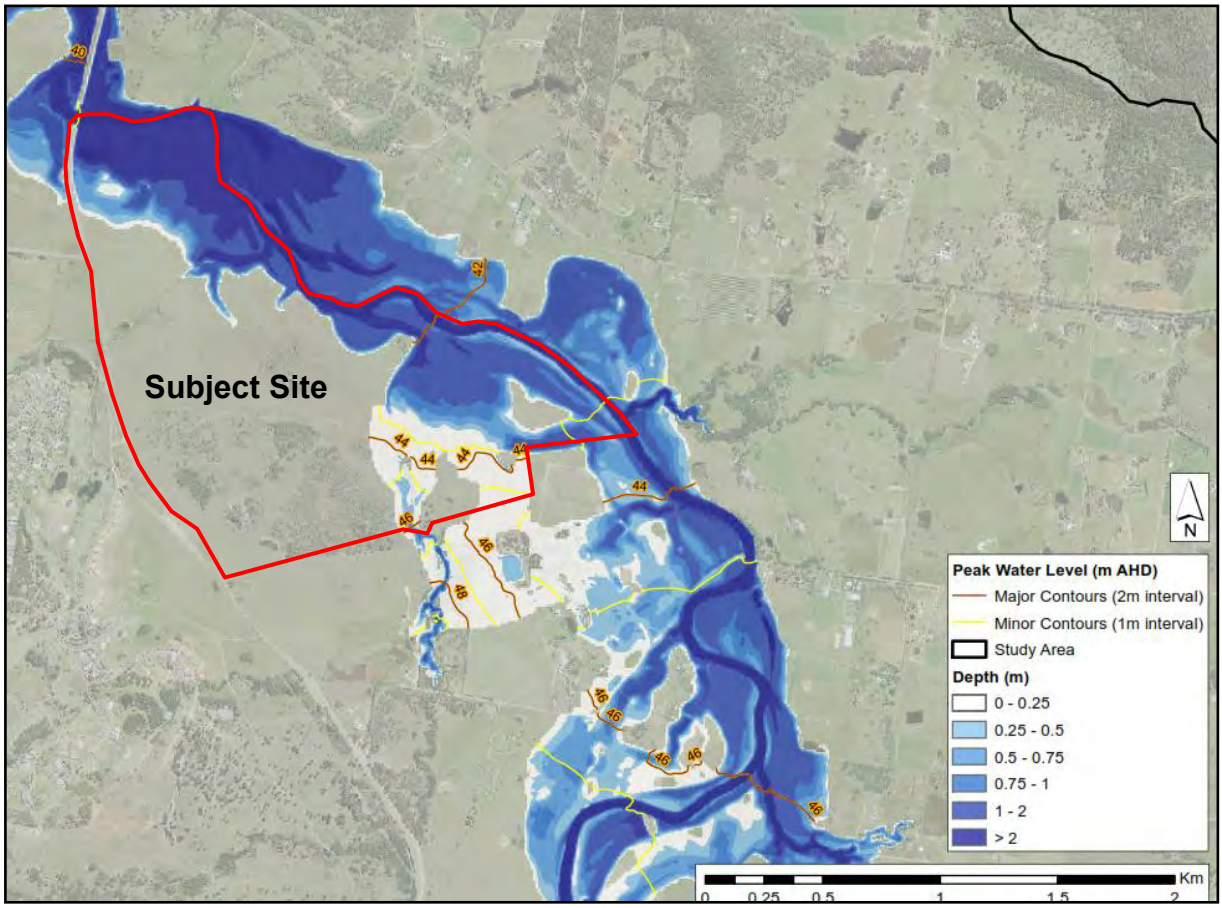


Figure 5 *- Peak flood levels and depths - Black Creek catchment (1% AEP event)*
Source: Draft Black Creek Flood Study - Stage 2 (Nulkaba to Branxton) by WMA Water

2.12 SALINITY

Council's mapping does not indicate the site to be affected by acid sulphate soils. However, the Catchment Management Authority (CMA), in their letter of advice at the rezoning stage, indicated that the site is within Black Creek catchment which is a recognised salinity sub-catchment containing occurrences of urban, dryland and stream salinity. The median electrical conductivity of Black Creek in this area is measured to be 1500EC units, suggesting the risks associated with long term irrigation. To further add to these risks is the soil type within the site which has the potential to retain water in poorly drained areas when there is excessive watering. As per the recommendations of CMA, site investigations and development design should therefore give due consideration to the guidelines and recommendation of the following documentation:

- Site investigations for urban salinity (DLWC 2002);
- Land Use Planning and Urban Salinity (DIPNR 2005);
- Other relevant guidelines under the Local Government Salinity Initiative NSW.

Based on these investigations a Salinity Management Plan shall be prepared which identifies the practices necessary to mitigate the salinity risks and provides for an ongoing Salinity Management Program. This will be undertaken as part of the DA for Stage 2, when actual works are proposed to commence.

2.13 BUSHFIRE

The south-west part of the site, together with northern and eastern boundaries, are identified as bushfire prone land containing Vegetation Categories 1 & 2 and bushfire buffer areas as shown in ***Figure 6***. A Bushfire Threat Assessment for the proposal undertaken by *HDB Town Planning and Design* is attached as ***Appendix F***.

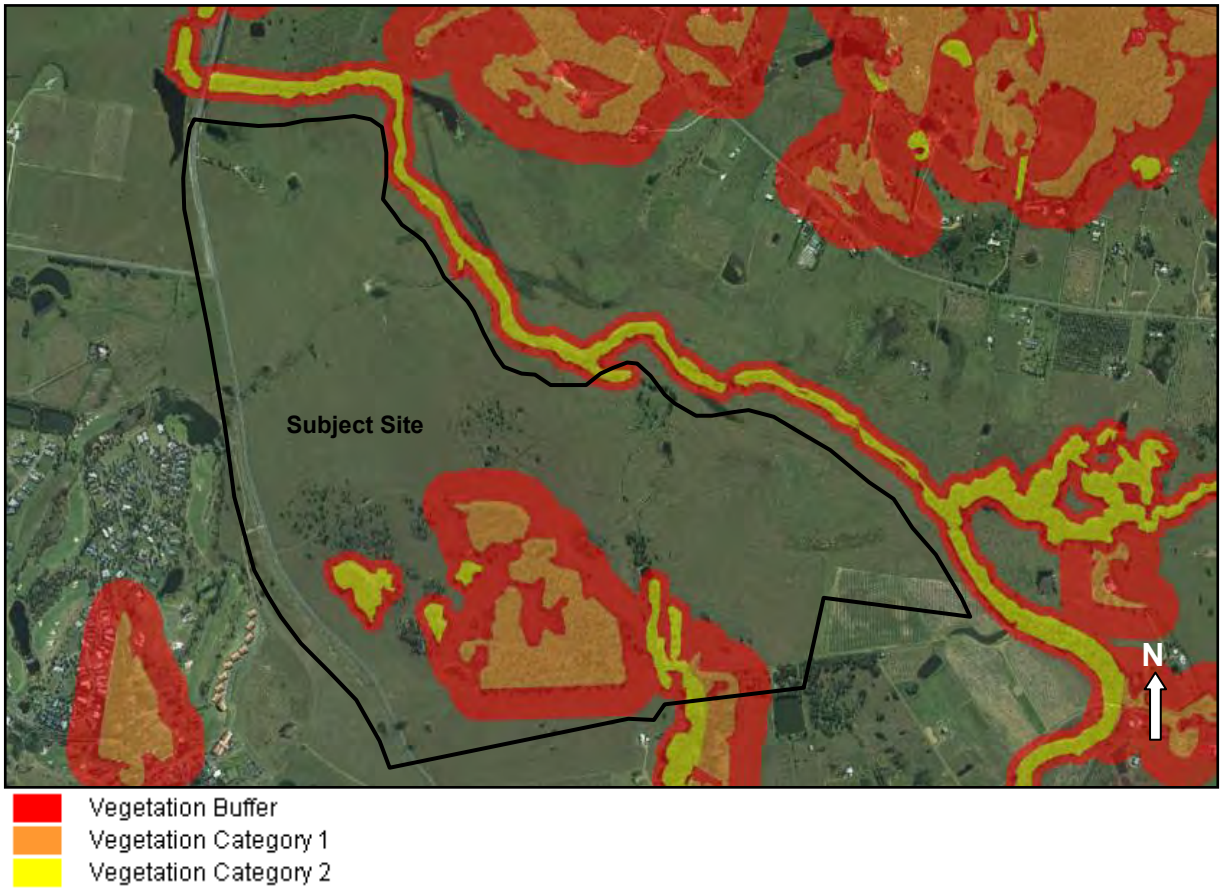


Figure 6 *- Bushfire map*
Source: Cessnock City Council

3.0 PROPOSED DEVELOPMENT

This application seeks Council support for:

1 A staged development of the site as presented in the attached Concept and Management Plan (***Appendix G***) and represented in ***Figure 8***.

2 Development Consent for Stage 1 consisting of the Community Title subdivision of the site into four (4) superlots. Refer to ***Figure 7*** below and ***Appendix H***.

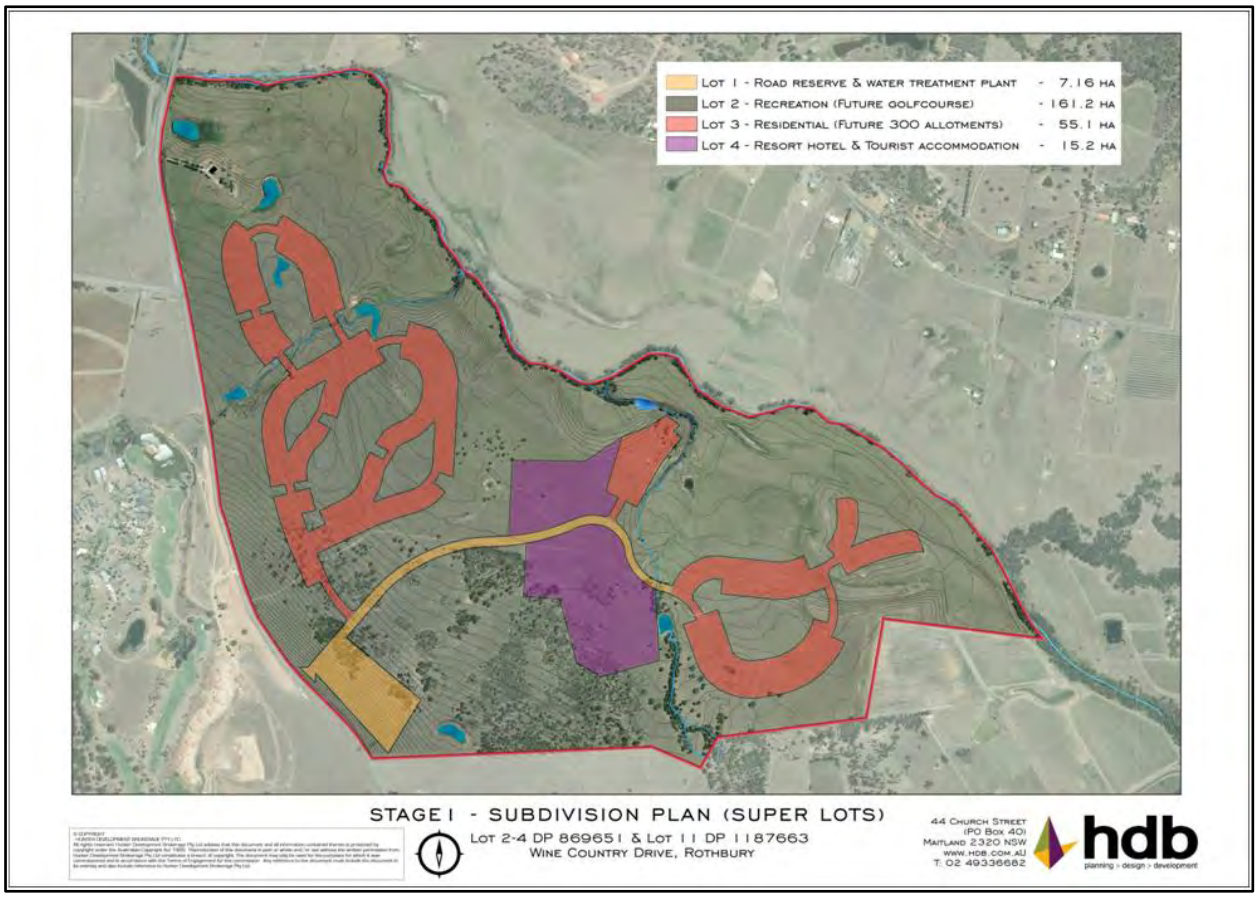


Figure 7 *- Stage 1 Subdivision plan (refer to* ***Appendix H*** *for enlarged copy)*
Source: HDB Town Planning and Design

This DA is not subject to a deferred commencement condition nor does it trigger any designated development requirements under Schedule 3 of the Act. However it is submitted as an integrated development seeking concurrence from the following authorities for the reasons listed below:

- Rural Fire Service as the development is proposed on bushfire affected land;
- NSW Office of Water as some of the works encroach into waterfront land; and
- Road and Maritime Services for construction of access to Wine Country Drive.

Figure 8 *- Concept Masterplan (refer to* ***Appendix G*** *for enlarged copy)*
Source: HDB Town Planning and Design

3.1 THE CONCEPT MASTERPLAN

3.1.1 VISION

"To develop a new major tourist attraction at the gateway of the Vineyard District through the establishment of a world-class 18 hole signature golf course, 5 star resort and architecturally designed residential development of international standard, that both brings together and drives top-end accommodation and recreational facilities, within the rural environment of the Lower Hunter Region."

3.1.2 DETAILS

The proposal constitutes an 'integrated residential/tourist development' which provides a variety of interdependent tourist-oriented development and uses within the SP3 Tourist Zone.

Once fully developed, the Masterplanned site will contain:

- Eighteen (18) hole signature golf course built to international standards and associated clubhouse that will meet the stringent code of the Australian Open, and potentially provide the facilities for a Golf Academy servicing South East Asia;
- A five (5) star fifty (50) room hotel;
- Short stay tourist villas (250);
- Public function, retail and food outlet centre with the capacity for state-of-the-art conferencing, telecommunications, tourism programs, and interpretive centre for the locality's natural and cultural heritage, and history of the wine industry;
- Sports, recreation and health spa resort, including swimming, tennis and gymnasium;
- Sustainable golf course management, landscaping, bush regeneration;
- Three hundred (300) long stay/permanent residences in three (3) specialised precincts, managed under Community Title regulations.
- Aboriginal Heritage Centre to exhibit artefacts that may be found on site and provide a building for the display of art and the sale of artefacts, and a base for tour operations, in agreement with the local aboriginal land council.

The agreed 50/50 split of tourist to permanent accommodation units will be designed and located within the resort to provide views over the course and to the surrounding vineyards and mountain ranges.

The development will be under a Community Title scheme with the buildings and all landscaping throughout the development conforming to a set style and quality of design, integrated into, and intimately associated with, the golf course.

The access to the site from Wine Country Drive will be aligned with that proposed for 'The Vintage' to facilitate the future construction of a roundabout that services both these sites. The main road to the development will connect with the hotel and central facilities. A network of internal roads off this main access will service the various precincts located throughout the site.

An onsite waste water system will be installed to collect, treat and reuse waste water from the site. In addition potable water will be sourced from Hunter Water Corporations main and held in an onsite reservoir for distribution.

Non-potable water to service the golf course will be sourced from both the recycled supply onsite and either from the PID system or Cessnock waste water treatment system via a pipeline to the site.

The future development of the site will include fairways, greens, lawns, managed grasslands and landscaped areas. The perimeter of the site and drainage lines will be enhanced through revegetation and the riparian areas along Black Creek will remain undisturbed. To reduce bushfire risks, the landscaping for the site will be undertaken in accordance with the guidelines of the accompanying Bushfire Threat Assessment.

3.2 STAGING

The development is planned in 7 stages, as demonstrated in ***Figures 7***, ***9***, ***10*** & ***11***.

3.2.1 PROPOSED STAGE 1 DEVELOPMENT

Stage 1 of the development involves subdivision of the site into four (4) superlots (refer ***Figure 7*** and ***Appendix H***), details provided in ***Table 1***, below. Proposed Lots 3 and 4 will be further subdivided in future Development Applications to accommodate thee hundred (300) single dwelling units and hotel and tourist accommodation with associated sporting/recreational facilities respectively.

A water treatment plant, services and roads will be established on Lot 1 in the future and the remainder of the subject site, being Lot 2, would contain the 18 hole Golf Course which will be constructed and managed to international standards. Further land set aside for environmental use will be held and maintained in Lot 2 (refer to ***Appendix G***).

Proposed Lots	Area	Intended future use
1	7.16 ha	Access and Services
2	161.21 ha	Superlot for recreation/golf course
3	55.10 ha	Superlot for 300 residential lots
4	15.15 ha	Superlot for 250 tourist villas, clubhouse and motel (50 rooms)
Total	**238.63 ha**	

Table 1 *- Details of Stage 1 Subdivision*

3.2.2 PROPOSED STAGE 2 DEVELOPMENT

Proposed Stage 2 (refer ***Figure 9***) will consist of:

- Construction of the Jack Nicklaus golf course (18 holes) and implementation of landscaping and environmental offsets;
- Install service connections to site;
- Potable water;
- Grey water;
- Electricity;
- Establish water quality control; and
- Construct temporary access to Wine Country Drive.

Figure 9 *- Stage 2 Subdivision plan*
Source: HDB Town Planning and Design

3.2.3 PROPOSED STAGE 3 DEVELOPMENT

Proposed Stage 3 (refer ***Figure 10***) will consist of:

- Construction of access roads to service Lots 303, 304 and 401;
- Extend services to each lot;
- Construct fifty (50) room five (5) star hotel complex and support tourism infrastructure including restaurant, club room and pro shop on Lot 401; and
- Construct fifty (50) residential lots and dwellings, twenty five (25) on Lot 303 and twenty five (25) on Lot 304.

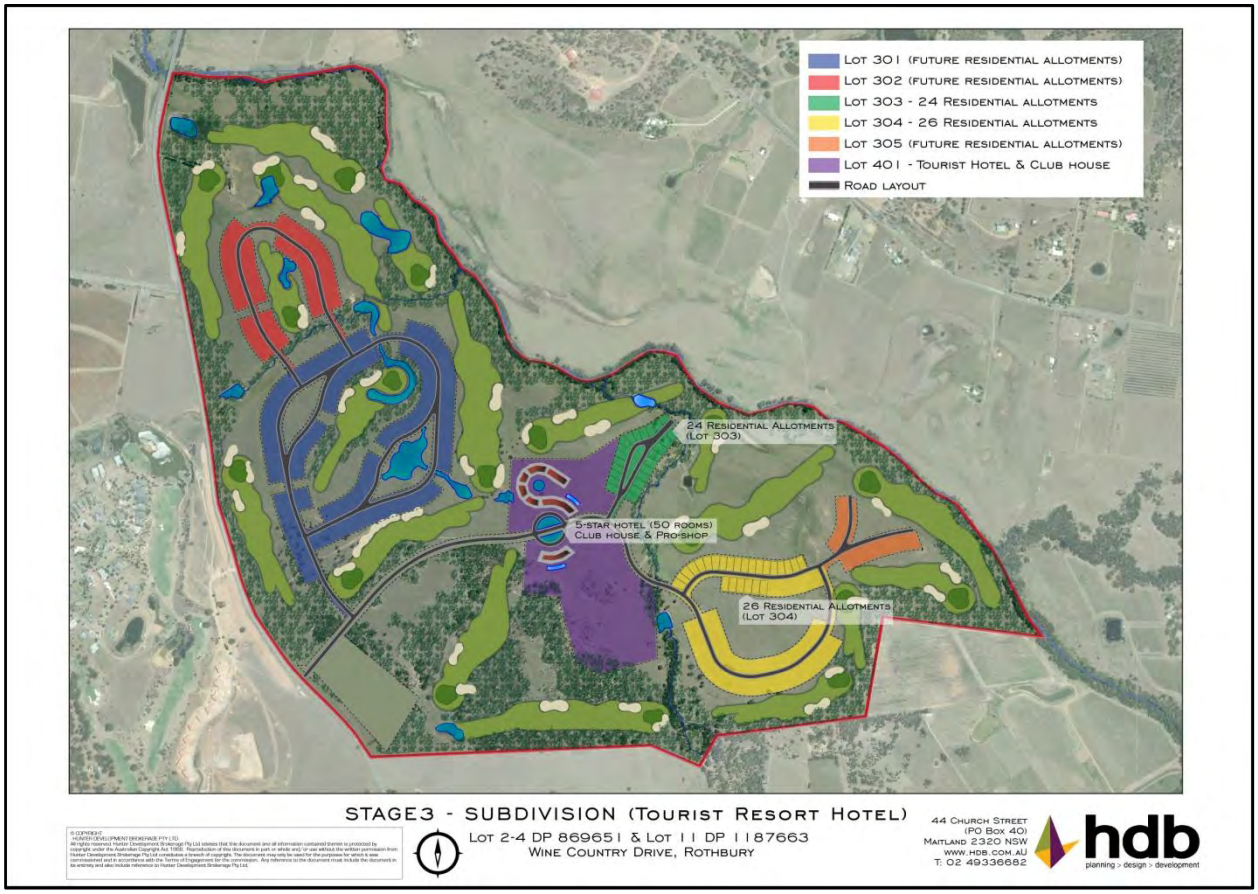


Figure 10 *- Stage 3 Subdivision plan*
Source: HDB Town Planning and Design

3.2.4 PROPOSED STAGE 4, 5, 6 & 7 DEVELOPMENT

Proposed Stage 4 will consist of the construction of:

- 70 villa units and supporting infrastructure such as day spa, swimming pool etc on Lot 402; and
- 70 residential lots and dwellings on Lots 304 and 304.

Proposed Stage 5 will consist of the construction of:

- 65 villa units and supporting infrastructure such as day spa, swimming pool etc on Lot 402; and
- 65 residential lots and dwellings on Lots 301.

Proposed Stage 6 will consist of the construction of:

- 60 villa units and supporting infrastructure such as day spa, swimming pool etc on Lot 402; and
- 60 residential lots and dwellings on Lots 301.

Proposed Stage 7 will consist of the construction of:

- 55 villa units and supporting infrastructure such as day spa, swimming pool etc on Lot 402; and
- 55 residential lots and dwellings on Lots 301.

Refer to ***Figure 11*** for Stage 4, 5, 6 and 7 subdivision plan.

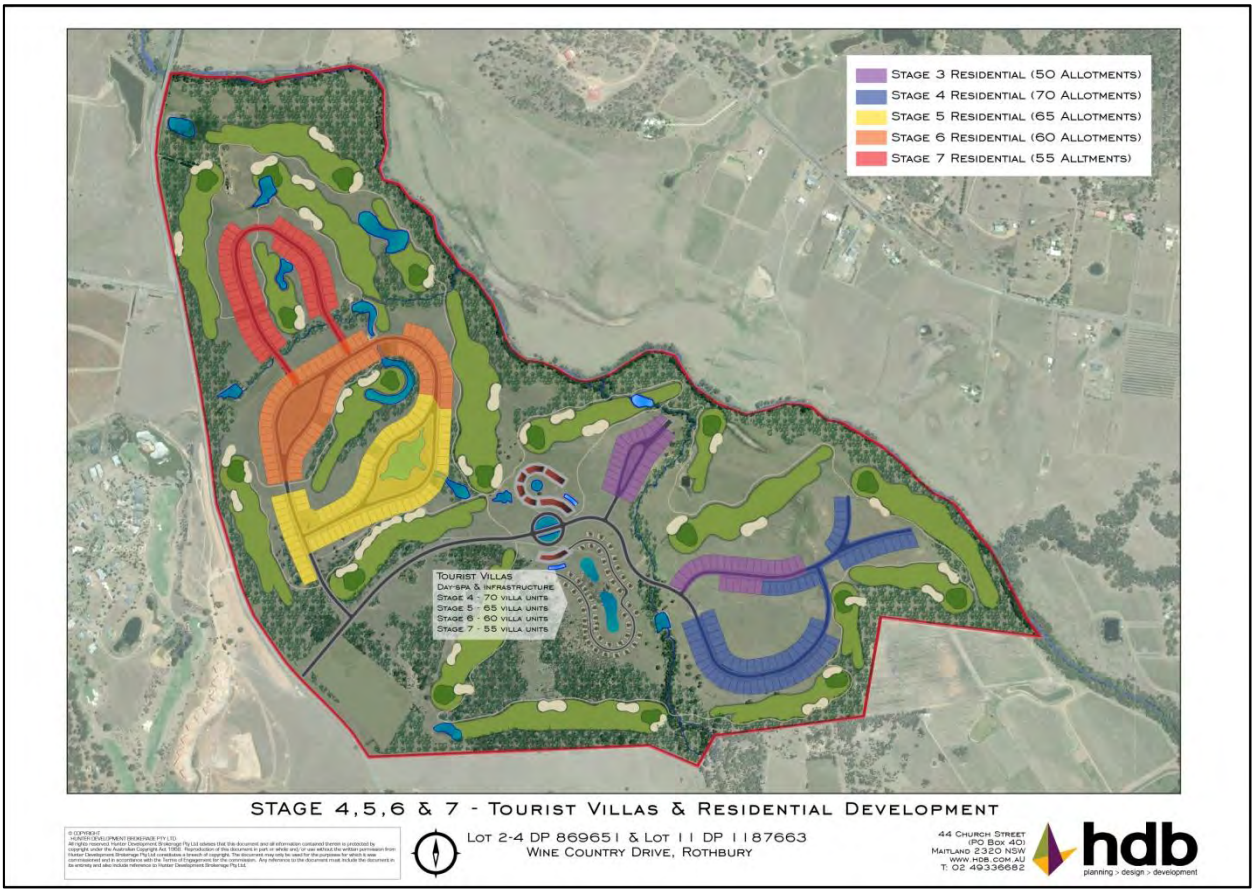


Figure 11 *- Stage 4, 5, 6 & 7 Subdivision plan*
Source: HDB Town Planning and Design

3.3 STAGED DEVELOPMENT CONSENT

This proposed development is a staged development pursuant to Division 2A of the Act. As provided for by Section 83B of the EP&A Act, consent is sought for:

- A Concept and Management Plan for the development of the site in 7 stages (***Appendix G***);
- Stage 1 of the development, being a 4 superlot subdivision (***Appendix H***), to be subject to future Development Application.

Pursuant to Section 83B(2) of the Act, a formal request is hereby made for this application to be treated as a 'Staged Development Application' and documented as provided for under Clause 70A of the Regulations which allows information required as part of future stages of the staged Development Application to be deferred to a later stage.

3.4 SUBDIVISION PRINCIPLES

Subdivision of the site will be under the Community Title legislation and all roads and services onsite will be largely owned and controlled by the community body. The major owner will be the golf course and resort corporation while the other three hundred (300) single dwellings will also have input into the operation,

At this stage a Draft Community Management Statement only is available. This Draft Statement will be subject to alterations and review as the ownership details and detail designs for each site become more apparent (refer ***Appendix S***).

3.5 CONSULTATION

The details of consultation with various authorities are summarised in ***Table 2***, below.

Authority	Method of consultation	Comments
Cessnock City Council, Roads and Maritime Services (RMS)	A meeting held with Council, RMS and Stevens Group at the Council Building on 3/9/2015. Meeting held on 8/9/2015 to discuss the DA.	This meeting was organised to discuss a potential roundabout on Wine Country Drive for access to the 'The Vintage' and the subject site as indicated in the 2005 DCP. RMS had previously reviewed the concept design as part of the rezoning and confirmed that it met the standards. It was however noted that standards have changed since 2005 and the specific design of the intersection will need to be reassessed by the RMS (refer to ***Appendix J***). In a separate meeting held between HDB and Council to discuss the DA, no issues were flagged in regard to the proposal.
Hunter Water	An application for developer services lodged with Hunter Water in November 2015.	Notice of formal requirements from Hunter Water is attached in ***Appendix J***.
Hunter Wine Country P I D	Email enquiry to the Operation Manager, Ken Bray, on 6/11/2015 about spare units in the PID system for use on the site.	Ken Bray in his response email advised that Hunter Wine Country PID presently has allocation available to be transferred to the proponent when required (refer to ***Appendix J***).
Ausgrid	Email enquiry	Response letter from Ausgrid is attached in ***Appendix J***.

Table 2 *- Details of Consultation with Various Authorities*

4.0 LEGISLATIVE CONSIDERATION

4.1 STRATEGIC PLANNING FRAMEWORK

4.1.1 INTRODUCTION

The strategic planning framework plays a vital role in informing the content of statutory planning instruments at regional, sub-regional and local levels. The guidelines and requirements of the strategies/legislations that have been reviewed in framing this proposal are discussed in this section.

4.1.2 REGIONAL STRATEGIES

Lower hunter regional strategy - 2006-31

The Lower Hunter Regional Development Strategy was developed to guide the region's growth by identifying future development areas, principal land use types, settlement patterns and conservation outcomes. In particular the strategy will:

- Ensure that sufficient employment lands are available to cater for 66,000 new jobs;
- Plan for an additional 160,000 residents and 115,000 new dwellings;
- Establish important green corridors, to protect and even enhance the Region's strong environmental and biodiversity assets; and
- Reinforce the role of the Newcastle city centre as the regional city.

The Cessnock vineyard district is a major tourist icon for the Lower Hunter Region which attracts other complementary development to the area, such as golf related tourism. The vineyard district has the opportunity to become a nucleus for quality golf courses. These include the Greg Norman designed "The Vintage" golf course, which adjoins the site, Cypress Lakes and now the proposed development on the subject site.

This development is not inconsistent with the vision expressed in the Lower Hunter Regional Strategy in that it will provide for a specific housing market and create an employment source that will continue long into the future as well as include self funded infrastructure and be designed to protect and enhance the environmental and ecological values of the site. Although the Strategy does not identify the site as a 'release area' other release sites not currently identified within the Strategy may be considered if it can be demonstrated that the proposal satisfies the Sustainability Criteria outlined in Appendix 1 of the Strategy. The site's capability to meet the threshold development criteria was demonstrated to Council at the planning proposal stage and was subsequently recognised through its rezoning to SP3 Tourist Zone under Amendment No.10 to Cessnock LEP, gazetted on 22 August 2014 (Gazette No. LW 22 August 2014).

Draft Hunter Regional Plan - 2016-36

The Draft Hunter Regional Plan provides an overarching framework to guide the development and investment in the Hunter Region to 2036. This document is currently on exhibition. Once finalised it will replace the regional strategies for Upper Hunter, Lower Hunter and Mid North Coast Regions providing

consolidated strategic planning considerations for the eleven (11) Local Government areas within these regions. It prioritises the growth and diversification of the Hunter economy so that it remains one of the most productive regional economies in Australia, and sets out the following goals:

- *Goal 1: Grow Australia's next major city;*
- *Goal 2: Grow the largest regional economy in Australia;*
- *Goal 3: Protect and connect natural environments;*
- *Goal 4: Support robust regional communities.*

The subject site lies at the interface of Hunter City and its surrounding landscape subregions and is identified as the hinterland in the Draft Hunter Regional Plan. This area will be influenced by its proximity to activities in Hunter City (and Cessnock) resulting in an increased demand for housing and visitor accommodation and recreational opportunities. Page 79 of the Draft Hunter Regional Plan states:

> *"As Hunter City and Cessnock grow, the hinterland will become an increasingly popular lifestyle destination, with towns, villages and surrounding rural areas subject to greater demand for new housing, including visitor accommodation, and associated infrastructure. Balancing growth in rural and resource areas will continue to be a challenge."*

The proposal addresses the challenges identified in the strategy in that it provides unique lifestyle choices, tourist accommodation and recreational opportunities that support the rapidly expanding Hunter City Metropolitan Area and other urban areas in its proximity, and abroad.

4.1.3 LOCAL STRATEGIES

Cessnock City Wide Settlement Strategy

According to Council's City Wide Settlement Strategy ('The Strategy') an additional +21,700 dwellings are targeted for Cessnock LGA to 2031, equivalent to approximately +870 dwellings per annum over the period of study (2007 – 2031). The 'Pokolbin vineyard and tourism precinct' is acknowledged in the Strategy as comprising a 'Specialised Centre' in the Lower Hunter commercial centres hierarchy with a target for +1,600 additional jobs by 2031. In relation to tourism, the Strategy recognises that the Hunter Region "is one of the most important markets for national and international tourism in NSW" and is the most popular tourist destination outside of Sydney.

The vineyards in the Lower Hunter, and the adjoining areas of the Upper Hunter, are in turn the single most important tourist attraction in the Hunter Valley. Section 11.3.3 of the Strategy is titled *"Permanent Residential Occupation As Part Of Major Tourist Development"*. It recognises the need to protect highly valued agricultural lands, such as the former Vineyards District, from encroachment by residential uses. The Strategy thus distinguishes between this specialised centre and other centres in the LGA by not allocating any dwelling targets.

This development is an integrated tourist development of international focus and while it includes 300 dwellings, it remains focussed on tourism with an equivalent number of tourist accommodation units and is located so as not to impact adversely on the vineyards. This has been accepted as evidenced by the support of the recent rezoning to allow the development to proceed.

4.2 STATUTORY PLANNING FRAMEWORK

4.2.1 INTRODUCTION

The statutory planning framework provides the legislative guidelines for regulating development at state, regional and local levels.

The scale of the proposed development and the type of activities that will be undertaken on the site do not trigger any designated development criteria as listed in Schedule 3 of the EP & A Regulation 2000.

The capital investment values for Stage 1 of the proposed development are below the threshold values specified in schedule 1 & 3 of State Environmental Planning Policy (State and Regional Development) 2011 and therefore it is not considered to be a state significant development. As such this DA is submitted to Cessnock City Council for approval under Part 4 of the Act.

4.2.2 ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979 (THE ACT)

The Environmental Planning and Assessment Act (the Act) provides the overarching statutory framework for planning in NSW.

The objectives of this Act are:

a) *To encourage:*

   i. *The proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment;*

   ii. *The promotion and co-ordination of the orderly and economic use and development of land;*

   iii. *The protection, provision and co-ordination of communication and utility services;*

   iv. *The provision of land for public purposes;*

   v. *The provision and co-ordination of community services and facilities;*

   vi. *The protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats;*

   vii. *Ecologically sustainable development; and*

   viii. *The provision and maintenance of affordable housing.*

Comment:

The proposal provides for tourism, housing, employment and recreational opportunities on a degraded parcel of land that is not suitable for any viable agricultural activity.

The concept Masterplan demonstrates an orderly development that safeguards the flora and fauna values of the site through revegetation and enhancement of remanent communities. The most effective means for the provision of utility infrastructure have been developed through servicing strategies to ensure that the site is capable of supporting the development without depleting the existing resources or environmental quality. The development is therefore considered consistent with the objectives of the Act.

Section 91 - Integrated development

In accordance with Section 91 of the Environmental Planning & Assessment Act 1979, the proposal is considered integrated development as it will require referral to the following authorities under the legislations as listed below:

- Roads Act 1993 – Section 100B authorisation for construction of the roundabout/intersection on Wine Country Drive for access to the subject site in the future.
- Rural Fires Act 1997 – Section 100B authorisation for the subdivision as part of the site is identified as being Bushfire Prone Land.
- Water Management Act 2000 – Section 91 activity approval for road works on waterfront land within the site.

Comment:

A Bushfire Threat Assessment has been undertaken for submission to RFS. The concept Masterplan indicates creek crossings and areas where the proposed works are on waterfront land. Therefore appropriate documents and payments accompany this DA to enable the referral and assessment of the application by the relevant State Government agencies.

4.2.3 STATE ENVIRONMENTAL PLANNING POLICIES

The State Environmental Planning Policies contain planning controls for certain areas or type of development and they also specify the development assessment system that may be applicable to the proposal.

There is no existing or draft SEPP's that prohibits or restricts the proposed development as outlined in this proposal. An assessment of relevant SEPP's against the development proposal is provided in ***Table 3*** below.

SEPP	Relevance	Consistency and Implications
SEPP 21 - Caravan Parks	Provides for development for caravan parks.	Not applicable.
SEPP 22 - Shops and Commercial Premises	Provides for the change of use of commercial premises.	Nothing in this DA affects the aims and provisions of this SEPP.
SEPP 30 - Intensive Agriculture	Provides considerations for consent for intensive agriculture.	Not applicable.
SEPP 32 - Urban Consolidation (Redevelopment of Urban Land)	Makes provision for the redevelopment of urban land suitable for multi-unit housing and related development.	Nothing in this DA affects the aims and provisions of this SEPP.
SEPP 33 - Hazardous & Offensive Development	The SEPP provides considerations for consent for hazardous & offensive development.	Nothing in this DA affects the aims and provisions of this SEPP.
SEPP 36 - Manufactured Homes Estates	Makes provision to encourage manufactured homes estates by permitting this use where caravan parks are permitted and allowing subdivision.	Not applicable.
SEPP 44 - Koala Habitat Protection	Applies to land across NSW that is greater than 1 ha and is not a National Park or Forestry Reserve. It encourages the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range.	Nothing in this DA affects the aims and provisions of this SEPP.
SEPP 55 - Remediation of Land	This SEPP applies to land across NSW and states that land must not be developed if it is unsuitable for a proposed use because of contamination	Potential contamination of the land has been investigated in accordance with SEPP 55. Coffey previously investigated site contamination in 2006 and a more recent correspondence from them (6 June 2012) confirms that the recommendations made in the 2006 report remain applicable and the land is still considered to be suitable for the proposed uses (see ***Appendix K***).
SEPP 62 - Sustainable Aquaculture	Relates to development for aquaculture and arising from rezoning of land and is of relevance for the site specific rezoning proposals.	Not applicable.
SEPP 64 - Advertising and Signage	Ensure that outdoor advertising is compatible with the desired amenity and visual character of an area, provides effective communication in suitable locations and is of high quality design and finish.	Nothing in this DA affects the aims and provisions of this SEPP.
SEPP - Housing for Seniors or people with a Disability 2004	Aims to encourage provision and provide development standards for housing for seniors, including residential care facilities.	Nothing in this DA affects the aims and provisions of this SEPP.
SEPP - Infrastructure 2007	Provides a consistent approach for infrastructure and the provision of services across NSW, and to support greater efficiency in the location of infrastructure and service facilities.	The development falls within the category of 'traffic generating development' as defined in Schedule 3 of this policy and hence requires referral to RMS.
SEPP - Mining, Petroleum Production and Extractive Industries 2007	Aims to provide proper management of mineral, petroleum and extractive material resources and ESD.	Not applicable.

SEPP	Relevance	Consistency and Implications
SEPP - (Rural Lands) 2008	Aims to facilitate economic use and development of rural lands, reduce land use conflicts and provide development principles.	The Agricultural Land Assessment prepared by Peak Land Assessment (2013) advises that the land is of low to medium agricultural value and is not suitable for cropping due to poor soils. This was accepted at the rezoning stage.
State Environmental Planning Policy (State and Regional Development) 2011	Aims to identify developments and infrastructure that are of state significance due to their size, economic value or potential impacts.	Nothing in this DA trigger any criteria for State Significant Development as specified in Schedule 1 and 3 of the SEPP.

***Table 3** – SEPP's Applicable to the Proposal*

4.2.4 CESSNOCK LOCAL ENVIRONMENTAL PLAN 2011

Part 2.1 land use zones

The site is zoned SP3 Tourist as indicated in ***Figure 12***.

Zone SP3 - Tourist

1 Objectives of zone

- *To provide for a variety of tourist-oriented development and related uses.*
- *To allow for integrated tourist development.*

2 Permitted without consent

Nil

3 Permitted with consent

Attached dwellings; Building identification signs; Business identification signs; Cellar door premises; Child care centres; Dwelling houses; Entertainment facilities; Environmental facilities; Environmental protection works; Exhibition homes; Flood mitigation works; Food and drink premises; Function centres; Home businesses; Home industries; Home occupations; Horticulture; Information and education facilities; Kiosks; Markets; Neighbourhood shops; Recreation facilities (indoor); Recreation facilities (outdoor); Registered clubs; Respite day care centres; Roads; Semi-detached dwellings; Sewage treatment plants; Tourist and visitor accommodation; Viticulture; Water recycling facilities; Water reticulation systems; Water storage facilities; Water treatment facilities

4 Prohibited

Any development not specified in item 2 or 3

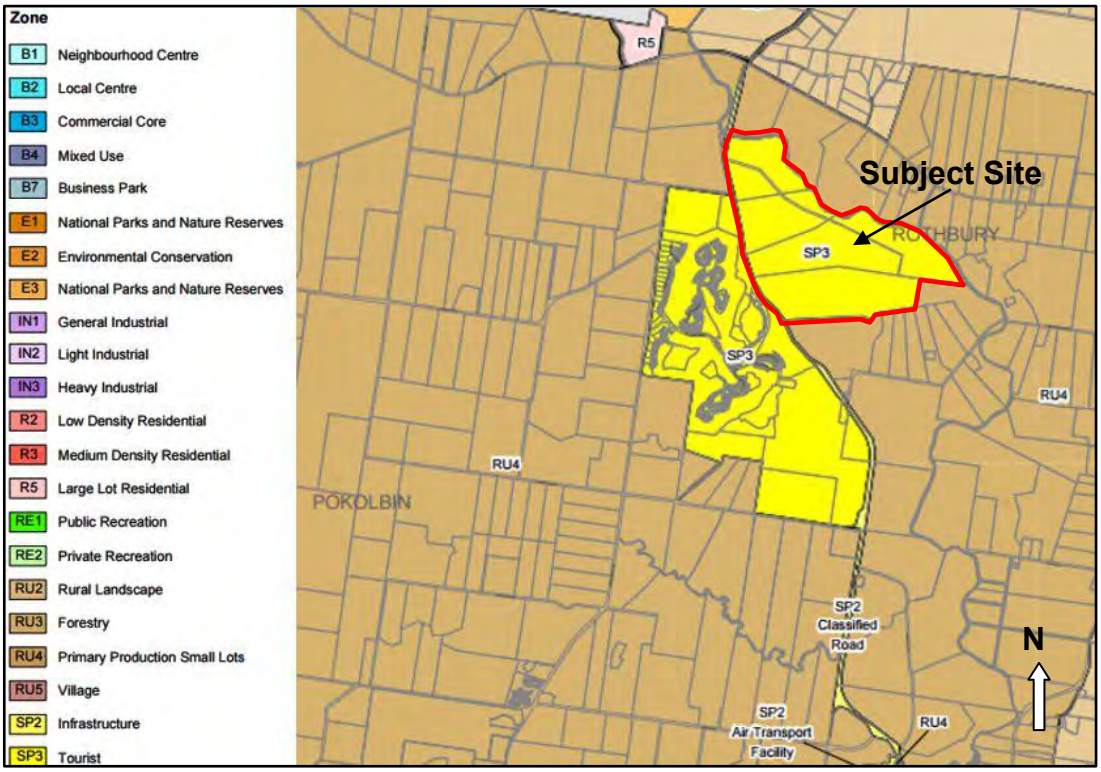


***Figure 12**: Zoning Map*
Source: Cessnock LEP 2011

Comment:

The site is zoned SP3 Tourist Zone which aims to promote tourism-oriented development on the land. The proposed integrated tourist/residential development and ancillary uses are permissible with consent in the zone and meets the zone objectives in providing a variety of tourist oriented development and allows for integrated tourist development.

Clause 6.1 - Arrangements For Designated State Public Infrastructure

1) *The objective of this clause is to require satisfactory arrangements to be made for the provision of designated State public infrastructure before the subdivision of land in an urban release area to satisfy needs that arise from development on the land, but only if the land is developed intensively for urban purposes.*

2) *Despite all other provisions, development consent must not be granted for the subdivision of land in an urban release area if the subdivision would create a lot smaller than the minimum lot size permitted on the land immediately before the relevant date, unless the Director-General has certified in writing to the consent authority that satisfactory arrangements have been made to contribute to the provision of designated State Public Infrastructure in relation to that lot.*

Comment:

The site is within an urban release area, however the proposed lot sizes range between 7ha and 55ha. Advice received from the Department of Planning and Environment (DoPE) confirmed that their current policy does not require lots in excess of 4,000m^2 to contribute towards state public infrastructure.

For the purposes of clause 6.1 of the LEP, satisfactory arrangements can be sought by requesting an exemption under this policy. DoPE has also indicated that the preferred process for this is to submit the Development Application with Council and then seek satisfactory arrangements.

This would require copies of the Development Application, Statement of Environmental Effects, and payment invoice from Council along with a request for satisfactory arrangements. Subject to review the satisfactory arrangement certificate would then be issued by the Department of Planning and Environment, noting that it would only relate to the specific DA submitted to Council consisting of lot's in excess of 4,000sqm. Any further development on the site would require a subsequent application to the Department of Planning and Environment.

Therefore following the submission of this application, satisfactory arrangements will be sought from the Department of Planning and Environment.

Clause 6.2 - Public Utility Infrastructure

1) *Development consent must not be granted for development on land in an urban release area unless the Council is satisfied that any public utility infrastructure that is essential for the proposed development is available or that adequate arrangements have been made to make that infrastructure available when required.*

2) *This clause does not apply to development for the purpose of providing, extending, augmenting, maintaining or repairing any public utility infrastructure.*

Comment:

This document includes servicing strategies and arrangements that will be in place to ensure that the site is provided with all the essential utility infrastructure thereby meeting the requirements of this clause.

Clause 6.3 Development Control Plan

1) *The objective of this clause is to ensure that development on land in an urban release area occurs in a logical and cost-effective manner, in accordance with a staging plan and only after a development control plan that includes specific controls has been prepared for the land.*

2) *Development consent must not be granted for development on land in an urban release area unless a development control plan that provides for the matters specified in subclause (3) has been prepared for the land.*

3) *The development control plan must provide for all of the following:*

   (a) *A staging plan for the timely and efficient release of urban land making provision for necessary infrastructure and sequencing,*

(b) An overall transport movement hierarchy showing the major circulation routes and connections to achieve a simple and safe movement system for private vehicles, public transport, pedestrians and cyclists,

(c) An overall landscaping strategy for the protection and enhancement of riparian areas and remnant vegetation, including visually prominent locations, and detailed landscaping requirements for both the public and private domain,

(d) A network of passive and active recreational areas,

(e) Stormwater and water quality management controls,

(f) Amelioration of natural and environmental hazards, including bush fire, flooding and site contamination and, in relation to natural hazards, the safe occupation of, and the evacuation from, any land so affected,

(g) Detailed urban design controls for significant development sites,

(h) Measures to encourage higher density living around transport, open space and service nodes,

(i) Measures to accommodate and control appropriate neighbourhood commercial and retail uses,

(j) Suitably located public facilities and services, including provision for appropriate traffic management facilities and parking.

Comment:

This DA is submitted as a Staged Development Application as an alternative to DCP under the provisions of Clause 83C(2) of the EP&A Act 1979 which states:

> *"if an environmental planning instrument requires the preparation of a development control plan before any particular or kind of development is carried out on any land, that obligation may be satisfied by the making and approval of a staged development application in respect of that land."*

The accompanying concept Masterplan outlines the various components of the proposal and the respective staging.

Those matters for consideration as mentioned in clause 6.3(3) of Cessnock LEP relating to; the staging and timely release of land; transport movements; overall landscaping strategy; recreation areas; water quality management; amelioration of hazards; urban design controls; efficient use of infrastructure; access to public facilities and services etc. are considered (where relevant) in this Statement of Environmental Effects. The details of the proposed development and an overview of the design outcomes in response to the constraints of the land and intended mitigation measures are contained in this document.

As the development progresses, separate DA's will be lodged for future stages as indicated in the Masterplan.

7.3 - Flood planning

1) The objectives of this clause are as follows:

(a) To minimise the flood risk to life and property associated with the use of land,

(b) To allow development on land that is compatible with the land's flood hazard, taking into account projected changes as a result of climate change,

(c) To avoid significant adverse impacts on flood behaviour and the environment.

2) This clause applies to land at or below the flood planning level.

3) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development:

(a) Is compatible with the flood hazard of the land,

(b) Is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties,

(c) Incorporates appropriate measures to manage risk to life from flood,

(d) Is not likely to significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and

(e) Is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

Comment:

The Masterplan prepared at the planning proposal stage has been amended to ensure that all the habitable areas are above the 1% AEP flood levels identified in the recent Black Creek Flood Study by WMA (June 2015).

Earthworks will be undertaken to ensure that the floor levels of the structures meet the new Flood Planning Levels and these details will be provided in relevant stages of future DAs.

Therefore the flood risks associated with the property has been investigated and the development is designed to accommodate the flood planning level to minimise threat to life and property and environment during flood events.

7.4 - Airspace operations

1) The objectives of this clause are as follows:

(a) To provide for the effective and ongoing operation of the Cessnock Airport by ensuring that such operation is not compromised by proposed development that penetrates the Limitation or Operations Surface for that airport,

(b) To protect the community from undue risk from that operation.

2) *If a development application is received and the consent authority is satisfied that the proposed development will penetrate the Limitation or Operations Surface, the consent authority must not grant development consent unless it has consulted with the relevant Commonwealth body about the application.*

3) *The consent authority may grant development consent for the development if the relevant Commonwealth body advises that:*

   (a) *The development will penetrate the Limitation or Operations Surface but it has no objection to its construction, or*

   (b) *The development will not penetrate the Limitation or Operations Surface.*

Comment:

The site is identified in Council's Obstacle Limitation Surface Mapping. However the proposed structures are anticipated to be below RL 60m AHD and will remain well under the affected heights (RL 140m AHD and above).

7.11 - Integrated tourist development at Wine Country Drive, Pokolbin

1) *This clause applies to land at Wine Country Drive, Pokolbin, being Lots 2-4, DP 869651 and Lot 11, DP 1187663.*

2) *Development consent must not be granted to any development on land to which this clause applies unless:*

   (a) *The consent authority is satisfied that the development is integrated tourist development, and*

   (b) *The total number of permanent residential dwellings on that land does not exceed 300, and*

   (c) *The total number of serviced apartments and hotel or motel accommodation units used for the purposes of tourist and visitor accommodation on that land does not exceed 300, and*

   (d) *The total number of permanent residential dwellings does not exceed the total number of serviced apartments and hotel or motel accommodation units on that land used for the purposes of tourist and visitor accommodation at any time.*

3) *In this clause:*

   Integrated tourist development means development carried out on a single parcel of land for the purposes of major tourist facilities that include an 18-hole golf course.

Comment:

The Masterplan demonstrates a tourism focused development encompassing 18 hole golf course, five (5) star hotel, tourist villas and residences and sports and recreational facilities. The number of permanent residences and tourist accommodation maintain the limit of 300 units. It should also be noted that the permanent residences are anticipated to be used as long stay holiday homes once again reinforcing the site's development as a major tourist destination.

The staging of the development is such that the land release and subsequent construction of permanent residential dwellings and tourist accommodation units will comply with the stipulated 1:1 ratio at any given time, pursuant to clause 7.2(d).

4.3 CESSNOCK DEVELOPMENT CONTROL PLAN 2010

The concept Masterplan is based on the guidelines provided in the Development Control Plan (DCP). Besides the general guidelines outlined in Part C of the DCP, controls for purpose built rural tourist accommodation outlined in Part D.4 and site specific Vineyards District guidelines in Part E.3 are also applicable to the development.

The Stage 1 proposal involves creation of four (4) superlots only, which will be subject to further subdivision and/or Development Applications in future under separate DA's. Therefore, a detailed investigation of the proposal against the relevant DCP guidelines is not considered necessary at this stage. The compliance of the proposal against the general requirements is demonstrated in the attached Concept and Management Plan (***Appendix G***).

5.0 KEY PLANNING / ENVIRONMENTAL ISSUES

This section provides an assessment of the likely impacts of the development, including environmental impacts on natural and built environments and the social and economic impacts in the locality.

5.1 CONTEXT & SETTING

The Cessnock vineyard district is a major tourist icon for the Lower Hunter Region which attracts other complementary development such as golf related tourism to the area. The subject site is situated at one of the key entry points to Cessnock's Vineyard District where tourism and viticultural activities are identified as the major economic drivers. Being in the immediate vicinity of Hunter Metropolitan area juxtaposing the Greg Norman designed golf course at 'The Vintage', the site has immense potential as a tourism oriented development to promote the local economy and supplement the recreational and specialised accommodation needs of the adjoining urban centres.

Considering its spectacular rural setting and very low agricultural value, a tourist orientated development would present a viable economic activity that is consistent with the planning instruments and surrounding land uses.

5.2 ACCESS, TRANSPORT & TRAFFIC

An assessment of the changed traffic conditions on Wine Country Drive from the operation of the Hunter Expressway is provided in Pages 2-5 of the updated Traffic Impact Assessment in ***Appendix L***. The study suggests that the opening of Hunter Expressway has resulted in reduced traffic flows in the vicinity of Tuckers Lane and Old North Road located to the north of the subject site. The traffic increase from the accounted background growth from the development in the area (including the Huntlee new town development) is therefore negated by this reduction in traffic flow brought about by the Hunter Expressway. The main component of the forecast traffic flows on Wine Country Drive is the Huntlee new town development. The predicted peak hour traffic flows from Stage 1 of the Huntlee new town development (which accounts for a background growth of 0.5% and the opening of Hunter Expressway) corresponds to an acceptable LoS (Level of Service) C/D for Wine Country Drive.

Two options for site access treatments have been considered as described below, and both these options are capable of providing a satisfactory level of service:

- A CHR/AUL priority controlled intersection serving as access only for the subject site.
- A four-leg one-lane roundabout serving as access for subject site to the east, and 'The Vintage' development to the west.

The report suggests that the roundabout would be the preferred option if monetary contributions from the subject site and 'The Vintage' can be coordinated. If the project timing and approvals are not favourable to the construction of a roundabout, then a CHR/AUL treatment for site access is considered as an acceptable alternative.

At the request of RMS the need to upgrade intersections of McDonalds Road and Palmers Lane was investigated and it was established that the current traffic conditions warrant upgrade works to these intersections regardless of the subject DA. The Huntlee New Town development is also seen to have a significant impact on these intersections. As these upgrades are not triggered by the proposed

development it is reasonable that only a proportion of the cost of upgrades that is commensurate with the level of impact be borne by the proponent of this project.

An analysis of available traffic data in locations close to the subject site shows a decrease in traffic flows on Wine Country Drive after the opening of the Hunter Expressway on 22 March 2014. This is consistent with the modelling effects of Hunter Expressway provided in Lower Hunter Transport Needs Study by Hyder Consulting 2012, where it was predicted that regional traffic choosing to use the B82 route to travel between the New England Highway at Branxton and the M1 Motorway at Freemans Waterhole would choose to use the new Expressway route as a faster, safer and more efficient route. The Traffic Impact Assessment concludes that there has been a reduction in flow of up to 2,500 vehicles per day on Wine Country Drive, post opening of the Hunter Expressway.

The Hunter Expressway and the Huntlee New Town development of are considered to be the two main contributors to background traffic growth in the area. While an increase in background traffic from the Huntlee new town development is noted, it is considered that it will be negated by the effect of the Hunter Expressway. Please refer to Page 5 of ***Appendix L*** for details.

In calculating the traffic generation rate from the proposed development, a peak-hour flow factor of 0.85 trips was used in the previous assessment based on *RTA Guide to Traffic Generating Development* published in 2002. With the publication of updated trip rates by RMS in August 2013, the peak-hour traffic generation rate by low density residential has dropped to 0.78 (PM) or 0.71(AM) in regional areas. The components of development, being three hundred (300) residential dwellings and three hundred (300) tourist accommodation units have remained unchanged since the original assessment. Hence the revised peak flow rates have resulted in a 12.5% reduction in predicted daily flows from the development (refer to Tables 1 and 2 of ***Appendix L*** for details). This level of traffic reduction is significant and warrants some reconsideration in the required level of road improvements and access arrangements than those previously considered.

At the request of RMS, a number of options for access to the site were considered in the previous assessment, including a new roundabout for access to both 'The Vintage' and the subject site. While this is preferred it would be unfair to ask one developer to bear the full cost if safe alternatives are available. It may be worthwhile to consider funding the roundabout through contributions.

It is proposed to subdivide the site as a Community Title subdivision. Roads and services onsite will, therefore, largely remain in private ownership under the control of the community association. A detailed Community Agreement has not been completed yet as this will need to be resolved in discussions with the respective owners and operators. A Draft Community Management Statement is, however, attached (***Appendix S***). It is envisaged that the final document will follow this form.

Needless to say roads will be constructed in accordance with Councils engineering requirement for development. These have been adopted in the Concept and Management Plan (***Appendix G***).

5.3 SERVICES

Electricity

Preliminary servicing advice from Ausgrid indicates that the development is capable of being serviced from their existing resources in the area. Refer to ***Appendix J*** for correspondence from Ausgrid.

Potable Water

There is no water main fronting the subject site, however it lies in the vicinity of the pump station located north of the intersection of Wilderness Road and Wine Country Drive, and the internal network servicing 'The Vintage' development. There is sufficient capacity in this system to provide the minimum pressure requirements on the peak day and for fire fighting purposes.

RPS was engaged to prepare a Servicing Strategy for secure domestic water supply to the development. A copy of the Water Servicing Report is attached as ***Appendix M***. The recommended option includes the construction of a 100mm main to the site from the low pressure zone downstream of the existing pump station and a private reticulation network within the site consisting of 100mm mains. In order to ensure steady supply, a private reservoir within the site will be required with a trickle feed from the HWC mains. This reservoir will be designed with 48-hour capacity to service the development.

The internal reticulation system within the site will be privately owned and operated, refer to Hunter Water Corporation letter (***Appendix J***) for details. There are no environmental constraints to the implementation of the recommended strategy and the new water mains will be wholly contained within the existing and proposed road reserves.

Non-potable water supply

In addition to the potable water supply, the development will need water for irrigation of the golf course and landscaped areas within the site. A Site Water Budget was prepared by Water Wise Consulting, at the planning proposal stage, to establish the water requirements for irrigation, while accounting for additional demand during the construction phase and periods of reduced rainfall. The study identified the need to secure 200 megalitres of water to meet these additional needs. Details are provided in the Site Water Budget attached as ***Appendix N***.

The site currently holds a PID (Pokolbin Irrigation District) license for 100 megalitres and approximately 19 megalitres may be sourced onsite through harvestable rights. Enquiries with Hunter Wine Country PID have indicated that there is spare capability in their system to allocate more units to the site if required, refer to ***Appendix J*** and ***N*** for details.

As an alternative option, 200 megalitres of recycled water can be sourced from Cessnock Waste Water Treatment Works (WWTW). Hunter Water in their letter advice (refer to Appendix 1 of Water Servicing Report attached in ***Appendix M***) has confirmed that there is sufficient capacity in the Cessnock Waste Water Treatment Works WWTW to cater for the loads from the development.

Wastewater

Whitehead and Associates were engaged to provide options for wastewater services to the site including provision of a recycled water supply. A copy of the Wastewater Options Report is attached as ***Appendix O***.

Three (3) potential options for servicing were considered and Option 2 being an onsite decentralised wastewater system that utilises a STEP (Site Tank Effluent Pump) / STEG (Site Tank Effluent Gravity) system was considered to be the most feasible option. Wastewater would then undergo further treatment via textile filters and advanced membrane bio-reactor (MBR) to ensure high quality effluent suitable for internal reuse and irrigation. The recycled water demand and drought security will be provided by constructing a return line from Cessnock WWTW and further treatment in the MBR. This option was considered to have minimal environmental impacts besides the low operational and maintenance costs when compared to the other options.

Option 2 being the common effluent sewer and textile filter was seen as the most appropriate option

5.4 STORMWATER

All stormwater falling on paved or irrigated areas, including the golf course and gardens, will be collected and passed through Gross Pollutant Trap and nutrient control devices before being discharged to detention or natural drainage paths.

Golf course design will be such that the runoff from the fairways are collected and treated to reduce nutrient loads before release. Further details of this will be lodged with subsequent DA's. Runoff entering the site will be conveyed through the site to Black Creek (refer ***Appendix R*** Stormwater Management Plan).

5.5 HERITAGE

There are no items of European heritage located on the site. The site does have a number of aboriginal heritage sites that have been identified in previous studies (refer ***Appendix P*** – Aboriginal Study). The sites identified in this study are shown on the Masterplan and will not be disturbed. In addition a transect north / south across the site has also been excluded from development.

A draft Aboriginal Cultural Heritage Management Plan (ACHMP) has been prepared and is currently under review by the local Aboriginal land Council.

The Aboriginal heritage at this site is seen as a major part of the project and the draft ACHMP is a way of integrating that into the ongoing operation of the site. A building will be provided to house and display items of Aboriginal heritage onsite and also act as an art gallery and gift shop. In addition the local Aboriginal land council have suggested that they can run Aboriginal tours from this centre which would add to the rich history of the area. A copy of the draft ACHMP is attached ***Appendix D***.

The agreement will be finalised prior to lodgement of subsequent DA's.

5.6 FLORA & FAUNA

In 2013 RPS were engaged to carry out a flora and fauna assessment as part of the rezoning proposal. Due to the highly disturbed nature of the area, the development was not seen as having any significant impact on the identified flora and fauna species as mentioned in Section 2.6 of this report. The site was considered to have low habitat value due to lack of variably sized hollows, few understorey shrubs, limited woody debris and rocks, and grazing by cattle. However, the following recommendations were made to safeguard the environmental values of the site:

- *Clearance of native vegetation should be minimised as far as is practical;*
- *The extent of vegetation clearing is to be clearly identified on construction plans;*
- *Extent of clearing within native vegetation should be fenced with highly visible temporary fencing to ensure that clearing does not extend beyond the area required;*
- *Vegetation clearing should avoid mature trees and stags wherever possible in favour of areas of younger regrowth;*

- *Attempts should be made to relocate hollow logs and felled trees containing hollows into adjacent habitats to provide further habitat resources for native fauna;*
- *Nest boxes should be installed in the retained vegetation to compensate for the removal of hollows throughout the vegetation to be cleared;*
- *Glider poles should be installed along the southern boundary of the site between the existing Central Hunter Riparian Forest and Central Hunter Ironbark-Spotted Gum-Grey Box Forest patches to maintain connectivity between these habitats for glider species;*
- *Any clearing should be supervised by a qualified ecologist to ensure previously identified habitat trees are 'soft-felled'. Felled trees must be left for a short period of time on the ground to give any fauna trapped in the trees an opportunity to escape before further processing of the trees. The ecologist is to handle any injured or displaced fauna and relocate displaced fauna were necessary;*
- *Revegetation of native flora on site should be implemented with the objective of increasing the connectivity between existing patches of native vegetation, increasing biodiversity with appropriate local species, and augmenting riparian corridors with suitable local species. See Appendix 5 for a list of suitable native flora to be used in revegetation;*
- *A restoration plan is to be developed for native revegetation areas;*
- *A management plan is to be developed for existing native vegetation, restored native vegetation, and vegetation plantings associated with landscaping of the site;*
- *Appropriate control measures should be employed to ensure that machinery working within the site does not bring materials (soils, weeds etc.) onto the site that may infect surrounding vegetation with Phytophthora cinnamomi;*
- *Minimise clearing and disturbance to riparian zones where possible. Locate soil or stockpiles away from watercourses to limit potential transport of these substances into the watercourses via runoff. Appropriate erosion and sedimentation controls to be implemented prior to the commencement of construction;*
- *Appropriate controls to be put in place to limit the flow of surface pollutants associated with the golf course and residential development into Black Creek;*
- *Appropriate landscaping of the site within any development, particularly within the golf course, to enhance retained vegetation, habitat corridors, and to provide seasonal foraging resources for species such as Grey-headed Flying-fox, Swift Parrot and Regent Honeyeater.*

In 2016 MJD Environmental were engaged to update the previous studies, which resulted in additional species being added for consideration, as listed on Pages 4 and 5 of the attached Ecological Update (***Appendix C)***. Site inspection confirmed that the vegetation delineation and community mapping included are generally consistent with the previous RPS report. The assessment supports the abovementioned recommendations with the option to replace the installation of glider poles by planting across the southern boundary as part of the revegetation, in consultation with an ecologist.

It was noted that the maturity of Eucalyptus Crebra and Casuarina Glauca regrowth has progressed from that described in the earlier assessment by RPS. Two additional hollow bearing trees were also

identified in the Central Hunter Ironbark Spotted Gum-Grey Box Forest which will be retained under the revised concept plan.

The flora and fauna assessment concluded that the vegetation outcome for the revised concept is largely consistent with the original concept with great emphasis on targeted revegetation.

Assessment under the TSC and EPBC Act determined that all additional threatened and migratory species were unlikely to be impacted by the proposal. However despite the highly modified nature of the identified Central Valley Eucalypt Forest and Woodland, and the proposed revegetation, the remanent patches satisfied the moderate condition criteria and therefore met minimum standards for further referral to the DoE under the EPBC Act. Consequently a referral document has been prepared and submitted to DoE seeking further advice on the proposal.

Onsite planting of vegetation has been provided for in the Masterplan to offset removal of vegetation. In addition the recommendations, aforementioned, will be taken into consideration in the more detailed design for each stage.

5.7 HAZARDS

Contamination

A Preliminary Contamination Assessment was undertaken by Coffey Geosciences Pty Ltd in March 2008 and an update to the assessment was provided in June 2012 confirming that the recommendations of the original report remains current. A copy of the assessment and the update are attached in ***Appendix K***. The site history analysis and site walkover identified no apparent areas of chemical of concern, or extensive contamination.

Flooding

Council recently revised the flood lands at this location in Black Creek and as a result predicted flood lands have risen on this site. Accordingly some new changes have been made to the previous concept plan and some areas will require filling to ensure that all sites proposed for dwellings and tourist accommodation are above the 1% AEP.

Storm flows in the local creek system are catered for in the drainage corridors which are placed to be relatively natural through the site (refer ***Appendix R***).

5.8 VISUAL IMPACT

Richard Lamb & Associates were engaged to identify the impacts of the proposal on the scenic quality, visual character and qualities of the Vineyards District. Copies of the original assessment undertaken in 2007, and a subsequent review undertaken in 2013, are attached in ***Appendix Q***.

The predominant landscape character (grazed flood plain and the remnant areas of vegetation) of the site are typical of the Vineyards District and the broader Hunter Region. There are no distinctive features that require preservation of views to or from the site and the existing landscape attributes are not considered to be a constraint on the future development. The site, as it exists, is considered to have low visual absorption capacity. However due to the flat topography and low viewing angles from public domain, buffer plantings and landscape belts can be easily established to improve its capacity to absorb the development without significant changes to the character of the site or locality. The site is seen to have a low to moderate scenic quality which will be enhanced through the proposed landscaping.

Twenty One (21) view points were identified in and around the subject site and the overall extent of visual impact was seen to be generally low, or low to medium. View from high sensitivity public viewing locations along Wine Country Drive will be managed through appropriate landscape design and buffers. Views from low sensitivity viewing places on or around Talga Road were not seen to be significantly affected by the proposal. The visual impact on the neighbouring 'The Vintage' development is not considered to be any more significant than that proposed within the north-east part of 'The Vintage' estate. The development is therefore considered to be compatible with the site and will not have any negative impact on the gateway to the Vineyards District or developments and land uses in its vicinity.

5.9 BUSHFIRE

The Bushfire Threat Assessment undertaken by HDB provides an assessment of the bushfire hazards associated with the site and examines the ability of the amended Masterplan to accommodate bushfire protection measures in accordance with *Planning for Bushfire Protection 2006* (PBP), (refer to ***Appendix F***). The minimum APZs (Asset Protection Zones) required for the development are identified in the document.

The assessment demonstrates that the proposed subdivision satisfies the performance criteria for bushfire management as stipulated in PBP and AS 3959-2009. All lots in the proposed subdivision are able to accommodate the required APZ. The future dwellings and special fire protection developments can be sited to achieve the required APZ corresponding to BAL 29 and radiant heat level less than, or equal to, 10 kw/m^2 respectively.

The following recommendations are made for the compliance of the proposal with the relevant legislative requirements:

- *The required APZs are to be maintained and grasslands to be managed to reduce fuel loads;*
- *The landscaping for the development, including the Golf Course, is to comply with the requirements of PBP 2006 with due consideration to the following:*
    - *Any vegetation enhancement that falls within the identified APZ, or in the vicinity of the asset, should be provided as smaller groups of plantings or scattered plantings with discontinuous canopies to avoid a direct fire path to the property; and*
    - *New landscaped areas to incorporate landscaping strips less than 20m in width, regardless of length, and not within 20m of each other or any other areas of vegetation being classified. In vegetation enhancement areas if mass plantings contiguous with the existing threat are proposed, the APZs are to be considered from the edge of proposed planting area.*
- *This assessment does not deal with the level of construction or specifications for dwellings on individual lots. Separate assessments are to be undertaken at the DA stage for dwellings in future. However, as the site is in an urban release area, a Subdivision BAL Plan for the entire site may be submitted for consideration as part of the Bushfire Safety Authority process at the DA stage for residential subdivision. This would exempt future dwellings from further bushfire considerations under section 79BA of the EP&A Act and hence streamline the residential development process.*
- *The road network and utilities / services shall meet the fire fighting and management requirements as outlined in PBP 2006.*

6.0 PROJECT JUSTIFICATION AND NEED

The strategic location of the site at the entrance of the Vineyards District alongside 'The Vintage' offers ample potential for an integrated tourist development as per the provisions of clause 7.11 of the Cessnock Local Environmental Plan. The site is not identified as a 'release area' within the Lower Hunter Regional Strategy 2006 – 31, however is considered to satisfy the sustainability criteria. Importantly this site has not been identified as regionally significant agricultural land on the Natural Resources Map in the Lower Hunter Regional Strategy.

The Net Community Benefit Test (NCBT) and Economic Impact Assessment undertaken by Hill PDA at the planning proposal stage concluded that the proposal "*would deliver a strong positive impact on community welfare"* when assessed against the relevant State and local Government policy aims, objectives and aspirations.

> *"It is estimated that the proposed development will generate 61,300 visitor nights and 3,000 day trippers, with the net additional tourists generated by the proposed development conservatively estimated to input an additional $6.5 million into the economy on an annual basis. This annual return together with the initial capital investment of $150 million to establish the resort and recurring operational costs of $6.5 million annually, the facility will be a major employment generator and long term financial stimulus to the local economy."*

Assuming the development implements mitigation measures, the only potentially minor impacts occur during the construction phase with a slight increase in traffic movements; otherwise, the proposed development would have only positive impacts. Therefore the development of the site to provide an internationally recognised tourist facility with permanent occupancy in an area specialised in tourism and viticulture activities would strengthen the local economy and establish a viable use on the site otherwise considered unsuitable for agricultural purposes.

The proposed golf course, together with the high quality accommodation, conference and recreational facilities, will complement and help to support the existing tourist activities in the wine district, potentially making the Hunter one of Australia's most successful tourist destinations.

This application is needed to establish the boundaries for the various uses on the site and through the proposed Masterplan identifies the future direction of the development. As each area will be subject to further detailed design prior to lodgement of DA's for each of the stages, a more conceptual Masterplan has been proposed at this stage, for Councils approval.

7.0 CONCLUSION

This application proposes to reinforce the Masterplan put forward with the recent rezoning application. The contents, and for that part, the Masterplan remain the same as proposed previously and supported by Council and Government agencies.

The subject site was rezoned in 2014 to allow for the proposed development. The proposal was favourably supported by Cessnock City Council on the following grounds, as quoted from Cessnock City Council agenda 22 January 2014.

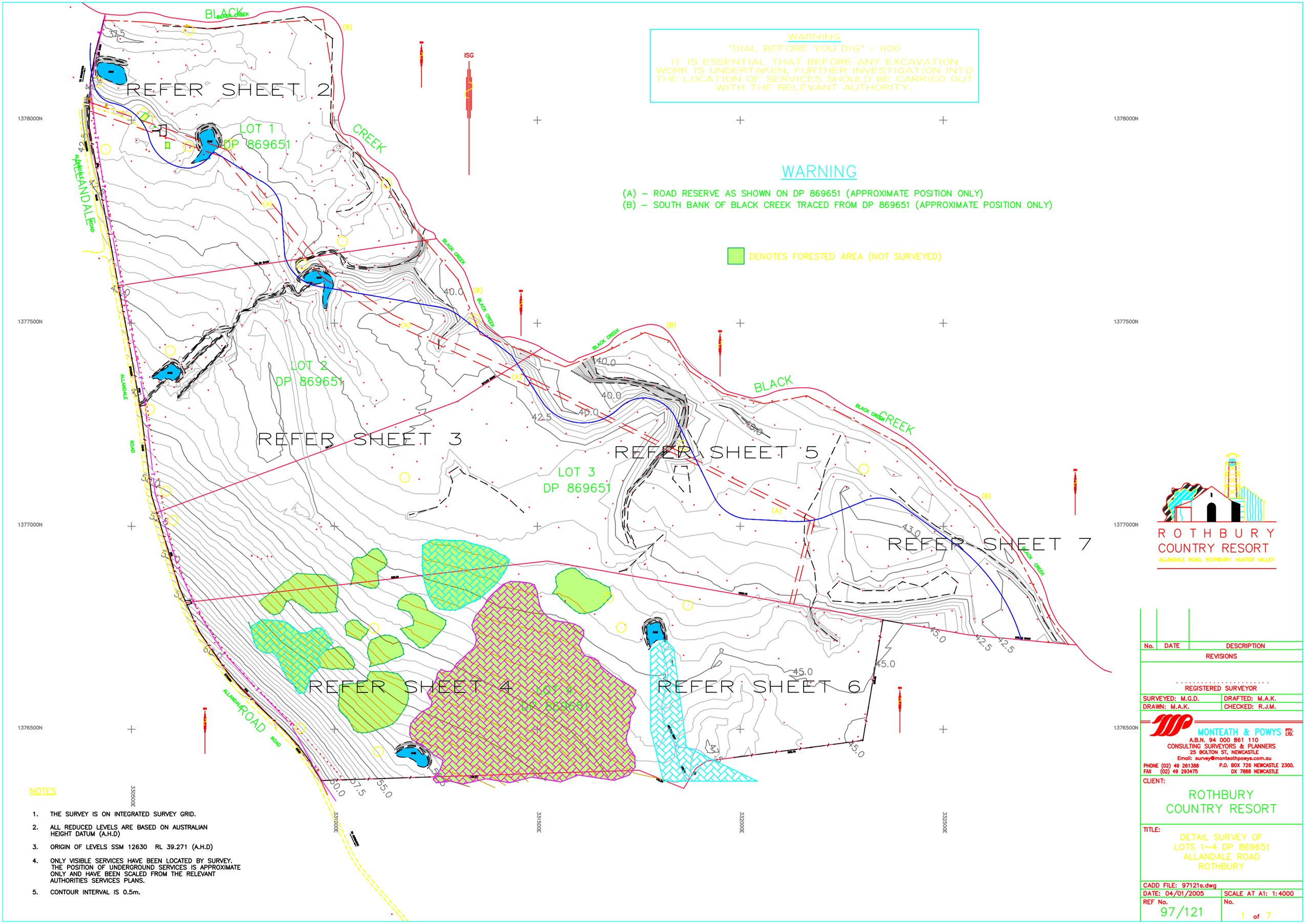
- *The proposal is considered a positive tourism based use of the land on the edge of the Vineyards District that is not suitable for viticultural uses.*
- *The proposal will broaden the tourism appeal of the LGA for a national and international market.*
- *The proposals co-location next to the existing Vintage Golf development has strategic merit creating a golfing tourist destination with significant flow on benefits to the Vineyards District tourism market and the Cessnock LGA.*

The adoption of a Masterplan for the site will give security to move the project forward and complete the detailed design and refinement of each of the components of this project. It will set the framework for major investment to flow to the project and guarantee a major world class tourist attraction in the Cessnock vineyard area.

Further, more detailed design will form part of subsequent DA's after further product research and investment has been concluded. To take this next step it is important that the ultimate aim is clearly defined by the Concept Plan approval.

APPENDIX A

SITE SURVEY PLAN



NOTES

1. THE SURVEY IS ON INTEGRATED SURVEY GRID.
2. ALL REDUCED LEVELS ARE BASED ON AUSTRALIAN HEIGHT DATUM (A.H.D)
3. ORIGIN OF LEVELS SSM 12630 RL 39.271 (A.H.D)
4. ONLY VISIBLE SERVICES HAVE BEEN LOCATED BY SURVEY. THE POSITION OF UNDERGROUND SERVICES IS APPROXIMATE ONLY AND HAVE BEEN SCALED FROM THE RELEVANT AUTHORITIES SERVICES PLANS.
5. CONTOUR INTERVAL IS 0.5m.

ROTHBURY COUNTRY RESORT
ALLANDALE ROAD, ROTHBURY, HUNTER VALLEY

No.	DATE	DESCRIPTION
REVISIONS		

REGISTERED SURVEYOR

SURVEYED: M.G.D.	DRAFTED: M.A.K.
DRAWN: M.A.K.	CHECKED: R.J.M.

MONTEATH & POWYS PTY. LTD.
A.B.N. 94 000 861 110
CONSULTING SURVEYORS & PLANNERS
25 BOLTON ST, NEWCASTLE
Email: survey@monteathpowys.com.au
PHONE (02) 49 261388 P.O. BOX 726 NEWCASTLE 2300.
FAX (02) 49 293475 DX 7888 NEWCASTLE

CLIENT:
ROTHBURY COUNTRY RESORT

TITLE:
DETAIL SURVEY OF LOTS 1~4 DP 869651 ALLANDALE ROAD ROTHBURY

CADD FILE: 97121s.dwg

DATE: 04/01/2005	SCALE AT A1: 1:4000
REF No. 97/121	No. 1 of 7

DATE OF LAST EDIT: 05/01/2005 – MAK

APPENDIX B

FLORA AND FAUNA ASSESSMENT

RPS 2013

Flora and Fauna Assessment

Lots 1 to 4 DP 869651 Main Road, Rothbury

Prepared by:

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Client Manager: Paul Hillier
Report Number: PR116561
Version / Date: Final / June 2013

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IMPORTANT NOTE

We have prepared this report for the sole purposes of Grant Entities / Capital Hunter Unit Trust ("**Client**") for the specific purpose of only for which it is supplied ("**Purpose**"). This report is strictly limited to the purpose, facts and matters stated in it, and does not apply directly or indirectly and will not be used for any other application, purpose, use or matter.

In preparing this report we have made certain assumptions. We have assumed that all information and documents provided to us by the Client, or as a result of a specific request or enquiry, were complete, accurate and up-to-date. Where we have obtained information from a government register or database, we have assumed that the information is accurate. Where an assumption has been made, we have not made any independent investigations with respect to the matters the subject of that assumption. We are not aware of any reason why any of the assumptions are incorrect.

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In this note, a reference to loss and damage includes past and prospective economic loss, loss of profits, damage to property, injury to any person (including death) costs and expenses incurred in taking measures to prevent, mitigate or rectify any harm, loss of opportunity, legal costs, compensation, interest and any other direct, indirect, consequential or financial or other loss.

Document Status

Version	Purpose of Document	Orig	Review	Review Date
Draft	Draft for Client Review	BS	PH	08/04/2013
Final	Final for Submission	BS / AS	PH	13/06/2013

Approval for Issue

Name	Signature	Date
Paul Hillier		13/06/2013

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Plates

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Summary

RPS Australia East Pty Ltd (RPS) was engaged by the HDB Town Planning and Design to provide a Flora and Fauna Assessment for an integrated tourism and residential proposal, to be situated on a 240 ha parcel of land approximately 8 km south of Branxton, NSW at Rothbury. The parcel is known specifically as Lots 1 to 4 DP869651, and lies to the east of Main Road and to the south and west of Black Creek, henceforth referred to as the 'site'.

The objective of this assessment was to provide a description of the terrestrial and aquatic habitats available on-site for both flora and fauna, to determine the likelihood of occurrence of threatened species and their habitats, as well as assessing the likelihood of the proposal to have a significant impact on any threatened species, populations or ecological communities listed within the Threatened Species Conservation Act 1995 (TSC Act) and/or Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Recommendations with regard to minimisation and mitigation of impacts are provided for any ecologically significant values on site. The report recognises the relevant requirements of the Environmental Planning and Assessment Act 1979 (EP&A Act) as amended by the Environmental Planning and Assessment Amendment Act 1997 (EP&AA Act).

Database searches were undertaken to identify existing records of threatened species, populations and Endangered Ecological Communities (EECs) occurring within the site and the surrounding locality. Flora and fauna surveys were undertaken across the site in March 2013.

Flora surveys across the site resulted in the identification of one threatened flora species occurring on-site, namely, the Slaty Red Gum (*Eucalyptus glaucina*).

Four vegetation communities are present on site:

- MU 13 Central Hunter Riparian Forest;
- MU 18 Central Hunter Ironbark − Spotted Gum – Grey Box Forest;
- *Casuarina glauca* Woodland; and
- *Melaleuca decora* Stand.

Central Hunter Ironbark − Spotted Gum – Grey Box Forest is listed as an Endangered Ecological Community (EEC) under the TSC Act. The Central Hunter Riparian Forest is considered commensurate with River-flat Eucalypt Forest On Coastal Floodplains, which is also listed as an EEC. Cleared pastures cover 86% (206ha) of the site.

Terrestrial fauna surveys across the site resulted in the positive identification of six threatened fauna species, namely Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Squirrel Glider (*Petaurus norfolcensis*), East-coast Freetail Bat (*Mormopterus norfolkensis*), Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), Little Bentwing-bat (*Miniopterus australis*), and Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*).

The habitat within the majority of the site has limited resource availability, due to high disturbance rates by cattle grazing, a reduced understorey, and young age of trees that lack larger hollows. The trees on site offer foraging resources and small hollows for birds, gliders, possums, and microbats. Most of the habitats on site lack understory shrubs or dense ground cover. Two small creek lines run through the site and several farm dams offer habitat for many amphibian species.

It was determined that 23 threatened fauna species and three flora species listed under the TSC Act, and five threatened fauna and two threatened flora species listed under the EPBC Act, may possibly occur on the site. The value of the habitats within the site was however limited due to the highly disturbed condition of mostly regrowth vegetation, containg low diversity and limited connectivity to larger areas of habitats. Assessments of Significance (see **Appendix 1**) concluded that the proposal was unlikely to significantly impact on any of these threatened species.

Assessment under SEPP 44 found that no 'Potential Koala Habitat' occurs within the site and that no further assessment under SEPP 44 was required.

Mitigation measures have been recommended where impacts cannot be avoided and the implementation of these measures should reduce adverse impacts on ecological values of the site.

1.0 Introduction

HDB Town Planning and Design commissioned RPS Australia East Pty Ltd (RPS) to provide a Flora and Fauna Assessment for a proposed integrated tourism and residential development on a 240 ha parcel of land situated approximately 8 km south of Branxton in NSW, at Rothbury. The parcel is known specifically as Lots 1 to 4 DP869651 and lies to the east of Main Road and to the south of Black Creek, henceforth referred to as the 'site'. The location of the site is presented in **Figure 1**.

This assessment aims to examine the likelihood of the proposal to have a significant effect on any threatened species, populations or ecological communities listed within the *Threatened Species Conservation Act 1995* (TSC Act). The report recognises the relevant requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act) as amended by the *Environmental Planning and Assessment Amendment Act 1997* (EP&AA Act). Assessment is also made with regard to those threatened entities listed federally under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.1 Site Particulars

Locality – Rothbury, NSW.

LGA – Cessnock.

Area – The site is 240 ha in total.

Boundaries – The site lies at the far northern end of the Cessnock City Council LGA. It is bordered by Main Road (Wine Country Drive; State Route 82) to the west and Black Creek to the north and east. The southern boundary consists of a mix of pastoral grazing, agricultural, and lightly wooded residential private land.

Current Land Use – Almost the entire site is used for grazing cattle. One residential dwelling, with a few small associated buildings, is found in the north-west corner of the site.

Topography – The site is relatively flat with an elevation of approximately 50 m AHD, ranging 10 m above and below this elevation across the gently undulating landscape. The undulations create a number of low hills and small depressions across the site, some of which have been modified for use as farm dams. The drainage pattern throughout the site is to the north-east.

Hydrology- Two small creek lines run through the site, one on the eastern side of the site running south to north, and the other in the north-west portion of the site running from west to east. Both creek lines are slow-flowing to stationary and connect several farm dams along their length. At least ten farm dams and a number of swampy depressions can be found across the site, particularly in the cleared pastures. Both small creek lines flow into Black Creek which forms the northern border of the site and is part of the Hunter Catchment.

Vegetation – The vegetation on site consisted of somewhat isolated patches of open woodland (31.5 ha) and riparian vegetation (2.5 ha), with the remainder of the site existing as cleared pastoral lands (206 ha).

1.2 Description of the Proposal

The proposal involves the development an integrated tourism and residential complex featuring an 18 hole golf course, 550 permanent and temporary residential dwellings, a 50 room hotel, associated sporting facilities, roads, pathways, and other infrastructure. The changes to the landscape resulting from the proposal will include the clearing of 9.7 ha of native vegetation, together with proposed revegetation of 49.8

ha with native vegetation. Major areas of revegetation will include the southern and western boundaries of the site as well as augmentation of existing riparian vegetation along Black Creek at the northern boundary of the site. A concept site plan for the proposal is shown in **Figure 2**.

1.3 Scope of the Study

The scope of this Flora and Fauna Assessment is to:

- Identify vascular plant species occurring within the site, including any threatened species listed under the TSC Act or EPBC Act;
- Identify and map the extent of vegetation communities within the site, including any Endangered Ecological Communities listed under the TSC Act or EPBC Act;
- Identify any fauna species, including threatened and migratory species, and populations or their habitats, which occur within the site and are known to occur in the wider locality;
- Assess the potential of the proposed development to have a significant impact on any threatened species, populations or ecological communities (or their habitats) identified from the site; and
- Describe measures to be implemented to avoid, minimise, manage or monitor potential impacts of the proposal.

In addition to the survey work conducted within the site boundary and its immediate surrounds, consideration has been afforded to habitats within 10 km of the site in order to appreciate the environmental context of the site. This has included assessment of potential indirect impacts.

1.4 Legislation and Policy

1.4.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as matters of National Environmental Significance (NES). Matters of NES identified in the Act include:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (listed under the Ramsar Convention);
- Threatened species and communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas; and
- The Great Barrier Reef Marine Park.

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of NES require approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities (the Minister).

1.4.2 NSW Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act 1995* (TSC Act) provides for the protection and management of threatened species, populations and ecological communities listed under the schedules 1, 1A and 2 of the Act. The purpose of the TSC Act is to:

- Conserve biological diversity and promote ecologically sustainable development;

- Prevent the extinction and promote the recovery of threatened species, populations and ecological communities;
- Protect the critical habitat of those species, populations and ecological communities that are endangered;
- Eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities;
- Ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed; and
- Encourage the conservation of threatened species, populations and ecological communities through co-operative management.

1.5 NSW Environmental Planning and Assessment Act 1979

The proposal will be submitted for approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), which provides the framework for assessing developments in NSW.

1.6 Noxious Weeds Act 1993

The *NSW Noxious Weeds Act 1993* provides for the identification and classification for noxious weeds in each New South Wales Local Government Area (LGA). The Act imposes obligations on occupiers of land to control noxious weeds declared for their LGA.

1.7 SEPP 44 (Koala Habitat Protection)

Schedule 2 of State Environmental Planning Policy (SEPP) No. 44 – 'Koala Habitat Protection' aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range, and to reverse the current state trend of koala population decline. SEPP 44 applies to the Cessnock Local Government Area.

1.8 Qualifications and Licensing

Qualifications

This report was written by Bret Stewart BSc and reviewed by Paul Hillier BSc of RPS. The academic qualifications and professional experience of all RPS consultants involved in the project are documented in **Appendix 6**.

Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence S100536 (Valid 31 December 2013);
- Animal Research Authority (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2014);
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2016); and
- Certificate of Accreditation of a Corporation as an Animal Research Establishment (Trim File No: 01/1522 & Ref No: AW2001/014) issued by NSW Agriculture (Valid 22 May 2014).

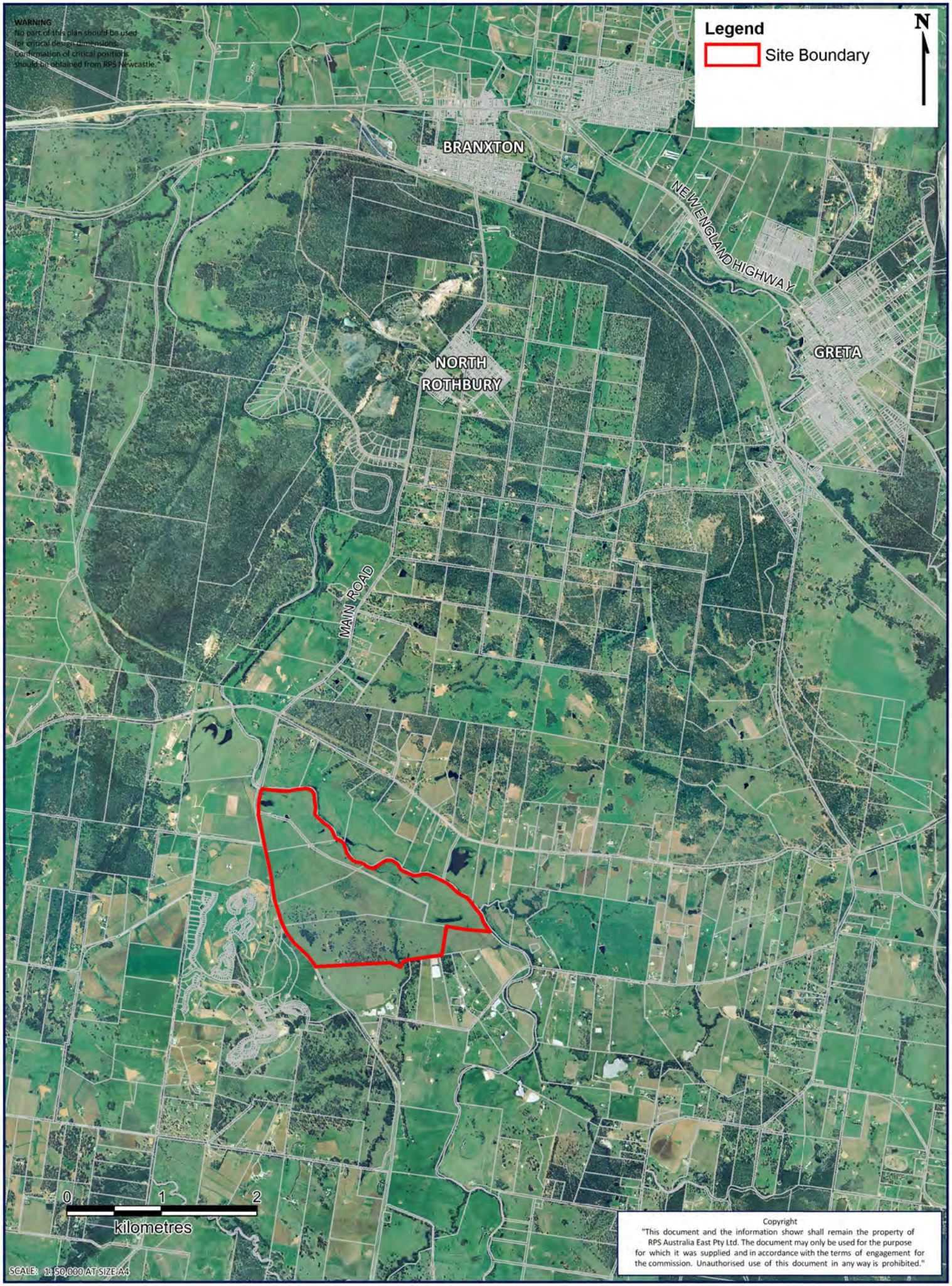
1.9 Certification

As the principal author, I, Paul Hillier, make the following certification:

- The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the Survey Area;
- Commonwealth, state and local government policies and guidelines formed the basis of project surveying methodology, or where the survey work has been undertaken with specified departures from industry standard guidelines, details of which are discussed and justified in Section 2.6; and
- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the Animal Research Act 1995, National Parks and Wildlife Act 1974 and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

Principal Author and Certifier:

Paul Hillier
Senior Ecologist – Senior Project Manager
June 2013



TITLE: FIGURE 1 SITE LOCALITY	LOCATION: ROTHBURY	DATUM: DATUM PROJECTION: MGA ZONE 56	DATE: 02/04/2013 PURPOSE: PURPOSE	LAYOUT REF: J:\JOBS\116k\116561 Main Road Rothbury\10- Drafting\Mapinfo\Workspaces\Figures VERSION (PLAN BY): PH (A-A4)

CLIENT: HDB
JOB REF: 116561

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
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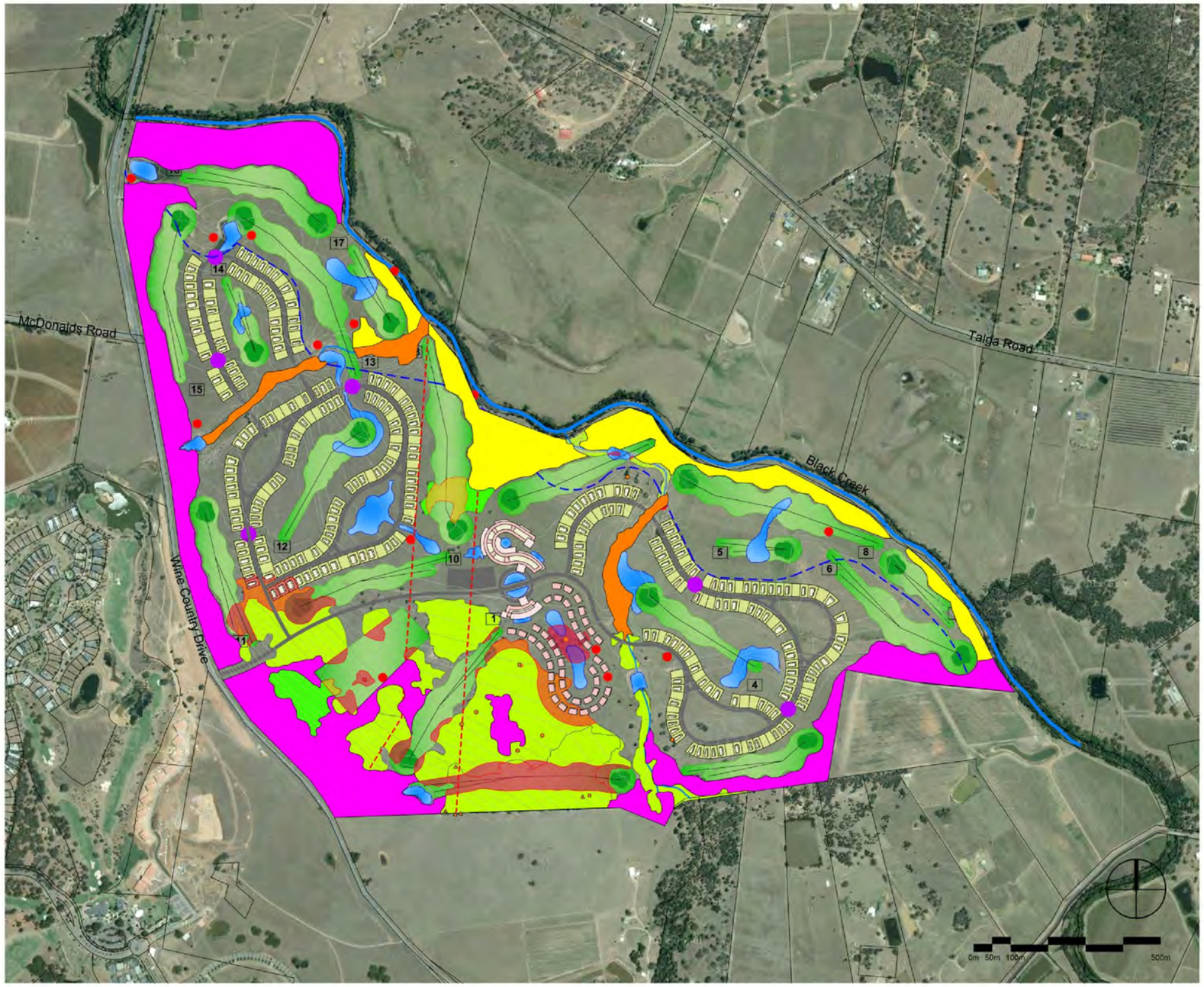
RPS

Figure 2 Development Proposal



Legend

- Existing Modified or Highly Modified EEC's
  Total Area approximately 307,657m²
- Existing Modified or Highly Modified EEC - Areas to be Removed
  Total Area approximately 87,990m²
- Existing Tree Stands (Not EEC's)
- EEC Planting to be Established
  Central Hunter Ironbark - Spotted Gum - Grey Box Forest
  Total Area approximately 340,666m²
- EEC Planting to be Established
  Eucalyptus Glaucina
  Total Area approximately 120,204m²
- EEC Planting to be Established
  Central Hunter Riparian Forest
  Total Area approximately 36,680m²

EEC Modification/Removal

- Modified MU 18 - Central Hunter Ironbark - Spotted Gum - Grey Box Forest (EEC) - approx. 24,854m²
- Highly modified MU 18 - Central Hunter Ironbark - Spotted Gum - Grey Box Forest (C. maculate regrowth, no understorey)(remnant EEC) - approx. 2,274m²
- Highly modified MU 18 - Central Hunter Ironbark - Spotted Gum - Grey Box Forest (E. crebra / E. moluccana / C. glauca only, no understorey)(remnant EEC) - approx. 973m²
- Highly modified MU 18 - Central Hunter Ironbark - Spotted Gum - Grey Box Forest (E. crebra regrowth, no understorey)(remnant EEC) - approx. 59,389m²
- MU 13 - Central Hunter Riparian Forest (EEC) - approx. 500m²
- **Total EEC Removed approx. 87,990m²**

Non EEC Modification/Removal

- Open Melaleuca decora stand - approx. 7,600²
- Casuarina glauca stand - appox. 1,000 m²
- **Total Non EEC Removed approx. 8,600m²**

EEC Establishment

- Central Hunter Ironbark - Spotted Gum - Grey Box Forest - Area approximately 340,666m²
- Eucalyptus Glaucina - Area approximately 120,204m²
- Central Hunter Riparian Forest - Area approximately 36,680m²
- **Total area for EEC establishment approx. 497,620m²**

CAPITAL CORPORATION

NOTE: All dimensions, areas, lot numbers, catchment & number of lots are subject to the approval of council & other authorities and the final survey & town plan and should be considered as conceptual only. Do not rely on the information in this plan for any purchase, disposal or other matter.

TITLE: REGROWTH STRATEGY PLAN
For Discussion Purposes Only

PROJECT: JACK NICKLAUS GOLF COURSE OF AUSTRALIA
LOTS 1 to 4
WINE COUNTRY DRIVE
POKOLBIN

DWG NO: SK 102 REV: A
DATE: 18/04/2013 JOB No: 11/11
SCALE: NTS

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2.0 Methodology

A comprehensive desktop review, alongside a range of field survey techniques, was undertaken to record the ecological characteristics of the site. Survey effort was undertaken with consideration for Cessnock Council's DCP 56 Flora and Fauna Survey Guidlines (Murray et. al. 2002).

2.1 Desktop Assessment

2.1.1 Literature Review

A review of relevant information was undertaken to provide an understanding of ecological values occurring, or potentially occurring, on the site and locality (i.e. within 10 km of the site). Reports prepared for the site and nearby sites have been reviewed for the purpose of assessing the likelihood of threatened species or ecological communities occurring within the site. Information sources reviewed included:

- Review of fauna and flora records contained in the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife within a 10 km radius of the site;
- Review of fauna and flora records contained in the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) Protected Matters Search within a 10 km radius of the site;
- Review of other ecological surveys undertaken within the site - Wildthing Environmental Consultants (2005) *Statement of Effect on Threatened Flora & Fauna Report for Proposed Residential Golf Resort, Lots 1-4 DP869651 Wine Country Drive, Branxton, NSW;* and
- Review of other ecological surveys undertaken in the Rothbury locality - Harper Somers O'Sullivan (2007) *Ecological Constrains Master Plan (ECMP) for Huntlee.*

A review of the previous surveys undertaken within the site (Wildthing Environmental Consultants 2005) has been considered in satisfying the requirements of Cessnock Council's DCP 56. The combined survey effort of Wildthing Environmental Consultants 2005 and RPS surveys is provided in **Table 1** below:

Table 1 Combined Survey Effort

Source	Terrestrial Elliot A	Terrestrial Elliot B	Arboreal Elliot B	Cage Traps	Hair Tubes	Harp Trap	Anabat	Spot lighting	Flora Quadrats
	Trap Nights						Hours		
Wildthing 2005	100	0	24	100	221	0	1.5	3	2
RPS 2013	300	300	72	72	240	12	48	5.66	4
Total	400	300	96	172	461	12	49.5	8.66	6

In addition to the above, eight trap nights of motion sensor detection trapping were undertaken by RPS. Whilst not a requirement of DCP 56, camera use can be beneficial in recording the presence of larger, or trap shy fauna that may occur on site.

The following sections provide additional detail on the methods employed for the current (2013) survey.

2.1.2 Existing Vegetation Mapping

Desktop analysis of regional mapping of the site and its surrounds was informed by large-scale vegetation mapping projects and aerial photography, including:

- Preliminary consultation of the Lower Hunter & Central Coast Regional Environmental Management Strategy (LHCCREMS), Extant Vegetation of the Lower Hunter and Central Coast Map (NPWS 2003) was employed to determine the broad categorisation of the site;
- Aerial Photograph Interpretation (API) and consultation of topographic map (Scale1:25000) of the site; and
- Literature review of previous fieldwork carried out within the site or surrounds including:
  - (1) Wildthing Environmental Consultants (2005) Statement of Effect on Threatened Flora & Fauna Report for Proposed Residential Golf Resort, Lots 1-4 DP869651 Wine Country Drive, Branxton, NSW; and
  - (2) Harper Somers O'Sullivan (2007) Ecological Constrains Master Plan (ECMP) for Huntlee.

2.2 Site Survey

Flora and fauna survey of the site was undertaken by RPS ecologists on the 11th - 15th March 2013.

2.3 Flora Survey

The site was traversed on foot and all species observed were recorded. Notes were made on the structure and condition of the vegetation in, and adjoining, the site. Four flora quadrats were undertaken within the different stratification units across the site. An inventory of plant species observed on site was compiled and is included in **Appendix 2**.

2.3.1 Vegetation Communities

Ground-truthing of the vegetation mapping produced by NPWS (2003) (LHCCREMS). A total of four quadrats (20 m X 20 m, or 10 m X 40 m) were undertaken together with transects throughout the site. These quadrats and transects were stratified based on LHCCREMS vegetation mapping. All mapped vegetation types were sampled at least once, with more extensive vegetation types targeted for proportionally increased sampling effort. Transects helped characterise variations within vegetation communities including age, density and composition of understory, and level of disturbance. Delineation of the highest quality vegetation was done with a GPS whilst walking the perimeter of vegetation. The flora quadrats conducted on site allowed for the confirmation of previously determined vegetation communities. Although cleared pasture covers a large portion (206 ha) of the site, quadrats and transects did not sample these areas proportionately, as these areas are highly disturbed, have a high incidence of exotic species, and are mostly devoid of native trees or shrubs. Refer to **Figure 3** for flora survey locations.

2.3.2 Significant Flora Survey

A list of potentially occurring significant flora species from the locality (10 km radius) was compiled, which included threatened species (Endangered or Vulnerable) and EECs listed under the TSC Act and/or the EPBC Act.

Targeted flora surveys were conducted over two days of field surveys. In line with methodology such as the 'Random Meander Technique' described by Cropper (1993), targeted searches were conducted across the site for threatened flora species known to potentially occur within the site.

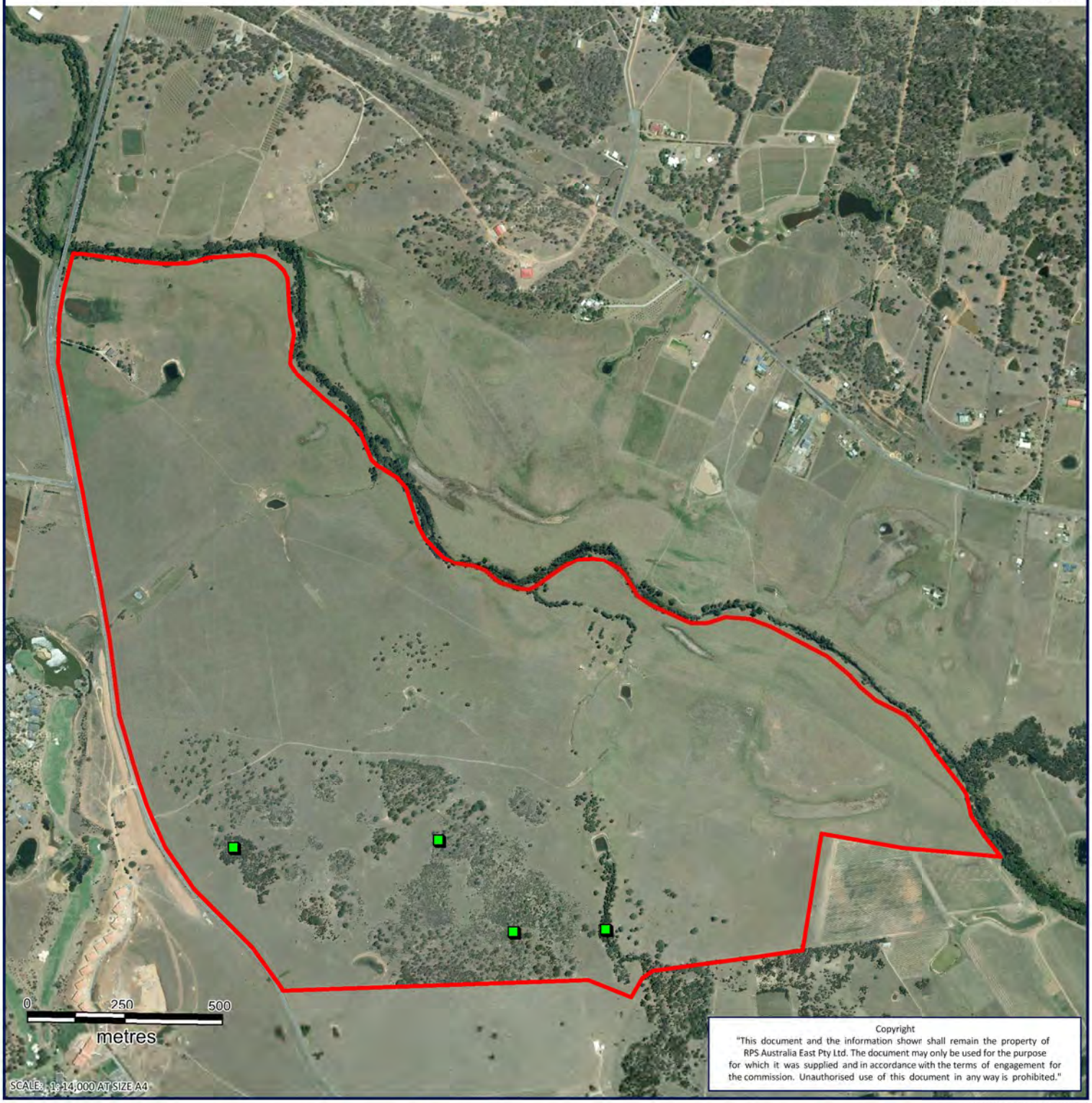
Legend

Site Boundary

Flora Quadrat

N

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.



SCALE: 1:14,000 AT SIZE A4

TITLE: FIGURE 3 FLORA SURVEY METHOD LOCATIONS	LOCATION: ROTHBURY	DATUM: DATUM PROJECTION: MGA ZONE 56	DATE: 02/04/2013 PURPOSE: PURPOSE	LAYOUT REF: J:\JOBS\116k\116561 Main Road Rothbury\10- Drafting\Mapinfo\ Workspaces\Figures VERSION (PLAN BY): PH (A-A4)

CLIENT: HDB
JOB REF: 116561

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2.4 Fauna Survey

An expected fauna species list for the site was prepared upon completion of database interrogations and literature review. A desktop assessment of the potential use of the site by threatened fauna species (as listed under the TSC Act and EPBC Act) identified within the vicinity of the site was undertaken prior to the commencement of field surveys.

The presence of fauna within the site was determined through a variety of survey techniques, including Elliot traps, hair tubes, cage traps, spotlighting, call playback, harp trapping, Anabat recordings, infrared cameras and opportunistic sightings. These methodologies are described in further detail below.

The survey effort for the fauna survey techniques employed was undertaken in accordance with the Cessnock City Council's DCP 56 (Murray et. al. (2002). The locations of fauna surveys were chosen based on the requirements for each stratification unit established in previous vegetation mapping (LHCCREMS).

2.4.1 Avifauna

The presence of avifauna within the site was assessed via opportunistic observations during all days of fieldwork. Additional bird censuses were undertaken in the vicinity of farm dams and in several locations within each vegetation stratification unit. Bird census locations are shown in **Figure 4**. Birds were identified by direct observation, by recognition of calls, or distinctive features such as nests, feathers and owl regurgitation pellets.

Nocturnal surveys (see **sections 2.4.7** and **2.4.8**) were undertaken to detect nocturnal bird species on site.

2.4.2 Arboreal Mammal Trapping

Arboreal trapping was undertaken using tree mounted Elliott B size traps. Traps were mounted on brackets set at approximately 2 m in height on trees with a DBH greater than 30 cm. Traps were baited with a rolled oats, peanut butter and honey mixture and the tree trunks were sprayed liberally with a brown sugar, vanilla extract, and water mix each day in the late afternoon. Traps were checked early each morning. Arboreal traps targeted mammals such as the threatened Squirrel Glider (*Petaurus norfolcensis*), which has been recorded within 10 km of the site.

A total of three trapping transects, containing six Elliott B size arboreal traps, were installed. Trapping was undertaken over four nights, resulting in 72 arboreal trap nights within the site. The location of each trap line is shown in **Figure 4**.

2.4.3 Terrestrial Mammal Trapping

Terrestrial trapping was undertaken using Elliott A, Elliott B and cage traps. Elliott traps were baited with a mixture of rolled oats, peanut butter and honey. Cage traps were baited with chicken necks. Traps were checked within 2 hours of sunrise each morning, with any captures identified and released at point of capture. Traps were re-baited where necessary. The selected locations of the trap lines focused on stratification units, as well as areas consisting of understorey that would provide protection for terrestrial mammal species. The location of each trap line is shown in **Figure 4**.

Terrestrial traps targeted small terrestrial mammals such as dasyurids (e.g. Antechinus and Dunnarts) and rodents (e.g. rats and mice). A total of three trapping transects were undertaken within the site containing 25 Elliot A, 25 Elliot B and six cage traps per line. This resulted in 300 Elliott A trap nights, 300 Elliott B trap nights and 72 cage trap nights within the site.

2.4.4 Hair Tubes

Surveys were undertaken using Faunatech Hair Tubes across the site. These were baited with rolled oats, peanut butter and honey. Trees in which arboreal Hair Tubes were erected were sprayed each day with a brown sugar, vanilla extract, and water mix. At each trap line location, 10 arboreal and 10 terrestrial Hair Tubes were set. The location of each trap line is shown in **Figure 4**.

Hair Tubes targeted small-medium mammals such as dasyurids (e.g. Antechinus and Dunnarts), rodents (e.g. rats and mice), gliders, possums and bandicoots. A total of three trapping transects were undertaken within the site, resulting in 120 arboreal trap nights and 120 terrestrial trap nights.

Any hair samples retrieved during the survey were sent to Barbara Triggs at 'Dead Finish', for analysis.

2.4.5 Herpetofauna

Herpetofauna (frog and reptile) searches were carried out across the site targeting areas of appropriate habitat. Suitable habitats sampled on site included: margins of farm dams and riparian areas, fallen timber and stags with loose bark, and abandoned man-made structures with associated ground cover objects.

During nocturnal spotlighting surveys, censuses of frog calls were conducted in the vicinity of farm dams and species were identified by call.

2.4.6 Micro-Chiropteran Bats

Microbat echolocation calls were recorded using Anabat II Detector and CF ZCAIM units were set to remotely record for the entire night (6pm to 6am). Each of the three trap line locations had four consecutive nights of sampling, with emphasis placed on those areas deemed likely to provide potential foraging and flyway sites for microbats. The location of each microbat call survey site is shown in **Figure 4**.

Bat call analysis was undertaken by Anna McConville, who is experienced in the analysis of bat echolocation calls. Each call sequence ('pass') was assigned to one of three categories, according to the confidence with which an identification could be made. These categories being:

- Definite - Pass identified to species level and could not be confused with another species;
- Probable - Pass identified to species level and there is a low chance of confusion with another species; or
- Possible - Pass identified to species level, but short duration or poor quality of the pass increases the chance of confusion with another species.

Harp Traps were also utilised at all three trap line locations across the site. Harp Traps are designed to catch microbats, allowing for visual identification of species occurring on the site. Any microbats caught were identified early the following morning and kept in a small cloth bag which was kept in a cool dark environment until they could be released at nightfall at the site of capture. **Appendix 4** shows the Anabat report with all results, whilst **Figure 4** shows Harp Trap locations.

2.4.7 Spotlighting

Spotlighting was undertaken with the use of a 75-Watt hand-held spotlight and head torch whilst driving and walking over the site. Areas of dense bush and farm dams were targeted, however, tracks and cleared pastures were also spotlighted whilst traversing, entering, and exiting the site. Spotlighting efforts targeted medium to large sized terrestrial and arboreal mammals, (which were typically located by reflective eye shine and examined and identified through binoculars), and nocturnal birds such as owls and nightjars. A total of

5.66 person hours of spotlighting was conducted over 2 nights. **Figure 4** displays the spotlighting survey effort across the site.

2.4.8 Nocturnal Call Playback

Pre-recorded calls of Owl, Koala and Glider species with the potential to occur within the site were broadcast during the surveys in an effort to either elicit vocal responses or to attract the species to the playback site. The calls were broadcast through an amplification system (loud hailer) designed to project the sound for at least 1 km under still night conditions.

As described by Kavanagh and Peake (1993) and Debus (1995), the call of each species was broadcast for at least five minutes, followed by five minutes of listening, and stationary spotlighting. Following the final broadcast and listening, the area was spotlighted on foot. Species targeted included the Barking Owl (*N. connivens*), Powerful Owl (*Ninox strenua*), Masked Owl (*T. novaehollandiae*), Sooty Owl (*Tyto tenebricosa*), Squirrel Glider (*Petaurus norfolcensis*), Yellow-bellied Glider (*Petaurus australis*), and Koala (*Phascolarctus cinerius*). A total of two call playback sessions were undertaken on two consecutive nights within the site. The location of the call playback sites are shown in **Figure 4**.

2.4.9 Infrared Camera

Two infrared cameras were set up on site. One was in riparian vegetation and the other in eucalypt woodland. The cameras are designed to detect motion and take photographs when movement triggers a sensor. The area in front of the cameras was baited with sardines and a mixture of rolled oats, peanut butter, and honey. Target species included the Spotted-tail Quoll (*Dasyurus maculates*), which has been recorded within 10 km of the site. A total of eight camera-nights were completed during the survey period. The location of the camera sites are shown in **Figure 4**.

2.4.10 Secondary Indications and Incidental Observations

Opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of resident fauna were noted. Such indicators included:

- Distinctive scats left by mammals;
- Scratch marks on tree trunks made by various types of arboreal animals;
- Nests made by various guilds of birds;
- Feeding scars on Eucalyptus trees made by Gliders;
- Whitewash, regurgitation pellets and prey remains from Owls;
- Aural recognition of bird and frog calls;
- Skeletal material of vertebrate fauna; and
- Searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, and diggings).

2.5 Habitat Survey

An assessment of the relative value of the habitat present on site was conducted. Significant fauna habitat including hollow-bearing trees, hollow logs and wombat burrows were identified. All hollow-bearing trees were recorded using a GPS. This was undertaken to assist with the development of actions to minimise impacts of the proposal on resident fauna. Transects within the habitats identified on site helped to delineate areas of higher quality habitat within mapped vegetation communities. The assessment also considered the potential value of the site (and surrounds) for all major guilds of native flora and fauna.

Habitat assessment for threatened species known to occur, or with the potential to occur, in the area was based on the specific habitat requirements of each threatened fauna species in regards to home range, feeding, roosting, breeding, movement patterns and corridor requirements. Consideration was given to contributing factors including topography, soil, light, and hydrology for threatened flora and assemblages.

2.6 Limitations

Limitations associated with this Flora and Fauna Assessment are presented herewith. The limitations have been taken into account specifically with relation to threatened species assessments, results and conclusions.

In these instances, a precautionary approach has been adopted; as such 'assumed presence' of known and expected threatened species, populations and ecological communities has been made where relevant and scientifically justified to ensure a holistic assessment.

2.6.1 Seasonality

Threatened flora species should be surveyed within their respective flowering periods to ensure accurate identification. The flowering periods for cryptic species recorded within 10 km of the site were considered during desktop surveys. The current survey was conducted outside the flowering period for four cryptic species, which may have greatly reduced detectability when not in flower, specifically the *Cryptostylis hunteriana* (Leafless Tongue-orchid), *Pelargonium* sp. *Striatellum* (Omeo Stors-bill), *Prasophyllum* sp. *Wybong*, and *Pterostylis gibbosa* (Illawarra Greenhood). Although the presence of these species could not be verified during flora surveys, habitat assessments and analysis of the suitability of habitats on site for each species compensate for this limitation.

The flowering and fruiting plant species that attract some opportunistic nomadic or migratory threatened species, often fruit or flower in cycles spanning a number of years. Furthermore, these resources might only be accessed in some areas during years when resources more accessible to threatened species fail. As a consequence, threatened species may be absent from some areas where potential habitat exists for extended periods, as may be the case for the above-mentioned opportunistic species. This limitation has been reduced to some extent by the large amount of survey work that has been undertaken throughout the local area, as well as local knowledge of species occurrence.

2.6.2 Data Availability & Accuracy

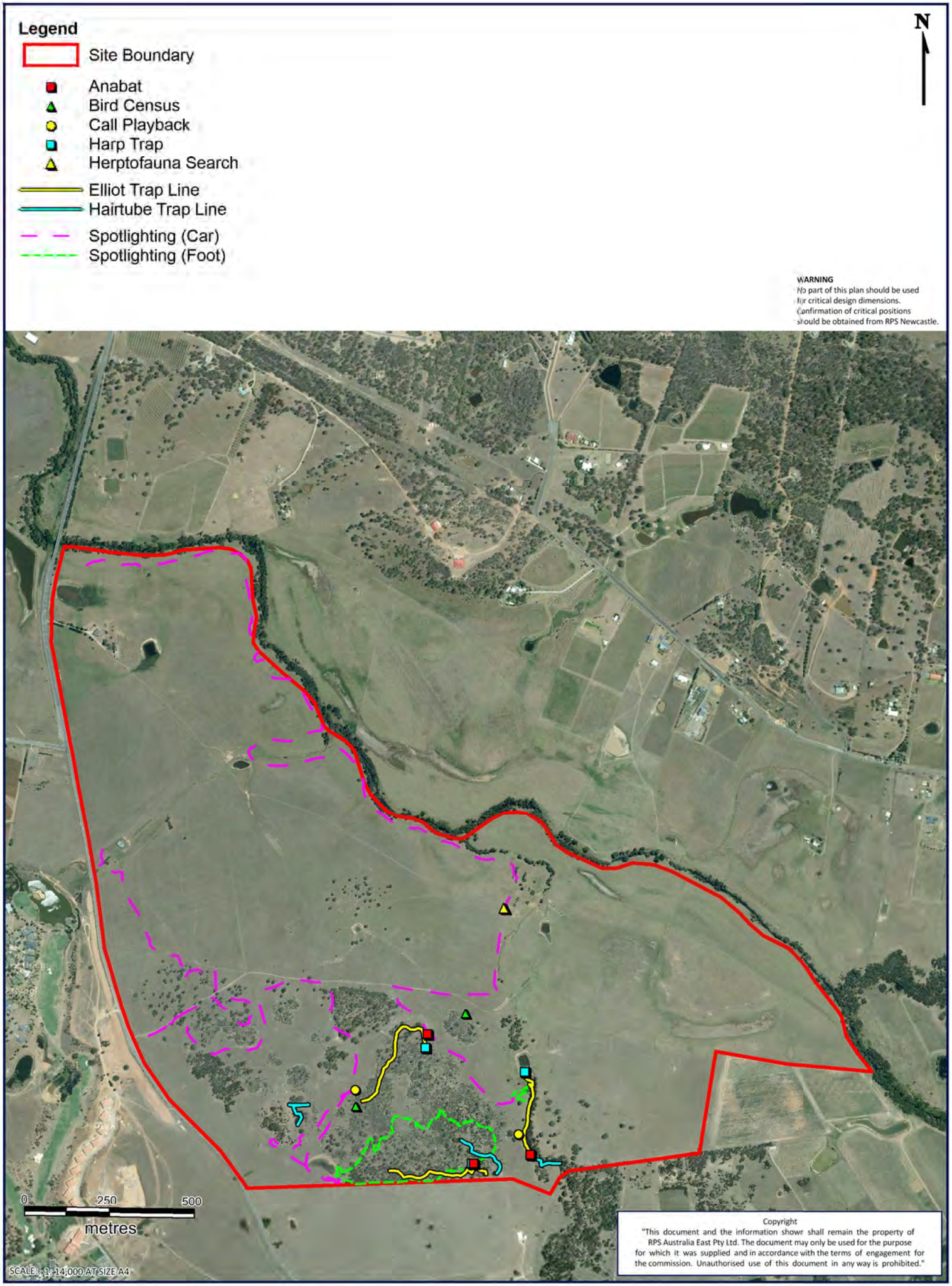
The collated threatened flora and fauna species records provided by the Atlas of NSW Wildlife are known to vary in accuracy and reliability. Traditionally, this is due to the reliability of information provided to the NPWS for collation and/or the need to protect specific threatened species locations. For the purposes of this assessment, this information has been considered to have a maximum accuracy of ± 1km.

Threatened flora and fauna records within the region were predominantly sourced from the online OEH Bionet and SEWPAC Protected Matters Search Tool. Limitations exist with regards to this data and its accuracy.

2.6.3 Fauna

The presence of fauna within a particular area is not static over time - it may be seasonal or in response to the availability of a particular resource. Some fauna species that have been recorded in the local area occur on a seasonal or migratory basis, and may be absent from the locality for much of the year. Fauna behaviours may have also affected detectability; species that are easily disturbed or cryptic may not have been detected during surveys.

As such, where survey effort targeting particular threatened fauna species has not been undertaken, habitat assessment and prediction of the occurrence of threatened fauna species has been applied. The precautionary principle was applied where marginal habitat was identified or predicted to occur, or where species are migratory or nomadic and were therefore likely to utilise habitat components at some stage during their life cycle.



TITLE: FIGURE 4 FAUNA SURVEY METHOD LOCATIONS

LOCATION: ROTHBURY

DATUM: DATUM
PROJECTION: MGA ZONE 56

DATE: 02/04/2013
PURPOSE: PURPOSE

LAYOUT REF: J:\JOBS\116k\116561 Main Road Rothbury\10- Drafting\Mapinfo\Workspaces\Figures
VERSION (PLAN BY): PH (A-4)

CLIENT: HDB
JOB REF: 116561

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3.0 Results

3.1 Desktop Assessment

3.1.1 Literature Review

A review of the literature listed in **Section 2.1** and database search results identified the following threatened species, populations and ecological communities as potentially occurring on the site or within 10 km of the site (**Table 2**).

Table 2 - Threatened Flora and Fauna Desktop Search Results

Scientific Name	Common Name	TSC Act	EPBC Act	No. of Records	Notes and Source
Flora					
Acacia bynoeana	Bynoe's Wattle	E	-	2	Recorded within 10 km of the site[1]
Acacia pendula	*Acacia pendula* population in the Hunter catchment	E2	-	1	Recorded within 10 km of the site[1]
Allocasuarina glareicola	-	E	E	0	Species or species habitat may occur within area[2]
Angophora inopina	Charmhaven Apple	V	V	0	Species or species habitat likely to occur within area[2]
Callistemon linearifolius	Netted Bottle Brush	V	-	12	Recorded within 10 km of the site[1]
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	0	Species or species habitat may occur within area[2]
Cymbidium canaliculatum	*Cymbidium canaliculatum* population in the Hunter Catchment	E2	-	2	Recorded within 10 km of the site[1]
Eucalyptus castrensis	Singleton Mallee	E	-	9	Recorded within 10 km of the site[1]
Eucalyptus glaucina	Slaty Red Gum	V	V	144	Recorded within 10 km of the site[1] Species or species habitat likely to occur within area[2] Recorded on site during 2013 surveys (RPS)
Eucalyptus parramattensis subsp. *decadens*	Earps' Gum	V	V	25	Recorded within 10 km of the site[1] Species or species habitat likely to occur within area[2]
Eucalyptus pumila	Pokolbin Mallee	V	V	24	Recorded within 10 km of the site[1] Species or species habitat likely to occur within area[2]
Euphrasia arguta	-	CE	CE	0	Species or species habitat may occur within area[2]
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	7	Recorded within 10 km of the site[1] Species or species habitat likely to occur within area[2]

Scientific Name	Common Name	TSC Act	EPBC Act	No. of Records	Notes and Source
Pelargonium sp. *Striatellum* (G.W.Carr 10345)	Omeo Stork's-bill	E	E	0	Species or species habitat likely to occur within area[2]
Persoonia pauciflora	North Rothbury Persoonia	CE	CE	62	Recorded within 10 km of the site[1] Species or species habitat known to occur within area[2]
Prasophyllum sp. *Wybong* (C.Phelps ORG 5269)	a leek-orchid	-	CE	0	Species or species habitat may occur within area[2]
Prostanthera cineolifera	Singleton Mint Bush	V	V	0	Species or species habitat likely to occur within area[2]
Pterostylis gibbosa	Illwarra Greenhood	E	E	0	Species or species habitat may occur within area[2]
Rutidosis heterogama	Heath Wrinklewort	V	-	21	Recorded within 10 km of the site[1]
Streblus pendulinus	Siah's Backbone	-	E	0	Species or species habitat likely to occur within area[2]
Zannichellia palustris	-	E	-	1	Recorded within 10 km of the site[1]
Amphibians					
Heleioporus australiacus	Giant Burrowing Frog	V	V	1	Recorded within 10 km of the site[1]
Litoria aurea	Green and Golden Bell Frog	E	V	0	Species or species habitat may occur within area[2]
Litoria littlejohni	Littlejohn's Tree Frog	V	V	0	Species or species habitat may occur within area[2]
Mixophyes balbus	Stuttering Frog	E	V	0	Species or species habitat likely to occur within area[2]
Mixophyes iteratus	Giant Barred Frog	E	E	0	Species or species habitat may occur within area[2]
Reptiles					
Reptiles					
Hoplocephalus bungaroides	Broad-headed Snake	E	E	0	Species or species habitat likely to occur within area[2]
Birds					
Anthochaera phrygia	Regent Honeyeater	CE	E, M	3	Recorded within 10 km of the site[1] Species or species habitat likely to occur within area[2]
Botaurus poiciloptilus	Australasian Bittern	E	E	0	Species or species habitat known occur within area[2]
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	2	Recorded within 10 km of the site[1]
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	7	Recorded within 10 km of the site[1]
Cthonicola sagittata	Speckled Warbler	V	-	8	Recorded within 10 km of the site[1]
Circus assimilis	Spotted Harrier	V	-	1	Recorded within 10 km of the site[1]

Scientific Name	Common Name	TSC Act	EPBC Act	No. of Records	Notes and Source
Climacteris picumnus victoriae	Brown Treecreeper (eastern subsp.)	V	-	3	Recorded within 10 km of the site[1]
Daphoenositta chrysoptera	Varied Sittella	V	-	7	Recorded within 10 km of the site[1]
Dasyornis brachypterus	Eastern Bristlebird	E	E	0	Species or species habitat likely to occur within area[2]
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	1	Recorded within 10 km of the site[1]
Erythrotriorchis radiatus	Red Goshawk	E	V	0	Species or species habitat likely to occur within area[2]
Glossopsitta pusilla	Little Lorikeet	V	-	10	Recorded within 10 km of the site[1]
Grantiella picta	Painted Honeyeater	V	-	1	Recorded within 10 km of the site[1]
Hieraaetus morphnoides	Little Eagle	V	-	1	Recorded within 10 km of the site[1]
Ixobrychus flavicollis	Black Bittern	V	E	1	Recorded within 10 km of the site[1]
Lathamus discolor	Swift Parrot	E	E	5	Recorded within 10 km of the site[1] Species or species habitat likely to occur within area[2]
Lophoictinia isura	Square-tailed Kite	V	-	1	Recorded within 10 km of the site[1]
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	2	Recorded within 10 km of the site[1]
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subsp.)	V	-	3	Recorded within 10 km of the site[1]
Ninox connivens	Barking Owl	V	-	2	Recorded within 10 km of the site[1]
Ninox strenua	Powerful Owl	V	-	4	Recorded within 10 km of the site[1]
Petroica boodang	Scarlet Robin	V	-	3	Recorded within 10 km of the site[1]
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	75	Recorded within 10 km of the site[1] Recorded on site during 2013 surveys (RPS)
Rostratula australis	Australian Painted Snipe	E	V, M	0	Species or species habitat may occur within area[2]
Tyto novaehollandiae	Masked Owl	V	-	1	Recorded within 10 km of the site[1]
Mammals					
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	1	Recorded within 10 km of the site[1] Species or species habitat may occur within area[2]

Scientific Name	Common Name	TSC Act	EPBC Act	No. of Records	Notes and Source
Dasyurus maculatus maculatus	Spotted-tailed Quoll (SE Mainland Pop)	V	E	8	Recorded within 10 km of the site[1] Species or species habitat may occur within area[2]
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	2	Recorded within 10 km of the site[1]
Miniopterus australis	Little Bentwing-bat	V	-	9	Recorded within 10 km of the site[1]
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	35	Recorded within 10 km of the site[1]
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	28	Recorded within 10 km of the site[1]
Myotis macropus	Southern Myotis	V	-	13	Recorded within 10 km of the site[1]
Petaurus australis	Yellow-bellied Glider	V	-	2	Recorded within 10 km of the site[1]
Petaurus norfolcensis	Squirrel Glider	V	-	60	Recorded within 10 km of the site[1]
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	6	Species or species habitat known to occur within area[2]
Phascolarctos cinereus	Koala (Qld, NSW, Vic and ACT Populations)	V	V	4	Recorded within 10 km of the site[1] Species or species habitat known to occur within area[2]
Pseudomys novaehollandiae	New Holland Mouse	-	V	0	Species or species habitat likely to occur within area[2]
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	32	Recorded within 10 km of the site[1] Foraging, feeding, or related behaviour known to occur within area[2]
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V	-	1	Recorded within 10 km of the site[1]
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	10	Recorded within 10 km of the site[1]
Vespadelus troughtoni	Eastern Cave Bat	V	-	3	Recorded within 10 km of the site[1]
Threatened Ecological Communities					
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland		E	CE	0	Community likely to occur within area[2]

Key:

V = Vulnerable
E = Endangered
E2 = Endangered Population
CE = Critically Endangered
M = Migratory

1 - OEH (2013) *Atlas of NSW Wildlife*, Office of Environment and Heritage (Accessed February 2013).

2 - SEWPAC (2013) Protected Matters Search, Department of Sustainability, Environment, Water, Population and Communities (Accessed February 2013).

Migratory species listed under the EPBC Act have also been considered under this assessment. **Table 3** lists potentially occurring migratory species.

Table 3 - Potentially occurring Migratory Species

Scientific Name	Common Name	EPBC Act Status
Anthochaera phrygia	Regent Honeyeater	E,M
Apus pacificus	Fork-tailed Swift	M
Ardea alba	Great Egret	M
Ardea ibis	Cattle Egret	M
Gallinago hardwickii	Latham's Snipe	M
Haliaeetus leucogaster	White-bellied Sea Eagle	M
Hirundapus caudacutus	White-throated Needletail	M
Merops ornatus	Rainbow Bee-eater	M
Monarcha melanopsis	Black-faced Monarch	M
Myiagra cyanoleuca	Satin flycatcher	M
Rhipidura rufifrons	Rufous Fantail	M
Rostratula benghalensis	Painted Snipe	M

Key:
M = Migratory
E = Endangered

3.1.2 Existing Report Results

Results from previous reports detected numerous threatened flora, fauna and/or Ecological Communities on site. **Table 4** below highlights these results.

Table 4 - Previous reports threatened species results

Scientific Name	Common name	TSC Act Status	EPBC Act Status	Notes and Source
Flora				
Acacia bynoeana	Bynoe's Wattle	E	V	Occurs locally[2]
Eucalyptus glaucina	Slaty Red Gum	V	V	Occurs locally[2]
Eucalyptus parramattensis susbsp. *decadens*	Drooping Red Gum	V	V	Occurs locally[2]
Persoonia pauciflora	North Rothbury Persoonia	E	CE	Occurs locally[2]
Avifauna				
Climacteris picumnus victoriae	Brown Treecreeper (eastern subsp.)	V	-	Occurs locally[2]
Chthonicola sagittata	Speckled Warbler	V	-	Occurs locally[2]
Lathamus discolor	Swift Parrot	E	E	Occurs locally[2]
Melithreptus gularis gularis	Black-chinned Honeyeater	V	-	Occurs locally[2]
Neophema pulchella	Turquoise Parrot	V	-	Occurs locally[2]
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V	-	Occurs locally[2] and on site[1]
Mammals				
Miniopterus australis	Little Bentwing Bat	V	-	Occurs locally[2]

Scientific Name	Common name	TSC Act Status	EPBC Act Status	Notes and Source
Miniopterus schreibersii	Eastern Bentwing-Bat	V	-	Occurs locally[2]
Mormopterus norfolkensis	East-coast Freetail-bat	V	-	Occurs locally[2]
Myotis adversus	Large-footed Myotis	V	-	Occurs locally[2]
Petaurus norfolcensis	Squirrel Glider	V	-	Occurs locally[2]
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Occurs locally[2]
Ecological Communities				
Hunter Valley Dry Rainforest; equivalent to Lowland Rainforest	-	E	-	Occurs locally[2]
Central Hunter Riparian Forest	-	E	-	Occurs locally[2] and on site[1]
Wollombi Redgum – River Oak Woodland; equivalent to River-Flat Eucalypt Forest on Coastal Floodplains	-	E	-	Occurs locally[2]
Hunter Lowland Redgum Forest	-	E	-	Occurs locally[2]
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion (MU 18) (LHCCREMS);	-	E	-	Occurs locally[2] and on site[1]

Key:
V = Vulnerable
E = Endangered

1- Wildthing Environmental Consultants (2005) *Statement of Effect on Threatened Flora & Fauna Report for Proposed Residential Golf Resort, Lots 1-4 DP869651 Wine Country Drive, Branxton, NSW.*

2- Harper Somers O'Sullivan (2007) *Ecological Constrains Master Plan (ECMP) for Huntlee.*

3.1.3 Vegetation Mapping

A review of regional mapping - 'Lower Hunter & Central Coast Regional Environmental Management Strategy (LHCCREMS)', (NPWS 2003) identified two vegetation communities within the site, namely:

- MU 13 Central Hunter Riparian Forest; and
- MU 18 Central Hunter Ironbark – Spotted Gum – Grey Box Forest.

3.2 Field Survey

The prevailing weather conditions during the site survey period are presented in **Table 5** below:

Table 5 - Prevailing Weather Conditions*

Measurement		11 March 2013	12 March 2013	13 March 2013	14 March 2013	15 March 2013
Temperature		17.0-27.3	16.3-27.0	15.2-28.2	14.8-27.1	18.0-25.0
Wind (km/h)		0-9	4-13	4	0-6	0-6
Cloud		6/8	1/8	0/8	4/8	8/8
Rain (24 hrs to 9:00am)		0	0	0	0	0
Sun	*Rise*	0645	0646	0647	0648	0648
	Set	1913	1912	1911	1909	1908
Moon	*Rise*	0528	0623	0717	0810	0902
	Set	1759	1841	1922	2004	2047

*Sources: http://www.bom.gov.au/climate/dwo/201303/html/IDCJDW2079.201303.shtml
http://www.ga.gov.au/bin/geodesy/run/gazmap_sunrise?placename=Maitland&placetype=0&state=0#loc
http://www.ga.gov.au/geodesy/astro/moonrise.jsp

3.2.2 Flora Survey

3.2.2.1 Vegetation Community Mapping

Ground-truthing of the site, together with flora quadrats and transects, identified four vegetation communities on the site, namely:

- MU 18 Central Hunter Ironbark – Spotted Gum – Grey Box Forest (CHISGGB Forest);
- MU 13 Central Hunter Riparian Forest (CHR Forest);
- *Casuarina glauca* Regrowth;
- Open *Melaleuca decora* stand; and
- Cleared pasture.

CHR Forest and CHISGGB Forest were identified as being generally consistent with the descriptions provided by LHCCREMMS (NPWS 2003). A single stand of Pure *Casuarina glauca* (Swamp Oak) Woodland and an area containing scattered *Melaleuca decora* did not exhibit characteristics commensurate with the vegetation communities described in LHCCREMS, and as such, are described and mapped henceforth as distinct communities. Cleared pasture is the most extensive vegetation type on site.

A description of the vegetation communities identified within the site is provided below.

MU 18 Central Hunter Ironbark – Spotted Gum – Grey Box Forest

Plate 1 Map Unit 18 – Central Hunter Ironbark – Spotted Gum – Grey Box Forest

Classification: This vegetation community is listed as an EEC under the NSW TSC Act.

Description: This vegetation community constitutes the largest area of native vegetation on site and occupies the moderately fertile soils on gently undulating topography. The CHISGGB Forest on site was found to be varying in condition, as a result of past land clearing and subsequent regrowth of canopy species. These variants of the community's condition were found to be distinct enough to warrant separate delineations across the site. The majority of this community occurred as mostly disconnected regrowth pure *Eucalyptus crebra* (Narrow-leaved Ironbark) stands, with a particularly young age cohort of juvenile trees descendent from one or few mature trees. This variant has been mapped separately as '*E. crebra* regrowth' in **Figure 5**, and is also shown in **Plate 2** below. The smaller patches of this variant were completely void of an understorey, with the exception of some shrub patches within the largest area in the south.

A single stand of a *Corymbia maculata* (Spotted Gum) regrowth variant was also recorded on site. Its formation was similar to that of the *E. crebra* regrowth variant, with juvenile trees derived from a small number of parent trees and a completely absent understorey (see **Plate 3**). Two areas of the site were found to contain more mature trees, containing *E. crebra*, *Eucalyptus moluccana* (Grey Box) and *Casuraina glauca* (Swamp Oak). This variant also did not contain an understorey (see **Plate 4**).

One area within the south of the site was recorded as having moderate species diversity, both within the canopy and within the understory (see **Plate 1**). Notably, however, much of this area was still partially modified by past clearing, containing a high number of juvenile *E. creba* trees throughout and a lower overall species diversity than that which would naturally occur. Floristic details of this more intact example of the CHISGGB has been provided below.

Plate 2 Map Unit 18 – *E. crebra* regrowth variant

Plate 3 Map Unit 18 – *C. maculata* regrowth variant

Plate 4 Map Unit 18 – *E. crebra*, *E. moluccana* and *C. glauca* variant

Area: 28.33 hectares.

Canopy Layer: To 20 metres, with 40% Projected Foliage Cover (PFC). The dominant species was *E. crebra* with subdominant species including *E. moluccana* (Grey Box), *Eucalyptus glaucina* (Slaty Red Gum), *C. maculata* (Spotted Gum), and *C. glauca*.

Shrub Layer: 1.5 to 8 metres, with up to 50% PFC. Dominant species include juvenile *E. crebra*, *Melaleuca decora*, *Pultenaea spinosa*, *Hakea sericea* (Needlebush), and *Cassinia aculeata* (Dolly Bush).

Ground Layer: To 0.2 metres, with 80% PFC. Dominant species include native and introduced grasses and forbs such as *Eragrostis tenuifolia* (Elastic Grass), *Microlaena stipoides* (Weeping Grass), *Goodenia hederacea* (Ivy Goodenia) and *Pratia purpurascens* (Whiteroot).

MU 13 Central Hunter Riparian Forest

Plate 5 MU 13 Central Hunter Riparian Forest

Classification: This vegetation community corresponds with the Central Hunter Riparian Forest which is commensurate with the EEC River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions listed under the NSW TSC Act.

Description: A vegetation community widespread throughout the central to lower Hunter Valley, this vegetation community occurs along a stationary to slowly flowing creekline on site. It persists as a narrow corridor less than 50 metres wide, fringing and forming a canopy over the small creek. An extensive corridor of this vegetation exists just off site along Black Creek on the northern boundary.

Area: 2.47 hectares.

Canopy Layer: To 12 metres, with 90% Projected Foliage Cover (PFC). Dominanted by *C. glauca*.

Shrub Layer: None

Ground Layer To 0.25 metres, with 80% PFC. The ground layer is composed of a combination of both native and exotic grasses and forbs dominated by *M. stipoides,* and also including *Viola hederacea* (Ivy-leaved Violet), *Hypochaeris radicata* (Flatweed), *P. purpurascens*, and *Commelina cyanea* (Scurvy Weed).

Casuarina glauca Regrowth

Plate 6 *Casuarina glauca* Regrowth

Classification: This vegetation community is not commensurate with any communities listed under the NSW TSC Act and/or the EPPBC Act.

Description: This vegetation community is composed of a single dominant tree species, *C. glauca*, which is represented elsewhere on site and in the surrounding region within MU 13 Central Hunter Riparian Forest. However, this vegetation community exists as a pure stand of a single tree species over pasture grasses in an area of higher elevation. It is not associated with a riparian zone or wetland and does not display any additional landscape features or vegetation that would be commensurate with MU 13.

Area: 1.61 hectares.

Canopy Layer: To 12 metres, with 80% Projected Foliage Cover (PFC). Dominanted by *C. glauca*.

Shrub Layer: None

Ground Layer To 0.3 meters, with 80% PFC. The ground layer is composed of a combination of both native and exotic grasses and forbs dominated by *M. stipoides,* and also includes *Viola hederacea* (Ivy-leaved Violet), *P. purpurascens*, and *Brunoniella australis* (Blue Trumpet).

Open *Melaleuca decora* Stand

Plate 7 Melaleuca decora Stand

Classification: This vegetation community is not commensurate with any communities listed under the NSW TSC Act and/or the EPPBC Act.

Description: This vegetation community consists of an open stand of *M. decora* low trees in a low-lying damp area of pasture downslope from a farm dam.

Area: 1.25 hectares.

Canopy Layer: To 5 metres, with open canopy. One dominant species, namely *M. decora*.

Shrub Layer: None.

Ground Layer: To 0.3 meters, with 80% PFC. The ground layer is composed of a combination of both native and exotic grasses including *M. stipoides*, *P. purpurascens*, and *Paspalidium distans*.

Cleared Pasture

Classification: This vegetation community does not correspond with any communities listed under the NSW TSC Act and/or the EPPBC Act.

Description: The Cleared Pasture assemblage comprises approximately 206 hecatres, or 86% of the total area of the site, and is composed of native and exotic pasture species such as *M. stipoides*, *P. purpurascens*, and *Paspalidium distans*.

Area: 206.34 hectares.

Legend

- Site Boundary

Vegetation Communities

- Casuarina glauca stand
- Modified MU 18 - Central Hunter Ironbark -Spotted Gum - Grey Box Forest (EEC)
- Highly modified MU 18 - Central Hunter Ironbark -Spotted Gum - Grey Box Forest (C. maculata regrowth, no understorey) (remnant EEC)
- Highly modified MU 18 - Central Hunter Ironbark -Spotted Gum - Grey Box Forest (E. crebra / E. moluccana / C. glauca only, no understorey) (remnant EEC)
- Highly modified MU 18 - Central Hunter Ironbark -Spotted Gum - Grey Box Forest (E. crebra regrowth, no understorey) (remnant EEC)
- MU13 - Central Hunter Riparian Forest (EEC)
- Open Melaleuca decora stand

N

WARNING

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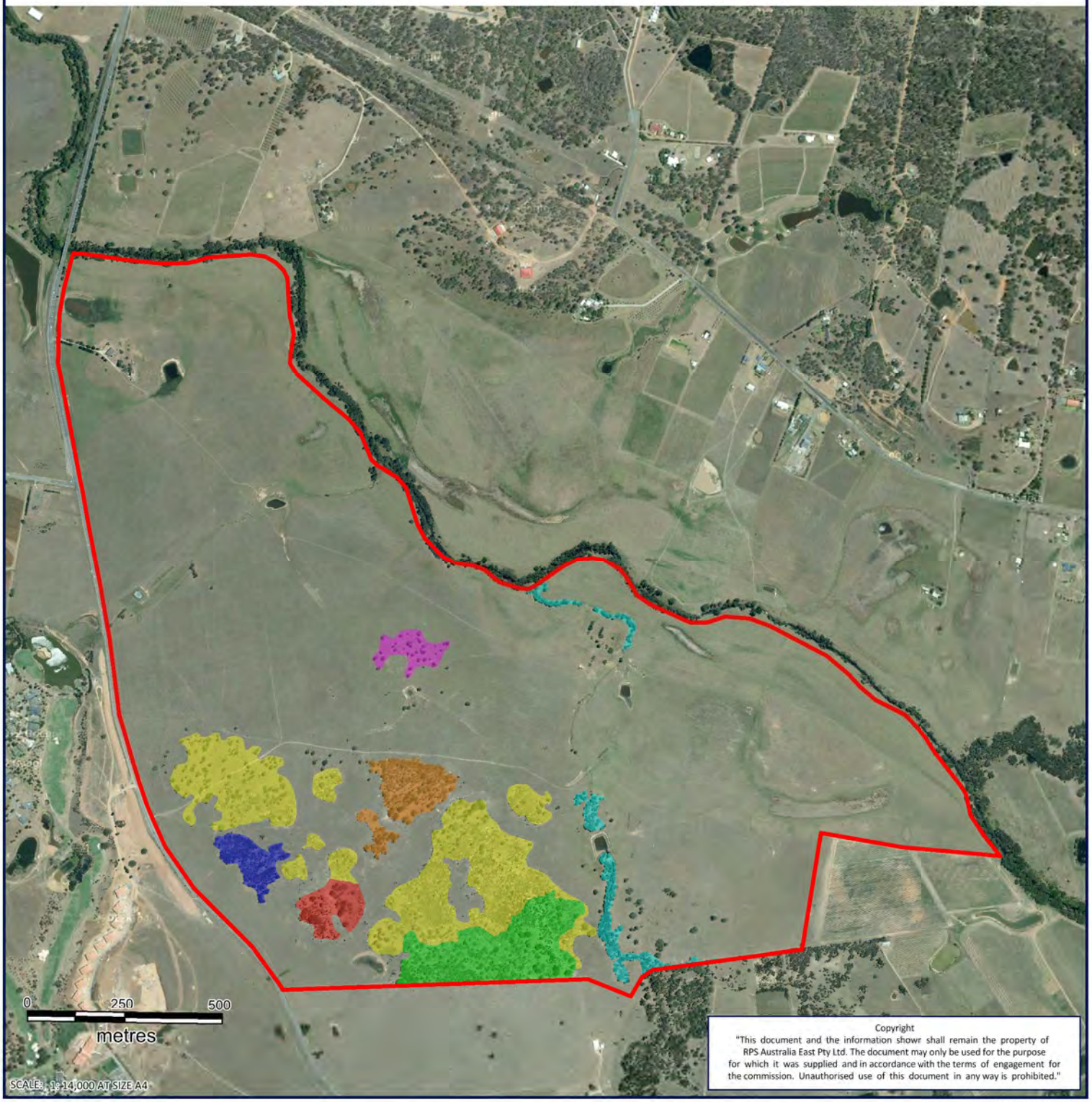
Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries 'on the ground'. Therefore, this map should only be treated as an indication of aproximate peripheries between delineated vegetation communities. Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.



SCALE: 1:14,000 AT SIZE A4

TITLE: FIGURE 5 VEGETATION MAP | LOCATION: ROTHBURY | DATUM: DATUM | PROJECTION: MGA ZONE 56 | DATE: 02/04/2013 | PURPOSE: PURPOSE | LAYOUT REF: J:\JOBS\116k\116561 Main Road Rothbury\10- Drafting\Mapinfo\Workspaces\Figures | VERSION (PLAN BY): PH (A-4)

CLIENT: HDB
JOB REF: 116561

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3.2.3 Significant Flora

Targeted searches for threatened flora species identified in **Table 2** as potentially occurring on site were conducted during field surveys. *Eucalyptus glaucina* (Slaty Red Gum), which is listed as Vulnerable under the TSC Act and Vulnerable under the EPBC Act, was identified during these searches. This species was recorded in two small stands near the southern boundary of the site in the Central Hunter Ironbark – Spotted Gum – Grey Box Forest (**Figure 6**). Within the two separate stands found on site: one contains eleven mature trees and at least 30 saplings and is located at the south-west limit of the CHISGGB Forest, and the other containing one mature tree and 27 saplings, located at the south-east limit of the CHISGGB Forest on site. Saplings were also observed in a cleared paddock area directly adjacent to the south of the site.

Plate 8 *Eucalyptus glaucina* Stand.

3.3 Fauna Survey

Survey techniques employed to determine the composition of fauna species detected 78 species on site.

3.3.1 Avifauna

A total of 42 bird species were recorded during field surveys. The species recorded on site consisted of many common birds typical of open country and open woodland habitats, including Australian Magpie, Eastern Rosella, Pied Butcherbird, and Noisy Miner. A nest tended by at least eleven White-winged Choughs was observed in the riparian habitat. Australian Wood Ducks were routinely observed on farm dams. There was a low diversity and abundance of small passerines on site, which may be related to the lack of flowering eucalypts at the time of the survey, as well as the young age and low diversity of canopy trees and lack understory shrub species in most of the woodland habitats on site.

One TSC Act listed Vulnerable bird species, the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), was recorded on site. This species inhabits a wide range of open woodland habitats. On site, it was observed in parts of the CHISGGB Forest with a dense understory of shrubs and immature trees. One active nest occupied by three individuals was found in a *Melaleuca decora* low tree in the south-east end of the CHISGGB Forest on site. Two very old nests were found in the north-east portion of the CHISGGB Forest. **Figure 6** displays the locations of the Grey-crowned Babbler and associated nesting sites. An inventory of fauna species recorded on the site is provided in **Appendix 3**.

3.3.2 Arboreal Mammal Trapping

Arboreal mammal trapping resulted in two captures, a Squirrel Glider (*Petaurus norfolcensis*) and an incidental capture of a Green Tree Frog (*Litoria caerulea*).

The Squirrel Glider is listed as Vulnerable under the TSC Act. It was captured within a stand of pure *Casuarina glauca* in the Central Hunter Riparian Forest habitat on site. Upon release, it was observed gliding from the riparian vegetation into a group of large trees in the cleared pasture nearby. One of these trees contained hollows that could provide suitable refuge for this species. Squirrel Gliders are likely to utilise any woodland habitats on site that are adequately connected, and travel to woodland habitats off site via the strip of riparian vegetation at the southern end of the site.

3.3.3 Terrestrial Mammal Trapping

Terrestrial mammal trapping resulted in the capture of one mammal and one reptile species. Black Rats (*Rattus rattus*) were frequently caught in the Central Hunter Riparian Forest. The Black Rat is an invasive non-native species that occupies a wide range of habitats, often in association with disturbance. One Red-bellied Black Snake was captured incidentally in an Elliott B trap within the CHISGGB Forest. A full list of mammal species recorded on site is in **Appendix 3**.

3.3.4 Hair Tubes

Multiple hair samples were collected using the Hair Tube methods on site. All hairs collected were determined to be the Common Brushtail Possum (*Trichosurus vulpecula*).

3.3.5 Herpetofauna

Three reptiles and nine amphibians were detected on site. The relatively high diversity of frog species reflects the abundance of available wetland habitats on site, mostly in the form of farm dams. At the time of surveys, many areas of the site were waterlogged or partially inundated by recent rains.

The reptiles recorded included the Eastern Snake-necked Turtle (*Chelodina longicollis*) and the Red-bellied Black Snake (*Pseudechis porphyriacus*), two species that are often associated with wetland areas.

Frogs were found in the farm dams throughout the site and included ten common tree frog (Hylidae) and froglet (Myobatrachidae) species. Overall, wetland habitats were the most important areas for herpetofauna on site, both in riparian vegetation and cleared pastures.

No threatened reptile or amphibian species were detected on site during surveys. A full list of herpetofauna recorded on site is in **Appendix 3**

3.3.6 Micro-Chiropteran Bats

A total of ten microbat species were recorded on site − nine detected via the use of Anabat echo-location call recorders and one additional species caught using harp traps. Of these species, four are listed as Vulnerable

under the TSC Act. These include Little Bentwing Bat (*Miniopterus australis*), Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), East-coast Freetail Bat (*Mormopterus norfolkensis*) and Yellow-bellied Sheathtail bat (*Saccolaimus flaviventris*).

Refer to **Appendix 3** for a detailed list of recorded species, and **Appendix 4** for the Anabat Call Recording report.

3.3.7 Spotlighting

Two mammal and nine frog species were recorded during spotlighting surveys on site. The Common Brushtail Possum (*Trichosurus vulpecula*) was recorded in low numbers within the CHISGGB Forest, and the Common Ringtail Possum (*Pseudocheirus peregrines*) was found in the Central Hunter Riparian Forest along Black Creek on the northern border of the site.

Frog species were identified by call while spotlighting in the vicinity of wetland areas.

3.3.8 Nocturnal Call Playback

No responses to call playback calls were heard during the surveys.

3.3.9 Infrared Camera

Motion sensor images captured only cattle on camera. Although these cameras were set up to target the Spotted-tail Quoll, they were unsuccessful in capturing any signs of presence of this threatened species.

3.4 Habitat Survey

Fauna habitats identified on site can be broadly separated into woodlands, aquatic habitats and Cleared Pasture. These environments provide opportunities for terrestrial and arboreal fauna, as well as habitats for aquatic and wetland species.

3.4.1 Terrestrial Habitats

All habitats on site have been subject to grazing by cattle, as well as some degree of past vegetation clearing. Subsequently, most woodland habitats constitute some degree of regrowth of canopy trees with sparse to absent understory over pasture grasses. Due to the young age of the regrowth, it provides few of the habitat features important to terrestrial fauna such as hollow logs, woody debris, leaf litter, or dense and complex understory. Dense pasture grass provides the only widely available cover. An area of woodland in the south of the site contained more mature canopy trees as well as a present shrub layer. This area may provide better cover for terrestrial species, though the level of ground cover is still affected by grazing. The terrestrial habitats on site are suitable for browsing by macropods and foraging by birds, but overall, they have a low abundance of sufficient refugia for small mammals, reptiles, or nesting birds.

Grazing by cattle and past vegetation clearing have affected all flora habitats on site, resulting in a high incidence of weeds and poor condition of understorey flora communities. Clearing and ongoing grazing pressures have largely eliminated the shrub layer throughout most of the site and has limited the diversity of what remains to hardy and generally unpalatable species that can withstand intensive grazing, such as *P. spinosa* and *H. sericea*, which were the most abundant shrubs within the site. The ground layer is similarly limited to hardy pasture grasses and weeds that can tolerate grazing and have subsequently formed a dense grassy layer limiting the potential for less hardy flora species to establish or compete.

3.4.2 Arboreal Habitats

The site's Eucalypt Woodlands, *C. glauca* stands and riparian vegetation contain potential foraging resources such as foliage, pollen, nectar, seeds and invertebrates for birds, possums, and gliders, as well as small tree-hollows suitable for roosting/nesting habitat for hollow dependant fauna. Areas containing *Casuarina glauca* are a potential food resource for Glossy Black-Cockatoos. The young regrowth trees that dominate most habitats lack hollows. Only a few of the scattered mature trees and dead stags contain hollows. The majority of hollows recorded are small in size and would mainly be suitable for roosting microbats or small arboreal mammals. None of the hollows recorded would be suitable for use by large forest owls, with a small number of hollows of a medium size providing potential shelter for larger arboreal mammals, such as Brush-tailed Possum.

3.4.3 Aquatic habitats

The aquatic habitats on site consist of creek lines, dams and wet depressions within the cleared pasture. Two slow flowing to stationary creeks connect farm dams on site and flow into Black Creek to the north of the site. Except for a south-north flowing creek at the southern end of the site upstream from a dam, all water bodies on site are within areas of cleared pasture. These features provide habitat mainly for frogs, aquatic reptiles such as tortoises, and aquatic and wading bird species. The emergent grasses in low swampy areas and taller fringing vegetation found in these habitats provide the best habitat for frogs. A high incidence of *Gambusia holbrooki* (Eastern Mosquitofish) was noted to occur within creeks and water bodies throughout the site. Eastern Mosquitofish is known to predate on frog eggs and tadpoles, therefore reducing the quality of the aquatic frog habitat on site.

3.4.4 Fauna Habitat Connectivity

The native vegetation on site is concentrated at the south-western corner and isolated from native vegetation to the north and east by at least 0.5 km of cleared pasture. To the west, the site is bounded by Main Road, beyond which is a golf course and mixed residential development. The main habitat connectivity lies to the south via the Riparian vegetation that fringes a small south-north flowing creek which continues off site. However, the woodland fragment to the south of the site is itself relatively small and isolated.

The site's Riparian vegetation is separated from the remainder of the site's woodlands by less than 50 m of cleared pasture. Connectivity across these woodlands is strongest toward the south, becoming more tentative to the north and west, as the forest is reduced to patches of regrowth seeded from isolated stands of one or more mature trees. This riparian vegetation therefore provides the most valuable habitat corridor for those less mobile fauna species, particularly arboreal mammals, to move into habitats both within and south of the site.

Black Creek forms the northern and eastern boundary of the site with a corridor of *C. glauca* dominated riparian vegetation occurring immediately off-site which eventually connecting to extensive eucalypt woodland habitats to the north. However, Black Creek is isolated from the site's woodlands by cleared pasture and, so, has limited potential to provide a movement corridor between the eucalypt woodlands to the north and the vegetation on site.

Legend

Site Boundary

Threatened Flora

Eucalyptus glaucina

Threatened Fauna and Habitat Features

Grey-crowned Babbler

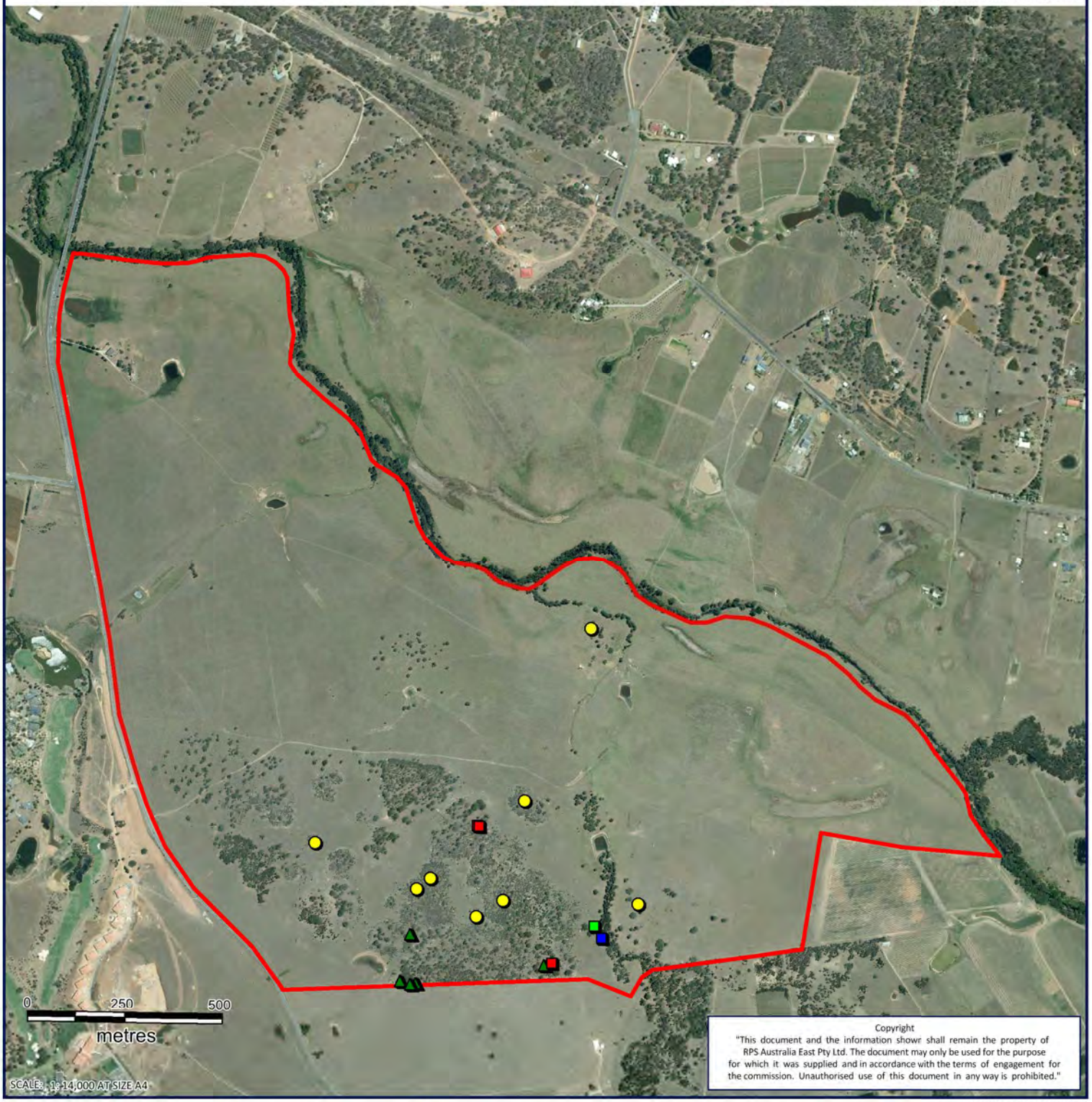
Grey-crowned Babbler Nest

Squirrel Glider

Hollow-bearing Tree

N

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.



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				PROJECTION:	MGA ZONE 56	PURPOSE:	PURPOSE

LAYOUT REF: J:\JOBS\116k\116561 Main Road Rothbury\10- Drafting\Mapinfo\Workspaces\Figures

VERSION (PLAN BY): PH (A-4)

CLIENT: HDB

JOB REF: 116561

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4.0 Impact Assessment

4.1 Proposed works

The proposal involves the creation of an integrated tourism and residential development. The proposal will primarily involve development within cleared pasture areas with limited conservation value, however, 34 ha of native vegetation exists on site and 9.7 ha of this vegetation will potentially be cleared. The largest areas of native vegetation clearing will accommodate a driving range and the fairway for two holes of an eighteen-hole golf course. Much smaller areas of clearing will be associated with the construction of residential housing and the required asset protection zones (APZ) around these buildings. Development within cleared pasture areas will involve modification or removal of some farm dams,as well as the installation of additional dams and water features.

The proposal will also include revegetation with native flora and the removal of cattle from the site. The most extensive contiguous areas of revegetation will cover the site's boundaries. Revegetation of the western boundary will form a corridor through a large area of cleared pasture along Main Road. Along the southern boundary, existing patches of native vegetation will be connected with one another and with previously fragmented habitats off site. Along the northern and eastern boundary, the existing riparian corridor of Black Creek will be widened. Throughout the site, patches of native vegetation will be planted in association with the golf course in areas which are currently cleared pasture.

4.2 Discussion of Impacts

Likely impacts are those impacts that may arise as a result of: activities associated with clearing of native vegetation, on site construction, ongoing activities associated with development such as roads, traffic, the activities of residents and tourists on site, and further degradation of retained vegetation such as weed infestation and erosion.

4.2.1 Native Vegetation Losses and Gains

Table 6 below provides a breakdown of the proposed losses of native vegetation as a result of the proposed development.

Table 6 - Proposed Vegetation Removal and Retention

Vegetation Community	Proposed Removal (ha)	Proposed Retention/ enhancement (ha)	Proposed revegetation (ha)	Total Retained / replanted area (ha)	Net Gain/ Loss (ha)
MU13 - Central Hunter Riparian Forest	0.05	2.42	3.67	6.09	+3.62
MU 18 – Central Hunter Ironbark – Spotted Gum – Grey Box Forest	2.49	3.95	34.07	38.02	+31.58
MU 18 - *C. maculata* Regrowth variant	0.23	1.55	0	1.55	-0.23
MU 18 - *E. crebra* / *E. moluccana* / *C. glauca* dominant variant	0.10	2.91	0	2.91	-0.10
MU 18 - *E. crebra* Regrowth variant	5.94	11.16	0	11.16	-5.94
Open Melaleuca decora stand	0.76	0.49	0	0.49	-0.76
Casuarina glauca stand	0.10	1.61	0	1.61	-0.10

Vegetation Community	Proposed Removal (ha)	Proposed Retention/ enhancement (ha)	Proposed revegetation (ha)	Total Retained / replanted area (ha)	Net Gain/ Loss (ha)
Eucalyptus glaucina plantings	0	0	12.02	12.02	+12.02

The proposal will result in clearing 9.7 ha of native vegetation together with revegetation including 37.7 ha of native EEC vegetation community restoration and 12.0 ha of E.glaucina plantings for landscaping. Thus, revegetation activities will offset EEC vegetation communities lost through clearing resulting in a net gain of 28.9 ha of native EEC vegetation for the site, a ratio of vegetation restored/ lost of approximately 73 to 1 for MU 13 Central Hunter Riparian Forest and 4 to 1 for MU18 Central Hunter Ironbark – Spotted Gum – Grey Box Forest.

4.2.2 Loss of fauna habitat

Approximately 9.7 ha of native vegetation is proposed to be removed. This vegetation contains potential foraging habitat for woodland bird species, possums, gliders, and bats. Of the eight hollow-bearing trees recorded within the site three are proposed to be removed, containing a combined total of approximately eight small hollows (2-10cm wide) and two medium hollows (11-20cm wide). This removal represents a loss of this habitat resource, mainly for microbats and small arboreal mammals. There is potential for a small loss of dead wood and dead trees as a result of removal woodland habitats. However, as described in **Section 3.4.1**, the site contains a general paucity of this habitat resource.

Approximately 49.8 ha of revegetation will compensate for the loss of native vegetation in the long-term, although the availability of mature native vegetation will still be decreased in the short-term, as areas of revegetation will take years to grow to the size of the vegetation currently existing on site. The loss of foraging resources, such as flowering trees can be offset by including species within revegetation that provide a greater structural complexity of native understorey species and that produce flowers within a much shorter timeframe than *Eucalyptus* species.

4.2.3 Habitat fragmentation/ loss of fauna habitat connectivity

As a result of vegetation clearing, habitat fragmentation will be modestly increased within a proportion of the woodland in the south of the site. Fauna species that tuilise the forest canopy to move through the site would need to negotiate around the proposed fairways. An area of woodland along the southern boundary may become temporarly isolated as a result of the addition of the southern most fairway. The fragmentation of this particular area may prevent Squirrel Gliders from reaching a small protion of wodland on the southern boundary, however this woodland does not act as a corridor to other areas of woodland. Notwistanding, it is reccomended that glider poles are installed as a temporary measure until the proposed revegetation recconects this area.

Revegetation will improve connectivity between some areas on site, as well as significantly improving connectivity to habitats off site. Importantly, the proposal includes revegetation of the riparian corridor which runs north-south across the site and revegetation along the southern boundary of the site. Both of these proposed revegetation areas would connect the site's woodland to vegetation along Black Creek. The proposed southern boundary revegetation would constitute a completely continuous habitat link between the site's retained vegetation and the Black Creek riparian vegetation.

4.2.4 Impacts to aquatic habitats

The primary modification of aquatic habitats will be through the removal of farm dams within the cleared pasture. These provide potential habitat for common frog species as well as foraging opportunities for

herons, egrets, and waterfowl. However, additional dams and water features will be constructed as part of the proposal which will compensate for the removal of existing farm dams. The proposal has the potential to decrease water quality of the unnamed creek that runs through the site and Black Creek, by increasing sedimentation during construction and increasing the incidence of water pollution as part of the Golf Course operations and pollution associated with urban areas. The greater amounts of hard surfaces also have the potential to alter flow regimes within the site. Recommendations have been provided in Section 5, such that the potential risks to the aquatic riparian habitats are considered and avoided.

4.2.5 Fauna injury and/or mortality

Ongoing threats as a result of the proposal include increased traffic, and thus vehicle-animal strikes, on-site due to the establishment of roads and driveways on-site. Urban developments also often lead to the increase incidence of domestic and feral dogs and cats potentially predating on native species, including birds, frogs, reptiles and mammals. Recommendations have been provided in Section 5, such that the potential risks to fauna are considered and avoided.

4.2.6 Edge effects and weed invasion

Introduced pasture grasses occur throughout the site in all vegetation communities. Landscaping associated with the residential areas and the proposed golf course has potential to introduce additional weed species. Increased activity and vehicle movements on site could introduce weed species from other areas that may establish in areas of native vegetation. Recommendations have been provided in Section 5, such that the potential risks to habitats from weed invasion are considered and avoided.

4.3 Threatened Species and Communities Likelihood of Occurrence Assessment

Within Section 3.1 there are 21 threatened flora species, 47 threatened fauna species and six Threatened Ecological Communities listed on the TSC Act and/or EPBC Act that are known, or are predicted, to occur within a 10 km radius of the site.

The likelihood of occurrence is presented in tabulated form (refer to **Table 7**):

‘**Species / Community’** – Lists each threatened species / EEC known from the locality (10 km radius). The status of each threatened species under the TSC Act and the EPBC Act are also provided.

‘**Habitat Description’** – Provides a brief account of the species / community and the preferred habitat attributes required for the existence / survival of each species / community.

‘Likelihood of Occurrence on Site’ – Assesses the likelihood of each locally recorded species and EEC to occur within the site, using knowledge of each species’ habitat and lifecycle requirements and with regard to the habitat types present within the site, results of the literature review and database searches and current field investigations. The location and number of records of the species (OEH Atlas of NSW Wildlife) were also considered in determining probability of occurrence.

'Potential for Impact’ – Assesses the likelihood of impacts to each species / community that would result from the proposed development, taking into account direct and indirect short and long-term impacts.

Table 7 Threatened Species/Communities Assessment Table

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Flora					
Acacia bynoeana Bynoe's Wattle	E	V	Small, prostrate shrub found in low heath and open woodland, generally on loamy clays and sand. Occurs from the Lower Hunter south to Southern Highlands. Flowering occurs during the summer months (September to March) and is characterised by a single bright yellow, globular flower located within the leaf axil.	This species has not been recorded on site during this survey or previous surveys. However, one small population was found approximately 4 km north-east of the site. This population represents the northernmost limit of the known distribution and occurs in a habitat type not previously known to support this species. The typical habitat for this species and the low woodland of *Eucalyptus* sp. aff. *agglomerata* where it was found north of the site, does not occur on site. Therefore this species is **unlikely** to occur.	Although this species was recorded approximately 4 km from the site, suitable habitat was not found on site and this conspicuous species was not recorded during targeted flora searches, therefore it is unlikely to be affected by the proposed activities and an AoS for this species is not required.
Acacia pendula population in the Hunter Catchment	E2	-	Medium, erect tree with hard, fissured bark and a spreading crown with a pendulous habit. Occurs from Victoria north to Queensland, including the western slopes and western plains of NSW. The disjunct population within the Hunter catchment is at the eastern distributional limit of the species range and consists of less than 1000 individuals. In the Hunter, this species occurs on heavy soils in small floodplains and undulating topography in dry schlerophyll forests and woodlands.	This species was not recorded on site during current or previous surveys. Only one record exists within 10 km of the site, and the only populations recorded to date within the Hunter catchment occur at Jerrys Plains, Edderton, Wybong, Appletree Creek, Warkworth, and Appletree Flat. As this conspicuous species was not recorded during extensive targeted searches on site, it is considered **unlikely** to occur on site.	As this species is considered unlikely to occur, it is unlikely to be affected by the proposed activities and an AoS for this species is not required.
Allocasuarina glareicola	E	E	Small to medium slender, erect, smooth-barked shrub found in open woodland on acidic, low fertility tertiary alluvial gravels with lateritic soil. Restricted to a few small populations within a 36km² area in and around Castlereagh Nature Reserve north-east of Penrith, NSW	This species has not been recorded on site during current or previous surveys and there are no records within 10 km of the site. The Castlereagh open woodland community and acidic, low fertility soils that this species prefers are not found on the site. It is **unlikely** to occur on site	The species was not recorded on or near the site and no suitable habitat can be found on site. Therefore, it is unlikely to be affected by the proposed activities and an AoS for this species is not required.
Angophora inopina Charmhaven Apple	V	V	Small to medium tree found in shallow sandy soils in open woodland, swamp woodland and wet heath. The main occurrences of this species are in the Wyong and Lake Macquarie LGAs (from Charmhaven to Wyee and Morisset, and north to near Toronto), with disjunct populations also in Port Stephens LGA (south of Karuah).	This species was not recorded on site during current or previous surveys and there are no records within 10 km of the site. The main populations are located in Wyong, Lake Macquarie LGA and Port Stephens LGA. It is therefore considered **unlikely** to occur.	This species was not recorded on site and there are no known remnant populations near the site. This species is unlikely to be affected by the proposed activities; therefore, an AoS for this species is not required.
Callistemon linearifolius Nettle Bottle Brush	V	-	Shrub that grows in dry sclerophyll forest on the coast and adjacent ranges. Re-sprouting / juvenile specimens difficult to distinguish from other *Callistemon* species such as *C. rigidus* (Stiff Bottlebrush) or *C. linearis* (Narrow-leaved Bottlebrush) without the aid of flowering parts.	This species was not recorded on site during current or previous surveys. However, suitable habitat is present and there are twelve records within 10 km of the site. As this species was not recorded during extensive targeted searches of the site, it is considered **unlikely** to occur on site.	As this conspicuous species was not recorded during targeted searches on site, it is unlikely to be affected by the proposed activities and an AoS for this species is not required.
Cryptostylis hunteriana Leafless Tongue-orchid	V	V	A very rare leafless, saprophytic orchid, which has a symbiotic relationship with a mycorrhizal fungi which provides the plant with all its nutrient requirements. This orchid remains underground for the majority of its lifecycle, flowering periodically when conditions are optimal to reproduce. This species is extremely cryptic as it does not flower every year. Known to occur within a range of habitats including woodlands to swamp heaths. Within the Hunter region larger populations have been typically found in woodland dominated by *E. racemosa* (Scribbly Gum) and it prefers areas with an open grassy understorey. The species typically prefers moist sandy soils in sparse to dense heath and sedgeland, or moist to dry clay loams in coastal forests.	This species has not been recorded on or within 10 km of the site. Suitable woodland habitats dominated by Scribbly gum do not occur on site. Based on absence of preferred habitat and lack of records within the locality, it is considered **unlikely** to occur.	This species was not recorded on site and is rare within the surrounding area, thus this species is unlikely to be affected by the proposed activities, and an AoS for this species is not required.
Cymbidium canaliculatum population in the Hunter Catchment	E2	-	An epiphytic orchid which grows in hollows and forks of eucalypts and acacias. The species ranges across northern and eastern Australia from the Kimberley region to Cape York and south through Queensland into NSW. In NSW this species occurs primarily in the north-eastern quarter of the state. The population in the Hunter Catchment represents the south-eastern distributional limit of the species range and consists of few than 500 individuals.	This species was not recorded on site during current or previous surveys. However, there are two records within 10 km of the site and suitable habitat in the form of mature eucalypts exists on site. Therefore, this species has **potential** to occur on site.	The proposal may have a significant impact on the Hunter Catchment population of this species. Therefore, a 7-part test of significance (TSC Act) has been prepared for this species in **Appendix 1**.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Eucalyptus castrensis Singleton Mallee	E	-	A tall, smooth-barked mallee that exists as a single dense stand within Singleton Army Training Area. It occurs on a low broad ridgetop on loam over sandstone	This species has not been detected on site during current or previous surveys. Nine records exist within 10 km of the site. As there is no suitable habitat on site and this tall conspicuous species was not recorded during targeted searches, it is considered **unlikely** to occur on site.	As this conspicuous species is known only from a single dense stand and was not recorded during targeted searches on site, it is unlikely to be affected by the proposed activities and an AoS for this species is not required.
Eucalyptus glaucina Slaty Red Gum	V	V	Red Gum that is locally frequent but sporadic in grassy woodland on deep fertile and moist soils. Recorded within Hunter Lowland Redgum Forest and Central Hunter Ironbark Spotted Gum Grey Box communities in the lower central Hunter.	**Recorded** on site during this survey.	The proposal may have a significant impact on this species. Therefore, a 7-part test of significance (TSC Act) has been prepared for this species in **Appendix 1,** as well an AoS (EPBC Act) in **Section 4.3.**
Eucalyptus parramattensis subsp. decadens Earp's Gum	V	V	Red Gum species that grows in dry sclerophyll woodland on sandy soils, often in low damp sites. Locally this species occurs almost exclusively in association with Kurri Sand Swamp Woodland (KSSW) and ecotonal areas.	This species has not been detected on site during current or previous surveys. Twenty five records exist within 10 km of the site. The site does not support preferred habitat and this large tree species was not recorded during targeted flora searches. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and the low-nutrient sandy wetlands that it prefers are not found on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Eucalyptus pumila Pokolbin Mallee	V	V	A tall, smooth-barked mallee that is known only from a single population west of Pokolbin. It occurs on north-west facing slopes derived from sandstone as a mid-canopy species within dry schlerophyll woodland.	This species has not been detected on site during current or previous surveys; however, twenty four records exists within 10 km of the site. No suitable habitat occurs on site. As this is a tall conspicuous mallee species and no mallee species were recorded on site, it is considered **unlikely** to occur.	This species was not recorded on site and no suitable habitat is present. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Euphrasia arguta	CE	CE	*E. arguta* grows in grassy areas near rivers, recorded from Bathurst to Walcha and was thought to be extinct. A few recent records have come from the Nundle area, near the Hastings River, and the Barrington tops. *Euphrasia arguta* is an annual plant which grows 20-35cm high with densely haired branches, flowering from October to January.	This species has not been detected during current or previous surveys and no records exist within 10 km of the site. Suitable grassy habitat near river edges does occur on site, however, due to its extreme rarity and degradation of the site by grazing, it is considered **unlikely** to occur.	This species was not recorded on site and is extremely rare. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Grevillea parviflora subsp. parviflora Small-flower Grevillea	V	V	A low open to erect shrub. Occurs in light, clayey soils in woodlands. Most plants appear capable of suckering from a rootstock. Relatively widespread within the Cessnock LGA. Occurs within Werakata National Park. Much confusion surrounds the taxonomy of this species and other similar *Grevillea* taxa and a NPWS-funded study of the species is currently in progress.	This species has not been recorded on site during current or previous surveys. However, seven records exist within 10 km of the site. The CHISGGB Forest on the site comprises potentially suitable habitat for this species, however, the understorey is highly degraded and heavily grazed. It is considered **unlikely** to occur.	This conspicuous species was not recorded on site. Although suitable habitat occurs on site, it has been degraded by years of grazing and is unlikely to have supported this species during the time of its pastoral use. This species is unlikely to be affected by the proposed activities. Therefore, an AoS is not required.
Pelargonium sp. Striatellum (G.W.Carr 10345) Omeo Storks-bill	E	E	A tufted perennial herb known to occur within the South Eastern Highlands, South East Corner IBRA Bioregions and the Hawkesbury-Nepean, Murrumbidgee, Southern Rivers and North East Natural Resource Management Regions. This species grows in exposed lake beds or just above the high water mark of intermittently inundated or ephemeral lakes.	This species has not been recorded on site or within 10 km of the site. The site does not support suitable habitat. Therefore it is **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Persoonia pauciflora North Rothbury Persoonia	CE	CE	A small spreading shrub needle-like leaves; the total known population occurs within 2 km of North Rothbury in Central Hunter Ironbark Spotted Gum Grey Box communities.	The species was not recorded on site during current or previous surveys. Although the entire known range exists within 10 km of the site and suitable habitat exists, no individuals were found during extensive targeted searches in the areas of suitable habitat. There is unlikely to be a viable seedbank on site as the nearest known record of this species is approximately 4 km away and intensive grazing on site is likely to have removed any plants that might have been present historically. As this is a conspicuous perennial shrub species, the lack of records therein indicates that it is **unlikely** to occur on site.	This species was not recorded on site. Although suitable marginal habitat occurs on site, it has been degraded by years of grazing and is unlikely to support a viable seedbank of this species. Thus, this species is unlikely to be affected by the proposed activities and an AoS is not required.
Prasophyllum sp. *Wybong* (C.Phelps ORG 5269)	-	CE	A terrestrial perennial orchid which grows in open eucalypt woodland and grassland. It appears as a single leaf over winter and spring, flowers in spring, and then dies back to a dormant tuber over summer and autumn. Endemic to NSW, most populations are small, though a large number of individuals are found near Wybong.	The species was not recorded on site during current or previous surveys and there are no records within 10 km of the site. Although there is suitable habitat on site, it is heavily degraded by weed invasion and grazing. Due to the lack of records and poor quality of the habitat, this species is considered **unlikely** to occur.	This species was not recorded on site and suitable habitats have been heavily degraded by weed invasion and grazing and are unlikely to support this species. Thus, this species is unlikely to be affected by the proposed activities and an AoS is not required.
Prostanthera cineolifera Singleton Mint Bush	V	V	A small to moderate-sized, erect shrub with strongly aromatic branches and narrow-ovate leaves. It grows in open woodland on exposed sandstone ridges usually associated with shallow or skeletal sands.	This species has not been detected during current or previous surveys on site and no records exist within 10 km of the site. There is no suitable habitat on site. Therefore, this species is considered **unlikely** to occur.	No suitable habitat for this species occurs on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Pterostylis gibbosa Illawarra Greenhood	E	E	Ground-dwelling orchid which grows in open forest or woodland on flat or gently sloping land with poor drainage. It is a deciduous orchid that is only visible above the ground between late summer and spring, only when soil moisture levels can sustain its growth. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark (*E. crebra*), Forest Red Gum (*E. tereticornis*) and Black Cypress Pine (*C. endlicheri*).	This species has not been detected during current or previous surveys and no records exist within 10 km of the site. Known populations of this species predominantly occur on the Central Coast with a disjunct population located in the Hunter Valley. The potential habitat for this species on site has been highly degraded by intensive grazing which has reduced the ground layer to a dense association of hardy pasture grasses and weeds, therefore this species is considered **unlikely** to occur.	Due to the lack of records in the surrounding area and highly degraded habitats on site, this species is unlikely to be affected by the proposed activities and an AoS is not required.
Rutidosis heterogama Heath Wrinklewort	V	V	A small Asteraceous herb occurring in the Hunter Region growing in disturbed areas and adjacent parcels of bushland within the Cessnock LGA. This species is also noted as occurring within coastal heathland habitats between Wyong and Evans Head on sandy substrates or moist areas within open forest.	Current and previous surveys did not detect this species on site. However, six records exist within 10 km of the site. The site does not support heathland habitats or sandy substrates which comprise preferred habitat for the species. Therefore, it is considered **unlikely** to occur.	Suboptimal habitat for this species occurs on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore an AoS for this species is not required.
Streblus pendulinus Siah's Backbone	-	E	This tall shrub or tree inhabits warmer rainforests along watercourses north from Milton, NSW.	Current and previous surveys did not detect this species on site and no records exist within 10 km of the site. Warm rainforest in which this species prefers do not occur on site. Therefore it is considered **unlikely** to occur.	No suitable habitat for this species occurs on site. Thus, this species is unlikely to be affected by the proposed activities and an AoS for this species is not required.
Zannichellia palustris	E	E	In NSW, known only from the lower Hunter. Grows in fresh or slightly saline stationary or slowly flowing water.	This species was not detected during current or previous surveys. One record for this species exists within 10 km of the site. Stationary water in the creek line on site offers potential habitat for this species. Therefore it is considered as having **potential** to occur.	This species has potential to occur and the water quality of aquatic habitats on site may be impacted by the proposal, therefore a a 7-part test of significance (TSC Act) has been prepared for this species in **Appendix 1,** as well an AoS (EPBC Act) in **Section 4.3.**
Amphibians					
Heleioporus australiacus Giant Burrowing Frog	V	V	The current distribution of *H. australiacus* is south-eastern NSW to Vic. Locally it occurs north to Jervis Bay, and is mostly restricted to sandy creek banks, often in association with crayfish burrows in this area. The northern population has a marked preference for sandstone ridge-top habitat and broader upland valleys. In these locations the frog is associated with small headwater creek lines and along slow flowing to intermittent creek-lines. *H. australiacus* is grey to dark chocolate brown or black above with a white belly, a few yellow spots along the flanks.	This species was not detected on site during current or previous surveys. There is one record within 10 km of the site; however, the lack of suitable habitat on site indicates that this species is **unlikely** to occur.	This species was not recorded on site and no suitable habitat is present. This species is unlikely to be affected by the proposed activities. Therefore an AoS is not required.
Litoria aurea Green and Golden Bell Frog	E	V	Inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. Thought to be displaced from more established sites by other frog species, thus explaining its existence on disturbed sites. Previously widespread within the region, but now sparsely distributed within the Lower Hunter and Central Coast areas. A relatively stable population occurs on Kooragang Island.	Current and previous surveys did not detect this species on site, and there are no records within 10 km of the site. The farm dams and creeklines on site could provide suboptimal habitat for this species, but they are lacking in key habitat features such as emergent bulrushes or spikerushes and diurnal sheltering sites. Additionally, *Gambusia holbrooki*, an introduced predatory fish, was found on site. Therefore it is **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Litoria littlejohni Littlejohns Tree Frog	V	V	A pale brown frog with dark speckles which occurs along permanent rocky creeks with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. Occurs on the plateaus and eastern plains of the Great Dividing Range. Records within the Hunter Region occur from within the Watagan State Forest.	This species has not been recorded on site or within 10 km of the site. The site is located outside of this species known distribution which extends from Newcastle and continues south into the Victorian border. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and the site is located out of its known distribution. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Mixophyes balbus Stuttering Frog	E	V	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Breed in streams during summer after heavy rain, outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Eggs are laid on rock shelves or shallow riffles in small, flowing streams.	This species has not been recorded on site or within 10 km of the site. No suitable wet forest habitats persist on site in which this species would occur. Therefore it is **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Mixophyes iteratus Giant Barred Frog	E	E	Mostly restricted to wet sclerophyll forest and rainforest, including Antarctic Beech forest. Usually found within close proximity to permanent running water (Robinson, M, 1998). Hunter Region records are largely confined to the Watagan National Park and to the north of Heaton State Forest (Atlas of NSW Wildlife data).	This species has not been recorded on site or within 10 km of the site. No suitable rainforest persist on site in which this species would occur. Therefore it is **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Reptiles					
Hoplocephalus bungaroides Broad-headed Snake	E	E	Largely confined to Triassic sandstones, including the Hawkesbury, Narellan and Shoalhaven formations, within the coast and ranges. Nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer.	This species has not been recorded on site or within 10 km of the site. It is largely limited to exposed rocky outcrops which do not occur on site. It is highly **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Birds					
Anthochaera phrygia Regent Honeyeater	CE	E, M	Nomadic Honeyeater that disperses to non-breeding areas, including the coast, in winter, where flowering trees are sought. Within the region, mostly recorded in Box-Ironbark Eucalypt associations along creek flats, river valleys and foothills. Coastal swamp forests in Lower Hunter are used when more western resources fail. The main feed tree for coastal areas is *E. robusta* (Swamp Mahogany). Hunter records are more common in near coastal areas such as Cessnock LGA. Feed trees in this region are *C. maculata* (Spotted Gum), *E. fibrosa* (Broad-leaved Ironbark), *E. crebra* (Narrow-leaved Ironbark) and various stringybark sp. Nests mainly west of the divide, although local breeding attempts have occurred at Quorrobolong.	This species was not detected on site, but there are six records within 10 km of the site. *C. maculata* and *E. crebra* are present on site offering potential foraging resources for this species. Therefore it is considered as having **potential** to occur.	Due to the removal of *C. maculata* and *E. crebra* trees as a result of the proposal, it is considered that the proposal may have a significant impact upon this potentially occurring species.. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1** as well an AoS (EPBC Act) in **Section 4.3.**
Botaurus poiciloptilus Australasian Bittern	E	E	The distribution of this species ranges from south-east Queensland to south-east South Australia, Tasmania and south-west of Western Australia. Preferred habitat includes permanent and seasonal freshwater habitats. It forages in shallow water in wetlands with tall dense vegetation (Garnett et al. 2010).	This species was not detected on site and no records exist within 10 km of the site. Suitable habitat in the form of permanent freshwater habitats and wetlands are found on site, however, the creek line and dams on site do not contain the tall, dense vegetation required for the protection of this secretive species. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Callocephalon fimbriatum Gang-gang Cockatoo	V	-	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Move to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting.	This species was not detected on site. However, two records exist within 10 km of the site. Their distribution is limited to the lower Hunter, however, vagrants do fly further north. Suitable foraging eucalypts do occur on site. Therefore, it is considered as having **potential** to occur.	Due to the removal of eucalypt trees as a result of the proposal, it is considered that the proposal may have a significant impact upon this potentially occurring species. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Calyptorhynchus lathami Glossy Black-Cockatoo	V	-	Occurs in forests and woodlands where it forages predominantly on *Allocasuarina* cones. Requires large Eucalypt tree hollows for nesting. Sparse occurrences on the valley floor, but resident in ranges and adjacent areas surrounding the Hunter Valley. Most commonly encountered around the south and south-western areas of the lake and in the Watagan Mountains N.P. These locations have good stands of *Allocasuarina* sp., especially *A. littoralis* (Black She-oak).	This species was not detected on site, however seven records exist within 10 km of the site. Several pure stands of *Casuarina glauca* within the Central Hunter Riparian community on site could provide foraging habitat for this species. It is therefore considered as having **potential** to occur.	Due to the removal of *Casuarina glauca* trees as a result of the proposal, it is considered that the proposal may have a significant impact upon this potentially occurring species. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Cthonicola sagittata Speckled Warbler	V	-	Occupies Eucalypt and Cypress woodlands in drier coastal areas and on the western slopes of the Great Dividing Range. Appears unable to persist in districts where no forested fragments larger than 100 ha remain. Occurs in the central and southern Hunter Region where suitable habitat exists. Associated with extensive stands of *B. spinosa* (Blackthorn) in some areas (HBOC).	This species was not detected on site however eight records exist within 10 km of the site. Although woodlands with grassy understoreys do occur on site, this species generally prefers these habitats when they are associated with ridgetops and gullies. The woodlands on site are also very low in diversity and would offer limited flowering season and foraging opportunities. Therefore it is considered as having **potential** to occur.	Despite there being potential for this species to occur, the habitat to be impacted upon is not core habitat for this species. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Circus assimilis Spotted Harrier	V	-	Occurs in grassy open woodland, inland riparian woodland, grassland, and shrub steppe across most of the continent. Forages for terrestrial mammals over open habitats including the edge of wetlands.	This species was not recorded on site; however there is one previous record within 10 km of the site. The open grassy areas of the cleared paddock and associated dams and wetland areas provide potential suboptimal foraging habitat, therefore this species is considered as having **potential** to occur.	Despite there being potential for this species to occur, the foraging habitat on site (cleared paddocks) is very well represented in the surrounding area and does not represent important core habitat for this species. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Climacteris picumnus victoriae Brown Treecreeper (eastern subsp.)	V	-	Frequents drier forests and woodlands, particularly open woodland lacking a dense understorey. Also found in grasslands in proximity to wooded areas where there are sufficient logs, stumps and dead trees nearby. Occasionally found in mallee and *E. camaldulensis* (River Red Gum) forest bordering wetlands with an open understorey of *Acacia* sp., *Muehlenbeckia* sp. (Lignum), *Typha sp.* (Cumbungi) and *Poa* sp. (grasses). Feeds on invertebrate larvae and small insects, particularly ants. Utilises hollows for roosting/nesting.	This species was not detected on site however three records exist within 10 km of the site. Suitable habitat for this species occurs on site within the woodlands. Therefore it is considered as having **potential** to occur.	Due to the removal of eucalypt trees as a result of the proposal, it is considered that the proposal may have a significant impact upon this potentially occurring species. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Daphoenositta chrysoptera Varied Sittella	V	-	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	This species was not detected on site. However, seven records exist within 10 km of the site. This species rarely persists in habitat fragments that are less than 100 ha in a remnant patch. The habitat on site does not provide a suitable amount of continuous habitat to sustain this species. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Dasyornis brachypterus Eastern Bristlebird	E	E	The Eastern Bristlebird occurs in three separate populations; one in south-east Queensland and north-east NSW and the other two south of Wollongong (NSW). It inhabits a wide range of habitats including sedgeland, heathland, schlerophyll forest, woodland and rainforest.	This species was not detected on site or within 10 km of the site. The distribution of this species persists as three disjunct populations, the closest one being on the Central Coast of NSW. Based on this distribution and lack of records it is considered **unlikely** to occur.	This species was not recorded on site and the site is outside of its known distribution. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Ephippiorhynchus asiaticus Black-necked Stork	E	-	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. It has also been recorded on farm dams and sewage treatment ponds. Within the Hunter Region it occurs sporadically on freshwater or estuarine wetlands, along coastal and near coastal environments such as Gloucester.	This species was not detected on site. However, one record exists within 10 km of the site. Suitable river systems and swamps do not persist on site, and the farm dams on site may provide only marginal foraging for this sporadic visitor to the region. Therefore this species is **unlikely** to occur on site.	The small, highly modified wetlands on site are unlikely to be used for foraging and this species only sporadically occurs in the region. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Erythrotriorchis radiates Red Goshawk	CE	V	The Red Goshawk is sparsely distributed from western Kimberley to the north-eastern NSW. Preferred habitat in NSW includes subtropical rainforest and Melaleuca forest along coastal rivers. Records in NSW are rare.	This species was not detected on or within 10 km of the site. Due to its preference of foraging among subtropical rainforest and melaleuca forest along coastal rivers, the habitat on site does not constitute suitable foraging habitat for this species. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Glossopsitta pusilla Little Lorikeet	V	-	*Glossopsitta pusilla* extends from Cairns to Adelaide coastally and to inland locations. Commonly found in dry, open eucalypt forests and woodlands. Can be found in roadside vegetation to woodland remnants. *G. pusilla* feeds on abundant flowering Eucalypts, but will also take nectar from *Melaleuca* sp and *Mistletoe* sp. *E. albens* (White Box) and *E. melliodora* (Yellow Box) are favoured food sources on the western slopes in NSW. On the eastern slopes and coastal areas favoured food sources are *C. maculata* (Spotted Gum), *E. fibrosa* (Broad-leaved Ironbark), *E. robusta* (Swamp Mahogany) and *E. pilularis* (Blackbutt). Nesting takes place in hollow bearing trees.	This species was not recorded on site; however, there are ten records within 10 km of the site. The eucalypt woodlands on site provide suitable habitat and Spotted Gum is a potentially important food source. Therefore this species has **potential** to occur on site.	The removal of eucalypt woodlands on site by the proposed activities may have a significant impact on this species. Therefore a 7-part test of significance (TSC Act) has been prepared for this species in **Appendix 1**.
Grantiella picta Painted Honeyeater	V	-	*G. picta* lives almost entirely on the berries of mistletoes, and therefore its movements are tied to the flowering and fruiting of these plants, other food sourced consists of nectar and insects. This species has a particular liking for mistletoes associated with acacia species eg. *Acacia pendula*. It usually appears in south-eastern Australia in September and departs in February or March.	This species was not recorded on site; however, a single record exists within 10 km of the site. No trees bearing mistletoe were observed during the current survey; however, a previous survey on site recorded the presence of the She-oak Mistletoe *Amyema cambagei*. Due to the scarcity of this important food source on site and suboptimal habitat, this species is considered **unlikely** to occur.	This species was not recorded on site and only marginal habitat can be found on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Hieraaetus morphnoides Little Eagle	V	-	Can be found across most of Australia, but more commonly found near coastal to inland regions in NSW and Victoria. This species is part-migratory to nomadic and dispersive in some areas.	This species was not detected on site. However, one record exists within 10 km of the site. This species occupies a wide range of habitats and has a wide distribution. Therefore it is considered as having **potential** to occur.	Despite this species having potential to occur, the habitat to be impacted upon as a result of the proposal would not impact upon this species foraging habitats. Therefore, it is unlikely to be affected by the proposal and an AoS for this species is not required.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Ixobrychus flavicollis Black Bittern	V	E	Solitary species, living near water (estuarine to brackish) in mangroves and other trees which need to form only a narrow fringe of cover. A riparian species that occasionally ventures into the open within estuarine habitats. Sedentary resident along Dora and Stockton Creeks in western Lake Macquarie has also been recorded semi-regularly in the Paterson River but is likely to occur in any brackish to estuarine forested coastal creeks in the lower NSW coast.	This species was not detected on site. However, a single record exists within 10 km of the site. The dense emergent aquatic vegetation that this species prefers for cover does not occur on site. Therefore, the aquatic habitats on site are not suitable and this species is **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, Therefore, an AoS for this species is not required.
Lathamus discolour Swift Parrot	E	E	On the mainland this species frequents Eucalypt forests and woodlands with large trees having high nectar production during winter. Mainland winter foraging sites often vary from year to year. Nests only in Tasmania, but regularly visits the Hunter Region in winter. Visits the Hunter Region when food sources are abundant or food sources are lacking in other areas. Food sources used in the Hunter include *E. robusta* (Swamp Mahogany) on the coast, and near coastal to inland *Lathamus discolour* uses *C. maculata* (Spotted Gum), *E. fibrosa* (Broad-leaved Ironbark) and *E. crebra* (Narrow-leaved Ironbark). Occasional records have come from *E. alba* (White Box) and *E. sideroxylon* (Mugga Ironbark). These food source trees have been recorded as roosting sites for *L. discolor*.	This species was not detected on site. However, up to eighty individuals were observed within 10 km north of the site during previous surveys (HSO 2007). The individuals recorded during the previous survey were seen foraging on *C. maculata* and *E. crebra* which are abundant in the Central Hunter Ironbark – Spotted Gum – Grey Box Forest areas on this site. Therefore, it is considered as having **potential** to occur.	Due to the removal of *C. maculata* and *E. crebra* trees as a result of the proposal, it is considered that the proposal may have a significant impact upon this potentially occurring species. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1** as well an AoS (EPBC Act) in **Section 4.3.**
Lophoictinia isura Square-tailed Kite	V	-	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	This species was not detected on site. However, a single record exists within 10 km of the site. The site supports potential foraging habitat for species as it supports habitat for small mammals. The site does not support preferred nesting habitat. Therefore, it is considered as having **potential** to occur.	Despite this species having potential to occur, the habitat to be impacted upon as a result of the proposal would not impact upon this species foraging habitats. Therefore, it is unlikely to be affected by the proposal and an AoS for this species is not required.
Melanodryas cucullata cucullata Hooded Robin (south-eastern form)	V	-	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	This species was not detected on site. However, two records exist within 10 km of the site. The habitat on site does not constitute suitable habitat for this species. It is generally found further inland. Therefore, it is considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, Therefore, an AoS for this species is not required.
Melithreptus gularis gularis Black-chinned Honeyeater (eastern subsp.)	V	-	Black-chinned Honeyeater occurs in eastern Australia, along the inland slopes of the Great Dividing Range, extending to the coast between Sydney and Newcastle, NSW, and again between Brisbane and Rockhampton, Qld. Occurs in eucalypt woodlands and open forests, with a ground cover of grasses and low understorey of shrubs. They have also been recorded in a variety of other habitats, including savannah and riparian woodlands and farmland, preferring edges of forest and pasture and other grasses.	This species was not detected on site. However, three records exist within 10 km of the site. Suitable habitat does occur on site for this species and records have been found close to the site. Therefore, it is considered as having **potential** to occur.	Due to the removal of eucalypt trees as a result of the proposal, it is considered that the proposal may have a significant impact upon this potentially occurring species. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Ninox connivens Barking Owl	V	-	The Barking Owl is found throughout continental Australia except for the central arid regions. Although common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains (especially the Pilliga) and in some north-east coastal and escarpment forests. They inhabit 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 soils.	This species was not detected on site. However, two records exist within 10 km of the site. This species requires large hollows for roosting, and hollow-bearing trees have been found on site. The site supports potential foraging habitat. Therefore, it is considered as having **potential** to occur.	The potential removal of hollow-bearing trees on site by the proposed activities may have a significant impact on this species. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Ninox strenua Powerful Owl	V	-	Occurs in wet or dry sclerophyll forests and woodlands where suitable prey species occur (being predominantly arboreal mammals). Requires large hollows, usually in Eucalypt trees, for nesting. Roosts in dense vegetation within such areas. Roosts in dense vegetation within such species as *S. glomulifera* (Turpentine), *A. littoralis* (Black She-Oak), *A. melanoxylon* (Blackwood), *A. floribunda* (Rough-barked Apple), *E. cupressiformis* (Cherry Ballart) and *M. nodosa* (Ball Honeymyrtle). Many coastal records exist across the Hunter region.	Current and previous surveys did not detect this species on site;. However, four records exist within 10 km of the site. Hollows large enough to provide roosting dens for this species are not present on site. Gliders and possums are present on site, offering a prey resource to this species. Therefore, it is considered as having **potential** to occur.	Some potential foraging habitat will be removed by proposed activities on site. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Petroica boodang Scarlet Robin	V	-	Ranges from SE Qld to the Victoria coast into South Australia. Also occurs in Western Australia in the south west. *P. boodang* occur in single, pairs, in summer, forages in stringybark, other eucalypt woodland, from stumps, low branches (Pizzey 2007). Perches prominently, flying down swiftly to seize prey. Is part migratory in which in autumn/winter moves to more open habitats. Habitat are foothill forests, woodlands, watercourses, in autumn/winter more open habitats, river red gum woodlands, golf courses, parks, orchards and gardens (Pizzey 2007).	This species was not detected on site. However, three records exist within 10 km of the site. Although this species is generally associated with further inland locations the site supports potential habitat for the species. Therefore, it is considered as having **potential** to occur.	Due to the removal of eucalypt trees as a result of the proposal, it is considered that the proposal may have a significant impact upon this potentially occurring species. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Pomatostomus temporalis temporalis Grey-crowned Babbler (eastern subspecies)	V	-	Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. As well as open Eucalypt woodlands with a grassy groundcover and sparse, tall shrub layer. *P. temporalis temporalis* may also be observed along streams in cleared areas and grassy road verges.	**Recorded** on site.	The proposal may have a significant impact on this recorded species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Rostratula australis Australian Painted Snipe	E	V	This species has a widespread distribution along the east coast of Australia. Preferred habitats include shallow freshwater wetlands, swamps and inundated grassland.	This species was not detected on or within 10 km of the site. It requires wetlands, swamps and/or inundated grasslands all of which do not occur on site. Therefore, it is considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Tyto novaeholladiae Masked Owl	V	-	Found in a range of habitats, locally within sclerophyll forests and woodlands where appropriate/preferred prey species occur (being predominantly terrestrial mammals). Requires large Eucalypt hollows for nesting and prefers to roost in these hollows as well.	This species was not recorded on site during current or previous surveys; however fifteen records exist within 10 km of the site. Hollow-bearing trees are present on site and due to the records of gliders and possums on site, it represents potential foraging habitat for this species. Therefore, it is considered as having **potential** to occur.	The removal of hollow-bearing trees and foraging habitat by the proposed activiteis may have a significant impact on this species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Mammals					
Chalinolobus dwyeri Large-eared Pied Bat	V	V	This species forages in tall open forests and the edges of rainforest. It roosts in mine shafts and similar structures. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of *H. ariel* (Fairy Martin), frequenting low to mid-elevation dry open forest and woodland close to these features. Found in well-timbered areas containing gullies. This species probably forages for small, flying insects below the forest canopy. Hunter Region records for this species are largely confined to the Watagan Mountains, but it has been recorded on the southern side of Port Stephens (OEH 2012a).	This species was not detected on site. However, one record exists within 10 km of the site. Based on its habitat preference of rainforest edges and the use of caves and existing mine shafts for roosting, it is considered **unlikely** to occur as these habitat requirements do not persist on site.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Dasyurus maculatus maculatus Spotted-tailed Quoll (SE Mainland Pop)	V	E	Found in a variety of forested habitats. This species creates a den in fallen hollow logs or among rocky outcrops. Generally does not occur in otherwise suitable habitats that are in close proximity to urban development. Hunter Region records are largely confined to the surrounding ranges (OEH 2012a).	This species was not detected on site; however eight records exist within 10 km of the site. One of these records is located in close proximity to the south-western boundary of the site. The site supports potential foraging habitat but does not support preferred den habitat. Therefore, it is considered as having **potential** to occur.	The proposal may have a significant impact on this recorded species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Falsistrellus tasmaniensis Eastern False Pipistrelle	V	-	This species is found in a variety of forest types, such as open forests, woodlands and wetter sclerophyll forests (usually with trees >20m). This species roosts in tree hollows and caves. Appears to locally favour upland habitats. A limited number of records occur on the central coast and the Lower Hunter Region (OEH 2012a).	This species was not recorded on site during current or previous surveys. It has been recorded in the adjacent property and two records exist within 10 km of the site. The site offers roosting and foraging habitat for this species. Therefore, it is considered as having **potential** to occur.	The proposal may have a significant impact on this recorded species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Miniopterus australis Little Bentwing-bat	V	-	Prefers to forage in well-vegetated areas, such as within wet and dry sclerophyll forests and rainforests. Requires caves or similar structures for roosting habitat. Largely confined to more coastal areas in the Lower Hunter Region (OEH 2012a).	This species was **recorded** on site during current surveys.	The proposal may have a significant impact on this recorded species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Miniopterus schreibersii oceanensis Eastern Bentwing-bat	V	-	This species utilises a range of habitats for foraging, including rainforest, wet and dry sclerophyll forests, woodlands and open grasslands. Requires caves or similar structures for roosting habitat. Widely distributed across the Lower Hunter Region (OEH 2012a).	This species was **recorded** on site during current surveys.	The proposal may have a significant impact on this recorded species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Mormopterus norfolkensis Eastern Freetail-bat	V	-	This species is distributed south of Sydney extending north into south-eastern Queensland. There are no records west of the Great Dividing Range. Most records of this species have been reported from dry Eucalypt forest and woodland. It is expected that open forested areas and the cleared land adjacent to bushland, constitutes important habitat for this species. It is a predominantly tree-dwelling species, roosting in hollows or behind loose bark in mature Eucalypts. Widely distributed across the Lower Hunter Region (OEH 2012a).	This species was **recorded** on site during current surveys.	The proposal may have a significant impact on this recorded species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Myotis macropus Southern Myotis	V	-	Usually found near bodies of water, including estuaries, lakes, reservoirs, rivers and large streams, often in close proximity to their roost site. Although usually recorded foraging over wet areas, it also utilises a variety of wooded habitats adjacent to such areas including rainforest, wet and dry sclerophyll forest, woodland, and swamp forest. Roosts in small colonies of between 15 and several hundred individuals in caves, mines and disused railway tunnels. A number of records from the Central Coast, with fewer numbers in the Lower Hunter Region (OEH 2012a) and Central Hunter Region (RPS pers. obs.).	This species was not detected on site. However, 13 records exist within 10 km of the site. The creeks and farm dams on site offer potential foraging habitat for this species, whilst the wooded areas may provide suitable roosting habitat. Therefore, it is considered as having **potential** to occur.	The proposal may have a significant impact on this potentially occurring species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Petaurus australis Yellow-bellied Glider	V	-	Usually associated with tall, mature wet Eucalypt forest. Also known from tall dry open forest and mature woodland. The diverse diet of this species is primarily made up of Eucalypt nectar, sap, honey dew, manna and invertebrates found under decorticating bark and pollen. Tree hollows for nest sites are essential, as are suitable food trees in close proximity. Most records in the Lower Hunter Region occur in the Watagan Mountains and other areas exhibiting significant stands of forest (OEH 2012a).	This species was not detected on site and only two records exist within 10 km of the site. As woodland habitats on site consist of regrowth with a small proportion of mature trees and this species prefers tall mature woodland, it is considered **unlikely** to occur.	This species was not recorded on site and only suboptimal habitat exists on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Petaurus norfolcensis Squirrel Glider	V	-	Occurs in eucalypt forests and woodlands where it feeds on sap exudates and blossoms. In these areas tree hollows are utilised for nesting sites. This species also requires winter foraging resources when the availability of normal food resources may be limited, such as winter-flowering shrub and small tree species. Widely distributed across the lower hunter region (OEH 2012a).	This species was **recorded** on site during the current survey.	The proposal may have a significant impact on this recorded species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Petrogale penicillata Brush-tailed Rock-wallaby	E	V	Occurs in forests and woodlands along the Great Divide and on the western slopes in escarpment country with rocky outcrops, steep rocky slopes, gorges, boulders and isolated rocky areas. The majority of populations favour north-facing aspects, but some southern aspects have been recorded. Apart from the critical rock structure *Petrogale penicillata* also requires adjacent vegetation types, associated types include, dense rainforest, wet sclerophyll, vine thicket, dry sclerophyll forest and open forest. They also require suitable caves and rocky overhangs for shelter and also for 'lookout' posts. Records exist from the Watagan Mountains where it is associated with the above habitats (OEH 2012a.	Current and previous surveys did not detect this species on site; however, six records exist within 10 km of the site. No suitable habitat requirements in the form of rock formations occur on site. Therefore, it is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Phascolarctos cinereus Koala	V	V (Qld, NSW, Vic and ACT Populations)	Occurs in forests and woodlands where it requires suitable feed trees (particularly *Eucalyptus* spp.) and habitat linkages. Will occasionally cross open areas, although it becomes more vulnerable to predator attack and road mortality during these excursions. Records from the Lower Hunter Region are largely confined to the greater Port Stephens area, the Lake Macquarie hinterland and the Watagan Mountains, with a small number of records from Cessnock LGA (OEH 2012a).	This species was not detected on site during current or previous surveys; however, four records exist within 10 km of the site. The site supports koala secondary feed tree species. Therefore, it is considered as having **potential** to occur.	The proposal may have a significant impact on this potentially occurring species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1,** as well an AoS (EPBC Act) in **Section 4.3.**
Pseudonomys novaehollandiae New Holland Mouse	-	V	This species has a patchy distribution within open woodlands, heathlands and in hind dune vegetation throughout Eastern Australia. In the Hunter Region the species stronghold is in the Myall Lakes region.	This species was not detected on or within 10 km of the site. Suitable heathland and dune vegetation does not persist on site. Therefore, it is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Pteropus poliocephalus Grey-headed Flying-fox	V	V	This species forages over a large area for nectar/fruits. Seasonally roosts in communal base camps situated within wet sclerophyll forests or rainforests. Frequently observed to forage in flowering Eucalypts. May occur anywhere within the Hunter Region where food or roosting resources are available.	This species was not detected on site during current or previous surveys; however thirty two records exist within 10 km of the site. The site supports suitable foraging habitat when the Eucalypts no site are in flower. Therefore, this species is considered as having **potential** to occur.	The proposal may have a significant impact on this recorded species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1,** as well an AoS (EPBC Act) in **Section 4.3.**
Saccolaimus flaviventris Yellow-bellied Sheathtail Bat	V	-	Range of habitats from rainforest to arid shrubland, roosts in tree-hollows. A limited number of records occur on the central coast and the Lower Hunter Region (OEH 2012a).	This species was **recorded** on site during the current survey.	The proposal may have a significant impact on this recorded species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Scoteanax rueppellii Greater Broad-nosed Bat	V	-	Forages in moister gullies and wet sclerophyll forests as well as in lightly wooded areas and open spaces/ecotones. This species roosts in tree hollows and is relatively widespread within the Lower Hunter Region (OEH 2012a).	This species was not recorded on site, however, suitable habitat is present throughout the site and ten records exist within 10 km of the site. Therefore, this species is considered as having **potential** to occur.	The proposal may have a significant impact on this recorded species. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Vespadelus troughtoni Eastern Cave Bat	V	-	A cave dweller, known from wet sclerophyll forest and tropical woodlands from the coast and Dividing Range to the drier forests of the semi-arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally in buildings. In all situations, the roost sites are frequently in reasonably well-lit areas. The distribution of this species is largely to the north of the Hunter Region (Strahan 1995).	This species was not detected on site. Three records exist within 10 km of the site. No caves suitable for roosting occur on site. Potential foraging habitat does exist on site, however due to the low records within the locality it is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site. Thus, this species is unlikely to be affected by the proposed activities. Therefore, an AoS for this species is not required.
Vegetation Communities					
Hunter Valley Dry Rainforest (MU 3) (LHCCREMS)	V	-	Occurs in gullies and on steep hillslopes with south facing aspects at low elevation. Ranges from the Barrington footslopes and along the northern rim of the Hunter Valley floor. A diverse canopy layer 15-25m high consistis of species such as *Elaeocarpus obovatus* (Hard Quandong), *Baloghia inophylla* (Brush Bloodwood), *Streblus brunonianus* (Whalebone Tree), *Mallotus philippensis* (Red Kamala), *Capparis arborea* (Brush Caper Berry), *Olea paniculata* (Native Olive) and *Dendrocnide excelsa* (Giant Stinging Tree).	Not found on site.	This community was not found on site during flora surveys and ground truthing, therefore, an AoS is not required.
Wollombi Redgum – River Oak Woodland (MU 14) (LHCCREMS) commensurate with River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin, and South East Corner bioregions	E	-	Occurs on alluvial soils associated with major tributaries of Wollombi Brook. Dominant trees include *Eucalyptus cunninghamiana* and *Angophora floribunda*	Not found on site.	This community was not found on site during flora surveys and ground truthing, therefore, an AoS is not required.
Hunter Lowlands Redgum Forest (MU 19) (LHCCREMS)	E	-	Occurs in open depressions and drainage flats from Muswellbrook to the Lower Hunter. Dominant trees include *Eucalyptus tereticornis* and *Eucalyptus punctata*	Not found on site.	This community was not found on site during flora surveys and ground truthing, therefore, an AoS is not required.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Central Hunter Riparian Forest (MU 13) (LHCCREMS) commensurate with River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin, and South East Corner bioregions	E	-	This community occurs on the river flats of coastal floodplains from the vicinity of Taree south along the coast to the border with Victoria. The composition of the dominant tree layer varies considerably, which can form a tall open layer of eucalypts in excess of 40m in height but can be considerably shorter in regrowth stands or poorer quality sites. In the Hunter Catchment this vegetation community is commensurate with Central Hunter Riparian Forest, classified by the Lower Hunter Central Coast Regional Biodiversity Conservation Strategy (LHCCREMS) as Map Unit (MU) 13. Central Hunter Riparian Forest is characterised by canopy species such as *Eucalyptus tereticornis*, *Casuarina glauca*, and *Angophora floribinda* forming open forest along rivers and smaller tributaries.	**Recorded** on site.	The proposal may have a significant impact on this recorded vegetation community. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion (MU 18) (LHCCREMS)	E	-	This community occurs in the central Hunter Valley primarily between Maitland and Musswellbrook. This community is dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *Corymbia maculata* (Spotted Gum), and *Eucalyptus moluccana* (Grey Box), with occasionally dominant or co-dominant *Eucalyptus fibrosa* (Broad-leaved Ironbark) and *Eucalyptus tereticornis* (Forest Red Gum). It typically forms open forest or woodland in undulating country on clayey soils. Classified by the LHCCREMS as Map Unit (MU) 18.	**Recorded** on site.	The proposal may have a significant impact on this recorded vegetation community. Therefore, a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
TSC Act - White Box Yellow Box Blakely's Red Gum Woodland EPBC Act - White Box-Yellow Box-Blakely's Red Gum grassy woodland and derived native grassland	E	CE	An open grassy woodland community (sometimes occurring as a forest formation) in which the most obvious species are one or more of the following: *Eucalyptus albens* (White Box), *E. melliodora* (Yellow Box) and *E. blakelyi* (Blakely's Red Gum). Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW.	Not found on site.	This community was not found on site during flora surveys and ground truthing, therefore, an AoS is not required.

Notes:

V = Vulnerable Species.
E = Endangered Species
E2 = Endangered Population
CE = Critically Endangered Species

4.4 Impact Assessment under the TSC Act

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts on 'threatened species, populations or ecological communities (or their habitats)' listed under the TSC Act. The Assessment of Significance (7-part test) is used to determine whether there is likely to be a significant impact on threatened species, populations or ecological communities, or their habitats and thus, whether a Species Impact Statement (SIS) is required. **Table 7** identified the following species (**Table 8**) as requiring assessment via 7-part tests under the TSC Act (see **Appendix 1**).

Table 8 : TSC Act listed species to be assessed.

TSC Act Listed Species	
Critically Endangered Species	
Regent Honeyeater	
Endangered Species	
Swift Parrot	
Vulnerable Species	
Gang-gang Cockatoo	Squirrel Glider
Glossy Black-Cockatoo	Koala
Brown Treecreeper (eastern subsp.)	Eastern Bentwing Bat
Little Lorikeet	Little Bentwing Bat
Black-chinned Honeyeater (eastern subsp.)	Southern Myotis
Scarlet Robin	Yellow-bellied Sheathtail-bat
Grey-crowned Babbler	Eastern False Pipistrelle
Barking Owl	Grey-headed Flying-fox
Powerful Owl	Greater Broad-nosed Bat
Masked Owl	Eastern Freetail-bat
Spotted-tail Quoll	
Flora	
Cymbidium canaliculatum (population in the Hunter Catchment))	*Eucalyptus glaucina* (Slaty Red Gum)
Zannichellia palustris	
Threatened Ecological Communities	
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion (MU 18) (LHCCREMS)	Central Hunter Riparian Forest (MU 13) (LHCCREMS) commensurate with River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin, and South East Corner bioregions.

The application of the 7-part test to each species concluded that there is not likely to be a significant effect on threatened species, populations or ecological communities, or their habitats arising from the proposed activities.

4.5 State Environmental Planning Policy No. 44 (Koala Habitat Protection)

Assessment of potential koala habitat under SEPP 44 requires the following steps be undertaken:

(a) Identification of 'potential Koala habitat' within the proposed development area; if the total tree cover contains 15% or more of the koala food tree species listed in Schedule 2 of SEPP 44, then it is deemed to be 'potential Koala habitat'. Identification of 'potential koala habitat requires the determination of the presence of 'core koala habitat';

(b) Identification of 'core Koala habitat' within the development area; 'Core Koala habitat' is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (females with young), recent sightings and historical records of a Koala population;

(c) Identification of 'core Koala habitat' requires that a plan of management must accompany the DA application; and

(d) If the rezoning of lands, other than to environmental protection, involves potential or core Koala habitat then the Director of planning may require a local environmental study be carried out.

Two species of trees listed in Schedule 2 of the above policy as 'Koala Feed Tree Species' occur on the site, specifically, *E. glaucina* and *E. moluccana*. *E. glaucina* and *E. moluccana* occur as a sub-dominant canopy trees over small portions of the south-west and south-east limits of the CHISGGB Forest (MU 18) on site.

Whilst in some parts of the site (within two separate stands in the south-west and south-east limits of CHISGGB Forest on site) the proportion of 'Koala Feed Tree Species' occur at a density of greater than 15%, as a proportion of the total number of trees on the site it does not constitute 'Potential Koala Habitat'.

Nevertheless, additional investigations were conducted during surveys within the small patches of Koalas feed trees exceeded 15%. Targeted searches for Koalas were conducted using the Koala Spot Assessment Technique (SAT). These assessments failed to record any evidence of past or current use of the feed trees on site by Koalas. Therefore, vegetation on site does not constitute 'Core Koala Habitat'.

Furthermore, the poor connectivity between the Koala feed trees on site and woodlands off site further decrease the likelihood of Koalas utilising these trees on site, as Koalas would have to traverse large areas of unsuitable woodland habitat or at least 0.5 km of cleared paddocks to reach these relatively small stands of secondary feed trees. Revegetation planned as part of the proposed development will improve connectivity between the feed trees on site and surrounding woodlands by creating corridors of planted native trees along the southern boundary of the site and connecting the creekline on site with the riparian vegetation along Black Creek on the site's northern boundary.

4.6 Impact Assessment under the EPBC Act

Matters of National Environmental Significance (MNES) are identified by the Protected Matters Report generated by a Protected Matters Search. The following MNES are considered in this assessment.

4.6.1 World Heritage Properties:

The site is not a World Heritage area, and is not in close proximity to any such area.

4.6.2 National Heritage Places:

The site is not a National Heritage place, and it is not in close proximity to and such places.

4.6.3 Wetlands of International Significance (declared Ramsar wetlands);

The Ramsar listed Hunter Estuary Wetland, which comprises Kooragang Nature Reserve and Shortland Wetlands, is located over 30 km south-east of the site. However, the site is located upstream from these wetlands. As such the potential for impact on waterways should be considered. While a few farm dams may be removed or impacted by the proposal, the proposed activities are not expected to have an impact on any connected body of water such as Black Creek; therefore, the proposal will not impact upon the Hunter Estuary Wetland.

4.6.4 Great Barrier Reef Marine Parks:

The site is not part of, or within close proximity to, any Great Barrier Reef Marine Park.

4.6.5 Commonwealth Marine Areas:

The site is not part of, or within close proximity to, any Commonwealth Marine Area.

4.6.6 Threatened Ecological Communities;

The critically endangered White Box – Yellow Box – Blakely's Red Gum Grassy Woodland was found to be likely to occur within the area during database searches. However, this ecological community was not found on site during a review of existing vegetation mapping for the area, or extensive ground truthing on site during flora surveys.

4.6.7 Threatened Species

The Likelihood of Occurrence assessment in **Section 3.6** determined that several species listed under the EPBC Act potentially occur in habitat found on site. The species are as follows:

Endangered Species

Flora

- *Zannichellia palustris.*

Fauna

- Spotted-tailed Quoll.
- Regent Honeyeater.
- Swift Parrot.

Vulnerable Species

Flora

- *Eucalyptus glaucina.*

Fauna

- Koala.
- Grey-headed Flying-fox.

Endangered species listed under the EPBC Act

Under the EPBC Act, an action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of a population;
- Reduce the area of occupancy of the species;
- Fragment an existing population into two or more populations;
- Adversely affect habitat critical to the survival of a species;
- Disrupt the breeding cycle of a population;
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- Introduce disease that may cause the species to decline; or
- Interfere with the recovery of the species.

Flora

Zannichellia palustris is a poorly understood submerged aquatic plant species which is known in Australia only from the Murray River Estuary in South Australia and the lower Hunter region in NSW. Fresh or slightly saline stationary or slowly flowing water constitutes suitable habitat for this species, and it has been recorded in Black Creek, which forms the northern and eastern boundary of the site. The proposed activities on site have the potential to decrease the water quality of Black Creek and the unnamed creek that runs through the site. Increasing sedimentation during construction, increasing incidence of water pollution as part of the golf course operations, and pollution associated with urban areas, all have the potential to decrease the quality of habitat for this species to the extent that its local population is likely to decline. These impacts can be reduced to an acceptable level provided that sufficient mitigation and water quality management techniques are implemented, including erosion and sedimentation controls during construction, minimising clearing and disturbance to riparian zones, and ongoing management of surface pollutants associated with the golf course and residential development to prevent runoff into wetland areas.

Fauna

The Regent Honeyeater, Swift Parrot and Spotted-tailed Quoll utilise a range of forest and woodland environments. The Regent Honeyeater and Swift Parrots arrive in the Hunter region during their migratory periods, during the winter months for half the year, with the site being at the northern end of their migration. The trees available on site, particularly *Corymbia maculata* when in flower, offer foraging habitat to these species. Extensive unfragmented habitat exists within the surrounding areas, offering additional foraging habitat to the species. However, the CHISGGB Forest on site could be used as a stopover between larger areas of habitat in the surrounding region. The Spotted-tail Quoll requires large hollow logs and dense ground vegetation, which are both scarce to nonexistent on site. It is likely to only use the wooded portions of the southern end of the site for foraging, as the only woodland areas contiguous to those on site are connected to the small strip of Central Hunter Riparian vegetation in the south-east. The habitat on site provides no cover for denning sites of this species and only very marginal foraging habitat. Revegetation of cleared pasture areas by the proposed on-site activities will improve the connectivity of the woodland habitats on site with suitable habitats in the surrounding area. In particular, the riparian woodland of Black Creek, which borders the site to the north is not currently connected to the CHISGGB Forest on site, and the proposed activities may expand this riparian vegetation into the site and offer some connectivity to

woodlands on site. The habitat on site is not considered critical for any of these species, and surrounding vegetation within 10 km of the site provides higher quality and more abundant resources. Therefore, the proposal is not expected to have a significant impact on these matters of NES.

Vulnerable species listed under the EPBC Act

Under the EPBC Act, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of an important population of a species;
- Reduce the area of occupancy of an important population;
- Fragment an existing important population into two or more populations;
- Adversely affect habitat critical to the survival of a species;
- Disrupt the breeding cycle of an important population;
- Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- Introduce disease that may cause the species to decline; or
- Interfere substantially with the recovery of the species.

Flora

Eucalyptus glaucina (Slaty Red Gum) was recorded on site (**Figure 6)**. Two separate stands were found on-site: one contains eleven mature trees and at least 30 saplings, and is located at the south-western limits of the CHISGGB Forest. The other, containing one mature tree and 27 saplings, is located at the south-east limit of the CHISGGB Forest on site. Although the proposed development on site will remove 8.76 ha of the CHISGGB Forest, which constitutes potential habitat, the two stands of Slaty Red Gum along the southern border of the site will be avoided during vegetation clearing. These stands will be retained along the edge of a portion of the proposed golf course and will form part of a larger strip of vegetation along the southern boundary of the proposed development. Potential habitat for this species will be increased in the long-term with the restoration of 34.1 ha of CHISGGB Forest, and the population of *E. glaucina* on site will be increased with approximately 12.0 ha of plantings of this species along Black Creek. Grazing pressures on this species will be removed as cattle will be removed from the site following the proposed development. As all the Slaty Red Gums on site will be retained and extensive areas of potential habitat for this species will be retained, the proposal is not expected to have a significant impact on this matter of NES.

Fauna

The Koala could potentially utilise the site for foraging, as well as for resting and passing through. Two eucalypt species present on site are suitable feed trees for this species. Both eucalypt species, *E. glaucina* and *E. moluccana* are considered as only secondary feed species. All Slaty Red Gums on site will be retained within the proposed development, while some Grey Box may be lost. As neither of these species persist over a large area of the site and do not come close to constituting 15% of the total trees on site or even within larger woodland patches where they occur, these trees do not constitute Potential Koala Habitat. Although some secondary feed trees will be lost, the connectivity between the remaining feed trees and woodlands off-site will be improved by revegetation along the southern boundary of the proposed development and connecting the creekline with larger areas of riparian vegetation along Black Creek to the

north. Revegetation along Black Creek will include approximately 12.0 ha of *E. glaucina*, a Koala feed tree species.

The Grey-headed Flying-fox could utilise canopy trees on site for foraging and roosting. Various eucalypt trees including *C. maculata*, *E. moluccana* and *E. crebra*, will be removed as a part of the proposal; however, larger vegetation parcels surround the site, which this species can utilise for foraging and roosting. Approximately 8.76 ha of eucalypt woodland will be removed and the trees to be removed from the site do not comprise a significant area of potential habitat available to the species in the locality. Revegetation will result in a net gain of approximately 25.3 ha of foraging habitat for this species in the long-term.

The proposal is not expected to have a significant impact on these matters of NES based on the surrounding available habitats and vegetation being retained on site.

4.6.8 Migratory Species

Twelve terrestrial migratory species nationally listed under the EPBC Act have been recorded or have potential habitat within a 10 km radius of the site (see Table 3). The following species are considered as having potential to occur on site:

- Great Egret.
- Cattle Egret.
- Rainbow Bee-eater.

Under the EPBC Act, an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The Great Egret and Cattle Egret inhabit wetland and floodplain habitats. Neither species were recorded on-site, however the farm dams, creeklines, and occasionally inundated areas of the grassy paddock could provide foraging habitat for these species. Although some of the farm dams will be removed or impacted by the proposal, the creekline will be retained and some additional water features will remain on site. Although some potential foraging habitat will be lost, extensive areas of higher quality foraging habitat are found along the northern border of the site along Black Creek.

The Rainbow Bee-eater has been recorded within 10 km of the site. Suitable foraging habitat exists throughout the site in the woodlands, riparian vegetation, and cleared paddocks. As this species is a habitat generalist, foraging in a wide range of open habitats including around human habitation, the proposal is unlikely to alter the habitat in a way that renders it unsuitable to this species. Foraging habitat of a similar quality to that found on site is found throughout the surrounding area.

It is unlikely that the proposal will have a significant impact on any migratory species.

4.6.9 EPBC Act Assessment Conclusion

Pursuant to the EPBC Act, an assessment of potential impacts arising from the proposal on MNES has been undertaken. This assessment has been undertaken in accordance with the EPBC Act and *EPBC Act Policy Statement 1.1 - Significant Impact Guidelines Matters of National Environmental Significance* (DEWHA, 2009).

No threatened species, threatened ecological communities or listed migratory species are expected to be impacted upon as a result of the proposal. Surface impacts as a result of the proposal are limited to the removal of approximately 9.7 ha of native vegetation, and the availability of large areas of similar habitat in close proximity to the site leads to the conclusion that the thresholds for determining that a significant impact is likely, as listed above, have not been reached. It is therefore considered unlikely that the above listed threatened species, migratory species and/or ecological community will be affected by the proposal.

4.7 Key Threatening Processes

A Key Threatening Process (KTP) is defined in the TSC Act as a process that 'threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities'. They are listed under Schedule 3 of the TSC Act, and may adversely affect threatened species, populations or ecological communities or could cause species, populations or ecological communities that are not threatened, to become threatened.

Seven KTPs have the potential to arise as a consequence of the construction of the proposed development:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands;
- Anthropogenic Climate Change;
- Clearing of native vegetation;
- Invasion of native plant communities by exotic perennial grasses;
- Infection of native plants by *Phytophthora cinnamomi*;
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants;
- Loss of hollow-bearing trees;
- Removal of dead wood and trees; and
- Predation by the feral cat (*Felis catus*).

No other KTPs are believed to be likely to occur as a consequence of the proposed clearing and subsequent integrated tourism and residential proposal.

5.0 Recommendations

The following recommendations are provided to mitigate potential impacts on all biodiversity values on site with particular focus on any species, population or ecological community listed under the TSC Act and/or EPBC Act:

- Clearance of native vegetation should be minimised as far as is practical;
- The extent of vegetation clearing is to be clearly identified on construction plans;
- Extent of clearing within native vegetation should be fenced with highly visible temporary fencing to ensure that clearing does not extend beyond the area required;
- Vegetation clearing should avoid mature trees and stags wherever possible in favour of areas of younger regrowth;
- Attempts should be made to relocate hollow logs and felled trees containing hollows into adjacent habitats to provide further habitat resources for native fauna;
- Nest boxes should be installed in the retained vegetation to compensate for the removal of hollows throughout the vegetation to be cleared;
- Glider poles should be installed along the southern boundary of the site between the existing CHR Forest and CHISGGB Forest patches to maintain connectivity between these habitats for glider species;
- Any clearing should be supervised by a qualified ecologist to ensure previously identified habitat trees are 'soft-felled'. Felled trees must be left for a short period of time on the ground to give any fauna trapped in the trees an opportunity to escape before further processing of the trees. The ecologist is to handle any injured or displaced fauna and relocate displaced fauna were necessary;
- Revegetation of native flora on site should be implemented with the objective of increasing the connectivity between existing patches of native vegetation, increasing biodiversity with appropriate local species, and augmenting riparian corridors with suitable local species. See **Appendix 5** for a list of suitable native flora to be used in revegetation;
- A restoration plan is to be developed for native revegetation areas;
- A management plan is to be developed for existing native vegetation, restored native vegetation, and vegetation plantings associated with landscaping of the site;
- Appropriate control measures should be employed to ensure that machinery working within the site does not bring materials (soils, weeds etc.) onto the site that may infect surrounding vegetation with *Phytophthora cinnamomi*;
- Minimise clearing and disturbance to riparian zones where possible. Locate soil or stockpiles away from watercourses to limit potential transport of these substances into the watercourses via runoff. Appropriate erosion and sedimentation controls to be implemented prior to the commencement of construction;
- Appropriate controls to be put in place to limit the flow of surface pollutants associated with the golf course and residential development into Black Creek;
- Appropriate landscaping of the site within any development, particularly within the golf course, to enhance retained vegetation, habitat corridors, and to provide seasonal foraging resources for species such as Grey-headed Flying-fox, Swift Parrot and Regent Honeyeater;
- Speed limits on site should be designed with consideration given to the potential risk of vehicle strikes to native fauna;
- The proposed residential areas on site to be designated a cat-free development to prevent increased predation of native fauna by domestic cats; and

- Manage potential weed infestations to minimise the spread of weeds on the site. Management of noxious weeds are to be undertaken in accordance with the *Noxious Weeds Act* 1993.

6.0 Conclusion

In total, 23 threatened fauna species and three flora species listed under the Threatened Species Conservation Act 1995 were identified with the potential to occur or of known habitat within the site. One threatened flora species, *Eucalyptus glaucina* (Slaty Red Gum), was identified on site. Assessments of Significance (see **Appendix 1)** concluded that the proposal was unlikely to significantly impact on any of these threatened species.

In total, five threatened fauna species and two threatened flora listed under the Environmental Protection and Biodiversity Conservation Act 1999 were assessed as possibly occurring on the site, or that the site supports preferred habitat for the species. Assessments under the EPBC Act (see **Section 4.6**) concluded that the Proposal was unlikely to significantly impact on any of the identified species or communities.

Assessment under SEPP 44 found that whilst small patches of *E. glaucina* and *E. moluccana* within the Central Hunter Ironbark – Spotted Gum – Grey Box Forest offer potential secondary feed trees, the site does not constitute 'Potential Koala Habitat' as described by SEPP 44. The site does not constitute 'Core Koala Habitat' as defined by SEPP 44. No further assessment under SEPP 44 was required.

Field surveys undertaken within the site resulted in the identification of six threatened fauna species, specifically the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Squirrel Glider (*Petaurus norfolcensis*), East-coast Freetail Bat (*Mormopterus norfolkensis*), Large Bentwing Bat (*Miniopterus schreibersii oceansis*), Eastern Bentwing-bat (*Miniopterus australis*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*).

Four vegetation communities, MU 13 Central Hunter Riparian Forest (EEC), MU 18 Central Hunter Ironbark – Spotted Gum – Grey Box Forest (EEC), *Casuarina glauca* woodland, and a *Melaleuca decora* stand, were delineated on site through flora quadrats, transects, and consultation with existing literature.

Most fauna habitats on site were considered to be low quality due to the lack of variably sized hollows, few understorey shrubs, limited woody debris and rocks, and grazing by cattle. Flora habitats were similarly degraded by cattle grazing and subsequent domination of ground cover by hardy pasture grasses and weeds.

The proposal will contribute to multiple Key Threatening Processes listed under the TSC Act; however, with recommendations to mitigate and minimise environmental impacts, these processes can be controlled.

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Appendix 1

TSC Act Seven Part Test

TSC Act Assessment of Significance (7-Part Test)

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of proposed activities on 'threatened species, populations or ecological communities or their habitats' (threatened biota) listed under the TSC Act. The '7-part test' is used to determine whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats and thus whether a Species Impact Statement (SIS) is required to be produced.

The significance of the impacts on those threatened species and EECs which have been recorded in the site or are likely to occur and are likely to utilise habitat to be potentially impacted by the proposed activities (see **Table 4**) have been assessed. The following communities and species have been considered:

Fauna

Critically Endangered

- Regent Honeyeater.

Endangered

- Swift Parrot.

Vulnerable

- Gang-gang Cockatoo;
- Glossy Black-Cockatoo;
- Brown Treecreeper (eastern subspecies);
- Little Lorikeet;
- Black-chinned Honeyeater (eastern subspecies);
- Barking Owl;
- Powerful Owl;
- Scarlet Robin;
- Grey-crowned Babbler (eastern subspecies);
- Masked Owl;
- Spotted-tailed Quoll.
- Eastern False Pipistrelle.
- Little Bentwing-bat;
- Eastern Bentwing-bat;
- Eastern Freetail-bat;
- Southern Myotis;
- Squirrel Glider;
- Koala;
- Grey-headed Flying-fox;

- Greater Broad-nosed Bat; and
- Yellow-bellied Sheathtail Bat.

Flora

Endangered

- *Zannichellia palustris.*

Vulnerable

- *Eucalyptus glaucina* (Slaty Red Gum).

Endangered Population

- *Cymbidium canaliculatum* (population in the Hunter Catchment).

Threatened Ecological Communities

- River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basing, and South East Corner bioregions; commensurate with Central Hunter Riparian Forest (MU 13) (LHCCREMS); and
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion (MU 18) (LHCCREMS).

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Threatened Flora

- *Zannichellia palustris;* and
- *Eucalyptus glaucina* (Slaty Red Gum).

Zannichellia palustris has been recorded at Black Creek, which forms the northern boundary of the site, and has potential to occur within the unnamed creek that runs through the site. The proposed development has potential to reduce the water quality of waterways both on site, and directly adjacent to the site, which may adversely impact local populations of this species. These impacts can be reduced to an acceptable level provided that sufficient mitigation and water quality management techniques are implemented, including erosion and sedimentation controls during construction, minimising clearing and disturbance to riparian zones, and ongoing management of surface pollutants associated with the golf course and residential development to prevent runoff into wetland areas.

Eucalyptus glaucina is found in two disjunct populations, one on the north coast of NSW, and the other near Casino and west of Maitland between Taree and Broke in the Hunter Catchment. *E. glaucina* can be locally frequent, but is sporadic in its occurrence. This species grows in grassy woodlands and dry eucalypt forest on deep, moderately fertile alluvial or clayey soils.

E. glaucina was found along the southern border of the site in the south-west and south-eastern limits of the CHISGGB Forest. These two stands consisted of 11 mature trees, over 30 saplings (south-west) and one mature tree and 27 saplings (south-east). All *E. glaucina* on site will be retained in the proposed development. Although some potential habitat will be cleared directly adjacent to the north of extant *E. glaucina* stands, contiguous habitat will remain to the west and east of these stands. The individuals on site are displaying some resilience as a large number of saplings (in one case 27 saplings surrounding a single mature tree) are germinating and growing on previously cleared and grazed land. The species will further

benefit from the removal of cattle from the site, as lack of regeneration through grazing pressure is a significant threat to this species. As no extant trees will be removed and extensive uncleared areas will persist immediately surrounding the *E. glaucina* on site, the proposed development is not likely to have an adverse effect on the life cycle of this species such that a viable local population is likely to be placed at risk of extinction.

Threatened Fauna

Woodland/Forest Birds

- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Brown Treecreeper (eastern subsp.) (*Climacteris picumnus victoriae*);
- Regent Honeyeater (*Anthochaera phrygia*);
- Swift Parrot (*Lathamus discolor*);
- Little Lorikeet *(Glossopsitta pusilla*);
- Black-chinned Honeyeater (eastern subsp.) (*Melithreptus gularis gularis*);
- Scarlet Robin (*Petroica boodang*); and
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*).

The Gang-gang Cockatoo is generally found in tall mountain forests and woodlands in summer, particularly in heavily timbered and mature wet sclerophyll forests. In winter, it may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often in urban areas. While potential foraging habitat for this species occurs on site, the site contains only a small area of low quality habitat and much larger areas of higher quality habitat occur less than 2 km to the north and west of the site. Only two records of this species exist in within 10 km of the survey area, indicating that it is not a frequent visitor to the area. Due to the small area of vegetation to be removed, it is unlikely that the proposal will affect the life cycle of the Gang-gang Cockatoo such that a viable local population of the species is likely to be placed at risk of extinction.

Glossy Black Cockatoos occur in forests and woodlands, mostly in the ranges surrounding the Hunter Valley, with only sparse occurrences on the valley floor. They forage primarily cones of *Allocasuarina* trees, with *Casuarina* trees providing a less desirable secondary food source. The pure stands of *Casuarina glauca* on site are potential food trees for this species, although *C. glauca* is not a preferred food. Although suitable habitat for this species is present on site, much larger areas of suitable habitat can be found directly adjacent to the site's northern border along Black Creek. Due to the small area of foraging habitat being removed and the much larger areas of suitable habitat off site, it is unlikely that the proposal will affect the life cycle of the Glossy Black-Cockatoo such that a viable local population of the species is likely to be placed at risk of extinction.

Brown Treecreepers occupy drier open forests and woodlands with an abundance of logs, stumps and dead trees. They nest in tree hollows and forage for insects in trees, decorticating bark and leaf litter. The site does offer suitable habitat for this species. However, current and previous surveys have not detected this species on site. This species has permanent territories. As it was not detected on site, it may not be currently occupied by resident individuals. The proposed net gain in native vegetation and improved habitat connectivity may enhance the habitats for this species in the future. It is therefore considered unlikely that the proposal will affect the life cycle of the Brown Treecreeper such that a viable local population of the species is likely to be placed at risk of extinction.

Neither the **Regent Honeyeater** nor **Swift Parrot** were detected within the site. However, the habitat is considered suitable for foraging during winter migration and large numbers of Swift Parrots were recorded to the north of the site (HSO 2007). Both species commonly feed on nectar produced by winter-flowering eucalypts such as *C. maculata* and hence, potential foraging habitat for these species may be impacted by the proposal. Despite potential habitat existing, the habitat on site is only a small, fragmented portion of the available habitat for these species within the wider area. Revegetation proposed for the site will also augment available habitat for these species in the long term. Thus, it is unlikely that the proposal will affect the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

Little Lorikeets feed on nectar and pollen primarily from flowering eucalypts, including Spotted Gum, but also melaleucas and mistletoes. Thus, the proposal may affect potential foraging habitat for this species. Little Lorikeets nest in hollow openings mainly in smooth-barked eucalypts such as *E. viminalis*, *E. blakelyi* and *E. dealbata*. Although hollow-bearing trees were found on site, they were not of the preferred species or of a suitable size for Little Lorikeet nests. The habitat on site is only a small, fragmented portion of the available habitat for this species in the wider area. Thus, it is unlikely that the proposal will affect the life cycle of the Little Lorikeet such that a viable local population is likely to be placed at risk of extinction.

Black-chinned Honeyeaters feed on nectar and lerp in the foliage and bark of trees in eucalypt woodlands and open forests such as those found on site. They typically travel in small groups of two or three individuals covering a large home range (approximately 140 ha). They occur naturally at low densities and experience competition with more aggressive native bird species such as Noisy Miners which are abundant across the site. Although some suitable habitat for this species will be cleared, large portions will be retained and revegetation on site, which will compensate for this loss in the long-term. Larger areas of unfragmented and higher quality habitat occur less than 2 km to the north and west of the site. Therefore, the local population is more likely to be sustained within these areas and only occasionally utilise the habitats on site for foraging. Revegetation on site will improve connectivity to the habitats north and west of the site and, in the long-term, the flora species used in revegetation will provide additional foraging habitat. Thus, it is unlikely that the proposal will affect the life cycle of this species such that a viable local population is likely to be placed at risk of extinction.

The Scarlet Robin feeds on invertebrates taken from tree trunks, dead branches, logs and other woody debris. Despite potential habitat existing, this species has not been detected during current and previous surveys and the vegetation to be retained on site together with proposed revegetation will provide habitat for this species if it does persist on site. Thus, it is unlikely that the proposal will affect the life cycle of this species such that a viable local population is likely to be placed at risk of extinction.

Grey-crowned Babblers were recorded on site. Three individuals were observed on a nest in a mature *Melaleuca decora* near the southern boundary of the site in CHISGGB Forest. The nest was in an area of dense *E. crebra* regrowth with moderately dense understorey. Two additional very old nests were found farther north, also within *E. crebra* regrowth. Grey-crowned Babblers could potentially nest throughout the CHISGGB Forest on site, particularly in denser areas, and forage throughout the woodlands on site. Despite the clearing of some suitable habitat as part of the proposal, this species is highly adaptive and relocates easily. The retention of habitats on site and proposed revegetation should allow this species to persist on site following development. Thus, it is unlikely that the proposal will affect the life cycle of the Grey-crowned Babbler such that a viable local population is likely to be placed at risk of extinction.

Forest Owls

- Barking Owl (*Ninox connivens*);
- Powerful Owl (*Ninox strenua*); and
- Masked Owl (*Tyto novaehollandiae*);

These forest owl species occur in wet or dry sclerophyll forests and woodlands in the coastal, tablelands and to the western plains of NSW where they hunt for a range of mammalian prey. These species nest in large hollows (preferably Eucalypt trees) where they also roost. Roosting can also occur in dense canopy vegetation, commonly within *S. glomulifera*, *A. littoralis* and *A. melanoxylon*. These owls are predators of arboreal mammals such as Common Brushtail Possums, Sugar Gliders, Grey-headed Flying-foxes, and microbats. In addition, some terrestrial mammals commonly taken include the Bush Rat, European Rabbit, and Brown Antechinus. A high density of small mammals (many of which are hollow-dependent), is required for a suitable foraging habitat for these forest owls.

None of the threatened forest owl species have been recorded on site. However, records do exist within a 10 km radius. As no hollows of a suitable size for roosting were recorded, the proposal may only impact on potential foraging habitat for forest owls within the site. These species require large foraging territories in the range of two thousand hectares or more. Thus, the woodlands on site represent only a very small portion of foraging habitat. The foraging habitat contains few of the habitat features necessary to sustain high densities of small mammals, such as woody debris and ground cover. The value of the site for foraging is further diminished by its relative isolation from larger areas of suitable habitat in the surrounding area and the scarcity of hollow-bearing trees. Due to their large territories and utilisation of a wide range of habitats, it is unlikely that the proposal will affect the life cycle of the forest owls such that a viable local population of the species is likely to be placed at risk of extinction.

- Spotted-tail Quoll (*Dasyurus maculatus*)

The distribution of the Spotted-tail Quoll ranges from South Queensland to Kosciuszko NP, mainly within 200 km of the coast. A total of 44 known sites have been recorded in NSW, however, detailed distribution and abundance records of this species are absent due to the scale of its entire range. The Spotted-tail Quoll inhabits a wide variety of forest types including rainforest, wet and dry sclerophyll forest, coastal heathlands and woodlands. Habitat requirements include hollow logs, hollow-bearing trees, rock shelters or other suitable den sites, as well as relatively dense vegetation for foraging. This species is an opportunistic carnivore and hunts a wide range of prey such as small mammals like possums, gliders and rats, as well as birds, reptiles and invertebrates.

The Spotted-tail Quoll was not recorded within the site during fauna surveys, although eight records exist within 10 km of the site. The site lacks habitat features important to this species, such as large hollow logs, large hollow-bearing trees, rock shelters, or dense vegetation. Most of the woodland habitats on site have poor understory cover and are too open and exposed to provide suitable foraging habitat for this species. Small portions of the CHISGGB Forest along the southern boundary of the site are denser, although they would only provide marginal foraging habitat. The relatively poor connectivity of these areas to woodlands off site further diminishes their value as foraging habitat for this species. Due to the specific habitat requirements of this species and poor connectivity of the site, it is considered unlikely that the proposal will affect the life cycle of the Spotted-tail Quoll such that a viable local population of the species is likely to be placed at risk of extinction.

- Squirrel Glider (*Petaurus norfolcensis*)

The distribution of the Squirrel Glider ranges from western Victoria up to north Queensland, mainly inland of the Great Dividing Range. A separate population exists along the coast between southern QLD and southern NSW. The species is widely distributed in the Hunter region and has been previously recorded within 10 km of the site. Squirrel Gliders inhabit dry sclerophyll forests, woodlands and swamp forests where they feed on sap exudates and blossoms. Hollow-bearing trees are used as dens for shelter and breeding and are consequently an essential part of the habitat.

A single individual Squirrel Glider was captured in an arboreal Elliott B trap placed on a *Casuarina glauca* tree within the Central Hunter Riparian Forest (MU 13) habitat on site. Squirrel Gliders are likely to utilise all woodland habitats on site and potentially also scattered paddock trees in the cleared pasture areas, provided these trees are not too distant from woodland areas to prevent access by gliding. Upon release, the captured animal was observed to glide from the riparian vegetation into a group of paddock trees, one of which contained multiple hollows. Some of the hollow trees present on site will be removed as a result of the proposal, which is a potential threat to this species. The large areas of cleared pasture in the northern and eastern end of the site limit connectivity to habitats north and east of the site, while Main Road and developments to the west also limit connectivity. Both the CHISGGB Forest (MU 18) and Central Hunter Riparian Forest provide habitat for this species on site. The Central Hunter Riparian Forest around the creek at the southern end of the site is connected to contiguous woodland habitats to the south and provides an important corridor for movement between woodland habitats off-site and the larger areas of CHISGGB Forest on-site. The proposal will increase the fragmentation of on-site habitats, reduce the available habitat for this species and remove some hollow-bearing trees. However, revegetation, as part of the proposal, will increase the connectivity between habitat on site and the surrounding area in the long-term. In particular, the revegetation along the southern boundary will enhance connectivity with a patch of woodland to the south, while revegetation along Main Road to the west will open up a new potential movement corridor to extensive riparian woodland along Black Creek and large areas of woodland to the north. As habitat for this species will be retained on site, and connectivity to habitat off-site will be retained or improved by the proposal, it is considered unlikely that the proposal will affect the life cycle of the Squirrel Glider such that a viable local population of the species is likely to be placed at risk of extinction.

- Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox is distributed from Melbourne in Victoria up to Bundaberg in Queensland and mainly inhabits sclerophyll forests, woodlands, subtropical and temperate rainforests as wells as heaths and swamps. The selection of habitat is dependent on the availability of foraging opportunities in the form of nectar, pollen and fruits. Common feed trees include *Eucalyptus*, *Melaleuca* and *Banksia*. Grey-headed Flying-foxes are known to migrate long distances in response to foraging availability as nectar and pollen sources vary over time. Communal roost sites are commonly located in close proximity to a reliable food source and near water bodies, in coastal areas within rainforest patches, mangroves or riparian vegetation.

Grey-headed Flying-foxes were not detected during current or previous surveys on site. However, thirty two records exist within 10 km of the site. Foraging habitat is present on site as well as potential roosting habitat among the mature eucalypts. However, it is not considered suitable habitat for a camp to persist on site. It can therefore be considered that this species only uses the site for foraging on a transient basis. Potential impacts of the proposal of this species would therefore be limited to the removal of foraging opportunities. Due to the widespread distribution of potential feed trees within the locality and migration patterns of this species, it is considered unlikely that the proposal will affect the life cycle of the Grey-headed Flying-fox such that a viable local population of the species is likely to be placed at risk of extinction.

Cave-roosting bats

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*); and
- Little Bentwing-bat (*Miniopterus australis*).

Both the Little Bentwing-bat and Eastern Bentwing-bat have a widespread distribution ranging from Cape York to NSW, with Eastern Bentwing-bat spreading down to Central Victoria. These insectivorous bats commonly inhabit wet and dry sclerophyll forests as well as rainforests. All species require caves or similar structures with specific characteristics for roosting purposes. Suitable roost sites are not common and should therefore be considered of high conservation significance.

The Eastern Bentwing-bat and Little Bentwing-bat were both detected on site. No caves or structures suitable for roosting exist on site. Little Bentwing-bats have been recorded roosting in tree hollows, however, their choice of roost sites is highly variable with factors relating to microclimate, leaf litter, tree height, hollow entrance and hollow size, amongst others (Richardson 1977). The proposal will result in the clearing of some potential foraging habitat and hollow-bearing trees, though large areas of retained foraging habitat on site will be augmented by proposed revegetation. Larger areas of habitat exist in the surrounding area. Therefore, it is considered that the proposal will not affect the life cycle of the above cave-roosting bats such that a viable local population of the species is likely to be placed at risk of extinction.

Hollow-roosting Bats

- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Southern Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

All of the above hollow-roosting bats have widespread distributions, ranging mainly along coastal areas from southern QLD to Victoria, with the exception of the Yellow-bellied Sheathtail-bat, which is distributed over most of Australia. The Southern Myotis prefers wetland habitat near estuaries and large lakes, while the remaining bats inhabit wet or dry sclerophyll forests, rainforests or woodlands. These species primarily roost in tree hollows, but also under decorticating bark and in cracks and fissures. The Southern Myotis roosts in caves, artificial habitats and tree hollows.

Both the Eastern Freetail-bat and Yellow-bellied Sheathtail-bat were recorded foraging on site during surveys. The remaining hollow-roosting bats have the potential to occur and forage on site. Due to the small hollows and fissures observed on site which may be utilised by individual bats, it is unlikely that the sizes of the hollows are large enough to accommodate a roosting colony. The removal of vegetation on site may reduce foraging habitat for these species, however, larger areas of habitat exist to the north of the site that could easily provide the required resources for all the above hollow-roosting bats. Therefore, it is considered unlikely that the proposal will affect the life cycle of the above hollow-roosting bats such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

An endangered population of *Cymbidium canaliculatum* has potential to occur within the site. The population of this species within the Hunter Catchment is at the south-eastern distributional limit of the species' range and is disjunct from populations of the species, which range from north-east NSW through northern Queensland, northern NT and into the Kimberley region of WA. The Hunter Catchment population has its south-eastern distributional limit at Weston and Pokolbin, but is mostly centred on the Upper Hunter north of Singleton.

C. canaliculatum habitat is present on site as this species may grow on the upper branches of some of the eucalypts in the CHISGGB Forest community, including *E crebra*, *E. moluccana*, and dead stags. The recruitment, germination, and persistence of this species depend on rotting wood in the hollows, fissures, trunks, and forks of its host trees. Although eucalypts will be cleared as part of the proposal, the majority of the CHISGGB Forest on the site will remain after development. As part of the proposal, the potential habitat for *C. canaliculatum* will be expanded in the long-term by revegetation of native eucalypts on site. Therefore,

it is considered unlikely that the proposal will affect the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Two Endangered Ecological Communities, namely (MU 18) 'Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion' and 'River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin, and South East Corner bioregions' commensurate with (MU 13) Central Hunter Riparian Forest were recorded and mapped on site. Approximately 8.76 ha and 0.05 ha respectively of these communities are expected to be cleared as a result of this proposal.

Large areas of CHISGGB Forest exist north of the site (Huntlee) and the entire northern and eastern boundary of the site is bordered by Central Hunter Riparian Forest. Revegetation activities on site will result in the restoration of approximately 34.07 ha of CHISGGB Forest and 3.67 ha of Central Hunter Riparian Forest. Although clearing of these communities will occur on site, it is not considered to:

(i) Have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or

(ii) Substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) **the extent to which habitat is likely to be removed or modified as a result of the action proposed.**

Flora

- *Zannichellia palustris*

This species was not detected within the site; however, records exist from Black Creek, which flows directly adjacent to the site. No potential habitat will be removed from the site as a result of the proposed activities. Black Creek and a small unnamed creek on site have potential to be modified by pollution and sedimentation as a result of the proposed activities.

- *Eucalyptus glaucina* (Slaty Red Gum).

This species was recorded on site. Approximately 8.76 ha of potential habitat will be removed from the site as a result of the proposed activities. Approximately 34.07 ha of potential habitat will be restored following revegetation activities on site.

- *Cymbidium canaliculatum* (population in the Hunter Catchment).

This species was not detected within the site. Approximately 8.76 ha of potential habitat will be removed from the site as a result of the proposed activities. Approximately 49.76 ha of potential habitat will be restored following revegetation activities on site.

Fauna

Woodland/Forest Birds

- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Brown Treecreeper (eastern subsp.) (*Climacteris picumnus victoriae*);
- Regent Honeyeater (*Anthochaera phrygia*);
- Swift Parrot (*Lathamus discolor*);
- Little Lorikeet (*Glossopsitta pusilla*);
- Black-chinned Honeyeater (eastern subsp.) (*Melithreptus gularis gularis*);
- Scarlet Robin (*Petroica boodang*); and
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*).

Potential foraging habitat occurs within the site for all Woodland/Forest bird species. Breeding habitat on site exists for the Grey-crowned Babbler and potentially Brown Treecreeper. Approximately 9.7 ha of potential habitat will be removed as a result of the proposed activities. Approximately 49.76 ha of potential habitat will be restored following revegetation activities on site.

Forest Owls

- Barking Owl (*Ninox connivens*)
- Powerful Owl (*Ninox strenua*); and
- Masked Owl (*Tyto novaehollandiae*);

Potential foraging habitat exists on sites for forest owl species. Consequently, approximately 9.7 ha of potential habitat will be removed from the site, as a result of the proposed activities. Approximately 34.07 ha of potential habitat will be restored following revegetation activities on site.

Mammals

- Spotted Tail Quoll (*Dasyurus maculatus*)

Potential low-quality foraging habitat exists within the site for the Spotted Tail Quoll, particularly within the CHISGGB Forest. Consequently, approximately 9.7 ha of potential habitat will be removed from the site as a result of the proposed activities. Approximately 37.74 ha of potential habitat will be restored following revegetation activities on site.

- Squirrel Glider (*Petaurus norfolcensis*)

A Squirrely Glider was recorded on site and both potential foraging and breeding habitat exists within the site. Consequently, approximately 9.7 ha of potential habitat will be removed from the site as a result of the proposed activities. Approximately 49.76 ha of potential habitat will be restored following revegetation activities on site.

- Grey-headed Flying-fox (*Pteropus poliocephalus*)

Potential foraging habitat exists within the site for the Grey-headed Flying-fox within CHISGGB Forest. Consequently, approximately 8.76 ha of potential habitat will be removed from the site as a result of the proposed activities. Approximately 34.07 ha of potential habitat will be restored following revegetation activities on site.

Cave-roosting bats

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*); and
- Little Bentwing-bat (*Miniopterus australis*).

Potential foraging habitat occurs across the site for both Cave-roosting bats. Approximately 9.7 ha of potential foraging habitat will be removed from the site. Approximately 49.76 ha of potential habitat will be restored following revegetation activities on site.

Hollow-roosting Bats

- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Southern Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

The site provides suitable foraging and roosting habitat for all the hollow-roosting bats. Consequently, approximately 9.7 ha of potential habitat will be removed from the site, as a result of the proposed activities, including the removal of three hollow bearing trees. Approximately 49.76 ha of potential habitat will be restored following revegetation activities on site.

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

The vegetation to be removed will increase fragmentation within the site in some areas. However, revegetation will improve connectivity within the site in other areas. Revegetation will improve connectivity between habitats on site and habitat directly adjacent to the site.

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

Flora

- *Eucalyptus glaucina*

This species was recorded on site during flora surveys. The habitat to be cleared will affect the ability of this species to continue to spread within its immediate surrounds, however, substantial areas of habitat will be retained. The population of *E. glaucina* on site is restricted to the southern border of the site and is isolated from other populations by cleared paddocks. Populations of the species are known to occur in extensive areas (at least 859 ha) of suitable habitat within 10 km to the north of the site (HSO 2007). Although the habitat on site is not important for the long-term survival of the species in the wider area surrounding the site, the habitat on site is important for the long-term survival of the species in the distinct locality in which it occurs on site. A large number of saplings around the mature trees on site indicate that the species is capable of expanding its population and increasing its numbers at this locality. The habitat to be cleared by the proposal will remove potential areas for the local populations to expand into, particularly directly to the north of the trees recorded on site. However, due to the retention of all recorded *E. glaucina* trees and some suitable habitat directly adjacent to stands of *E. glaucina* on site, the habitat being removed is not considered important for the long-term survival of this species within the locality.

- *Cymbidium canaliculatum* (population within the Hunter Catchment)

This species was not detected during comprehensive flora surveys on site. Although the habitat found on site represents an isolated patch of suitable habitat within a wider area of cleared paddocks, 8.76 ha of this habitat will be removed and 19.57 ha will be retained. The proposal includes revegetation totalling 49.76 ha, which will expand the potential habitat for this species on site in the long-term. However, in the short-term, some habitat in the form of large eucalypts will be lost. The habitat being removed is not considered important for the long-term survival of this species within the locality.

Fauna

Woodland/Forest Birds

- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Brown Treecreeper (eastern subsp.) (*Climacteris picumnus victoriae*);
- Regent Honeyeater (*Anthochaera phrygia*);
- Swift Parrot (*Lathamus discolor*);
- Little Lorikeet *(Glossopsitta pusill*a);
- Black-chinned Honeyeater (eastern subsp.) (*Melithreptus gularis gularis*);
- Scarlet Robin (*Petroica boodang*); and
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*).

The habitat on site represents only small, low-quality and somewhat isolated patch of seasonal foraging habitat for the Gang-gang Cockatoo, Regent Honeyeater, Swift Parrot, Little Lorikeet, and Black-chinned Honeyeater. These species are likely to only utilise the site for foraging when tree species are in flower or during part of their seasonal migrations. Glossy Black-Cockatoos may forage on *C. glauca* at any time of year. Brown Treecreepers and Scarlet Robins may forage for insects in the woodlands on site at any time of year. Due to the young age cohort of trees on site and the availability of higher quality habitat for these highly mobile species within the locality, the habitat on site is considered to be of low importance. The long-term survival of these species within the locality is more likely to be sustained by more extensive areas of similar habitat within 2 km to the north and west of the site, with the habitats on site representing a less important area of occasional sporadic foraging.

Three Grey-crowned Babblers were observed on a nest on site and two additional old, disused nests were found during this survey. Grey-crowned Babblers are known for their utilisation of a variety of habitat types, however, considering that the site offers known breeding habitat, it is considered important habitat for the long-term survival of this species in the locality. The nesting site and the vegetation in the immediate vicinity will be retained on-site, and available habitat on site will be augmented by proposed revegetation. While some clearing of suitable habitat will occur, this species is adaptable and can persist within the remaining patches of vegetation. The increased connectivity between habitats on site and surrounding suitable habitats as a result of revegetation will also benefit this species. Although the habitat on site is considered important for the long-term survival of this species in the locality, sufficient habitat for the continued nesting and breeding of this species will be retained on site.

Forest Owls

- Barking Owl (*Ninox connivens*);
- Powerful Owl (*Ninox strenua*); and
- Masked Owl (*Tyto novaehollandiae*);

The potential foraging habitat present within the site is not considered to be significant for the long-term survival of these species in the locality.

Mammals

- Spotted Tail Quoll (*Dasyurus maculatus*)

The potential foraging habitat present within the site is not considered to be significant for the long-term survival of this species in the locality.

- Squirrel Glider (*Petaurus norfolcensis*)

The potential foraging and breeding habitat present within the site is likely to be significant for a small number of individuals of this species in the locality. A small are of woodland may become potentially become innacessible for this species. Therefore glider poles have been reccomended to mitigate this fragmentation and enable this species to contue to access all retained areas of woodland. The areas of habitat to be retained and revegetated are of a sufficient size and connectivity to allow this species to persist in the area at its current level of abundance.

- Grey-headed Flying-fox (*Pteropus poliocephalus*)

The potential foraging habitat present within the site is not considered to be significant for the long-term survival of this species in the locality.

Cave-roosting Bats

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*); and
- Little Bentwing-bat (*Miniopterus australis*).

The potential foraging habitat present within the site is not considered to be significant for the long-term survival of these species in the locality.

Hollow-roosting Bats

- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Southern Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

The potential foraging and/or breeding habitat present within the site is not considered to be significant for the long-term survival of these species in the locality.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No areas of critical habitat occur within the site.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Flora

- *Eucalyptus glaucina*

The proposal is inconsistent with one of the sixteen priority actions identified by the Office of Environment and Heritage (OEH) to help recover this species, specifically, to 'protect known populations and areas of potential habitat from clearing and development', which is listed as a high priority. However, no individual *E. glaucina* will be cleared as a result of the proposal and habitat will remain in the vicinity of existing trees.

- *Cymbidium canaliculatum* (population within the Hunter Catchment)

No recovery or threat abatement plans exist for this species at the present time.

- *Zannichellia palustris*

No recovery or threat abatement plans exist for this species at the present time.

Fauna

Woodland/Forest Birds

- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Brown Treecreeper (eastern subsp.) (*Climacteris picumnus victoriae*);
- Regent Honeyeater (*Anthochaera phrygia*);
- Swift Parrot (*Lathamus discolor*);
- Little Lorikeet *(Glossopsitta pusill*a);
- Black-chinned Honeyeater (eastern subsp.) (*Melithreptus gularis gularis*);
- Scarlet Robin (*Petroica boodang*); and
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*).

Of the threatened Woodland/Forest Birds under consideration for this site, two of the species had a recovery plan or threat abatement plan, including:

- Regent Honeyeater; and
- Swift Parrot.

As potential habitat will be removed during the current proposal, the proposal would be inconsistent with objective 1 in Table 5 (Clearing of native vegetation) of the National Recovery Plan for the Swift Parrot *Lathamus discolour* (Saunders and Tzaros 2011).

One specific objective listed under the Regent Honeyeater Recovery plan 1999-2003 (Menkhorst et al. 1999) states that 'maintaining and enhancing the value of Regent Honeyeater habitat at Key sites and throughout their former range'. The proposal removes potential foraging habitat for this species and is therefore inconsistent with this recovery plan.

The OEH has published Priorities Action Statements for an additional five species, including:

- Gang-gang Cockatoo;
- Glossy Black-Cockatoo;
- Brown Treecreeper;
- Black-chinned Honeyeater; and
- Grey-crowned Babbler.

However, the proposal is consistent with all listed priority actions for these species.

Forest Owls

- Barking Owl (*Ninox connivens);*
- Powerful Owl (*Ninox strenua*); and
- Masked Owl (*Tyto novaehollandiae*);

As potential habitat will be removed during the current proposal, the proposal would be inconsistent with objective 5 (minimise loss and fragmentation of owl habitat areas) of the large forest owl recovery plan (DEC 2006).

Mammals

- Spotted Tail Quoll (*Dasyurus maculatus*)

As potential habitat will be removed during the current proposal, the proposal would be inconsistent with objective 4.1 (reduce the rate of loss and fragmentation of Spotted-tailed Quoll habitat) of the Spotted-tailed Quoll draft recovery plan (Long & Nelson, 2004).

- Squirrel Glider (*Petaurus norfolcensis*)

No recovery or threat abatement plans have been developed for the Squirrel Glider at this stage. However, the OEH has published Priorities Action Statements for this species. The proposal is potentially inconsistent with one of nine current priority actions for this species, namely to 'ensure the largest hollow bearing trees (including dead trees) are given highest priority for retention in PVP assessments and other environmental planning instruments, or other land assessment tools.' The hollow bearing trees that may be removed as a result of the proposed actions contain only small hollows (2 to 10cm diameter).

- Grey-headed Flying-fox (*Pteropus poliocephalus*)

As potential habitat will be removed during the current proposal, the proposal would be inconsistent with objective 1 (to identify and protect foraging habitat) and 2 (to protect and increase the extent of key winter and spring foraging habitat) of the Grey-headed Flying-fox draft recovery plan (DECCW, 2009).

Cave-roosting Bats

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*); and
- Little Bentwing-bat (*Miniopterus australis*).

No recovery or threat abatement plans have been developed for the Eastern Bentwing-bat or Little Bentwing-bat at this stage. However, the OEH has published Priorities Action Statements for this species. The proposal is consistent with all current priority actions for these species.

Hollow-roosting Bats

- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Southern Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

No recovery or threat abatement plans have been developed any of the hollow-roosting bats at this stage. However, the OEH has published Priorities Action Statements for these species. The proposal is potentially inconsistent with one of the current priority actions that has been listed for all five of these species, namely to 'ensure the largest hollow bearing trees (including dead trees) are given highest priority for retention in PVP assessments and other environmental planning instruments, or other land assessment tools.' The hollow bearing trees that may be removed as a result of the proposed actions contain only small hollows (2 to 10cm diameter).

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Key Threatening Processes (KTPs) are listed under Schedule 3 of the TSC Act 1995. There are nine KTPs that have the potential to affect the site as a consequence of the proposal, namely:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands;

The proposal may potentially cause minor alterations to the flows within the water courses of the site through increased hard surface areas and some small scale diversions of water flows via culverts or similar flow control structures. However, the proposal will also involve revegetation along much of the creek within the site, as well as along the southern side of Black Creek, improving bank stabilisation of these waterways. In addition, the development of the infrastructure and golf course would entail the creation of additional water catchments that would be designed to control flows and water quality into the waterways. Therefore, this KTP is unlikely to be of a magnitude that would decrease the condition of the River-flat Eucalypt Forest On Coastal Floodplains EEC.

- Anthropogenic climate change.

Potential changes to landuse that result in any increase in human activity or changes to ground cover within the sites would likely increase the rate of anthropogenic climatic change,however, by a minor incremental amount.

- Clearing of native vegetation.

Approximately 9.7 ha of native vegetation will be cleared to accommodate the proposal. The clearing of native vegetation on site will be compensated by the proposed revegetation of approximately 49.76 ha, providing an overall net gain in native vegetation. Therefore, the proposal will contribute to this KTP only in the short term.

- Loss of hollow-bearing trees.

A number of local threatened fauna species are reliant on hollow-bearing trees for roosting and breeding purposes, including the Squirrel Glider and hollow-roosting insectivorous bats. Eight hollow-bearing trees were recorded on site and at least four are likely to be removed as a result of the proposal. Therefore, the proposal is expected to result in a very minor contribution to this key threatening process.

- Removal of dead wood and dead trees.

Potential exists for removal of dead standing and fallen timber within the sites. Given the small area to be cleared and the relatively low abundance of dead standing and fallen timber on site, it is not expected that a major increase in activities relation to this KTP would result from the proposal.

- Invasion of native plant communities by exotic perennial grasses.

The proposal has the potential to contribute to this KTP due to the removal of vegetation. The site already contains exotic perennial grasses, and further clearing with higher levels of traffic could increase the spread

of exotic species. Planting of grasses for the proposed golf course could also introduce exotic grasses to the area. The proposed development will provide an opportunity to enact a weed control program to ameliorate this KTP.

- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.

The proposal has the potential to contribute to this KTP due to the landscaping that is incorporated into the golf course and residential development. Proposed revegetation with native plant species will ameliorate this KTP and preference will be given to native plant species in landscaping designs.

- Infection of native plants by *Phytophthora cinnamomi.*

The proposal has the potential to contribute to this KTP due to the regular occurrence of vehicles on site that could be carrying and spreading the fungus. Appropriate mitigation measures involving vehicles on site will provide an opportunity to ameliorate this KTP.

- 'Predation by the Feral Cat (*Felis catus*)'

Feral cats are free-living, have minimal or no reliance on humans for their ecological requirements, and survive and reproduce in self-perpetuating populations. Any increase in human habitation density as a result of the proposed development may result in an increased number of feral cats establishing, particularly due to irresponsible and reckless owners loosing or abandoning cats. This may lead to increased predation upon certain native species. Community and landowner liaison, awareness and education are required to counter this problem.

Appendix 2

Flora Species List

Appendix Key: * = introduced species
(E) = listed as Endangered in NSW.
(V) = listed as Vulnerable in NSW.
(V*) = Species listed under the Commonwealth EPBC Act as Vulnerable
(E*) = Species listed under the Commonwealth EPBC Act as Endangered

Family	Scientific Name	Common Name
Acanthaceae	*Brunoniella australis*	Blue Trumpet
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair
	Cheilanthes sieberi	Rock Fern
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed
Anthericaceae	*Arthropodium milleflorum*	Pale Vanilla Lily
	Dichopogon strictus	Chocolate Lily
	Tricoryne elatior	Yellow Rush Lily
Asphodelaceae	*Aloe maculata**	Common Soap Aloe
	*Asphodelus fistulosus**	Onion Weed
Asteraceae	*Brachyscome multifida*	Cut-leaved Daisy
	Cassinia aculeata	Dolly Bush
	*Chondrilla juncea**	Skeleton Weed
	Chrysocephalum apiculatum	Common Everlasting
	*Cirsium vulgare**	Spear Thistle
	*Conyza bonariensis**	Flax-leaf Fleabane
	*Conyza sumatrensis**	Tall Fleabane
	Eclipta platyglossa	Yellow Twin-heads
	*Hypochaeris radicata**	Flatweed
	Ozothamnus diosmifolius	Ball Everlasting
	*Senecio madagascariensis**	Fireweed
Cactaceae	*Opuntia stricta var. stricta**	Common Prickly Pear
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell
Casuarinaceae	*Allocasuarina luehmannii*	Bulloak
	Casuarina glauca	Swamp Oak
Commelinaceae	*Commelina cyanea*	Scurvy Weed, Native Wandering Jew
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-rush

Family	Scientific Name	Common Name
Euphorbiaceae	*Phyllanthus virgatus*	-
Fabaceae/faboideae	*Daviesia genistifolia*	Broom Bitter Pea
	Glycine tabacina	Twining Glycine
	Kennedia rubicunda	Dusky Coral Pea
	Pultenaea spinosa	-
Goodeniaceae	*Goodenia hederacea subsp. hederacea*	Ivy-leaved Goodenia
	Goodenia paniculata	Swamp Goodenia
Hypoxidaceae	*Hypoxis hygrometrica*	Golden Star
Juncaceae	*Juncus usitatus*	Common Rush
Juncaginaceae	*Triglochin microtuberosa*	Water Ribbons
Lobeliaceae	*Pratia purpurascens*	Whiteroot
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Meliaceae	*Melia azedarach*	White Cedar
Myrtaceae	*Angophora floribunda*	Rough-barked Apple
	Callistemon linearifolius	Netted Bottle Brush
	Corymbia maculata	Spotted Gum
	Eucalyptus crebra	Narrow-leaved Ironbark
	***Eucalyptus glaucina* (V, V*)**	**Slaty Red Gum**
	Eucalyptus moluccana	Grey Box
	Melaleuca decora	-
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn
Plantaginaceae	*Plantago lanceolata**	Ribwort
Poaceae	*Austrostipa ramosissima*	Stout Bamboo Grass
	Chloris truncata	Windmill Grass
	Chloris ventricosa	Tall Chloris
	Cymbopogon refractus	Barbwire Grass

Family	Scientific Name	Common Name
	*Digitaria violascens**	
	Echinopogon caespitosus var. caespitosus	Tufted Hedgehog Grass
	Eragrostis brownii	Brown's Lovegrass
	*Eragrostis curvula**	African Lovegrass
	*Eragrostis tenuifolia**	Elastic Grass
	Microlaena stipoides	Weeping Grass
	Opercularia hispida	Hairy Stinkweed
	Paspalidium distans	-
	*Paspalum dilatatum**	Paspalum
	Rytidosperma laeve syn. Austrodanthonia laevis	Wallaby Grass
Proteaceae	*Hakea sericea*	Needlebush
Ranunculaceae	*Clematis aristata*	Old Man's Beard
Rubiaceae	*Asperula conferta*	Common Woodruff
Solanaceae	*Solanum nigrum**	Black Nightshade, Black-berry Nightshade
	*Solanum pseudocapsicum**	Jerusalem Cherry
Stackhousiae	*Stackhousia viminea*	Slender Stackhousia
Verbenaceae	*Verbena bonariensis**	Purpletop
Violaceae	*Viola hederacea*	Ivy-leaved Violet

Appendix 3

Fauna Species List

Appendix Key: ✓ = Species Detected
* = introduced species
(C) = listed as CAMBA species
(J) = listed as JAMBA species
(E) = listed as Endangered in NSW.
(V) = listed as Vulnerable in NSW.
(V*) = Species listed under the Commonwealth EPBC Act as Vulnerable
(E*) = Species listed under the Commonwealth EPBC Act as Endangered
(M) = Species listed under the Commonwealth EPBC Act as Migratory

Data Source: **1** = Species recorded during this survey **(RPS, 2013)**
2 = Species recorded previously on site **(Wildthing 2005)**

Family Name	Common Name	Scientific Name	1	2
Birds				
Anatidae	Australian Wood Duck	*Chenonetta jubata*	✓	✓
Columbidae	Crested Pigeon	*Ocyphaps lophotes*		✓
	Common Bronzewing	*Phaps chalcoptera*	✓	
Phalacrocoracidae	Little Pied Cormorant	*Microcarbo melanoleucos*	✓	
Ardeidae	White-necked Heron	*Ardea pacifica*	✓	
	White-faced Heron	*Egretta novaehollandiae*	✓	✓
Threskiornithidae	Straw-necked Ibis	*Threskiornis molucca*		✓
Rallidae	Eurasian Coot	*Fulica atra*	✓	
Falconidae	Brown Falcon	*Falco berigora*		✓
Charadriidae	Masked Lapwing	*Vanellus miles*	✓	
Cacatuidae	Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	✓	
	Galah	*Eolophus roseicapillus*	✓	✓
Psittacidae	Eastern Rosella	*Platycercus eximius*	✓	✓
	Laughing Kookaburra	*Dacelo novaeguineae*		✓
Pardalotidae	Spotted Pardalote	*Pardalotus punctatus*	✓	
Meliphagidae	Noisy Miner	*Manorina melanocephala*	✓	✓
	Striped Honeyeater	*Plectorhyncha lanceolata*	✓	
Pomatostomidae	**Grey-crowned Babbler (eastern subspecies) (V)**	***Pomatostomus temporalis temporalis***	✓	✓
	Willie Wagtail	*Rhipidura leucophrys*		✓
Campephagidae	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	✓	
Artamidae	Pied Butcherbird	*Cracticus nigrogularis*	✓	
	Grey Butcherbird	*Cracticus torquatus*		✓
	Australian Magpie	*Cracticus tibicen*	✓	✓
Corvidae	Australian Raven	*Corvus coronoides*	✓	✓

Family Name	Common Name	Scientific Name	1	2
Monarchidae	Magpie-lark	*Grallina cyanoleuca*	✓	✓
Corcoracidae	White-winged Chough	*Corcorax melanorhamphos*		✓
Motacillidae	Australasian Pipit	*Anthus novaseelandiae*		✓
Hirundinidae	Welcome Swallow	*Hirundo neoxena*	✓	✓
Sturnidae	Common Myna*	*Sturnus tristis**	✓	
Mammals				
Petauridae	**Squirrel Glider (V)**	***Petaurus norfolcensis***	✓	
Pseudocheiridae	Common Ringtail Possum	*Pseudocheirus peregrinus*	✓	✓
Phalangeridae	Common Brushtail Possum	*Trichosurus vulpecula*	✓	
Macropodidae	Eastern Grey Kangaroo	*Macropus giganteus*	✓	
	Swamp Wallaby	*Wallabia bicolor*		✓
Emballonuridae	**Yellow-bellied Sheathtail-bat (V)**	***Saccolaimus flaviventris***	✓	
Molossidae	**East Coast Freetail-bat (V)**	***Mormopterus norfolkensis***	✓	
	Eastern Freetail-bat	*Mormopterus* sp. 2	✓	
	Southern Freetail-bat	*Mormopterus* sp. 4	✓	
	White-striped Freetail-bat	*Tadarida australis*	✓	
Vespertilionidae	Gould's Wattled Bat	*Chalinolobus gouldii*	✓	
	Chocolate Wattled Bat	*Chalinolobus morio*	✓	
	Little Bentwing-bat (V)	***Miniopterus australis***	✓	
	Common Bentwing-bat (V)	***Miniopterus schreibersii oceanensis***	✓	
	Lesser Long-eared Bat	*Nyctophilus geoffroyi*	✓	
Muridae	Black Rat*	*Rattus rattus**	✓	
Canidae	Fox*	*Vulpes vulpes**		✓
Bovidae	European cattle*	*Bos taurus**	✓	
Celidae	Eastern Snake-necked Turtle	*Chelodina longicollis*	✓	
Scincidae		*Cryptoblepharus pulcher*	✓	

Family Name	Common Name	Scientific Name	1	2
	Eastern Blue-tongued Skink	*Tiliqua scincoides*		✓
Elapidae	Red-bellied Black Snake	*Pseudechis porphyriacus*	✓	✓
Amphibians				
Myobatrachidae	Common Eastern Froglet	*Crinia signifera*	✓	✓
	Brown-striped Frog	*Limnodynastes peronii*	✓	
	Spotted Grass Frog	*Limnodynastes tasmaniensis*	✓	
	Smooth Toadlet	*Uperoleia laevigata*	✓	
Hylidae	Green Tree Frog	*Litoria caerulea*	✓	✓
	Eastern Dwarf Tree Frog	*Litoria fallax*	✓	✓
	Broad-palmed Frog	*Litoria latopalmata*	✓	✓
	Peron's Tree Frog	*Litoria peronii*	✓	
	Tyler's Tree Frog	*Litoria tyleri*	✓	
	Verreaux's Tree Frog	*Litoria verreauxii*		✓

Appendix 4

Anabat Report

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BAT CALL ANALYSIS REPORT
Rothbury, NSW
RPS Australia East Pty Ltd

21 March 2013

This report has been prepared to document the analysis of digital ultrasonic bat echolocation calls received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by

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B.Env.Sc.

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1.0 INTRODUCTION

This report has been commissioned by RPS Australia East Pty Ltd to analyse bat echolocation call data (Anabat, Titley Electronics) collected from Rothbury, NSW. Data was provided electronically to the author. This report documents the methods involved in analysing bat call data and the results obtained only.

2.0 METHODS

The identification of bat echolocation calls recorded during surveys was undertaken using AnalookW (Version 3.8m) software. The identification of calls was undertaken with reference to Pennay and others (2004) and through the comparison of recorded reference calls from north-eastern NSW and the Sydney Basin. Reference calls were obtained from the NSW database and from the authors personal collection.

Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species
- Probable - Pass identified to species level and there is a low chance of confusion with another species
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality
- Unknown - Either background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

Call sequences that were less than three pulses in length were not analysed and were assigned to 'Unknown' and only search phase calls were analysed. Furthermore, some species are difficult to differentiate using bat call analysis due to overlapping call frequencies and similar shape of plotted calls and in these cases calls were assigned to species groups.

The total number of passes (call sequences) per unit per night was tallied to give an index of activity.

It should be noted that the activity levels recorded at different sites may not be readily able to be compared. Such comparisons are dependent on many variables which need to be carefully controlled during data collection and statistically analysed. Influential variables include wind, rain, temperature, duration of recording, season, detector and microphone sensitivity, detector placement, weather protection devices etc.

Description of the Characteristics Used to Differentiate Species

Miniopterus australis was differentiated from *Vespadelus pumilus* which it overlaps with, by the presence of a down-sweeping tail on pulses.

Miniopterus schreibersii oceanensis was differentiated by *Vespadelus regulus* by a combination of uneven consecutive pulses and the presence of a down-sweeping tail.

Chalinolobus gouldii was identified other species by the presence of curved alternating pulses. Mormopterus norfolkensis was differentiated from Mormopterus species 2 by the presence of flat alternating pulses. Mormopterus species 2 could not be differentiated from Mormopterus species 4 where they overlap in characteristic frequency (~30 kHz).

Myotis adversus was not able to be differentiated from *Nyctophilus* species since calls did not display characteristics that allow the genus to be separated such as pulse interval less than 75ms or greater than 95 ms, the absence of a central kink and slope between 300-400 OPS.

Chalinolobus morio was identified from *Vespadelus vulturnus* by the presence of a down-sweeping tail.

3.0 RESULTS

A total of 1269 call sequences were recorded, of which 887 call sequences were able to be analysed (ie were not 'noise' files or bat calls of short length). Of the bat calls, 338 call sequences (38%) were able to be confidently identified (those classified as either definite or probable identifications) to species level (Table 1). Species recorded confidently within the site include:

- *Chalinolobus gouldii* (Gould's wattled bat)
- *Chalinolobus morio* (Chocolate wattled bat)
- *Miniopterus australis* (Little bentwing bat)
- *Miniopterus schreibersii oceanensis* (Eastern bentwing bat)
- *Mormopterus norfolkensis* (East-coast freetail bat)
- *Mormopterus* species 2 (Eastern freetail bat)
- *Mormopterus* species 4 (Southern freetail bat)
- *Saccolaimus flaviventris* (Yellow-bellied sheathtail bat)
- *Tadarida australis* (White-striped freetail bat)

Additional bat species that are known to exist within the locality of the site, but could not be confidently identified to species (those classified as possible or as a species group), include:

- *Falsistrellus tasmaniensis* (Eastern falsistrelle)
- *Myotis macropus* (Large-footed myotis)
- *Nyctophilus geoffroyi* (Lesser long-eared bat)
- *Nyctophilus gouldi* (Gould's long-eared bat)
- *Scoteanax rueppellii* (Greater broad-nosed bat)
- *Scotorepens orion* (Eastern broad-nosed bat)
- *Scotorepens balstoni* (Inland broad-nosed bat)
- *Vespadelus darlingtoni* (Large forest bat)
- *Vespadelus pumilus* (Eastern forest bat)
- *Vespadelus regulus* (Southern forest bat)
- *Vespadelus troughtoni* (Eastern cave bat)
- *Vespadelus vulturnus* (Little forest bat)

It should be noted that additional bat species may be present within the site but were not recorded by the detectors and habitat assessment should be used in conjunction with these results to determine the likelihood of occurrence of other bat species.

Table 1 below summarises the results of the bat call analysis

Table 1: Results of bat call analysis (number of passes per site per night)

IDENTIFICATION	Trapping Site 1, 20130310, 10/03/2013	Trapping Site 1, 20130310, 11/03/2013	Trapping Site 1, 20130310, 12/03/2013	Trapping Site 1, 20130312, 12/03/2013	Trapping Site 1, 20130312, 13/03/2013	Trapping Site 1, 20130312, 14/03/2013	Trapping Site 2, 20130310, 10/03/2013	Trapping Site 2, 20130310, 11/03/2013	Trapping Site 2, 20130310, 12/03/2013	Trapping Site 3, 20130311, 11/03/2013	Trapping Site 3, 20130311, 12/03/2013	Trapping Site 3, 20130312, 12/03/2013	Trapping Site 3, 20130312, 13/03/2013	Trapping Site 3, 20130312, 14/03/2013
DEFINITE														
Chalinolobus gouldii	-	29	1	-	29	8	-	6	-	-	-	-	1	-
Chalinolobus morio	-	1	-	-	1	-	-	-	-	-	-	-	-	-
Miniopterus australis	-	6	-	-	5	1	-	-	-	-	1	-	-	-
Miniopterus schreibersii oceanensis	-		-	-	2	-	-	3	-	-	-	-	-	1
Mormopterus norfolkensis	-	2	-	-	-	-	-	2	-	2	1	-	-	-
Mormopterus species 2	-	7	-	-	1	-	-	5	-	-	-	-	3	-
Mormopterus species 4	-	2	-	-	-	-	-	-	-	7	1	-	3	-
Saccolaimus flaviventris	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Tadarida australis	-	14	2	-	11	-	-	17	7	21	7	-	27	3
PROBABLE														
Chalinolobus gouldii	-	9	1	-	7	8	-	1	-	1	-	-	5	-
Chalinolobus morio	-	5	-	-	1	-	-	-	-	-	-	-	-	-

IDENTIFICATION	Trapping Site 1, 20130310, 10/03/2013	Trapping Site 1, 20130310, 11/03/2013	Trapping Site 1, 20130310, 12/03/2013	Trapping Site 1, 20130312, 12/03/2013	Trapping Site 1, 20130312, 13/03/2013	Trapping Site 1, 20130312, 14/03/2013	Trapping Site 2, 20130310, 10/03/2013	Trapping Site 2, 20130310, 11/03/2013	Trapping Site 2, 20130310, 12/03/2013	Trapping Site 3, 20130311, 11/03/2013	Trapping Site 3, 20130311, 12/03/2013	Trapping Site 3, 20130312, 12/03/2013	Trapping Site 3, 20130312, 13/03/2013	Trapping Site 3, 20130312, 14/03/2013
Miniopterus australis	-	8	-	-	5	-	-	-	1	-	-	-	-	-
Miniopterus schreibersii oceanensis	-	2	-	-	6	1	-	-	-	-	-	-	2	-
Mormopterus norfolkensis	-	1	-	-	-	-	-	-	1	-	-	-	-	-
Mormopterus species 2	-	-	1	-	2	-	-	1	6	-	-	-	-	2
Mormopterus species 4	-	3	-	-	1	-	-	-	1	2	-	-	1	-
Saccolaimus flaviventris	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Tadarida australis	-	1	-	-	4	-	-	-	3	-	1	-	2	-
POSSIBLE														
Chalinolobus gouldii	-	-	-	-	2	1	-	-	1	-	-	-	-	-
Miniopterus schreibersii oceanensis	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Mormopterus norfolkensis	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Mormopterus species 4	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Saccolaimus flaviventris	-	-	-	-	-	-	-	2	1	-	-	-	-	-
SPECIES COMPLEX														
Chalinolobus gouldii / Mormopterus norfolkensis / Mormopterus species 2 */ Scotorepens balstoni*	-	18	3	-	20	1	-	6	20	9	-	-	14	2

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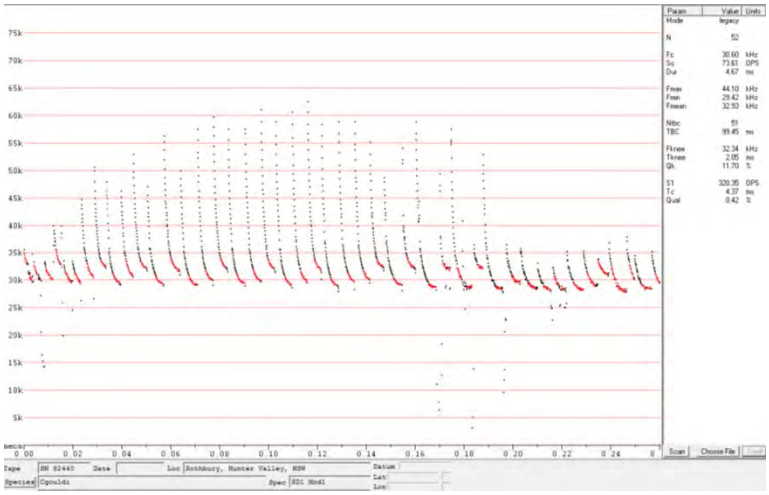
Chalinolobus gouldii / Mormopterus norfolkensis / Scotorepens balstoni / Scoteanax rueppellii	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Chalinolobus gouldii / Mormopterus species 2 / *Scotorepens balstoni*	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Chalinolobus gouldii / Mormopterus species 2 / *Mormopterus* species 4	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Chalinolobus gouldii / Mormopterus species 4	-	1	-	-	3	-	-	3	4	1	-	-	3	1
Chalinolobus gouldii / Scotorepens balstoni	-	3	1	-	-	-	-	-	-	-	-	-	-	-
Chalinolobus gouldii / Scotorepens balstoni / Scoteanax rueppellii	-	7	4	-	5	9	-	6	4	11	7	-	-	-
Chalinolobus morio / Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	-	5	-	-	9	-	-	1	-	-	-	-	-	-
Falsistrellus tasmaniensis / Scotorepens orion	-	1	4	-	3	1	-	-	3	1	-	-	3	-
Falsistrellus tasmaniensis / Scotorepens orion / Scoteanax rueppellii	-	4	1	-	9	5	-	8	2	1	3	-	13	2
Miniopterus australis / Vespadelus pumilus	-	24	-	-	28	-	-	1	2	1	-	-	4	-
Miniopterus schreibersii oceanensis / Vespadelus darlingtoni / Vespadelus regulus	-	18	2	-	28	4	-	19	3	6	1	-	28	5
Mormopterus norfolkensis / Mormopterus species 2	-	5	-	-	1	-	-	25	54	-	1	-	-	2

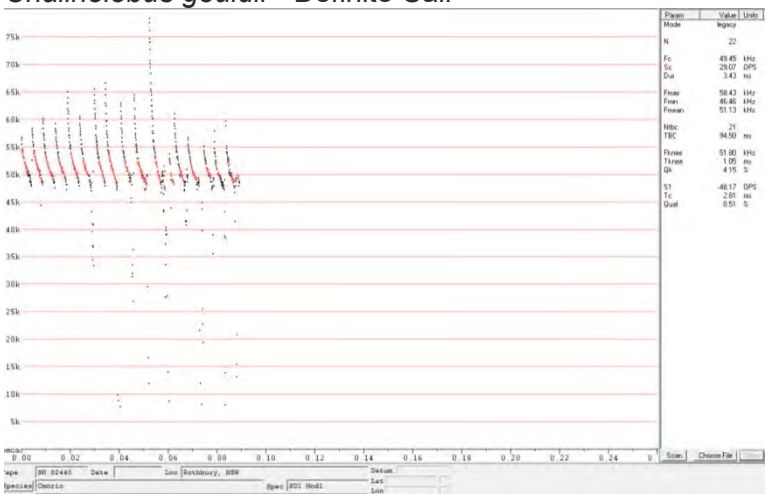
IDENTIFICATION	Trapping Site 1, 20130310, 10/03/2013	Trapping Site 1, 20130310, 11/03/2013	Trapping Site 1, 20130310, 12/03/2013	Trapping Site 1, 20130312, 12/03/2013	Trapping Site 1, 20130312, 13/03/2013	Trapping Site 1, 20130312, 14/03/2013	Trapping Site 2, 20130310, 10/03/2013	Trapping Site 2, 20130310, 11/03/2013	Trapping Site 2, 20130310, 12/03/2013	Trapping Site 3, 20130311, 11/03/2013	Trapping Site 3, 20130311, 12/03/2013	Trapping Site 3, 20130312, 12/03/2013	Trapping Site 3, 20130312, 13/03/2013	Trapping Site 3, 20130312, 14/03/2013
Mormopterus species 2 / *Mormopterus* species 4	-	3	-	-	3	-	-	2	2	1	1	-	11	1
Myotis macropus / Nyctophilus geoffroyi / Nyctophilus gouldii	-	-	-	-	2	-	-	-	-	-	-	-	2	1
UNKNOWN														
'Noise' files	8	7	9	-	-	-	7	1	-	5	7	8	5	3
Unknown	-	34	9	5	66	5	-	54	49	27	13	-	47	13
TOTAL	**8**	**226**	**38**	**5**	**254**	**44**	**7**	**164**	**164**	**96**	**45**	**8**	**174**	**36**

4.0 SAMPLE CALLS

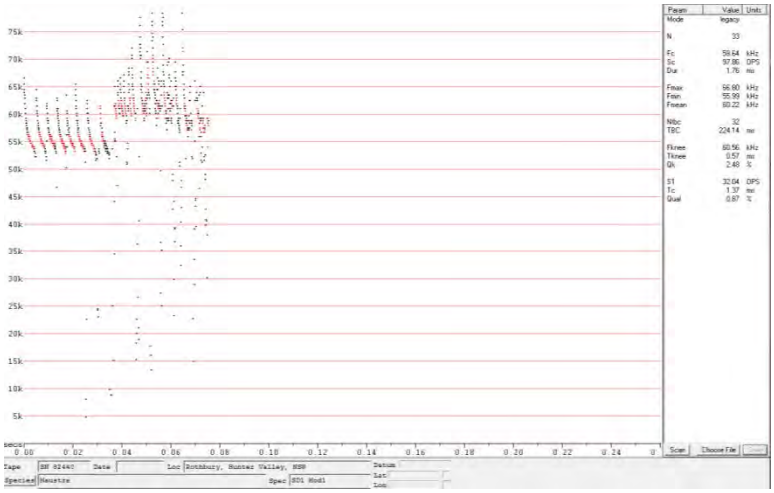
A sample of the calls actually identified from the site for each species is given below.



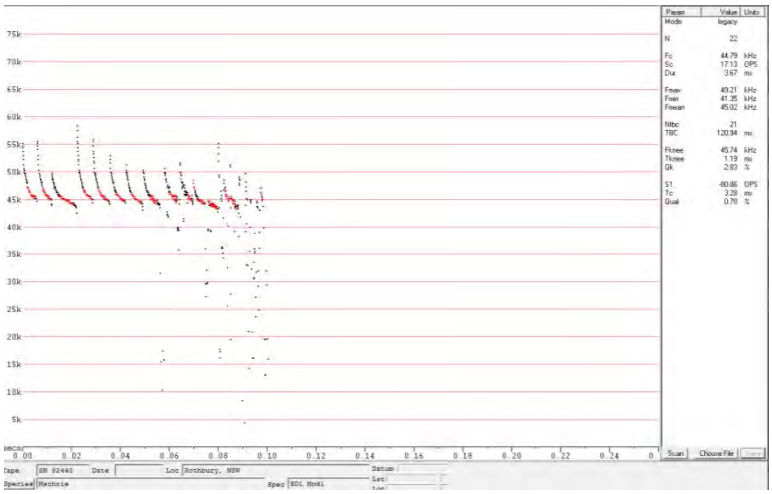
Chalinolobus gouldii - Definite Call



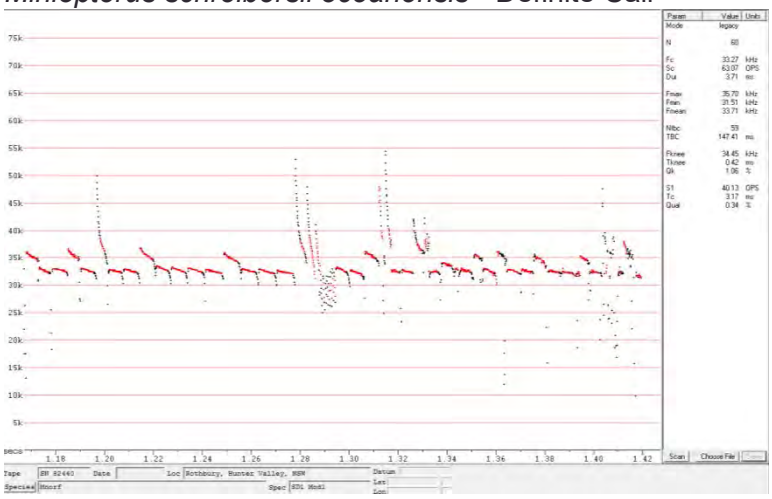
Chalinolobus morio - Definite Call



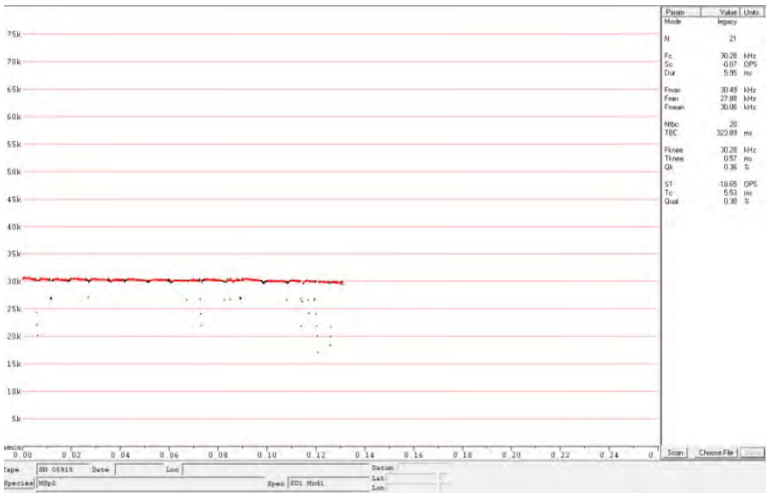
Miniopterus australis - Definite Call



Miniopterus schreibersii oceanensis - Definite Call

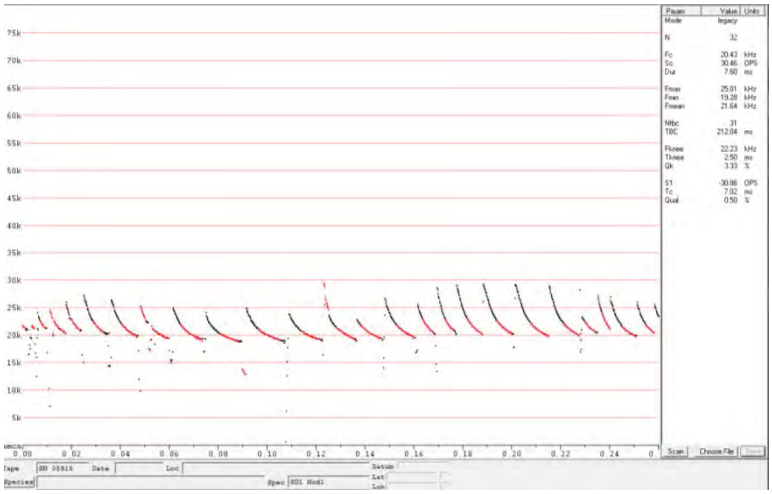


Mormopterus norfolkensis - Definite Call

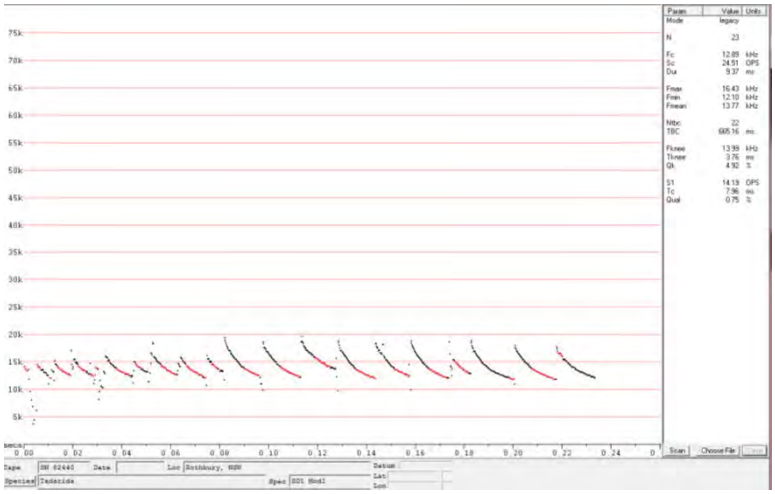


Mormopterus species 2 - Definite Call

Mormopterus species 4 - Definite Call



Saccolaimus flaviventris - Definite Call



Tadarida australis - Definite Call

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Appendix 5

Flora Species to be Considered for Revegetation

Scientific Name	Common Name
MU18 – Central Hunter Ironbark – Spotted Gum – Grey Box Forest	
TREES	
Casuarina glauca	Swamp Oak
Corymbia maculata	Spotted Gum
Eucalyptus crebra	Narrow-leaved Ironbark
Eucalyptus glaucina	Slaty Red Gum
Eucalyptus moluccana	Grey Box
SHRUBS	
Acacia falcata	-
Acacia longifolia	-
Acacia parvipinnula	Silver-stemmed Wattle
Allocasuarina littoralis	Black She-oak
Allocasuarina luehmannii	Bulloak
Allocasuarina torulosa	Allocasuarina torulosa
Breynia oblongifolia	Coffee Bush
Cassinia aculeata	Dolly Bush
Dodonaea viscosa subsp cuneata	Wedge-leaf Hop-bush
Grevillea montana	-
Indigofera australis	Australian Indigo
Macrozamia flexuosa	-
Melaleuca decora	-
Xanthorrhoea media	Grass Tree
GROUNDCOVERS	
Austrostipa ramosissima	Stout Bamboo Grass
Chloris ventricosa	Tall Chloris
Cymbopogon refractus	Barbwire Grass
Dianella caerulea	Blue Flax-lily
Dianella revoluta	Blueberry Lily
Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass
Lomandra longifolia	Spiny-headed Mat-rush
Microlaena stipoides	Weeping Grass
Themeda australis	Kangaroo Grass
MU13 – Central Hunter Riparian Forest	
TREES	
Allocasuarina luehmannii	Bulloak
Angophora floribunda	Rough-barked Apple
Casuarina glauca	Swamp Oak
Eucalyptus amplifolia subsp. *amplifolia*	Cabbage Gum
Eucalyptus camaldulensis	River Redgum
Eucalyptus glaucina	Slaty Red Gum
Eucalyptus moluccana	Grey Box
Eucalyptus tereticornis	Forest Redgum
Melaleuca decora	-
Melaleuca nodosa	Prickly-leaved Paperbark
SHRUBS	
Acacia parvipinnula	Silver-stemmed Wattle
GROUNDCOVERS	
Aristida vagans	Threeawn Speargrass
Commelina cyanea	Scurvy Weed
Cynodon dactylon	Common Couch
Lomandra longifolia	Spiny-headed Mat-rush
Microlaena stipoides	Weeping Grass
Paspalidium distans	-

Appendix 6

Staff Qualifications

Curriculum Vitae

PAUL HILLIER

Senior Ecologist / Project Manager

Newcastle, NSW

Bachelor of Environmental Science (Environmental Management)

AREAS OF EXPERTISE:

Paul has broad range of Ecological Assessment reporting and project management experience from 9 years of professional ecological work both in Australia and abroad. Project experience has primarily included a range of flora and fauna assessment disciplines as required by a wide range of corporate and domestic client requirements. Paul has been employed both within the private and public sector, providing a strong knowledge and understanding of the role of both developers and government in legislation and planning.

Paul has the majority of his experience within the consultancy industry, primarily focussing on the preparation of Flora and Fauna Assessments, Environmental Assessments, Environmental Impact Statements, Review of Environmental Factors and Statement of Environmental Effects. Paul has experience with targeted threatened flora and fauna surveys, including a strong knowledge of Geographic Information Systems mapping and analyses.

SELECTED PROJECT EXPERIENCE:

Ecology

- Ecological Constraints Master Plan – Huntlee, Singleton and Cessnock, NSW (2007-2010)
- Ecosystem Function Analysis – Wambo Coal, Singleton NSW (2010).
- Ecological Assessment Report – White Rock Wind Farm, Glen Innes, NSW (2011)

PREVIOUS EXPERIENCE:

Ecological Records Officer – West Yorkshire Ecology 2007-2009

Duties included collection and collation of ecological records from across West Yorkshire, United Kingdom; Preparation of fee proposals for ecological services; GIS/ spatial analysis and database management; Database searches and reporting; Liaison with client, stakeholder groups, state and local governing bodies; Review of local planning applications and consequent consultations to local councils.

Ecologist – Harper Somers O'Sullivan 2004-2006

Duties included flora and fauna surveying and survey design; overseeing and contribution to the preparation of complex ecological and environmental reports for both small and large projects; liaison with both the private sector and federal, state and local government department.

MEMBERSHIPS & ACHIEVEMENTS:

- NSW Driver's Licence (Class C)
- OH&S Induction Training (White Card)
- Senior First Aid
- For Australian Wildlife Needing Aid (FAWNA), NSW Australia

Curriculum Vitae

ZIGGY ANDERSONS

Senior Ecologist/Project Manager

Newcastle, NSW

Bachelor of Science Botany Major 2010

White Card (OH&S Induction Training)

Maritime Services Boating Licence

AREAS OF EXPERTISE:

Ziggy has a diverse range of experiences in the fields of Ecology and Natural Resource Management. He has worked in the rehabilitation, ecological assessment, environmental management and business development fields across NSW and Qld. Clients have included state government agencies, civil contractors but have predominantly been within the resource sector. Ziggy is experienced in the management of large resource projects including project inception, client liaison, project design, project management, liaising with regulatory agencies and business development.

Ziggy also has experience in ecological assessment methodologies and has a particular interest in ecosystem rehabilitation and plant ID and ecology.

SELECTED PROJECT EXPERIENCE:

ENVIRONMENT

- Flora and Fauna assessment project design
- Flora and fauna identification and habitat assessment
- Targeted threatened flora and fauna surveys
- Delineation and mapping of vegetation communities
- Endangered Ecological Community (EEC) assessment
- Experience with GPS/GIS for project design and mapping
- Conducting Field Surveys for Flora, Fauna and Habitat Identification
- Report Preparation including Fauna and Flora Assessments
- Ecological Monitoring and Reporting
- Vegetation Management Plan Reporting
- Understanding of environmental legislation

PREVIOUS EXPERIENCE:

Mackay Regional Manager – Kleinfelder Ecobiological **(2012)**

Ziggy was employed to establish a regional office in Mackay to service the Central and Northern Qld regions. During his employment he was responsible for the whole gamut of activities involved in ecological consultancy including; business development, client liaison, project management, negotiations with regulatory bodies, ecological assessments, report development and review, budgeting, workflow and business management.

Ecological Consultant (Business Owner) – Evergreen Vegetation Consultants **(2010-2011)**

Ziggy owned and operated his own ecological consultancy business with a significant two year contract with Callide Mine (AngloAmerican). Ziggy was responsible for developing and implementing Management Action Plans

that related to an EPBC non-compliance as well as acting in a support role to the environmental department staff. During this period Ziggy was responsible for contractor management (quote review, contract development, contractor management), community liaison, incident investigation and management, reporting and liaising with regulatory agencies, advising senior leadership team on ecological matters etc.

Botanist and Bush Regenerator – Sustainable Resource Management Group (2009-2010)

Ziggy acted as the company's botanist and was part of the Bush Regeneration Team. The company had numerous contracts with the Hunter Valley CMA as well as Landcare groups within the Hunter and Mid North Coast region. He had a range of responsibilities including ecological assessments, report writing, quoting, project management, and team supervision.

Boatbuilder (1998-2009)

During his career as a boatbuilder Ziggy was responsible for staff supervision and client liaison for a number of multimillion dollar projects.

VOLUNTEER WORK

- Callide Valley Landcare Chair (October 2009 to 2011)
- Callide Valley Landcare Treasurer (August to October 2009)
- Clean up Australia Day Coordinator, Bohnock, NSW (March 2007)
- Self initiated weed management and revegetation of Charley's Island/ Farquhar Pk, Manning River NSW (2007-2008)

MEMBERSHIPS & ACHIEVEMENTS:

- Drivers Licence (C, MR (Motorcycle), and RMDL (Boat))
- RTD02 ChemCert Chemical Accreditation AQF III
- HLTFA301B Apply First Aid Certificate
- 91476NSW Course in Sustainable Private Native Forestry
    - Follow environmental care procedures
    - Operator core knowledge and skills
    - Protect coastal & tableland native forest
    - Apply biodiversity conservation principles
    - Apply silviculture principles
- Qld Black Coal Generic Induction (Surface)
- S1, S2, S3 Supervisor Training (Qld)
- G2 Risk Assessment Training (Qld)
- HLTFA301C - Apply First Aid
- Standard 11 Generic Induction Refresher (Qld)
- RIIVEH201A – Operate Light Vehicle
- RIIVEH305A – Operate and Maintain a Four-Wheel Drive Vehicle
- Qld BioCondition v2.1 Training

Curriculum Vitae

LAUREN VANDERWYK

Field Ecologist

Newcastle, NSW

Bachelor of Science, University of Newcastle

AREAS OF EXPERTISE:

Lauren has a broad range of ecological field experience and experience in Bushfire and Ecological Assessment reporting. Her experience within the consulting industry has primarily included a wide range of flora and fauna assessment disciplines as required by a wide range of public and private clients. Lauren's knowledge of the Central Coast and Newcastle regions has expanded extensively since the commencement of her career, particularly in the area of threatened flora and fauna species.

SELECTED PROJECT EXPERIENCE:

Environment

- Flora and fauna identification and habitat assessment
- Targeted threatened flora and fauna surveys
- Delineation and mapping of vegetation communities
- Endangered Ecological Community (EEC) assessment
- Conducting Field Surveys for Flora, Fauna and Habitat Identification
- Report Preparation including Fauna & Flora Assessments
- Ecological Monitoring and Reporting
- Bushfire Threat Assessment & Management reporting
- Understanding of environmental legislation.

Ecology

- Santos- On site supervisor for coal seam gas exploration in the Gunnedah region
- Centennial Coal Charbon– Field surveys identifying management issues for the development of a Compensatory Habitat Management Plan at Charbon Colliery
- Morisset – Flora and fauna surveys to produce an Ecological Assessment and Bushfire Threat Assessment

PREVIOUS EXPERIENCE:

Environmental Scientist - Ecobiological (2011)

Primary roles included bush regeneration and the identification of a wide range of native and non-native plant species for rehabilitation of various sites. Some ecological surveys and Ecological Assessment reporting was carried out during her time with Ecobiological.

Trainee Ecologist - Pygmy Possum Ecological Consulting (2008-2010)

Ecological field surveys were the main role at Pygmy Possum. Fauna surveys carried out across the Central Coast have provided for an increased knowledge in common and threatened fauna species as well as the vegetation communities in which they inhabit. Exposure to ecological reporting also occurred.

VOLUNTEER EXPERIENCE:

- Biodiversity research for independent researchers and Australian Geographic in East Kimberley (2011);
- Amphibian (*Litoria subglandulosa* and *Mixophyes balbus*) research at the New England Tablelands with Simon Clulow, Carl Gerhardt and Marion Anstis (2010);
- Bandicoot Research in Manly with the Australian Wildlife Conservancy (2010);
- Microbat dietary surveys and tracking at Empire Bay with Leroy Gonsalves (2010);
- Green and Golden Bell frog research at the Sydney Olympic Park (2010);
- Bush regeneration at Wamberal Lagoon Nature Reserve with National Parks and Wildlife Services primarily restoring Littoral Rainforest (EEC) (2007-2010);
- Fauna research including pit trapping, Elliot trapping, triangulation (for amphibians) and spotlighting for the Watagans fauna database (2007); and
- Bush-stone Curlew surveys at Empire Bay on the Central Coast undertaking call play back methods (2010).

MEMBERSHIPS & ACHIEVEMENTS:

- NSW Driver's Licence (Class C)
- OH&S Induction Training (White Card)
- Santos approved 4WD course
- ChemCert II certification
- Landscape Function Analysis Training
- Member of the Ecological Society of Australia (ESA)
- Member of the Hunter Bird Observatory Club (HBOC)

APPENDIX C

ECOLOGICAL UPDATE

MJD ENVIRONMENTAL PTY LTD 2016

Our Ref: 16010 Ecological update
Via: email

Date: 26 April 2016

Attn: Mathew Egan
HDB
PO Box 40
Maitland NSW 2320

Dear Mat

RE: ECOLOGICAL UPDATE – GOLDEN BEAR INTEGRATED TOURIST DEVELOPMENT

This ecological update has been prepared by MJD Environmental to accompany a development application to Cessnock City Council (CCC) by HDB on behalf of Capital Hunter the proponents for the proposed Golden Bear Integrated Tourist Development over land at Lots 2 to 4 DP 869651 and Lot 11 DP 1187663, Wine Country Drive, Pokolbin.

The need for this ecological update arises from the required concept plan revision as a result of a recent flood study conducted by CCC. As such modifications to increase floor levels, access and Golf Course Facilities have been made to the Concept Plan in response to the flood study.

On this basis the scope of this advice is to provide a contemporary update of the previous ecological assessment prepared by RPS (2013) in relation to the revised concept and as such should be read in conjunction with the RPS report. This shall be informed by:

- Undertaking a review of the RPS (2013) Ecological report titled, *Flora and Fauna Assessment: Lots 1 to 4 DP 869651 Main Road, Rothbury* (Version Final/June 2013).
- Undertaking updated database searches for threatened species, populations and ecological communities within a 10km radius of the site – the key databases being, the NSW Atlas of Wildlife and Commonwealth Protected Matters search tool.
- Undertake a site inspection and high level validation of the RPS (2013) ecological assessment to confirm the vegetation community mapping, extent, habitat features (hollow-bearing trees, recorded nesting sites) and make any opportunistic observations.

RPS (2013)

The RPS (2013) report determined:

- The field assessment and report were prepared from March to June 2013. The survey and report were conducted in accordance with Flora and Fauna Guidelines adopted by CCC prepared by Murray, M., Bell, S., Hoye, G. (2002). *Flora and fauna survey Guidelines: Lower Hunter Central Coast Region 2002. Lower Hunter & Central Coast Regional Environmental*

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Management Strategy, NSW. The report was prepared in a format to satisfy both the rezoning and Development Application for the proposal.

- Database searches of the NSW Atlas and Commonwealth Protected Matters Tool, resulted in the following occurring or likely to occur within a 10km radius from the site:
    - 21 flora species;
    - 47 fauna species;
        - 5 amphibian species;
        - 1 reptile species;
        - 25 bird species;
        - 16 mammals species;
    - 1 threatened ecological community; and
    - 12 migratory species.
- An additional 5 endangered ecological communities were noted from previous studies reviewed for the locality.
- Field survey identified and delineated four vegetation communities on site being:
    - MU 18 Central Hunter Ironbark – Spotted Gum – Grey Box Forest (CHISGGB Forest) - EEC;
    - MU 13 Central Hunter Riparian Forest (CHR Forest) – EEC;
    - *Casuarina glauca* Regrowth;
    - Open *Melaleuca decora* stand; and
    - The remaining site areas comprised Cleared pasture dominated by exotic species.
- Targeted surveys recorded the following threatened species:
    - Slaty Red Gum (*Eucalyptus glaucina*)
    - Grey-crowned Babbler (*Pomatostomus temporalis temporalis*);
    - Squirrel Glider (*Petaurus norfolcensis*);
    - East-coast Freetail Bat (*Mormopterus norfolkensis*);
    - Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*);
    - Little Bentwing-bat (*Miniopterus australis*); and
    - Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*).
- Habitat resources on site were limited due to the high level of disturbance and isolation of extant vegetation. Key habitat features were noted as the two small creeklines running through the site and eight hollow-bearing trees.
- Impact assessment of the proposal concluded that:
    - the proposal would not have a significant impact under the Threatened Species Conservation Act (1995);
    - an assessment of significance for MNES listed under the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) determined that the thresholds for determining significance were not reached and therefore it was considered unlikely that the proposal would have a significant impact; and
    - SEPP 44 assessment included Koala SAT surveys and determined the site did not constitute Koala habitat.

Based on assessment of the proposal the RPS (2013) report made 13 recommendations as follows:

- Clearance of native vegetation should be minimised as far as is practical;
- The extent of vegetation clearing is to be clearly identified on construction plans;
- Extent of clearing within native vegetation should be fenced with highly visible temporary fencing to ensure that clearing does not extend beyond the area required;
- Vegetation clearing should avoid mature trees and stags wherever possible in favour of areas of younger regrowth;
- Attempts should be made to relocate hollow logs and felled trees containing hollows into adjacent habitats to provide further habitat resources for native fauna;
- Nest boxes should be installed in the retained vegetation to compensate for the removal of hollows throughout the vegetation to be cleared;
- Glider poles should be installed along the southern boundary of the site between the existing Central Hunter Riparian Forest and Central Hunter Ironbark-Spotted Gum-Grey Box Forest patches to maintain connectivity between these habitats for glider species;
- Any clearing should be supervised by a qualified ecologist to ensure previously identified habitat trees are 'soft-felled'. Felled trees must be left for a short period of time on the ground to give any fauna trapped in the trees an opportunity to escape before further processing of the trees. The ecologist is to handle any injured or displaced fauna and relocate displaced fauna were necessary;
- Revegetation of native flora on site should be implemented with the objective of increasing the connectivity between existing patches of native vegetation, increasing biodiversity with appropriate local species, and augmenting riparian corridors with suitable local species. See Appendix 5 for a list of suitable native flora to be used in revegetation;
- A restoration plan is to be developed for native revegetation areas;
- A management plan is to be developed for existing native vegetation, restored native vegetation, and vegetation plantings associated with landscaping of the site;
- Appropriate control measures should be employed to ensure that machinery working within the site does not bring materials (soils, weeds etc.) onto the site that may infect surrounding vegetation with *Phytophthora cinnamomi*;
- Minimise clearing and disturbance to riparian zones where possible. Locate soil or stockpiles away from watercourses to limit potential transport of these substances into the watercourses via runoff. Appropriate erosion and sedimentation controls to be implemented prior to the commencement of construction;
- Appropriate controls to be put in place to limit the flow of surface pollutants associated with the golf course and residential development into Black Creek;
- Appropriate landscaping of the site within any development, particularly within the golf course, to enhance retained vegetation, habitat corridors, and to provide seasonal foraging resources for species such as Grey-headed Flying-fox, Swift Parrot and Regent Honeyeater;
- Speed limits on site should be designed with consideration given to the potential risk of vehicle strikes to native fauna;
- The proposed residential areas on site to be designated a cat-free development to prevent increased predation of native fauna by domestic cats; and

- Manage potential weed infestations to minimise the spread of weeds on the site. Management of noxious weeds are to be undertaken in accordance with the Noxious Weeds Act 1993.

Updated Database Searches

Updated database searches were conducted of the NSW Wildlife Atlas (27-4-2016) and Commonwealth Protected Matters Tool (22-4-2016). The searches resulted in the following additional species requiring consideration for complete assessment of the proposal.

Scientific Name	Common Name	TSC Act	EPBC Act	No. of Records	Notes & Source
Flora					
Thesium australe	Austral Toadflax	V	V	0	Species or species habitat may occur with area[2]
Birds					
Falco subniger	Black Falcon	V		1	Recorded within 10km of the site[1]
Neophema pulchella	Turquoise Parrot	V		1	Recorded within 10km of the site[1]
Tyto tenebricosa	Sooty Owl	V		1	Recorded within 10km of the site[1]
Epthianura albifrons	White-fronted Chat	V		1	Recorded within 10km of the site[1]
Petroica phoenicea	Flame Robin	V		1	Recorded within 10km of the site[1]
Mammals					
Potorous tridactylus	Long-nosed Potoroo	V	V	0	Species or species habitat may occur with area[2]
Pseudomys oralis	Hastings River Mouse	E	E	0	Species or species habitat may occur with area[2]
Threatened Ecological Communities					
Central Hunter Valley Eucalypt Forest and Woodland Corresponds to Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion (MU 18 – LHCCREMS)		E	CE	-	Community likely to occur in the area[2]

Scientific Name	Common Name	TSC Act	EPBC Act	No. of Records	Notes & Source
Hunter Valley Weeping Myall (*Acacia Pendula*) Woodland		E	CE	-	Community likely to occur in the area[2]
Migratory Species					
Cuculus optatus	Oriental Cuckoo		M	0	Species or species habitat may occur with area[2]
Monarcha trivirgatus	Spectacled Monarch		M	0	Species or species habitat may occur with area[2]
Motacilla flava	Yellow Wagtail		M	0	Species or species habitat may occur with area[2]
Pandion haliaetus	Osprey	V	M	0	Species or species habitat may occur with area[2]
Tringa nebularia	Common Greenshank		M	0	Species or species habitat may occur with area[2]

Key:
V = Vulnerable M = Migratory
E = Endangered CE = Critically Endangered

1 - *Atlas of NSW Wildlife*, Office of Environment and Heritage (Accessed 27-4-2016).
2 – Commonwealth Protected Matters Search Tool, Department of the Environment (Accessed 22-4-2016)

Site inspection

A site inspection was carried out on 14th April 2016. The site inspection was carried out in accordance with the aforementioned scope. The site inspection revealed the following:

- Vegetation delineation and community mapping including comments on condition were confirmed as generally accurate. As expected, the maturity of *Eucalyptus crebra* and *Casuarina glauca* regrowth had progressed from that observed and described in the RPS (2013) report. Ecotones of *C. glauca* with scattered *E. crebra* within the highly modified MU 18 - Central Hunter Ironbark-Spotted Gum-Grey Box Forest (*E. crebra* / *E. moluccana* / *C. glauca* only, no understorey) variant described by RPS were still present and no understory had developed in these areas.
- Many of the mature *E. crebra* in the south-eastern portion of the vegetated area on site were observed showing signs of stress with dieback in the canopy.

- The presence and location on site of Grey-crowned Babbler nest was confirmed. No foraging individuals were observed or heard calling during the site inspection.
- The presence and location of *Eucalyptus glaucina* was confirmed on the southern boundary.
- The presence and location of hollow-bearing trees was confirmed over the site. An additional two hollow-bearing trees were observed in the highly modified MU 18 - Central Hunter Ironbark-Spotted Gum-Grey Box Forest (*C. maculata* regrowth, no understorey) variant described by RPS. The hollows were present in two large *C. maculata* (Spotted Gum).

Revised Concept

Despite the highly modified nature of vegetation onsite, similar to the previous concept, the revised concept acknowledges the sites ecological character and seeks to avoid vegetation clearing and secondly rehabilitate the EECs and pasture area on site via targeted revegetation.

The vegetation outcome based on the revised concept is generally consistent with the previous concept with an existing vegetation area of 34 ha, a proposed clearing area of 12.95 ha and revegetation area of 38.75 ha. This will result in an increase of 4.75ha of vegetated area on site. All *E. glaucina* and Grey-crowned Babbler nest will be retained. The northern most hollow-bearing tree shall be removed under the revised concept and was not scheduled for removal under the previous concept. Importantly, the revised concept shall retain the two additional hollow-bearing trees recorded during the site inspection.

Additional Assessment

A threatened species likelihood of occurrence assessment has been conducted for the additional threatened species and ecological community records detailed previously that were not covered in the RPS (2013) report (Refer to Attachment 1). Based on the results of the site investigation, it is considered the impact considerations outlined in chapter 4 of the RPS report remain current and have therefore underpinned the likelihood of occurrence assessment.

The likelihood of occurrence assessment determined that all species had a low to moderate likelihood of occurrence and potential for impact as a direct result of the proposal. In all cases it was concluded that the proposal was unlikely to affect each species such that further impact assessment via application of the 7-part test is required.

An assessment of significance has been prepared for the threatened ecological community recorded on site and additional migratory species results from the updated protected matters search (Refer to Attachment 2). This assessment concluded that:

- assessment under the EPBC Act for additional migratory species concluded the proposal was unlikely to have a significant impact on the additional migratory species; and
- assessment of the Highly modified Central Hunter Ironbark-Spotted Gum-Grey Box Forest mapped on site was undertaken and based on the conservation advice, confirmed this community corresponds, in large, with Central Hunter Valley Eucalypt Forest and Woodland. On this basis an assessment against the key diagnostic criteria and key thresholds set out in the conservation advice was undertaken. This assessment determined the community meets the minimum thresholds for a patch of the ecological community to be subject to the referral, assessment and compliance provision of the EPBC Act.

  On this basis a referral under the EPBC Act shall be required.

Conclusion

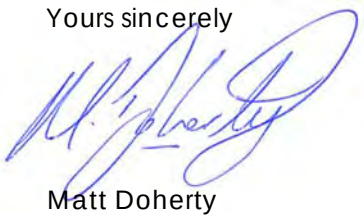
This ecological update has determined that the site characteristics remain largely consistent with that described in the RPS (2013) report. An additional two hollow-bearing trees were recorded on site and shall be retained under the revised concept plan. The revised concept plan is underpinned by an objective to rehabilitate the retained EEC areas on site and revegetate substantial areas of cleared pasture thus resulting in a net environmental gain across the site with long term management as part of the tourist development.

Assessment under the TSC and EPBC Act determined that all additional threatened and migratory species were unlikely to be impacted upon as a result of the proposal. However, despite the highly modified nature of Central Hunter Valley Eucalypt Forest and Woodland on site coupled with the intended rehabilitation, the remnant patches satisfy the moderate condition criteria and therefore meet the minimum thresholds for further assessment via referral under the EPBC Act.

Finally, the recommendations set forth in the RPS (2013) report are generally supported. However, the recommendation for installation of glider poles to maintain connectivity may be negated in lieu of well-considered planting across the southern boundary as part of the proposed revegetation works. This should be done in consultation with an ecologist familiar with the target fauna species, revegetation and principles of ecological restoration.

We trust this is sufficient for your purposes, however should you require any further information or clarification, please do not hesitate to contact the writer.

Yours sincerely



Matt Doherty
Director
MJD Environmental Pty Limited

Encl: Attachment 1 – Likelihood of Occurrence Assessment
Attachment 2 – EPBC Act Assessment of Significance

Attachment 1 – Likelihood of Occurrence Assessment

Species	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence / Potential Impact
Flora				
Thesium australe Austral Toadflax	V	V	Austral Toadflax is a small, straggling herb to 40 cm tall and is often hidden amongst grasses and herbs. Often in association with Kangaroo Grass (*Themeda australis*). Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. It may persist in some areas in the broader region. (OEH 2013)	Low - This species has not been detected within a 10km radius of the site and suitable habitat is not present. On this basis this species is considered unlikely to be affected by this proposal and therefore an assessment of significance is not required.
Birds				
Falco subniger Black Falcon	V		The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring. (OEH 2014)	Moderate – Given the wide home range and habit of this species, the potential for an individual to fly over the site during foraging cannot be discounted. However, the proposal does not seek to remove all vegetation or foraging environs from the site and also seeks to improve vegetated areas across the site. On this basis this species is considered unlikely to be affected by this proposal and therefore an assessment of significance is not required.
Neophema pulchella Turquoise Parrot	V		Turquoise Parrot is typically recorded west of the Great Divide on the tablelands and western slopes, extending to the coastal districts through the dry forest corridor of the Hunter Valley (Crome & Shields, 1992). The species occurs in eucalypts woodlands and open forests, with a ground cover of grasses and low understorey of shrubs (NPWS, 2002). This species forages primarily on the seeds of shrubs, grasses and herbs, both native and introduced, and the spore cases of mosses. Breeding pairs nest in small hollow branches of Eucalypts.	Moderate – Given the wide home range and habit of this species. The site offers potential foraging and nesting opportunities for the species. The proposal does not seek to remove all vegetation or foraging environs from the site and also seeks to improve vegetated areas across the site. Additionally, of the 10 hollow-bearing trees recorded on site, 7 will be retained under the proposal. On this basis this species is considered unlikely to be affected by this proposal and therefore an assessment of significance is not required.
Tyto tenebricosa Sooty Owl	V		Occurs in wet Eucalypt forest and rainforest with tall emergent trees, often in easterly facing gullies. Within these areas this species hunts for a range of mainly mammalian prey at all levels of the forest strata.	Low - Suitable habitat for this species is not present on site.

Species	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence / Potential Impact
			Roosts in tree hollow or dense canopy vegetation. Also nests in large Eucalypt tree hollows. The majority of Hunter records exist from the Watagan mountains (Atlas of NSW Wildlife data).	On this basis this species is considered unlikely to be affected by this proposal and therefore an assessment of significance is not required.
Epthianura albifrons White-fronted Chat	V		The White-fronted Chat occupies foothills and lowlands below 1000 m above sea level (North 1904; Higgins et al. 2001; Barrett et al. 2003). In New South Wales the White-fronted Chat occurs mostly in the southern half of the state, occurring in damp open habitats along the coast, and near waterways in the western part of the state (Higgins et al. 2001). Along the coastline, White-fronted Chats are found predominantly in saltmarsh vegetation although they are also observed in open grasslands and sometimes in low shrubs bordering wetland areas. (North 1904; Higgins et al. 2001; Barrett et al. 2003).	Low - Suitable habitat for this species is not present on site. On this basis this species is considered unlikely to be affected by this proposal and therefore an assessment of significance is not required.
Petroica phoenicea Flame Robin	V		The Flame Robin is found in south-eastern Australia (Queensland border to Tasmania, western Victoria and south-east South Australia). In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins & Peter 2002).	Moderate - Suitable breeding habitat for this species is not present on site. However marginal wintering habitat for this species is present on site. The proposal does not seek to remove all vegetation or foraging environs from the site, moreover the proposal seeks to improve vegetated areas across the via rehabilitation and revegetation of the extant communities on site. On this basis this species is considered unlikely to be affected by this proposal and therefore an assessment of significance is not required.
Mammals				
Potorous tridactylus Long-nosed Potoroo	V	V	Prefers cool rainforest, wet sclerophyll forest and heathland. Essentially, requires dense understorey with occasional open areas. These open areas most likely consist of sedges, ferns, heath or grass-trees. Sleeps by day in a nest on the ground, and digs for succulent roots, tubers, fungi and subterranean insects. Some diggings seemingly attributable to this species may belong to *Isoodon macrourus* (Northern Brown Bandicoot). Generally east of the divide, hides by day in dense vegetation, sometimes feeds during winter during daylight hours during overcast or low light conditions.	Low - This species has not been detected within a 10km radius of the site and suitable habitat is not present. On this basis this species is considered unlikely to be affected by this proposal and therefore an assessment of significance is not required.

Species	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence / Potential Impact
Pseudomys oralis Hastings River Mouse	E	E	The Hastings River Mouse is a small rodent with a head-and-body length of about 17 cm. The species has patchy distribution spanning the Great Dividing Range from the Hunter Valley, south of Mt Royal, north to the Bunya Mountains near Kingaroy in south-east Queensland, at elevations between 300 m and 1100 m. The Hastings River Mouse inhabits: ▪ A variety of dry open forest types with dense, low ground cover and a diverse mixture of ferns, grass, sedges and herbs. ▪ Access to seepage zones, creeks and gullies is important, as is permanent shelter such as rocky outcrops and fallen logs. ▪ Nests may be in either gully areas or ridges and slopes. They eat seeds, leaves, insects and fungi. ▪ Home range is generally between 0.5ha and 4ha and there may be some overlap with other individuals. (OEH 2014)	Low - This species has not been detected within a 10km radius of the site and preferable habitat is not present given the highly modified nature of the extant vegetation on site coupled with the lack of rocky outcrops and sparsity of fallen timber. On this basis this species is considered unlikely to be affected by this proposal and therefore an assessment of significance is not required.
Threatened Ecological Communities				
Central Hunter Valley Eucalypt Forest and Woodland Equivalent to Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion (MU 18 – LHCCREMS)	E	CE	This community occurs in the central Hunter Valley primarily between Maitland and Musswellbrook. This community is dominated by Eucalyptus crebra (Narrow-leaved Ironbark), Corymbia maculata (Spotted Gum), and Eucalyptus moluccana (Grey Box), with occasionally dominant or co-dominant Eucalyptus fibrosa (Broad-leaved Ironbark) and Eucalyptus tereticornis (Forest Red Gum). It typically forms open forest or woodland in undulating country on clayey soils. Classified by the LHCCREMS as Map Unit (MU) 18.	This community was recorded on site and subject to a 7-part test in the RPS (2013) report. The 7-part test concluded the proposal was unlikely to result in a significant impact to this community such that a local extinction shall occur on site or in the locality. Therefore, no further assessment under the TSC Act will be conducted. However, this community has been listed under the EPBC Act since the time of RPS (2013) report production. On this basis an assessment of significance has been prepared for in Attachment 2.
Hunter Valley Weeping Myall (*Acacia Pendula*) Woodland	E	CE		Low - This community was not found on site during flora surveys and site validation inspection. On this basis an assessment of significance is not required.

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NSW Office of Environment and Heritage (2014) *Black Falcon profile [http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=20269] Accessed 26-4-2016.*

NSW Office of Environment and Heritage (2014) *Hastings River Mouse profile [http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10689] Accessed 26-4-2016.*

Attachment 2 – EPBC Act Assessment of Significance

An assessment of significance has been prepared for the threatened ecological community recorded on site and additional migratory species results from the updated protected matters search.

Note – all other matters have been covered in the previous RPS (2013) report and therefore not readdressed herewith.

Migratory Species

Five additional migratory species nationally listed under the EPBC Act have been recorded in the updated protected matters search as being a, 'Species or species habitat may occur within (search) area'. These species are presented in the table below.

Species	TSC Act	EPBC Act	Type of Presence
Cuculus optatus Oriental Cuckoo		M	Species or species habitat may occur with area
Monarcha trivirgatus Spectacled Monarch		M	Species or species habitat may occur with area
Motacilla flava Yellow Wagtail		M	Species or species habitat may occur with area
Pandion haliaetus Osprey	V	M	Species or species habitat likely to occur with area
Tringa nebularia Common Greenshank		M	Species or species habitat may occur with area

Under the EPBC Act, an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

Cuculus optatus (Oriental Cuckoo)

The Oriental Cuckoo has an extremely large home range, wintering in the sub-tropical southern hemisphere, in Australia in the norther and eastern area. The species forages on insects and larve within forests. (Birdlife International 2016a) The closest record for this species is >18km to the north-west in the Singleton area and was recorded in 1992. Marginal habitat for this species onsite shall in large be retained and improved with active rehabilitation and revegetation.

*Monarcha trivirgatus (*Spectacled Monarch)

The key habitats for this species are absent from the site in that the site is not situated in a coastal location and does not contain rainforest, wet gullies or similar waterside vegetation.

Motacilla flava (Yellow Wagtail)

This species is widespread but better known from northern Australia where the species winters. The Yellow Wagtail prefers damp or wet habitats, however has been known to forage in pasture and hay fields. (Birdlife International 2016b) Despite the geographic site location, the preferred habitat for this species does not occur on site.

Pandion haliaetus (Osprey)

The key habitats for this species are largely absent from the site in that the site is not located in a coastal location and does not contain extensive areas of fresh, brackish or saline water for foraging. The farm dams and watercourses on site will be retained and embellished with the proposed revegetation on site. An individual could fly over the site between foraging grounds, however is unlikely to forage over the site given the poor habitat offerings. The site does not contain preferred breeding habitat.

Tringa nebularia (Common Greenshank)

This species occurs and forages in coastal environments and river estuaries where muddy/ mudflat areas occur. It is also known to occur on wetlands and swamps. The preferred habitat (foraging and breeding) for this species does not occur on site.

It is unlikely that the proposal will have a significant impact on any migratory species.

Threatened Ecological Community

One additional threatened ecological community nationally listed under the EPBC Act has been recorded in the updated protected matters search as being a, 'Community likely to occur in within the (search) area'. The community being, 'Central Hunter Valley Eucalypt Forest and Woodland'. Based on the SPRAT Profile – Listing and Conservation Advices, this community corresponds, in large part, to Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion Given this community listed as endangered under the NSW TSC Act. Highly modified patches of this community have been delineated on site and therefore further assessment is required under the EPBC Act.

Based on the conservation advice, in order to be considered a MNES under the EPBC Act, areas of the community must meet:

- The key diagnostic characteristics (per section 1.5.1 of the conservation advice); AND
- At least the minimum condition thresholds for moderate quality (per section 1.5.3 of the conservation advice).

Key Diagnostic Characteristics – (DoE 2015)

Key Diagnostic Feature (DoE 2015)	Response
It occurs in the Hunter River catchment (typically called the Hunter Valley region); **AND**	Yes – site occurs in the Hunter Valley.

Key Diagnostic Feature (DoE 2015)	Response
It typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from Permian sedimentary rocks; **AND**	Yes – site predominantly occurs on the Farley Formation within the Dalwood Group, being a clastic sediment rock type from the Permian period. The south-east corner of the site occurs on the Rutherford Formation within the Dalwood Group, being a clastic sediment rock type from the Permian period.
It does not occur on alluvial flats, river terraces, aeolian sands, Triassic sediments, or escarpments; **AND**	Correct
It is woodland or forest, with a projected canopy cover of trees of 10% or more; or with a native tree density of at least 10 native tree stems per 0.5 ha (at least 20 native tree stems/ha) that are at least one metre in height; **AND**	Yes - the highly disturbed patches of this community on site align with the stems per hectare density criteria for native trees.
The canopy of the ecological community is dominated by one or more of the following four eucalypt species: *Eucalyptus crebra* (narrow-leaved ironbark), *Corymbia maculata* (syn. *E. maculata*) (spotted gum), *E. dawsonii* (slaty gum) and *E. moluccana* (grey box); **AND**	Yes – the highly disturbed patches of this community on site are dominated by one of the 4 diagnostic species.
OR a fifth species, *Allocasuarina luehmannii* (bulloak, buloke) dominates in combination with one or more of the above four eucalypt species, in sites previously dominated by one or more of the above four eucalypt species;	No - *Allocasuarina luehmannii* while present, is not dominant.
Allocasuarina torulosa (forest oak/ she-oak, rose she-oak/oak), *Eucalyptus acmenoides* (white mahogany) and *E. fibrosa* (red/broad-leaved ironbark) are largely absent from the canopy of a patch; **AND**	Yes – these species are largely absent and have not been recorded on site in the RPs (2013) vegetation survey or observed during the recent site inspection.
A ground layer is present (although it may vary in development and composition), as a sparse to thick layer of native grasses and other native herbs and/or native shrubs.	Yes / No – a grassy ground layer is present, however the composition and native species richness is highly variable given the highly modified nature of the remnant vegetation on site.

On this basis the community is likely to meet the key diagnostic features to be considered a MNES under the EPBC Act.

Condition Thresholds (DoE 2015)

<table>
<tr><th>Condition Thresholds (DoE 2015)</th><th>Response</th></tr>
<tr><td>
<table>
<tr><th>Category and rationale</th><th colspan="3">Thresholds</th></tr>
<tr><td>Class A. High quality condition e.g. A larger patch with good quality native understorey</td><td colspan="3">Patch size is ≥ 5 ha; AND
≥ 50% of perennial understorey vegetative cover is native; AND the patch contains at least 12 native understorey species.</td></tr>
<tr><td>Class B. High quality condition e.g. A patch with high quality native understorey</td><td colspan="3">Patch size is ≥ 0.5 ha AND
≥ 70% of perennial vegetative cover in each layer present[24] is native; AND the patch contains at least 12 native understorey species.</td></tr>
<tr><td>Class C. Moderate quality condition e.g. A patch with good quality native understorey</td><td colspan="3">Patch size is ≥ 0.5 ha; AND
≥ 50% of perennial understorey vegetative cover is native; AND the patch contains at least 12 native understorey species.</td></tr>
<tr><td rowspan="2">Class D. Moderate quality condition e.g. A moderate to large sized patch with: connectivity to a native vegetation area; or a mature tree; or a tree with hollows.</td><td colspan="3">Patch size is ≥ 2 ha; AND
≥ 50% of perennial understorey vegetative cover is native; AND</td></tr>
<tr><td>The patch is contiguous with another patch of native woody vegetation[25] ≥ 1 ha in area</td><td>OR</td><td>The patch has at least one large locally indigenous tree (≥ 60 cm dbh[26]), or at least one tree with hollows.</td></tr>
<tr><td colspan="4"><u>Notes to the above</u>
Perennial understorey vegetation cover (i.e. below the tree canopy) includes vascular plant species, of both the ground layer and the mid/shrub layer (where present), with a life-cycle of more than two growing seasons. The ground layer includes herbs (i.e. grasses and forbs) and some low shrubs (woody plants ≤ 0.5 m high). Measurement of perennial understorey vegetation cover excludes annuals, cryptogams, leaf litter or exposed soil.
In addition, please see the footnotes below and Section 1.5.4 of this document for further information to assist in determining the presence of the ecological community and significant impacts (including on the timing of surveys and sampling protocols).</td></tr>
</table>
</td><td>The overall patch is approx. 28.33 ha (RPS (2013) and based on the DoE (2015) conservation advice the community would comprise several patches on site where a separation distance of greater than 30m occurs. On this basis the small stands of <2ha are likely to not be considered to form the community, however the remaining large patches shall qualify and contain hollow-bearing trees.
Based on the RPS (2013) report flora species list coupled with the vegetation mapping and despite the highly modified nature of the vegetation community on site, the patch is considered likely to meet the condition threshold criteria for Class D – moderate quality condition.</td></tr>
</table>

On this basis the community is likely to meet the condition thresholds for Class D moderate quality condition to be considered a MNES under the EPBC Act. In accordance with the Conservation Advice Class D meets the minimum thresholds for a patch of the ecological community to be subject to the referral, assessment and compliance provision of the EPBC Act. Thus in the first instance a referral under the EPBC Act shall be required.

References

BirdLife International (2016a). *Species factsheet: Cuculus optatus*. [http://www.birdlife.org] Accessed 26-4-2016.

BirdLife International (2016b). *Species factsheet: Motacilla flava*. [http://www.birdlife.org] Accessed 26-4-2016.

Department of Environment (April 2015) *Conservation Advice - Central Hunter Valley eucalypt forest and woodland ecological community*. [http://www.environment.gov.au/biodiversity/threatened/communities/pubs/130-conservation-advice.pdf] Accessed 26-4-2016.

APPENDIX D

DRAFT ABORIGINAL CULTURAL HERITAGE MANAGEMENT PLAN

HDB 2016

ABORIGINAL HERITAGE MANAGEMENT PLAN (AHMP)

INTRODUCTION

This Aboriginal Heritage Management Plan (AHMP) has been developed to assist and guide the development of a Golf Course, Resort and Residential Estate on Lots Lot 11 DP1187663 and Lots 2-4 DP869651in Rothbury, NSW. This AHMP defines the actions and procedures that have been and will be implemented at the resort to facilitate the protection and management of known Aboriginal heritage values.

The Aboriginal Heritage Assessment, carried out in 1998 (Burramoko Archaeological Services) of the subject site identified the known objects and a recommended a transect of the site be set aside for protection from the proposed development. This recommendation and adoption of the proposed conservation and buffer zone was supported by Mindaribba Local Aboriginal Land Council.

This AHMP has been prepared not only to protect and enhance known Aboriginal Objects but also establish protocols that will be triggered for any objects that may be discovered during the development process. It has drawn details of Aboriginal heritage, and recommended mitigation and management strategies, from the report for the Aboriginal Heritage Impact Assessment prepared by Burramako (1998) and subsequently reviewed and updated assessment undertaken by Myall Coast Archaeological services.

AIMS AND OBJECTIVES

This Aboriginal Heritage Management Plan seeks to establish a framework to ensure that the Aboriginal cultural significance of the site is protected before, during and after the proposed development is undertaken. It aims to foster engagement and understanding of Aboriginal cultural significance and ensure compliance with the relevant state and federal legislation.

The design of the development has had due regard to the known items of Aboriginal cultural significance and as such these are all located in areas of proposed conservation, buffer zones, or within areas that will allow for them to be retained within their existing setting.

This plan aims to ensure that any additional finds are managed in a manner that is consistent with the cultural sensitivity of the local Aboriginal community and taking advice from the nominated representatives. This framework seeks to ensure that any additional finds are not destroyed but rather managed/conserved in the manner which the custodians of the culture deem appropriate, and are displayed on the site.

To this end it is proposed to provide a building in which to display and inform visitors. This would be constructed and run by the Mindaribba Local Aboriginal Land Council.

ABORIGINAL COMMUNITY

It is acknowledged that the Aboriginal community have a principal role in identifying cultural significance and cultural values and that Aboriginal people have the right to be consulted and involved in all aspects of investigation and decision making.

Ongoing Consultation throughout the assessment phase of the project has occurred with the Aboriginal community through the established registered stakeholders (Registered Aboriginal Parties); MLALC, Lower Wonnaruah Tribal Council and Tracey Skene Aboriginal Heritage advisor for the project.

In relation to Aboriginal heritage it is recognised that Mindaribba Local Aboriginal Land Council (Mindaribba LALC) function as the central point of contact with the Aboriginal community in relation to

heritage issues. Where Aboriginal community participation is specified in the actions and procedures throughout this document, it is understood that Mindaribba LALC will generally fulfil this role.

Mindaribba LALC representatives and the other registered stakeholders will be consulted on the effectiveness of this AHMP, any future versions, and any other heritage issues that are deemed relevant by either party.

DEFINITIONS

The following definitions apply to this plan:

- **Aboriginal Relic** *refers to burial sites and associated artefacts and human remains.*
- **AHA** refers to the Aboriginal Heritage Advisor
- **AHIP** is an Aboriginal Heritage Impact permit
- **Archaeologist** *refers to Myall Coast Archaeological Services or their nominee.*
- **ARG** *refers to the advisory group / consultative committee established to advise the proponent on all Aboriginal matters of interest throughout the life of the project. It is constituted with representatives of the RAP and the proponent. It is an administrative arm to ensure ongoing consultation throughout the life of the project. It is not a RAP.*
- **Expected finds** *refers to existing unrecorded objects expected to be present in a subsurface / surface context as identified in the previous assessment of the sites in the project area.*
- **OEH** *refers to the Office of Environment and Heritage.*
- **RAP** *refers to the registered Aboriginal parties.*
- **The Proponent** *refers to Capital Hunter Pty Ltd and its agents/contractors.*
- **Unexpected or New** *refers to other objects that are outside of the range of those that were identified (and expected also to be present in a subsurface context) as part of the previous assessment of the sites in the project area.*

It is expressly understood by all parties (the Proponent, RAP ARG,) that:

- An AHIP is not required as all known Objects are to be protected/conserved and left in-situ
- If during construction objects are discovered and harm cannot be avoided then an AHIP will be sought
- The plan is a result of a consultative process between RAP and the Proponent.
- This plan deals with the ongoing management of Aboriginal Cultural Heritage for the development approval, and may be reviewed and updated from time to time.
- This plan sets out the requirements, protocols and procedures for protecting the known Aboriginal Objects and new or unexpected Aboriginal Objects and Aboriginal relics.
- It sets out the roles, responsibilities, relationships and conduct of all parties and personnel including dispute resolution procedures
- It sets out clear procedures for monitoring, recording and managing expected and unexpected Aboriginal heritage (objects / artefacts) and relics.
- The plan must be in force prior to any ground disturbance process.

THE PLAN

1. Details of induction program for all workers associated with construction activities

An Aboriginal Heritage induction program will be developed and approved by ARG. It may be reviewed and updated from time to time as deemed necessary.

The program will outline protocols and responsibilities with respect to the management of Aboriginal cultural heritage for the site. It will also provide an overview of the site types present as well as procedures for reporting the identification of Aboriginal archaeological sites.

In addition, Aboriginal cultural awareness training will be mandatory for all staff whose roles may reasonably bring them into contact with Aboriginal sites and / or involve consultation with local Aboriginal community members. Training will also be offered on a voluntary basis to all other staff and contractors.

An Aboriginal cultural awareness training package will be developed for use throughout the operational life of the development. The training package will be completed prior to ground disturbance works commencing.

The cultural awareness training package is to be developed in collaboration with the RAP and will, at a minimum, involve the presentation of information on the Aboriginal history of the area (pre- and post-contact), the nature of known sites, potential Aboriginal archaeological resources, identification of Aboriginal archaeological sites, relevant management policies and procedures, and statutory obligations.

A register of all persons having completed Aboriginal heritage inductions & cultural awareness training will be maintained throughout the construction and operational phases of the development.

2. Details of WHS protocols required for site access

2.1 Safety

Access to the site during construction will be via approved site or visitor's induction only. There will be no unauthorised access to the site during the construction operations phases.

All persons attending the site must abide by all site safety policies and procedures whilst on site.

All work activities conducted on the site must be assessed and documented to identify potential hazards and any controls implemented. A Risk Assessment (RA) and Safe Work Procedure (SWP) will be developed for the tasks to be conducted by the proponent. The RA and SWP will be reviewed and approved by the proponent to the tasks being conducted.

2.2 Relationship obligations of Aboriginal Induction Service providers with other workers / management

All workers, Aboriginal inductors and contractors shall treat each other with due professionalism, courtesy and respect. If an occasion arises where a person feels aggrieved by another's behaviour or attitude then the dispute resolution process is triggered.

An outline of the procedures and protocols between the contractors, employees and the Aboriginal monitors / workers, shall be developed and completed in conjunction with the proponent, prior to commencement of the construction project.

2.3 Aboriginal Community Access

Aboriginal community members may, during the development process, wish to access the site and / or areas within the site for cultural purposes (e.g. education and ceremony).

The proponent is committed to facilitating such access. All access requests must go through ARG and be approved by ARG. The relevant site inductions and safety briefings will be required to be completed.

Access, in all instances, will be subject to relevant operational and safety considerations and cannot be guaranteed; and access to some of the site will be restricted during periods of construction.

There will be no unauthorised access to the site.

3. Responsibilities of stakeholders

Each party involved in the development of the site and / or having knowledge / carriage of matters relating to matters of Aboriginal cultural heritage have varying responsibilities. This section outlines the understood responsibilities.

Aboriginal Heritage Advisor - to advise on Aboriginal heritage matters.

Archaeologist - to assess and develop management strategies for known, new objects and relics and other tasks identified in the management plan.

ARG - to advise the proponent on all Aboriginal matters of interest throughout the life of the project and to oversee the functions and tasks in which the RAP may be involved.

Cessnock City Council - Monitor compliance with consent conditions and issue various compliance orders if necessary.

Proponent - responsible for the preparation and fulfilment of the management plan in consultation with RAP and Archaeologist in accordance with the guidelines for consultation.

RAP - to be consulted in accordance with legislated consultation guidelines regarding Aboriginal heritage management and undertake tasks as per the management plan.

4. Details of mitigation and management strategies

Prior to construction and in collaboration with ARG a survey map indicating the known objects and conservation transect and buffer zones will be produced and form the basis for management protocols.

A table/checklist of management procedures will also be produced outfling what is protected, mitigation measures required and other actions will also be established. The table will outline the actions, responsibility for those actions and time frame for implementation.

All Aboriginal heritage management and mitigation works carried out under the AHMP for the project will be documented to a standard comparable to that required by the Code of Practice for Archaeological Investigation of Aboriginal Objects 2010. This includes the completion of site cards in accordance with salvage and repatriation protocols granted under any AHIP.

The map and table will be standalone documents but will form part of this document at Appendix A

5. Procedures for new sites, relics and human remains

Refer to flowcharts 1, 2 and 3 in appendix B of this document

6. Reporting

ARG will develop the process and reporting format, including a data sheet to document the artefacts and compliance with mitigation measures. Such reporting shall be undertaken at least annually. ARG will be responsible for ensuring appropriate recording occurs and personnel to undertake the report compilation. The archaeologist may be involved at the request of ARG.

7. Compliance / review procedures

7.1 Review / update of the plan

The plan will be reviewed every three to five years by ARG and may include seeking technical advice from the archaeologist.

The review of the AHMP will involve a compliance audit to ensure that management procedures have been adhered to.

Request for review of the AHMP may also be raised by any of the stakeholders as part of ongoing implementation procedures.

If the AHMP is to be revised, copies of the document are to be sent to the registered Aboriginal parties for comment for a 7 day review period prior to finalisation. Their comments will be taken into account and the plan amended as required.

Following review and revision of the AHMP it, along with the RAP comments, will be forwarded to the consent authority for endorsement.

7.2 Suspected non-compliance with condition of consent

If a person has good reason to believe the proponent is not implementing the Aboriginal heritage conditions of Approval satisfactorily, then that person, or the supervisor, must notify the nominated dispute contact person giving full details outlining the potential breach. The nominated contact person shall refer the matter to ARG.

ARG shall meet to discuss the concern and if unable to resolve the concern, must refer the matter to Cessnock City Council for independent review.

8. Dispute Resolution

It is understood by all parties that any dispute regarding performance or activities conducted under this plan that:

- The issues will be resolved quickly rather an allowing them to escalate through inaction;
- All relevant parties should be consulted so that all sides of the story are taken into account;
- It will be handled sensitively – disputes should, where possible and appropriate, be resolved in a confidential context in order to minimise impact on others not affected by the dispute, and
- Work is to continue normally during the dispute resolution process subject to any reasonable concerns about WHS issues.

8.1 The resolution process

- The proponent in consultation with ARG shall nominate a person to be the dispute contact in the event a dispute arises.
- The monitor and / or project employee who feels that there is a dispute will contact their supervisor to discuss the concern.
- The supervisor will listen carefully to the monitor(s) and together they will try to resolve the dispute. If the supervisor and the concerned person are unable to resolve the dispute or it is not

appropriate that the supervisor deal with it, the matter should be referred to the nominated dispute contact person.

- The dispute is either resolved or referred to ARG.
- The dispute is either resolved or referred to an independent conciliator or mediator.

8.2 Technical Dispute

A technical dispute occurs where two parties disagree on a methodological or interpretative issue for any of the management recommendations of this AHMP.

The normal dispute resolution process above will apply except that the independent conciliator shall be the archaeologist who's decision will be final.

9. Ongoing consultation process

ARG has been established under a separate process as the conduit for ongoing consultation. Matters arising shall be considered at ARG meetings.

10. Ongoing / Future Management

It is recognised that given the history of the site there is the potential for addition items / relics of Aboriginal cultural heritage to be uncovered during the construction phase of the project. The purpose of this ACMP is to put in place a framework that would protect and manage any such finds.

An important element of this is providing the opportunity for the local community to manage their cultural heritage in a manner that both retains the link to place, and fosters greater understanding. This section sets the proposal for ongoing management of relics that may be found.

10.1 Cultural heritage

MLAC have been nominated custodian of Aboriginal cultural heritage associated with the site.

10.2 Onsite retention / display

The proponents of the development have put forward a proposal to develop / create an Aboriginal Cultural Centre to facilitate the enhancement of Aboriginal Heritage. It may be the storage and display of any Aboriginal finds / relics that may be discovered during construction that have been granted an AHIP. The Centre would operate as a standalone component of the broader development on the site.

The care, control and management of the Centre would be vested in the local community to run in accordance with protocols to be established through ARG prior to completion . It is hoped that this would provide an important component of ongoing information and attraction to the development as a whole, and an important opportunity to convey the importance of Aboriginal cultural heritage to the local area.

10.3 Design and Management

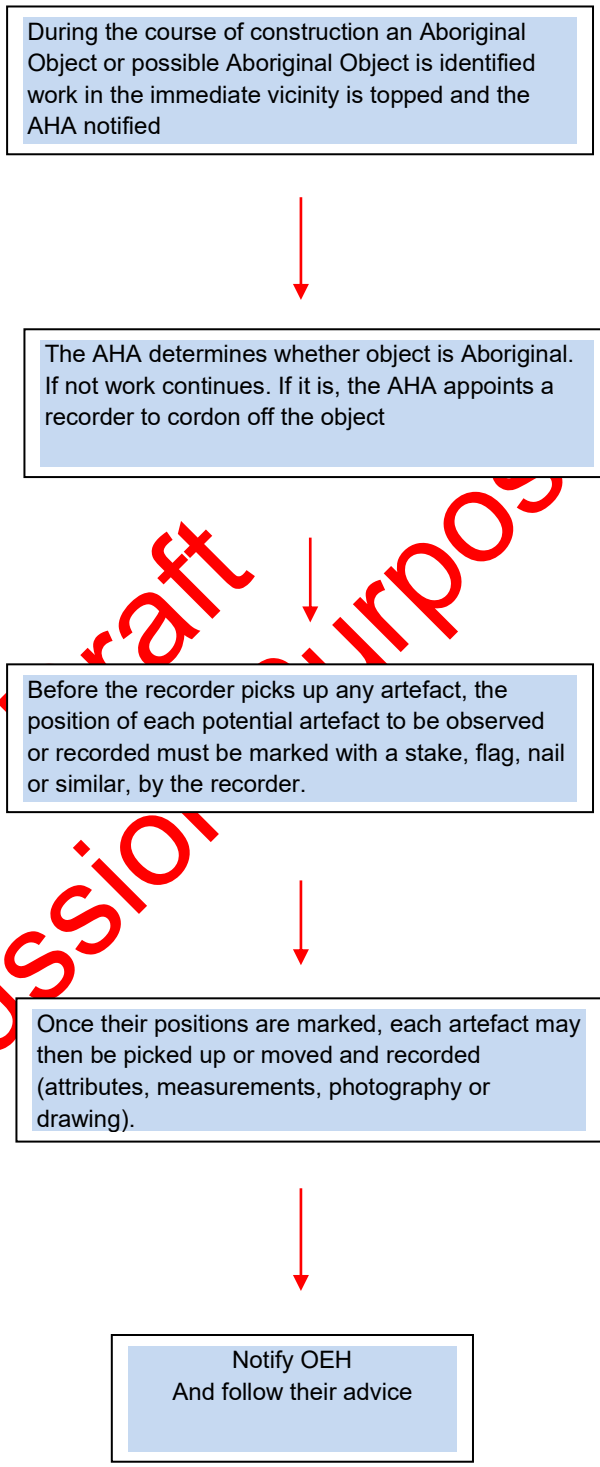
The proposal would be for the Aboriginal Cultural Centre to operate independently of the remainder of the development under the direct control and management of the local Aboriginal community.

The site and associated building car park and landscaping would be provided to the nominated representatives on an annual basis subject to the payment of a peppercorn rent and under a lease to be agreed. Operational conditions will apply to co-ordinate tourist and visitor access and maintenance.

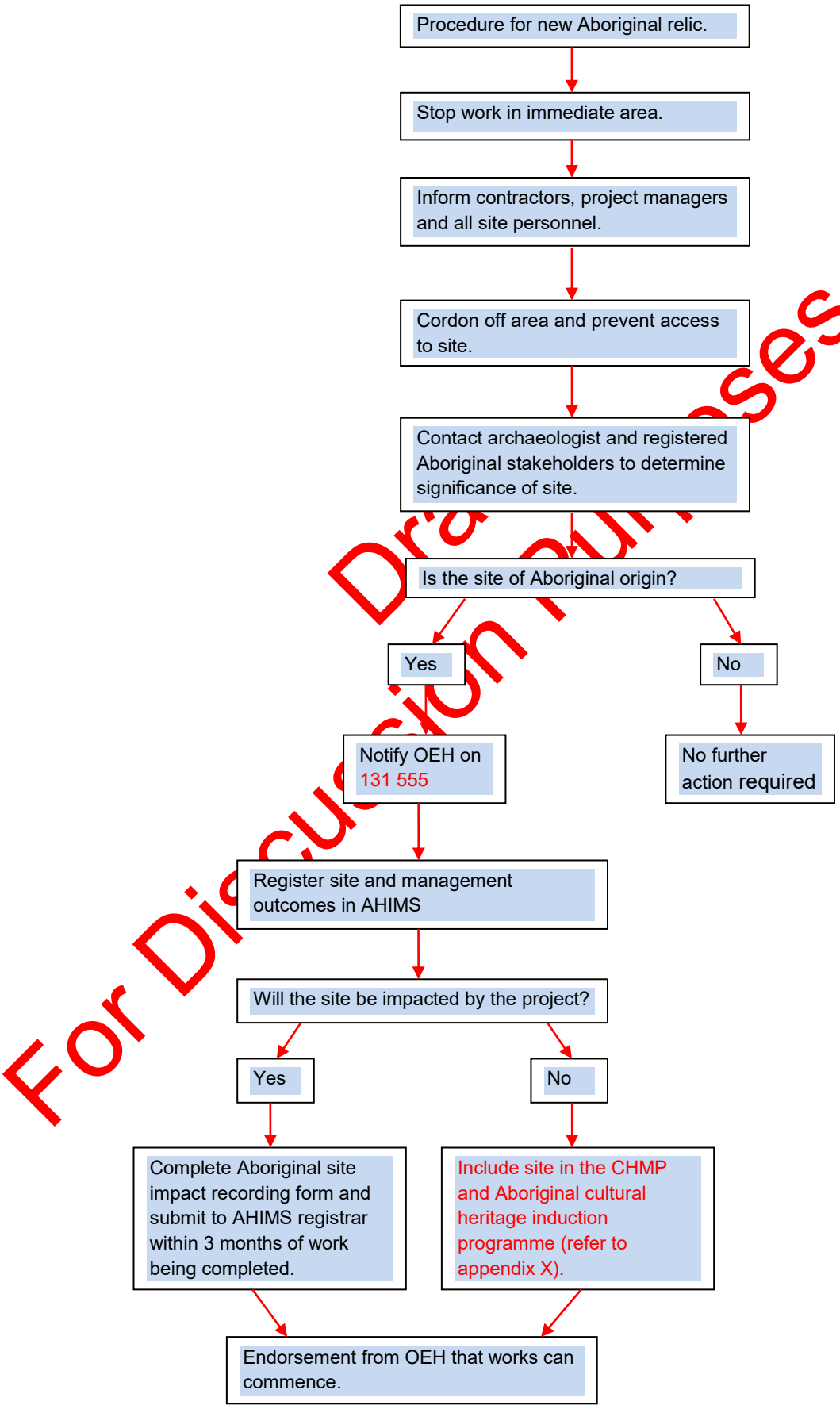
APPENDIX A

APPENDIX B

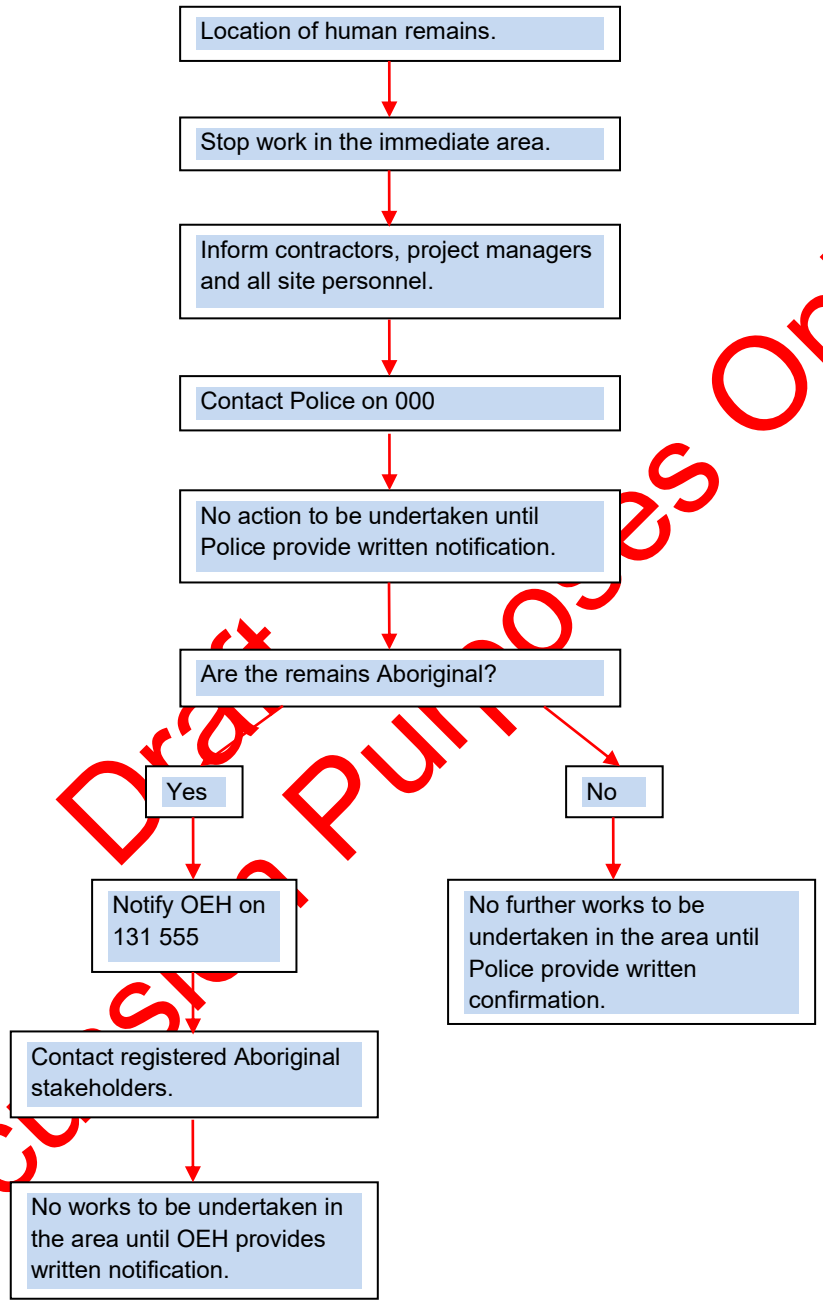
FLOWCHART 1 – PROCEDURE FOR UNRECORDED ABORIGINAL OBJECTS



FLOWCHART 2 – PROCEDURE FOR ABORIGINAL RELICS



FLOWCHART 3 – PROCEDURE FOR HUMAN REMAINS



APPENDIX E

CORRESPONDENCE WITH COUNCIL RE FLOODING

HDB
TownPlanning&Design

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File Ref: 11/011

21 July 2015

The General Manager
Cessnock City Council
Cessnock NSW 2325

Attention: Peter Jennings

Subject: Flood Study for Black Creek in relation to Lots 2-4 DP869651 and Lot 11 DP 1187663

Dear Peter

I refer to the draft Black Creek Flood Study Stage 2 Report which is currently on exhibition. In reviewing the document, it was noted that the1% AEP flood levels for Lots 2- 4 DP869651 and Lot 11 DP 1187667 are significantly higher than the flood levels considered in the recently gazetted planning proposal for the site.

The extent of residential development was determined by the flood levels (RL 40.3 - 40.58m AHD) provided by the supporting flood study for the rezoning. However, the current study indicates higher 1% AEP levels, generally in the range RL 40m - 42m AHD across the site, which will now require part of the site to be filled.

I would ask that you take into account the fact that the residential and tourist facilities at this site will be raised above the 1%AEP when determining the flood calculations for this area. .

Yours sincerely
HDB Town Planning & Design

Leena Sebastian
Town Planner

Enc: Copy of Masterplan

CESSNOCK
CITY COUNCIL

Contact: Peter Jennings
Our Ref: Black Creek Stage 2 – Flood Study 2015
Your Ref: 11/011

HDB Town Planning & Design
P.O. Box 40
MAITLAND NSW 2320

Attention : Ms Leena Sebastian

Dear Leena,

Re: BLACK CREEK Stage 2 - FLOOD STUDY (WMAwater)
Public Exhibition Comments

Thank you for your interest, and response to our recent Public Exhibition and Workshop, associated with the above 'Flood Study' presently being finalised by Flooding Consultants – WMAwater, on behalf of Council.

We appreciate your comments and these have been noted and listed as part of the community response to the exhibition and recent community workshop held on 28 July 2015.

Council appreciates your effort to provide your comments, these comments will be reviewed as part of the follow up action - all responses received will be tabulated and assessed as part of this community consultation stage of the study process.

Council will also respond directly with separate comments regarding the recent 'Black Creek Stage 2 Flood Study' findings and the Flood Study used in the Development associated with Lots 2 - 4 in DP869651, and details submitted by 'HDB Town Planning & Design' as part of this development.

Yours faithfully

Peter Jennings
Strategic Flooding & Drainage Planning Engineer

29 August 2015

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File Ref: 15/029

5 November 2015

Peter Jennings
Strategic Flooding and Drainage Planning Engineer
Cessnock City Council
PO Box 152
Cessnock NSW 2325

Attention: Peter Jennings

Black Creek Stage 2 Flood Study public exhibition comments

I refer to our letter 21 July 2015 and your response 29 August 2015 regarding the impact of the flood study on Lots 2-4 DP869651 and Lot 11 DP1187663, Wine Country Pokolbin (Jack Nicklaus Golf Course of Australia project).

It would be appreciated if you could advise as to when we are likely to receive the feedback foreshadowed in your response letter.

As you may be aware we are currently preparing a Development Application for the site and have had meetings with Council officers regarding this proposal.

Council's revised flooding levels for the site do create some concern and may impact the overall layout of the site. It would, therefore, be appreciated if we could either meet with Council officers, or receive further comment, as soon as possible so we can take this into consideration for the finalisation of the application.

Should you wish to discuss any matters please do not hesitate to contact the undersigned at your convenience.

Yours sincerely

HDB Town Planning & Design

Kerry Nichols

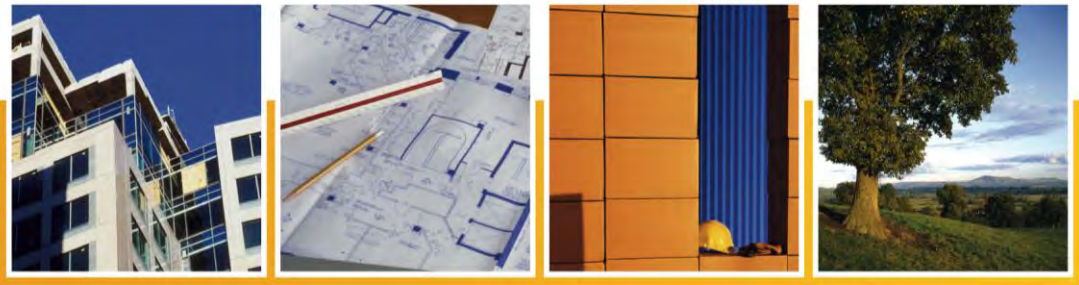
Director

APPENDIX F

BUSHFIRE THREAT ASSESSMENT

HDB 2016

BUSHFIRE THREAT ASSESSMENT



For

Staged Integrated Residential/Tourist Development

At

Lot 2-4 DP 869651 and Lot 11 DP 1187663
Wine Country Drive, Rothbury

Prepared for
Capital Hunter Pty Ltd

July 2016
Report 15/029 - 1

Prepared by

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Issue	Revision	Issued To	Qty	Issue Date	Author	Reviewed
Draft	1	HDB	1	19.4.16	LS	KN
Final	1	Client	1	12.7.16	LS	KN
Final	1	HDB	1	12.7.16	LS	KN

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Applicant:	HDB Town Planning & Design
HDB Project Manager:	Leena Sebastian
HDB Reference Number:	15/029

Project Manager ***Date*** 12.7.16

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1.0 INTRODUCTION

HDB Town Planning & Design (*HDB*) has been engaged by *Capital Corporation Pty Ltd* to undertake a Bushfire Threat Assessment (BTA) for a Staged Integrated Residential / Tourist development on Lots 2 - 4 DP869651 and Lot 11 DP 1187663 (hereafter referred to as the subject site), Wine Country Drive, Rothbury. The subject Development Application (DA) seeks Council's consent for a Concept Masterplan for the development and Stage 1 of the proposal, which constitutes a 4 Lot subdivision. Once fully developed the Masterplan site will contain a golf course, individual dwelling units, a hotel and tourist accommodation units along with associated sporting and recreational facilities.

The site is identified as bushfire prone land in Council's Bushfire mapping and is therefore subject to consideration under Section 100B of the Rural Fires Act and *Planning for Bushfire Protection 2006 (PBP 2006)*.

A previous Bushfire Threat Assessment was prepared by *HDB* in May 2013, in support of a planning proposal which was approved by Council in August 2014. It is understood that the Concept Masterplan has undergone minor amendments to accommodate the new flood levels identified in the recent Black Creek Flood Study by *WMA* (June 2015). This document provides an assessment of the bushfire hazards associated with the site and examines the ability of the amended Masterplan to accommodate bushfire protection measures in accordance with *Planning for Bushfire Protection 2006* (henceforth referred to as PBP 2006).

The minimum APZs (Asset Protection Zones) required for the development are identified in this document. The hotel and tourist accommodation component of the proposal are categorised as Special Fire Protection Purpose (SFPP) developments as the occupants of these facilities tend to be more vulnerable to the effects of bushfire events. As such, larger Asset Protection Zones (APZs) are specified for those developments on proposed Lot 4 than for residential subdivisions on proposed Lot 3.

2.0 SITE DETAILS

The subject site comprises four (4) lots identified as:

Lot / DP	Lots 2 – 4 DP 869651 and Lot 11 DP 1187663
Local Government:	Cessnock City Council
Locality:	Rothbury
Area:	Approximately 240 Ha
Zone:	SP3 Tourist Zone

The aerial photos of locality and the site are shown in ***Figures 1*** and ***2*** respectively.

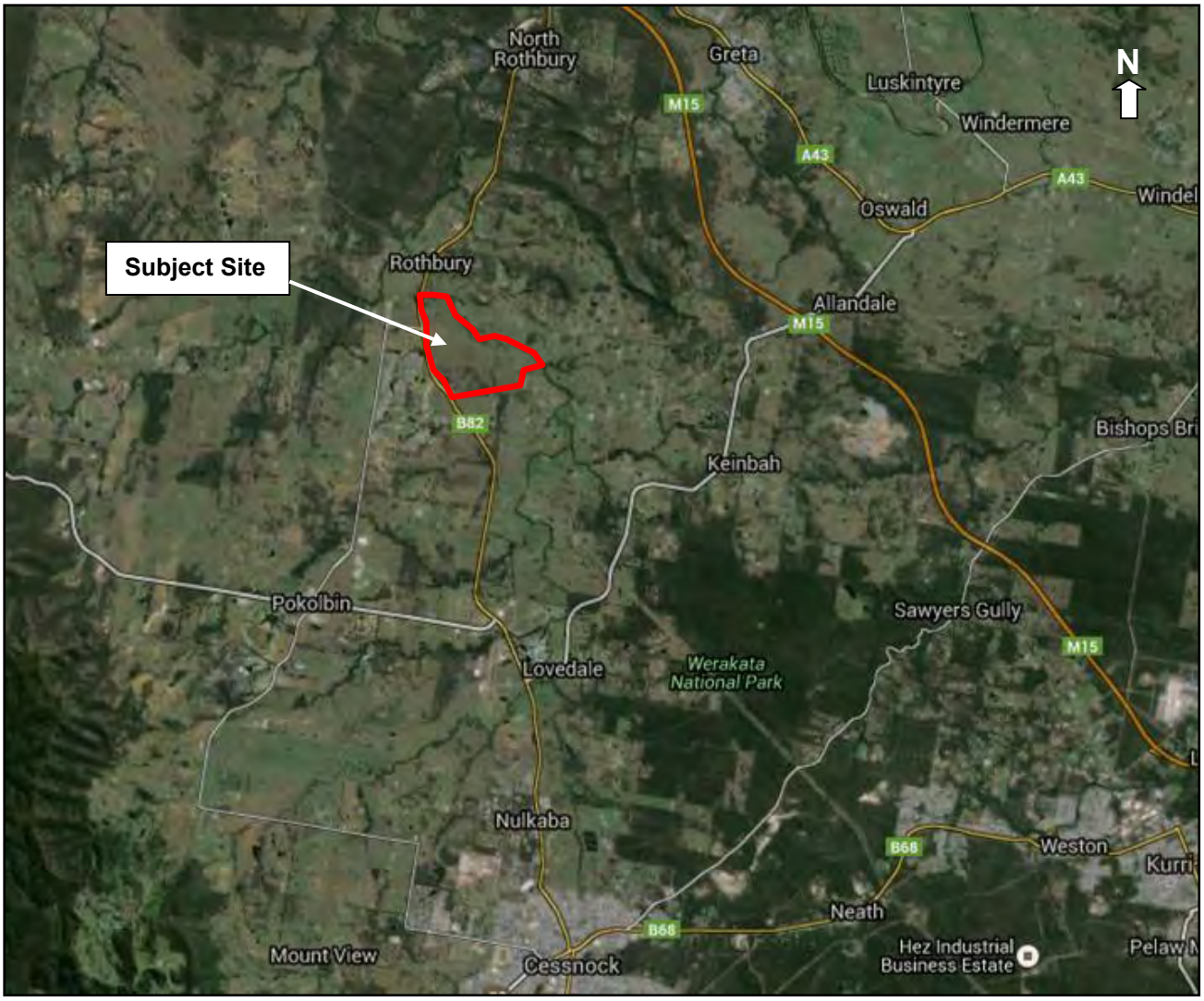


Figure 1 *– Aerial Photo Showing the Subject Site Location*
Source - Google Maps

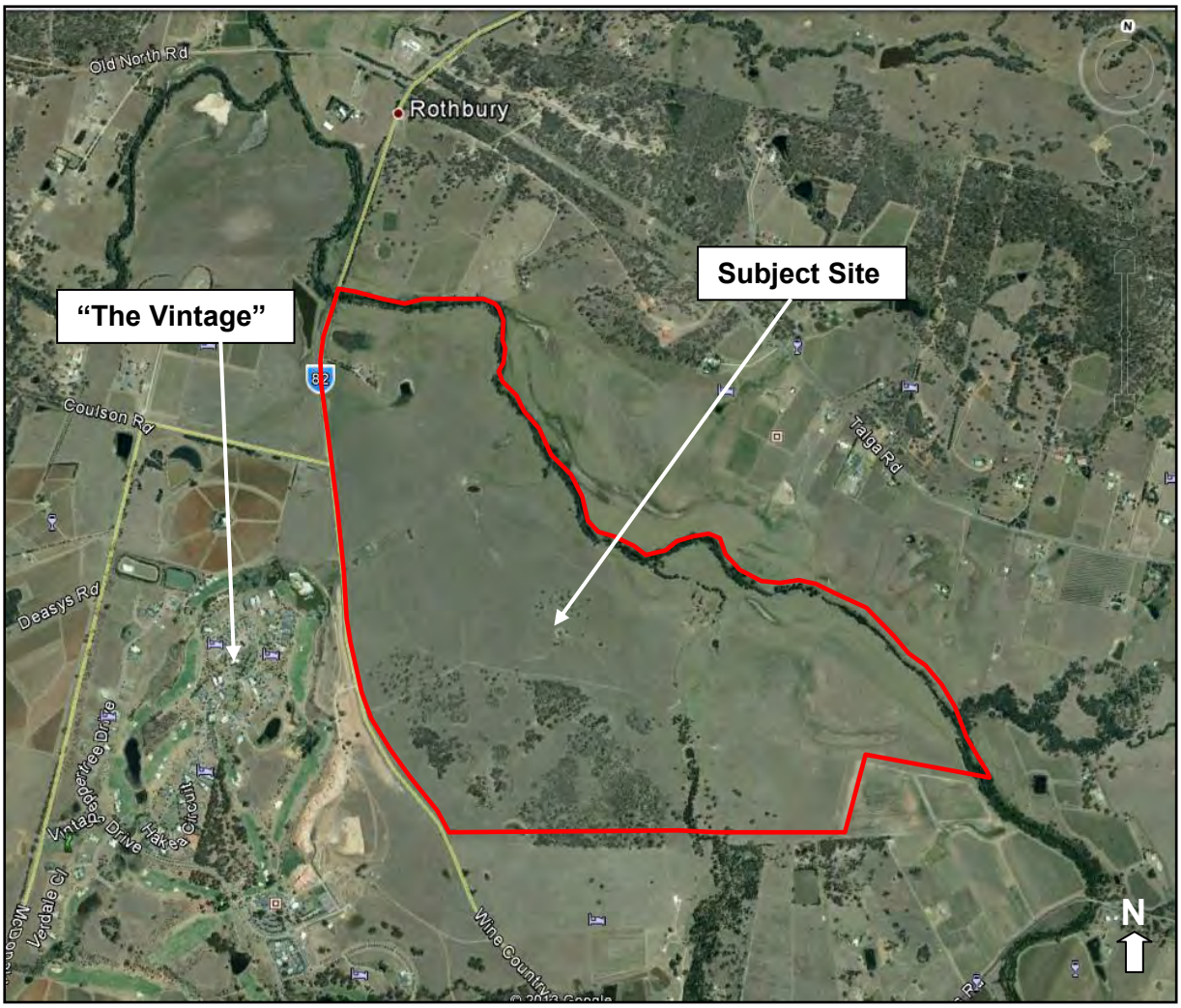


Figure 2 *- Aerial Photograph of the Site*
Source: Google Maps

2.1 SITE DESCRIPTION AND SURROUNDING USES

The subject site is located on Wine Country Drive approximately 8 kilometres south of Branxton and 14 kilometres north of Cessnock and is in close proximity to other golf resorts including "The Vintage" and "Cypress Lakes".

The site is irregularly shaped with an approximate area of 240 ha. The land is defined by Black Creek to the north and east. MR220 (Wine Country Drive) defines the site along the western boundary. The southern boundary is common with the rear of properties adjoining Wilderness Road.

The property is no longer used for grazing. A number of farm dams are scattered throughout the site.

Apart from a dwelling and some dilapidated sheds located in the northern part, there are no site improvements or any active land uses associated with the site.

To the west of the site is the 'Vintage', an integrated tourist / residential development. The land uses to the north, south and east are generally characterised by farmlands and vineyards interspersed with hotels and other tourism related activities.

2.2 SITE TOPOGRAPHY AND VEGETATION

The site largely contains flat alluvial flood plain deposits with established grass cover. It has a gentle slope (less than 4°) from south-west in a north-easterly direction towards Black Creek. There are two prominent drainage lines, a third order stream across the northern part and another one from the south draining in a northerly direction into Black Creek.

The site is generally cleared except for the vegetation along the riparian areas and scattered remanent vegetation to the south-west of the site. A Flora and Fauna Assessment undertaken by *RPS* at the Planning Proposal stage identified four (4) vegetation communities, including two EECs, amongst the remanent vegetation as below:

- Central Hunter Ironbark Spotted Gum forest (EEC);
- Central Hunter Riparian forest (EEC);
- Casuarina glauca woodland; and
- Open Melaleuca decora stand

Figure 3 shows the mapping of vegetation communities provided by *RPS* in their assessment.

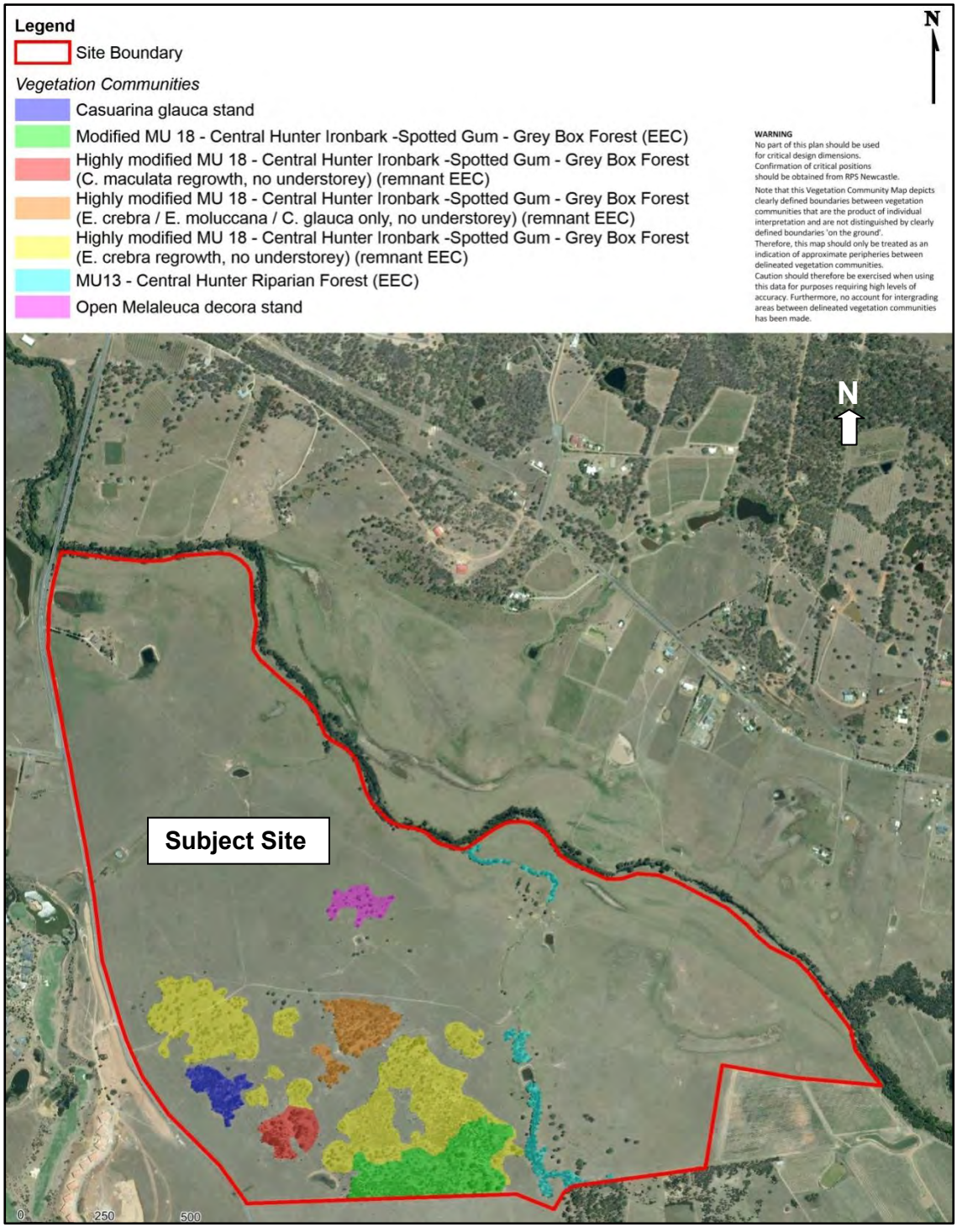


Figure 3 *- Vegetation communities on the site*
Source: Flora and Fauna Assessment by RPS

2.3 SITE CONSTRAINTS

2.3.1 FLOODING

Due to its location along the bank of Black Creek, the eastern parts of the property are affected by flooding.

2.3.2 BUSHFIRE

The south-west corner of the site, together with the northern and eastern boundaries, are identified as bushfire prone land containing Vegetation Categories 1 & 2 and bushfire buffer areas as shown in ***Figure 4***.

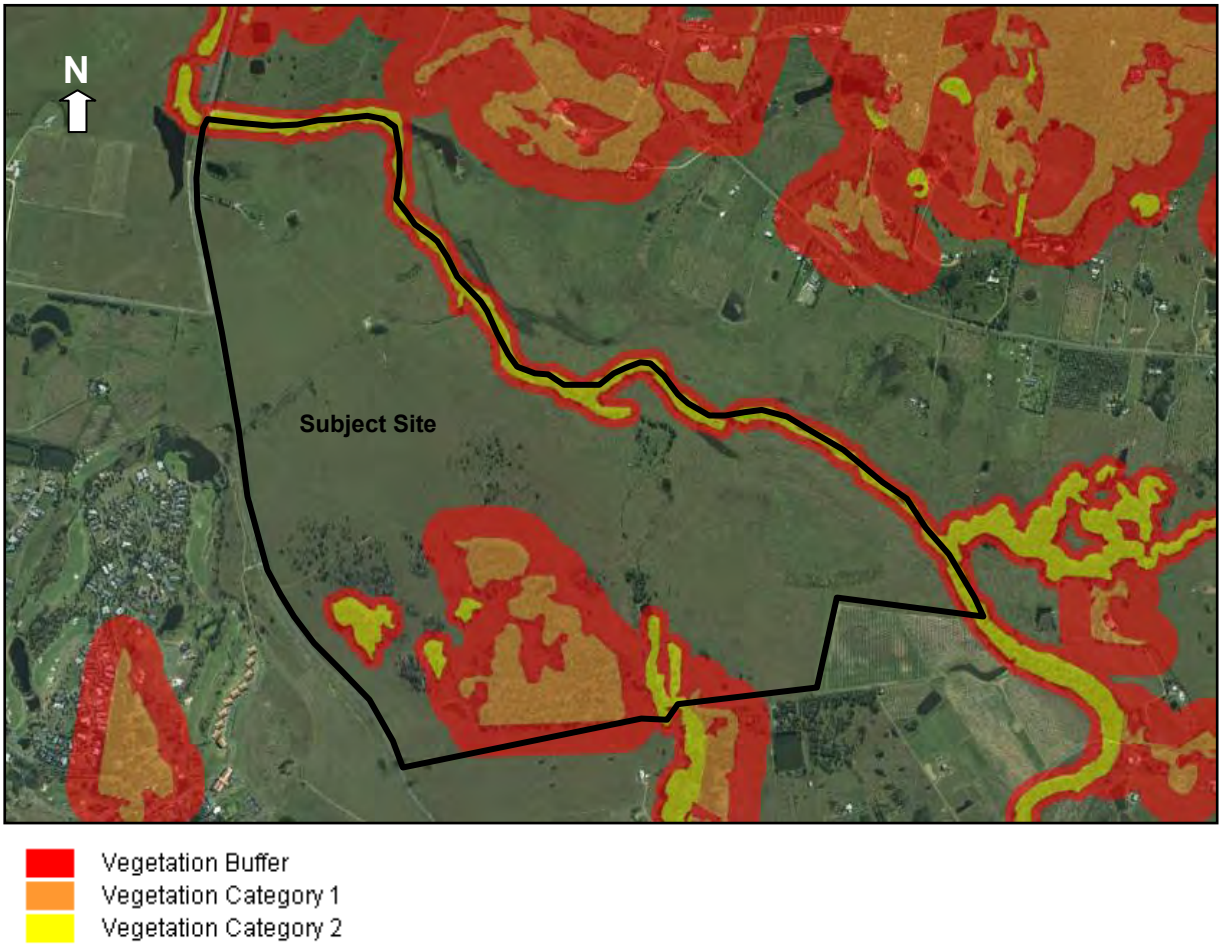


Figure 4 *- Bushfire Mapping*
Source: Cessnock City Council

2.3.3 FLORA AND FAUNA

The riparian areas and the south-western part of the site accommodate approximately 34 ha of native vegetation. These highly disturbed stands of remanent vegetation are mostly regrowth with no connectivity to larger habitat areas. *RPS* identified 23 threatened fauna species and three (3) flora species listed under the Threatened Species Conservation Act

1993, with the potential to occur, or of known habitat, within the site. One (1) threatened flora species, Eucalyptus glaucina, was also identified on site.

Five (5) threatened fauna species and two (2) threatened flora species listed under the Environmental Protection and Biodiversity Conservation Act 1999 were assessed as possibly occurring on the site, or that the site supports preferred habitat for the species.

The four (4) vegetation communities; Central Hunter Riparian forest (EEC), Central Hunter Ironbark - Spotted Gum - Grey Box forest (EEC), Casuarina glauca woodland, and Melaleuca decora stand identified on the site were delineated according to their level of degradation, as shown in ***Figure 3***.

The site was considered to have low habitat value due to the lack of variably sized hollows, few understorey shrubs, limited woody debris and rocks, and grazing by cattle.

The flora and fauna assessment concluded that the proposal was unlikely to have any impact on the flora and fauna significance of the site.

MJD Environmental Pty Ltd was engaged to provide an update on the earlier assessment with due regard to the changes in the concept Masterplan and the recent listings under the EPBC Act (Environmental Protection and Biodiversity Conservation Act). A copy of this report is attached as Appendix B. The study generally supports the recommendations set forth in the RPS report and provides the following additional comments with regard to the proposal:

- Two additional hollow bearing trees were identified on site which shall be retained under the revised concept plan;
- Assessment under TSC and EPBC Act determined that all additional threatened and migratory species were not likely to be impacted by the proposal. However, despite the highly modified nature of Central Hunter Valley Eucalypt Forest and Woodland on site coupled with the intended rehabilitation, the remnant patches satisfy the moderate condition criteria and therefore meet the minimum thresholds for further assessment via referral under the EPBC Act.

2.3.4 ABORIGINAL HERITAGE

An archaeological assessment undertaken on the site during the planning proposal stage identified sensitive areas which require conservation. Accordingly the Masterplan contains an archaeological / conservation buffer zone that needs to be protected.

2.3.5 OTHERS

The site is identified in the Council's Obstacle Limitation Surface Mapping, implying that any development on the site should not penetrate the airspace operations as specified in the mapping.

The property is not affected by mine subsidence or acid sulphate soils.

3.0 PROPOSED DEVELOPMENT

Stage 1 of the proposal involves:

- A Concept Masterplan for staged development of the site into an integrated residential / tourist facility comprising;
    - Eighteen (18) hole signature golf course built to international standards, along with associated clubhouse, that will meet the stringent code of the Australian Open and will provide the facilities for the Jack Nicklaus Golf Academy servicing South East Asia;
    - A five (5) star fifty (50) room hotel, of the Golden Bear Lodge or Hilton hotels calibre;
    - Short stay tourist villas (250);
    - Public function, retail and food outlet centre with the capacity for state-of-the-art conferencing, telecommunications, tourism programs, and an interpretive centre for the locality's natural and cultural heritage, and history of the wine industry;
    - Sports, recreation and health spa resort, including swimming pool, tennis court and gymnasium;
    - Three hundred (300) long stay / permanent residences in three (3) specialised precincts; and
- Torrens Title subdivision of the subject site into four (4) super lots to accommodate the various components of the integrated tourist / residential development in future stages. The proposed Lot 1 will contain the main access to the development and other services, including a waste water treatment plant. The proposed Lot 2 will accommodate an 18 hole golf course. While proposed Lots 3 will be subdivided further in future stages to accommodate permanent dwellings, Lot 4 with the tourist accommodation and associated sporting and recreational facilities will form the prime feature of the development.

The main access to the development will lead to the hotel and centrally located facilities. A network of internal roads off this main access will service the various precincts located throughout the site. The future development of the site will include fairways, greens, lawns and landscaped areas between the identified bushfire hazards and the permanent residential dwellings on the site. Managed grasslands will surround the permanent dwellings and tourist accommodation units while the perimeter of the site, and the riparian vegetation, will be enhanced with new plantings.

Figure 5 shows the proposed Plan of Subdivision in Stage 1. The Concept Masterplan and Stage 1 Subdivision plan are attached as ***Appendix A***. As indicated in the Masterplan the proposal will require removal of some site vegetation with Council's consent, hence these areas are not considered as a threat in the assessment.

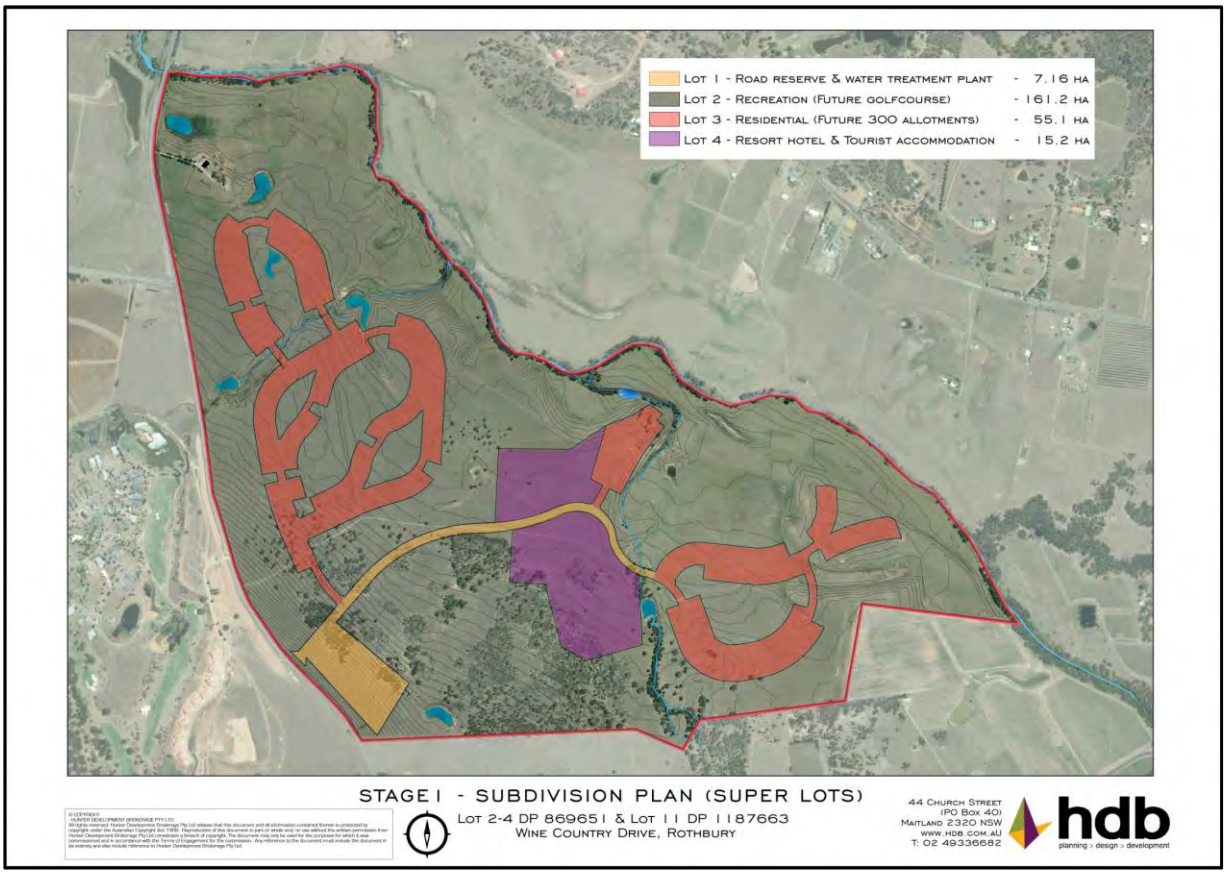


Figure 5 *- Stage 1 Subdivision Plan (Refer to* ***Appendix A*** *for enlarged copy)*
Source: HDB Town Planning and Design

4.0 LEGISLATIVE REQUIREMENTS

This assessment is undertaken in accordance with the requirements and guidelines of the following documents:

- Environmental Planning & Assessment Act 1979;
- Section 100B of the Rural Fires Act;
- Planning for Bushfire Protection 2006 (PBP 2006); and
- AS 3959 – 2009 Construction of buildings in bushfire prone areas.

5.0 BUSHFIRE THREAT ASSESSMENT

This assessment adopts the methodology outlined in Appendix 3 of PBP 2006 which involves the following steps:

- Step 1 – Identify all vegetation assemblages within 140 m of the site;
- Step 2 – Determine the effective slope under the vegetation;
- Step 3 – Determine the Fire Danger Index (FDI) for the area;
- Step 4 – Match the relevant FDI, appropriate vegetation, distance, and effective slope classes to determine the level of bushfire attack.

5.1 VEGETATION AND SLOPE ASSESSMENT

The Flora and Fauna Assessment undertaken by *RPS* identified the different vegetation communities on the subject site as shown in ***Figure 3***. Based on this information and a separate site investigation undertaken in accordance with PBP 2006, all vegetation within the 140 m buffer that influence the bushfire behaviour were identified and classified as indicated in ***Figure 6***. The following dominant vegetation assemblages were identified within the 140 m buffer.

Woodlands

Highly modified / disturbed stands of Central Hunter Ironbark Spotted Gum - Grey Box forest (EECs) with understorey consisting of juvenile regrowth and / or native and introduced grasses, exist within the south-western part of the site. These areas of scattered vegetation with foliage cover less than 30% are identified as woodlands.

The proposed clearing within the site will largely occur within these areas providing a significant fire break and overall reduction in fuel loading. As such the areas of proposed clearing are excluded from the assessment.

Open Forest

Denser areas of remanent Central Hunter Ironbark Spotted Gum - Grey Box forest and an isolated stand of Casuarina glauca with foliage cover ranging from 30% - 70% were also found within the south-western part of the site. These areas are identified as open forest for bushfire threat assessment purpose.

Rainforest

Central Hunter Riparian Forest exists as a narrow corridor less than 20 m wide on either side of Black Creek and along the drainage lines through the site. These areas are assessed as 'Rainforests' as per Appendix 2 of PBP 2006.

A single line of trees along the creek as well as isolated patches of riparian vegetation are considered as exclusions and therefore not included in the assessment.

Grassland

At present approximately 206 ha of the site is covered by open grassland consisting of native and exotic pasture species such as M. stipoides, P purpurascens and Paspalidium distans. In the future these grasslands will be largely occupied by the golf course containing greens,

fairways, and pathways which are considered as low threat areas. Any remaining grassland will be mowed / slashed and kept below 100 mm height to reduce bushfire risks. Therefore these managed areas with reduced fuel loads are not considered as a threat in the assessment. Refer to ***Appendix B*** for details.

Slope assessment

The 0.5 m contour interval obtained from the site survey by *Monteath and Powys Pty Ltd* was used for determining the effective slope under the vegetation assemblages. The effective slope under the vegetation generally varies from 1° - 2° upslope with respect to the proposed lots.

In general, amongst the vegetation assemblages identified within the 140 m buffer, those located within the site are seen to be the main source of bushfire risk as they occur in close proximity to the proposed lots. However some of these areas will be cleared for development reducing them to isolated stands of vegetation with very low fuel loading. Such areas will no longer be a threat and therefore excluded from the assessment.

The FDI for Cessnock LGA is 100. Accordingly, a summary of the vegetation and slope analysis and the recommended APZ for the site (corresponding to FD1 100) is provided in the figure in ***Appendix B*** and ***Table 1*** below.

Direction	Distance to the vegetation from the subject site boundary	Vegetation Assemblage	Effective Slope	Required APZ / Comments
North	Adjoins the boundary.	Riparian vegetation along Black Creek-treated as rainforest for bushfire threat assessment purpose.	Downslope <0-5°	The minimum APZ requirement for residential development is 14 m and that required for tourist and hotel developments is 40 m. Proposed Lots 3 and 4 are located in excess of these distances from the vegetation assemblages along the northern boundary. Refer to ***Appendix B***.
South	Within the site and adjoining the boundary.	A mix of remnant vegetation assemblages (categorised forests and woodlands) and riparian vegetation along the drainage line.	Varies - Flat, 1-2° upslope	An APZ of 60 m is applicable to the western and southern boundaries of part of proposed Lot 4. Apart from this, the required APZs are generally accommodated outside the proposed lot boundaries. Refer to ***Appendix B***.
East	Adjoins the boundary.	Riparian vegetation along Black Creek-treated as rainforest for bushfire threat assessment purpose.	Downslope <0-5°	The minimum APZ requirement for residential development is 14 m and that required for tourist and hotel developments is 40 m. Proposed Lots 3 and 4 are located in excess of these distances from the vegetation assemblages along the northern boundary. Refer to ***Appendix B***.
West	Generally lacks any vegetation except for the south-west corner of the site.	Contains some patches of remnant forest and woodlands which will be largely cleared for development purposes.	Upslope<0-5°	Generally free from bushfire hazards. The APZs, where required, will be accommodated within the golf course and the proposed new access road.

Table 1 *- Summary of vegetation and slope analysis within 140 m of the site and the required APZ*
Source – HDB Town Planning & Design

***Figure 6** - Site Vegetation - Remnant Central Hunter Ironbark - Spotted Gum - Grey Box Forest in the south-west part of the site*
Source – HDB Town Planning & Design

***Figure 7** - Site Vegetation - Casuarina glauca Forest within the south-west part of the site*
Source – HDB Town Planning & Design

Figure 8 *- View towards the north-east - Riparian vegetation along Black Creek*
Source – HDB Town Planning & Design

6.0 BUSHFIRE MANAGEMENT MEASURES

6.1 DETERMINATION OF THE ASSET PROTECTION ZONES (APZ)

Planning for Bushfire Protection 2006 (PBP 2006) requires appropriately sized fire breaks to be established on the hazard side if bushfire threat exists on, or adjacent to, the development site. These firebreaks known as Asset Protection Zones (APZs) are determined based on the vegetation type and effective slope under the vegetation. APZs ensure that the buildings are separated from the hazard and the fuel loads around them are minimised to reduce the impact of radiant heat and ember attack.

Appendix 2 of PBP 2006 specifies the minimum requirement for Asset Protection Zones (m) for residential and rural residential subdivision purposes to correspond to a radiant heat exposure less than or equal to 29 kW/m^2, which translates to BAL 29 (Bush Fire Attack Level 29). The APZ for residential development has been obtained from Table 2.4.2 of Australian Standard AS 3959-2009 which corresponds to a FDI value of 100. The proposed Lot 3, being a residential lot accommodating permanent dwellings in future, will require APZs of 14 m and 25 m in certain locations as indicated in ***Appendix B***.

The proposed hotel and tourist accommodation, being in the category of 'Special Fire Protection Purpose Developments', will require larger APZs to ensure that the radiant heat levels are less than 10 kW/m^2. Consequently, the proposed APZs for Lot 4 are in accordance with Table A2.6 (Appendix 2) of PBP 2006. Apart from a portion of proposed Lot 4, which requires 60 m setback distances from the vegetation assemblages adjoining its western and southern boundaries, the APZs for the development are largely accommodated within the golf course (Lot 2 recreation) and to a lesser extent within the proposed access roads. Refer to ***Appendix B*** for details.

6.2 ROADS AND ACCESS

The concept Masterplan provides the following information on the roads and access that will service the development:

- A new roundabout on Wine Country Drive will be constructed to provide access to the development;
- The internal road network will consist of 20 m and 25 m wide two-lane sealed access roads with a few bifurcations into single lanes of width 10 m within the residential area;
- The site is gently sloping and there are no constraints affecting the construction of roads to an average grade well below 10 degrees and there is no vegetation or landscaping that would affect a minimum vertical clearance of 4 m above these roads at all times;
- The length of the cul-de-sacs servicing proposed Lot 3 in the south-east corner of the site exceeds the 200 m limit. However, this part of the site being more than

100 m from the bushfire vegetation along Black Creek is not exposed to high bushfire risk and hence considered acceptable;

- The roads have inner radii greater than 6 m to allow for rapid access and egress of vehicles;
- The proposed roads are capable of handling fully loaded fire fighting vehicles; and
- Lot 4 intended for SFPP development will have direct access to the main road connecting to Wine Country Drive, thereby providing for the safe evacuation of occupants in case of a bushfire emergency.

The proposed road network and access arrangements for the development satisfy the performance criteria for access stipulated in sections 4.1.3 and 4.2.7 of PBP 2006.

6.3 SERVICES

The proposed subdivision will be serviced by electricity, telecommunications, and an internally reticulated water and sewer system.

The fire hydrant spacing, sizing, and pressures are able to comply with AS 2419.1-2005, to ensure adequate water supply for fire fighting.

All new electrical and telecommunications cable can be provided underground to meet the requirements of PBP 2006.

6.4 LANDSCAPING AND MAINTENANCE

All landscaping should be in accordance with the requirements of Appendix 5 of PBP 2006, and regular maintenance is required to reduce fuel loads. Any new landscaping adjoining bushfire prone vegetation should incorporate adequate firebreaks to stop the spread of fire. In areas where new landscaping adjoins an identified threat, smaller groups of plantings or scattered plantings with discontinuous canopies should be provided to avoid a direct fire path to the property. Strips of vegetation less than 20 m in width, regardless of length and not within 20 m of each other or any other areas of vegetation being classified, is considered as a low threat area. Therefore all new plantings within the Masterplan site are to comply with these criteria to reduce bushfire threats.

6.5 CONSTRUCTION REQUIREMENTS

Separate assessments shall be undertaken for each individual lot in subsequent stages to determine the level of construction required for the dwellings. Alternatively a BAL mapping for the entire subdivision site and relevant details can be submitted as part of the Bushfire Safety Authority Approval at the subdivision stage of residential lots to obtain an exemption from further bushfire considerations at the DA stage for dwellings.

The construction of future dwellings should be in accordance with the requirements of AS 3959-2009 depending on the BAL rating.

6.6 SPECIAL CONSIDERATIONS

Ecological Constraints: Flora and Fauna

Due to the highly modified nature of the vegetation community on site, the vegetation removal required for the development is not anticipated to have any adverse impacts. However the extent of occurrence of the remnant vegetation is significantly large and is considered to meet the condition threshold criteria for Class D requiring a referral to the DoE. (Department of Environment) for further assessment. The vegetation removal considered in this report is therefore subject to approval by the DoE.

Flooding

The eastern part of the site is identified as flood prone land. However all the habitable spaces and access roads will comply with the flood planning levels. The entrance / exit points to the site are located along the western boundary, away from the flood prone areas, therefore flooding is not considered to be a constraint to the location of building envelopes, access roads or any services that may affect the bushfire management measures on the property.

6.7 ASSESSMENT OF ENVIRONMENTAL IMPACT

As concluded by the flora and fauna assessment, the proposed clearing for development purpose will not have any significant impact on the flora and fauna communities on the site due to their varying levels of degradation / disturbance.

The development proposal will incorporate extensive landscaping with suitable species of trees, as per the guidelines of PBP Appendix 5 resulting in net gain vegetation across the site. These areas will be managed to reduce fuel loading, thereby preventing the spread of fire into the built up areas within the site. The bushfire management plan for the development is, therefore, not likely to have any detrimental impacts on the environment.

7.0 CONCLUSION AND RECOMMENDATIONS

This assessment demonstrates that the proposed subdivision satisfies the performance criteria for bushfire management as stipulated in PBP and AS 3959-2009. All lots in the proposed subdivision are able to accommodate the required APZ. The future dwellings and special fire protection developments can be sited to achieve the required APZ corresponding to BAL 29 and radiant heat level less than or equal to 10 kw/m^2 respectively.

It is therefore considered that having regard to the Bushfire Threat Assessment, the subject site is suitable for subdivision and development.

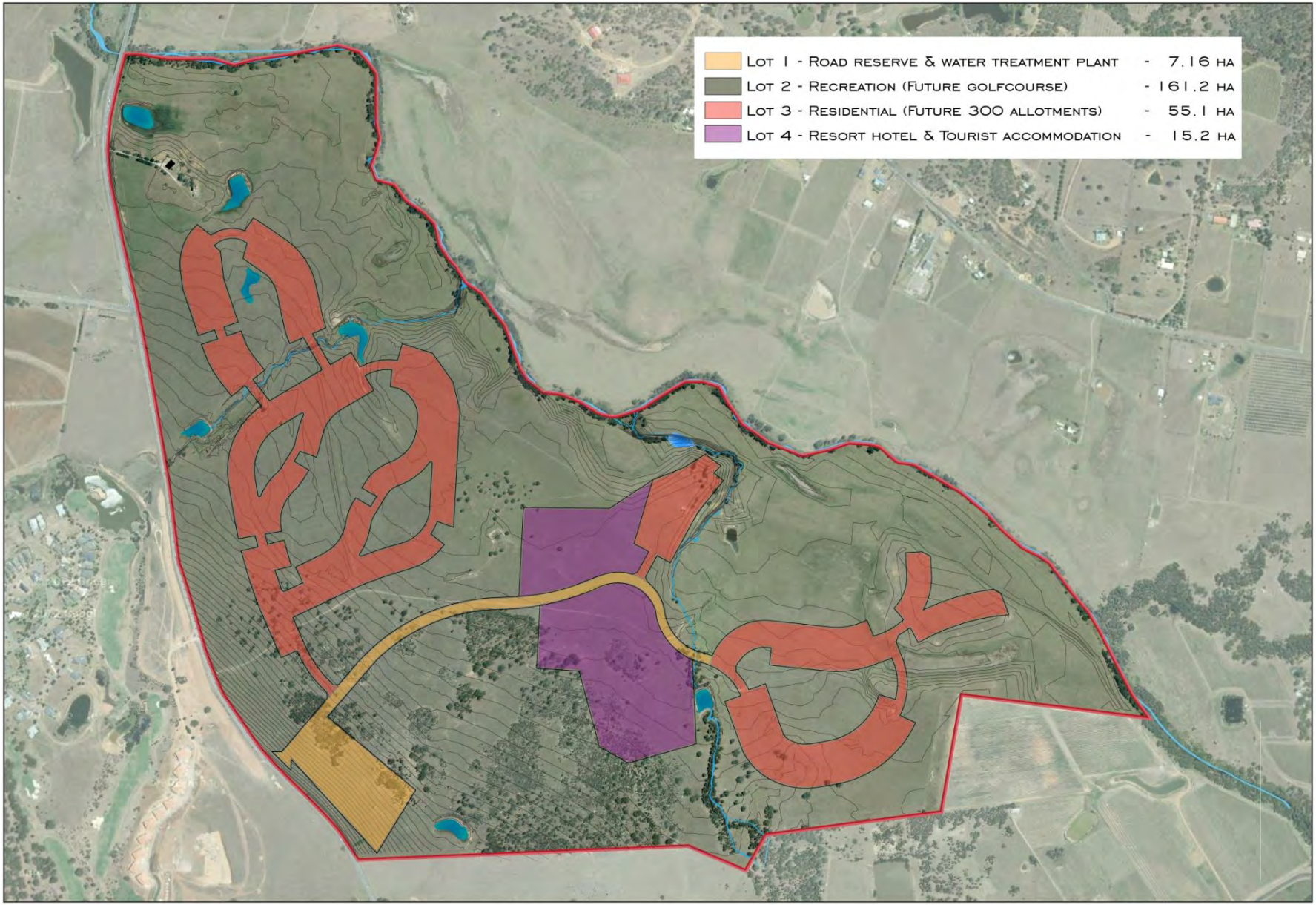
The following recommendations are made for the compliance of the proposal with the relevant legislative requirements.

- The required APZs are to be maintained and grasslands to be managed to reduce fuel loads.
- The landscaping for the development, including the Golf Course, is to comply with the requirements of PBP 2006 with due consideration to the following:
    - Any vegetation enhancement that falls within the identified APZ, or in the vicinity of the asset, should be provided as smaller groups of plantings or scattered plantings with discontinuous canopies to avoid a direct fire path to the property; and
    - New landscaped areas to incorporate landscaping strips less than 20 m in width, regardless of length, and not within 20 m of each other or any other areas of vegetation being classified. In vegetation enhancement areas if mass plantings contiguous with the existing threat are proposed, the APZs are to be considered from the edge of proposed planting area.
- This assessment does not deal with the level of construction or specifications for dwellings on individual lots. Separate assessments are to be undertaken at the DA stage for dwellings in future. However, as the site is in an urban release area, a Subdivision BAL Plan for the entire site may be submitted for consideration as part of the Bushfire Safety Authority process at the DA stage for residential subdivision. This would exempt future dwellings from further bushfire considerations under section 79BA of the EP&A Act and hence streamline the residential development process.
- The road network and utilities / services shall meet the fire fighting and management requirements as outlined in PBP 2006.

Appendix A

Concept Masterplan

Stage 1 Subdivision plan



STAGE 1 - SUBDIVISION PLAN (SUPER LOTS)

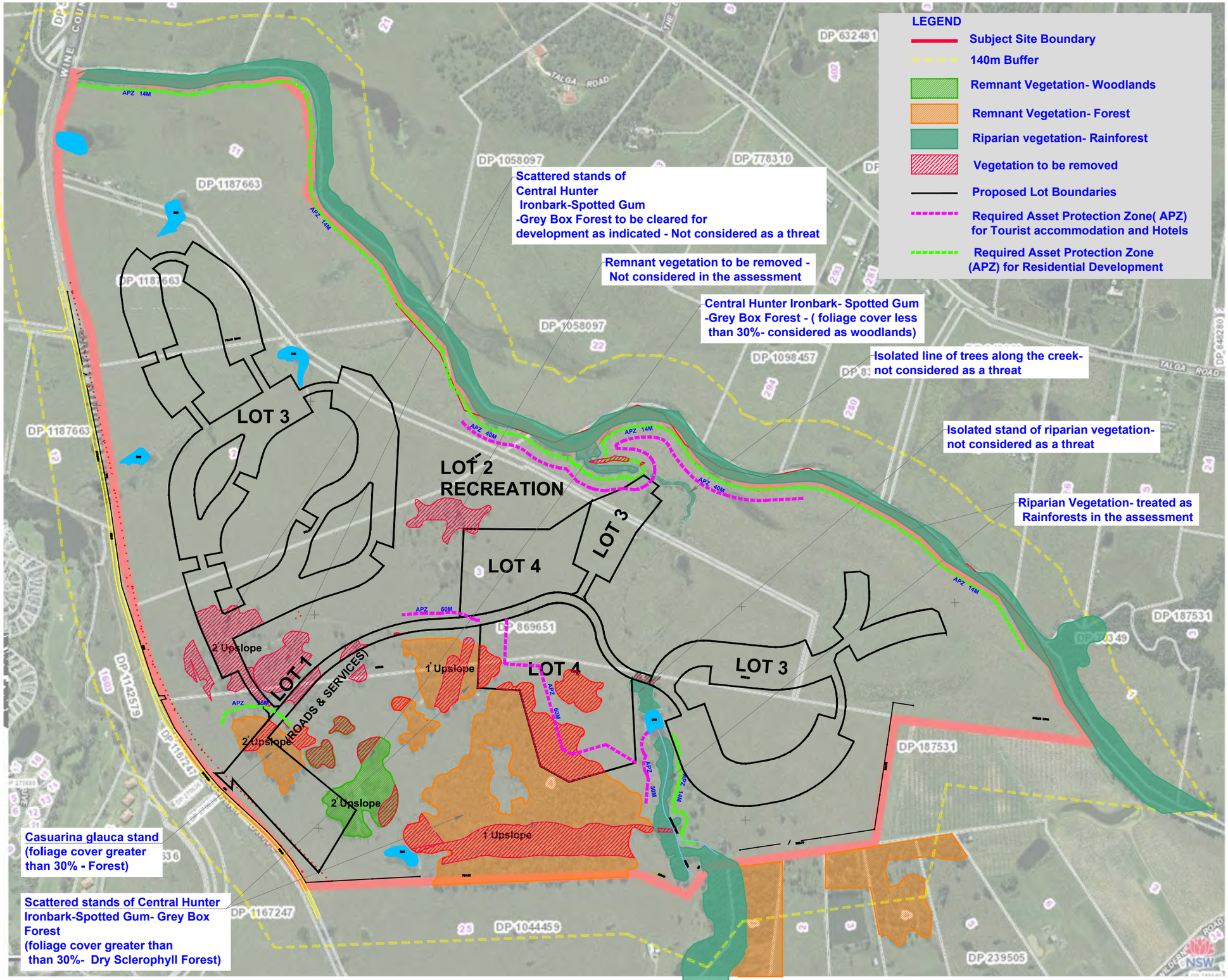
Lot 2-4 DP 869651 & Lot 11 DP 1187663
Wine Country Drive, Rothbury

44 Church Street
(PO Box 40)
Maitland 2320 NSW
www.hdb.com.au
T: 02 49336682

hdb
planning > design > development

Appendix B

Vegetation and slope analysis and the required APZ



NOTE: All dimensions, areas, lot numbers, easments & number of lots are subject to the approval of council & other authorities and the final survey & linen plan and should be considered as conceptual only. Do not rely on the information in this plan for any purchase, disposal or other matter.

N

TITLE: BUSHFIRE THREAT ASSESSMENT

PROJECT: JACK NICKLAUS GOLF COURSE OF AUSTRALIA
LOTS 2-4 DP 869651 and Lot 11 DP 1187663, WINE COUNTRY DRIVE
POKOLBIN

DWG NO: BTA 101
REV: 0
DATE: 21/03/2016
JOB No: 15/029
SCALE: NTS

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APPENDIX G

CONCEPT AND MANAGEMENT PLAN

HDB 2016

Pokolbin Tourist, Golf & Residential Development

Concept and Management Plan

Prepared By

hdb
planning > design > development

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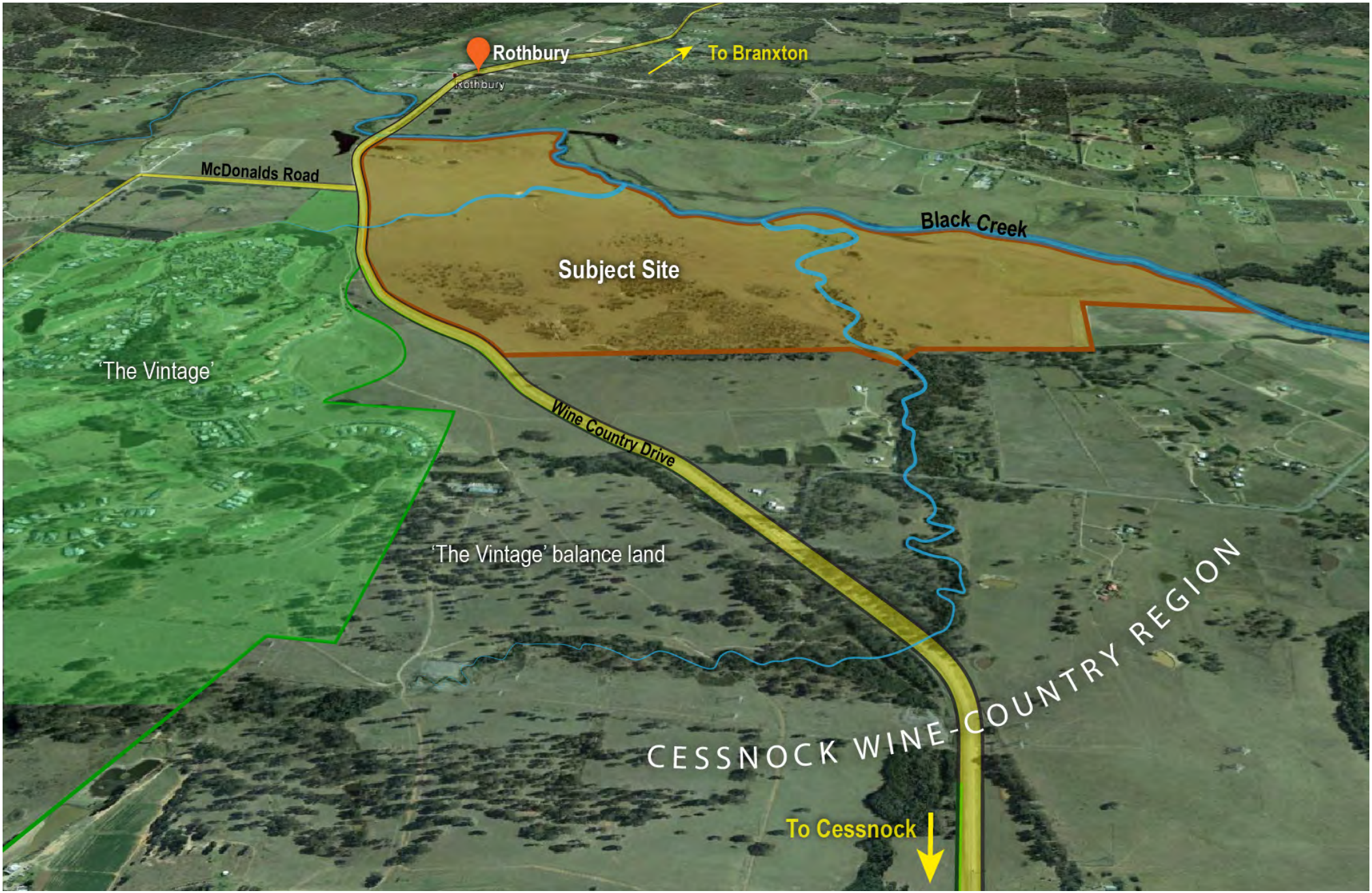

Rothbury
Rothbury
To Branxton
McDonalds Road
Black Creek
Subject Site
'The Vintage'
Wine Country Drive
'The Vintage' balance land
CESSNOCK WINE-COUNTRY REGION
To Cessnock

1. INTRODUCTION

1.1. Project Description

1.1.1 Background

The subject site was rezoned in 2014 to allow for the proposed development. The proposal was favorably supported by the Cessnock City Council on the following grounds as quoted from Cessnock City Council agenda 22 Jan 2014,

- The proposal is considered a positive tourism based use of the land on the edge of the Vineyards District that is not suitable for viticultural uses.

- The proposal will broaden the tourism appeal of the LGA to a national and international market.

- The proposals co-location next to the existing Vintage Golf development has strategic merit creating a golfing tourist destination with significant flow on benefits to the Vineyard District tourism market and the Cessnock LGA.

1.1.2 Site and Context

The irregular shaped site is formed with Lots 1 to 4 DP 869651, Wine Country Drive, Pokolbin which accounts for a total area of approximately 240 hectares.

The subject site is defined by Wine Country Drive on the West and Southwest, and on North and East from Black Creek.

The property has a history of grazing that ceased some time ago. A number of farm dams and drainage lines scattered throughout the site. No site improvements or any active land uses are associated with the site apart from a dwelling and some dilapidated sheds located in the northern section.

1.1.3 Ultimate Proposal for the site

The proposal is for an integrated tourist development, a form of development where all of the components of the development are interdependent on each other and none of them can, or should, exist alone. This form of integrated tourist development is new to the Lower Hunter Region and will include the following components:

- Eighteen (18) hole signature golf course built to international standards and associated clubhouse

- A five (5) star fifty (50) room hotel, of the Golden Bear Lodge or Hilton hotels calibre;

- Short stay tourist villas (250);

- Public function, retail and food outlet centre with the capacity for state-of-the-art conference, telecommunications, tourism programs, and interpretive centre for the locality's natural and cultural heritage, and history of the wine industry;

- Recreation and health spa, including swimming, tennis and gymnasium facilities;

- Sustainable golf course management, landscaping, bush regeneration, and environmental stewardship precincts. The site design will also enhance the public amenity of natural features adjoining Black Creek;

- Three hundred (300) long stay / permanent residences in three (3) specialised precincts, managed under Community Title regulations.

By managing the site under a Community Title scheme, the buildings and all landscaping throughout the development will conform to a set style and quality of design, integrated into and intimately associated with the golf course.

1. INTRODUCTION

1.2 Constraints

The site is constrained by several environmental and heritage related issues. The development has been designed to take each of these into account and avoid/manage the potential impacts to minimise the effects and risk.

1.2.1 Environmental

The environmental values of the site have been reviewed several times. While the site does have some environmental value, the prolonged and historic uses of the site for agricultural pursuits have impacted significantly on the site.

23 threatened fauna species and three flora species listed under the Threatened Species Conservation Act 1993 were identified with the potential to occur or of known habitat within the site by RPS. One threatened flora species, Eucalyptus glaucina was also identified on site.

Five threatened fauna species and two threatened flora species listed under the Environmental Protection and Biodiversity Conservation Act 1999 were assessed as possibly occurring on the site, or that the site supports preferred habitat for the species.

1.2.2 Flooding

The site is impacted by flooding from Black Creek. This is generally restricted to the eastern portion of the site. In certain areas of the site this includes depths of greater then 2m.

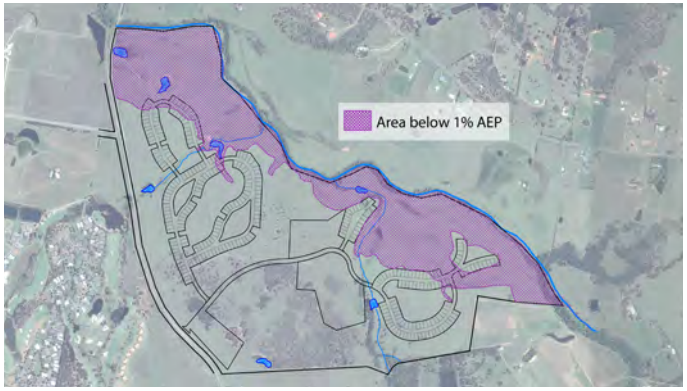
1.2.3 Bushfire

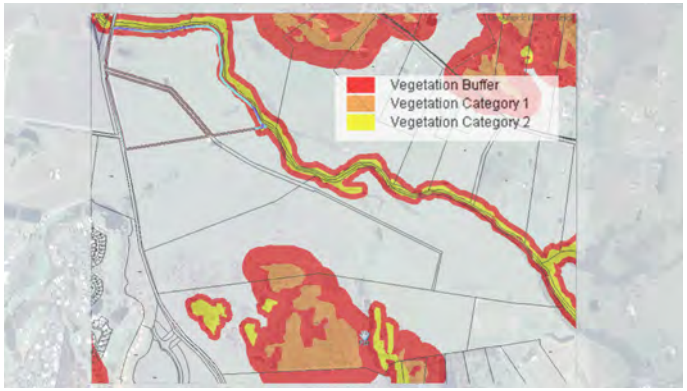
The south west part of the site together with northern and eastern boundaries are identified as bushfire prone land. The area in the south west provides the largest area of remanent vegetation. The nominated areas to the north and east correspond with the riparian vegetation. The corresponding mapping shows that the site contains Vegetation Categories 1 & 2 and bushfire buffer areas.

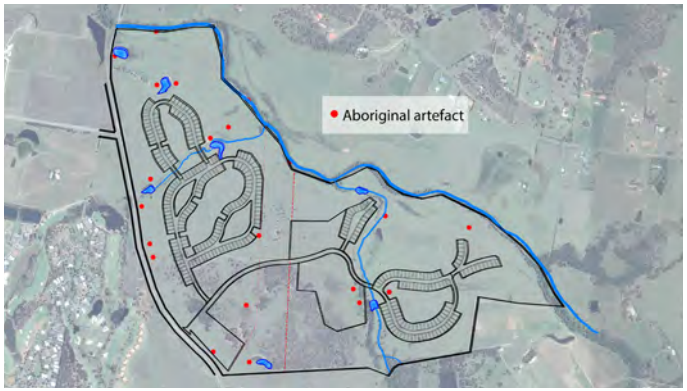
1.2.4 Aboriginal Heritage

A number of items of aboriginal cultural significance have been identified on the site. Locations of these items are spread across the site with a particular concentration through the middle area.

No items of European heritage area located on the site. A heritage item of local significance, Blick Bros. Graves at Belbourie Winery, exists on the adjoining property to the north-east.







2. VISION

2.1 Vision

Considering both on-site spatial issues and contextual setting of the locality together with expected development outcomes, it was evaluated that an 'Integrated' approach is most fitting. In this sense, site's future development is envisioned to be well-integrated both in terms of proposed land uses and activities; at the same time, complementing Lower Hunter Region's unique tourism sector to attract national and international tourists. Such development is expected to be achieved through the following vision and associated key elements,

To develop a new major tourist destination at the gateway of Vineyard District. Through the establishment of a 'World-class 18-hole signature golf course, 5-Star Resort & Architecturally Designed Residential Development' of international standards, that both brings together and drives 'top-end' accommodation and recreational facilities, within a serene rural environment of Lower Hunter Region.

2.2 Elements

- World-class, internationally renown 18-hole Golf course design.
- Centrally located 5-Star Resort complex to become the core activity area for residents, golfers and visitors.
- Three distinct residential precinct which effortlessly connect with the golf course create a unique and engaging residential offering within the Hunter Region's Wine Country.
- Integrated transportation network to suit inhabitants' convenience, mood and needs, while ensuring safe mobility.
- High quality public realm with well-linked series of formal and informal recreational spaces reflecting landscape and urban design excellence.

2.3. Deliverables

2.3.1 Integrated Tourism Development

The proposal is envisioned to be a converging point for wine-country tourism, world-class golfing activities and residential development. The tourist complex will provide both short term and long term living and as well as a board range of leisure facilities for residents and guests.

Tourist accommodation and related facilities are to match international resort standards through out. The intention is to seek to engage with the best five star hotel operators to bring international level services and facilities to the Hunter Wine region.

The proposed hotel complex will introduce a new level of luxury living serviced with 50 rooms, which will be the centerpiece that brings the accommodation and recreational components together. This will be complemented by 250 self-contained luxury villas with day spa facilities. Visitors will have a choice between conventional hotel rooms and suites as well as these luxury villas.

In addition to this, clubhouse, conference facilities, gymnasium, sporting facilities for tennis and swimming, entertainment centre and retail facilities will also be available in this complex.

2.3.2 Worldclass Golf Getaway Experience

The key component of the proposal includes an eighteen (18) hole signature golf course, which is to be built to international championship course standards. The course and associated infrastructure are intended to be developed under the banner of a brand name, ensuring both national and international recognition of the quality of the course.

The Golf Course is fundamental to the design and development of the remainder of the site, which will set the tone and speak to the architectural and landscape elements that design the site. In this regard it is envisaged that the Golf Course itself will lead the spatial development.

2.3.3 Community Living

The residential component of the development will provide for 300 dwellings of unique character with each having direct access/views of the golf course.

Each dwelling will be presented on a lot in excess of 750 sqm providing the opportunity for stately homes. The architectural style of dwellings is to reflect and complement the unique rural character of the Hunter Wine Region. All residential dwellings are to be fully-serviced and provided with ease of access to reflect on a contemporary-healthy living style.

The intended Architectural and Landscape outcomes for the residential areas, are expected to achieve design excellence within both communal and private realms through the proposed management scheme.

3. DEVELOPMENT CONTROLS

3.1. Staged Development

3.1.1. Sec.83B - Need for Staged Development Application

This application pursuant to Environmental Planning and Assessment Act 1979 (The Act), is proposed to be treated as a 'Staged Development Application' with regard to following *Sec.83B* of the Act,

Part 4, Division 2A
83B Staged development applications

(1) For the purposes of this Act, a staged development application is a development application that sets out concept proposals for the development of a site, and for which detailed proposals for separate parts of the site are to be the subject of subsequent development applications. The application may set out detailed proposals for the first stage of development.

(2) A development application is not to be treated as a staged development application unless the applicant requests it to be treated as a staged development application.

(3) If consent is granted on the determination of a staged development application, the consent does not authorise the carrying out of development on any part of the site concerned unless:

(a) consent is subsequently granted to carry out development on that part of the site following a further development application in respect of that part of the site,

or

(b) the staged development application also provided the requisite details of the development on that part of the site and consent is granted for that first stage of development without the need for further consent.

(4) The terms of a consent granted on the determination of a staged development application are to reflect the operation of subsection (3).

The Environmental Planning Instrument (Cessnock Local Environmental Plan 2011) also prescribes the need for a staging plan.

The unique set of controls that apply to this site, as an integrated tourist development making the staging of critical importance. The need to ensure that *"the total number of permanent residential dwellings (to) not exceed the total number of serviced apartments and hotel or motel accommodation units on that land used for the purposes of tourist and visitor accommodation at any time"* requires careful programing of the proposed development.

3.1.2. Stage 1

Stage 1 is proposed to create 4 super lots under a Community title subdivision, to allocate land for particular uses. Land within the proposed Lot 3 will be subdivided in future to accommodate 300 single dwelling units, while Lots 4 is intended for hotel and tourist accommodation (300) and associated sporting/recreational facilities forming the prime feature of the development.

A water treatment plant will be established on the southern most section within Lot 1. The remainder of the subject site being Lot 2 would contain the 18-hole Golf Course and regeneration of vegetation.

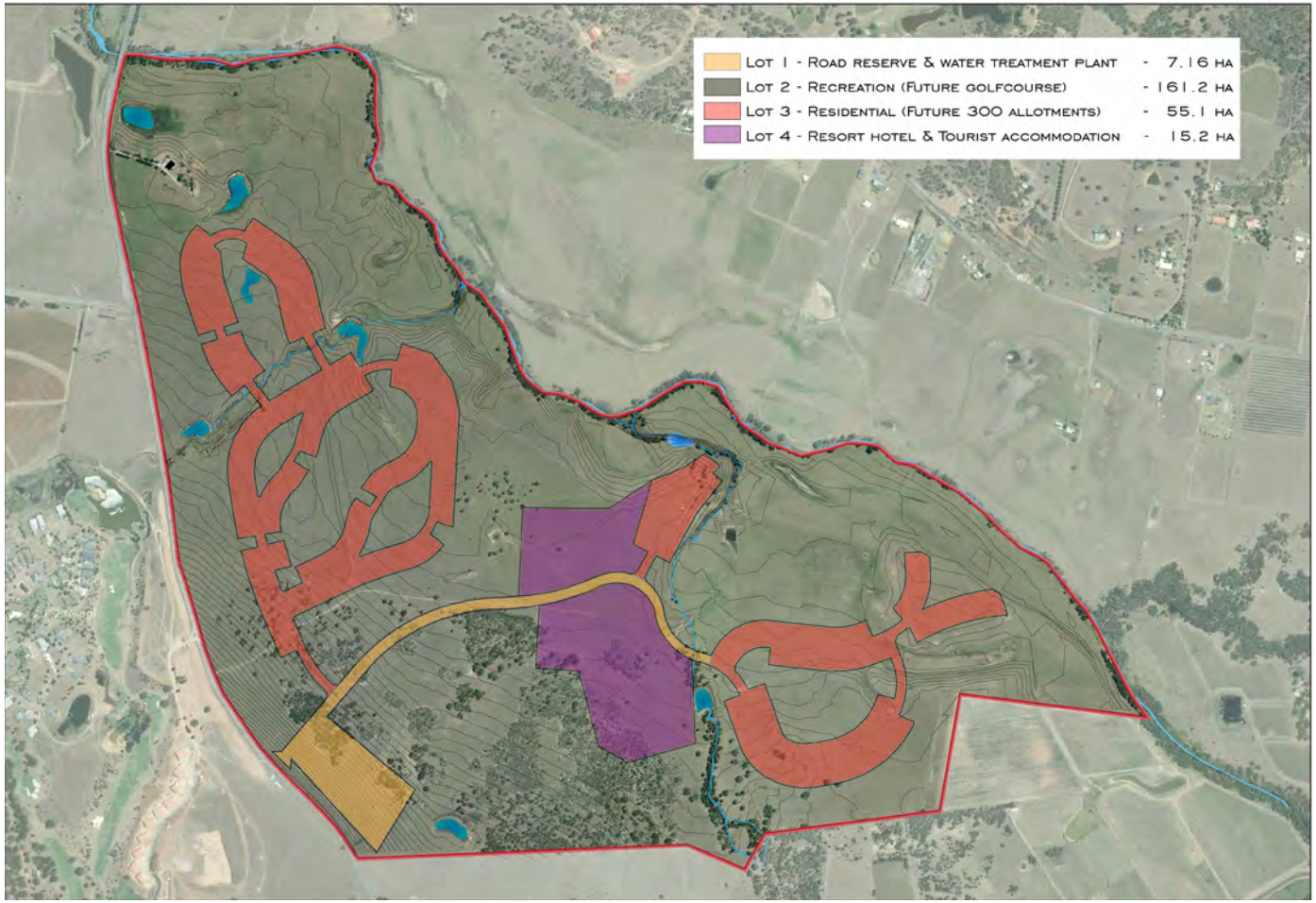
Lot 1 - 7.16ha

Lot 2 - 161.2ha

Lot 3 - 55.10ha

Lot 4 - 15.15ha

No actual works are proposed to take place on the site as lots created will not be subjected to development until further design and DAs are proposed. They are Super-lots created to define boundaries of uses for future design purposes.



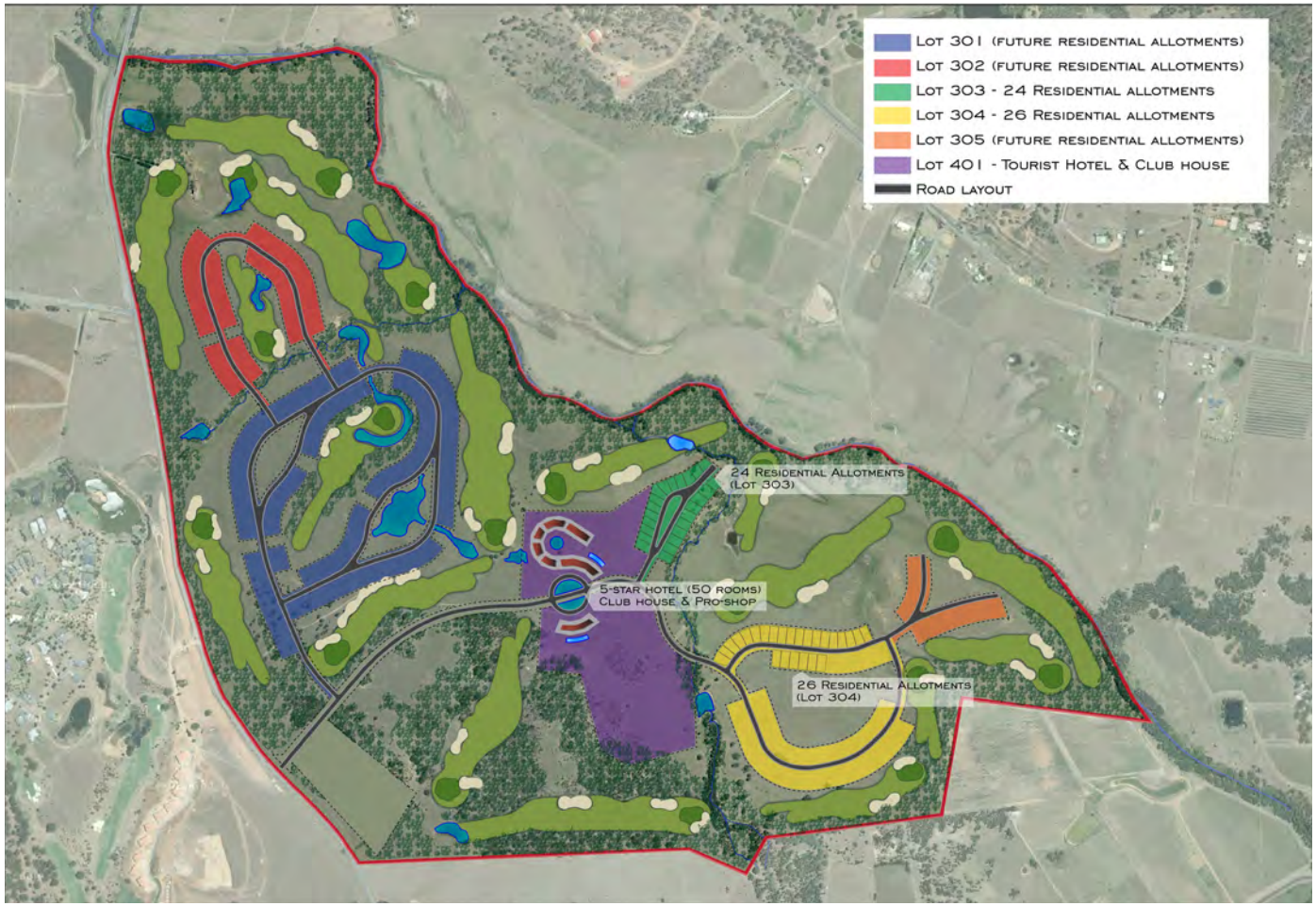
3.1.3. Stage 2

Construction of major golf course (18 holes) and Implementation of landscaping and environmental offsets.

- Install service connections to site
- Potable water
- Grey water
- Electricity
- Telecommunications
- Establish water quality control.
- Construct temporary access to Wine Country Drive.

3.1.4. Stage 3

Construction of access roads to service Lots 303, 304 & 401. Extend services to each lot. Construct 50 room 5-Star Hotel complex and support tourism infrastructure including restaurant, club room and pro shop on Lot 401. Construct 50 residential lots and dwellings, 25 on Lot 303 and 25 on Lot 304.



3.1.5. Stage 4, 5, 6 & 7

Stage 4:

Construction of 70 villa units and supporting infrastructure such as day spa, swimming pool etc on Lot 402. Construction of 70 residential lots and dwellings on Lot 304 & 305.

Stage 5:

Construction of 65 villa units and supporting infrastructure such as day spa, swimming pool etc on Lot 402. Construction of 65 residential lots and dwellings on Lot 301.

Stage 6:

Construction of 60 villa units and supporting infrastructure such as day spa, swimming pool etc. on Lot 402. Construction of 60 residential lots and dwellings on Lot 301

Stage 7:

Construction of 55 villa units and supporting infrastructure such as day spa, swimming pool etc on Lot 402. Construction of 55 residential lots and dwellings on Lot 302.

3.2. Transportation

3.2.1. Integrated Travel Network

The objective is to achieve safe passage of people and vehicles within the development, utilizing the aesthetic quality and amenity of golf courses and outdoor environments for pedestrians, cyclists and cars.

One of the key proposals in this sense, is to incorporate elements of golf course design into transportation network, which increases accessibility within the development. Buggy tracks and pathways within golf courses are to be utilized as shared accessways together with proposed sealed public roads and walking/ cycling tracks, to create an integrated mobility network.

3.2.2. Multi-modal transportation

The public road network is designed with simple pattern to facilitate safe and convenient traffic and pedestrian movements, while providing ease of access to all land use clusters and key activity areas. The general circular design ensures that users return to the point of origin ensuring easy way finding and spacial awareness.

A bus stop and turn-around will be created at the hotel. The roads will be suitable sized so that public buses, will be able to access and navigate through the site.

With sprawling areas of open space incorporating not only the golf course but large areas of landscaping, the opportunity exists for considerable pedestrian/cycling movements within the site. Potential to develop nature corridors and creek reserves as passive recreational spaces/ accessways is to be maximized with use of paved/ unpaved golf tracks as a part of the movement network.

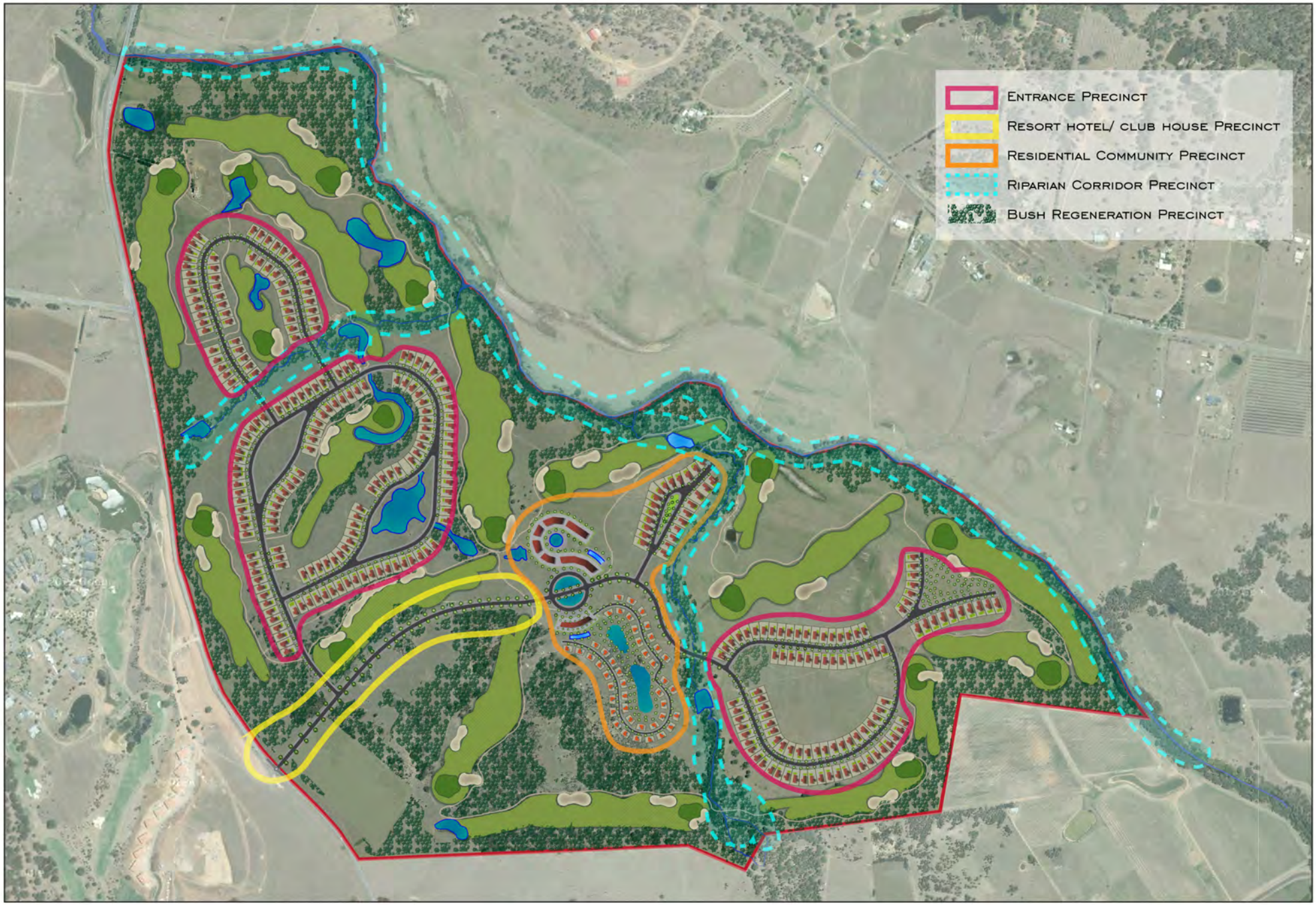
3.2.3. Vehicular Parking

Parking for the resort hotel and for ancillary tourist related facilities is to be provided in accordance with the provisions of Cessnock DCP 2011 Part C.1: Parking and Access. Bus/ coach parking facilities shall be provided as per demand at the hotel site.

Each residential allotment is to have at least two parking spaces to accommodate vehicular parking for residential purposes.

3.2.4. Proposed intersection

Access to the site is located opposite to the round-about intersection proposed for 'The Vintage' facility. This access can be connected with this proposed roundabout intersection if required. Unless funds are contributed from 'The Vintage' at this stage, it is proposed to construct a CHR/40C priority controlled intersection to the site only, in accordance with the Traffic Study.


Entrance Precinct
Resort hotel/ club house Precinct
Residential Community Precinct
Riparian Corridor Precinct
Bush Regeneration Precinct

3.3. Landscaping

3.3.1. Landscape Precincts

The main objective of landscape design is accentuating natural environmental features, while the golf course will require its own unique response (subject to further design). The remainder of the site will be landscaped in accordance with the following 5 precincts (***Figure 4.2***).

1. Entrance Precinct

The Entrance precinct must set the standard and show visitors & tourists the level of service & satisfaction that the can expect from the development. Key features for the Entrance Precinct are,

- Integrated landscape and gateway signage to respond to character of Wine Country Drive streetscape;
- Boulevard design for the main entrance passage between gateway and resort hotel;
- Termination or arrival at destination in entering the resort hotel complex;

2. Resort Hotel/ Clubhouse Precinct

Landscape design within the Resort Hotel/ Clubhouse complex, should aim to highlight the landmark quality of the building. Key landscape features for Resort Hotel Precinct are,

- Creation of openness and Enhancing the landmark quality of Resort Hotel building;
- Achieving visual links to golf courses, attractive scenery and view corridors from Resort Hotel and Clubhouse;
- Creation of human-scale spaces to facilitate outdoor recreation, movements and dining within public places;
- Facilitate convenient seating, safe passage and shade in outdoor environments;
- Creation of 'eco-friendly' environment within luxury villas catering for privacy and tranquility;

3. Residential Community Precincts (3)

Residential precincts are aimed at achieving three unique neighbourhood-type environments that form sense of place, sense of belonginess and security. Key landscape features for the residential areas should achieve,

- Safety within public spaces and roads through visible building frontages;
- Shaded roads and public spaces to sustain communal, recreational and leisure activities;
- Unique visual links to and from golf courses for cost-effective landscaping solutions for each dwelling;
- Simple and flexible landscape designs with low maintenance.
- Landscape thresholds where trucks cross roads to reduce speed environment.

Landscape plans, siting of private open spaces, balconies or courtyards within each dwelling development must reflect on these overarching features.

3.3. Landscaping

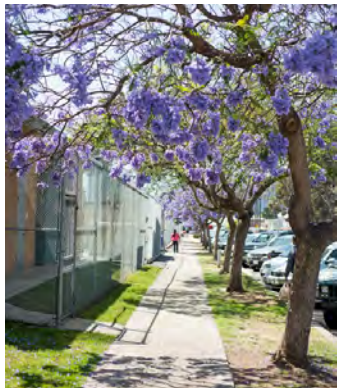
3.3.1. Landscape Precincts (cont.)

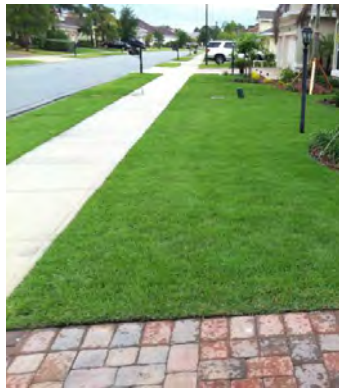
4. Riparian Corridor Precinct (Black Creek and tributaries)
This precinct is identified as a buffer area along Black Creek and its two tributaries, which require specific riparian corridor management practices as per Office of Water (NSW), and facilitating walking/ cycling pathways for integrated transport network. Landscaping strategies should include,

- Improving water-health, bank stability, ecosystem rehabilitation and biodiversity within Black Creek and its tributaries;
- Incorporating riparian corridor management measures within the design and enhancement of shared pathway;
- Facilitating safe passage, ease of access, amenity, durability and compatibility for a range of activities including cycling, jogging, walking and gathering;
- Incorporating seating, viewing decks and drinking water facilities etc. within identified locations.

5. Bush Regeneration Precinct (Tree Planting along boundaries)
Bush Regeneration is to be carried out on identified areas and buffers with the main intention of screening and ecosystem rehabilitation purposes. The subject site already contains few vegetation species including riparian vegetation that is scattered throughout. Bush regeneration is to achieve,

- Improved ecological health of on-site vegetation through replantation on identified sites;
- Planning for Bushfire Protection requirements;
- Buffering or screening-off objectives through appropriate plantation and vegetation schemes;
- A vegetation community that is native to the locality, and compliments the proposed landscape strategies, requires low-maintenance, resilient and compatible with golf course development.





3. DEVELOPMENT CONTROLS

3.4. Recreational Spaces

3.4.1. Formal Recreation

The proposed Resort Hotel complex at the heart of activities within the development, is to accommodate specific commercially viable recreational and retail facilities to cater to the needs of both resident and tourist communities. These include,

- Reception and conference facilities;
- Bar & bistro, restaurants, cafes and indoor/ outdoor dining areas;
- Entertainment and business centres;
- Tourist retail shops, shopping centres including small shops.

The primary objective of recreational spaces within these premises is to create a gradual transition between the vast open landscape of the golf courses and the indoor space of main resort building.

Recreational spaces within residential precincts are to have facilities that cater to the needs of permanent residents including,

- Community sports areas including playgrounds, kids' play areas, play-courts;
- Gathering places such as BBQs, boardwalks and seating places are also proposed as formal recreational spaces.

3.4.2. Passive Open Spaces

Large part of the proposed spatial development accounts for a continuous network of open spaces including golf courses, roads, waterways and vegetated areas. Permanent/ long term residents, tourists and visitors are expected to utilize these spaces for their passive recreational needs. In this sense,

- Proposed land uses (residential, golf courses and tourist accommodation) are to be well-linked with surrounding open spaces;
- Proposed transportation network is to utilize open spaces and golf courses to improve aesthetic quality;

Passive open spaces are also to facilitate day-to-day activities such as recreational walking, jogging, outdoor fitness, site seeing as well as community gatherings such as small events, functions and outdoor family activities.

3.5. Services

3.5.1. Stormwater Management

Stormwater run-off from the golfcourse area and sealed areas will have nutrient loads and therefore will need to be treated prior to re-use or discharge into natural watercourses.

The golfcourse will follow the principles of 'Improving the Environment Management of New South Wales Golf Courses'.

3.6.1. Electricity and gas

Preliminary consultation with Ausgrid indicates that the development is capable of being serviced from their existing resources in the area. Existing gas connections can also be extended to the site to service future development.

3.6.2. Telecommunication

National Broadband Network services are currently available in the locality and will be utilized to service the site to meet the requirements of proposed developments.

3.6.3. Potable Water

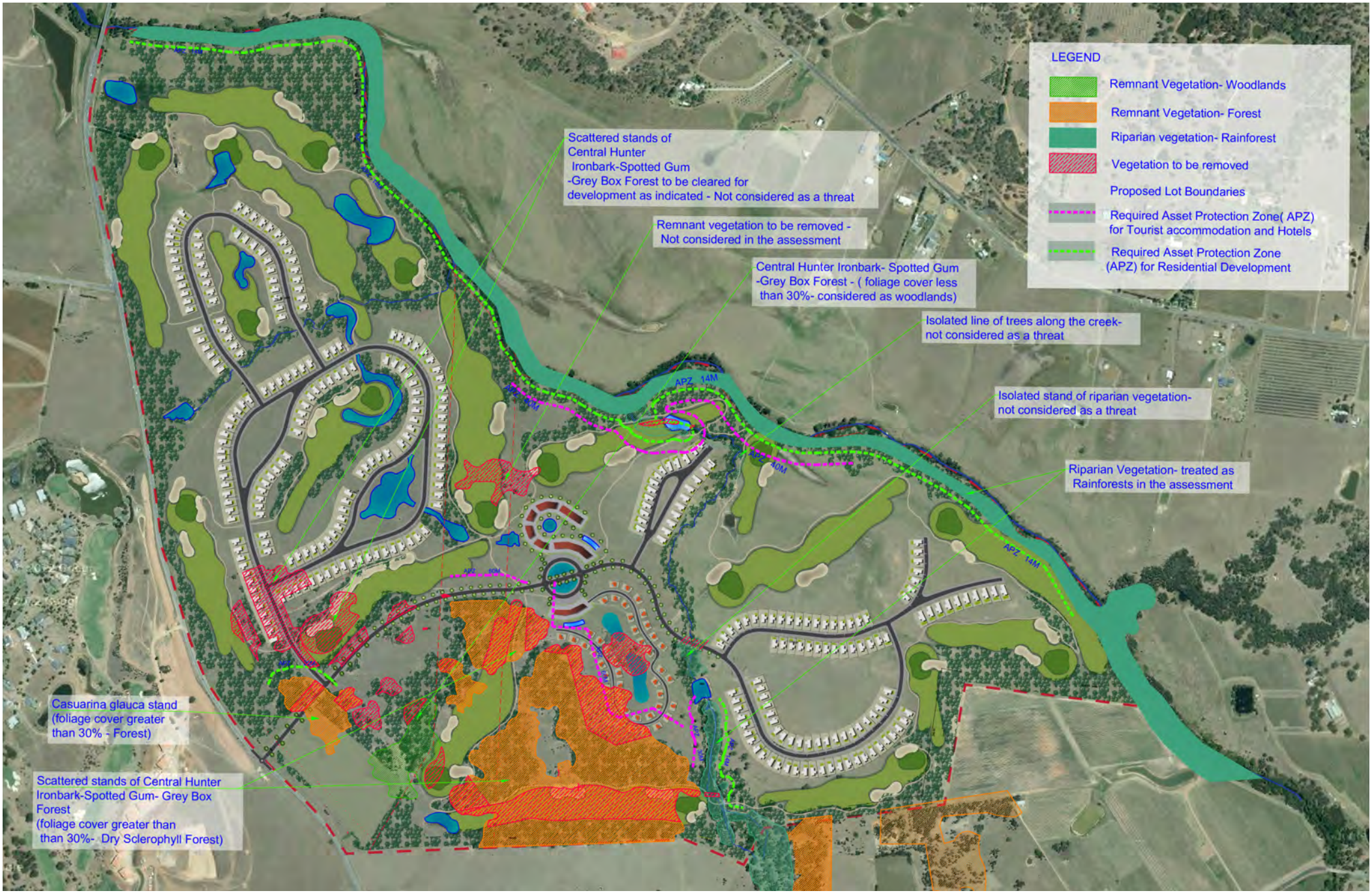
The site does not have direct access to water main from Wine Country Drive. However, existing facilities within the locality (pump station and internal services within 'The Vintage') has sufficient capacity to provide for peak usage and firefighting purposes.
Potable water supply strategies for the future development includes,

- Construction of 100mm water main to the site from existing pump station;
- Construction of a private reservoir with trickle feed from Hunter Water mains; and
- Privately owned and operated internal reticulation system.

3.6.4. Non-potable Water

Non-potable water requirements including irrigating golf courses and landscaped areas are proposed to be achieved through,
- 100 megalitres from existing Pokolbin Irrigation District License;
- 19 megalitres through on-site harvestable rights; and/ or
- 200 megalitres of recycled water that can be sourced from Cessnock Waste Water Treatment Works.

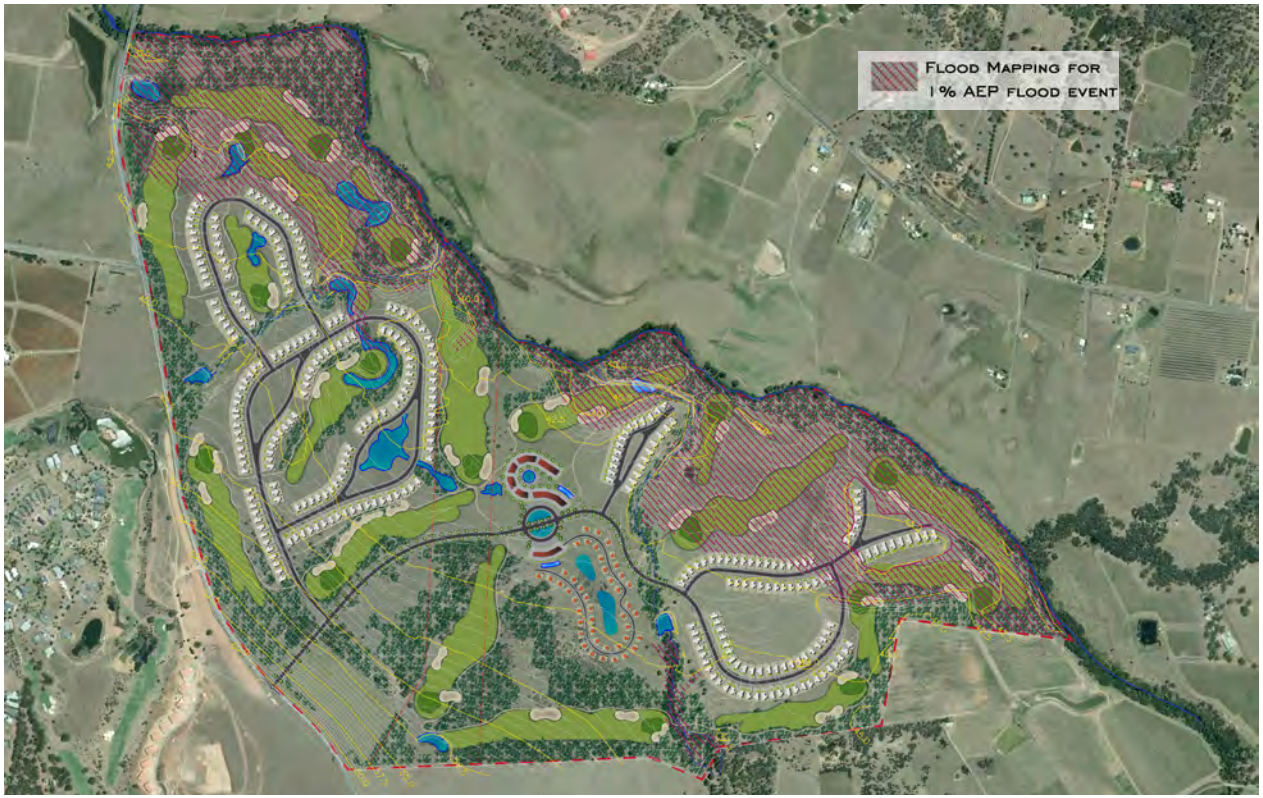
Site's non-potable water requirement is estimated at 200 megalitres.


LEGEND
Remnant Vegetation- Woodlands
Remnant Vegetation- Forest
Riparian vegetation- Rainforest
Vegetation to be removed
Proposed Lot Boundaries
Required Asset Protection Zone(APZ) for Tourist accommodation and Hotels
Required Asset Protection Zone (APZ) for Residential Development
Scattered stands of Central Hunter Ironbark-Spotted Gum -Grey Box Forest to be cleared for development as indicated - Not considered as a threat
Remnant vegetation to be removed - Not considered in the assessment
Central Hunter Ironbark- Spotted Gum -Grey Box Forest - (foliage cover less than 30%- considered as woodlands)
Isolated line of trees along the creek- not considered as a threat
Isolated stand of riparian vegetation- not considered as a threat
Riparian Vegetation- treated as Rainforests in the assessment
Casuarina glauca stand (foliage cover greater than 30% - Forest)
Scattered stands of Central Hunter Ironbark-Spotted Gum- Grey Box Forest (foliage cover greater than than 30%- Dry Sclerophyll Forest)
APZ 14M
APZ 40M
APZ 60M

3.6. Hazard and Risk Management

3.6.1. Flood Mitigation

Proposed master plan for the development is designed with due considerations to 1% AEP flood modelling. All habitable spaces proposed within the development including residential allotments, tourist accommodation and public roads meet Cessnock Council's flood planning requirements.



3.6.2. Salinity Management

Salinity levels associated with Black Creek catchment area will be managed with a Salinity Management Plan within Stage 2 of the proposed development.

3.6.3. Planning for Bushfire Protection

Bushfire Threat Assessment undertaken by HDB for the proposed development and works, determines the following for protection against potential bushfire hazard,

Lot 1 - Public roads and water treatment plant

APZ within proposed road network involves removal of vegetation on identified locations. All public roads will have widths greater than 20m and inner radii greater than 6m to allow convenient access for standard fire-fighting vehicles.

Lot 2 - Recreation

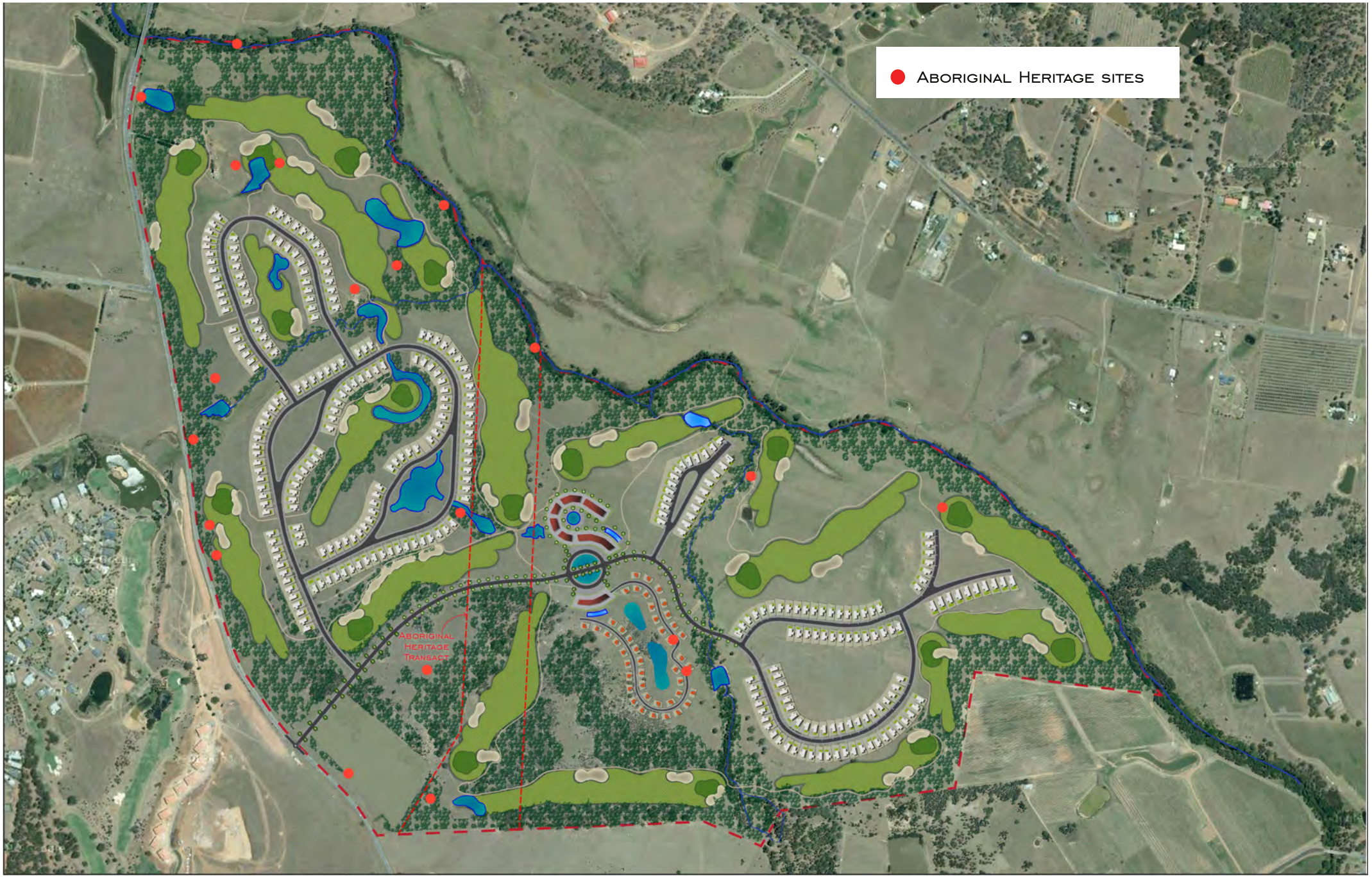
Main golf courses can be classified as modified vegetation areas with low bushfire threat. However, major riparian Vegetation along Black Creek is associate with an APZ up to 40m, within which all replantation and landscaping must comply with PBP criteria.

Lot 3 - Residential allotments

14-25m setbacks (APZ) between buildings and vegetation assemblages on certain locations within proposed Lot 3 (future residential) to achieve fire safety levels equivalent to BAL 29. All residential allotments have direct access from public roads to facilitate fire fighting purposes.

Lot 4 - Resort hotel and Luxury Villas

Resort hotel complex and luxury villas precinct are considered under 'Special Fire Protection Purpose Developments' category, to provide for larger APZ. Hence, APZ within these precincts are determined up to 60m setback distance from vegetation assemblages towards south and south-west.


Aboriginal Heritage sites
Aboriginal Heritage Transact

3. DEVELOPMENT CONTROLS

3.7. Heritage Management

The identified Aboriginal Heritage sites are proposed to be separated from all development and works. Additionally, a transect across North-south the site is also been excluded from development.

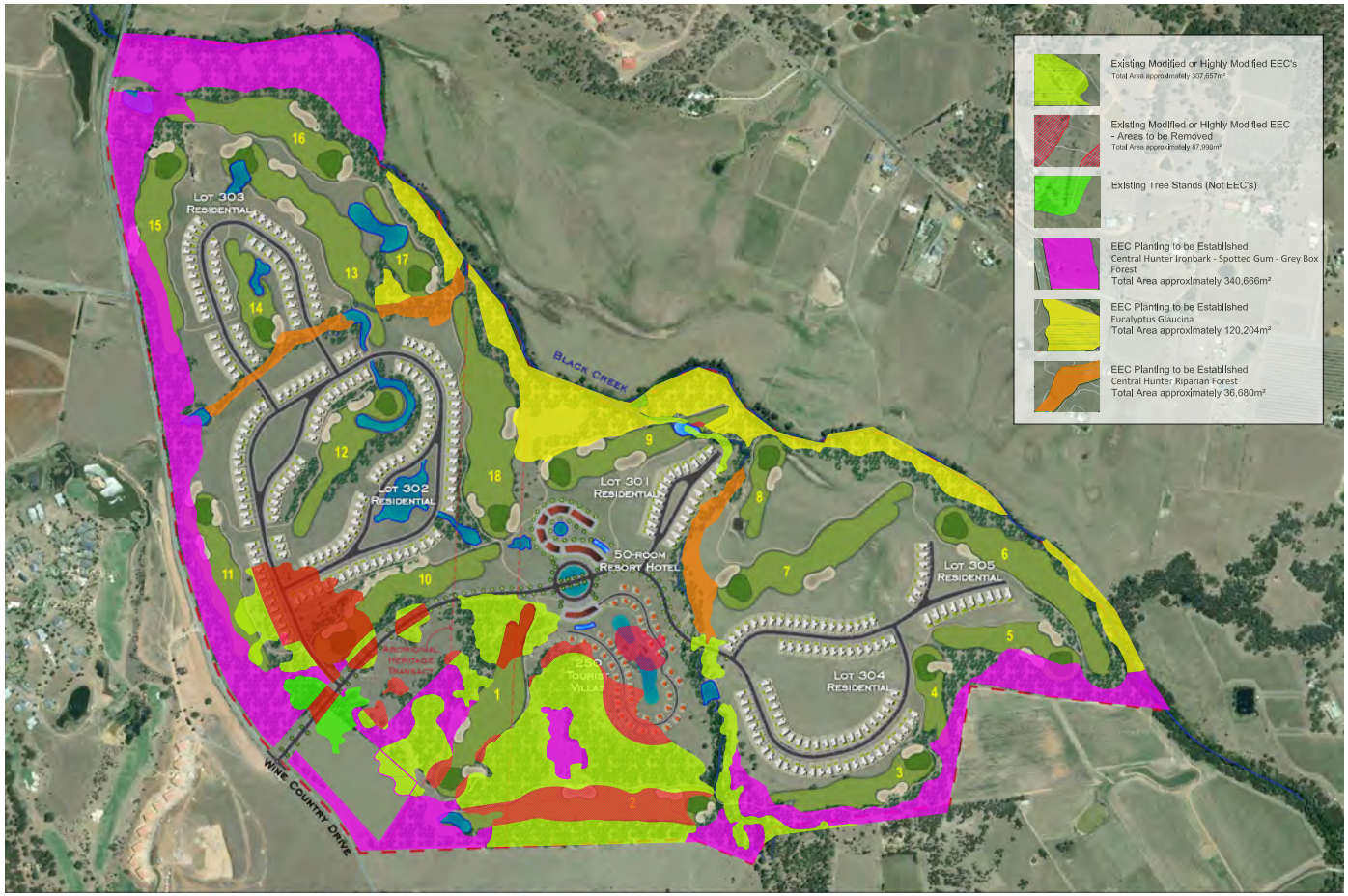
A draft Cultural Heritage Management Plan is been prepared and currently under review by the local Aboriginal Land Council. Further consultation and agreements with Aboriginal parties are also currently taking place with regard to Aboriginal Heritage Management.

3.8. Flora and Fauna protection

Flora and Fauna Assessments carried out by RPS and later addendum by MJD categorized the on-site remnant patches of vegetation to be in 'Moderate' condition habitat for potential EEC. A number of recommendations were provided by RPS regarding the protection of site's ecological value.

As a result, formal request for consultation and advice is made to The Department of Environment with regard to proposed vegetation removal on subsequent stages of the development.

On-site planting is proposed as a main strategy in off-setting vegetation removal and bush regeneration. A significant part of the site will be planted with native local species. These include planting along site boundaries for screening/ fencing purposes and along riparian corridors for bush regeneration purposes. All planting schemes are subject to detail design and approvals in subsequent stages of the development.



4. DESIGN CONCEPT

4.1. Worldclass Golf course

4.1.2. Golf course Design

The Golf Course is fundamental to the design and development of the remainder of the site. The design concept is predicated on the golf course setting in terms of standards of finish, landscape quality and aesthetics. In this regard it is a fundamental that the course is designed by a widely recognized brand name. It is intended that the course would be of international championship golf standards, thereby, attracting golfers, tourists from across the globe and provide the opportunity for course to host national and international level events.

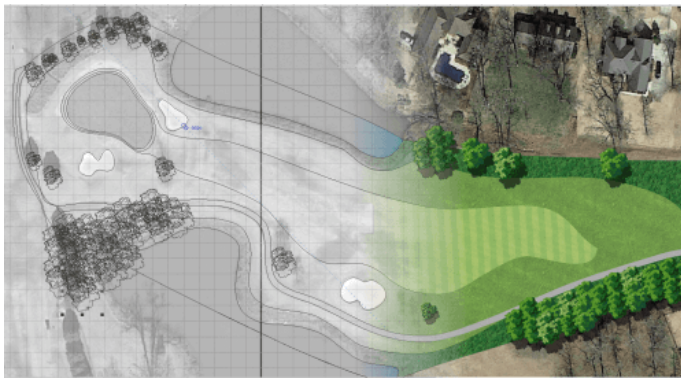
The course is adopt a design philosophy of *enhancing the natural environment, and creating courses that are both challenging and enjoyable*.

- Blend in with residential areas and tourist facilities to form a pristine landscape that stimulate overall spatial development;

- Incorporate on-site natural features and cultural assets within the design to create unique courses (tees, fairways, roughs, hazards and greens etc.), both visually appealing and challenging to stroke play;

- Enhance the amenity and aesthetic quality of out-door public and semi-public spaces;

- Be of a standard so as to attract national and international



4.2. Resort Hotel Complex

4.2.1. 5-Star Resort Hotel

A 5-Star hotel complex of Golden Bear Lodge or Hilton Hotels calibre is to act as the central core of activities within the development. The Resort Hotel complex is proposed to contain,

- Golf course clubhouse building with ancillary retail;
- 5-Star rated resort hotel complex with a maximum number of 300 units of tourist and visitor accommodation;
- Communal spaces such as function centre, day spa and recreational facilities, with ancillary retail;

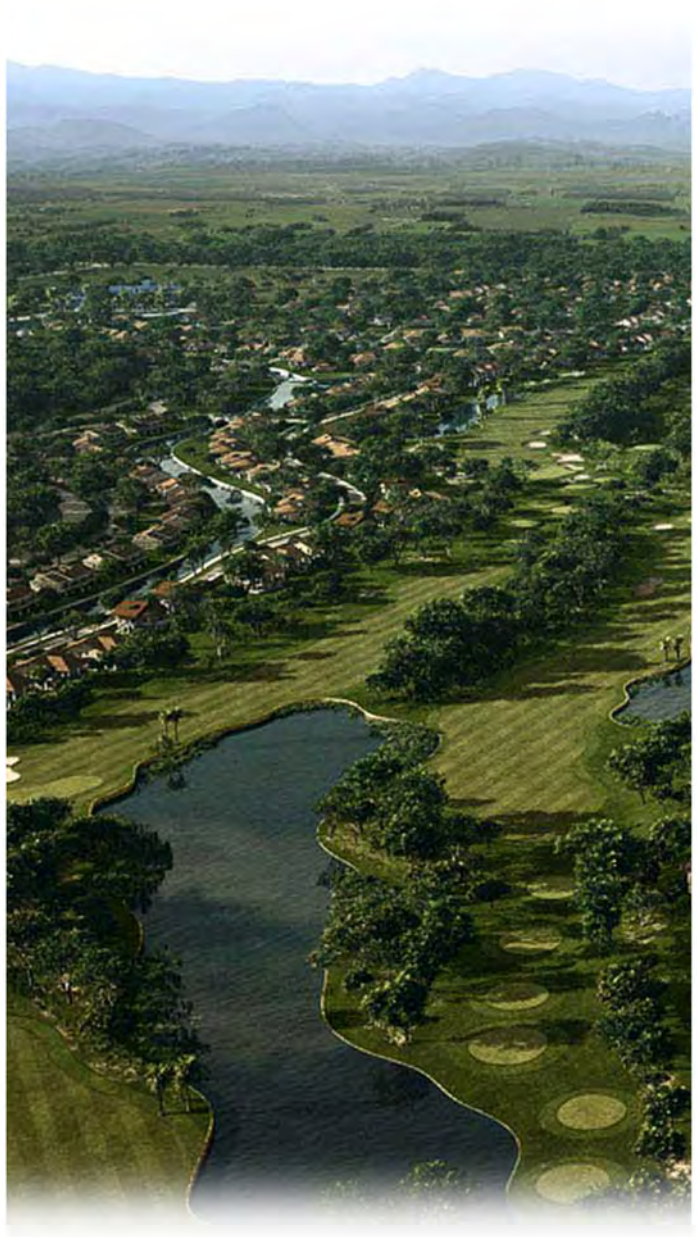
The resort hotel complex may provide varying types of accommodation facilities including conventional in-house hotel rooms and suites (50), as well as apartments and 1-or-2-bedroom villas (250), thus catering both short and medium stay needs for a range of user groups.

The hotel complex (with its retail, communal and entertainment facilities) is envisioned as the 'Activity Core' for the development. The activity core is centrally located, well-linked with formal and informal access ways, and designed as an architectural landmark in providing sense of direction within the development.

4.2.2. Building Design

Resort Hotel plays a crucial role as the main 'Physical element' of the development that brings the tourism component together. Hence, the architectural design for Resort Hotel building is envisaged to be of a landmark qualify overlooking the golf-course and visible from specific viewpoints within the subject site. Both architectural design of the building and landscape design of surrounding spaces and golf courses should respond to this prominent statement of the resort hotel. Building design should also stimulate ancillary communal and retail spaces, with a strong focus on facilitating a range of activities.

Short stay tourist villas are proposed in the vicinity of the hotel complex, which are also to respond to the landscape vision of the golf course and to the architectural theme of the resort hotel complex.



4.3. Tourist Villas

4.3.1. Play-and-stay accommodation

Short-term accommodation component in addition to the 50-rooms of the proposed resort hotel, is provided with self-contained villas and day-spa facilities up to a capacity of 250 units. Villas and day-spas are proposed to be sited within the 'central activity core', yet, intentionally separated from crowded and busy areas, to create an enclosed tranquil environment. Each luxury villa is to achieve,

- Self-contained unit, fully furnished and serviced to accommodate a range of visitors;
- Close association with golf activities and day-spa facilities;
- Relaxed environment and healthy-living style as an escape from city-life;

Day-spas are to have typical facilities such as remedial treatments, massages, relaxation and aromatherapy, meditation, yoga etc to cater to the needs of regular golfers and permanent/ long-term residents.

4.3.2. Villa Design

Primary objective of the design of each villa and day-spa unit is to form a distinct environment, which is enclosed and creates a strong sense of tranquility and eco-friendly living. Landscape designing should aim at achieving a distinct environment with special emphasis on creating an enclosed precinct. Vegetation and plant schemes should define and guide the spatial design within the precinct, utilizing plant schemes that are native to the site.

Architectural designs for buildings should respond to this landscape setting with emphasis on creating an eco-friendly sense within each unit. In this sense, the use of materials and colors should enhance each unit's relationship with natural environment. At the same time, developments should reflect on identified needs of a wide range of visitors.

4.4. Residential

4.4.1. Three distinct communities

Residential component within the proposal is to have a specific themed development in identified three different precincts as shown in ***Figure 3.4***. Each precinct is aimed at achieving unique residential quality with a sense of place and belonging, that contributes to forming a community. Permanent residential component is to achieve;

- A maximum number of 300 dwellings/ lots each with an average lot size of 750m^2;
- Great visual access to golf courses for aesthetic quality and recreational needs;
- Direct access to public road network;

The residential development is expected to be offered for sale with completed dwellings, where no lots will be offered for sale as vacant undeveloped land. Only one dwelling will be allowed on each allotment. Dwelling construction is to be managed by the developer to a high-quality standard that will align with a common theme of the resort resulting in a premium built environment. Residential flat buildings, attached and semi-attached dwellings are to be specifically excluded.

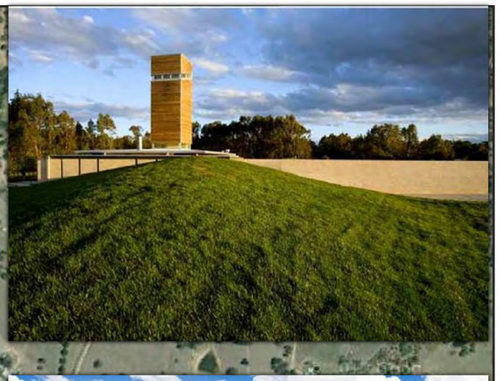
The development will also have an overarching Community Title Plan, which will ensure the ongoing maintenance of the development.

4.4.2. Dwelling design

Individual dwellings are to be designed and managed within a themed development that reflects top-end golf-acreage living. The dwelling design is to consist of,

- A contemporary architectural style and building form that make a unique statement, yet, does not dominate surrounding landscape;
- Modern living areas with solar comfort and thermal efficiency responding to winter and summer seasons;
- Openings looking into pristine landscapes and scenery of golf courses, water features and vast open spaces;
- Active street frontages through appropriate siting and orientation of habitable spaces, verandahs or balconies;
-Separate landscape plans that address APZ requirements as well as surrounding landscape quality;
- Materials, colours and architectural details that complements the predominant greenery.

All dwellings will have a maximum building height of 12m/ 2-storey, while tourist villas and day spa buildings will have...



16
15
13
17
14
12
18
9
8
7
6
5
4
3
2
1
11
10

LOT 303
RESIDENTIAL

BLACK CREEK

LOT 302
RESIDENTIAL

LOT 301
RESIDENTIAL

50-ROOM
RESORT HOTEL

LOT 305
RESIDENTIAL

ABORIGINAL
HERITAGE
TRANSACT

250
TOURIST
VILLAS

LOT 304
RESIDENTIAL

WINE COUNTRY DRIVE

CONCEPT MASTERPLAN - POKOLBIN TOURIST, GOLF & RESIDENTIAL DEVELOPMENT

LOT 2-4 DP 869651 & LOT 11 DP 1187663
WINE COUNTRY DRIVE, ROTHBURY

44 CHURCH STREET
(PO BOX 40)
MAITLAND 2320 NSW
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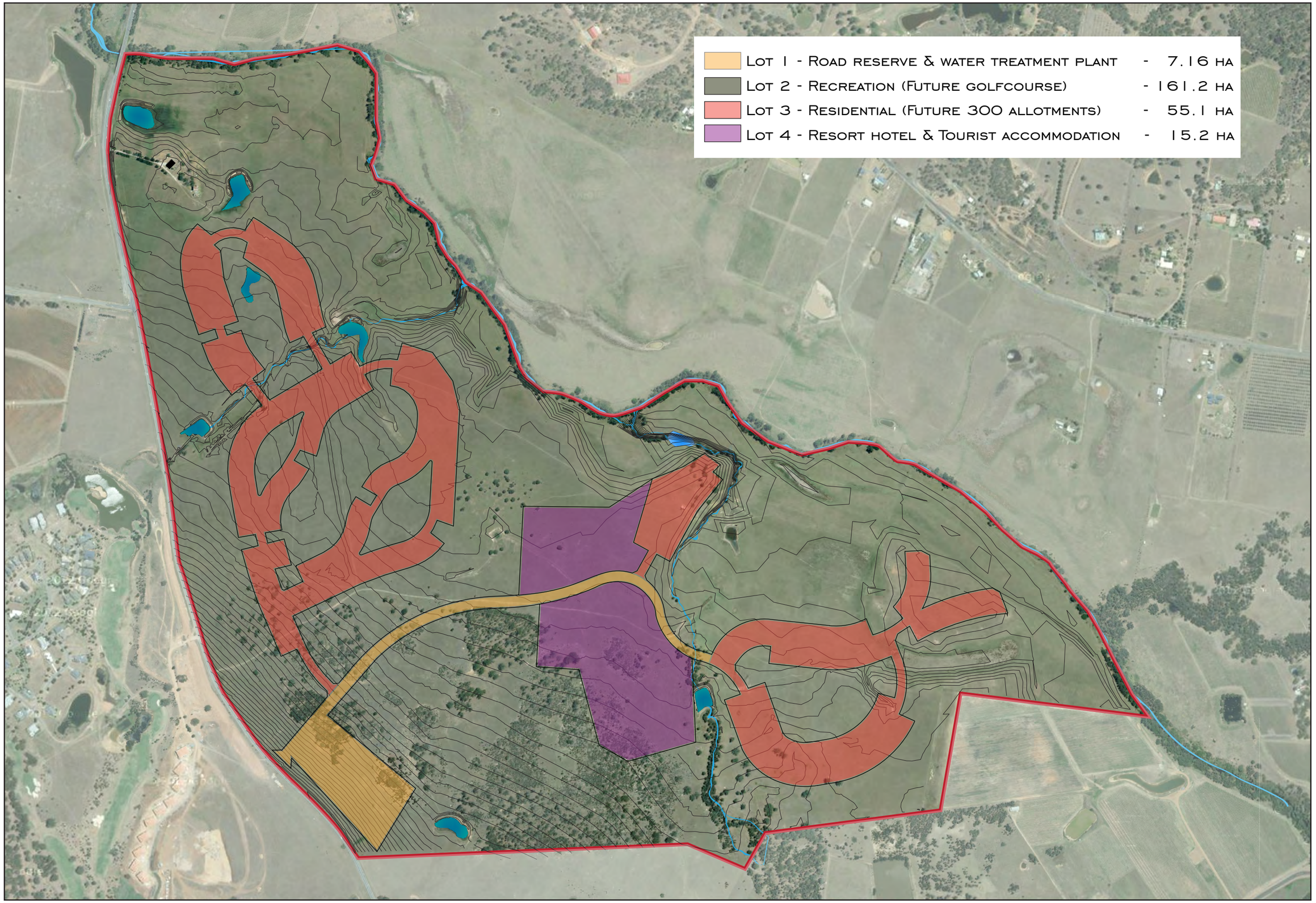
APPENDIX H

STAGE 1 SUBDIVISION PLAN

HDB 2016



STAGE 1 - SUBDIVISION PLAN (SUPER LOTS)

Lot 2-4 DP 869651 & Lot 11 DP 1187663
Wine Country Drive, Rothbury

44 Church Street
(PO Box 40)
Maitland 2320 NSW
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NOTE: ALL DIMENSIONS, AREAS, LOT NUMBERS EASEMENTS & NUMBER OF LOTS ARE SUBJECT TO THE APPROVAL OF COUNCIL & OTHER AUTHORITIES AND TO THE FINAL SURVEY & LINEN PLAN AND SHOULD BE CONSIDERED AS CONCEPTUAL ONLY. DO NOT RELY ON THE INFORMATION IN THIS PLAN FOR ANY PURCHASE, DISPOSAL OR OTHER MATTER.

M.G.A. NORTH

Talga Road

RESERVE ROAD 20.115 WIDE
TO BE CLOSED

Black

Wine

Country

Drive

Creek

RESERVE ROAD 10.06 WIDE
TO BE CLOSED

Pt 3
Pt 2
Pt 3
35.904Ha
Total
Pt 2
(21.718Ha)
Pt 3
(2.764Ha)
(5.081Ha)
4
15.142Ha
Total
(10.061Ha)
Pt 3
Pt 2
(11.422Ha)
2
186.202Ha
Total
Road Widening
0.294Ha
1
7.083Ha

Proposed Plan of Subdivision
Lot 11 DP 1187663 & Lot 2 - 4 DP 869651
Wine Country Drive
Lovedale

Drawn: AOB
Date 19/7/2016
HDB Job No. 15/029
Scale: 1:10000 @ A3

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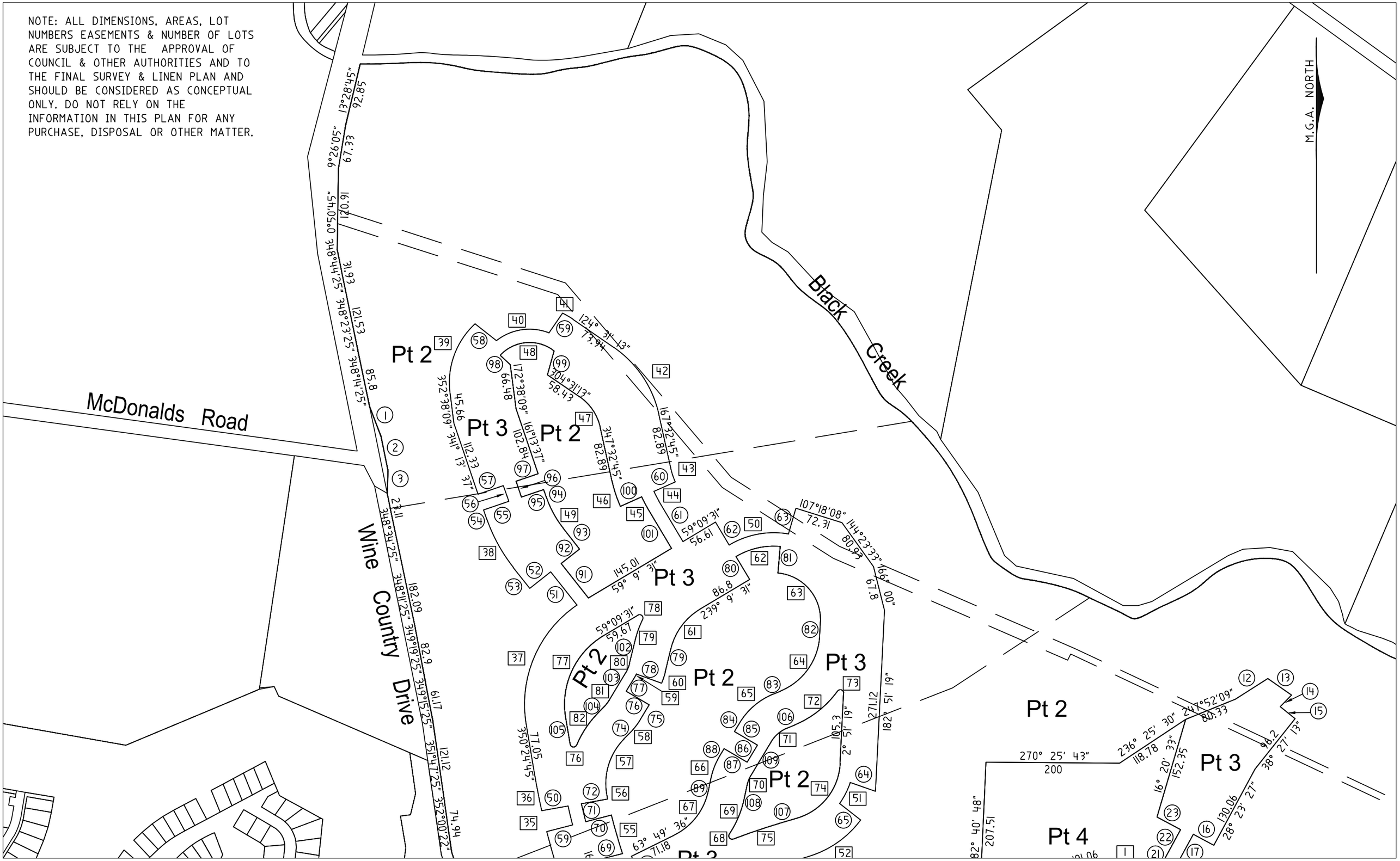

Drawn: AOB
Date 19/7/2016
HDB Job No. 15/029
Scale: 1:5000 @ A3

Proposed Plan of Subdivision
Lot 11 DP 1187663 & Lot 2 - 4 DP 869651
Wine Country Drive, Rothbury
Sheet 2 of 5

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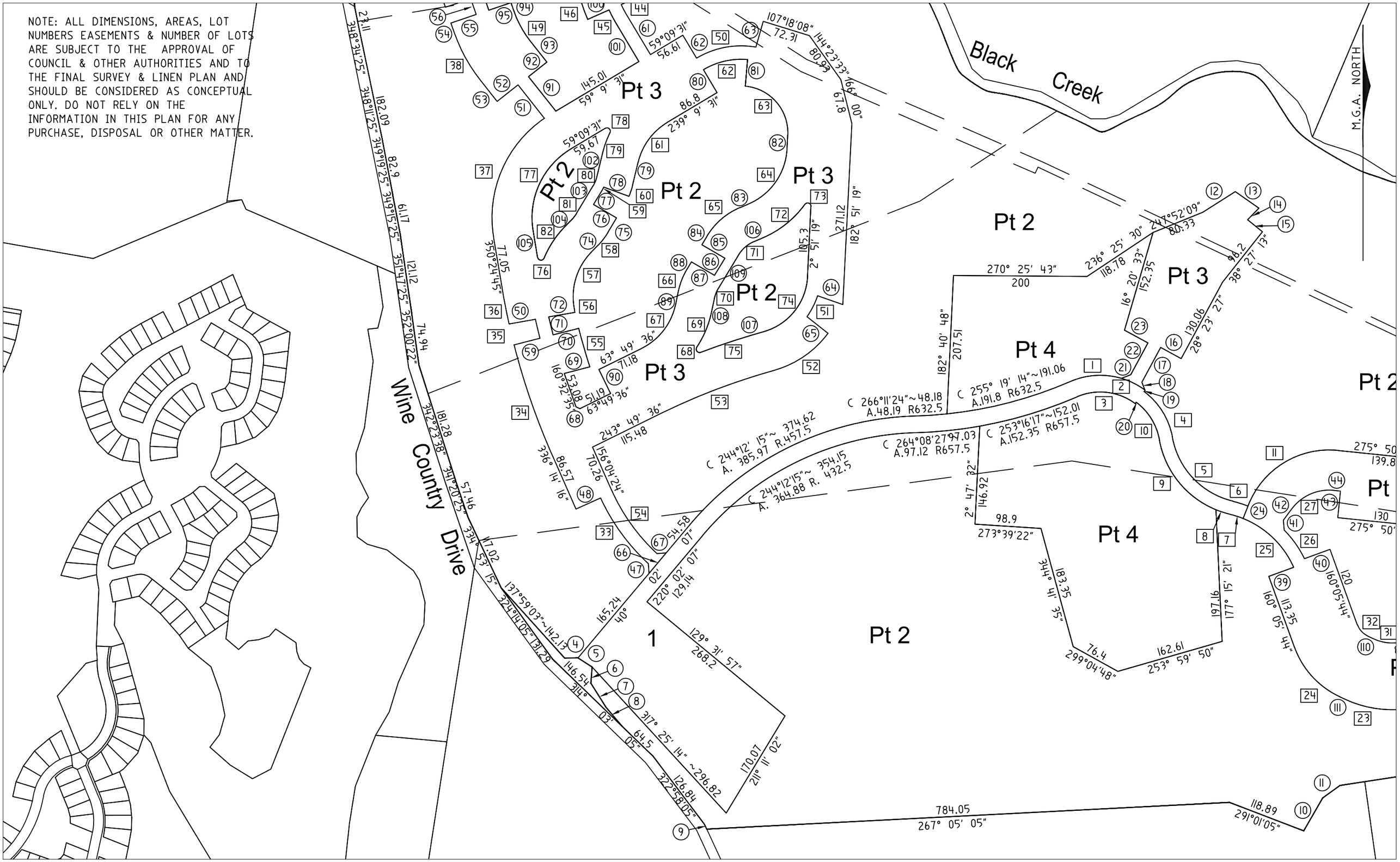

Drawn: AOB
Date 19/7/2016
HDB Job No. 15/029
Scale: 1:5000 @ A3

Proposed Plan of Subdivision
Lot 11 DP 1187663 & Lot 2 - 4 DP 869651
Wine Country Drive, Rothbury
Sheet 3 of 5

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M.G.A. NORTH

Black Creek

Pt 2
Pt 3
Pt 4

Proposed Plan of Subdivision
Lot 11 DP 1187663 & Lot 2 - 4 DP 869651
Wine Country Drive, Rothbury
Sheet 4 of 5

Drawn: AOB
Date 19/7/2016
HDB Job No. 15/029
Scale: 1:5000 @ A3

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Short Line Table

	Bearing	Distance
1	339° 13' 45"	49.63
2	348° 34' 25"	52.18
3	2° 12' 15"	33.31
4	89° 30' 58"	20.28
5	302° 52' 14"	25.2
6	3° 58' 28"	24.11
7	327° 54' 48"	42.74
8	319° 46' 32"	37.88
9	334° 46' 25"	7.77
10	210° 02' 05"	57.14
11	234° 16' 05"	31.94
12	237°35'53"	57.65
13	304° 56' 4"	43.15
14	44° 5' 38"	24.23
15	308° 55' 37"	28.58
16	118° 23' 27"	35
17	28° 23' 27"	59
18	339° 3' 16"	13.03
19	36° 40' 32"	2.5
20	216° 40' 32"	2.5
21	68° 37' 34"	15.27
22	28° 23' 27"	54.09
23	298° 23' 27"	40
24	201° 51' 53"	20
25	246° 54' 1"	17.88
26	337° 10' 11"	40.69
27	249° 2' 8"	25.76
28	139° 46' 24"	35.15
29	177° 4' 1"	50.34
30	267° 4' 1"	36.48
31	297° 22' 33"	21.45
32	357° 4' 1"	39.52
33	297° 22' 33"	17.5
34	339° 2' 8"	51.98
35	152° 15' 49"	40.03
36	19° 50' 57"	15.18
37	339° 13' 38"	44.85
38	294° 19' 9"	40
39	250° 5' 44"	39.65
40	70° 5' 44"	40.86
41	175° 9' 27"	14.95
42	216° 47' 59"	20.99
43	5° 50' 5"	40
44	275° 50' 5"	9.81
45	249° 2' 8"	43.68
46	105° 27' 19"	40
47	355° 52' 23"	14.35
48	245° 54' 40"	40.25
49	75° 41' 57"	40
50	260° 3' 9"	40.04
51	321° 42' 27"	63.58
52	231° 42' 27"	40
53	321° 42' 27"	39.7
54	340° 39' 7"	14.95
55	71° 13' 37"	40
56	340° 57' 47"	25
57	251° 13' 37"	40
58	128° 14' 31"	40.76
59	34° 31' 13"	35.65
60	245° 57' 3"	35
61	149° 9' 31"	70.27
62	149° 9' 31"	40
63	16° 8' 26"	40.29
64	289° 14' 33"	40.15
65	128° 18' 3"	40.03
67	85° 55' 51"	13.92
66	220° 2' 7"	40
68	114° 13' 55"	6.37
69	255° 41' 57"	39.72
70	75° 41' 57"	39.79
71	166° 21' 17"	27.66
72	260° 3' 9"	39.91
73	347° 15' 51"	2.64
74	224° 25' 14"	14.1
75	211° 7' 47"	25.83
76	120° 22' 28"	39.97
77	211° 2' 24"	23.17
78	290° 0' 2"	40.1
79	193° 38' 16"	36.02
80	149° 9' 31"	40
81	4° 58' 43"	40
82	2° 51' 19"	20.54
83	67° 23' 49"	12.87
84	31° 7' 47"	15.15
85	300° 22' 28"	40
86	31° 7' 47"	30
87	120° 22' 28"	40
88	31° 7' 47"	13.08
89	11° 47' 52"	20.32
90	333° 49' 36"	40
91	141° 42' 27"	64.36
92	231° 42' 27"	35
93	141° 42' 27"	39.7
94	160° 39' 7"	13.99
95	71° 13' 37"	35
96	160° 57' 39"	25
97	251° 13' 37"	35
98	133° 7' 8"	20.71
99	15° 30' 7"	37.02
100	245° 57' 3"	35
101	329° 9' 31"	70.27
102	193° 38' 16"	36.02
103	211° 7' 47"	48.47
104	44° 25' 14"	14.1
105	350° 24' 45"	40.34
106	247° 23' 49"	12.87
107	73° 34' 50"	21.13
108	191° 47' 52"	20.32
109	211° 7' 47"	58.23
110	114° 33' 36"	9.23
111	114° 33' 36"	9.23

Curve Table

	Bearing	Distance	Arc	Radius
1	266° 28' 26"	~76.37	77.91	112.5
2	296° 29' 42"	~39.77	39.98	112.5
3	276° 39' 16"	~87.56	91.69	87.5
4	328° 13' 14"	80.79	82.73	110
5	316° 32' 39"	131.49	139.16	120
6	287° 35' 38"	23.83	23.85	160
7	107° 35' 38"	20.85	20.87	140
8	107° 47' 40"	21.83	21.85	140
9	141° 0' 57"	134.68	140.5	140
10	148° 13' 14"	66.1	67.69	90
11	238° 19' 23"	158.32	170.22	130
12	262° 26' 6"	69.52	70.16	150
13	237° 6' 58"	57.83	58.25	140
14	200° 21' 60"	83.06	85.40	105
15	13° 29' 23"	90.47	91.72	105
16	253° 13' 52"	175.09	175.81	560
17	72° 34' 35"	218.98	220.77	500
18	59° 38' 4"	8.78	8.83	23.42
19	53° 45' 16"	27.48	27.51	160
20	357° 20' 29"	99.49	101.17	160
21	20° 1' 51"	33.5	33.54	210
22	52° 21' 30"	233.18	242.58	250
23	97° 21' 29"	100.55	102.08	170
24	135° 27' 10"	109.19	103.32	130
25	133° 56' 28"	105.23	107.88	140
26	144° 43' 22"	52.36	52.59	160
27	246° 19' 2"	68.98	72.12	70
28	262° 26' 6"	115.87	116.93	250
29	357° 20' 29"	87.05	88.52	140
30	47° 48' 21"	160.53	169.39	150
31	97° 21' 29"	41.4	42.03	70
32	137° 19' 40"	23.22	23..84	30
33	143° 56' 47"	121.76	122.55	310.78
34	160° 53' 11"	176.2	176.4	1050
35	166° 31' 38"	29.19	29.19	1010
36	168° 56' 7"	54.14	54.15	1050
37	203° 3' 21"	194.19	205.10	180
38	151° 10' 47"	82.29	82.66	250
39	199° 56' 8"	110.07	114.35	120
40	261° 35' 58"	79.51	83.21	80
41	299° 58' 34"	18.22	18.24	115
42	326° 1' 59"	121.01	123.9	165
43	341° 44' 54"	21.21	21.25	105
44	332° 33' 17"	16.59	16.6	140
45	152° 33' 17"	18.96	18.97	160
46	161° 44' 54"	39.39	39.46	195
47	146° 1' 59"	55.01	56.32	75
48	85° 24' 42"	80.9	85.24	60
49	331° 10' 47"	51.02	51.25	155
50	259° 28' 50"	90.3	91.22	130
50	259° 28' 50"	90.3	91.22	130
51	26° 33' 58"	35.13	35.28	110
52	55° 0' 26"	95.56	97.25	150
53	69° 16' 2"	182.59	161.72	950
54	324° 26' 38"	116.92	117.72	290
55	163° 53' 19"	60.03	60.04	950
56	167° 15' 51"	2.64	2.64	950
57	195° 52' 55"	90.77	94.64	95
58	217° 46' 31"	24.3	24.36	105
59	208° 6' 60"	6.83	6.84	65
60	198° 23' 51"	17.42	17.44	105
61	216° 23' 53"	73.51	75.48	95
62	257° 8' 5"	67.9	69.02	110
63	319° 1' 16"	96.96	107.11	70
64	35° 7' 34"	101.45	107.01	95
65	49° 15' 48"	65.36	66.46	105
66	21° 27' 50"	35.26	35.43	105
67	37° 48' 44"	83.33	86.27	95
68	141° 27' 38"	9.53	12.63	5
69	202° 49' 16"	57.36	57.73	150
70	201° 27' 49"	16.79	12.83	5
71	229° 15' 48"	31.12	31.65	50
72	231° 37' 27"	81.55	82.59	150
73	289° 21' 11"	9.59	12.83	5
74	38° 13' 4"	104.17	111.09	90
75	71° 19' 43"	79.37	79.39	1010
76	96° 29' 22"	9.61	12.9	5
77	204° 47' 8"	135.5	143.98	120
78	312° 39' 37"	9.59	12.83	5
79	19° 54' 1"	32.72	32.79	150
80	22° 23' 2"	15.21	15.26	50
81	37° 46' 31"	11.57	11.6	50
82	33° 29' 37"	56.87	57.21	150

Drawn: AOB
Date 19/7/2016
HDB Job No. 15/029
Scale: NTS @ A3

Proposed Plan of Subdivision
Lot 11 DP 1187663 & Lot 2 - 4 DP 869651
Wine Country Drive, Rothbury
Sheet 5 of 5

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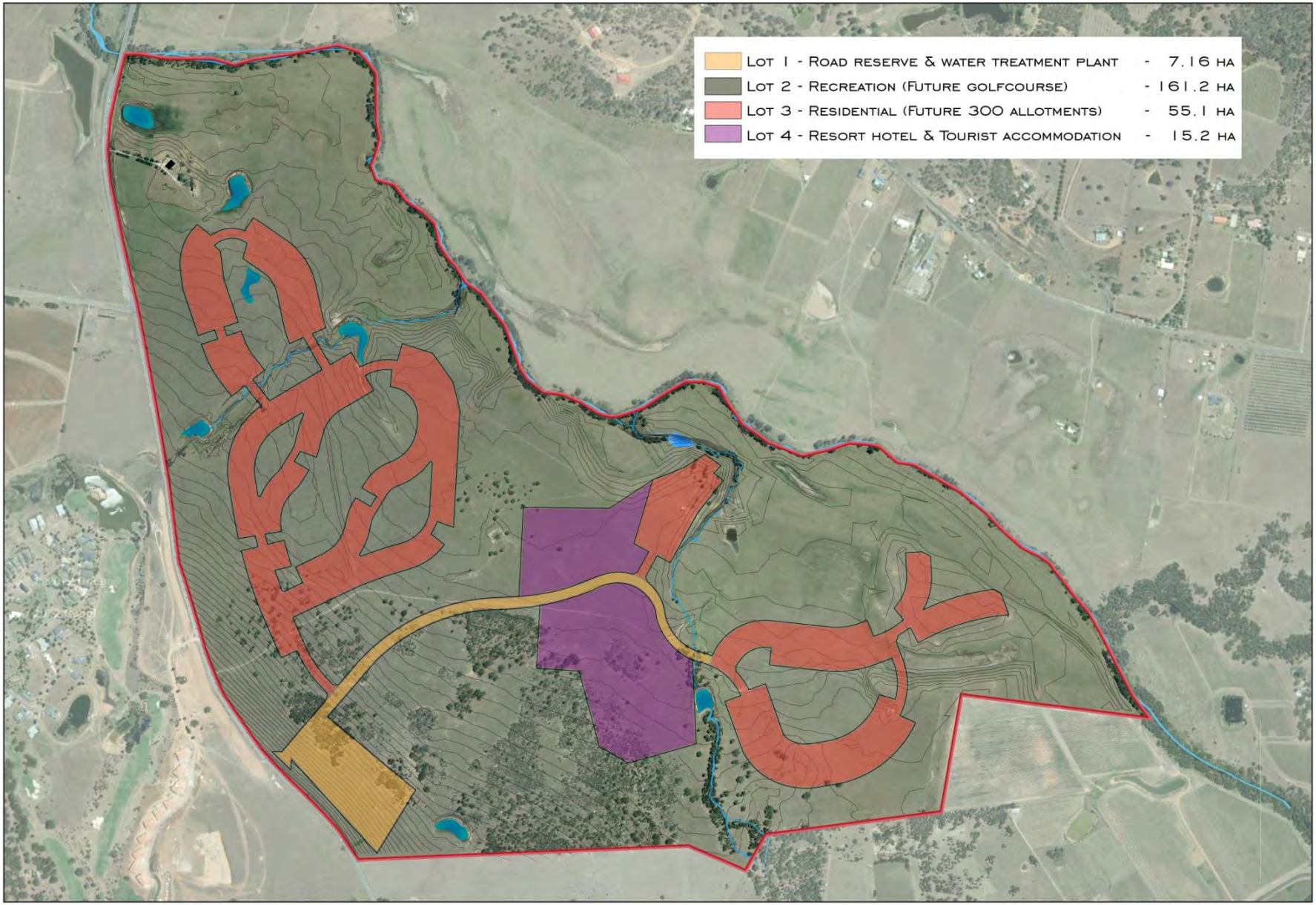
APPENDIX I

STAGED DA PLANS

HDB 2016



STAGE 1 - SUBDIVISION PLAN (SUPER LOTS)

Lot 2-4 DP 869651 & Lot 11 DP 1187663
Wine Country Drive, Rothbury

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STAGE2 - SUBDIVISION (Golfcourse)

Lot 2-4 DP 869651 & Lot 11 DP 1187663
Wine Country Drive, Rothbury

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Maitland 2320 NSW
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STAGE3 - SUBDIVISION (Tourist Resort Hotel)

Lot 2-4 DP 869651 & Lot 11 DP 1187663
Wine Country Drive, Rothbury

44 Church Street
(PO Box 40)
Maitland 2320 NSW
www.hdb.com.au
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STAGE 4,5,6 & 7 - Tourist Villas & Residential Development

Lot 2-4 DP 869651 & Lot 11 DP 1187663
Wine Country Drive, Rothbury

44 Church Street
(PO Box 40)
Maitland 2320 NSW
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APPENDIX J

CONSULTATION WITH:

AUSGRID

HUNTER WATER CORPORATION

ROADS AND MARITIME SERVICES

HUNTER WINE COUNTRY PID

03 October 2014

Thomas Potter
Hunter Development Brokerage
PO Box 40
Maitland NSW 2320

145 Newcastle Road
Wallsend NSW 2287
All mail to PO Box 487
Newcastle NSW 2300
T +61 2 131 525
www.ausgrid.com.au

Dear Thomas

Preliminary Servicing Advice – Golden Bear Integrated Tourist Development – Wine Country Drive Pokolbin.

I refer to your enquiry, received 19 September 2014, requesting preliminary serving advice for the proposed integrated tourist development Wine Country Drive, Pokolbin.

The proposed development is to be a staged development of:

- 300 residential lots
- 50 room hotel
- 250 villas
- eighteen hole golf course and club house
- function centre, retail premises, indoor recreation facility, landscaping, olive groves and vineyards.

An assessment of the surrounding sub transmission (33000 volt and above) and distribution (11000 and 415 volt) network has been completed in relation to the proposed development.

The following advice was provided by relevant sections within Ausgrid:

The estimated electrical load requirement is approximately 5MVA, for the entire development.

The existing 11000 volt network has spare capacity in the area for the proposed development to cater for a large percentage of the future electrical load of the development.

It is unlikely major upstream 11000 volt augmentation works will be required to provide electricity supply to the development. The requirement for incremented 11000 volt network upgrades will be assessed as the development progresses.

This development will be considered as an ‘urban’ development and will require an alternate 11000 volt supply for all proposed stages.

The 11000 volt connection options and upstream upgrade works will be dependent upon the final arrangement and staging of the development. Additional information is required from the developer to determine the preferred 11000 volt supply strategy.

Ausgrid's preferred connection location is toward the north western corner of the development to utilise the existing spare capacity in feeder 34644.

The above high level analysis information relates to the electrical supply capacity in the general area.

There are many influencing factors that could affect the available supply capacity including, but not limited to, other developments, future augmentation, load growth and policy changes. This preliminary response is based on information available at the time and may change into the future. It is expected that a connection application will be submitted by the developer. Upon receipt of the connection application a more detailed planning study will be undertaken to enable a Design Information Package to be produced outlining the connection requirements.

It is envisaged the development will be supplied via underground 11000 volt cables to kiosk substations at multiple locations. Each new kiosk substation will require protection by a registered easement as per Ausgrid's Network Standard 141. Further, underground low voltage (415 volt) distribution network would then be reticulated throughout the development providing connection points to each lot. The underground cables are generally installed in the council road reserve or covered by an easement if located on private land. This distribution work is Contestable and would be developer funded. Information regarding Contestability and connection to the Ausgrid network can be found in our Electrical Supply Standards, in particular ES10, and Network Standards on our website, www.ausgrid.com.au

If existing Ausgrid assets are found to be located within the development boundaries and located in areas other than council road reserve, the asset will need to be covered by an easement or relocated at the developers cost. Identification of these assets may require survey identification, or from Dial Before You Dig plans. A property search is advised to be undertaken to identify any easement or property issues.

Please do not hesitate to contact me if you require any further information or assistance.

Yours sincerely

Peter Keith
Engineering Officer
Customer Supply – Planning & Reliability
Ausgrid

☎ (02) 4910 1662
🖷 (02) 4933 0814
✉ pkeith@ausgrid.com.au
🖳 www.ausgrid.com.au

Ausgrid Reference: 1900048563 **Your Reference:**

Leena Sebastian

From: Brett Burchill [BBurchill@ausgrid.com.au]
Sent: Thursday, 10 December 2015 8:52 AM
To: kerry@hdb.com.au
Cc: Peter Keith
Subject: Response to Enquiry - Golden Bear Integrated Tourist Development

Good Morning Kerry,

I am writing in response to your enquiry to Peter Keith dated the 6 November 2015 regarding the Golden Bear Integrated Tourist Development.

The comments made in Ausgrid's original response dated 3 October 2014 still apply for this site.

Additionally however our Earthing and Insulation Coordination group have asked me to pass on the following information:

The developer should be made aware that site specific distribution earthing designs will be required for the kiosks. Due to the lack of MEN and no direct cable sheath paths available to direct fault current back to the zone substation, earthing designs will almost certainly be required to be segregated which may result in large segregation distance requirements from development infrastructure to maintain safety compliance. Typically metallic object separation distances can be expected around 15-20m, however specific earthing design may require larger distances depending on the fault level and clearing time of the supplying feeder.

Please let me know if you have any questions.

Regards,

Brett Burchill | Engineer - Customer Supply Planning & Reliability | Area Management - Lower Hunter | Ausgrid

Level 1, 15-17 Church Street Maitland NSW 2320 AUSTRALIA
☎: 02 4910 1702 (Extn 51702) | Mob: 0400 309 208 | ✉: BBurchill@ausgrid.com.au |

03 October 2014

Thomas Potter
Hunter Development Brokerage
PO Box 40
Maitland NSW 2320

145 Newcastle Road
Wallsend NSW 2287
All mail to PO Box 487
Newcastle NSW 2300
T +61 2 131 525
www.ausgrid.com.au

Dear Thomas

Preliminary Servicing Advice – Golden Bear Integrated Tourist Development – Wine Country Drive Pokolbin.

I refer to your enquiry, received 19 September 2014, requesting preliminary serving advice for the proposed integrated tourist development Wine Country Drive, Pokolbin.

The proposed development is to be a staged development of:

- 300 residential lots
- 50 room hotel
- 250 villas
- eighteen hole golf course and club house
- function centre, retail premises, indoor recreation facility, landscaping, olive groves and vineyards.

An assessment of the surrounding sub transmission (33000 volt and above) and distribution (11000 and 415 volt) network has been completed in relation to the proposed development.

The following advice was provided by relevant sections within Ausgrid:

The estimated electrical load requirement is approximately 5MVA, for the entire development.

The existing 11000 volt network has spare capacity in the area for the proposed development to cater for a large percentage of the future electrical load of the development.

It is unlikely major upstream 11000 volt augmentation works will be required to provide electricity supply to the development. The requirement for incremented 11000 volt network upgrades will be assessed as the development progresses.

This development will be considered as an ‘urban’ development and will require an alternate 11000 volt supply for all proposed stages.

The 11000 volt connection options and upstream upgrade works will be dependent upon the final arrangement and staging of the development. Additional information is required from the developer to determine the preferred 11000 volt supply strategy.

Ausgrid's preferred connection location is toward the north western corner of the development to utilise the existing spare capacity in feeder 34644.

The above high level analysis information relates to the electrical supply capacity in the general area.

There are many influencing factors that could affect the available supply capacity including, but not limited to, other developments, future augmentation, load growth and policy changes. This preliminary response is based on information available at the time and may change into the future. It is expected that a connection application will be submitted by the developer. Upon receipt of the connection application a more detailed planning study will be undertaken to enable a Design Information Package to be produced outlining the connection requirements.

It is envisaged the development will be supplied via underground 11000 volt cables to kiosk substations at multiple locations. Each new kiosk substation will require protection by a registered easement as per Ausgrid's Network Standard 141. Further, underground low voltage (415 volt) distribution network would then be reticulated throughout the development providing connection points to each lot. The underground cables are generally installed in the council road reserve or covered by an easement if located on private land. This distribution work is Contestable and would be developer funded. Information regarding Contestability and connection to the Ausgrid network can be found in our Electrical Supply Standards, in particular ES10, and Network Standards on our website, www.ausgrid.com.au

If existing Ausgrid assets are found to be located within the development boundaries and located in areas other than council road reserve, the asset will need to be covered by an easement or relocated at the developers cost. Identification of these assets may require survey identification, or from Dial Before You Dig plans. A property search is advised to be undertaken to identify any easement or property issues.

Please do not hesitate to contact me if you require any further information or assistance.

Yours sincerely

Peter Keith
Engineering Officer
Customer Supply – Planning & Reliability
Ausgrid

☎ (02) 4910 1662
🖷 (02) 4933 0814
✉ pkeith@ausgrid.com.au
🖳 www.ausgrid.com.au

Ausgrid Reference: 1900048563 **Your Reference:**

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

14 January 2016

Capital Hunter Pty Ltd
C/- HDB Town Planning & Design
PO Box 40
MAITLAND NSW 2320

Ref: 2004-2138/7.010

Attention: Mr Kerry Nichols

Dear Kerry

NOTICE OF FORMAL REQUIREMENTS FOR PROPOSED DEVELOPMENT

Hunter Water's requirements for the provision of water and sewerage facilities to the subdivision of 4 into 601 lots and development of a Golf Resort comprising 18 Hole Golf Course, 300 dwellings, 300 tourist units & restaurants at Lots 2 - 4 DP 869651 & Lot 11 DP 1187663 1184 Wine Country Road Rothbury are as follows:

Network Infrastructure and Delivery

1 Design and construct major works to connect each of the lots to the existing water and sewer system(s). The works must be designed by an Accredited Design Consultant and constructed by an Accredited Major Works Contractor:

Extend water and sewer each of the proposed lots in accordance with approved Water and Sewer Servicing Strategies (refer to Conditions 2, 3 and 5 below) and the **Specific Connection Details** for this development as detailed below.

The design must be submitted to Hunter Water for assessment. A Major Works assessment/administration fee of $2,896 must be paid when designs are submitted.

The designs will be reviewed, and if approved, an Instrument of Agreement will be returned by Hunter Water for execution by the developer. At this time Hunter Water will also advise the value of other fees that may be applicable to completion of the works.

It is the responsibility of the Accredited Designer to lodge approved designs at plan.check@hunterwater.com.au.

All contractors engaged by the developer must have insurances in place in accordance with the Agreement.

Specific Connection Details

2 Water Supply

The development site is located on the periphery of Hunter Water's water supply network. Network constraints means that the demand from the proposed development cannot currently be supplied from Hunter Water's existing infrastructure.

As the development is to house above 100 residences, Hunter Water's Design Guidelines dictates the need for an alternative connection point to provide supply security. Security of supply can potentially be obtained by establishing a connection from the North Rothbury system to the north of the site, but this would need to be confirmed as part of a developer funded servicing strategy as discussed below.

As advised in Hunter Waters Preliminary Servicing Advice of 22 March 2013, in view of the above and given the scale and nature of the development, a developer funded local water servicing strategy is required to determine the optimal method of servicing this development. The servicing strategy meet Hunter Water's design requirements and as a minimum include:

- Lot and development layout
- Staging of development
- Investigation of alternative options
- Identification of least community cost option
- Security of supply
- Minimum pressure requirement
- Fire fighting flow requirement

In addition, the strategy is to identify potential future developments in its immediate vicinity and incorporate options for servicing such developments. It is noted that the owner of a 100 acre property located on the western side of McDonalds Road, Ruthbury has expressed current interest in access to potable water, recycled and wastewater.

3 Wastewater Transportation

The proposed development is in the Cessnock Waste Water Treatment Works (WWTW) catchment and would be serviced by Rothbury 3 Waste Water Pump Station (WWPS).

As advised in Hunter Water's prior correspondence dated 22 March 2013 the demand from the proposed development cannot currently be supplied from Hunter Water's existing infrastructure. The developer is required to prepare a developer funded local Wastewater Servicing Strategy addressing, at a minimum, the following matters:

- Overall loads for the area;
- Surrounding potential developments;
- Connection points to the existing system;
- Staging of development;
- Investigation of alternative options;
- Identification of least community cost option; and
- Pump station(s) duty and emergency storage.

4 Wastewater Treatment

There is sufficient capacity at Cessnock Waste Water Treatment Works (WWTW) to cater for the loads from the development.

5 Recycled Water

There is an opportunity for recycled water to be utilised for this development. There is currently sufficient capacity to provide supply in the order of 200,000kL per annum of recycled water supply from Cessnock WWTW. However this supply would be dependent on:

- Availability of on-site storage;
- Availability of flows during dry weather;
- Existing environmental flow requirements; and
- The timing and progression of other development in the vicinity wishing to access supply of recycled water.

The recycled water from Cessnock would be provided for restricted use, and would not be suitable for public access. The current treatment processes at Cessnock WWTW (secondary treatment, maturation ponds and UV disinfection system) achieve Log reduction of 2.0 for Virus, 4.0 for Protozoa and 4.0 for Bacteria and approx. 100 per 100mL for E.coli. Further onsite treatment would be required to treat the recycled water suitable for un restricted use refer to Table 3.8 of the Australian Guidelines for Water Recycling (2006). The developer should contact Cessnock City Council and the Department of Health for further information on onsite treatment standards and approvals.

The developer is required to prepare a developer funded local Recycled Water Servicing Strategy addressing, at a minimum, the following matters:

- Lot layout
- Staging of Development
- Investigation of alternative options
- Identification of least community cost option
- Security of supply
- Minimum pressure requirement
- Fire fighting flow
- Potential future developments in its immediate vicinity and options for servicing such developments.

6 The above-mentioned servicing strategies are to be prepared by an Accredited Design Consultant with reference to the WSAA Hunter Water Design Guidelines.

Servicing strategies should be submitted to Hunter Water for review and approval and services should be designed and constructed in accordance with these approved strategies. Please contact Hunter Water to discuss the scope of work prior to commencement.

A separate strategy review fee of $1,149 is required to be paid for each servicing strategy that is submitted (by asset class).

7 Financial Contribution

A reimbursement contribution may be required towards the cost of any water and sewer infrastructure that is constructed by a third party developer and utilised to serve this development. Reimbursements cannot be determined until the connection points are defined. You will be advised of any reimbursements after the design plans are assessed and the connection points are approved.

8 Community Title Subdivision - Connection Options

Option 1 - Individual Connections per Lot to Hunter Water

Construct works to connect each of the lots to the existing water and sewer systems of Hunter Water.

Each lot within the development is to be provided with a point of connection to water and a point of connection to sewer.

The developer must meet the requirements of Hunter Water's Dealing No. E476715 and on this basis each lot owner will become an individual customer of Hunter Water. The works are required to be handed over to Hunter Water to own, operate and maintain. Hunter Water requires a solicitor's undertaking that the Dealing will be contained in the Management Statement and that a copy of the Management Statement will be forwarded to Hunter Water following its registration.

The Dealing requires the water and sewer mains for this development to be contained within statutory easements. These easements must be listed in the Management Statement for this development.

OR

Option 2 - Single Point of Connection to Hunter Water

Construct works to connect the lot owned by the Community Association to the existing water and sewer systems of Hunter Water. This option requires the Community Association to become the single customer of Hunter Water. The Association, as the owner of the internal water and sewer services, is responsible for the supply of water and sewer services to each of the individually owned lots.

Hunter Water requires a solicitor's undertaking that the following statement will be contained in the Management Statement and that a copy of the Management Statement will be forwarded to Hunter Water following its registration:

"*Water and sewer services are supplied by Hunter Water Corporation to the boundary of the lot owned by the Community Association. The Community Association is responsible for the provision and maintenance of the internal water and sewer services and the payment of Hunter Water Corporation accounts*".

Individual Metering

Properties that are within Community Title schemes that have one connection to the water supply network may be eligible for individual metering subject to terms and conditions.

Individual metering allows each property within the Community Title scheme to be billed separately for the water usage based on the consumption of each lot's individual meter.

To be eligible for individual metering the Community Title scheme would need to comply with the attached Individual Metering Guideline. Key requirements of the Guidelines include:

- The Individual Metering Guideline only applies to existing Community Title developments, i.e. the Community Association must submit the Application Form for Individual Metering;
- The internal water system must be designed and constructed to comply with the Design Criteria; and
- A certified plan of the internal water system and meter assembly layout must be submitted to Hunter Water with the Application. The individual metering by-laws must be included in the Management Statement.

For further information on Hunter Water's Individual Metering requirements go to the website hunterwater.com.au

Other Development Requirements

9 Submit the Development Consent Conditions determined by Council for this specific development. Hunter Water will confirm that the final development description is consistent with the details supplied by you for this application.

10 Hunter Water will require a Review of Environmental Factors (REF) to be submitted (refer Appendix HW 1 of Water Supply Code of Australia – Hunter Water Edition) prior to providing final approval of designs. A REF considers the likely impacts a development may have on the environment. At all times, methods for preventing or reducing adverse environmental impacts should be considered and where appropriate, incorporated into the project design.

Please contact the Hunter Water Developer Services Group prior to engaging the services of a consultant to prepare and submit an REF to confirm the need and scope for such an assessment. Hunter Water will make a determination if an REF is required in accordance with the provisions of Environmental Planning and Assessment Act 1979. An 'environmental report assessment fee' of $1,102 is to be paid if an REF is required.

Please note that a Controlled Activity Approval will be required from the NSW Office of Water for any excavation within 40 metres of a water body or should groundwater be present.

11 Provide one copy of the final plan of subdivision and a DXF file of the subdivision showing only lot numbers and boundaries directly on the MGA grid. The lot boundaries should be produced directly from your calculation software, with all edges matched and unbroken, and also match as near as possible the final deposited plan of the subdivision.

12 Submit an application for a hydraulic design assessment of internal water and sewerage services for this development, including rainwater tanks and any alternative water supply systems. If you are unsure please contact Hunter Water's Hydraulic Consultant on (02) 4979 9467.

13 Contact Hunter Water's Hydraulic Consultant on (02) 4979-9467 **to** make the necessary application for a Trade Waste Permit and pay the prescribed fees as your proposed development has been identified as having the potential to discharge trade waste into Hunter Water's sewerage system. The discharge of trade waste to the sewer will not be permitted without a permit authorising that discharge.

These requirements are valid for 12 months from the date of this letter and are specific to this development. All fees and charges are subject to adjustment using the Consumer Price Index (CPI) on 1 July each year.

Please refer to the attached Development and Design Assessment fact sheet, which details the conditions under which water and sewer facilities are available to new customers. Hunter Water reserves the right to amend its requirements if we find an error has been made.

Yours faithfully

PAUL MCKOY
Developer Services Engineer

Enquiries: Paul McKoy
Tel: (02) 4979-9476
Email: paul.mckoy@hunterwater.com.au

Transport
Roads & Maritime
Services

1 November 2013

SF2011/00184
CR2013/007578
CL

Intersect Traffic
PO Box 268
EAST MAITLAND NSW 2323

Attention: Mr Jeff Garry

WINE COUNTRY DRIVE (MR220): VINTAGE BALANCE LAND AND BEGGAR'S BRIDGE VINEYARD, ROTHBURY

Dear Mr Garry,

I refer to your email dated 7 October 2013, regarding the traffic study for the subject development forwarded to Roads and Maritime Services for advice.

Roads and Maritime has reviewed your request for information prior to proceeding with a traffic study for the subject development and the following comments are provided:

- Cessnock City Council has advised that the Golden Bear development is still active. The preferred access arrangement with both developments is a 4 way one lane circulating roundabout on Wine Country Drive which services both developments. Concept plans, previously provided to Roads and Maritime, for the Golden Bear development are based on this arrangement.

  Comment: Consideration has been given to relocating the Golden Bear / Vintage traffic to the Wine Country Drive / McDonalds Road intersection, in lieu of a new intersection on Wine Country Drive. However, this would have a major impact on the Golden Bear proposals should its access be at this location.

- Should the Golden Bear development not proceed concurrently with the Vintage development at the time the new Vintage intersection on Wine Country Drive is required, Vintage is required to construct a new Austroads CHR / CHL intersection, in accordance with the current conditions of development consent / Cessnock Development Control Plan (DCP). Roads and Maritime would be prepared to review this, in consultation with Council. A focus on the Wine Country Drive / McDonalds Road intersection may be feasible for the Vintage / Beggar's Bridge development. Should the Golden Bear development proceed, a new T intersection would need to be constructed at the location of the proposed roundabout in this instance.

- The traffic study should consider all reasonable options. Should the original new intersection location be retained, Vintage would also be required to upgrade the Wine Country Drive / McDonalds Road intersection to a CHR(S) / AUL intersection by the developer as required in the DCP.

- The traffic generating impacts of the proposed development on the Wine Country Drive / Palmers Lane intersection should be included.

- You should also submit your proposed directional splits in diagram form prior to proceeding with the study, taking into account the changed traffic dynamics with the Hunter Expressway.

Please contact me on 4924 0688 if you require further advice.

Yours sincerely,

Dave Young
Manager, Land Use
Hunter Region

Cc. General Manager
Cessnock City Council

Leena Sebastian

From: Hunter Vineyard Management [ken@huntervineyard.com.au]
Sent: Friday, 23 August 2013 6:29 AM
To: 'Thomas Potter'
Subject: RE: Jack Nicklaus Golf Course of Australia-1111

Hi Thomas,
The Hunter Wine Country PID would have 80 units[mgl] available to transfer to the proposed project.
We have a list of members wishing to decrease their allocations.
I would expect that in the foreseeable future we would be able to transfer allocation to your client.
The PID has a 5023 unit allocation, & that supplies our 450 members properties.

Kind regards,

Ken Bray

Operations Manager
Hunter Wine Country P I D
820 Hermitage Road
POKOLBIN NSW 2320
0418 68 1877

From: Thomas Potter [mailto:thomas@hdb.com.au]
Sent: Thursday, 8 August 2013 1:10 PM
To: hvms@bigpond.com; ken@huntervineyard.com.au
Subject: FW: Jack Nicklaus Golf Course of Australia-1111

Hi Ken,

Thank you for the telephone conversation regarding the above proposal.

As discussed we are currently finalising our planning proposal for this project, part of which requires confirmation that we can obtain the water required to operate the proposal – in particular the golf course.

An independent study undertaken for this proposal has indentified that approximately 200mgL per annum will be required for the golf course and landscaping maintenance.

The site has 100mgL allocation from the Pokolbin Private Irrigation District (PID) and harvestable rights of about 19mgL.

The study indicates the remainder (about 80mgL) will have to be purchased from PID. However, the agricultural study states additional water can be purchased from the PID but that supply can be unreliable in drought years. There is no confirmation in the documentation that water will be available from Pokolbin PID, and no other sources identified, so there is no confirmation that the golf course can be maintained with a sufficient and constant supply of water.

Could you please give us some assurance or indication in a return email, that the additional 80mgL is in fact obtainable, as per our telephone conversation.

We are investigating other options including recycling, however at this early stage we need to back up all of our options in order to put these questions of uncertainty to rest.

We appreciate your assistance with this issue.

Regards,

Thomas Potter
Planner / Urban Designer
☎: 49 33 66 82
🖷: 49 33 66 83
🖷:
✉: thomas@hdb.com.au

1st Floor, 44 Church Street (PO Box 40) | MAITLAND NSW 2320

Leena Sebastian

From: Hunter Vineyard Management [ken@huntervineyard.com.au]
Sent: Monday, 9 November 2015 4:49 PM
To: 'Louise Townsend'; kerry@hdb.com.au
Subject: RE: 15/029 - Jack Nicklaus Golf Course of Australia

Hi Kerry,
As per the previous correspondence referred too, The Hunter Wine Country PID at this time has allocation available to be transferred to your client when required.
Should we have an inquiry for a significant increase in allocation, I will make contact with you & discuss the options at that time.

As questioned in your inquiry, low water levels maybe an issue on occasions.
The PID has an ongoing programme at our pump site so improvements are ongoing to ensure we have mineable interruptions due to low river levels.
In your project designs, it will be important to include adequate water storage to cover the peak periods of demand in the hotter months of December, January & sometimes February.

I am available to discuss your options & our operational procedures when needed.

Kind regards,

Ken Bray

Operations Manager
Hunter Wine Country P I D
820 Hermitage Road
POKOLBIN NSW 2320
0418 68 1877

From: Louise Townsend [mailto:admin@hdb.com.au]
Sent: Friday, 6 November 2015 2:29 PM
To: ken@huntervineyard.com.au
Subject: 15/029 - Jack Nicklaus Golf Course of Australia

Dear Ken

I enclose a copy of an email dated 23 August 2013 and wish to advise we are currently preparing a Development Application for the development of the Jack Nicklaus Golf Course Resort on Wine Country Drive.

Can you please confirm the current status of the PID system and if we can acquire any further units for use on the site. It would also be appreciated if you could advise what the likely cost of those would be, and the likely limitations on supply e.g. how often low water levels in the Hunter River have interrupted supply and for how long.

If you wish to discuss any matters please do not hesitate to give me a call.

Kerry Nichols
Director
G.D.U.R.P./ G.A.I.C.D
C.P.P. / M.P.I.A

HDB Town Planning and Design
1st Floor 44 Church Street (PO Box 40)
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Mobile: 0418 490 188
E: kerry@hdb.com.au
Web: www.hdb.com.au

APPENDIX K

PRELIMINARY CONTAMINATION ASSESSMENT

COFFEY GEOSCIENCES PTY LTD 2006

CONTAMINATION UPDATE LETTER

COFFEY ENVIRONMENTS AUSTRALIA PTY LTD 2012

HUNTER DEVELOPMENT BROKERAGE PTY LTD

PROPOSED REDEVELOPMENT

LOTS 1, 2, 3 AND 4 IN DP 869651, ROTHBURY

PRELIMINARY CONTAMINATION ASSESSMENT

N09908/01-AC

8 March 2006

N09908/01-AC KJG
8 March 2006

Hunter Development Brokerage Pty Ltd
1st Floor, 44 Church Street
MAITLAND NSW 2320

Attention: Kieren Fitz-Gibbon

Dear Kieren

RE: PROPOSED REDEVELOPMENT
LOTS 1, 2, 3 AND 4 IN DP 869651, ROTHBURY
PRELIMINARY CONTAMINATION ASSESSMENT

Coffey Geosciences Pty Ltd (Coffey) is pleased to provide our Preliminary Contamination Assessment report for the above site.

We draw your attention to the enclosed sheet entitled *'Important Information about your Coffey Environmental Assessment'* which should be read in conjunction with this report.

If you have any questions please do not hesitate to contact Kirsty Greenfield or the undersigned.

For and on behalf of

COFFEY GEOSCIENCES PTY LTD

ARTHUR LOVE

Distribution:	Original	Held by Coffey Geosciences Pty Ltd
	1 Copy	Coffey Geosciences Pty Ltd Library
	3 Copies	Hunter Development Brokerage Pty Ltd

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Email newcastl@coffey.com.au

TABLE OF CONTENTS

1. INTRODUCTION

This report presents the results of a Preliminary Contamination Assessment carried out by Coffey Geosciences Pty Ltd (Coffey) for Hunter Development Brokerage Pty Ltd at Lots 1, 2, 3 and 4 in DP 869651 off Branxton Road, Rothbury, as shown on Drawing N09908/01-1.

The work was commissioned by Kieren Fitz-Gibbon of Hunter Development Brokerage on behalf of The Arris Group Pty Ltd. The commission was in response to a proposal submitted by Coffey on 10 February 2006 (Ref: N09908/1-AA).

It is understood that the site is to be redeveloped as the 'Golden Bear Resort' a Resort Hotel Golf Residential Development involving an 18-hole golf course, clubhouse, resort facilities, villa accommodation for 250 people and a permanent residential component of 300 residential lots. Cessnock City Council requires the Preliminary Contamination Assessment as part of the re-zoning application. This report addresses the SEPP 55 guidelines for information appropriate for making a decision for planning purposes with respect to possible land contamination.

1.1 Objectives and Scope of Work

The objectives of the Preliminary Contamination Assessment 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;
- Provide a preliminary assessment of site contamination;
- Assess the need for further investigations.

The proposed scope of work for the project included:

- A site history review and site visit to identify potential areas of environmental concern (AECs) and chemicals of concern (CoCs);
- Site Walkover;
- Reporting.

The assessment has been conducted in accordance with the relevant sections of NSW EPA, *Contaminated Sites, Guidelines for Consultants Reporting on Contaminated Sites* (Reference 1).

2. SITE IDENTIFICATION AND HISTORY

2.1 Location and Site Features

The site is located off Branxton Road, Rothbury and is known as Lots 1, 2, 3 and 4 in DP 869651 within the Cessnock City Council municipality. The site is irregular in shape and has an area of approximately 250 hectares. The site is bounded by Black Creek to the north and east, Branxton Road to the west and rural properties to the south.

At the time of the site visit, the site was generally vacant cleared land with some stands of mature trees. The northern corner of the site contained a small farm.

The main features observed during the site visit are shown on Drawing N09908/01-2 and are summarised below.

The main site features are as follows:

- The site had a gentle slope (<5^0) from the west to the east towards Black Creek on the eastern site boundary;
- The site was predominantly covered by open grass land with some stands of mature trees and several small dams;
- The site was fenced along the western and southern boundaries, with Black Creek on the eastern boundary;
- The northern corner of the site was used for farming cattle. The majority of the cattle were grazing in a paddock between Black Creek and a farmhouse. This paddock had stagnant water, likely due to recent rain;
- The farmhouse was of a brick construction and there were two concrete water tanks on the northern side of the house. There was a gravel driveway between the farmhouse and Branxton Road;
- To the south-east of the house there were two large concrete storage tanks, with a rusting galvanised iron roof. A shed made of rusting galvanised iron sheeting was located adjacent to the tanks.
- No evidence of chemical storage areas was observed during the site walkover.

2.2 Current Surrounding Land Use

The surrounding landuses observed during the site visit was as follows:

- Rural/ agricultural landuse to the north, south and east of the site;
- Rural/ agricultural and open space (golf course) landuse to the west of the site.

2.3 Local Geology and Hydrogeology

Reference to the 1: 250 000 scale *Singleton Regional Geological* sheet indicates that the site is located near the Lochinvar Anticline and is underlain by the Rutherford Formation, belonging to the Permian aged Dalwood Group. The Rutherford Formation comprises mudstone, sandstone, conglomerate and shale.

Regional groundwater beneath the site would be expected to occur in the bedrock at an unknown depth, however it is possible that groundwater perched within the residual deposits may be present. It is anticipated that regional groundwater flow in the vicinity of the site would be towards Black Creek located on the northern and eastern site boundary. The residual soils are expected to have a moderate hydraulic conductivity.

3. SITE HISTORY REVIEW

The site history study undertaken by Coffey included:

- A site visit;
- A title search;
- A search of Cessnock City Council records on the site;
- A review of selected historical aerial photographs from the last 50 years;
- A check of NSW EPA records for notices on the site.

3.1 Site Visit

A Coffey Environmental Engineer visited the site on 28 February 2006. Observations made during the site visits are summarised in Section 2.1 and Section 2.2.

3.2 Titles Search

A list of past registered proprietors and lessors of the site was obtained from the Land Titles Office. The current title details and cadastral plan are included in Appendix B.

The titles search revealed that Lots 1 and 2 in DP 869651 have a similar history. Both Lots were owned by John Tulloch between 1900 and 1953. Between 1953 and 1964, the Lots were owned by a dairy farmer and in 1964, both Lots were sold to AJ Edden Pty Ltd. Between 1974 and 1997, the Lots were owned by three different companies, Talhanson Pty Ltd and Romeo Holdings Pty Ltd and Romalto Holdings Pty Ltd. In 1997, Lot 1 was sold to Samuel Ng, who is the current owner of Lot 1. In 1997, Lot 2 was sold to New Horizon International Pty Ltd. Lot 2 is currently owned by Capital Hunter Pty Ltd, who bought Lot 2 in 2004.

The titles search revealed that Lot 3 had a more complex history, with the lot comprising three separate lots until 1997 and one of these separate lots comprised three separate lots until 1960. Between 1891 and 1964, the lots comprising Lot 3 were owned by various individuals, including a wine grower, a farmer, a dairy farmer and a grazier. In 1964, Lot 3 was sold to A J Edden Pty Ltd. Between 1974 and 1997, Lot 3 was owned by three different companies, Talhanson Pty Ltd and Romeo Holdings Pty Ltd and Romalto Holdings Pty Ltd. In 1997, Lot 3 was sold to Samuel Ng, who is the current owner.

Lot 4 has a similar history, with Lot 4 being owned by a number of individuals between 1897 and 1964. In 1964, Lot 3 was sold to A J Edden Pty Ltd. Between 1974 and 1997, Lot 3 was owned by three different companies, Talhanson Pty Ltd and Romeo Holdings Pty Ltd and Romalto Holdings Pty Ltd. In 1997, Lot 4 was sold to New Horizon International Pty Ltd. Lot 4 is currently owned by Capital Hunter Pty Ltd, who bought Lot 4 in 2004.

3.3 Cessnock City Council Records

Cessnock City Council holds computer recorded information pertaining to historical building applications and development applications relating to properties in the Cessnock City Council area since 1995.

A search of the Cessnock City Council records indicated there are no computerised records for approved building applications or development applications for Lots 1, 2, 3 and 4 in DP 869651.

3.4 Aerial Photograph Review

Selected aerial photographs of the site were purchased from the Department of Land and Water Conservation and reviewed by a Coffey Environmental Engineer. The results of the assessment are summarised in Table 1.

TABLE 1 – AERIALPHOTOGRAPH REVIEW

YEAR	SITE	SURROUNDING LAND
1963	The majority of the site comprises cleared land that appears to be used for agricultural purposes, with eight distinct areas of the site appearing to be under cultivation. Two areas of the site appear to contain dwellings with tracks leading to the dwellings from the western site boundary with Branxton Road. There are several stands of trees in the southern part of the site.	The surrounding landuse is predominantly cleared agricultural landuse.
1975	The major changes from the previous photograph are the removal of the dwelling near the centre of the site and a lack of cultivation in areas previously cultivated. Tracks leading across the site are less distinct and there is no apparent landuse. Five dams have been constructed across the site.	There have been no major changes to surrounding landuse from the previous photograph.
1984	The tracks and area where the dwelling was previously located are barely visible. There has been a slight increase in vegetation across the site.	There has been an increase in rural residential landuse immediately north of the site.
1998	There are no major changes to the site from the previous photograph.	There has been an increase in rural residential landuse surrounding the site.
2004	There are no major changes to the site from the previous photograph.	There has been an increase in rural residential landuse surrounding the site.

3.5 NSW EPA Records

A check with the NSW EPA website www.environment.nsw.gov.au revealed that no notices have been issued on the site under the Contaminated Land Management Act (1997).

3.6 Summary of Site History

A summary of the site history for Lots 1, 2, 3 and 4 in DP 86965, Rothbury is as follows:

- Generally, the site has been owned by a number of individuals between 1891 and 1964, including a grazier, a dairy farmer, a wine grower and a merchant. It is likely that the site was used for rural/ agricultural purposes during this time;
- In 1964, the four lots were sold to a company called A J Edden Pty Ltd. Between 1964 and the present day, the site has been owned by a number of different companies. Lot 1 and Lot 3 are currently owned by Samuel Ng, while Lots 2 and 4 are currently owned by Capital Hunter Pty Ltd;
- The aerial photographs indicate the site was used for agricultural landuse from pre-1963 to some time between 1963 and 1975. At this time, it appears there were also two areas used for rural residential landuse;

- The aerial photographs indicate that dwelling or other building in the centre of the site had been removed by 1975 and that from 1975 onwards, the majority of the site remained undeveloped with no apparent landuse;
- The northern corner of the site appears to have been used for farming since the pre-1960s. Cattle were observed grazing in the paddock between a farmhouse and Black Creek during the site visit;
- No building applications or development applications were identified by Cessnock City Council between 1995 and today;
- The NSW EPA has no notices on the site under the Contaminated Land Management Act (1997).

4. AREAS AND CHEMICALS OF CONCERN

Based on the site walkover and the site history assessment, it is considered that the potential areas of concern relate to the area of the site used for farming. The main potential contamination sources on the site are outlined in Table 2 below.

TABLE 2 - SUMMARY OF POTENTIAL AREAS AND CHEMICALS OF CONCERN

AREA OF CONCERN	DESCRIPTION OF POTENTIALLY CONTAMINATING ACTIVITY	CoCs*	LIKELIHOOD OF CONTAMINATION (BASED ON SITE HISTORY STUDY ONLY)**	COMMENTS
1. House and sheds	Asbestos containing materials used in construction	Asbestos	Medium	The house and sheds appear to have been built prior to 1963.
2. Shed	Storage and use of pesticides and other chemical for cattle	OCP, OPP, arsenic	Low	Chemicals may have been stored on site for cattle drenches/ dips.
3. Septic tanks	Leaking from septic tanks	Faecal coliforms	Low	It is likely that there are septic tanks near the house.

NOTE:

**CoC - Chemicals of Concern*

*** It is important to note that this is not an assessment of the financial risk associated with the AEC in the event contamination is detected, but a qualitative assessment of the probability of contamination being detected at the potential AEC based on the site history study.*

Metals - Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc

BTEX - Benzene, Toluene, Ethylbenzene and Xylene

TPH - Total Petroleum Hydrocarbons

PAH – Polycyclic Aromatic Hydrocarbons

5. DISCUSSION AND CONCLUSIONS

The site history study indicated that the site has been cleared and used for agricultural purposes, including two dwellings from pre-1963 to some time between 1963 and 1975. Prior to 1975, one dwelling was removed and it appears that since 1975, the majority of site has remained undeveloped with no apparent landuse. The site walkover indicated that the majority of the site is vacant, cleared land, with the northern portion of the site used for cattle farming. A brick farmhouse and two large concrete and galvanised iron tanks were observed in the northern portion of the site, as well as cattle grazing between the farmhouse and Black Creek on the northern site boundary. No apparent areas of concern of chemicals of concern were identified during the site history study and site walkover.

Based on the assessment presented above, it is considered unlikely that there is wide-spread soil contamination that would prevent the site from being suitable for the proposed development. Localised soil contamination may be present around the house locations and shed, especially residual pesticides which may have been used for treatment of cattle grazed on the site, or as a deterrent to termite attack on structures. Building materials containing asbestos may be present in the existing house and shed, and fragments of such material may be present at the former house site.

Coffey recommends that preliminary assessment of soil contamination be conducted in the vicinity of the house and shed locations, after demolition of those structures is complete. The purpose of the investigation will be to assess the need for further investigation and/or remediation.

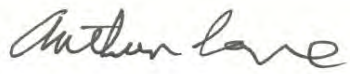
6. LIMITATIONS

The work preformed by Coffey included only a site history study including a site walkover and did not include any sampling and testing. Therefore, the assessments hade in this report should be considered a preliminary only. It is important to note that sampling and testing is required to check the presence of absence of contamination.

Further discussion on the uses and limitations of this assessment are presented in the attached document *'Important Information about your Coffey Environmental Assessment'*.

For and on behalf of

COFFEY GEOSCIENCES PTY LTD



ARTHUR LOVE

Information

Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of the subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Coffey Geosciences Pty Ltd ABN 057 056 335 516

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they have incorporated the report findings.

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design toward construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

** For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, National Headquarters, Canberra, 1987.*

20252 / 07-01

N09908/01-AC
8 March 2006

APPENDIX A

Title History Search

ADVANCE LEGAL SEARCH PTY LIMITED

(ACN 077 067 068)
ABN 49 077 067 068

PO Box 149
Yagoona NSW 2199

Telephone: +612 9754 1590
Mobile: 0412 169 809
Facsimile: +612 9754 1364
Email: alsearch@optusnet.com.au

27 February 2006

COFFEY GEOSCIENCES Pty Ltd
13 Mangrove Rd
SANDGATE NSW 2304

Attention Kirsty Greenfield

RE: **off Branxton Road, Rothbury**
Ref: NO9908/01
Purchase Order: 16567

Note 1: **Folio Identifier 1/869651**
Note 2: **Folio Identifier 2/869651**
Note 3: **Folio Identifier 3/869651**
Note 4: **Folio Identifier 4/869651**

Note 1:

Current Search

Folio Identifier 1/869651 (attached)
Lot 1 DP 869651 (plan attached)
Dated 20 February 2006
Registered Proprietor:
SAMUEL NG

Title Tree
Lot 1 DP 869651

Folio Identifier 1/869651

Folio Identifier 1/133849

Certificate of Title Volume 12380 Folio 128

Certificate of Title Volume 1311 Folio 233

****

Summary of Proprietor(s)
Lot 1 DP 869651

Year	Proprietor
	(Lot 1 DP 869651)
1997 – todate	Samuel Ng
1997 – 1997	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
	(Lot 1 DP 133849)
1988 – 1997	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
	(Lot 1 DP 61089 - CT Vol 12380 Fol 128)
1975 – 1988	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
1974 – 1975	Talhanson Pty Limited
	(Land in Parish Rothbury - Area 255 Acres - CT Vol 1311 Fol 233)
1974 – 1974	Talhanson Pty Limited
1964 – 1974	A J Edden Pty Limited
1953 – 1964	Rayden John Ware, dairy farmer
1938 – 1953	J.Y Tulloch & Sons Pty Limited
1900 – 1938	John Younie Tulloch, store keeper

*****

Note 2:

Current Search

Folio Identifier 2/869651 (attached)
Lot 2 DP 869651 (plan attached)
Dated 20 February 2006
Registered Proprietor:
CAPITAL HUNTER PTY LIMITED

Title Tree
Lot 2 DP 869651

Folio Identifier 2/869651

Folio Identifier 1/133849

Certificate of Title Volume 12380 Folio 128

Certificate of Title Volume 1311 Folio 233

****

Summary of Proprietor(s)
Lot 2 DP 869651

Year	Proprietor
	(Lot 2 DP 869651)
2004 – todate	Capital Hunter Pty Limited
1997 – 2004	New Horizon International Pty Limited
1997 – 1997	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
	(Lot 1 DP 133849)
1988 – 1997	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
	(Lot 1 DP 61089 - CT Vol 12380 Fol 128)
1975 – 1988	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
1974 – 1975	Talhanson Pty Limited
	(Land in Parish Rothbury - Area 255 Acres - CT Vol 1311 Fol 233)
1974 – 1974	Talhanson Pty Limited
1964 – 1974	A J Edden Pty Limited
1953 – 1964	Rayden John Ware, dairy farmer
1938 – 1953	J.Y Tulloch & Sons Pty Limited
1900 – 1938	John Younie Tulloch, store keeper

*****

Note 3:

Current Search

Folio Identifier 3/869651 (attached)
Lot 3 DP 869651 (plan attached)
Dated 20 February 2006
Registered Proprietor:
SAMUEL NG

Title Tree
Lot 3 DP 869651

Folio Identifier 3/869651

(a)

Folio Identifier 1/133849

CT Vol 12380 Folio 128

CT Vol 1311 Folio 233

****

(b)

Folio Identifier 1/183215

CT Vol 7953 Folio 176

CT Vol 7116 Folio 240 & 241

CT Vol 4374 Folio 159

CT Vol 4110 Folio 55

CT Vol 2904 Folio 238

CT Vol 2759 Folio 26 & 27

P A 20352

Conveyance BK 3 No. 976

*****

(c)

Folio Identifier 149/661699

CT Vol 7906 Folio 102

/ | \

1052-50 1052-54 1028-6

** ** **

Summary of Proprietor(s)
Lot 3 DP 869651

Year	Proprietor
	(Lot 3 DP 869651)
1997 – todate	Samuel Ng
1997 – 1997	Romeo Holdings Pty Limited Romalto Holdings Pty Limited

See Notes (a), (b) & (c)

Note (a)

	(Lot 1 DP 133849)
1988 – 1997	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
	(Lot 1 DP 61089 - CT Vol 12380 Fol 128)
1975 – 1988	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
1974 – 1975	Talhanson Pty Limited
	(Land in Parish Rothbury - Area 255 Acres - CT Vol 1311 Fol 233)
1974 – 1974	Talhanson Pty Limited
1964 – 1974	A J Edden Pty Limited
1953 – 1964	Rayden John Ware, dairy farmer
1938 – 1953	J.Y Tulloch & Sons Pty Limited
1900 – 1938	John Younie Tulloch, store keeper

****

Note (b)

	(Lot 1 DP 183215)
1988 – 1997	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
	(Part Portion 149 Parish Rothbury - Area 200 Acres 2 Roods 36 ½ Perches - CT Vol 7953 Fol 176)
1975 – 1988	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
1974 – 1975	Talhanson Pty Limited
1964 – 1974	A J Edden Pty Limited
1963 – 1964	John Carrington Smith, farmer
1960 – 1963	William George Ware, dairy farmer
	(Part Portion 149 parish Rothbury - Area 200 Acre 2 Roods 36 ½ Perches - CT Vol 7116 Fol 240 & 241)
1956 – 1960	Gwenneth Mary Ware, spinster George Thomas William Ware, retired grazier
	(Part Portions 149 Parish Rothbury - Area 200 Acre 3 Roods 15 Perches - CT Vol 4374 Fol 159)
1930 – 1956	Ellen Elizabeth Matthews, widow Lancelot Vernon Matthews, farmer Geoffrey Matthews, farmer
	(Portion 149 parish Rothbury & other lands - Area 1209 Acre 0 Roods 34 Perches - CT Vol 4110 Fol 55)
1928 – 1930	J.B Holmes & Sons Pty Limited
	(Portion 149 parish Rothbury & other lands - Area 1315 Acre 2 Roods 24 Perches - CT Vol 2904 Fol 238)
1919 – 1928	J.B Holmes & Sons Pty Limited
	(Portion 149 Parish Rothbury & other lands - Area 1315 Acre 2 Roods 24 Perches – CTVol 2759 Fol 26 & 27)
1917 – 1919	Spencer Harrison Holmes, grazier Charles Philips Holmes, grazier
	(Portion 149 Parish Rothbury & other lands - Area 1315 Acre 2 Roods 24 Perches)
1910 – 1917	Spencer Harrison Holmes, grazier Charles Philips Holmes, grazier
1897 – 1910	Spencer Harrison Holmes, grazier Charles Philips Holmes, grazier Alexander Gordon Elizabeth Philips Holmes Ellen Millar Holmes

*****

Note (c)

	(Lot 149 DP 661699)
1988 – 1997	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
	(Lot 149 DP 661699 - Area 140 Acre 2 Roods 21 Perches - CT Vol 7906 Fol 102)
1975 – 1988	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
1974 – 1975	Talhanson Pty Limited
1964 – 1974	A J Edden Pty Limited
1963 – 1964	John Carrington Smith, farmer
1960 – 1963	William George Ware, dairy farmer
1960 – 1960	Claude Allen Pankhurst, farmer

See (ci), (cii) & (ciii)

(ci)

	(Land being in Parish Rothbury - Area 14 Acres 1 Rood 0 Perches - CT Vol 1052 Fol 50)
1952 – 1960	Claude Allen Pankhurst, farmer
1951 – 1952	Claude Allen Pankhurst, dairy farmer Grace Elizabeth Pankhurst
1938 - 1951	J. Y Tulloch & Sons Pty Limited
1931 – 1938	John Younie Tulloch, vigneron
1931 – 1931	Harry Hyne Capper, merchant Sidney Woodgate, retired bank manager
1897 – 1931	Harry Hyne Capper, merchant
1892 – 1897	Robert Johnson, wine grower
1892 – 1892	Roland John Lumby, wine grower

****

(cii)

	(Land in Parish Rothbury - Area 30 Acres 3 Rood 38 Perches - CT Vol 1052 Fol 54)
1945 – 1960	Claude Allen Pankhurst, farmer
1934 – 1945	Catherine Mary McNamara, spinster
1891 – 1934	John McNamara, farmer

****

(ciii)

	(Land in Parish of Rothbury - Area 95 Acre 1 Roods 21 Perches - CT Vol 1028 Fol 6)
1945 – 1960	Claude Allen Pankhurst, farmer
1934 – 1945	Catherine McNamara, spinster
1891 – 1934	John McNamara, farmer

*****

Note 4:

Current Search

Folio Identifier 4/869651 (attached)
Lot 4 DP 869651 (plan attached)
Dated 20 February 2006
Registered Proprietor:
CAPITAL HUNTER PTY LIMITED

Title Tree
Lot 4 DP 869651

Folio Identifier 4/869651

Folio Identifier 1/183215

Certificate of Title Volume 7953 Folio 176

Certificate of Title Volume 7116 Folio 240 & 241

Certificate of Title Volume 4374 Folio 159

Certificate of Title Volume 4110 Folio 55

Certificate of Title Volume 2904 Folio 238

Certificate of Title Volume 2759 Folio 26 & 27

P A 20352

Conveyance BK 3 No. 976

*****

Summary of Proprietor(s)
Lot 4 DP 869651

Year	Proprietor
	(Lot 4 DP 869651)
2004 – todate	Capital Hunter Pty Limited
1997 – 2004	New Horizon International Pty Limited
1997 – 1997	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
	(Lot 1 DP 183215)
1988 – 1997	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
	(Part Portion 149 parish Rothbury - Area 200 Acres 2 Roods 36 ½ Perches - CT Vol 7953 Fol 176)
1975 – 1988	Romeo Holdings Pty Limited Romalto Holdings Pty Limited
1974 – 1975	Talhanson Pty Limited
1964 – 1974	A J Edden Pty Limited
1963 – 1964	John Carrington Smith, farmer
1960 – 1963	William George Ware, dairy farmer
	(Part Portion 149 parish Rothbury - Area 200 Acre 2 Roods 36 ½ Perches - CT Vol 7116 Fol 240 & 241)
1956 – 1960	Gwenneth Mary Ware, spinster George Thomas William Ware, retired grazier
	(Part Portions 149 Parish Rothbury - Area 200 Acre 3 Roods 15 Perches - CT Vol 4374 Fol 159)
1930 – 1956	Ellen Elizabeth Matthews, widow Lancelot Vernon Matthews, farmer Geoffrey Matthews, farmer
	(Portion 149 parish Rothbury & other lands - Area 1209 Acre 0 Roods 34 Perches - CT Vol 4110 Fol 55)
1928 – 1930	J.B Holmes & Sons Pty Limited
	(Portion 149 parish Rothbury & other lands - Area 1315 Acre 2 Roods 24 Perches - CT Vol 2759 Fol 26 & 27)
1915 – 1928	Spencer Harrison Holmes, grazier Charles Philips Holmes, grazier
	(Portion 149 Parish Rothbury & other lands - Area 1315 Acre 2 Roods 24 Perches)
1910 – 1915	Spencer Harrison Holmes, grazier Charles Philips Holmes, grazier
1897 – 1910	Spencer Harrison Holmes, grazier Charles Philips Holmes, grazier Alexander Gordon Elizabeth Philips Holmes Ellen Millar Holmes

Department of Lands
Reliable from the ground up

Cadastral Records Enquiry Report

Box : 97 **Reference** : coffey– rothbury

Requested Parcel : Lot 2 DP 869651

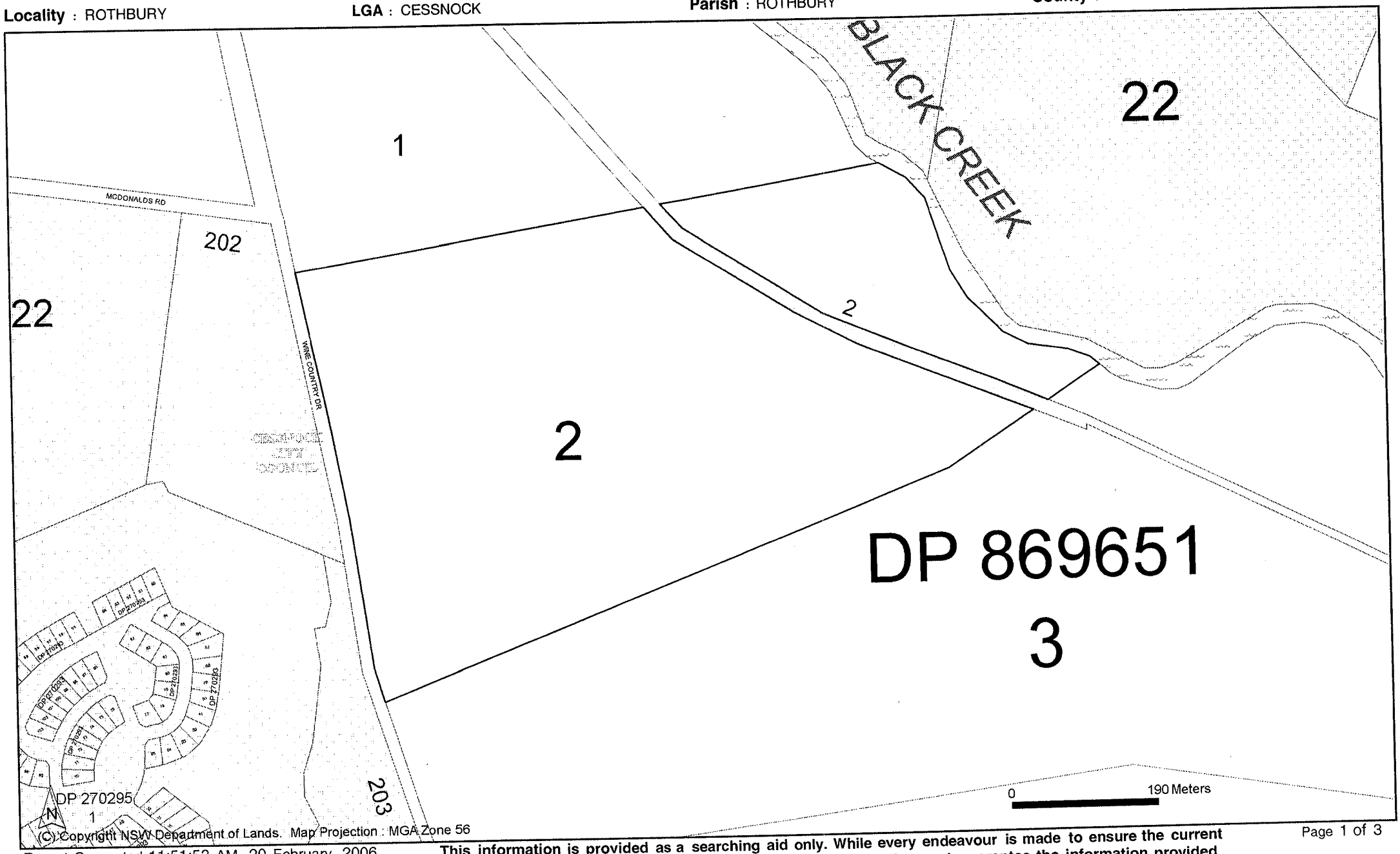
Identified Parcel : Lot 2 DP 869651

Locality : ROTHBURY

LGA : CESSNOCK

Parish : ROTHBURY

County : NORTHUMBERLAND



Report Generated 11:51:53 AM, 20 February, 2006

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

Box : 97

Department of Lands
Reliable from the ground up

Cadastral Records Enquiry Report

Requested Parcel : Lot 4 DP 869651

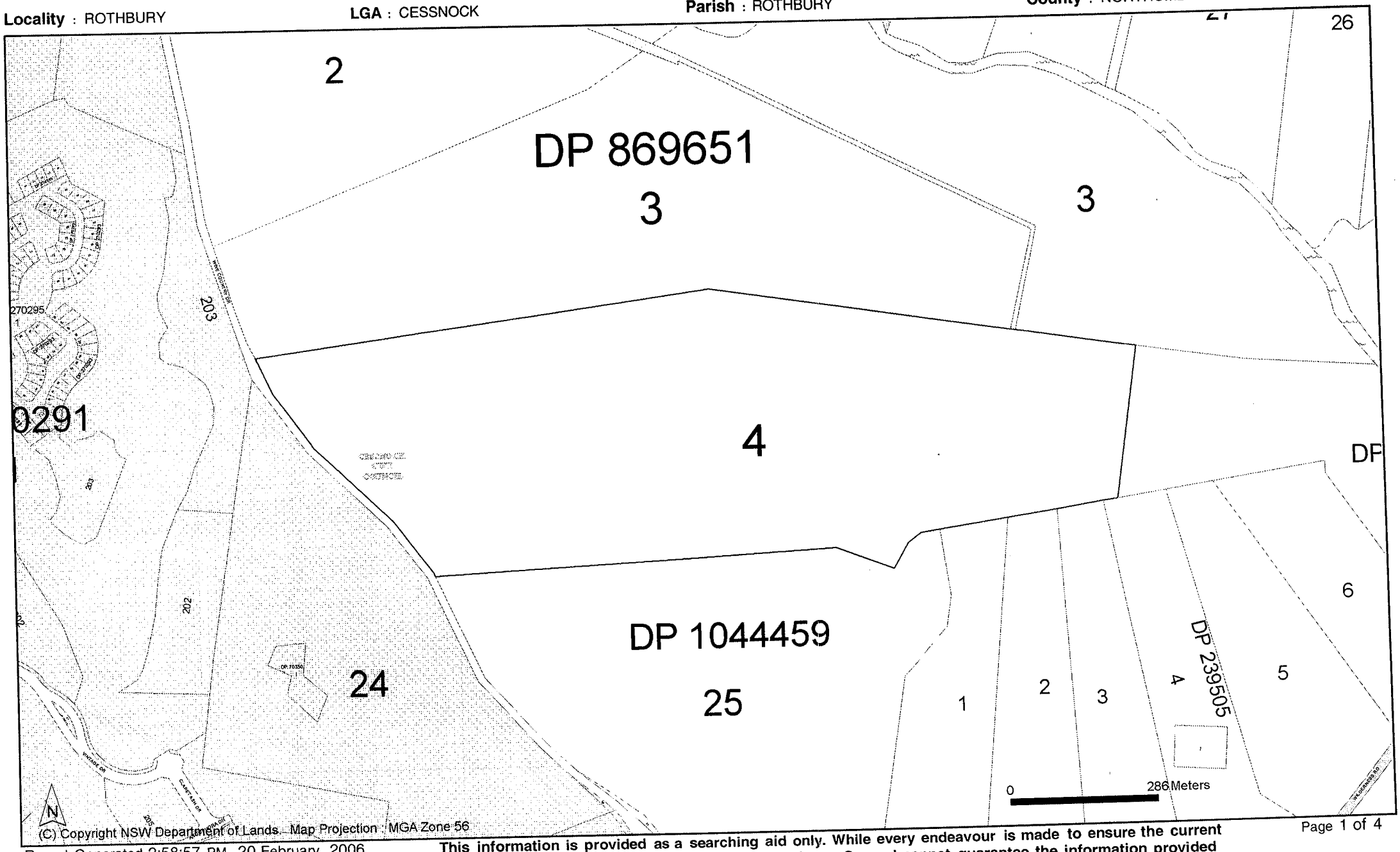
Identified Parcel : Lot 4 DP 869651

Locality : ROTHBURY

LGA : CESSNOCK

Parish : ROTHBURY

County : NORTHUMBERLAND



Report Generated 2:58:57 PM, 20 February, 2006

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Ph. 0297541590 *Fax.* 0297541364

Title Search

EziSearch
An Approved LPI *NSW*
Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 1/869651

SEARCH DATE	TIME	EDITION NO	DATE
20/2/2006	8:44 AM	5	27/2/2004

LAND

LOT 1 IN DEPOSITED PLAN 869651
AT ROTHBURY
LOCAL GOVERNMENT AREA: CESSNOCK
PARISH OF ROTHBURY COUNTY OF NORTHUMBERLAND
TITLE DIAGRAM: DP869651

FIRST SCHEDULE

SAMUEL NG (T 3429498)

SECOND SCHEDULE (3 NOTIFICATIONS)

1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2. LAND EXCLUDES THE ROAD(S) SHOWN IN THE TITLE DIAGRAM
3. AA455732 MORTGAGE TO CAPITAL HUNTER PTY LIMITED

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

Coffey - Rothbury ALSP PRINTED ON 20/2/2006

Information Provided Through
Advance Legal Search Pty Ltd
Ph. 0297541590 *Fax.* 0297541364

Title Search

EziSearch
An Approved LPI *NSW*
Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 2/869651

SEARCH DATE	TIME	EDITION NO	DATE
20/2/2006	8:45 AM	5	1/3/2004

LAND

LOT 2 IN DEPOSITED PLAN 869651
AT ROTHBURY
LOCAL GOVERNMENT AREA: CESSNOCK
PARISH OF ROTHBURY COUNTY OF NORTHUMBERLAND
TITLE DIAGRAM: DP869651

FIRST SCHEDULE

CAPITAL HUNTER PTY LIMITED (T AA458571)

SECOND SCHEDULE (2 NOTIFICATIONS)

1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2. LAND EXCLUDES THE ROAD(S) SHOWN IN THE TITLE DIAGRAM

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

Coffey - Rothbury ALSP PRINTED ON 20/2/2006

Information Provided Through
Advance Legal Search Pty Ltd
Ph. 0297541590 *Fax.* 0297541364

Title Search

EziSearch
An Approved LPI *NSW*
Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 4/869651

SEARCH DATE	TIME	EDITION NO	DATE
20/2/2006	8:48 AM	5	1/3/2004

LAND

LOT 4 IN DEPOSITED PLAN 869651
AT ROTHBURY
LOCAL GOVERNMENT AREA: CESSNOCK
PARISH OF ROTHBURY COUNTY OF NORTHUMBERLAND
TITLE DIAGRAM: DP869651

FIRST SCHEDULE

CAPITAL HUNTER PTY LIMITED (T AA458571)

SECOND SCHEDULE (2 NOTIFICATIONS)

1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2. LAND EXCLUDES THE ROAD(S) SHOWN IN THE TITLE DIAGRAM

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

Coffey - Rothbury ALSP PRINTED ON 20/2/2006

Information Provided Through
Advance Legal Search Pty Ltd
Ph. 0297541590 *Fax.* 0297541364

Title Search

EziSearch
An Approved LPI *NSW*
Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 3/869651

SEARCH DATE	TIME	EDITION NO	DATE
20/2/2006	8:46 AM	6	27/2/2004

LAND

LOT 3 IN DEPOSITED PLAN 869651
AT ROTHBURY
LOCAL GOVERNMENT AREA: CESSNOCK
PARISH OF ROTHBURY COUNTY OF NORTHUMBERLAND
TITLE DIAGRAM: DP869651

FIRST SCHEDULE

SAMUEL NG (T 3429499)

SECOND SCHEDULE (3 NOTIFICATIONS)

1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2. LAND EXCLUDES THE ROAD(S) SHOWN IN THE TITLE DIAGRAM
3. AA455732 MORTGAGE TO CAPITAL HUNTER PTY LIMITED

NOTATIONS

UNREGISTERED DEALINGS: NIL

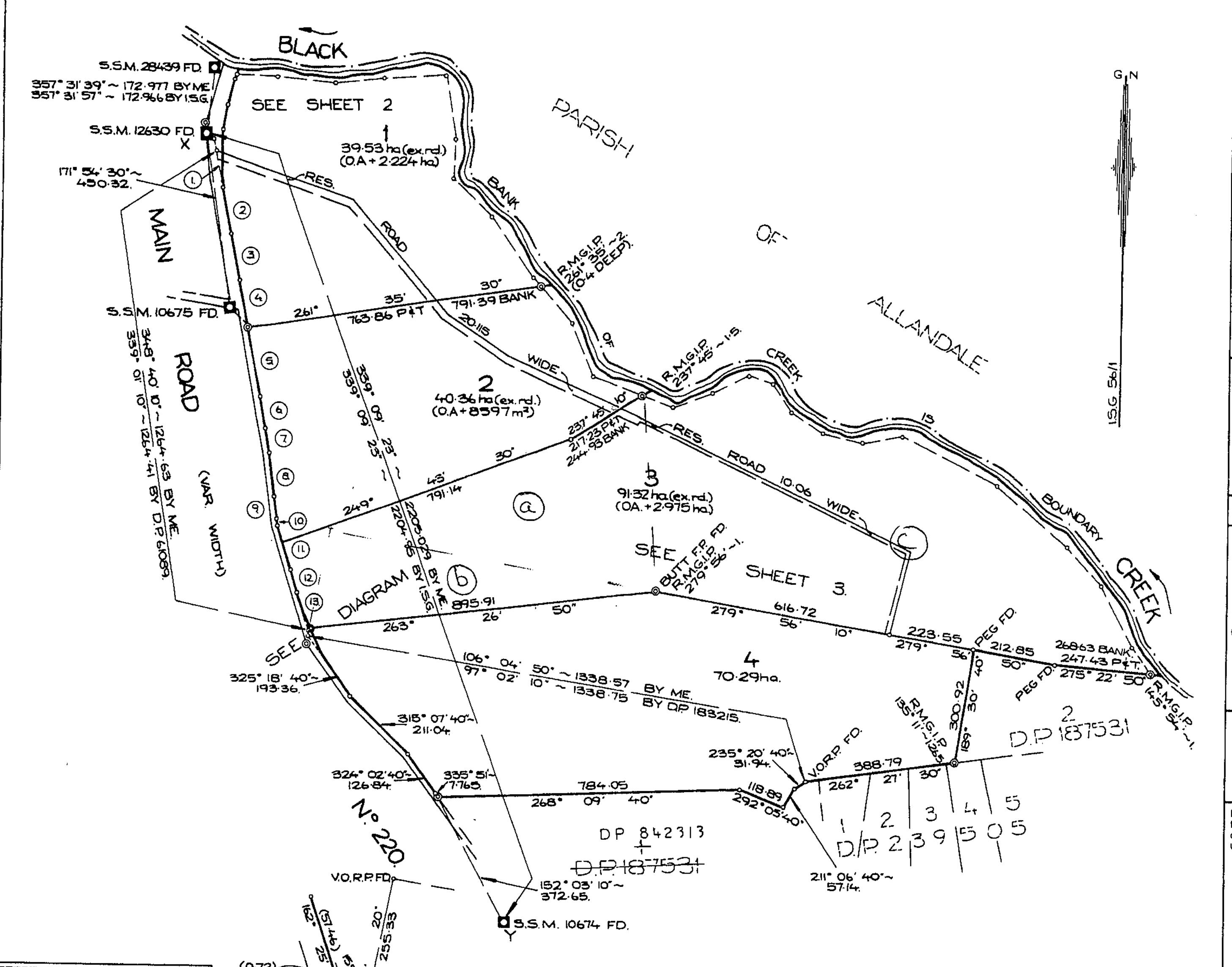
*** END OF SEARCH ***

Coffey - Rothbury ALSP PRINTED ON 20/2/2006

PLAN FORM 2

Plan Drawing only to appear in this space

SIGNATURE AND SEALS ONLY



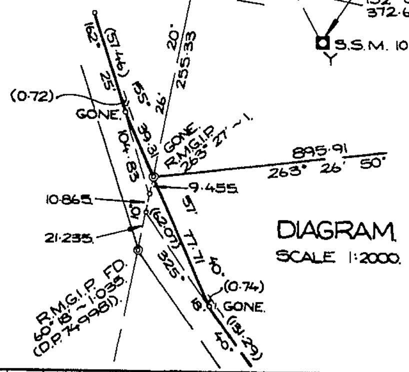


DIAGRAM
SCALE 1:2000.

REFERENCE TO SHORT LINES		
LINE	BEARING	DISTANCE
1	169° 49'	94.36
2	169° 28'	121.53
3	169° 19'	121.73
4	169° 39'	120.72
5	169° 16'	182.09
6	170° 24'	82.9
7	170° 20'	61.17
8	172° 52'	121.12
9	173° 14'	57.54
10	172° 35'	17.405
11	163° 26'	120.92
12	163° 33'	60.36
13	162° 25'	104.83

SURVEYORS (PRACTICE) REGULATION 1996 : CLAUSE 32(2).

MARK	I.S.G CO-ORDINATES EASTING	NORTHING	ZONE	ACC.
S.S.M. 10674	331141.724	1376044.742	56/1	2
S.S.M. 12630	330357.165	1378105.390	56/1	2
S.S.M. 28439	330349.718	1378278.196	56/1	3

COMBINED SEA LEVEL AND SCALE FACTOR = 0.99994

SOURCE: I.S.G CO-ORDINATES ADOPTED FROM S.C.I.M.S AS AT 12 TH NOVEMBER 1996.

Crown Lands Office Approval

PLAN APPROVED .... Authorised Officer
Land District ....
Paper No ....
Field Book .... pages ....

Council's Certificate

I hereby certify that –

(a) the requirements of the Local Government Act, 1919 (other than the requirements for the registration of plans), and

*(b) the requirements of ~~Part 3 Division 2 of the Water Board Act 1987, or~~ Part 5 Division 7 of the Hunter Water Board (Corporatisation) Act 1991,

have been complied with by the applicant in relation to the proposed SUBDIVISION
(insert "new road", "subdivision" or "consolidated lot") set out herein

Subdivision No. 14/96
Date 6TH JUNE 1997
(Signature)
General Manager/~~Authorised Person~~
Council File No. 150/596/M

*This part of certificate to be deleted where the application is only for consolidated lot or the opening of a new road or where the land to be subdivided is wholly outside the areas of operations of the Water Board and the Hunter Water Corporation Ltd.

Delete if inapplicable

SURVEYOR'S REFERENCE: 14220 CHECKLIST

MPD

OFFICE USE ONLY

DP 869651

Registered: 23.7.1997

C.A: No. 14/96 OF 6-6-1997

Title System TORRENS

Purpose. SUBDIVISION

Ref. Map PARISH#

Last Plan. DP183215 DP661699 DP61089

9132-15

PLAN OF SUBDIVISION OF LOT 1, D.P. 183215, LOT 149, D.P.661699 AND PART LOT 1, D.P. 61089.

Lengths are in metres. Reduction Ratio 1: 8000.

LGA CESSNOCK

Locality: ROTHBURY

Parish: ROTHBURY

County: NORTHUMBERLAND

This is sheet 1 of my plan in 3 sheets. (Delete if inapplicable).

I, IAN HAROLD MARSHALL of MARSHALL SCOTT P.O.BOX 165, CESSNOCK, 2325. a surveyor registered under the Surveyors Act 1929 hereby certify that the survey represented in this plan is accurate has been made in accordance with the ~~Survey Practice Regulation 1990~~ and was completed on 16.12.1996

Surveyors (Practice) Regulation 1996
Datum Line of Azimuth: X-Y.
Clause 8(4): COUNTRY.

Plans used in preparation of survey/compilation

D.P. 61089
D.P. 183215
D.P. 725089
D.P. 749981
R 21778.1603

PANEL FOR USE ONLY for statements of intention to dedicate public roads, to create public reserves, drainage reserves, easements, restrictions on the use of land or positive covenants.

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

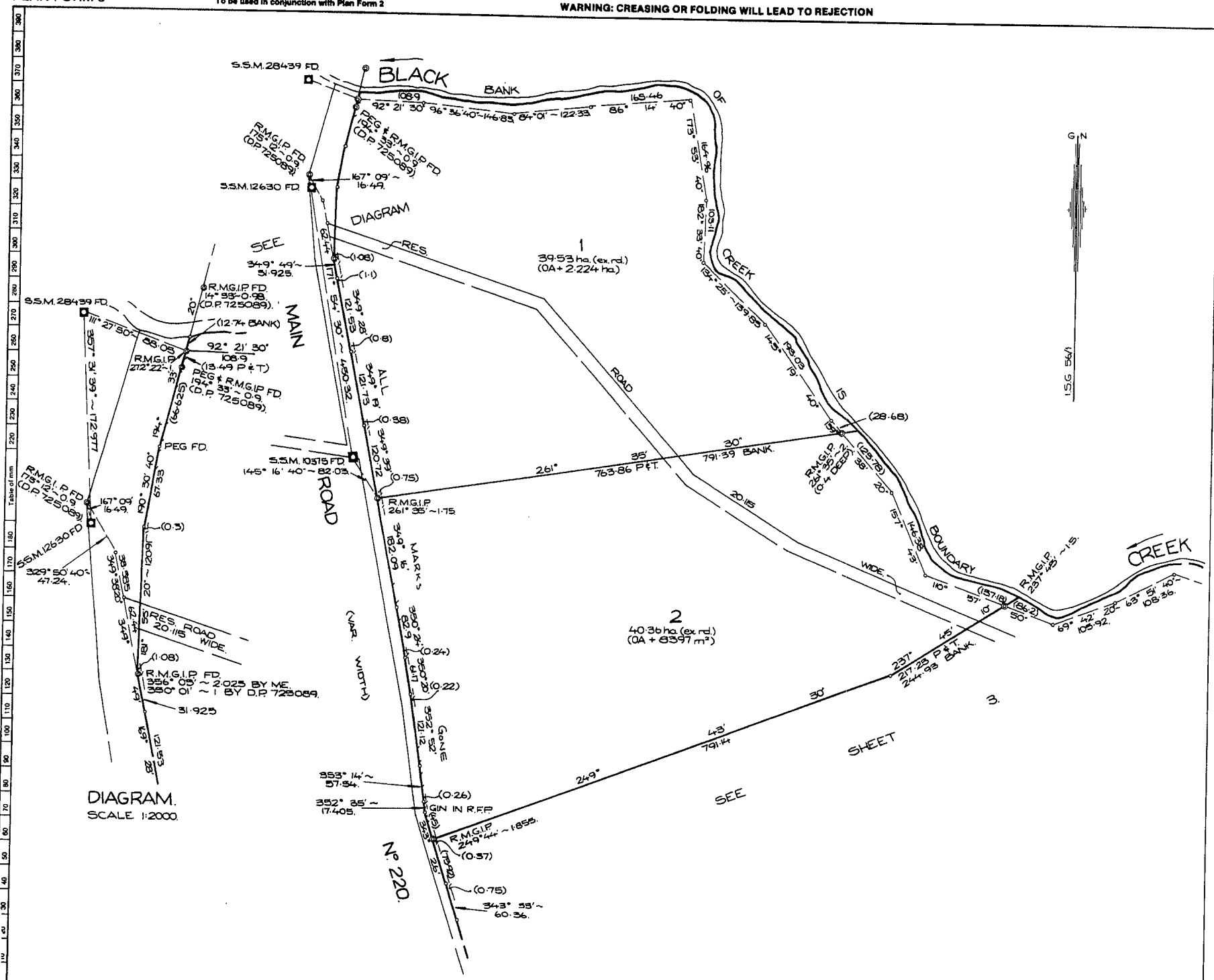
DP 869651

PLAN FORM 3

To be used in conjunction with Plan Form 2

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

*OFFICE USE ONLY



DP 869651

Registered: 23.7.1997

This is sheet 2 of my plan in 3 sheets dated 16TH DECEMBER 1996.

Surveyor registered under Surveyors Act 1929

This is sheet 2 of the plan of 3 sheets covered by my Certificate No 130/696/14 of 6TH JUNE 1997

General Manager/~~Authorised Person~~

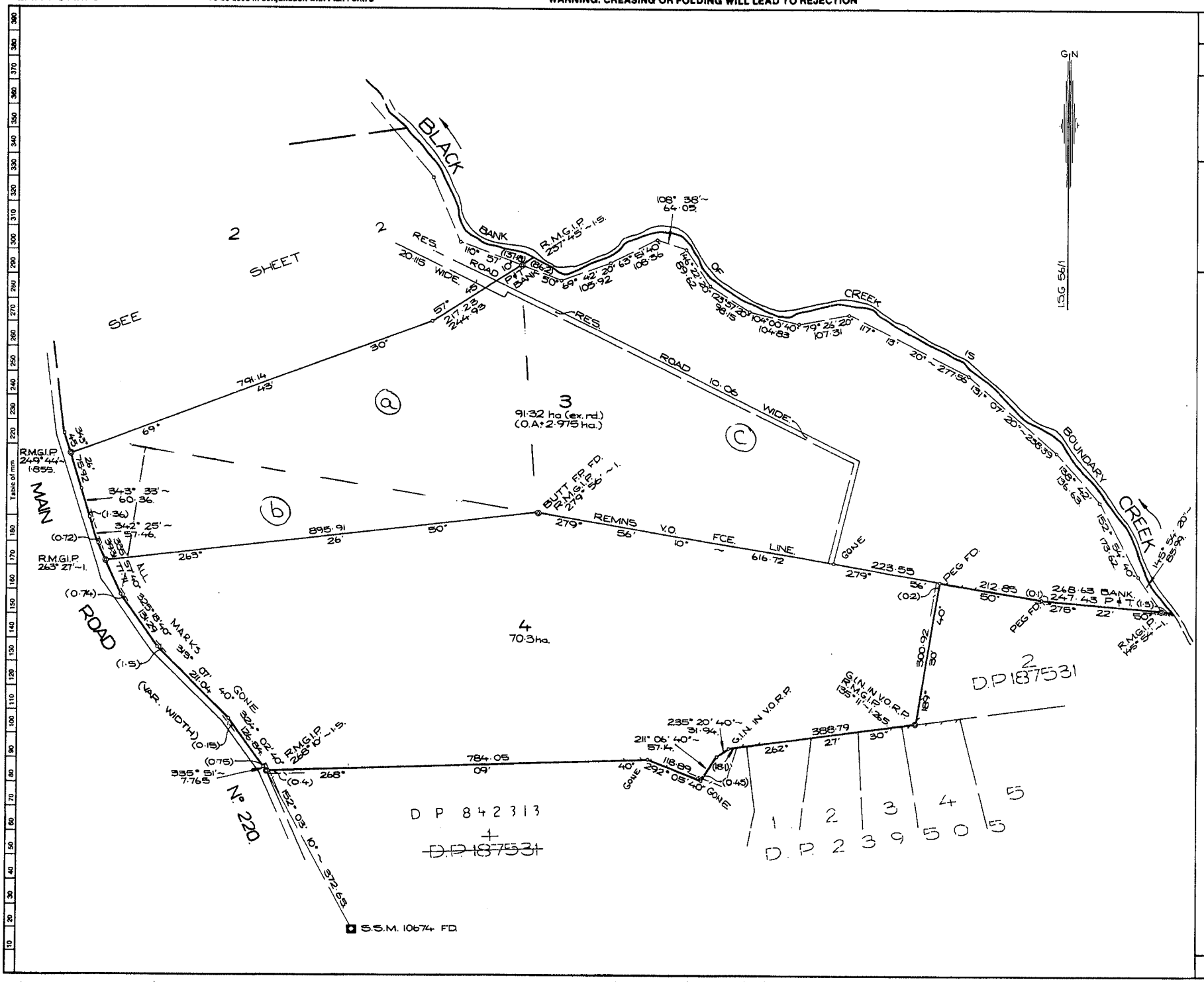
For use where space is insufficient in any panel on Plan Form 2

DP 869651

Reduction Ratio 1: 4000.

Plan Drawing only to appear in this space

PLAN FORM 3 | To be used in conjunction with Plan Form 2 | WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION | *OFFICE USE ONLY



DP 869651

Registered: 23·7·1997

This is sheet 3 of my plan in 3 sheets dated 16TH DECEMBER 1996.

Surveyor registered under Surveyors Act 1929

This is sheet 3 of the plan of 3 sheets covered by my Certificate No. 150/596/14 of 6TH JUNE 1997

General Manager/Authorised Person

For use where space is insufficient in any panel on Plan Form 2.

DP 869651

Reduction Ratio 1: 5000.

Plan Drawing only to appear in this space

SURVEYOR'S REFERENCE: 14220.

Information Provided Through
Advance Legal Search Pty Ltd
Ph. 0297541590 *Fax.* 0297541364

Historical Search

EziSearch
An Approved LPI *NSW*
Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
20/2/2006 8:51AM

FOLIO: 2/869651

First Title(s): OLD SYSTEM
Prior Title(s): 1/133849

Recorded	Number	Type of Instrument	C.T. Issue
25/7/1997	DP869651	DEPOSITED PLAN	FOLIO CREATED EDITION 1
19/9/1997	3429500	TRANSFER	EDITION 2
19/5/1998	3995791	MORTGAGE	EDITION 3
5/4/2001	7527824	CAVEAT	
22/11/2002	9151419	WITHDRAWAL OF CAVEAT	
22/11/2002	9151421	DISCHARGE OF MORTGAGE	
22/11/2002	9151422	MORTGAGE	EDITION 4
20/12/2002	9237763	CAVEAT	
13/8/2003	9876530	CAVEAT	
11/2/2004	AA407280	CAVEAT	
1/3/2004	AA458568	DISCHARGE OF MORTGAGE	
1/3/2004	AA458569	WITHDRAWAL OF CAVEAT	
1/3/2004	AA458570	WITHDRAWAL OF CAVEAT	
1/3/2004	AA458571	TRANSFER	EDITION 5

*** END OF SEARCH ***

Coffey - Rothbury ALSP

PRINTED ON 20/2/2006

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Ph. 0297541590 *Fax.* 0297541364

Historical Search

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Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
20/2/2006 8:50AM

FOLIO: 1/869651

First Title(s): OLD SYSTEM
Prior Title(s): 1/133849

Recorded	Number	Type of Instrument	C.T. Issue
25/7/1997	DP869651	DEPOSITED PLAN	FOLIO CREATED EDITION 1
19/9/1997	3429498	TRANSFER	EDITION 2
19/5/1998	3995788	MORTGAGE	EDITION 3
5/4/2001	7527827	CAVEAT	
21/1/2002	8287183	CAVEAT	
22/11/2002	9151351	WITHDRAWAL OF CAVEAT	
22/11/2002	9151352	WITHDRAWAL OF CAVEAT	
22/11/2002	9151353	DISCHARGE OF MORTGAGE	
22/11/2002	9151354	MORTGAGE	EDITION 4
20/12/2002	9237762	CAVEAT	
13/8/2003	9876531	CAVEAT	
27/2/2004	AA455729	WITHDRAWAL OF CAVEAT	
27/2/2004	AA455730	WITHDRAWAL OF CAVEAT	
27/2/2004	AA455731	DISCHARGE OF MORTGAGE	
27/2/2004	AA455732	MORTGAGE	EDITION 5

*** END OF SEARCH ***

Coffey - Rothbury ALSP PRINTED ON 20/2/2006

Information Provided Through
Advance Legal Search Pty Ltd
Ph. 0297541590 *Fax.* 0297541364

Historical Search

EziSearch
An Approved LPI *NSW*
Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
20/2/2006 8:52AM

FOLIO: 3/869651

First Title(s): OLD SYSTEM
Prior Title(s): 1/133849 1/183215
149/661699

Recorded	Number	Type of Instrument	C.T. Issue
25/7/1997	DP869651	DEPOSITED PLAN	FOLIO CREATED EDITION 1
9/9/1997	3397409	DEPARTMENTAL DEALING	EDITION 2
19/9/1997	3429499	TRANSFER	EDITION 3
19/5/1998	3995788	MORTGAGE	EDITION 4
5/4/2001	7527827	CAVEAT	
21/1/2002	8287183	CAVEAT	
22/11/2002	9151351	WITHDRAWAL OF CAVEAT	
22/11/2002	9151352	WITHDRAWAL OF CAVEAT	
22/11/2002	9151353	DISCHARGE OF MORTGAGE	
22/11/2002	9151354	MORTGAGE	EDITION 5
20/12/2002	9237762	CAVEAT	
13/8/2003	9876531	CAVEAT	
27/2/2004	AA455729	WITHDRAWAL OF CAVEAT	
27/2/2004	AA455730	WITHDRAWAL OF CAVEAT	
27/2/2004	AA455731	DISCHARGE OF MORTGAGE	
27/2/2004	AA455732	MORTGAGE	EDITION 6

*** END OF SEARCH ***

Coffey - Rothbury ALSP PRINTED ON 20/2/2006

Information Provided Through
Advance Legal Search Pty Ltd
Ph. 0297541590 *Fax.* 0297541364

Historical Search

EziSearch
An Approved LPI *NSW*
Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
20/2/2006 8:53AM

FOLIO: 4/869651

First Title(s): OLD SYSTEM
Prior Title(s): 1/183215

Recorded	Number	Type of Instrument	C.T. Issue
25/7/1997	DP869651	DEPOSITED PLAN	FOLIO CREATED EDITION 1
19/9/1997	3429501	TRANSFER	EDITION 2
19/5/1998	3995791	MORTGAGE	EDITION 3
5/4/2001	7527824	CAVEAT	
21/1/2002	8287185	CAVEAT	
22/11/2002	9151419	WITHDRAWAL OF CAVEAT	
22/11/2002	9151420	WITHDRAWAL OF CAVEAT	
22/11/2002	9151421	DISCHARGE OF MORTGAGE	
22/11/2002	9151422	MORTGAGE	EDITION 4
20/12/2002	9237763	CAVEAT	
13/8/2003	9876530	CAVEAT	
11/2/2004	AA407280	CAVEAT	
1/3/2004	AA458568	DISCHARGE OF MORTGAGE	
1/3/2004	AA458569	WITHDRAWAL OF CAVEAT	
1/3/2004	AA458570	WITHDRAWAL OF CAVEAT	
1/3/2004	AA458571	TRANSFER	EDITION 5

*** END OF SEARCH ***

Coffey - Rothbury ALSP PRINTED ON 20/2/2006

TRANSFER

Form: 97-01T
Licence: 026CN/0526/96

New South Wales
Real Property Act 1900

3429500 K

Instructions for filling out this form are available from the Land Titles Office

Office of State Revenue use only

N.S.W. STAMP DUTY
220897 8125 04 00215036 3/03 $2.00

(A) **LAND TRANSFERRED**
Show no more than 20 titles. If appropriate, specify the share or part transferred.

2/869651

(B) **LODGED BY**

LTO Box	Name, Address or DX and Telephone
	M DUNCAN & ASSOCIATES P.O BOX 70 STRAWBERRY HILLS 2012 REFERENCE (15 character maximum):

TRANSFEROR ROMEO HOLDINGS PTY. LIMITED AND ROMALTO HOLDINGS PTY LIMITED

acknowledges receipt of the consideration of $350,000.00
and as regards the land specified above transfers to the transferee an estate in fee simple.
Encumbrances (if applicable) 1. 2. 3.

(F) **TRANSFEREE**

T TS (s713 LGA) TW (Sheriff)	NEW HORIZON INTERNATIONAL PTY LIMITED ACN 072 779 698

(G) **TENANCY:**

We certify this dealing correct for the purposes of the Real Property Act 1900. **DATE** .....
Signed in my presence by the transferor who is personally known to me.

.....
Signature of Witness

Refer to Annexure "A" for transferor's signature.

.....
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

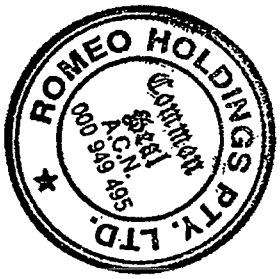
.....
CA DUNCAN solicitor for the Transferee

NB: if signed on the tranferee's behalf by a solicitor or licensed conveyancer, show the signatory's full name in block letters.

"A"

This is the Annexure marked "A" referred to in the Memorandum of Transfer between Romeo Holdings Pty. Limited (A.C.N. 000 949 495) & Romalto Holdings Pty. Limited (A.C.N. 000 949 502) [as Transferor] and New Horizon International Pty. Limited (A.C.N. 072 779 698) [as Transferee] in respect to Folio Identiifer 2/869651.

The Common Seal of ROMEO HOLDINGS)
)
PTY. LIMITED (A.C.N. 000 949 495) was)
)
hereunto affixed in the presence of:)



F Romeo ..... M Romeo .....
Director Secretary

The Common Seal of ROMALTO HOLDINGS)
)
PTY. LIMITED (A.C.N. 000 949 502) was)
)
hereunto affixed in the presence of:)

F Romeo ..... M Romeo .....
Director Secretary

Form: 97-01T

Licence: 026CN/0526/96

TRANSFER

New South Wales

Real Property Act 1900

3429499 Q

Instructions for filling out this form are available from the Land Titles Office

Office of State Revenue use only

$2.00 220897 8125 04 00215036?/03 STAMP DUTY N-S-W-

(A) **LAND TRANSFERRED**
Show no more than 20 titles. If appropriate, specify the share or part transferred.

3/869651

(B) **LODGED BY**

LTO Box	Name, Address or DX and Telephone
	M DUNCAN & ASSOCIATES P.O BOX 70 STRAWBERRY HILLS 2012 REFERENCE (15 character maximum):

TRANSFEROR ROMEO HOLDINGS PTY. LIMITED AND ROMALTO HOLDINGS PTY LIMITED

acknowledges receipt of the consideration of $350,000.00

and as regards the land specified above transfers to the transferee an estate in fee simple.

Encumbrances (if applicable) 1. 2. 3.

(F) **TRANSFEREE**

T **TS** (s713 LGA) **TW** (Sheriff)	SAMUEL NG

(G) **TENANCY:**

We certify this dealing correct for the purposes of the Real Property Act 1900. **DATE** .....

Signed in my presence by the transferor who is personally known to me.

Refer to Annexure "A" for transferor's signature.

.....
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

.....
CA DUNCAN solicitor for the Transferee

NB: if signed on the tranferee's behalf by a solicitor or licensed conveyancer, show the signatory's full name in block letters.

"A"

This is the Annexure marked "A" referred to in the Memorandum of Transfer between Romeo Holdings Pty. Limited (A.C.N. 000 949 495) & Romalto Holdings Pty. Limited (A.C.N. 000 949 502) [as Transferor] and Samuel Ng [as Transferee] in respect to Folio Identiifer 3/869651.

The Common Seal of ROMEO HOLDINGS)
PTY. LIMITED (A.C.N. 000 949 495) was)
hereunto affixed in the presence of:)

ROMEO HOLDINGS PTY. LTD. Common Seal A.C.N. 000 949 495

S Romeo
Director

M Romeo
Secretary

The Common Seal of ROMALTO HOLDINGS)
PTY. LIMITED (A.C.N. 000 949 502) was)
hereunto affixed in the presence of:)

ROMALTO HOLDINGS PTY. LTD. Common Seal A.C.N. 000 949 502

S Romeo
Director

M Romeo
Secretary

Req:R650634 /Doc:DL 3429501 /Rev:27-Sep-1997 /Sts:NO.OK /Prt:20-Feb-2006 08:57 /Pgs:ALL /Seq:1 of 2
Ref:ALSP /Src:M

Form: 97-01T
Licence: 026CN/0526/96

TRANSFER

New South Wales

Real Property Act 1900

3429501 H

Instructions for filling out this form are available from the Land Titles Office

Office of State Revenue use only

N.S.W. STAMP DUTY
220897 8125 04 00215036B/03 $2.00

(A) **LAND TRANSFERRED**
Show no more than 20 titles. If appropriate, specify the share or part transferred.

4/869651

(B) **LODGED BY**

LTO Box	Name, Address or DX and Telephone
	M DUNCAN & ASSOCIATES P.O. BOX 70 STRAWBERRY HILLS 2012 REFERENCE (15 character maximum):

TRANSFEROR ROMEO HOLDINGS PTY. LIMITED AND ROMALTO HOLDINGS PTY LIMITED

acknowledges receipt of the consideration of $350,000.00
and as regards the land specified above transfers to the transferee an estate in fee simple.
Encumbrances (if applicable) 1. 2. 3.

(F) **TRANSFEREE**

T TS (s713 LGA) TW (Sheriff)	NEW HORIZON INTERNATIONAL PTY LIMITED ACN 072 779 698
(G)	**TENANCY:**

We certify this dealing correct for the purposes of the Real Property Act 1900. **DATE** .....
Signed in my presence by the transferor who is personally known to me.

..... Signature of Witness

Refer to Annexure "A" for transferor's signature.

..... 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

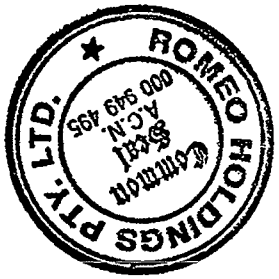
..... CA DUNCAN solicitor for the Transferee

NB: if signed on the tranferee's behalf by a solicitor or licensed conveyancer, show the signatory's full name in block letters.

"A"

This is the Annexure marked "A" referred to in the Memorandum of Transfer between Romeo Holdings Pty. Limited (A.C.N. 000 949 495) & Romalto Holdings Pty. Limited (A.C.N. 000 949 502) [as Transferor] and New Horizon International Pty. Limited (A.C.N. 072 779 698) [as Transferee] in respect to Folio Identiifer 4/869651.

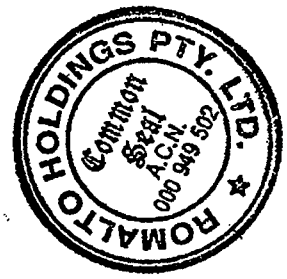
The Common Seal of ROMEO HOLDINGS PTY. LIMITED (A.C.N. 000 949 495) was hereunto affixed in the presence of:)



F Romeo
Director

M Romeo
Secretary

The Common Seal of ROMALTO HOLDINGS PTY. LIMITED (A.C.N. 000 949 502) was hereunto affixed in the presence of:)



F Romeo
Director

M Romeo
Secretary

12380128

NEW SOUTH WALES

Appln. No.11089

Prior Title Vol.1311 Fol.233

Vol. 12380 Fol. 128

Edition issued 4-7-1974

CANCELLED W

ON ISSUE OF NEW FOLIO 1133149

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.

CANCELLED

S

ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot 1 in Deposited Plan 61089 in the City of ~~Greater~~ Cessnock, Parish of Rothbury and County of Northumberland being part of Portion 149 granted to Jane Coulson on 19-4-183[illegible] and part of Portion 148 granted to Henry Coulson on 9-10-1861. EXCEPTING THEREOUT the roads shown in the plan hereon.

FIRST SCHEDULE

~~TALHANSA PTY. LIMITED.~~

SECOND SCHEDULE

GRY 1. Reservations and conditions, if any, contained in the Crown Grants above referred to.
2. ~~Mortgage No.N822352 to Ecanda[illegible]ed. Entered 9-5-1974.~~ Discharged P 208348

(Page 1) Vol. 12380 Fol. 128

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.

AMENDMENT MADE IN LTO 23-4-1987 1614

20943:359 (70)

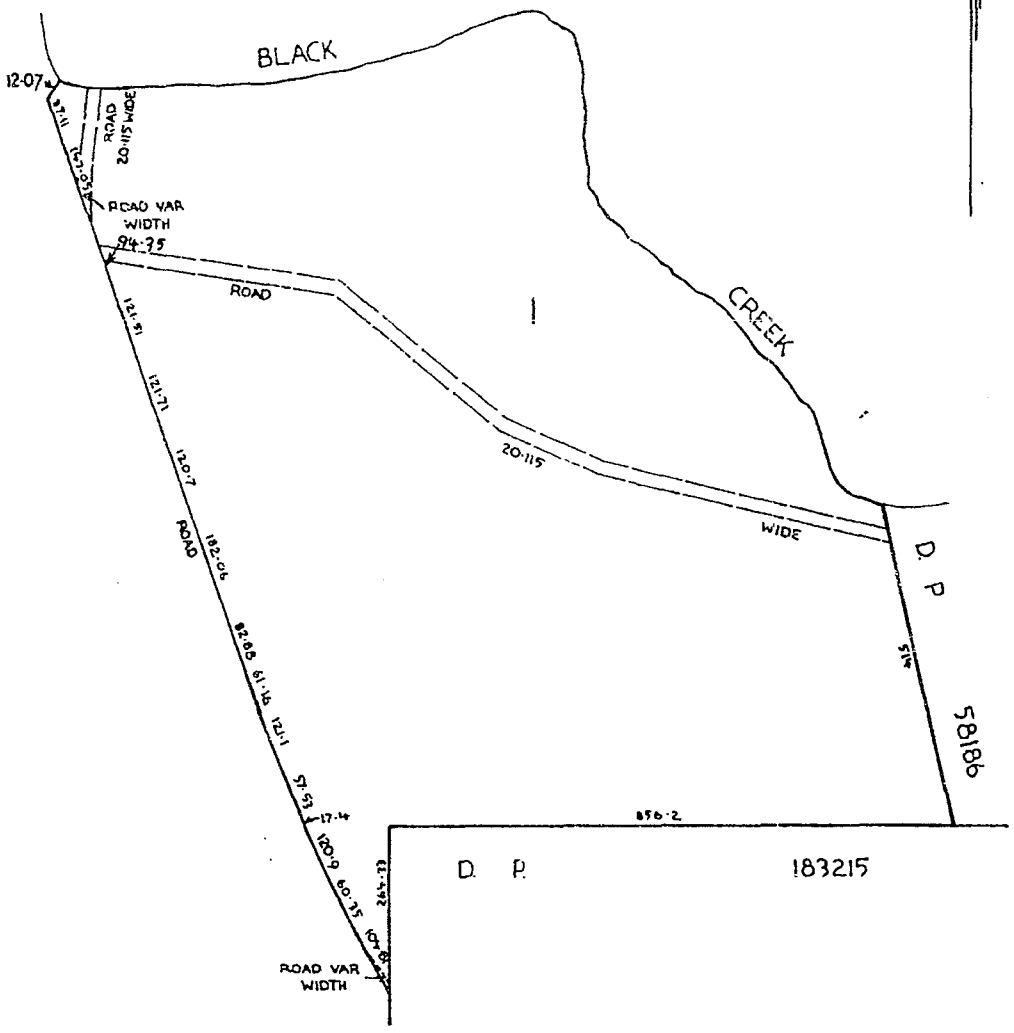
NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED.

Vol. 12380 Fol. 128

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES

B



AREA : 102·9 ha

THIS AREA DOES NOT INCLUDE THE AREA OF THE ROADS.

REDUCTION RATIO 1 : 8000

N822352 1/9

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General
~~Romeo Holdings Pty Limited and Romalto Holdings Pty Limited as tenants in common in equal shares~~	~~Transfer~~	~~P208349~~	~~19-3-1975~~	~~11-4-1975~~	
Her Most Gracious Majesty Queen Elizabeth The Second of part being Lot 3 in DP725089 and Romeo Holdings Pty Limited and Romalto Holdings Pty Limited as tenants in common in equal shares of the residue by Application X672586. Registered 21-7-1988.					
The State of New South Wales of the severed land being Lot 6 in DP 725089 and Romeo Holdings Pty Limited and Romalto Holdings Pty Limited as tenants in common in equal shares of the residue by Resumption X672586. Registered 21-7-1988					

THIS FOLIO IS CANCELLED AS TO PART
LOT(S) 3 AND 6 IN
PLAN 725089 SEE NEW
3/725089
6/

P208348 ad 19 T.R. 50 A
S138395 R
V71626 M R
DP725089 R (Public Roads Act, 1902)
X672586 RA (road)

SECOND SCHEDULE (continued)

INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION		
~~Mortgage~~	~~P208350~~	~~19-3-1975~~	~~to Talkarra Pty Limited~~	~~11-4-1975~~		Discharged	S138395	
V71626			Mortgage to National Commercial Banking Corporation of Australia Limited. Registered 26-4-1984					
X672586			Resumption. The part of the land above described being Lot 3 in DP725089 is public road. Registered 21-7-1988.					
X672586			Resumption. The part of the land above described being Lot 6 in DP 725089. Registered 21-7-1988					

REG GEN 18-4-1989

CANCELLED W

ON ISSUE OF NEW FOLIO 1/133149

Vol. 12380 Fol. 128

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

Vol. 12380 Fol. 128

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT			ENTERED	Signature of Registrar General
	NATURE	NUMBER	DATE		

SECOND SCHEDULE (continued)

		PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION		

(Page 4 of 4 pages)

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

202

B97
/Req: B103829 /Doc: CT 07953-176
/Prt: 20-Feb-2006

[CEI 07953176

Primary Appn No. 20352

Reference to Last Title s

Vol. 7116 Fols. 240 and 241

REGISTER BOOK

VOL. 7953 FOL. 176

MH Issued on Transfer No. H491536

S

CANCELLED W

ON ISSUE OF NEW FOLIO 1/183215

WILLIAM GEORGE WARE of Jerrys Plains, Dairy Farmer, is now the proprietor of an Estate in Fee Simple, subject nevertheless to the reservations and conditions, if any, contained in the Grant hereinafter referred to, and also subject to such encumbrances liens, and interests as are notified hereon, in That piece of land in the City of Greater Cessnock Parish of Rothbury and County of Northumberland shown in the plan hereon and therein edged red and also shown in plan lodged with Transfer No. B931169 being part of Portion 149 granted to Jane Coulson on 19th April 1839.

EXCEPTING THEREOUT the road coloured brown in plan hereon which was resumed to a depth of 50 feet below the surface.

XR

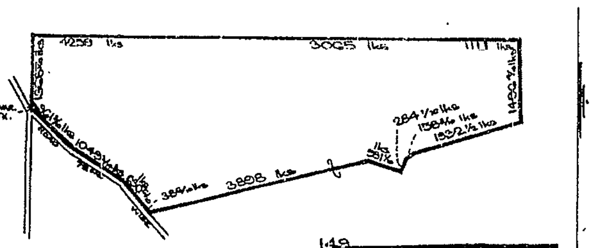
1/183215

GRY

In witness whereof I have hereunto signed my name and affixed my Seal, this Twenty-eighth day of July, 1960

Signed in the presence of J Wollmer

Registrar-General.



149

The Land WITHIN DESCRIBED IS Lot 1 in DP183215

Area: 200 ac. 2 rd. 36½ per.
Exclusive of the area of the road coloured brown.

Scale: 20 Chains to one inch.

H481536

NOTIFICATION REFERRED TO

No. H515088 MORTGAGE dated 17th May 1960. to BANK OF NEW SOUTH WALES
18th August 1960

REGISTRAR GENERAL.

MORTGAGE No. H515088 has been discharged.
See J485092 Entered 4th November 1963

REGISTRAR GENERAL

John Carrington Smith of East Maitland Farmer is
now the registered proprietor of the land within described.
See TRANSFER No. J485094 dated 4th July 1963.
Entered 4th November 1963.

REGISTRAR GENERAL

A.J. Edden Pty Limited is
now the registered proprietor of land within described.
See TRANSFER No. J739401 dated 13th July 1964.
Entered 2nd September 1964.

REGISTRAR GENERAL

Te
H822351

Persons are cautioned against altering or adding to this Certificate or any notification thereon.

V.C.N. Blight, Government Printer

Talbanson Pty. Limited is

now the registered proprietor of the land within described

See TRANSFER No. N822351 dated 9th April 1974

Entered 9th May 1974

REGISTRAR GENERAL

No. N822352 MORTGAGE dated 9th April 1974

to Esanda Limited:

Entered 9th May 1974

Discharged P208348 11-4-1975

REGISTRAR GENERAL

Romeo Holdings Pty Limited and Ronalto Holdings Pty Limited as tenants in common in equal shares are

now the registered proprietors of the land within described.

See TRANSFER No. P208349 dated 19th March 1975

Entered 11th April 1975

REGISTRAR GENERAL

No. P208350 MORTGAGE dated 19th March 1975

to Talbanson Pty Limited

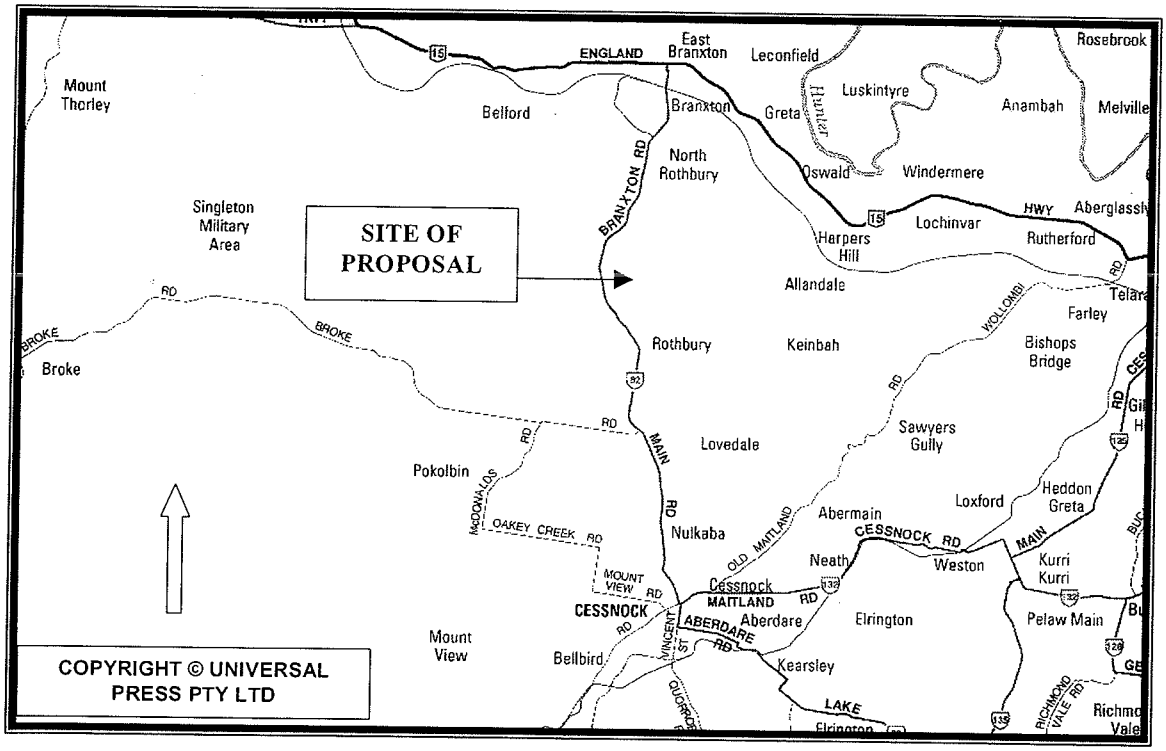
Entered 11th April 1975

Discharged 5138395 3-11-1980

REGISTRAR GENERAL

COMPUTER FOLIO NO FURTHER DEALINGS TO BE REGISTERED.

5138395 D/M. R



Coffey Geosciences Pty Ltd ACN 056 335 516		Geotechnical I **Resources** I Environmental I **Technical** I Project Management	
Drawn	KJG	HUNTER DEVELOPMENT BROKERAGE PTY LTD LOTS 1, 2, 3 and 4 in DP869651, ROTHBURY PRELIMINARY CONTAMINATION ASSESSMENT	Drawing no: **N09908/01-1**
Approved			
Date	17/02/06		
Scale		SITE LOCATION PLAN	Job no: N09908/01

Coffey Geosciences Pty Ltd ACN 056 335 516		Geotechnical I **Resources** I Environmental I **Technical** I Project Management	
Drawn	KJG	HUNTER DEVELOPMENT BROKERAGE PTY LTD LOTS 1, 2, 3 and 4 in DP869651, ROTHBURY PRELIMINARY CONTAMINATION ASSESSMENT	Drawing no: **N09908/01-2**
Approved			
Date	28/02/06		
Scale		SITE PLAN	Job no: **N09908/01**

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6 June 2012

HDB Town Planning and Design Pty Ltd
First Floor 44 Church Street
MAITLAND NSW 2320

Attention: Kerry Nichols

Dear Kerry

RE: Proposed Redevelopment Lots 1,2,3 and 4 DP 869651, Branxton Road, Rothbury NSW Letter Regarding Previous Preliminary Contamination Assessment (ref: N09908/01-AC, March 2006)

It is understood that HDB Town Planning & Design Pty Ltd (HDB) are preparing an application to re-zone the site located at Lots 1, 2, 3 and 4 DP 869651, Branxton Road, Rothbury NSW. The re-zoning is required for a proposed redevelopment comprising the 'Golden Bear Resort', a resort hotel/ residential development including an 18-hole golf-course, clubhouse, resort facilities, villa accommodation and permanent residential accommodation.

Coffey previously prepared a preliminary contamination assessment (ref: N09908/01-AC, dated 8 March 2006) for this redevelopment, which Cessnock City Council (Council) required as part of a re-zoning application. The application is on-going, and it is understood that Council require information on the applicability of the Coffey (2006) report.

HDB have requested that Coffey review the previous report, and assess if it is still applicable today based on potential changes in legislation and/or guidelines.

The objectives of the 2006 preliminary contamination assessment (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;
- Provide a preliminary assessment of site contamination;
- Assess the need for further investigations.

The proposed scope of work for the project included:

- A site history to identify potential areas of environmental concern (AECs) and chemicals of concern (COCs), including:
  - A title search to assess historical site ownership;
  - A search of Council records;
  - A review of selected aerial photographs from the last 50 years;
  - A check of NSW EPA records for notices on the site
- Site walkover; and,
- Reporting.

The assessment was carried out in general accordance with the relevant legislation and guidelines in 2006, namely:

- State Environmental Planning Policy (SEPP) 55 – Remediation of Land (1998), under the Environmental Planning and Assessment Act 1979. This SEPP is still current; and
- NSW EPA (1995) Guidelines for Consultants Reporting on Contaminated Sites. This guideline was re-issued in 2011 by NSW Office of Environment and Heritage.

HDB stated that the site ownership and use has not changed since 2006. The current site use comprises vacant land used for stock grazing (about 20 cattle). The site is understood to be secured, and therefore illegal dumping of waste is unlikely to have occurred.

Since 2006 the following changes to legislation and guidelines related to contaminated land have occurred:

- An update of the NSW EPA (1995) Consultants Reporting on Contaminated Sites guidelines was released by NSW Office of Environment and Heritage. The content of the guideline in regards to preliminary (Phase 1) site assessments did not change, and therefore the findings and conclusions of the Coffey (2006) report are not impacted by this update;
- Release of the National Environment Protection Measure (NEPM) guidelines in 2013. As no sampling and analysis is contained within the report, this does not impact on the findings or conclusions of the Coffey (2006) report.

As the requirements of the above legislation and guidelines has not changed since 2006, and information supplied by HDB indicates the site condition is unlikely to have changed since 2006, Coffey consider the 2006 report to be applicable for use in a re-zoning application.

Coffey consider the recommendations made regarding a preliminary soil contamination assessment are also still applicable. Coffey would recommend the addition of lead as a COC in the former house areas, due to potential use of lead based paints.

For and on behalf of Coffey Environments Australia Pty Ltd

Emma Coleman

Senior Environmental Scientist

Attachments: Important Information about your Coffey Environmental Report

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Important information about Coffey Environmental Report

Uncertainties as to what lies below the ground on potentially contaminated sites can lead to remediation costs blow outs, reduction in the value of the land and to delays in the redevelopment of land. These uncertainties are an inherent part of dealing with land contamination. The following notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report has been written for a specific purpose

Your report has been developed on the basis of a specific purpose as understood by Coffey and applies only to the site or area investigated. For example, the purpose of your report may be:

- To assess the environmental effects of an on-going operation.
- To provide due diligence on behalf of a property vendor.
- To provide due diligence on behalf of a property purchaser.
- To provide information related to redevelopment of the site due to a proposed change in use, for example, industrial use to a residential use.
- To assess the existing baseline environmental, and sometimes geological and hydrological conditions or constraints of a site prior to an activity which may alter the sites environmental, geological or hydrological condition.

For each purpose, a specific approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible, quantify risks that both recognised and unrecognised contamination pose to the proposed activity. Such risks may be both financial (for example, clean up costs or limitations to the site use) and physical (for example, potential health risks to users of the site or the general public).

Scope of Investigations

The work was conducted, and the report has been prepared, in response to specific instructions from the client to whom this report is addressed, within practical time and budgetary constraints, and in reliance on certain data and information made available to Coffey. The analyses, evaluations, opinions and conclusions presented in this report are based on those instructions, requirements, data or information, and they could change if such instructions etc. are in fact inaccurate or incomplete.

Subsurface conditions can change Interpretation of factual data

Subsurface conditions are created by natural processes and the activity of man and may change with time. For example, groundwater levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of the subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project and/or on the property.

Interpretation of factual data

Environmental site assessments identify actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from indirect field measurements and sometimes other reports on the site are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how well qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of Coffey through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other problems encountered on site.

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Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered with redevelopment or on-going use of the site. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. In particular, a due diligence report for a property vendor may not be suitable for satisfying the needs of a purchaser. Your report should not be applied for any purpose other than that originally specified at the time the report was issued.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other professionals who are affected by the report. Have Coffey explain the report implications to professionals affected by them and then review plans and specifications produced to see how they have incorporated the report findings.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel), field testing and laboratory evaluation of field samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Contact Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to land development and land use. It is common that not all approaches will be necessarily dealt with in your environmental site assessment report due to concepts proposed at that time. As a project progresses through planning and design toward construction and/or maintenance, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Environmental reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

APPENDIX L

TRAFFIC IMPACT ASSESSMENT

BETTER TRANSPORT FUTURES 2016

BETTER TRANSPORT FUTURES
MARK WAUGH

PO Box 114 New Lambton NSW 2305
BTF201670 HDB Pokolbin Golf Resort TIS Rev02.docx
30 April 2016

Mr. Mathew Egan
HDB Planning & Design
PO Box 40
Maitland NSW 2320

Dear Mathew,

Re: Proposed Golf Resort Development Wine Country Drive Pokolbin, NSW – Traffic Impact Assessment

Further to your instructions we have now completed the requested transport planning and engineering assessment of the proposed golf resort development at Wine Country Drive Pokolbin, NSW - Traffic Impact Assessment**.** This letter outlines the findings of our traffic Impact assessment investigations.

1) Background to Review

In October 2013 Better Transport Futures prepared a Traffic Impact Statement for the proposed golf resort Development on Wine Country Drive Pokolbin, NSW. The project was known as Golden Bear. Since that time the rezoning application for the development has been finalised and initial preparations are being made to submit a subdivision application for the project. As such there is a need to update the previously supplied traffic report to reflect changes in the broader road network such as the opening of the Hunter Expressway and some minor local changes.

With respect to local changes affecting the subject site, the key issue is in regard to the proposed treatment of the access intersection for the site. General agreement has been reached previously that the preferred entry to the site is via a roundabout which would also provide access to The Vintage development to the west of Wine Country Drive.

(Refer to Attachments A Concept Plan and Attachment B RMS Correspondence).

This letter provides supplementary information to address the above issues with respect to the likely traffic impacts of the development proposal, with specific reference to the following impacts:

1. Opening of the Hunter Expressway, and its effects on traffic flows on Wine Country Drive
2. The effects of background traffic growth on Wine Country Drive most notably from the approved Huntlee development near Branxton and to the north of the subject site.
3. The suitability of a 4 way roundabout as the access intersection treatment for the subject site.
4. Any impacts on nearby existing intersections along Wine Country Drive, such as McDonalds Road and Palmers Lane

This report presents the results of the supplementary investigations into the above to support the subdivision application for the proposed development.

2) Scope of Traffic Assessment

The Scope this supplementary Traffic Impact Statement is to document the current conditions on the adjacent road network at the subject site, any changes to the features of the development proposal, and any traffic impacts and appropriate mitigation measures resulting from the recent changes noted above. Specifically the work has included:

a. Review of available existing documentation relating to traffic movement and parking in the area, including any recent traffic movement and parking surveys
b. Collection of more current data on traffic flows on Wine Country Drive relating to the post opening Hunter Expressway conditions.
c. Calculation and analysis of projected changes in traffic conditions that may affect the access proposals for the subject site.
d. Assessment of the traffic and parking impacts of the proposed development, including
e. Preparation of a supplementary Traffic Impact Statement suitable for inclusion with the proposed subdivision application for the subject site.

3) Site Location

The subject site is located off Wine Country Drive approximately 8 kms north of Cessnock with a single access proposed direct off Wine Country Drive.

The location of the site is shown below in **Figure 1.**

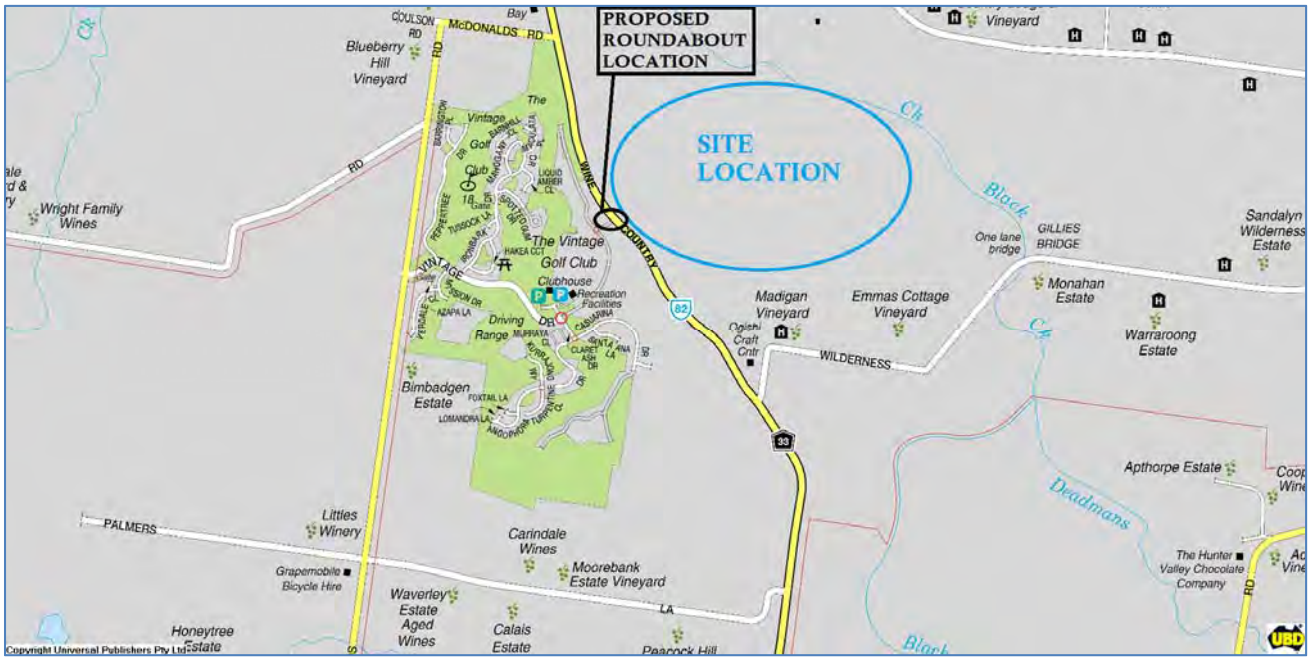


Figure 1 – Site Location
Map Source: UBD City Streets Version 5 (Newcastle)

The current concept plan for the subject site is included as **Attachment A** to this Report.

4) Effect of opening of Hunter Expressway on WCD traffic flows

The Hunter Expressway opened to traffic on 22 March 2014. The NSW Roads and Maritime Service (RMS) has stated that *"the expressway has improved travel times for motorists between Newcastle and the Upper Hunter and has improved journeys across the broader network. Preliminary traffic data shows around 20,000 vehicles per day using the Hunter Expressway on weekdays and weekends."*

Traffic data collected by RMS has shown that there are around 20,000 vehicles per day using the Hunter Expressway. The data also shows major decreases in traffic on the New England Highway, with around 45 per cent less traffic through Lochinvar and about 25 per cent less traffic through East Maitland and Maitland. Traffic at Weakleys Drive has experienced a decrease of 15 to 20 per cent of total traffic, with a reduction of 20 to 25 per cent in heavy vehicles.

Some connecting roads such as Cessnock Road, near the New England Highway, have experienced increases in traffic flow, in this case in the order of 1,500 vehicles per day. Buchanan Road and Hart Road have experienced similar increases in the order of 1,500 to 2,500 vehicles per day.

For the B82 route of which Wine Country Drive is a significant part, traffic counts post Hunter Expressway opening collected in 2014 by RMS are as follows:

Wine Country Drive 2014 Traffic Flows

North of Tuckers Lane, North Rothbury
Northbound – 1844 vehicles
Southbound – 1623 vehicles
Total: 3467

South of Lovedale Rd, Lovedale
Northbound – 4825 vehicles
Southbound – 4631 vehicles
Total: 9456

South of Russell St, Branxton
Northbound – 1269 vehicles
Southbound – 1422 vehicles
Total: 2691

Traffic data was collected at a number of sites in association with the proposed Huntlee Development in 2012, pre-opening of the Hunter Expressway. Recorded 2012 traffic flows available for this review are summarised below:

Wine Country Drive 2012 Traffic Flows

South of Main Railway Line
NB AM Peak 1 hr: 301
SB AM Peak 1 hr: 238
2-way total: 540

NB PM Peak 1 hr: 256
SB PM Peak 1 hr: 310
2-way total: 566
Total: 7751

North of Old North Road
NB AM Peak 1 hr: 205
SB AM Peak 1 hr: 209
2-way total: 414

NB PM Peak 1 hr: 219
SB PM Peak 1 hr: 223
2-way total: 442
Daily Total: 6151

Wine Country Drive 2013 Traffic Flows

(Pre HEX Opening 6th March 2013)

North of McDonalds Road
NB AM Peak 1 hr: 192
SB AM Peak 1 hr: 229
2-way total: 421

NB PM Peak 1 hr: 218
SB PM Peak 1 hr: 234
2-way total: 452

South of McDonalds Road
NB AM Peak 1 hr: 244
SB AM Peak 1 hr: 217
2-way total: 461

NB PM Peak 1 hr: 220
SB PM Peak 1 hr: 330
2-way total: 550

North of McDonalds Road the flows are very similar to those observed near reflect Old North Road. South of McDonalds Road the is an increased right turn flow out of McDonalds Road that is not reflected in the morning left turn flows, suggesting an alternate Am travel route to sites west of Wine Country Drive.

Analysis of available Wine Country Drive traffic data

A review of the above data, in particular the sites on Wine Country Drive near the main railway line, and also in the vicinity of Old North Road and Tuckers Lane reveals the following:

1. Traffic Flows at the site immediately south of the Main Railway Line and township of Branxton show a dramatic reduction post opening of the Hunter Expressway. This makes sense in that the Expressway and its new link road connection to the interchange east of the town means that the town of Branxton is now completely bypassed.
2. The two sites on Wine Country Drive North of Tuckers lane, and North of Old North Road, whilst approximately 3 kms apart, are in a part of the local network where there is likely to be little impact on the north south flows along Wine Country Drive. Tuckers lane connects to the east to Greta, but it does not connect to the Hunter Expressway, and so only caters for local traffic movements. (There are alternate routes such as the New England Highway and Lovedale Road that cater for movements to and from Greta from places such as Cessnock to the south, and Singleton to the west for example.)
3. Even allowing for some reduction in the recorded flows at Tuckers Lane north and south of the junction, the total change in flow from 6151 vehicles per day north of Tuckers Lane, to 3467 vehicles per day is a reduction of 2684 vehicles per day.
4. A decrease in traffic flows on Wine Country Drive is understood to be consistent with modelling of the effects of the Hunter Expressway (Lower Hunter Transport Needs Study, Hyder 2012), where it was predicted that regional traffic choosing to use the B82 route to travel between the New England Highway at Branxton and the M1 Motorway at Freemans Waterhole, would choose to use the new Expressway route as a faster, safer and more efficient route.

The influence of the Hunter Expressway and its new connections to the wider road network may have changed the travel patterns in locations such as Lovedale Road to the south. The traffic flows recorded on Wine Country Drive near Lovedale Road, at around 9500 vehicles per day in 2014. However when it is considered that the primary access routes for patrons of the wine district were from the south in any case, the higher flows on this section of Wine Country Drive in the heart of the Pokolbin district are to be expected, even if some travellers now choose to use the Hunter Expressway and its Lovedale Road interchange to gain access to the locality.

And so given the connection to the Hunter Expressway at Lovedale Road may have led to an increase in flows along that route, with the vast majority of the Pokolbin wine district being place to the south and west of the subject site, the influence on traffic flows on Wine Country Drive adjacent to the subject site is not expected to be significant.

The overall conclusion here is that the influence of the opening of the Hunter Expressway on traffic flows along Wine Country Drive adjacent to the subject site has been a reduction in flow by anything up to around 2500 vehicles per day (using the Old North Road and Tuckers Lane data). This is comparable to other roads connecting to the Hunter Expressway where reductions in flow were predicted and have been experienced post opening.

5) Effects of Background Traffic Growth

Background traffic growth is the result of wider regional effects of development and growth in the Hunter Region. It is required by the road authorities, most notably RMS, that some allowance is made for background growth over a period of 10 years. This requirement is a result of historic trends that have been observed where traffic flows along the main road network may increase by a factor in the range of 1% to 3% per annum, over the stated 10 year period.

In the case of Wine Country Drive there are a number of factors of significant influence:

1. The impacts of changes to the road network, most notably the opening of the Hunter Expressway discussed above.
2. Any significant known development in the vicinity, in this case the Huntlee development noted by RMS. Huntlee is located to the north of the subject site just south of Branxton and relies on Wine Country Drive as its principal access.

Whilst there may be some other level of background growth experienced, it is considered that this will be dwarfed by the magnitude of changes that could occur because of the Hunter Expressway and Huntlee impacts.

With respect to the Huntlee the following features are noted:

1. The overall concept is for development of a new town of some 7500 dwellings, and associated town centre and employment generating lands.
2. A Stage 1 development has already been approved and is underway. This comprises Village One of the town, with a total of over 2300 (2345) dwellings approved, along with a first stage of the Huntlee Town Centre.
3. The time frame noted for full development of Stage One of Huntlee is 2020, and full development by 2036. This is 4 years and 20 years from today. (it should be noted that historic data indicates forecast development rates are never achieved and the likely development scenarios will be longer than these forecasts)
4. Extensive traffic modelling of the Huntlee development has been undertaken, with the following characteristics.
    a. Wine Country Drive Stage One Traffic flows North of Old North Road (Hyder 2012) have been predicted at:
        i. 410 vehicles/hr NB AM
        ii. 690 vehicles/hr SB AM
        iii. 1,100 vehicles/hr 2-way AM
        iv. 760 vehicles/hr NB PM
        v. 520 vehicles/hr SB PM
        vi. 1,280 vehicles/hr 2-way PM

(Note: These are modelled flows pre-opening of the Hunter Expressway (HEX). They assumed in the first instance no flow reduction on Wine Country Drive, and then in alternate scenarios for Stage One and Full development a 30% reduction in flow on Wine Country Drive.)

5. Intersection performance at Old North Road applying the above forecast flows was predicted as Level of Service (LoS) B
6. Approved modelling for the Huntlee development incorporated a growth rate of 0.5% for other background growth.
7. The Huntlee trip distribution assumptions (again approved by RMS) allowed for 22% of trips to the south via Wine Country Drive for both Stage One, and Full Development Scenarios.

The Level of Service criteria for urban road conditions is defined in the RMS "Guide to Traffic Generating Development" and is reproduced overleaf for reference as **Table 1.** The observed traffic flows and lane configurations confirm the existing service levels in the LoS A and B range.

■ **Table 1 – Urban road peak hour flows per direction**

Level of Service	One lane (vehicles / hour)	Two lanes (vehicles per hour)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Source: Guide to Traffic Generating Developments, RTA October 2002

Applying this Level of Service criteria to the forecast flows along Wine Country D rive (near Old North Road) it can be seen that the forecast flows would fall within the acceptable LoS C /D range for peak conditions.

Commentary

The Huntlee modelling allows for a 0.5% per annum background growth factor in its modelling. This factor allows for all other development that affects flows on Wine Country Drive, and hence already has allowed for developments such as the subject site. If the analysis was to be forced to now include an allowance for the subject site, this would be "double dipping" on the growth.

6) Review of Traffic Generation Rates

The 2013 BTF Traffic Impact Statement assumed the following development traffic movements:

■ Table 2 – Development Traffic Flows (BTF March 2013)

Element	Peak flows	AM in	AM out	PM in	PM out	Daily
300 residential dwellings	255	38	217	217	38	2,700
50 hotel rooms	20	10	10	10	10	150
250 luxury villas	100	50	50	50	50	750
Golf course	30	10	20	10	20	100
Conference facility	45	45	0	0	45	90
Total	450	153	297	287	163	3,790

The previous assessment work assumed a peak hour flow factor of 0.85 trips per hour as per the RTA Guide to Traffic Generating Developments published in 2002.

Of interest here is that the NSW RMS published in August 2013 Updated Trip Rates for a number of categories of traffic generating development. These included revision to residential trip rates for regional areas to a level lower than the 2002 rates (which relied on survey data that was anything up to 30 years old.)

Low density residential peak hour generation rate has dropped from 0.85 trips to 0.78 (PM) or 0.71(AM) in regional areas. Daily trips are 7.4 trips per day.

The components for the Golden Bear development remains unchanged. So applying the new rates of residential trip generation only, a revised trip generation profile would be as follows:

■ Table 3 – Revised Traffic Flows (BTF 2016)

Element	AM Peak	AM in	AM out	PM Peak	PM in	PM out	Daily
300 residential dwellings	213	32	181	234	199	35	2,220
50 hotel rooms	20	10	10	20	10	10	150
250 luxury villas	100	50	50	100	50	50	750
Golf course	30	10	20	30	10	20	100
Conference facility	45	45	0	45	0	45	90
Total	408	147	297	429	287	163	3,310

The change in trip generation rates results in a 5% (PM) to 10% (AM) reduction in peak period flows, and around 12.5% reduction in predicted daily flows form the development.

This level of reduction is significant, particularly as it affects peak period flow conditions, and warrants some reconsideration of the proposed levels of road improvements for the access arrangements of the subject site.

7) Site Access Considerations

The NSW RMS has requested consideration of a number of options for access to the subject site. These include:

a. The preferred access arrangement with both the Golden Bear and Vintage developments proceeding is a new 4 way one lane roundabout

b. One alternative should the Golden Bear development proceed on its own would be a new CHR/AUL intersection. This would be in accordance with the current development conditions of consent.

c. Another alternative should the Vintage development proceed would be for its access to be focussed on the McDonalds Road intersection. This would require upgrading to CHR/AUL standard, and then if the Golden Bear development were to proceed this would then also require a new CHR/AUL intersection.

This matter was raised in a meeting with representatives for the Vintage development, Cessnock City Council and NSW RMS, and HDB on behalf of the proponent for the Golden Bear development. (Refer to attached meeting minutes 3.9.15. The general outcome of previous discussions was:

1. While there was overall agreement in principal to the concept of a 4 way roundabout controlled intersection to service both the Golden Bear and Vintage developments, there is some uncertainty around the timing of the requirement of the intersection, particularly from the Vintage development which claims a roundabout won't be necessary for some time.
2. The location of the intersection was dictated by Council to correspond with that already set for the Vintage and its location cannot be moved. This has led to an amendment of the plans for Golden Bear from those originally proposed.
3. The Vintage development has confirmed it would not be committed to constructing the roundabout for some considerable time and hence would not want to contribute to that roundabout until it is needed for its development.
4. Consequently with respect to the subject site, the following access strategy is proposed:
    1. Stage 1 access to suit the development of the super lots only, with access for servicing/ construction only.
    2. In latter stages (Stage 2 or 3) where the individual lots are starting to be developed the access spine road to the motel site and the first stage of the residential will be constructed. The site access intersection to be constructed to a standard to service this level of development.
    3. The access road into the site will be a dual carriage road with a separate median in the centre to incorporate extensive landscaping. Individual roads within the site will be constructed to the appropriate standard and at crossover points with the walking trails throughout the site extensive landscaping and raised pavement will be utilised to give the golf carts and pedestrians priority.
    4. Onsite car parking associated with the motel and the spa will be provided on an ongoing basis in accordance with the DCP.
    5. With respect to the ultimate roundabout controlled junction, a long term contribution through a VPA for the intersection at a future date, but reflecting the level of works already completed. The contribution would be a proportion of total costs that reflects a distribution including the subject site, the Vintage development and through traffic flows.
5. We understand that there is no warrant for road widening due to our development, however, it is also understood that the department may be seeking road widening which we are happy to provide at cost.

In relation to adjacent intersection performance previous survey data and analysis of the McDonalds Road / Wine Country Drive intersection (BTF 2013) confirmed free flow conditions at this location. However the overall volumes at this time when compared to the Austroads warrants for turn treatments confirm the existing need for CHR(S) / AUL treatment at this location. For the site access treatment a priority intersection was recommended.

Table 4 drawn from the Austroads Guide to Traffic Management Part 3 Traffic Studies and Analysis provides advice on intersection operation where traffic flows are relatively low and capacity analysis is unnecessary. Where these limits are not met, traffic effectively operates under free flow conditions. From the perspective of intersection capacity at the subject site access intersection the existing (2014) plus development flows are within the threshold limits for 'free flow' conditions as defined in the Austroads Guidelines. Thus further consideration of the intersection performance under these flow conditions is not necessary.

With respect to future Wine Country Drive flows (Development + 10 year growth) which takes account of the HEX, and Huntlee development, the forecast flows on Wine Country Drive push the major road flows beyond the free flow limits.

Table 4 – Intersection volumes below which capacity analysis is unnecessary

Type of road	Light cross and turning volumes maximum design hour volumes vehicles per hour (two way)		
Two-lane major road	400	500	650
Cross road	250	200	100
Four-lane major road	1000	1500	2000
Cross road	100	50	25

Source: Austroads Guide to Traffic Management Part 3 Traffic Studies and Analysis

Re-analysis of the priority junction arrangements recommend as part of the 2013 Traffic Impact Statement confirms the RMS recommendation for a CHR/AUL treatment would be satisfactory. Also considered was the proposed 4 way one lane roundabout with the new access for the Vintage development being the 4th (western) leg of the intersection. Allowing for some traffic from the Vintage development to make use of this intersection, the intersection modelling confirms that a 4 leg one lane roundabout would also be a satisfactory access solution.

As a worst case scenario, the forecast traffic flows for Wine Country Drive (Huntlee Stage One with HEX modelled flows (Hyder 2012) have been combined with the traffic generation forecast for the subject site to assess options for control of the site access intersection. A summary of the SIDRA intersection modelling is presented below. It confirms satisfactory performance in both cases.

Table 5 – 2015 AM / PM Site Access Intersection Operation – Priority Control (Seagull)

Location	Leg	Movement	Av. Delay (secs)	LoS	95th % Queue (metres)
Wine Country Drive	North	Through	Continuous	-	-
		Left	Continuous	-	-
Golden Bear Access	East	Right	< 10 / < 10	A / A	< 1 / < 1
		Left	< 1 / < 1	A / A	< 1 / < 1
Wine Country Drive	South	Right	Continuous	-	-
		Through	Continuous	-	-

Note: Figures are quoted as AM/PM

Table 6 – 2015 AM / PM Site Access Intersection Operation – 4 leg 1 Lane Roundabout Control

Location	Leg	Movement	Av. Delay (secs)	LoS	95th % Queue (metres)
Wine Country Drive	North	Right	< 10 / < 10	A / A	< 10 / < 47
		Through	< 10 / < 10	A / A	< 10 / < 47
		Left	< 15 / < 15	A / A	< 10 / < 47
Golden Bear Access	East	Right	<20 / < 10	B / A	41 / < 15
		Through	< 15 / < 10	B / A	41 / < 15
		Left	< 15 / < 15	B / A	41 / < 15
Wine Country Drive	South	Right	< 10 / < 10	A / A	< 30 / < 84
		Through	< 10 / < 10	A / A	< 30 / < 84
		Left	< 15 / < 10	A / A	< 30 / < 84
Vintage Access	West	Right	< 10 / < 25	A / B	< 10 / < 32
		Through	< 10 / < 20	A / B	< 10 / < 32
		Left	< 15 / < 20	A / B	< 10 / < 32
Intersection		ALL MOVEMENTS			

Note: Figures are quoted as AM/PM

8) Review of Performance of Other Wine Country Drive Intersections

The RMS has requested consideration of the performance of the nearby intersections on Wine Country Drive, being that of McDonalds Road and Palmers Lane. Specific turning movement data was not available for these intersections.

However if the above traffic data (Old North Road Data) is assumed as being consistent with northbound and southbound flows along Wine Country Drive in the vicinity of the nominated intersections (a fair assumption given the almost nil property access along this stretch of the road), and applied to the consideration of intersections treatment warrants at these locations, an indication of the need for any improvements can be made.

The Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads 2009) provides guidance on the warrants for various auxiliary lane treatments at intersections. **Figure 2** below illustrates the principles for a design speed of less than 100 kph. The posted speed limit on Wine Country D rive in the vicinity of the subject site is 90 kph. The warrants relate turn treatments to a combination of major road traffic volume and turning volumes.

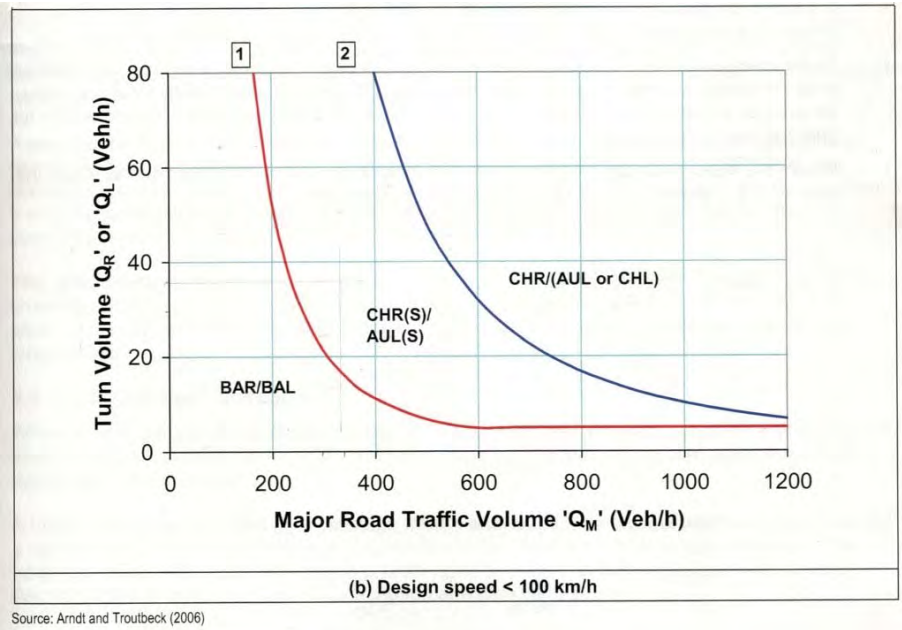


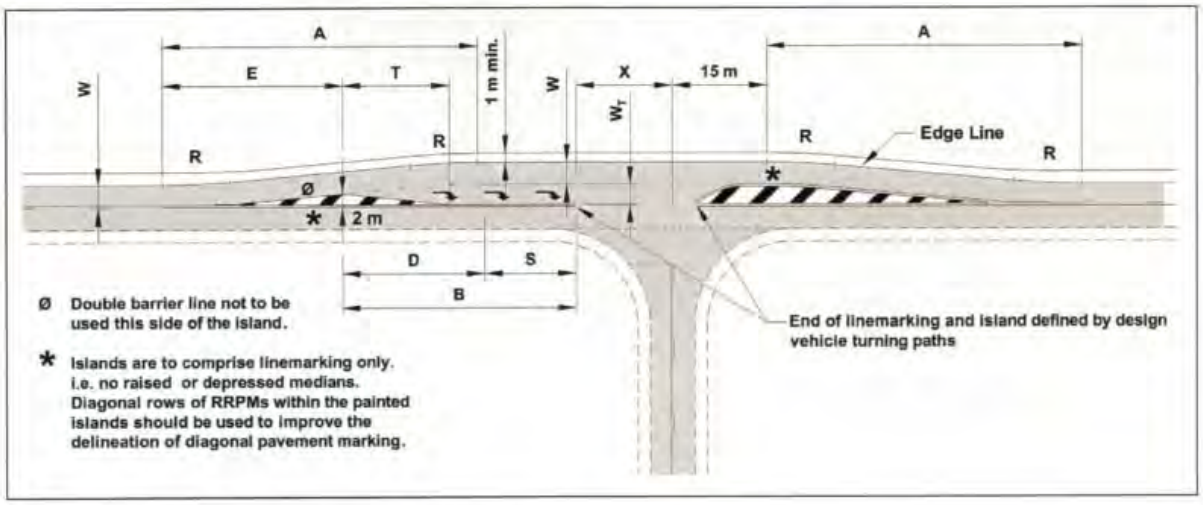
Figure 2 Warrants for turn treatments on major roads at unsignalised intersections
(Design Speed < 100kph)
Source: Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads 2009)

With major road flows (Wine Country Drive) in the order of 200 to 250 in the AM and PM peaks now, this suggests **CH**annelised **R**ight Turn Treatments (CHR (S)) are required now for the southbound right turns into McDonalds Road and Palmers Lane. This would be the case for minor road flows in the order of only 50 vehicles per hour. With the higher order flows caused by the Huntlee development in the future there would be a need for development of full CHR/AUL intersection treatments. This is however an impact caused by others and not a direct causal factor of the subject development.

COMMENT:
The significant factor here is that it is other development and baseline traffic that meets this warrant for intersection upgrades, not the subject sites traffic impact. A proportional allocation of contributions across impacting developments would be an equitable arrangement to deliver these improvements.

Figure 3 illustrates the basic concepts for this type (CHR(S) of right turn treatment.

GUIDE TO ROAD DESIGN PART 4A: UNSIGNALISED AND SIGNALISED INTERSECTIONS



Note: The dimensions of the treatment are defined below and values of A, D, R and T are shown in Table 7.1:

W = Nominal through lane width (m) (including widening for curves). For a new intersection on an existing road, the width is to be in accordance with the current link strategy.

W_T = Nominal width of turn lane (m), including widening for curves based on the design turning vehicle = 3.0 m minimum.

B = Total length of auxiliary lane including taper, diverge/deceleration and storage (m).

E = Distance from start of taper to 2.0 m width (m) and is given by:

$$E = 2\left(\frac{A}{W_T}\right)$$

T = Taper length (m) and is given by:

$$T = \frac{0.33xVxW_T}{3.6}$$

S = Storage length to cater for one design turning vehicle (m).

V = Design speed of major road approach (km/h).

X = Distance based on design vehicle turning path, typically 10–15 m.

Source: QDMR (2006)

Figure 7.6: Channelised right-turn treatment with a short turn slot [CHR(S)] two-lane rural road

Figure 3 Channelised right turn treatment with a short turn slot [CHR(S)] two lane rural standard road
Source: Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads 2009)

9) Conclusions

The following conclusions are drawn from this supplementary traffic assessment of the impacts of the Hunter Expressway, the Huntlee Development, and other changes since the rezoning traffic impact statement was completed:
:

a. A review of traffic flows on Wine Country Drive suggests that the opening of the Hunter Expressway has resulted in a reduction in traffic flows in the vicinity of Tuckers lane and Old North Road which is just to the north of the subject site.
b. Traffic Flows from the Stage One level of development of the Huntlee New Town and then the full development of that site, are a dominant component of the forecast traffic flows on Wine Country Drive.
c. Forecast Huntlee Stage One peak hour traffic flows will remain at acceptable LoS C /D. This allows for background growth (such as the subject site) and opening of the Hunter Expressway.
d. Even allowing for the Huntlee development and growth and Hunter Expressway effects, the proposed one lane roundabout is able to cater for the access requirements of the subject site.
e. Two options for site access treatments have been considered, both of which can provide satisfactory access operation:
    a. A CHR / AUL priority controlled intersection serving as access for the subject site only.
    b. A 4 leg one lane roundabout serving as access for the subject site to the east, and the Vintage development to the west.
f. Providing coordination of contributions from the subject site and Vintage development can be achieved, the roundabout access solution is still preferred.
g. An RMS requirement to consider upgrading the intersections of McDonalds Road and Palmers Lane is actually required now under existing flow conditions. It is also impacted significantly by other development traffic such as the Huntlee development. There is therefore an argument for upgrading being required now irrespective of the subject development. The subject site not being the sole contributor should therefore at worst contribute only a proportion of costs to these upgrades that is commensurate with its proportion of overall impact.

Our overall conclusion having regard for the additional assessment of issues raised by the NSW RMS is that the preferred traffic and access arrangements for the subject site remain a 4 leg one lane roundabout, and that any other works on Wine Country Drive are subject to proportional contributions commensurate with all development activity that is impacting on the road corridor.

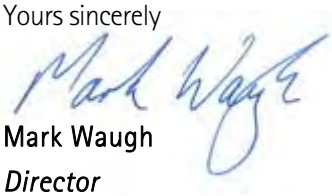
Should development timing and approvals be unfavourable for development of a roundabout, then the alternate CHR / AUL treatment for the site access is an acceptable alternative.

10) Further Information

We hope this supplementary traffic assessment provides sufficient information to assist you with the considerations for the subdivision application for the subject site.

If you have queries on any aspects of the traffic investigations please contact me.

Yours sincerely



Mark Waugh
Director

Technical References:
RMS Technical Direction td13-04a (Updated Trip Rates), NSW RMS August 2013
Austroads Guide to Traffic Management Part 3 Traffic Studies and Analysis (Austroads 2009)
Austroads Guide to Road Design Part 4A Unsignalised and Signalised Intersections (Austroads 2009)
Guide to Traffic Generating Developments, RTA October 2002

Attachments
A Site Plans

Attachment A –Site Plan

Attachment B – RMS Correspondence

Transport Roads & Maritime Services
NSW GOVERNMENT

1 November 2013

SF2011/00184
CR2013/007578
CL

Intersect Traffic
PO Box 268
EAST MAITLAND NSW 2323

Attention: Mr Jeff Garry

WINE COUNTRY DRIVE (MR220): VINTAGE BALANCE LAND AND BEGGAR'S BRIDGE VINEYARD, ROTHBURY

Dear Mr Garry,

I refer to your email dated 7 October 2013, regarding the traffic study for the subject development forwarded to Roads and Maritime Services for advice.

Roads and Maritime has reviewed your request for information prior to proceeding with a traffic study for the subject development and the following comments are provided:

- Cessnock City Council has advised that the Golden Bear development is still active. The preferred access arrangement with both developments is a 4 way one lane circulating roundabout on Wine Country Drive which services both developments. Concept plans, previously provided to Roads and Maritime, for the Golden Bear development are based on this arrangement.

  Comment: Consideration has been given to relocating the Golden Bear / Vintage traffic to the Wine Country Drive / McDonalds Road intersection, in lieu of a new intersection on Wine Country Drive. However, this would have a major impact on the Golden Bear proposals should its access be at this location.

- Should the Golden Bear development not proceed concurrently with the Vintage development at the time the new Vintage intersection on Wine Country Drive is required, Vintage is required to construct a new Austroads CHR / CHL intersection, in accordance with the current conditions of development consent / Cessnock Development Control Plan (DCP). Roads and Maritime would be prepared to review this, in consultation with Council. A focus on the Wine Country Drive / McDonalds Road intersection may be feasible for the Vintage / Beggar's Bridge development. Should the Golden Bear development proceed, a new T intersection would need to be constructed at the location of the proposed roundabout in this instance.

Roads & Maritime Services

Level 1, 59 Darby Street Newcastle NSW 2300 | Locked Bag 2030 Newcastle NSW 2300
T 02 4924 0688 | **F** 02 4924 0342 | **E** David.N.Young@rms.nsw.gov.au **www.rms.nsw.gov.au | 13 22 13**

- The traffic study should consider all reasonable options. Should the original new intersection location be retained, Vintage would also be required to upgrade the Wine Country Drive / McDonalds Road intersection to a CHR(S) / AUL intersection by the developer as required in the DCP.

- The traffic generating impacts of the proposed development on the Wine Country Drive / Palmers Lane intersection should be included.

- You should also submit your proposed directional splits in diagram form prior to proceeding with the study, taking into account the changed traffic dynamics with the Hunter Expressway.

Please contact me on 4924 0688 if you require further advice.

Yours sincerely,

Dave Young
Manager, Land Use
Hunter Region

Cc. General Manager
Cessnock City Council

APPENDIX M

WATER SERVICING REPORT

RPS 2016

Water Servicing Report

Wine Country Drive - Rothbury

Prepared by:

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Client Manager: Ian Murphy
Report Number: 130749
Version / Date: Ver.1 March 2016

IMPORTANT NOTE

This document is to be submitted to the Hunter Water Corporation for approval as the water servicing report for the subject area. Upon approval the document shall become the property of the Hunter Water Corporation. The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised copying or use of this document in any form whatsoever is prohibited.

We have prepared this report for the sole purposes of Capital Hunter Pty Ltd ("Client") for the specific purpose of the approval of a water servicing report for the subject site by Hunter Water Corporation ("Purpose"). This report is strictly limited to the Purpose and the facts and matters stated in it, and does not apply directly or indirectly and will not be used for any other application, purpose, use or matter.

In preparing this report we have made certain assumptions. We have assumed that all information and documents provided to us by the Client or as a result of a specific request or enquiry were complete, accurate and up-to-date. Where we have obtained information from a government register or database, we have assumed that the information is accurate. Where an assumption has been made, we have not made any independent investigations with respect to the matters the subject of that assumption. We are not aware of any reason why any of the assumptions are incorrect.

This report is presented without the assumption of a duty of care to any other person (other than the Client) ("Third Party"). The report may not contain sufficient information for the purposes of a Third Party or for other uses. Without the prior written consent of RPS Australia East Pty Ltd:

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(b) RPS Australia East Pty Ltd will not be liable to a Third Party for any loss, damage, liability or claim arising out of or incidental to a Third Party publishing, using or relying on the facts, content, opinions or subject matter contained in this report.

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In this note, a reference to loss and damage includes past and prospective economic loss, loss of profits, damage to property, injury to any person (including death) costs and expenses incurred in taking measures to prevent, mitigate or rectify any harm, loss of opportunity, legal costs, compensation, interest and any other direct, indirect, consequential or financial or other loss.

Document Status

Version	Purpose of Document	Orig	Review	Review Date
Ver.1	HWC Review	MW	IM	March 2016

Approval for Issue

Name	Signature	Date

Contents

Appendices

Summary

HDB Town Planning & Design has engaged RPS Australia East Pty Ltd (RPS) to prepare a water servicing report for a development creating an 18-hole golf course, 300 residential dwellings and 300 tourist units at Lots 2-4 DP 869651 and Lot 11 DP 1187663, 1184 Wine Country Drive, Rothbury.

Development Background

The development site is Lots 2-4 DP 869651 and Lot 11 DP 1187663, 1184 Wine Country Drive, Rothbury. Site access is directly off Wine Country Drive. The land is currently zoned SP3 Tourist.

The total site area is approximately 241.4 hectares (ha) and currently contains a single residential dwelling as well as some free standing sheds and associated farming structures.

The development is for an 18-hole golf course, 300 residential dwellings, 300 tourist units, alterations to the Wine Country Drive site access, construction of internal roads, drainage structures and basins. Vehicular access will be from Wine Country Drive. The development site is bound to the west by Wine Country Drive, small rural lots zoned RU4 to the south and Black Creek to the north and east.

The development will be staged; however, due to the site being located remotely from existing infrastructure capable of providing a secure supply, the construction of water infrastructure will be undertaken up-front to provide a secure supply to the ultimate development.

Recommended Servicing Option

The single option identified to provide water services to the subdivision requires the extension of mains from locations in the existing network that were identified by HWC.

The recommended option includes the construction of a 100mm lead in main along Wine Country Drive to the site, with a private reticulation network consisting of 100mm mains. In order to provide security of supply, a private reservoir within the site will be required with a trickle feed from the HWC mains. The reservoir will be designed with 48-hour storage capacity to service the development. Storage capacity is based upon average day demand flows.

Proposed Works

Works required to service the proposed subdivision are listed below:

- 1,100m x 100mm

Terms & Abbreviations

Abbreviation	Meaning
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
DA	Development Application
DRL	Draft Reticulation Layout
ET	Equivalent Tenement
HWC	Hunter Water Corporation
NPV	Net Present Value
PSC	Port Stephens Council
PV	Present Value
RPS	RPS Australia East Pty Ltd

1.0 Background

1.1 Development Description

The development site is Lots 2-4 DP 869651 and Lot 11 DP 1187663, 1184 Wine Country Drive, Rothbury. Site access is from Wine Country Drive which fronts the site. The land is currently zoned SP3 Tourist.

The total site area is approximately 241.1 hectares (ha) and currently contains a single residential dwelling as well as some free standing sheds and associated farming structures.

The development is for an 18-hole golf course, 300 residential dwellings and 300 tourist units, alterations to the Wine Country Drive site access, construction of internal roads, drainage structures and basins. Vehicular access will be from Wine Country Drive. The development site is bound to the west by Wine Country Drive, small rural lots zoned RU4 to the south and Black Creek to the north and east.

The development will be staged; however, due to the site being located remotely from existing infrastructure capable of providing a secure supply, the construction of water infrastructure will be undertaken up-front to provide a secure supply to the ultimate development.

The anticipated staging and timing is listed in **Table 1** below.

Table 1 Staging Details

Stage	ET	Cumulative ET	Year
1	30	30	2017
2	30	60	2017
3	330	390	2018
4	30	420	2018
5	30	450	2019
6	30	480	2019
7	30	510	2020
8	30	540	2020
9	30	570	2021
10	30	600	2021

1.2 Planning Context

The current zoning for the site under the Cessnock City Council (CCC) LEP is SP3 Tourist. There is no requirement for the site to be rezoned for the development to proceed. The lot layout is in accordance with CCC minimum lot size requirements.

The development site is bound to the west by Wine Country Drive, small rural lots zoned RU4 to the south and Black Creek to the north and east.

A plan showing the current zoning of the site is included in **Appendix 2** as **Exhibit C**.

1.3 Development Assumptions

Research by the developer indicates that there is a market for world class golf and tourism development in the Cessnock/Hunter Valley vineyards area. The proposed development will attract international tourism to the area.

1.4 Study Area

The study area includes the subject site as agreed with HWC at the inception meeting on 24th February 2016. The site is bound to the west by Wine Country Drive and to the north and east by Black Creek. The adjoining properties to the south are zoned RU4 and are not proposed to be re-zoned. The site is accessed from Wine Country Drive. The land falls generally to the north and east towards Black Creek. The total site area is approximately 241.4 ha and is zoned SP3 Tourist.

1.5 Projected Development in the Study Area

The study area includes the subject site. The proposed development is for an 18-hole golf course, 300 residential dwellings and 300 tourist units, alterations to the Wine Country Drive site access, construction of internal roads, drainage structures and basins.

Existing lots along the southern boundary of the site are zoned RU4 Primary Production Small Lots are not proposed to be rezoned in the future.

1.6 Liaison with Hunter Water

An application for a Section 50 certificate for the proposed subdivision has been submitted to HWC. The Notice of Formal Requirements for Proposed Development dated 14 January 2016 and additional emailed advice is attached in **Appendix 1**.

Information provided indicates the proposed water service connection point is located south of the proposed site access on Wine Country Drive. HWC advice states that there is no water main fronting the development site. The pump station to the south has sufficient capacity to provide the minimum pressure requirements on the peak day and to meet fire fighting requirements. An extension of the main from the pump station will be required to provide a water frontage to the site.

The study area for this report was agreed with HWC at the inception meeting on 24th February 2016.

Boundary conditions at the pump station were subsequently supplied by HWC.

1.7 Exhibits

- **Exhibit A** – Regional Plan
- **Exhibit B** – Local Plan
- **Exhibit C** – Zoning Plan
- **Exhibit D** – Environmental Plan
- **Exhibit E** – Staging Plan
- **Exhibit F** – Existing Water Supply Infrastructure
- **Exhibit G** – Proposed Water Supply Infrastructure

2.0 Options Development

2.1 Inception Meeting

The study area for this report was agreed upon with HWC as the development site. This agreement was made during the inception meeting on 24th February 2016.

HWC issued Preliminary Servicing Advice on 22 March 2013 outlining the requirements of a developer funded local water strategy to determine the optimal method of servicing the site.

A Notice of Formal Requirements was issued on 14 January 2016, noting that there is no water frontage to the development site. Due to the size of the proposed development, security of supply must be considered.

2.2 Points of connection and available capacity

The Notice of Formal Requirements issued on 14 January 2016 advised that the development site does not have frontage to HWC water infrastructure. There is sufficient capacity within the HWC network south of the site to provide minimum pressure requirements on a peak day and to meet fire fighting requirements. Advice indicates that a water main will require construction from the water pump station servicing The Vintage development south of the site on Wine Country Drive.

Review of the HWC water services plan shows additional connection points available to the north of the site along Wine Country Drive. Future development north of the site would require connection to these points to provide security of supply to any proposed development. The nearest available connection point is approximately 2.6km from the site.

2.3 Existing and Planned Hunter Water Assets

HWC operates the water supply system serving the Rothbury area. The system consists of a network of 250mm, 200mm, 150mm and 100mm mains.

Existing HWC assets in the general vicinity of the site include the pump station located north of the Wine Country Drive and Wilderness Road intersection and the internal network servicing The Vintage development.

2.4 Design Water Demands

To estimate design flows, values from the Water Services Association of Australia (WSAA) Water Supply Code of Australia WSA03-2002-2.3 Hunter Water Edition Version 1 have been adopted. Theoretical loadings have been determined and are expressed in terms of equivalent tenements (ET). An ET is the theoretical water demand for an average residential allotment. The criteria used to determine the theoretical water design flows are summarised below:

Residential

- Average Day Demand for new residential properties in the Cessnock City Council LGA = 285kl/yr
- Average Day Demand (l/s) = 0.009/ET
- Average Day Demand for flats/units (l/s) = 0.004/ET
- Peak Day Demand (l/s) = ADD x PDD Factor x Diversity Factor
- Peak Day Factor – Domestic (Houses) – 2.25
- Domestic (Flats/Units) – 2.20
- Diversity Factor - 2.653 x ET –0.1067
- Extreme Day Demand (l/s) = PDD x 1.15
- Unaccounted Water = 15% of Average Day Demand
- Design flows based on the potential lot yield are shown in **Table 2** below:

Table 2 Total Theoretical Water Loadings

	Estimated ET	Average Day Demand (l/s)	95th % Peak Day Demand	Peak Day Demand (l/s)	Extreme Day Demand	Unaccounted Water (l/s)
300 Residential Dwellings	300	2.711	7.045	8.806	10.127	0.407
300 Tourist Units	300	1.237	3.142	3.927	4.517	0.186

Table 3 Staged Theoretical Water Loadings

Stage	Estimated ET*	Average Day Demand (l/s)*	95th % Peak Day Demand*	Peak Day Demand (l/s)*	Extreme Day Demand*	Unaccounted Water (l/s)*
1-2, 4-10	30	0.271	0.7045	0.8806	1.0127	0.0407
3	330	1.779	3.847	4.808	4.618	0.2267
Total	600	3.948	10.187	12.733	14.644	0.593

* Denotes values given are per each individual stage

2.5 Option Assumptions

There has only been one option identified and investigated for the provision of water services to the study area.

Construction of a water main is required from the low pressure zone downstream of the existing HWC pump station located north of the intersection of Wine Country Drive and Wilderness Road to a reservoir within the site.

It should be noted that the internal water reticulation system servicing the development will be privately owned and operated.

Construction Costs

HWC Estimating Guidelines

Connection Points

North of Wine Country Drive and Wilderness Road intersection – HWC pump station

3.0 Servicing Options

3.1 Options Review

Only one option was investigated for the provision of water services to the proposed subdivision.

The provision of adequate water services to the site requires the construction of a 100mm main connecting to the low pressure zone downstream of the existing pump station north of the Wine Country Drive and Wilderness Road intersection. Security of supply will be achieved by way of a private on-site reservoir which will comprise 48 hours storage capacity at ADD flow rates.

Table 4 Staged Theoretical Water Loadings

Stage	ET	Cumulative ET	Year
1	30	30	2017
2	30	60	2017
3	330	390	2018
4	30	420	2018
5	30	450	2019
6	30	480	2019
7	30	510	2020
8	30	540	2020
9	30	570	2021
10	30	600	2021

The private reticulation system servicing the proposed development will comprise a network of 100mm water mains.

Required water infrastructure is detailed below:

Lead-in water mains - 1,100m x 100mm

Plans showing the proposed water main system servicing the development site are attached in **Appendix 2** as **Exhibits G & H**

3.2 Option Constraints

3.2.1 Technical Constraints

The proposed water infrastructure can be constructed, operated and maintained using standard procedures.

3.2.2 Community/Stakeholder Constraints

- It is anticipated that interruption to existing residents will occur during connection to the existing pump station on Wine Country Drive. Works shall be planned to minimise interruptions and residents shall be notified no less than 10 working days prior to the date on which the shutdown is required.
- There may be some minor traffic interruptions during construction of the water main along Wine Country Drive. Suitable traffic controls will be required and there are not expected to be any ongoing issues.
- Construction activity will generate noise in the surrounding area; however, it is expected to be minor and not cause any interruption to the surrounding residents.

3.2.3 Environmental Constraints

A desktop assessment of the route of the lead in mains has not identified any issues that would preclude the construction of the water mains. Water mains will be designed to be wholly within existing and proposed road reserves.

3.3 Water Demand Assessment

To estimate design flows, values in the Water Services Association of Australia (WSAA) Water Supply Code of Australia WSA03-2002-2.3 Hunter Water Edition Version 1 have been adopted. Theoretical loadings have been determined and are expressed in terms of equivalent tenements (ET). An ET is the theoretical water demand for an average residential allotment.

Details are provided in Section 2.4.

Advice provided by HWC indicates that the existing water network has adequate capacity to service the proposed development.

3.4 Infrastructure Description

The reticulation system servicing the proposed development will comprise a network of 100mm water mains.

Required water infrastructure is detailed below:

Lead-in water mains - 1,100m x 100mm

Plans showing the proposed water main system servicing the development site are attached in **Appendix 2** as **Exhibits G & H**

3.5 Computer Modelling

Pipe sizing has been confirmed with computer modelling using *'EPANET 2.0'*. The EPANET software has been developed by the Water Supply & Water Resources Division at the National Risk Management Research Laboratory of the US Environmental Protection Agency

HWC has provided Hydraulic Grade Line (HGL) data for the identified connection points which have been used in the model. They are listed in **Table 5** below.

Table 5 HGL Data

Location	ADD		95th % PDD		PDD	
	Pressure - Existing Development Load	HGL – Existing Development Load	Pressure - Existing Development Load	HGL - Existing Development Load	Pressure - Existing Development Load	HGL - Existing Development Load
	(m)					
Low Pressure side of PRV @ Water Pump Station	63.34	119.4	63.3	119.34	63.27	119.32

Table 6 HWC Water System Criteria

Maximum Pressures		Minimum Pressures				
Average Day	Peak Day	Peak Day	Peak Day Pump Systems	Under Fire Flow Conditions - Fire Flow Site	Under Fire Flow Conditions - Elsewhere	Failure Conditions
(m)						
60	60	20	25	15	3	12

Modelling of the proposed water network does not include diurnal demand factors as described in the Water Supply Code of Australia WSA 03-2002-2.3 Hunter Water Corporation Edition – Version 1. It is proposed to fill the on-site reservoir via a continuous trickle feed at ADD flow rates to maintain 48 hour storage capacity.

Detailed development plans are required before further modelling of the private water reticulation network can be undertaken. The size of the proposed private reservoir has been determined using the above values.

3.5.2 Average Day Flow Analysis

Average Day flow analyses have been completed using *'EPANET 2.0'* and tabulated results are attached as **Appendix 4**. To simulate minimum expected pressures in the proposed lead-in water main Average Day Minimum HGL values, from **Table 5** above, were applied at each of the boundary connection points.

These results indicate that the development will be provided with pressures above 20m on an Average Day.

3.5.3 Peak Day Flow Analysis

Peak Day flows have not been analysed as the internal water reticulation system will be privately owned and operated.

3.5.4 Fire Flow Analysis

The proposed reservoir will be sized to store 48 hours capacity at ADD flow rates, which equates to 682,200L. The proposed development will cater for residential and commercial properties; therefore, a fire fighting flow of 20L/s is required. During a fire fighting scenario, the reservoir could provide 20L/s supply for a period of 9.4 hours

As the internal water reticulation system will be privately owned and operated further analysis of the fire flows will not be required.

3.5.5 Pipe Failure Analysis

The only pipe failure scenario which could occur is the 100mm main feeding the reservoir. The reservoir will be designed with 48 hours storage capacity at ADD flow rates. Any failure should be rectified within this timeframe.

As the internal water reticulation system will be privately owned and operated further analysis of any pipe failure is not be required.

3.6 Financial Criteria

This section presents an assessment of the cost associated with the connection option. The aim of this assessment is to select an option that minimises infrastructure life cycle costs (capital, operation, maintenance and replacement costs) over the life of the proposed infrastructure. As there is only one option investigated, the costing is examined below.

3.6.1 Capital and Replacement Costs

Capital cost estimate has been prepared using the estimating spreadsheet supplied by Hunter Water, "*Pipeline and Pump Station Estimating Guidelines*".

Total capital cost to construct the water infrastructure required to service the proposed development (excluding the reservoir cost) is estimated at $310,000.

A copy of the output from the *Pipeline and Pump Station Estimating Guidelines* is included at **Appendix 3**.

3.7 Social Impact

- Construction of water infrastructure described in this report will provide water services to the proposed development that meet or exceed HWC operating guidelines
- Installation of the proposed infrastructure does not pose any health risks to the community
- No above ground features are required to be installed in relation to the water main. As such there will no affect on the visual amenity of the area. The proposed reservoir will be within the development site itself
- There will be increased levels of noise associated with construction of the required infrastructure but these will only be short term in nature
- Construction and operation of the proposed water assets do not pose any occupational health and safety risks outside those normally associated with these activities
- None of the proposed water assets are located within HWC Special Areas.

3.8 Environmental Impact

- Proposed water infrastructure will be constructed using standard materials and methods
- It is not expected any waterborne waste will be generated and any solid waste will be disposed of in an appropriate manner at an appropriate location
- No land, waterways or marine environments will be contaminated during construction or as a result of operation of the proposed water supply system
- Desktop survey has not revealed any threatened species or endangered communities that will be impacted by the construction of the proposed water infrastructure
- Desktop survey has identified the likelihood to contain aboriginal artefacts or items of cultural heritage along the route of the proposed water infrastructure. As only one option has been identified to provide a

water service to the site, further investigations and compliance with statutory requirements must be undertaken to protect any artefacts that are located along the route of the proposed water infrastructure.

3.9 Technical Assessment

- Performance - the proposed water supply system will be designed with sufficient capacity to ensure that HWC guidelines are met under a number of adverse operating scenarios
- System Reliability – the proposed water infrastructure will be constructed using standard materials and techniques maximising the reliability of the proposed system
- Flexibility and Adaptability – the proposed water infrastructure will be designed with redundancies and additional capacities to ensure future growth in the area can be adequately serviced. Investigations indicate that there are very limited opportunities for further development in the area, these being restricted to the larger allotments north of the development site fronting onto Wine Country Drive
- Maintainability – the proposed water infrastructure will be constructed using standard materials and techniques. Maintenance of the proposed system will be able to be undertaken using standard HWC operating procedures
- The proposed water supply system has been designed with sufficient capacity to provide security of supply to the development.

4.0 Recommended Option

Only one viable option for the provision of water services to the proposed subdivision has been identified and investigated, as such it is the recommended option.

Extension of mains from the existing 250mm main on the low pressure side of the water pumping station on Wine Country Drive south of the development site provides a point of connection that meets HWC licence requirements. Security of supply to the development is achieved via the proposed reservoir.

It is recommended that the water supply system detailed in this report be adopted as the servicing report for the proposed subdivision.

Appendix 1

Correspondence with Hunter Water

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

14 January 2016

Capital Hunter Pty Ltd
C/- HDB Town Planning & Design
PO Box 40
MAITLAND NSW 2320

Ref: 2004-2138/7.010

Attention: Mr Kerry Nichols

Dear Kerry

NOTICE OF FORMAL REQUIREMENTS FOR PROPOSED DEVELOPMENT

Hunter Water's requirements for the provision of water and sewerage facilities to the subdivision of 4 into 601 lots and development of a Golf Resort comprising 18 Hole Golf Course, 300 dwellings, 300 tourist units & restaurants at Lots 2 - 4 DP 869651 & Lot 11 DP 1187663 1184 Wine Country Road Rothbury are as follows:

Network Infrastructure and Delivery

1 Design and construct major works to connect each of the lots to the existing water and sewer system(s). The works must be designed by an Accredited Design Consultant and constructed by an Accredited Major Works Contractor:

Extend water and sewer each of the proposed lots in accordance with approved Water and Sewer Servicing Strategies (refer to Conditions 2, 3 and 5 below) and the **Specific Connection Details** for this development as detailed below.

The design must be submitted to Hunter Water for assessment. A Major Works assessment/administration fee of $2,896 must be paid when designs are submitted.

The designs will be reviewed, and if approved, an Instrument of Agreement will be returned by Hunter Water for execution by the developer. At this time Hunter Water will also advise the value of other fees that may be applicable to completion of the works.

It is the responsibility of the Accredited Designer to lodge approved designs at plan.check@hunterwater.com.au.

All contractors engaged by the developer must have insurances in place in accordance with the Agreement.

Specific Connection Details

2 Water Supply

The development site is located on the periphery of Hunter Water's water supply network. Network constraints means that the demand from the proposed development cannot currently be supplied from Hunter Water's existing infrastructure.

As the development is to house above 100 residences, Hunter Water's Design Guidelines dictates the need for an alternative connection point to provide supply security. Security of supply can potentially be obtained by establishing a connection from the North Rothbury system to the north of the site, but this would need to be confirmed as part of a developer funded servicing strategy as discussed below.

As advised in Hunter Waters Preliminary Servicing Advice of 22 March 2013, in view of the above and given the scale and nature of the development, a developer funded local water servicing strategy is required to determine the optimal method of servicing this development. The servicing strategy meet Hunter Water's design requirements and as a minimum include:

- Lot and development layout
- Staging of development
- Investigation of alternative options
- Identification of least community cost option
- Security of supply
- Minimum pressure requirement
- Fire fighting flow requirement

In addition, the strategy is to identify potential future developments in its immediate vicinity and incorporate options for servicing such developments. It is noted that the owner of a 100 acre property located on the western side of McDonalds Road, Ruthbury has expressed current interest in access to potable water, recycled and wastewater.

3 Wastewater Transportation

The proposed development is in the Cessnock Waste Water Treatment Works (WWTW) catchment and would be serviced by Rothbury 3 Waste Water Pump Station (WWPS).

As advised in Hunter Water's prior correspondence dated 22 March 2013 the demand from the proposed development cannot currently be supplied from Hunter Water's existing infrastructure. The developer is required to prepare a developer funded local Wastewater Servicing Strategy addressing, at a minimum, the following matters:

- Overall loads for the area;
- Surrounding potential developments;
- Connection points to the existing system;
- Staging of development;
- Investigation of alternative options;
- Identification of least community cost option; and
- Pump station(s) duty and emergency storage.

4 Wastewater Treatment

There is sufficient capacity at Cessnock Waste Water Treatment Works (WWTW) to cater for the loads from the development.

5 Recycled Water

There is an opportunity for recycled water to be utilised for this development. There is currently sufficient capacity to provide supply in the order of 200,000kL per annum of recycled water supply from Cessnock WWTW. However this supply would be dependent on:

- Availability of on-site storage;
- Availability of flows during dry weather;
- Existing environmental flow requirements; and
- The timing and progression of other development in the vicinity wishing to access supply of recycled water.

The recycled water from Cessnock would be provided for restricted use, and would not be suitable for public access. The current treatment processes at Cessnock WWTW (secondary treatment, maturation ponds and UV disinfection system) achieve Log reduction of 2.0 for Virus, 4.0 for Protozoa and 4.0 for Bacteria and approx. 100 per 100mL for E.coli. Further onsite treatment would be required to treat the recycled water suitable for un restricted use refer to Table 3.8 of the Australian Guidelines for Water Recycling (2006). The developer should contact Cessnock City Council and the Department of Health for further information on onsite treatment standards and approvals.

The developer is required to prepare a developer funded local Recycled Water Servicing Strategy addressing, at a minimum, the following matters:

- Lot layout
- Staging of Development
- Investigation of alternative options
- Identification of least community cost option
- Security of supply
- Minimum pressure requirement
- Fire fighting flow
- Potential future developments in its immediate vicinity and options for servicing such developments.

6 The above-mentioned servicing strategies are to be prepared by an Accredited Design Consultant with reference to the WSAA Hunter Water Design Guidelines.

Servicing strategies should be submitted to Hunter Water for review and approval and services should be designed and constructed in accordance with these approved strategies. Please contact Hunter Water to discuss the scope of work prior to commencement.

A separate strategy review fee of $1,149 is required to be paid for each servicing strategy that is submitted (by asset class).

7 Financial Contribution

A reimbursement contribution may be required towards the cost of any water and sewer infrastructure that is constructed by a third party developer and utilised to serve this development. Reimbursements cannot be determined until the connection points are defined. You will be advised of any reimbursements after the design plans are assessed and the connection points are approved.

8 Community Title Subdivision - Connection Options

Option 1 - Individual Connections per Lot to Hunter Water

Construct works to connect each of the lots to the existing water and sewer systems of Hunter Water.

Each lot within the development is to be provided with a point of connection to water and a point of connection to sewer.

The developer must meet the requirements of Hunter Water's Dealing No. E476715 and on this basis each lot owner will become an individual customer of Hunter Water. The works are required to be handed over to Hunter Water to own, operate and maintain. Hunter Water requires a solicitor's undertaking that the Dealing will be contained in the Management Statement and that a copy of the Management Statement will be forwarded to Hunter Water following its registration.

The Dealing requires the water and sewer mains for this development to be contained within statutory easements. These easements must be listed in the Management Statement for this development.

OR

Option 2 - Single Point of Connection to Hunter Water

Construct works to connect the lot owned by the Community Association to the existing water and sewer systems of Hunter Water. This option requires the Community Association to become the single customer of Hunter Water. The Association, as the owner of the internal water and sewer services, is responsible for the supply of water and sewer services to each of the individually owned lots.

Hunter Water requires a solicitor's undertaking that the following statement will be contained in the Management Statement and that a copy of the Management Statement will be forwarded to Hunter Water following its registration:

"*Water and sewer services are supplied by Hunter Water Corporation to the boundary of the lot owned by the Community Association. The Community Association is responsible for the provision and maintenance of the internal water and sewer services and the payment of Hunter Water Corporation accounts*".

Individual Metering

Properties that are within Community Title schemes that have one connection to the water supply network may be eligible for individual metering subject to terms and conditions.

Individual metering allows each property within the Community Title scheme to be billed separately for the water usage based on the consumption of each lot's individual meter.

To be eligible for individual metering the Community Title scheme would need to comply with the attached Individual Metering Guideline. Key requirements of the Guidelines include:

- The Individual Metering Guideline only applies to existing Community Title developments, i.e. the Community Association must submit the Application Form for Individual Metering;
- The internal water system must be designed and constructed to comply with the Design Criteria; and
- A certified plan of the internal water system and meter assembly layout must be submitted to Hunter Water with the Application. The individual metering by-laws must be included in the Management Statement.

For further information on Hunter Water's Individual Metering requirements go to the website hunterwater.com.au

Other Development Requirements

9 Submit the Development Consent Conditions determined by Council for this specific development. Hunter Water will confirm that the final development description is consistent with the details supplied by you for this application.

10 Hunter Water will require a Review of Environmental Factors (REF) to be submitted (refer Appendix HW 1 of Water Supply Code of Australia – Hunter Water Edition) prior to providing final approval of designs. A REF considers the likely impacts a development may have on the environment. At all times, methods for preventing or reducing adverse environmental impacts should be considered and where appropriate, incorporated into the project design.

Please contact the Hunter Water Developer Services Group prior to engaging the services of a consultant to prepare and submit an REF to confirm the need and scope for such an assessment. Hunter Water will make a determination if an REF is required in accordance with the provisions of Environmental Planning and Assessment Act 1979. An 'environmental report assessment fee' of $1,102 is to be paid if an REF is required.

Please note that a Controlled Activity Approval will be required from the NSW Office of Water for any excavation within 40 metres of a water body or should groundwater be present.

11 Provide one copy of the final plan of subdivision and a DXF file of the subdivision showing only lot numbers and boundaries directly on the MGA grid. The lot boundaries should be produced directly from your calculation software, with all edges matched and unbroken, and also match as near as possible the final deposited plan of the subdivision.

12 Submit an application for a hydraulic design assessment of internal water and sewerage services for this development, including rainwater tanks and any alternative water supply systems. If you are unsure please contact Hunter Water's Hydraulic Consultant on (02) 4979 9467.

13 Contact Hunter Water's Hydraulic Consultant on (02) 4979-9467 **to** make the necessary application for a Trade Waste Permit and pay the prescribed fees as your proposed development has been identified as having the potential to discharge trade waste into Hunter Water's sewerage system. The discharge of trade waste to the sewer will not be permitted without a permit authorising that discharge.

These requirements are valid for 12 months from the date of this letter and are specific to this development. All fees and charges are subject to adjustment using the Consumer Price Index (CPI) on 1 July each year.

Please refer to the attached Development and Design Assessment fact sheet, which details the conditions under which water and sewer facilities are available to new customers. Hunter Water reserves the right to amend its requirements if we find an error has been made.

Yours faithfully

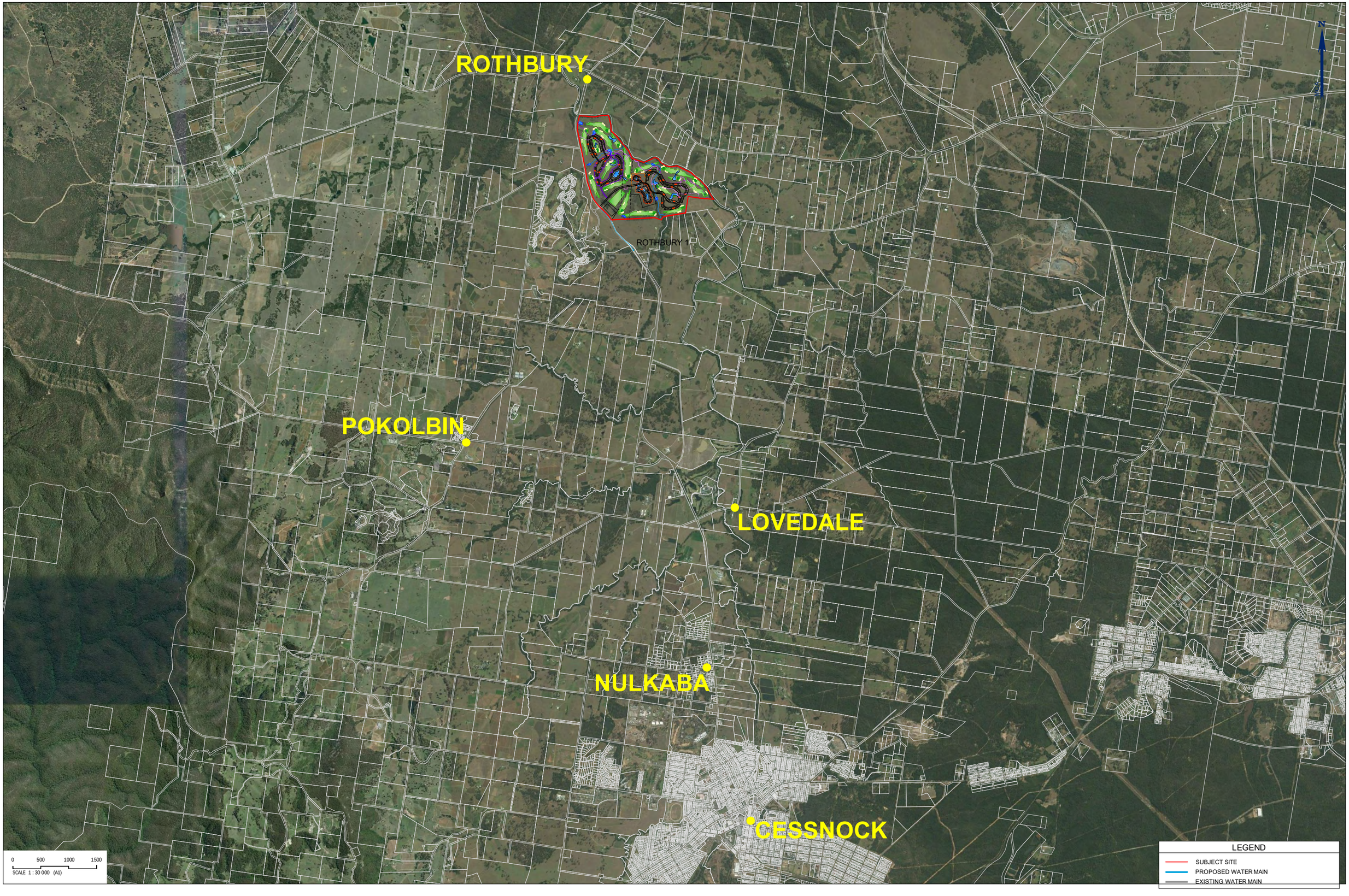
PAUL MCKOY
Developer Services Engineer

Enquiries: Paul McKoy
Tel: (02) 4979-9476
Email: paul.mckoy@hunterwater.com.au

Appendix 2

Exhibits

Exhibit A – Regional Plan



TITLE: REGIONAL PLAN
LOTS 2-4 DP 869651 & LOT 11 DP 1187663

LOCATION: WINE COUNTRY DRIVE
ROTHBURY

DATUM: AHD
PROJECTION: MGA

DATE: APRIL 2016
PURPOSE: WATER SERVICING REPORT

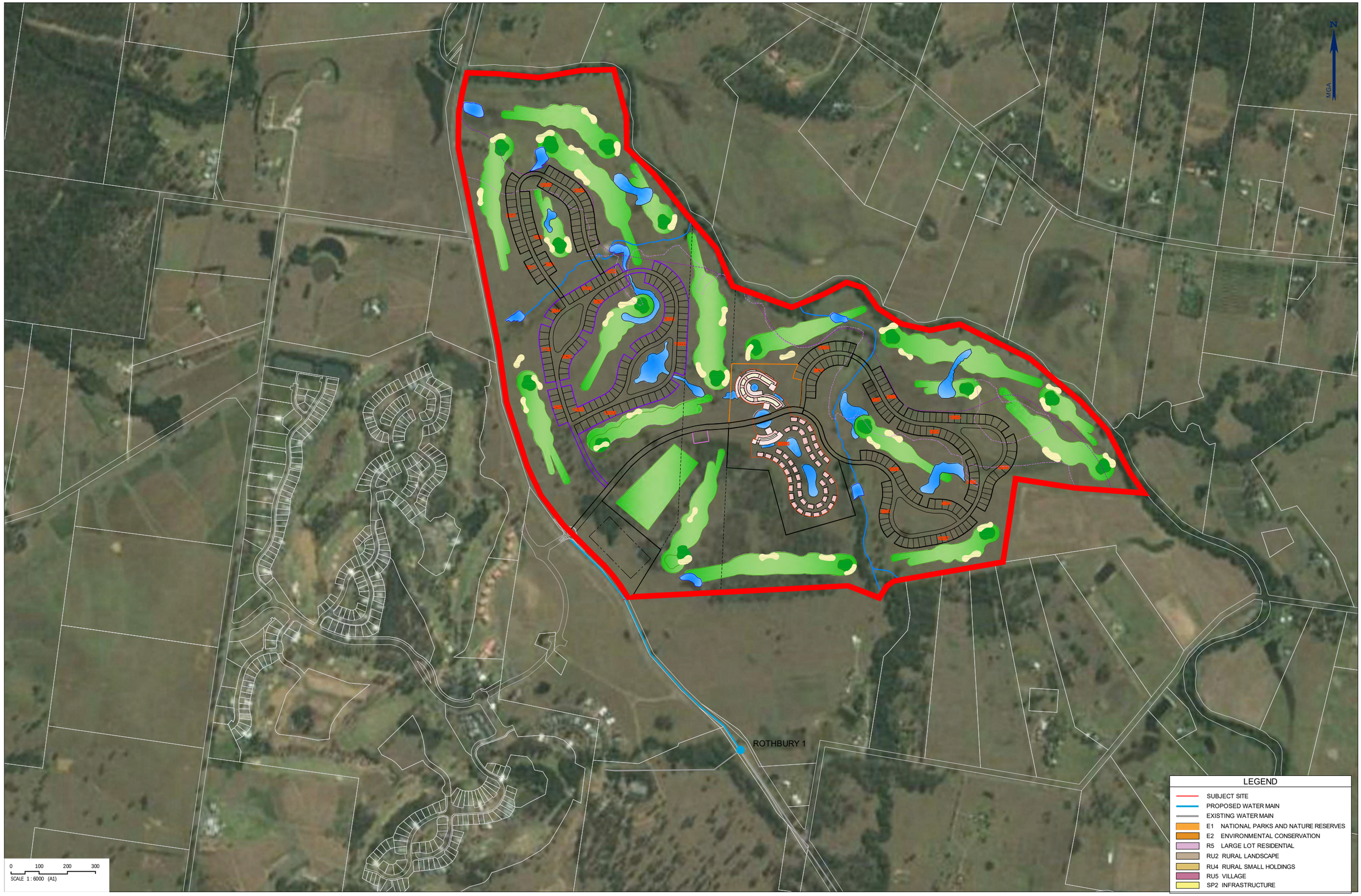
AUTOCAD REF: J:\OBS\130k\130749 Rothbury\07 - Water & Sewer
VERSION (PLAN BY):

CLIENT: CAPITAL HUNTER PTY LTD
JOB REF: 130749

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4940 4200 F: 02 4961 6794 www.rpsgroup.com.au

RPS

Exhibit B – Local Plan



TITLE: LOCALITY PLAN
LOTS 2-4 DP 869651 & LOT 11 DP 1187663

LOCATION: WINE COUNTRY DRIVE
ROTHBURY

DATUM: AHD
PROJECTION: MGA

DATE: APRIL 2016
PURPOSE: WATER SERVICING REPORT

AUTOCAD REF: J:\JOBS\130k\130749 Rothbury\07 - Water & Sewer
VERSION (PLAN BY):

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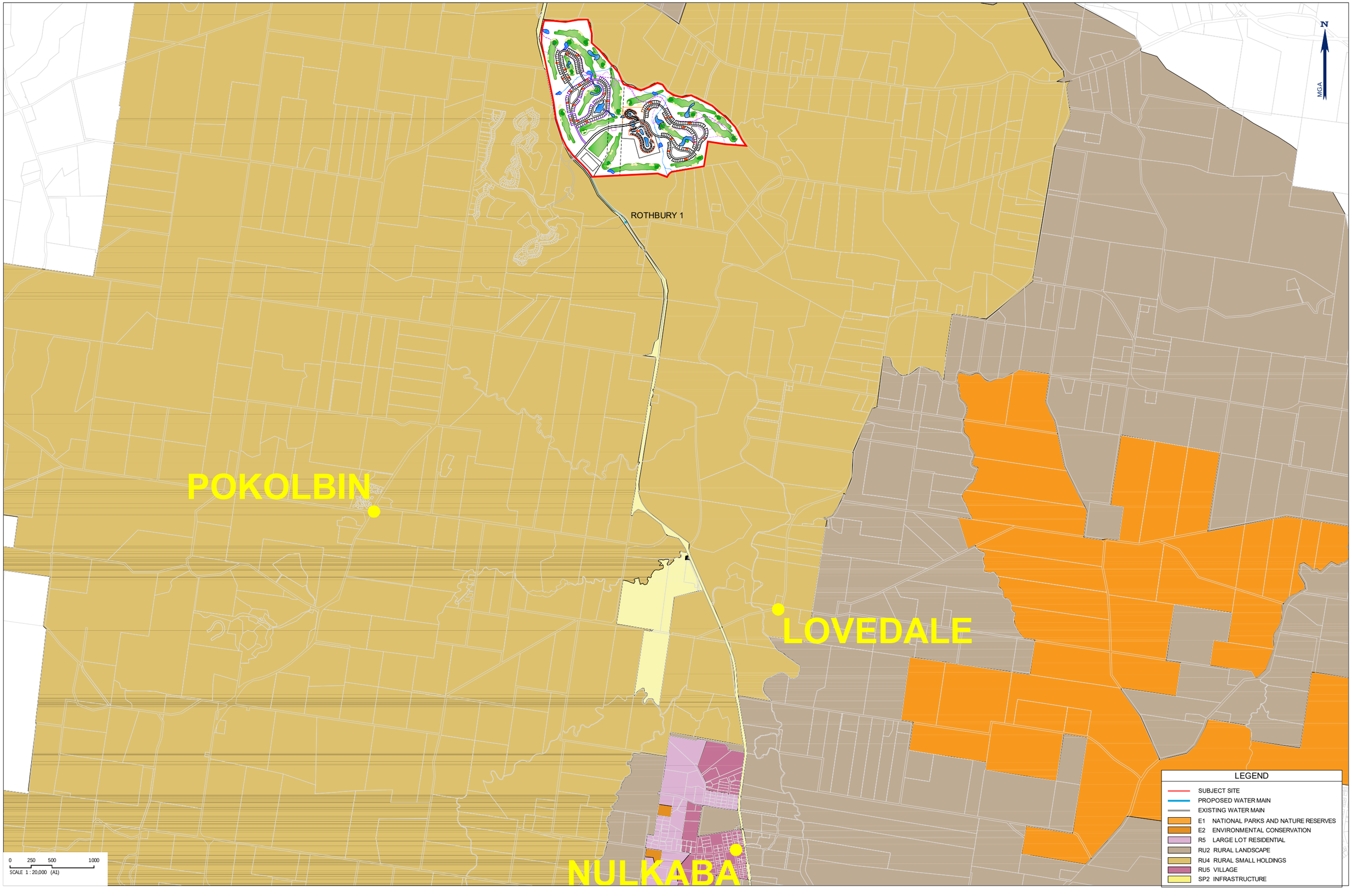
Exhibit C – LEP Zoning Plan



TITLE: LEP ZONING PLAN
LOTS 2-4 DP 869651 & LOT 11 DP 1187663

LOCATION: WINE COUNTRY DRIVE
ROTHBURY

DATUM: AHD
PROJECTION: MGA

DATE: APRIL 2016
PURPOSE: WATER SERVICING REPORT

AUTOCAD REF: J:\JOBS\130k\130749 Rothbury\07 - Water & Sewer
VERSION (PLAN BY):

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JOB REF: 130749

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Exhibit D – Environmental Plan

EASTERN BENTWING-BAT

SPOTTED-TAILED QUOLL

ROTHBURY 1

GREY-CROWNED BABBLER (EASTERN SUBSPECIES)

GREY-CROWNED BABBLER (EASTERN SUBSPECIES)

N

MGA

0 100 200 300

SCALE 1 : 6000 (A1)

LEGEND

- SUBJECT SITE
- PROPOSED WATER MAIN
- EXISTING WATER MAIN
- 13 - CENTRAL HUNTER RIPARIAN FOREST
- 17 - LOWER HUNTER SPOTTED GUM - IRONBARK FOREST
- 19 - HUNTER LOWLAND REDGUM FOREST
- THREATENED FAUNA
- THREATENED FLORA

TITLE: ECOLOGY PLAN
LOTS 2-4 DP 869651 & LOT 11 DP 1187663

LOCATION: WINE COUNTRY DRIVE
ROTHBURY

DATUM: AHD
PROJECTION: MGA

DATE: APRIL 2016
PURPOSE: WATER SERVICING REPORT

AUTOCAD REF: J:\JOBS\130k\130749 Rothbury\07 - Water & Sewer
VERSION (PLAN BY):

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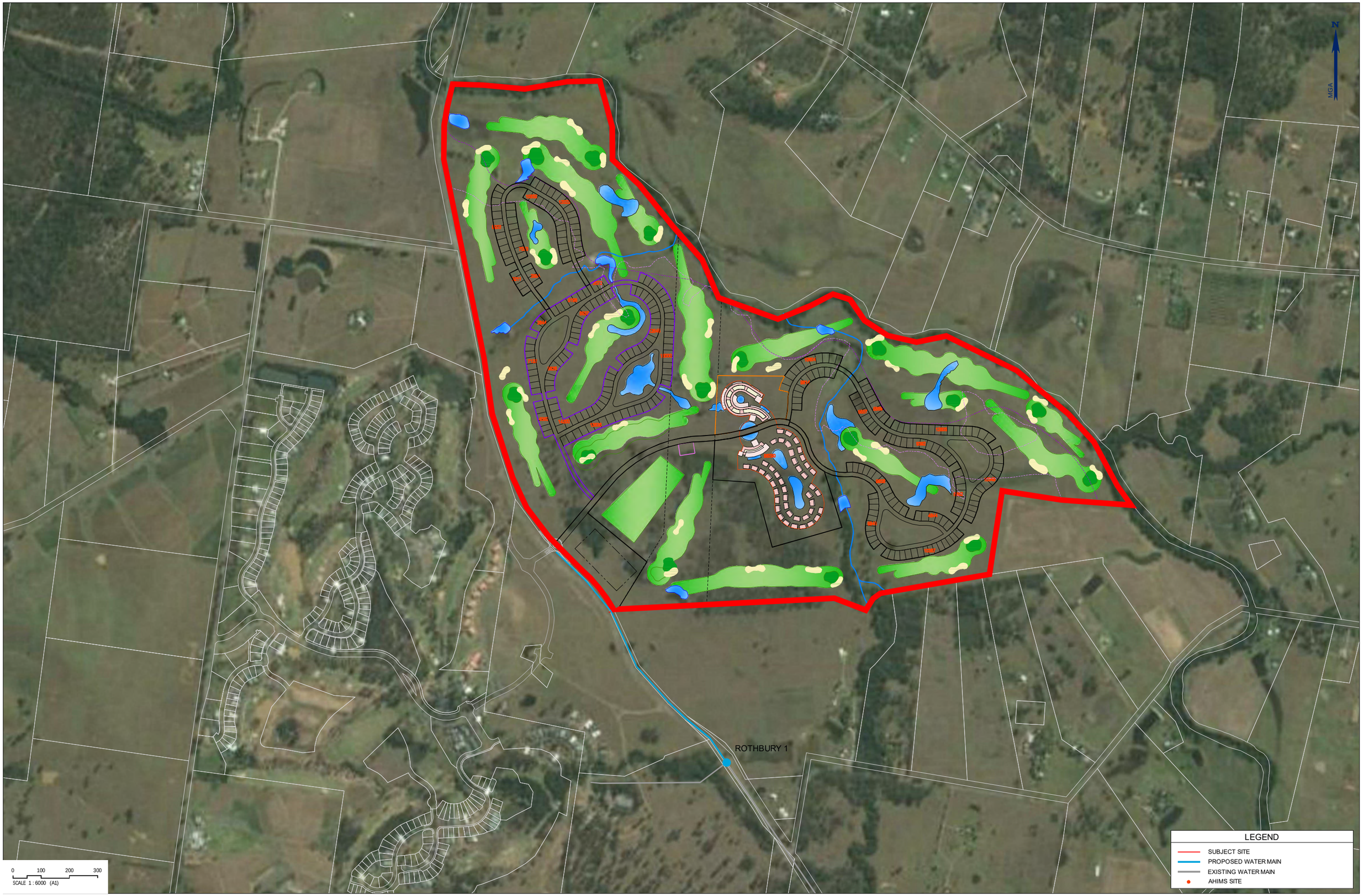
Exhibit E – Archaeological Plan



TITLE: ARCHAEOLOGY PLAN
LOTS 2-4 DP 869651 & LOT 11 DP 1187663

LOCATION: WINE COUNTRY DRIVE
ROTHBURY

DATUM: AHD
PROJECTION: MGA

DATE: APRIL 2016
PURPOSE: WATER SERVICING REPORT

AUTOCAD REF: J:\JOBS\130k\130749 Rothbury\07 - Water & Sewer
VERSION (PLAN BY):

CLIENT: CAPITAL HUNTER PTY LTD
JOB REF: 130749

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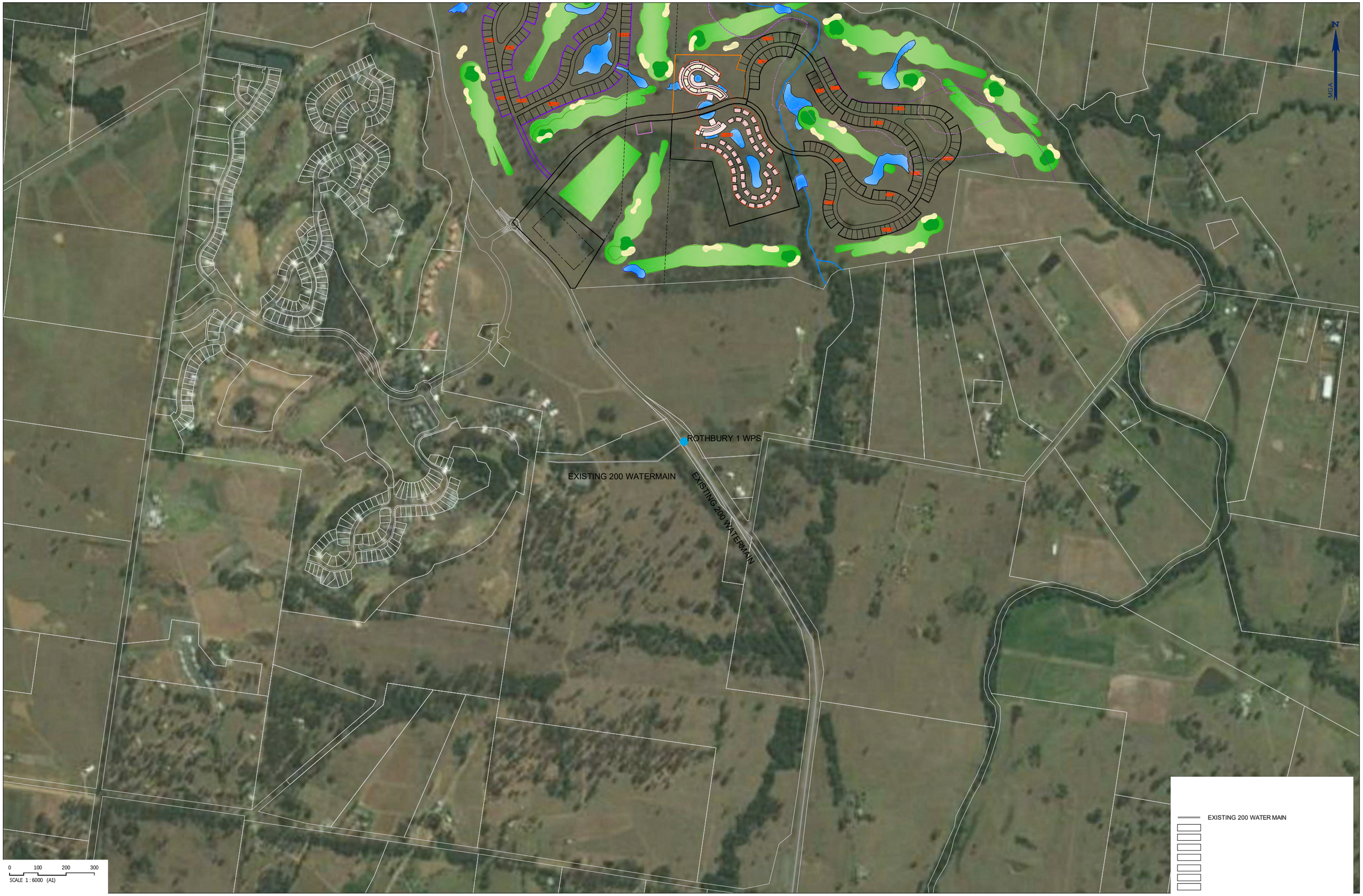
Exhibit F – Existing Water Supply Infrastructure



TITLE: EXISTING WATER
LOTS 2-4 DP 869651 & LOT 11 DP 1187663

LOCATION: WINE COUNTRY DRIVE
ROTHBURY

DATUM: AHD
PROJECTION: MGA

DATE: APRIL 2016
PURPOSE: WATER SERVICING REPORT

AUTOCAD REF: J:\JOBS\130k\130749 Rothbury\07 - Water & Sewer
VERSION (PLAN BY):

CLIENT: CAPITAL HUNTER PTY LTD
JOB REF: 130749

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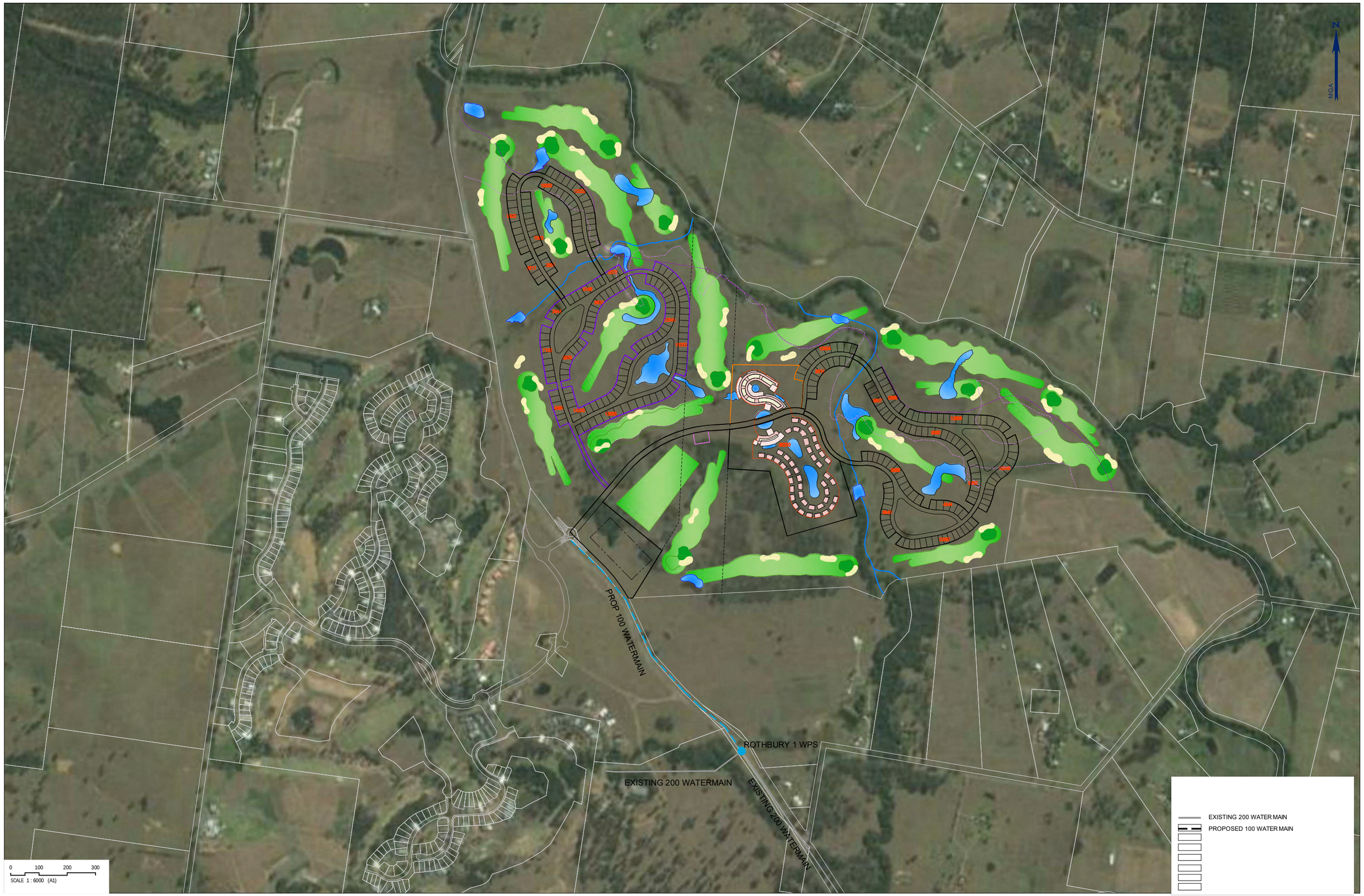
Exhibit G – Proposed Water Supply Infrastructure



TITLE: PROPOSED WATER
LOTS 2-4 DP 869651 & LOT 11 DP 1187663

LOCATION: WINE COUNTRY DRIVE
ROTHBURY

DATUM: AHD
PROJECTION: MGA

DATE: APRIL 2016
PURPOSE: WATER SERVICING REPORT

AUTOCAD REF: J:\JOBS\130k\130749 Rothbury\07 - Water & Sewer
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Appendix 3

Output from Pipeline and Pump Station Estimating Guidelines

WATER RETICULATION & TRUNK MAINS – PRELIMINARY OR DETAILED

PROJECT DESCRIPTION:

OPTION 1 - ROTHBURY

CONNECT TO ROTHBURY 1 PUMP STATION

ASSUMED CLASS B1 AREA

Item No.	Item Description	Qty	Unit	Preliminary OR Detailed Estimate Rate $/unit	Amount $
1	Site Establishment (Refer Table 9)	Item	Lump Sum		9000
2	Site Disestablishment (Refer Table 9)	Item	Lump Sum		9000
3	Preparation and implementation of the Construction EMP, undertake environmental induction of all employees and proposed sub-contractors.	Item	Lump Sum		3000
4	**OHS&R Management**				
4.1	Preparation and implementation of the Safety Management Plan.	Item	Lump Sum		5000
4.2	Extra over item 4.1 above for preparation and implementation of the Traffic Control Plan.	Item	Lump Sum		3000
5	**Construction of Reticulation Watermains (Refer Table 1)**				
5.1	Field Investigation and verification of depth and location of services along pipeline route including liaison with relevany authorities and arranging relocation and adjustment where required	Item	Lump Sum		
5.2	Supply all pipes materials including detector tape, pipe protection wrapping, rubber rings and lubricant for following pipe sizes (Refer Table 1):				
	a) Nominal DN 100 mm DICL Class K9 pipe.	1100	m	34	37400
5.3	Supply all pipe fittings including gaskets and ss bolts (Refer Table 1):	Item	Lump		
5.4	Clear, excavate and backfill in OTR conditions at nominal depth up to 1.5m depth to invert for reticulation pipelines with pipe support Type B or D & Drawing WCP-202 and disposal of excess excavated material including environmental erosion and sediment control. Includes Lay, bed, joint and test. Includes initial cleanup of disturbed areas and consumer service connections. Supply of materials, including detector tape, pipe protection wrapping and construction of thrust restraints, bulkheads and trenchstops for following pipe sizes (Refer Table 1):				
	a) Nominal DN 100 mm DICL Class K9 pipe.	1100	m	69	75900
5.6	Extra over Item 5.5 for constructing pipelines in close proximity to existing underground power, gas and telecommunications/optic fibre cables for the following pipe sizes:				
5.7	Extra over Item 5.5 for clearing of heavily tree covered areas including disposal of trees and rubbish from site		m2		0

5.8	Supply additional service connection pipe and fittings and install (Refer Table 4)	Item	Lump Sum		
5.9	Extra over rate to Item 5.5 for Terrain allowance (Refer Table 6) for the following pipe sizes:				
5.10	Extra over rate to Item 5.5 for additional excavation at depths to invert greater than 1.5m including disposal of excess excavated material for the following pipe sizes in the relevant area classification (Refer Table 3):				
5.11	Restoration of Surfaces (refer Table 5):				
5.12	Extra over item 5.5 for Excavation in rock and disposal of excess excavated material(Refer Table 7)		m3		0
5.13	Extra over rate to Item 5.5 for Additional compaction (Refer Table 7)		m3		0
5.14	Extra over rate to Item 5.5 for Excavate below specified design depth where directed including disposal of excess excavated material(Refer Table 7)		m3		0
5.15	Extra over Item 5.5 to Supply & place & compact sand (Refer Table 7)		m3		0
5.16	Extra over Item 5.5 for supply, place and compact stabilised sand cement (14:1) backfill		m3		0
5.17	Extra over Item 5.5 for supply, place and compact aggregate (Refer Table 7)		m3		0
5.18	Extra over rate to Item 5.5 for Supply & place ballast including disposal of excess excavated material (Refer Table 7)		m3		0
5.19	Dewatering of trench including establishment and disestablishment (Table 7)		m		0
5.2	Acid Sulphate Soil and Contamination (Refer Table 7)				0
5.21	Supply and place treated timber piling for pipe support	Item	Lump Sum		
5.22	Road crossing (refer Table 7)				
	(a) Thrust bore/directional drilling	40	m	820	32800
5.23	Extra over item 5.23 (a) for thrust boring/directional drilling under existing rail line (Refer table 7, note 7)		m		0
5.24	Supply and installation of pipe river crossing including supply of MSCL pipe, internal and external welding, testing of welds and 150 thick concrete encasement. Also includes mobilisation and demobilisation of dredge(if required) excavation & disposal of excavated material, backfilling, lay, bed and test for the following MSCL pipe sizes: (Refer Table 7)				
5.25	Supply and installation of pipe aerial creek crossing including supply of MSCL pipe with protection coating, internal and external welding, testing of welds. For the following MSCL pipe sizes: (Refer Table 7)				
5.26	Supply and Install additional pipe Items (Refer Table 8) (Note: show all items for detailed estimate)	Item	Lump Sum		
5.27	Supply and install additional DICL fittings (Refer Table 8) (Note: show all fittings for detailed estimate)	Item	Lump Sum		

5.28	Supply and Install valve pits (Refer table 8) (Note: show all pit sizes for detailed estimate)	Item	Lump Sum		
5.29	Supply and install a complete single flowmeter including in-ground concrete pit with aluminium covers and separate in-ground isolating stop valves upstream of flowmeter with bypass. (Refer Table 8)	Item	Lump Sum		
5.30	Preconstruction record (Refer Table 8)				
	(a) Photographic		m		0
	(b) Video	1100	m	0.7	770
5.31	Work as Executed Drawings (Refer Table 8)	1100	m	8	8800
5.32	Preparation of line sheets (Refer Table 8)	2	m	92	184
5.33	Land Matters (Refer Table 13)	Item	Lump Sum		
5.34	**Sub Total Reticulation Mains**				184854
	TOTAL ESTIMATED CONTRACT AWARD SUM (PRELIMINARY OR DETAILED)				184854.00

PRE-CONSTRUCTION COST (Table 10)

Design @ 15%	27728.10
Project management of Design	3327.37
Sub Total(B1)	31055.47
Pre-Construction Contingency (30% of B1)	9316.64
TOTAL PRE-CONSTRUCTION COST (B)	40372.11

CONSTRUCTION COST

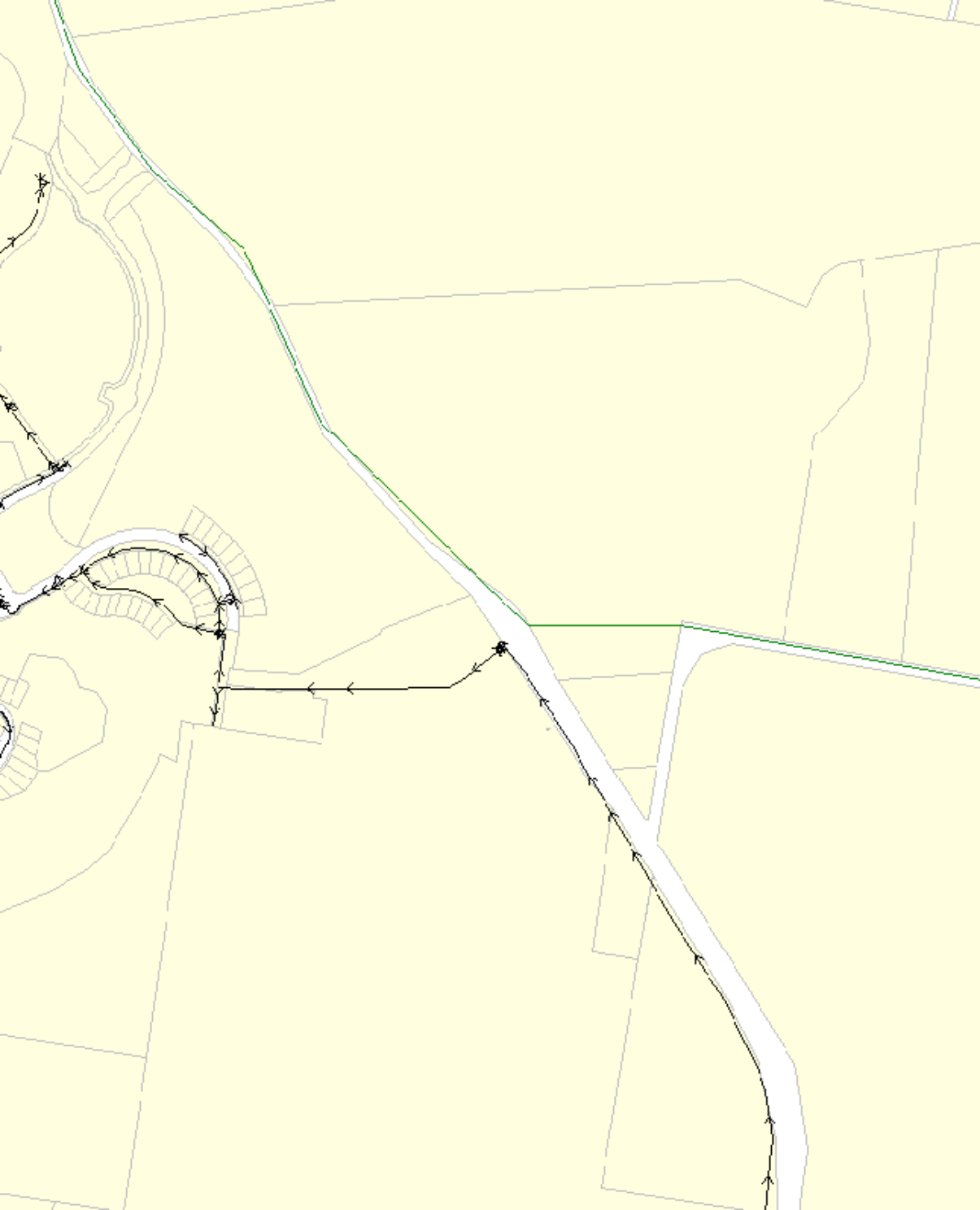
Total Estimated Contract Award Sum (A)	184854.00
Construction Management (Table 11) @ 12%	22182.48
Sub Total (C1)	207036.48
Construction contingency (Table 12) (30% of C1)	62110.94
TOTAL CONSTRUCTION COST (C)	269147.42

TOTAL PRELIMINARY PROJECT ESTIMATE (B+C) (PRELIMINARY OR DETAILED)	309519.54

Say $ 310,000.00

Appendix 4

Water Modelling Data



Network Table - Nodes

Node ID	Elevation m	Base Dema LPS	Demand LPS	Head m	Pressure m
Junc 2	55	3.95	3.95	113.3	58.3
Resvr 1	119.4	#N/A	-3.95	119.4	0

Network Table - Links

Link ID	Length m	Diameter mm	Flow LPS	Velocity m/s	Unit Headl m/km	Friction Factor
Pipe 1	1100	100	-3.95	0.5	5.55	0.043

APPENDIX N

SITE WATER BUDGET

WATER WISE CONSULTING 2013

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Site Water Budget

Jack Nicklaus Golf Course of Australia
Hunter Valley NSW

Prepared
May 2013

Contents

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BANGOR NSW 2235
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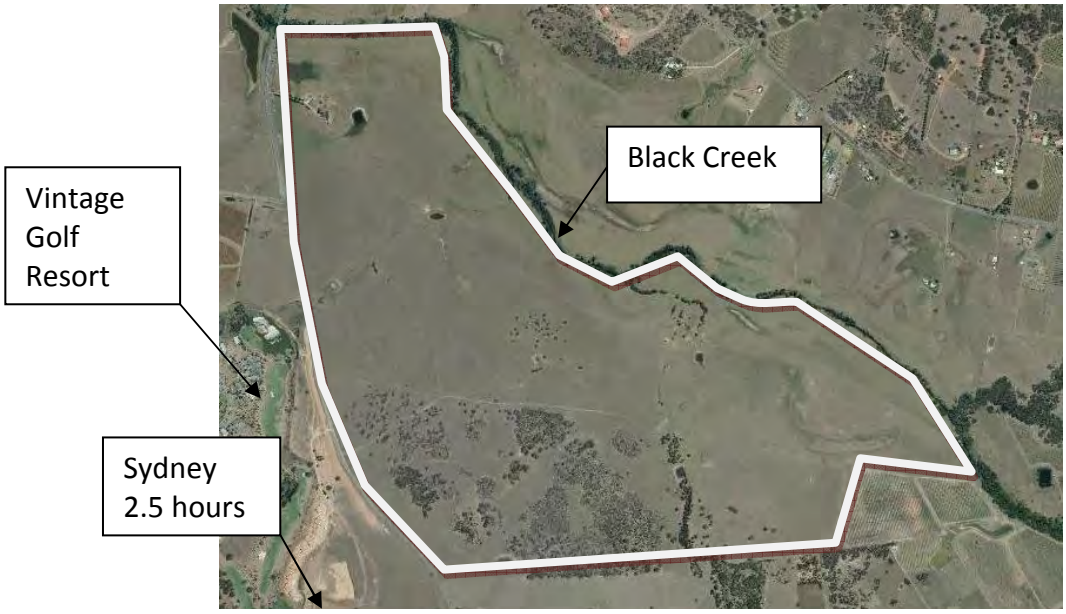
ABN 40 046 304 718

1 Introduction

The site is located within the Hunter Valley of NSW. A tourist hub offering visitor's first class activities include; Wineries, ballooning, skydiving, fishing and golf.

The proposed development comprises construction of a:

- World class 18 hole championship golf course
- Five start 50 room hotel
- 250 luxury short stay villas
- 300 permanent residential dwellings



2 Objective

The objective of this Site Water Budget (SWB) is to provide a predictive water balance model which will aid management of the site water storage and allocation.

3 Site Requirements

3.1 Approximate surface area requiring irrigation:

Area	Hectares
Greens (Incl. practice and Chipper)	1.2 - 2.0
Greens Surrounds	2.0 - 4.0
Tees	0.8 - 1.0
Mown Fairways	15.0 - 18.0
Irrigated Rough	10.0 - 12.0
Driving range	1.5 - 2.0
Resort landscaping	1.0 - 1.5
Road verges	10.0 - 12.0
Total	**41.5 - 52.5**

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3.2 Approximate surface area requiring water during construction for dust suppression and stabilisation:

Area of construction		Hectares
Road construction		6.0
Resort		2.0
Housing		12.0
Golf course		24.0
	Total	**44.0**

An allowance of approximately 6 megalitres should be accounted for to allow dust suppression (primarily during the construction of the roads) and other water projects that might be needed during the construction phase.

4 Water requirement - Golf Course and Landscape areas

The irrigation requirements have been calculated for the various phases of the project:

- Construction /Grow in
- Maintenance

4.1 Golf Course / Landscaping

Generally unless there is excessive high winds (dust suppression needs) little water is need during the construct of the golf course and landscape areas. Works normally will be centralised to limit the disturbance to the ground cover.

4.2 Planting timing

It is generally accepted that best practice is not to undertake seeding (bent grass) during the hottest months of the year (i.e. November to February) as Bent grasses grow most vigorously with temperatures between 15 and 25 C.

Couch being a warm season grass is most active at higher temperatures and will begin to become dormant when temperatures drop below 15 C. The use of turf rolls (e.g. green surround and tees) is less affected by the dormancy as the turf has an existing root structure.
Line planting however can be affected, therefore is advisable to undertake planting in the warmer months.

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5 Data

Information gained from the Bureau of Meteorology (BoM) indicates:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	72.5	107.4	71.4	49	42.8	59.9	30.5	34.1	46.7	53.3	72.7	75.8
Rainfall days >9mm	2.0	2.9	2.4	1.4	1.5	1.8	0.8	1.0	1.5	1.8	2.3	2.3
Evaporation	213.9	173.6	151.9	114	83.7	75.0	80.6	111.6	141	170.6	189	223.2
Air Temp >29◦C	13.7	10	6.1	0.9	0	0	0	0.1	1.1	5.0	7.4	11.1

Data has been taken from weather stations at Williamtown RAAF (evaporation) and Cessnock Airport.

6 Water Usage

Appendix A and B, give an indicative irrigation schedules for the Grow-in and firsts two year periods of operation.

The appendixes indicate that with average weather conditions the site will require a minimum water supply of, 167 Mega-litres for the 'grow-in' phase and 147 mega-litres for the next two years.

To allow for other construction needs and for possible reduction in the average rainfall, it is recommend that the site seek to secure a minimum allocation of 200 mega-litres.

7 Storage

Appendix C indicates the harvesting rights for the site. Harvesting rights are calculated on the area of the individual property title, of the total development site of 241 hectares the golf course site has been taken as 190 hectares.

Approximately 15 mega-litres (0.08 x 190 ha) could be captures per year. By example if the roads drained to onsite detection the surface area would exceed what would be needed to capture the 'harvesting rights'.

Consideration will need to be given to the location and size of the irrigation dam. Though not always practical the best located is central to the course as it allows the use of a smaller irrigation pipe network.

As the quantity of water made available from 'harvesting rights' is less than the expected loss to evaporation, the irrigation storage dam will need to be:

- sized to store sufficient water to cover extended dry periods
- take into account inflow rates compared to outgoing rates from supplementary supplies such as the PID or other onsite storage
- reliability of the incoming supplementary supplies

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8 Conclusion

In total the site will generate a water demand of 167 to 200 mg/litres per year dependant on the annual rainfall. This site has a PID licence for 100meg and there is availability to source a further 100mg at an annual cost of $55,000 for PID scheme if required. A further 19meg may be sourced onsite, subject to availability.

In respect to Water required for domestic use, this will be sourced from the existing Hunter Water Corporation main along the frontage subject to further calculations if instantaneous flow is not available a header tank reservoir can be constructed onsite to be filled overnight when demand is low.

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9 Appendix - A Grow in period

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Operational - Irrigation Schedule

Location	Approximate area of site under irrigation	Average number of sprinklers	Sprinkler output	Mega -litres per season				Average Water usage
	Hectares		l/min	Summer	Autumn	Winter	Spring	Total
Greens	1.2-2.0	100	113.10	4.95	2.17	1.55	3.69	12.35
Greens Surrounds	2.0-4.0	100	113.10	2.82	1.66	0.00	1.75	6.23
Tees	0.8-1.0	110	60.00	2.15	0.87	0.60	1.57	5.20
Fairways	15.0-18.0	800	113.10	24.95	9.70	6.59	18.13	59.37
Roughs	10.0-12.0	100	113.10	3.12	1.21	0.82	2.27	7.42
Landscaping	1.0-1.5	600	30.00	6.32	2.67	1.88	4.69	15.56
Totals	41.5-52.5	1810		44.31	18.28	11.44	32.10	106.13
	Water body surface area			Seasonal loss to evaporation				
	Acres			Mega-litres				
Dams	22.5			29.54	15.51	11.87	27.34	84.26
Total Water requirement for first 12 month								**190.38**

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Operational - Irrigation Schedule

Greens

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Bent	Bent	Bent	Bent	Bent	Bent	Bent	Bent	Bent	Bent	Bent	Bent
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Monthly Reference Evapotranspiration	ETo month		181.82	147.56	129.12	96.90	71.15	63.75	68.51	94.86	119.85	140.25	166.01	189.72
Daily Reference Evapotranspiration	ETo day		5.87	5.27	4.17	3.23	2.30	2.13	2.21	3.06	4.00	4.68	5.36	6.12
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%	20	20	30	30	30	30	30	30	30	30	20	20
Monthly Landscape Water Requirement	ETl month	mm/month	145.45	118.05	90.38	67.83	49.80	44.63	47.96	66.40	83.90	98.18	132.80	151.78
Daily Landscape Water Requirement	ETl day	mm/day	4.69	4.22	2.92	2.26	1.61	1.49	1.55	2.14	2.80	3.27	4.28	4.90
Soil Properties														
Root zone soil type	RZ		Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand
Soil infiltration rate	SIR	mm/hr	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50
Available water storage capacity	AWSC	mm/m	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Active root depth	RD	mm	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
Root zone available water storage	RAW	mm	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Management Allowable Depletion	MAD		20%	20%	30%	30%	30%	30%	30%	30%	30%	30%	20%	20%
Maximum soil water deficit	MSWD	mm	3.00	3.00	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	3.00	3.00
Sprinkler Data														
Sprinkler type			855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Sprinkler row spacing	SR	m	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Application rate	AR or PR	mm/hr	20.94	20.94	20.94	20.94	20.94	20.94	20.94	20.94	20.94	20.94	20.94	20.94
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement (Nil Rain)	IR	mm / month	171.12	138.88	106.33	79.80	58.59	52.50	56.42	78.12	98.70	115.50	156.24	178.56
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	30%	30%	40%	40%	40%	40%	30%	30%	20%	20%
Effective Rainfall	ER	mm / month	14.50	21.48	21.42	14.70	17.12	23.96	12.20	13.64	14.01	15.99	14.54	15.16
Irrigation water requirement with average rainfall allowance	IwR	mm/month	156.62	117.40	84.91	65.10	41.47	28.54	44.22	64.48	84.69	99.51	141.70	163.40
Calculated runtime per period	OT	min/month	449.00	337.00	244.00	187.00	119.00	82.00	127.00	185.00	243.00	286.00	406.00	469.00
Minimum Irrigation cycles per month	ID	days / month	31.00	28.00	21.00	16.00	12.00	10.00	11.00	15.00	19.00	22.00	31.00	31.00
Water Restrictions	WR	days / week	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	15.00	13.00	12.00	12.00	10.00	9.00	12.00	13.00	13.00	13.00	14.00	16.00
Maximum allowable runtime per cycle	RC	minutes	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cycle operating time		minutes	15.00	13.00	12.00	12.00	10.00	9.00	12.00	13.00	13.00	13.00	14.00	16.00
Calculations														
Number of sprinklers			100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated total volume of water per operating day		m^3	169.65	147.03	135.72	135.72	113.10	101.79	135.72	147.03	147.03	147.03	158.34	180.96
Water usage per month		m^3	1771.37	1327.79	960.33	736.28	469.03	322.79	500.13	729.27	957.84	1125.46	1602.63	1848.05

Season	m3	meg
Summer	4947.22	4.95
Autumn	2165.64	2.17
Winter	1552.18	1.55
Spring	3685.93	3.69
TOTAL	12350.97	12.35

Operational phase years 1 and 2

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Operational - Irrigation Schedule

Greens Surrounds

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Monthly Reference Evapotranspiration	ETo month		171.12	138.88	121.52	91.20	66.96	60.00	64.48	89.28	112.80	132.00	156.24	178.56
Daily Reference Evapotranspiration	ETo day		5.52	4.96	3.92	3.04	2.16	2.00	2.08	2.88	3.76	4.40	5.04	5.76
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%	30	30	40	40	40	40	40	40	40	40	30	30
Monthly Landscape Water Requirement	ETl month	mm/month	119.78	97.22	72.91	54.72	40.18	36.00	38.69	53.57	67.68	79.20	109.37	124.99
Daily Landscape Water Requirement	ETl day	mm/day	3.86	3.47	2.35	1.82	1.30	1.20	1.25	1.73	2.26	2.64	3.53	4.03
Soil Properties														
Root zone soil type	RZ		Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand
Soil infiltration rate	SIR	mm/hr	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50
Available water storage capacity	AWSC	mm/m	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Active root depth	RD	mm	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
Root zone available water storage	RAW	mm	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Management Allowable Depletion	MAD		30%	30%	40%	40%	40%	40%	40%	40%	40%	40%	30%	30%
Maximum soil water deficit	MSWD	mm	4.50	4.50	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	4.50	4.50
Sprinkler Data														
Sprinkler type			855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Sprinkler row spacing	SR	m	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50
Application rate	AR or PR	mm/hr	24.32	24.32	24.32	24.32	24.32	24.32	24.32	24.32	24.32	24.32	24.32	24.32
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement **estimated**	IR	mm / month	100.00	100.00	80.00	70.00	50.00	0.00	0.00	0.00	50.00	70.00	80.00	100.00
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	30%	30%	40%	40%	40%	40%	30%	30%	20%	20%
Effective Rainfall	ER	mm / month	15.00	21.00	21.00	15.00	17.00	24.00	12.00	14.00	14.00	16.00	15.00	15.00
Irrigation water requirement with average rainfall allowance	IwR	mm/month	85.00	79.00	59.00	55.00	33.00	0.00	0.00	0.00	36.00	54.00	65.00	85.00
Calculated runtime per period	OT	min/month	210.00	195.00	146.00	136.00	82.00	0.00	0.00	0.00	89.00	134.00	161.00	210.00
Irrigation Days	ID	days / month	27.00	22.00	13.00	10.00	7.00	6.00	7.00	9.00	12.00	14.00	25.00	28.00
Water Restrictions	WR	days / week	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	8.00	9.00	12.00	14.00	12.00	0.00	0.00	0.00	8.00	10.00	7.00	8.00
Maximum allowable runtime per cycle	RC	minutes	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00
Cycle operating time		minutes	8.00	9.00	12.00	14.00	12.00	#DIV/0!	#DIV/0!	#DIV/0!	8.00	10.00	7.00	8.00
Calculations														
Number of sprinklers			100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated total volume of water per operating day		m^3	90.48	101.79	135.72	158.34	135.72	0.00	0.00	0.00	90.48	113.10	79.17	90.48
Water usage per month		m^3	961.35	893.49	667.29	622.05	373.23	0.00	0.00	0.00	407.16	610.74	735.15	961.35

Season	m3	meg
Summer	2816.19	2.82
Autumn	1662.57	1.66
Winter	0.00	0.00
Spring	1753.05	1.75
TOTAL	6231.81	6.23

Operational phase years 1 and 2

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Tees

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Monthly Reference Evapotranspiration	ETo month		160.43	130.20	113.93	85.50	62.78	56.25	60.45	83.70	105.75	123.75	146.48	167.40
Daily Reference Evapotranspiration	ETo day		5.18	4.65	3.68	2.85	2.03	1.88	1.95	2.70	3.53	4.13	4.73	5.40
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%	30	30	40	40	40	40	40	40	40	40	30	30
Monthly Landscape Water Requirement	ETl month	mm/month	112.30	91.14	68.36	51.30	37.67	33.75	36.27	50.22	63.45	74.25	102.53	117.18
Daily Landscape Water Requirement	ETl day	mm/day	3.62	3.26	2.21	1.71	1.22	1.13	1.17	1.62	2.12	2.48	3.31	3.78
Soil Properties														
Root zone soil type	RZ		Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Soil infiltration rate	SIR	mm/hr	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40
Available water storage capacity	AWSC	mm/m	125.00	125.00	125.00	125.00	125.00	125.00	125.00	125.00	125.00	125.00	125.00	125.00
Active root depth	RD	mm	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
Root zone available water storage	RAW	mm	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75
Management Allowable Depletion	MAD		30%	30%	40%	40%	40%	40%	40%	40%	40%	40%	30%	30%
Maximum soil water deficit	MSWD	mm	5.63	5.63	5.63	5.63	5.63	5.63	5.63	5.63	5.63	5.63	5.63	5.63
Sprinkler Data														
Sprinkler type			855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Sprinkler row spacing	SR	m	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
Application rate	AR or PR	mm/hr	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement (Nil Rain)	IR	mm / month	132.11	107.22	80.42	60.35	44.31	39.71	42.67	59.08	74.65	87.35	120.63	137.86
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	30%	30%	40%	40%	40%	40%	30%	30%	20%	20%
Effective Rainfall	ER	mm / month	14.50	21.48	21.42	14.70	17.12	23.96	12.20	13.64	14.01	15.99	14.54	15.16
Irrigation water requirement with average rainfall allowance	IwR	mm/month	117.61	85.74	59.00	45.65	27.19	15.75	30.47	45.44	60.64	71.36	106.09	122.70
Calculated runtime per period	OT	min/month	765.00	558.00	384.00	297.00	177.00	103.00	199.00	296.00	395.00	464.00	690.00	798.00
Irrigation Days	ID	days / month	20.00	17.00	13.00	10.00	7.00	6.00	7.00	9.00	12.00	14.00	19.00	21.00
Water Restrictions	WR	days / week	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	39.00	33.00	30.00	30.00	26.00	18.00	29.00	33.00	33.00	34.00	37.00	38.00
Maximum allowable runtime per cycle	RC	minutes	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cycle operating time		minutes	39.00	33.00	30.00	30.00	26.00	18.00	29.00	33.00	33.00	34.00	37.00	38.00
Calculations														
Number of sprinklers			110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00
Calculated total volume of water per operating day		m^3	257.40	217.80	198.00	198.00	171.60	118.80	191.40	217.80	217.80	224.40	244.20	250.80
Water usage per month		m^3	776.26	565.91	389.38	301.31	179.47	103.92	201.11	299.92	400.20	471.00	700.17	809.81

Season	m3	meg
Summer	2151.98	2.15
Autumn	870.16	0.87
Winter	604.95	0.60
Spring	1571.37	1.57
TOTAL	5198.46	5.20

Operational phase years 1 and 2

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Fairways

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Monthly Reference Evapotranspiration	ETo month		139.04	112.84	98.74	74.10	54.41	48.75	52.39	72.54	91.65	107.25	126.95	145.08
Daily Reference Evapotranspiration	ETo day		4.49	4.03	3.19	2.47	1.76	1.63	1.69	2.34	3.06	3.58	4.10	4.68
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%	30	30	40	40	40	40	40	40	40	40	30	30
Monthly Landscape Water Requirement	ETl month	mm/month	97.32	78.99	59.24	44.46	32.64	29.25	31.43	43.52	54.99	64.35	88.86	101.56
Daily Landscape Water Requirement	ETl day	mm/day	3.14	2.82	1.91	1.48	1.05	0.98	1.01	1.40	1.83	2.15	2.87	3.28
Soil Properties														
Root zone soil type	RZ		Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam
Soil infiltration rate	SIR	mm/hr	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60
Available water storage capacity	AWSC	mm/m	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
Active root depth	RD	mm	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
Root zone available water storage	RAW	mm	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Management Allowable Depletion	MAD		40%	40%	40%	40%	50%	50%	50%	50%	40%	40%	40%	40%
Maximum soil water deficit	MSWD	mm	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Sprinkler Data														
Sprinkler type			855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Sprinkler row spacing	SR	m	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Application rate	AR or PR	mm/hr	16.97	16.97	16.97	16.97	16.97	16.97	16.97	16.97	16.97	16.97	16.97	16.97
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement (Nil Rain)	IR	mm / month	114.50	92.93	69.70	52.31	38.40	34.41	36.98	51.20	64.69	75.71	104.54	119.48
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	30%	30%	40%	40%	40%	40%	30%	30%	20%	20%
Effective Rainfall	ER	mm / month	15	21	21	15	17	24	12	14	14	16	15	15
Irrigation water requirement with average rainfall allowance	IwR	mm/month	100.00	71.45	48.28	37.61	21.28	10.45	24.78	37.56	50.68	59.72	90.00	104.32
Calculated runtime per period	OT	min/month	354.00	253.00	171.00	134.00	76.00	37.00	88.00	133.00	180.00	212.00	319.00	369.00
Irrigation Days	ID	days / month	9.00	7.00	5.00	4.00	3.00	3.00	3.00	4.00	5.00	6.00	8.00	9.00
Water Restrictions	WR	days / week	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	40.00	37.00	35.00	34.00	26.00	13.00	30.00	34.00	36.00	36.00	40.00	41.00
Maximum allowable runtime per cycle	RC	minutes	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	2.00	2.00	2.00	2.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00
Cycle operating time		minutes	20.00	19.00	18.00	17.00	26.00	13.00	15.00	17.00	18.00	18.00	20.00	21.00
Calculations														
Number of sprinklers			800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00
Calculated total volume of water per operating day		m^3	3619.20	3347.76	3166.80	3076.32	2352.48	1176.24	2714.40	3076.32	3257.28	3257.28	3619.20	3709.68
Water usage per month		m^3	9047.95	6464.53	4367.95	3402.58	1925.73	945.68	2242.20	3398.85	4585.90	5403.09	8143.47	9438.66

Season	m3	meg
Summer	24951.14	24.95
Autumn	9696.26	9.70
Winter	6586.73	6.59
Spring	18132.46	18.13
TOTAL	59366.59	59.37

Operational phase years 1 and 2

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Roughs

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Monthly Reference Evapotranspiration	ETo month		139.04	112.84	98.74	74.10	54.41	48.75	52.39	72.54	91.65	107.25	126.95	145.08
Daily Reference Evapotranspiration	ETo day		4.49	4.03	3.19	2.47	1.76	1.63	1.69	2.34	3.06	3.58	4.10	4.68
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%	30	30	40	40	40	40	40	40	40	40	30	30
Monthly Landscape Water Requirement	ETl month	mm/month	97.32	78.99	59.24	44.46	32.64	29.25	31.43	43.52	54.99	64.35	88.86	101.56
Daily Landscape Water Requirement	ETl day	mm/day	3.14	2.82	1.91	1.48	1.05	0.98	1.01	1.40	1.83	2.15	2.87	3.28
Soil Properties														
Root zone soil type	RZ		Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam
Soil infiltration rate	SIR	mm/hr	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60
Available water storage capacity	AWSC	mm/m	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
Active root depth	RD	mm	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
Root zone available water storage	RAW	mm	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Management Allowable Depletion	MAD		40%	40%	50%	50%	50%	50%	50%	50%	50%	50%	40%	40%
Maximum soil water deficit	MSWD	mm	12.00	12.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	12.00	12.00
Sprinkler Data														
Sprinkler type			855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Sprinkler row spacing	SR	m	35.50	35.50	35.50	35.50	35.50	35.50	35.50	35.50	35.50	35.50	35.50	35.50
Application rate	AR or PR	mm/hr	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement (Nil Rain)	IR	mm / month	114.50	92.93	69.70	52.31	38.40	34.41	36.98	51.20	64.69	75.71	104.54	119.48
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	30%	30%	40%	40%	40%	40%	30%	30%	20%	20%
Effective Rainfall	ER	mm / month	14.50	21.48	21.42	14.70	17.12	23.96	12.20	13.64	14.01	15.99	14.54	15.16
Irrigation water requirement with average rainfall allowance	IwR	mm/month	100.00	71.45	48.28	37.61	21.28	10.45	24.78	37.56	50.68	59.72	90.00	104.32
Calculated runtime per period	OT	min/month	628.00	449.00	304.00	237.00	134.00	66.00	156.00	236.00	319.00	375.00	566.00	655.00
Irrigation Days	ID	days / month	9.00	7.00	4.00	3.00	3.00	2.00	3.00	3.00	4.00	5.00	8.00	9.00
Water Restrictions	WR	days / week	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	70.00	65.00	76.00	79.00	45.00	33.00	52.00	79.00	80.00	75.00	71.00	73.00
Maximum allowable runtime per cycle	RC	minutes	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	2.00	2.00	2.00	2.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00
Cycle operating time		minutes	35.00	33.00	38.00	40.00	45.00	33.00	26.00	40.00	40.00	38.00	36.00	37.00
Calculations														
Number of sprinklers			100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated total volume of water per operating day		m^3	791.70	735.15	859.56	893.49	508.95	373.23	588.12	893.49	904.80	848.25	803.01	825.63
Water usage per month		m^3	1130.99	808.07	545.99	425.32	240.72	118.21	280.28	424.86	573.24	675.39	1017.93	1179.83

Season	m3	meg
Summer	3118.89	3.12
Autumn	1212.03	1.21
Winter	823.34	0.82
Spring	2266.56	2.27
TOTAL	7420.82	7.42

Operational phase years 1 and 2

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Operational - Irrigation Schedule

Landscaping

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Monthly Reference Evapotranspiration	ETo month		149.73	121.52	106.33	79.80	58.59	52.50	56.42	78.12	98.70	115.50	136.71	156.24
Daily Reference Evapotranspiration	ETo day		4.83	4.34	3.43	2.66	1.89	1.75	1.82	2.52	3.29	3.85	4.41	5.04
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%	20	20	30	30	30	30	30	30	30	30	20	20
Monthly Landscape Water Requirement	ETl month	mm/month	119.78	97.22	74.43	55.86	41.01	36.75	39.49	54.68	69.09	80.85	109.37	124.99
Daily Landscape Water Requirement	ETl day	mm/day	3.86	3.47	2.40	1.86	1.32	1.23	1.27	1.76	2.30	2.70	3.53	4.03
Soil Properties														
Root zone soil type	RZ		Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam
Soil infiltration rate	SIR	mm/hr	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90
Available water storage capacity	AWSC	mm/m	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00
Active root depth	RD	mm	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
Root zone available water storage	RAW	mm	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25	26.25
Management Allowable Depletion	MAD		20%	20%	30%	30%	40%	40%	40%	40%	30%	30%	20%	20%
Maximum soil water deficit	MSWD	mm	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
Sprinkler Data														
Sprinkler type			855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Sprinkler row spacing	SR	m	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Application rate	AR or PR	mm/hr	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement (Nil Rain)	IR	mm / month	140.92	114.37	87.57	65.72	48.25	43.24	46.46	64.33	81.28	95.12	128.67	147.05
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	30%	30%	40%	40%	40%	40%	30%	30%	20%	20%
Effective Rainfall	ER	mm / month	14.50	21.48	21.42	14.70	17.12	23.96	12.20	13.64	14.01	15.99	14.54	15.16
Irrigation water requirement with average rainfall allowance	IwR	mm/month	126.42	92.89	66.15	51.02	31.13	19.28	34.26	50.69	67.27	79.13	114.13	131.89
Calculated runtime per period	OT	min/month	607.00	446.00	318.00	245.00	150.00	93.00	165.00	244.00	323.00	380.00	548.00	634.00
Irrigation Days	ID	days / month	23.00	19.00	15.00	11.00	8.00	7.00	8.00	11.00	14.00	16.00	21.00	24.00
Water Restrictions	WR	days / week	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	27.00	24.00	22.00	23.00	19.00	14.00	21.00	23.00	24.00	24.00	27.00	27.00
Maximum allowable runtime per cycle	RC	minutes	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cycle operating time		minutes	27.00	24.00	22.00	23.00	19.00	14.00	21.00	23.00	24.00	24.00	27.00	27.00
Calculations														
Number of sprinklers			600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00
Calculated total volume of water per operating day		m^3	486.00	432.00	396.00	414.00	342.00	252.00	378.00	414.00	432.00	432.00	486.00	486.00
Water usage per month		m^3	2275.60	1672.05	1190.63	918.32	560.35	346.96	616.74	912.49	1210.90	1424.30	2054.31	2374.01

Season	m3	meg
Summer	6321.66	6.32
Autumn	2669.29	2.67
Winter	1876.19	1.88
Spring	4689.51	4.69
TOTAL	15556.66	15.56

Operational phase years 1 and 2

9 Appendix - B Operational period

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Grow in and establishment - Irrigation Schedule

Location	Approximate area of site requiring irrigation	Average number of sprinklers	Sprinkler output	Mega-litres per season				Average Water usage
	Acres		l/min	Summer	Autumn	Winter	Spring	Total
Greens	1.2-2.0	100	113.10	7.55	2.20	1.43	5.44	16.62
Greens Surrounds	2.0-4.0	100	113.10	2.82	0.91	0.00	1.65	5.37
Tees	0.8-1.0	126	60.00	4.74	1.37	0.77	2.85	9.73
Fairways	15.0-18.0	855	113.10	39.44	14.87	0.00	20.50	74.80
Roughs	10.0-12.0	108	113.10	4.90	1.89	2.77	2.44	12.00
Landscaping	1.0-1.5	600	30.00	6.01	1.86	0.00	0.00	7.87
Totals	41.5-52.5	1889		65.45	23.10	4.97	32.87	126.39
	Water body surface area			Seasonal loss to evaporation				
	Acres			Mega-litres				
Dams	22.5			29.54	15.51	11.87	27.34	84.26
Total Water requirement for first 12 month								**210.65**

Establishment and grow in phase

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Grow in and establishment - Irrigation Schedule

Greens

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Bent	Bent	Bent	Bent	Bent	Bent	Bent	Bent	Bent	Bent	Bent	Bent
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Monthly Reference Evapotranspiration	ETo month		213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily Reference Evapotranspiration	ETo day		6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Landscape Water Requirement	ETl month	mm/month	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily Landscape Water Requirement	ETl day	mm/day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Soil Properties														
Root zone soil type	RZ		Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam
Soil infiltration rate	SIR	mm/hr	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90
Available water storage capacity	AWSC	mm/m	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00
Active root depth	RD	mm	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Root zone available water storage	RAW	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Management Allowable Depletion	MAD		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Maximum soil water deficit	MSWD	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Sprinkler Data														
Sprinkler type			855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Sprinkler row spacing	SR	m	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Application rate	AR or PR	mm/hr	20.94	20.94	20.94	20.94	20.94	20.94	20.94	20.94	20.94	20.94	20.94	20.94
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement (Nil Rain)	IR	mm / month	251.65	204.24	178.71	134.12	98.47	88.24	94.82	131.29	165.88	194.12	229.76	262.59
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Effective Rainfall	ER	mm / month	14.50	21.48	14.28	9.80	8.56	11.98	6.10	6.82	9.34	10.66	14.54	15.16
Irrigation water requirement with average rainfall allowance	IwR	mm/month	237.15	182.76	164.43	124.32	89.91	76.26	88.72	124.47	156.54	183.46	215.22	247.43
Calculated runtime per period	OT	min/month	680.00	524.00	472.00	357.00	258.00	219.00	255.00	357.00	449.00	526.00	617.00	709.00
Minimum Irrigation cycles per month	ID	days / month	25.00	20.00	18.00	14.00	10.00	9.00	10.00	13.00	17.00	19.00	23.00	26.00
Water Restrictions	WR	days / week	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	28.00	27.00	27.00	26.00	26.00	25.00	26.00	28.00	27.00	28.00	27.00	28.00
Maximum allowable runtime per cycle	RC	minutes	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	2.00	2.00	2.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00
Cycle operating time		minutes	14.00	14.00	14.00	26.00	26.00	25.00	26.00	14.00	14.00	14.00	14.00	14.00
Calculations														
Number of sprinklers			100.00	100.00	100.00	10.00	20.00	30.00	40.00	55.00	70.00	85.00	100.00	100.00
Calculated total volume of water per operating day		m^3	316.68	305.37	305.37	29.41	58.81	84.83	117.62	174.17	213.76	269.18	305.37	316.68
Water usage per month		m^3	2682.13	2066.96	1859.66	140.60	203.38	258.73	401.39	774.29	1239.35	1763.67	2434.19	2798.41

Season	m3	meg
Summer	7547.51	7.55
Autumn	2203.64	2.20
Winter	1434.41	1.43
Spring	5437.21	5.44
TOTAL	16622.76	16.62

Establishment and grow in phase

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Grow in and establishment - Irrigation Schedule

Greens Surrounds

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Monthly Reference Evapotranspiration	ETo month		213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily Reference Evapotranspiration	ETo day		6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Landscape Water Requirement	ETl month	mm/month	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily Landscape Water Requirement	ETl day	mm/day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Soil Properties														
Root zone soil type	RZ		Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam
Soil infiltration rate	SIR	mm/hr	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90
Available water storage capacity	AWSC	mm/m	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00
Active root depth	RD	mm	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Root zone available water storage	RAW	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Management Allowable Depletion	MAD		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
			1	1	1	1	1	1	1	1	1	1	1	1
Maximum soil water deficit	MSWD	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Sprinkler Data														
Sprinkler type			855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Sprinkler row spacing	SR	m	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50
Application rate	AR or PR	mm/hr	24.32	24.32	24.32	24.32	24.32	24.32	24.32	24.32	24.32	24.32	24.32	24.32
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement **estimated**	IR	mm / month	100.00	100.00	80.00	70.00	50.00	0.00	0.00	0.00	50.00	70.00	80.00	100.00
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Effective Rainfall	ER	mm / month	15.00	21.00	14.00	10.00	9.00	12.00	6.00	7.00	9.00	11.00	15.00	15.00
Irrigation water requirement with average rainfall allowance	IwR	mm/month	85.00	79.00	66.00	60.00	41.00	0.00	0.00	0.00	41.00	59.00	65.00	85.00
Calculated runtime per period	OT	min/month	210.00	195.00	163.00	149.00	102.00	0.00	0.00	0.00	102.00	146.00	161.00	210.00
Irrigation Days	ID	days / month	25.00	20.00	18.00	14.00	10.00	9.00	10.00	13.00	17.00	19.00	23.00	26.00
Water Restrictions	WR	days / week	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	9.00	10.00	10.00	11.00	11.00	0.00	0.00	0.00	6.00	8.00	7.00	9.00
Maximum allowable runtime per cycle	RC	minutes	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00
Cycle operating time		minutes	9.00	10.00	10.00	11.00	11.00	#DIV/0!	#DIV/0!	#DIV/0!	6.00	8.00	7.00	9.00
Calculations														
Number of sprinklers			100.00	100.00	100.00	10.00	20.00	30.00	40.00	55.00	75.00	85.00	100.00	100.00
Calculated total volume of water per operating day		m^3	101.79	113.10	113.10	12.44	24.88	0.00	0.00	0.00	50.90	76.91	79.17	101.79
Water usage per month		m^3	961.35	893.49	746.46	67.86	92.74	0.00	0.00	0.00	347.78	567.20	735.15	961.35

Season	m3	meg
Summer	2816.19	2.82
Autumn	907.06	0.91
Winter	0.00	0.00
Spring	1650.13	1.65
TOTAL	5373.38	5.37

Establishment and grow in phase

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Grow in and establishment - Irrigation Schedule

Tees

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Monthly Reference Evapotranspiration	ETo month		213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily Reference Evapotranspiration	ETo day		6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Landscape Water Requirement	ETl month	mm/month	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily Landscape Water Requirement	ETl day	mm/day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Soil Properties														
Root zone soil type	RZ		Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam
Soil infiltration rate	SIR	mm/hr	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90
Available water storage capacity	AWSC	mm/m	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00
Active root depth	RD	mm	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Root zone available water storage	RAW	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Management Allowable Depletion	MAD		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Maximum soil water deficit	MSWD	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Sprinkler Data														
Sprinkler type			855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Sprinkler row spacing	SR	m	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
Application rate	AR or PR	mm/hr	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement (Nil Rain)	IR	mm / month	251.65	204.24	178.71	134.12	98.47	88.24	94.82	131.29	165.88	194.12	229.76	262.59
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Effective Rainfall	ER	mm / month	14.50	21.48	14.28	9.80	8.56	11.98	6.10	6.82	9.34	10.66	14.54	15.16
Irrigation water requirement with average rainfall allowance	IwR	mm/month	237.15	182.76	164.43	124.32	89.91	76.26	88.72	124.47	156.54	183.46	215.22	247.43
Calculated runtime per period	OT	min/month	1542.00	1188.00	1069.00	809.00	585.00	496.00	577.00	810.00	1018.00	1193.00	1399.00	1609.00
Irrigation Days	ID	days / month	25.00	20.00	18.00	14.00	10.00	9.00	10.00	13.00	17.00	19.00	23.00	26.00
Water Restrictions	WR	days / week	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	62.00	60.00	60.00	58.00	59.00	56.00	58.00	63.00	60.00	63.00	61.00	62.00
Maximum allowable runtime per cycle	RC	minutes	58.00	58.00	58.00	58.00	58.00	58.00	58.00	58.00	58.00	58.00	58.00	58.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	2.00	2.00	2.00	1.00	2.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00
Cycle operating time		minutes	31.00	30.00	30.00	58.00	30.00	56.00	58.00	32.00	30.00	32.00	31.00	31.00
Calculations														
Number of sprinklers			119.00	126.00	126.00	7.00	14.00	28.00	42.00	56.00	70.00	84.00	98.00	112.00
Calculated total volume of water per operating day		m^3	442.68	453.60	453.60	24.36	49.56	94.08	146.16	211.68	252.00	317.52	358.68	416.64
Water usage per month		m^3	1693.23	1381.63	1243.06	52.21	75.52	128.11	223.58	418.23	657.48	924.63	1265.52	1662.72

Season	m3	meg
Summer	4737.58	4.74
Autumn	1370.80	1.37
Winter	769.93	0.77
Spring	2847.63	2.85
TOTAL	9725.93	9.73

Establishment and grow in phase

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Grow in and establishment - Irrigation Schedule

Fairways

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Monthly Reference Evapotranspiration	ETo month		171.12	138.88	121.52	91.20	66.96	60.00	64.48	89.28	112.80	132.00	156.24	178.56
Daily Reference Evapotranspiration	ETo day		5.52	4.96	3.92	3.04	2.16	2.00	2.08	2.88	3.76	4.40	5.04	5.76
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%												
Monthly Landscape Water Requirement	ETl month	mm/month	171.12	138.88	121.52	91.20	66.96	60.00	64.48	89.28	112.80	132.00	156.24	178.56
Daily Landscape Water Requirement	ETl day	mm/day	5.52	4.96	3.92	3.04	2.16	2.00	2.08	2.88	3.76	4.40	5.04	5.76
Soil Properties														
Root zone soil type	RZ		Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam
Soil infiltration rate	SIR	mm/hr	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90
Available water storage capacity	AWSC	mm/m	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00
Active root depth	RD	mm	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Root zone available water storage	RAW	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Management Allowable Depletion	MAD		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Maximum soil water deficit	MSWD	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Sprinkler Data														
Sprinkler type			855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Sprinkler row spacing	SR	m	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Application rate	AR or PR	mm/hr	16.97	16.97	16.97	16.97	16.97	16.97	16.97	16.97	16.97	16.97	16.97	16.97
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement (Nil Rain)	IR	mm / month	201.32	163.39	142.96	107.29	78.78	70.59	75.86	105.04	132.71	155.29	183.81	210.07
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Effective Rainfall	ER	mm / month	15	21	14	10	9	12	6	7	9	11	15	15
Irrigation water requirement with average rainfall allowance	IwR	mm/month	186.82	141.91	128.68	97.49	70.22	58.61	69.76	98.22	123.37	144.63	169.27	194.91
Calculated runtime per period	OT	min/month	661.00	502.00	456.00	345.00	249.00	208.00	247.00	348.00	437.00	512.00	599.00	690.00
Irrigation Days	ID	days / month	20.00	16.00	14.00	11.00	8.00	7.00	8.00	11.00	13.00	16.00	18.00	21.00
Water Restrictions	WR	days / week	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	34.00	32.00	33.00	32.00	32.00	30.00	31.00	32.00	34.00	32.00	34.00	33.00
Maximum allowable runtime per cycle	RC	minutes	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	2.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	2.00	2.00
Cycle operating time		minutes	17.00	32.00	17.00	32.00	32.00	30.00	31.00	32.00	17.00	32.00	17.00	17.00
Calculations														
Number of sprinklers			675.00	765.00	855.00	90.00	180.00				315.00	405.00	495.00	585.00
Calculated total volume of water per operating day		m^3	2595.65	2768.69	3191.12	325.73	651.46	0.00	0.00	0.00	1211.30	1465.78	1903.47	2183.40
Water usage per month		m^3	14262.13	12278.11	12443.88	992.39	1429.47	0.00	0.00	0.00	4395.09	6625.04	9476.60	12895.97

Season	m3	meg
Summer	39436.21	39.44
Autumn	14865.73	14.87
Winter	0.00	0.00
Spring	20496.73	20.50
TOTAL	74798.67	74.80

Establishment and grow in phase

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Grow in and establishment - Irrigation Schedule

Roughs

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Monthly Reference Evapotranspiration	ETo month		171.12	138.88	121.52	91.20	66.96	60.00	64.48	89.28	112.80	132.00	156.24	178.56
Daily Reference Evapotranspiration	ETo day		5.52	4.96	3.92	3.04	2.16	2.00	2.08	2.88	3.76	4.40	5.04	5.76
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Landscape Water Requirement	ETl month	mm/month	171.12	138.88	121.52	91.20	66.96	60.00	64.48	89.28	112.80	132.00	156.24	178.56
Daily Landscape Water Requirement	ETl day	mm/day	5.52	4.96	3.92	3.04	2.16	2.00	2.08	2.88	3.76	4.40	5.04	5.76
Soil Properties														
Root zone soil type	RZ		Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam
Soil infiltration rate	SIR	mm/hr	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90
Available water storage capacity	AWSC	mm/m	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00
Active root depth	RD	mm	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Root zone available water storage	RAW	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Management Allowable Depletion	MAD		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Maximum soil water deficit	MSWD	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Sprinkler Data														
Sprinkler type			855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53	855-56-53
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10	113.10
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Sprinkler row spacing	SR	m	35.50	35.50	35.50	35.50	35.50	35.50	35.50	35.50	35.50	35.50	35.50	35.50
Application rate	AR or PR	mm/hr	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement (Nil Rain)	IR	mm / month	201.32	163.39	142.96	107.29	78.78	70.59	75.86	105.04	132.71	155.29	183.81	210.07
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Effective Rainfall	ER	mm / month	14.50	21.48	14.28	9.80	8.56	11.98	6.10	6.82	9.34	10.66	14.54	15.16
Irrigation water requirement with average rainfall allowance	IwR	mm/month	186.82	141.91	128.68	97.49	70.22	58.61	69.76	98.22	123.37	144.63	169.27	194.91
Calculated runtime per period	OT	min/month	1173.00	891.00	808.00	613.00	441.00	368.00	438.00	617.00	775.00	908.00	1063.00	1224.00
Irrigation Days	ID	days / month	20.00	16.00	14.00	11.00	8.00	7.00	8.00	11.00	13.00	16.00	18.00	21.00
Water Restrictions	WR	days / week	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	59.00	56.00	58.00	56.00	56.00	53.00	55.00	57.00	60.00	57.00	60.00	59.00
Maximum allowable runtime per cycle	RC	minutes	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	2.00	1.00	2.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00
Cycle operating time		minutes	30.00	56.00	29.00	56.00	56.00	53.00	55.00	29.00	30.00	29.00	30.00	30.00
Calculations														
Number of sprinklers			84.00	96.00	108.00	12.00	24.00	108.00	108.00	108.00	36.00	48.00	60.00	72.00
Calculated total volume of water per operating day		m^3	560.52	608.03	708.46	76.00	152.01	647.38	671.81	696.24	244.30	309.44	407.16	480.45
Water usage per month		m^3	1774.84	1540.78	1571.86	132.32	190.60	715.89	852.09	1199.68	502.30	785.19	1148.68	1587.20

Season	m3	meg
Summer	4902.82	4.90
Autumn	1894.77	1.89
Winter	2767.66	2.77
Spring	2436.16	2.44
TOTAL	12001.42	12.00

Establishment and grow in phase

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Jack Nicklaous Golf Course Development
Hunter Valley NSW

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Grow in and establishment - Irrigation Schedule

Landscaping

Investigation	Abbreviation	Units	Months											
Landscape Requirements			**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material			Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch
Days in month	Ds	days	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan month	various	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day	6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Crop Factor	Cf		0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Monthly Reference Evapotranspiration	ETo month		181.82	147.56	129.12	96.90	71.15	63.75	68.51	94.86	119.85	140.25	166.01	189.72
Daily Reference Evapotranspiration	ETo day		5.87	5.27	4.17	3.23	2.30	2.13	2.21	3.06	4.00	4.68	5.36	6.12
Species factor	Ks		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Density factor	Kd		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Microclimate factor	Kmc		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Landscape coefficient	Kl		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Allowable stress factor	Kas	%	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Landscape Water Requirement	ETl month	mm/month	181.82	147.56	129.12	96.90	71.15	63.75	68.51	94.86	119.85	140.25	166.01	189.72
Daily Landscape Water Requirement	ETl day	mm/day	5.87	5.27	4.17	3.23	2.30	2.13	2.21	3.06	4.00	4.68	5.36	6.12
Soil Properties														
Root zone soil type	RZ		Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam	Loam
Soil infiltration rate	SIR	mm/hr	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90
Available water storage capacity	AWSC	mm/m	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00
Active root depth	RD	mm	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Root zone available water storage	RAW	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Management Allowable Depletion	MAD		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Maximum soil water deficit	MSWD	mm	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Sprinkler Data														
Sprinkler type			855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5	855-56-5
Operating pressure		kPa	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
Sprinkler output	O	l/min	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Sprinkler nozzle			53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00	53.00
Sprinkler head spacing	SS	m	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Sprinkler row spacing	SR	m	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Application rate	AR or PR	mm/hr	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50
Distribution uniformity	DU	Audit	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Irrigation water requirement (Nil Rain)	IR	mm / month	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Monthly Rainfall (BOM Cessnock)	MR	mm /month	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Effective Rainfall Adjustment	ERA	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Effective Rainfall	ER	mm / month	14.50	21.48	14.28	9.80	8.56	11.98	6.10	6.82	9.34	10.66	14.54	15.16
Irrigation water requirement with average rainfall allowance	IwR	mm/month	199.40	152.12	137.62	104.20	75.14	63.02	74.50	104.78	131.66	154.34	180.76	208.04
Calculated runtime per period	OT	min/month	958.00	731.00	661.00	501.00	361.00	303.00	358.00	503.00	632.00	741.00	868.00	999.00
Irrigation Days	ID	days / month	21.00	17.00	15.00	12.00	9.00	8.00	8.00	11.00	14.00	17.00	19.00	22.00
Water Restrictions	WR	days / week	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Runtime per Cycle	Td	min/ day	46.00	43.00	45.00	42.00	41.00	38.00	45.00	46.00	46.00	44.00	46.00	46.00
Maximum allowable runtime per cycle	RC	minutes	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
Cycles per Day to prevent runoff & puddles	C	Cycles/day	2.00	1.00	2.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00
Cycle operating time		minutes	23.00	43.00	23.00	42.00	41.00	38.00	23.00	23.00	23.00	22.00	23.00	23.00
Calculations														
Number of sprinklers			150.00	300.00	450.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	600.00
Calculated total volume of water per operating day		m^3	207.00	387.00	607.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	828.00
Water usage per month		m^3	897.30	1369.08	1857.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3744.72

Season	m3	meg
Summer	6011.10	6.01
Autumn	1857.87	1.86
Winter	0.00	0.00
Spring	0.00	0.00
TOTAL	7868.97	7.87

Establishment and grow in phase

10 Appendix - B Harvesting Rights and Water Storage

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Dams and Harvesting Rights

Dams

Investigation	Abbreviation	Units	Months												
Requirements			**Yearly**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Plant material				Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch	Couch
Days in month	Ds	days	365.00	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	30.00	31.00	31.00
Monthly pan evaporation (BOM -Williamtown Airfield)	Epan	various	1728.80	213.90	173.60	151.90	114.00	83.70	75.00	80.60	111.60	141.00	165.00	195.30	223.20
Daily pan evaporation	Epan day	day		6.90	6.20	4.90	3.80	2.70	2.50	2.60	3.60	4.70	5.50	6.30	7.20
Dam Surface area	Dsa	m²	83200.00	83200.00	83200.00	83200.00	83200.00	83200.00	83200.00	83200.00	83200.00	83200.00	83200.00	83200.00	83200.00
Loss to evaporation		meg l	143.84	17.80	14.44	12.64	9.48	6.96	6.24	6.71	9.29	11.73	13.73	16.25	18.57
Monthly Rainfall (BOM Cessnock)	MR	mm	716.10	72.50	107.40	71.40	49.00	42.80	59.90	30.50	34.10	46.70	53.30	72.70	75.80
Loss to evaporation after rainfall		meg	84.26	11.76	5.51	6.70	5.41	3.40	1.26	4.17	6.45	7.85	9.29	10.20	12.26
Approximalte allowable harvesting rights (Dept Primary Industry)		Ml/ Ha	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Total Site area		Ha	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00
Area of site not contributing to catchment (housing etc)		Ha	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Site Catchment		Ha	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00
Harvesting right		Meg	15.20	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
Catchment capacity															
Rainfall adjustment		%	30.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00	37.00	38.00	39.00	40.00	41.00
Effective rainfall			214.83	21.75	33.29	22.85	16.17	14.55	20.97	10.98	12.62	17.75	20.79	29.08	31.08
Possible rainfall capture			408.18	41.33	63.26	43.41	30.72	27.65	39.83	20.86	23.97	33.72	39.50	55.25	59.05

Season	Loss to Evaporation after rainfall	
Summer	29.54	
Autumn	15.51	
Winter	11.87	
Spring	27.34	
TOTAL	84.26	

APPENDIX O

WASTEWATER OPTIONS REPORT

WHITEHEAD & ASSOCIATES 2016

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Wastewater Options Report for Proposed Golf Residential Tourist Resort, Wine Country Drive, Pokolbin, NSW

Prepared for: Hunter Valley Development Brokerage

Prepared by: Whitehead & Associates Environmental Consultants Pty Ltd
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Document Control Sheet

Document and Project Details	
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Author:	Benjamin Crawley
Project Manager:	Mark Saunders
Date of Issue:	31/08/2016
Job Reference:	Final_Report_1623_004.docx
Synopsis:	A residential and tourist facility is proposed for Rothbury, just north of Cessnock in NSW. This Report reviews and range of wastewater treatment and potential recycled water supply options for the development.
Client Details	
Client:	Hunter Development Brokerage
Primary Contact:	Mathew Egan

Document Distribution

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004	31/08/16	FINAL	1e		

Document Verification

Checked by: Mark Saunders	***Issued by:*** Benjamin Crawley

Disclaimer

The information contained in this report is based on independent research undertaken by Benjamin Crawley of Whitehead & Associates Environmental Consultants Pty Ltd (W&A). To my knowledge, it does not contain any false, misleading or incomplete information. Recommendations are based on an appraisal of the site conditions subject to the limited scope and resources available for this project, and follow relevant industry standards. The work performed by W&A included a desktop review only, and the conclusions made in this report are based on the information gained and the assumptions as outlined. Under no circumstances, can it be considered that these results represent the actual state of the site at all points as subsurface conditions are inherently variable. Concentrations of contaminants may also change with time, and the conclusions in this report have a limited lifespan.

Copyright Note

Executive Summary

Whitehead and Associates was engaged by Hunter Development Brokerage (HDB) Town Planning and Design to undertake a wastewater options concept report for the proposed development at 1184 Wine Country Drive, Pokolbin, NSW. The property has a total area of 240 hectares (ha) and compromises rural Lots 2-4 DP 1187663 and Lot 11 DP 869651. The Site is currently zoned under SP3 under the Cessnock 2011 LEP for tourism purposes.

The proposed development will consist of private residential dwellings, hotels, short stay villas, golf course with a clubhouse, restaurants, a bar and a community hub. The Site is currently un-sewered and will possibly require an alternative wastewater servicing solution as opposed to a conventional gravity sewer arrangement. Furthermore, a previous report by Water Wise Consulting in 2013 outlined that the development will require 200ML year of non-potable water to irrigate the golf course. The development will also require a non-potable supply for internal reuse and irrigation of private lawns to reduce demand on potable water supplies.

Three (3) possible servicing solutions were investigated to provide the most cost effective way of managing wastewater produced by the development and supplying non-potable water. The three solutions investigated had different methods of collecting and treating the wastewater produced at the Site and also differed in their method of supplying non-potable water.

To determine the most suitable servicing solution for the development, the three options were compared on considerations of costs, impact on the environment, suitability to staged development and deliverability.

The results of our analysis show that the most suitable option was Option 2 involving a STEP/STEG based common effluent scheme (CES) to collect the wastewater and a community decentralised scheme that utilises textile filters and an MBR to treat the wastewater to a suitable standard for internal reuse and irrigation.

It is proposed that recycled water demand will be met by building a return line from the Cessnock WWTW, before further treatment in the MBR. Rainwater will also be used to help meet the recycled water demand by capturing roof run-off and surface run-off.

Table of Contents

1 Introduction

Whitehead and Associates ("W&A") was engaged by Hunter Development Brokerage (HDB) Town Planning and Design ("the Client") to prepare a conceptual wastewater options report for the proposed development at 1184 Wine Country Drive, Pokolbin, NSW ("the Site"). The development will consist of the following features:

- An 18 hole golf course;
- 300 permanent residences;
- A 5-star hotel comprising 50 rooms;
- 250 short-stay villas;
- A clubhouse bistro seating up to 100 guests and 8 staff;
- A hotel with a fine dining restaurant that can host up to 100 guests and 14 staff;
- A café that can host up to 50 guests and 5 staff members; and
- A community hub that will consist of a day spa and swimming pool.

The report will focus on presenting a range of options for providing wastewater services and providing the Site with a secure non-potable water supply for irrigation and internal reuse. The options analysis will aim to determine the most cost effective and environmentally sustainable solution for the Site, whilst taking into consideration a range of driving (and sometimes competing) factors, including:

- acceptability to the Client, regulatory authorities (DPI, OEH and Planning NSW) and Council;
- protecting the environment, including native flora and fauna, surface water and ground water resources;
- providing beneficial reuse of treated wastewater;
- practicality of construction and maintenance;
- optimising development potential of the land; and
- economic viability.

2 Site Description

The Site is located at 1184 Wine Country Drive and comprises rural Lots 2-4 DP 1187663 and Lot 11 DP 869651. The Site is currently zoned SP3 under the Cessnock 2011 LEP for tourist purposes. Multiple intermittent waterways and farm dams are located across the Site with Black Creek running along the eastern and northern boundary. The Site is surrounded by rural properties to the north, east and south. To the west of the Site the 'Vintage' Golf Course and private dwellings exist. The Site has been extensively cleared of trees and now consists of mostly open grassed land. The location of the Site and the most recent proposed development design provided to W&A is presented in Figure 1.

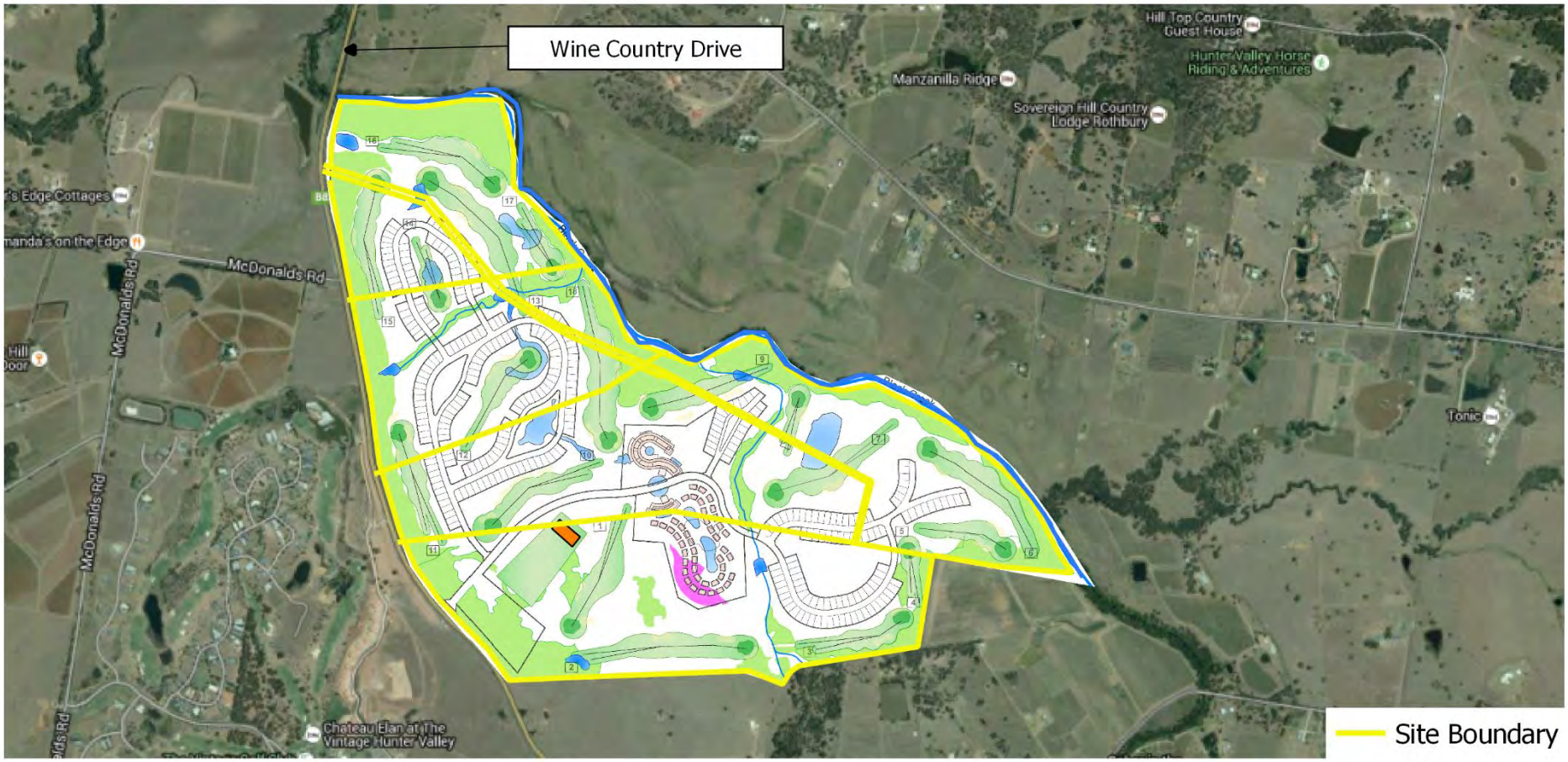

Figure 1: Site Location and Proposed Development (HDB, 1st June 2016)

Wastewater Options Report for Golf Residential Tourist Resort, Wine Country Drive, Pokolbin.

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Whitehead & Associates
Environmental Consultants

0 500 1000 1500 2000 m

(Approx Scale)

Revision	A
Drawn	BC
Approved	MS

3 Statutory Framework

3.1 Environmental Planning Assessment Act (1979)

The Environmental Planning and Assessment (EP&A) Act 1979 defines and regulates planning and development within NSW, sets out the development approval process and approvals required. Proponents of a recycled water scheme will be required to apply for development approval if the local council specifies in their local environmental plan (LEP) that the activity requires consent.

3.2 Protection of the Environment Operations Act 1997

The Protection of the Environment Operations Act 1997 (POEO Act) states that it is an offence to pollute waters, or permit waters to be polluted except where that pollution occurs in compliance with an environment protection licence (EPL). Other offences relating to land, air (including odour) and noise pollution are also covered in the POEO Act.

In addition, the POEO Act requires environment protection licences for certain activities listed in Schedule 1 of the Act ('scheduled activities'). The NSW Environment Protection Authority (EPA) issues these licences. Sewage treatment systems are a scheduled activity, defined under the Act as:

Sewage treatment systems (including the treatment works, pumping stations, sewage overflow structures and the reticulation system) that have an intended processing capacity of more than 2,500 persons equivalent capacity or 750 kilolitres per day and that involve the discharge or likely discharge of wastes or by-products to land or waters.

EPA will not generally license non-scheduled recycled water (treatment and reuse) systems, as they can typically be designed and operated to avoid pollution e.g. by using all the recycled water or by discharging surplus recycled water or untreated wastewater to the sewer.

3.3 IPART

The Independent Pricing and Regulatory Tribunal (IPART, NSW) regulate the licensing of private water schemes under the Water Industry Competition Act (WICA) 2006. Under WICA, private providers must obtain a licence to construct, maintain or operate any water industry infrastructure (network operators' licence), or to supply potable or non-potable water, or provide sewerage services by means of any water industry infrastructure (retail suppliers licence).

WICA is also supported by the Water Industry Competition (General) Regulation (WICR) 2008, which sets out the matters a licence application must address, standard licence conditions, information to be contained on the register of licences and the retailer of last resort provisions. The Regulation also provides for the establishment of a marketing code of conduct, a transfer code of conduct and a water industry code of conduct. Under WICR, network operator licensees for sewerage schemes are required to produce a Sewage Management Plan (SMP) and subsequent audit reports on the SMP before commercial operation of the scheme. The sustainability assessment is an audit of relevant components of the SMP, with the aim of helping to determine whether the proposed infrastructure will provide sewerage services which are sustainable and do not present a risk to the environment.

The licensed network operator must submit to IPART an Infrastructure Operating Plan and a Water Quality Plan which is consistent with the AGWR (2006) and addressing the Framework for Management of Recycled Water Quality and Use.

The Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1) (AGWR, 2006), were developed to provide guidance on the supply, use and regulation of recycled water schemes. The guidelines use a risk management framework comprising of twelve (12) elements with multiple barriers to control hazards. The framework is summarised by four (4) main categories: commitment to responsible use and management of recycled water; system analysis and management; supporting requirements; and review.

The principles of sustainable use of recycled water are based on three main principles:

- protection of public and environmental health is of paramount importance and should never be compromised;
- protection of public and environmental health depends on implementing a preventative risk management approach; and
- application of preventative measures and requirements for water quality should be commensurate with the source of recycled water and the intended uses.

In regards to public health, relatively few restrictions need to be placed on non-drinking water uses of tertiary treated and disinfected recycled water. End use controls and on-site constraints can also be used to minimise both human exposure to hazards and the impact on receiving environments; such as signage, use of buffer zones, and control of plumbing and distribution systems.

3.4 Local Governments Act 1993

For an on-Site wastewater management system to be installed (<2,500EP), an application must be submitted to Council for approval under Section 68 (Part C) of the Local Government Act 1993 (LG Act). The application must also be accompanied with:

- The prescribed application and inspection fees;
- A site plan detailing the location of the proposed on-site wastewater management (OWM) system in relation to all buildings, water storage tanks and property boundaries;
- Manufacturer's details of the proposed OWM system (OWM systems must maintain current accreditation from the NSW Department of Health otherwise Council may not approve of the installation); and
- A Site and Soil Evaluation Report conducted by an appropriately qualified and experienced wastewater consultant using methods as outlined in the New South Wales Department of Local Government 1998; Environment and Health Protection Guidelines: On-Site Sewage Management for Single Households and AS/NZS 1547:2012 On-Site Domestic Wastewater Management.

Community Systems

Under Section 68 (Part B) of LG Act 1993, approval is required from the local government authority for water supply, sewerage and stormwater drainage work as well as the installation and operation of a sewage management system, including private recycled water schemes that process sewage. Private individuals or companies that wish to produce and/or use recycled water in schemes larger than a single lot also require approval under Section 68.

An approval to install or operate is not required under Section 68 of the LG Act if a license under the Protection of Environment Operations Act 1997 is in force for the scheme (Clause 48 of the Local Government (General) Regulation). The local council is the approving authority of a

Section 68 approval with the NSW DPI (Office of Water) (NOW) and NSW Health acting as an advisor to the local council.

Section(s) 56-66 of the Local Government Act 1993 set out provisions in relation to flood retarding basins, water supply, sewerage works and facilities. Under these provisions, a non-metropolitan council must obtain Ministerial approval prior to undertaking certain works. This approval has been delegated to the NSW DPI (Office of Water). Under section 60(c) of the LG Act, a council must obtain approval to provide for sewage from its area to be discharged, treated or supplied to any person. DPI (Office of Water) has adopted the framework outlined in the AGWR for assessing s60 applications for approval to treat and supply recycled water under the LG Act.

3.5 Local Government General

On-Site Systems

The Local Government (General) Regulation 2005 requires that the owner of an OWM system seek approval by an application form to operate the facility in addition to any other approval required for the installation of an on-site sewage management facility.

Community Systems

The Local Government (General) Regulation 2005 provides detail on the approval to operate as well as the broad performance standards and other criteria for the operation of a recycled water scheme (Clauses 42 to 47). Clause 45 of the Regulation outlines the conditions of approval in relation to the operation of a recycled water scheme including the prohibition of the discharge of recycled water to any watercourse or onto land other than its related effluent application area.

3.6 Public Health Act 1991

Under the Public Health Act 1991, the Minister for Health has powers to issue orders and direct public authorities to take action to prevent public health risks. NSW Health has responsibilities under the Public Health Act 1991 for monitoring and managing public health risks and improving public health through regulation, health promotion and other public health measures.

NSW Health plays a key role in setting water quality compliance values for recycled water systems and must be informed of any incident that poses a risk to public health.

4 Site and Soil Assessment

Site assessment was limited to a desktop review only. Table 1 presents the findings of the site assessment and the constraint each parameter poses to on-site wastewater management (OSSM).

Table 1 Site Assessment

Parameter	Constraint
Climate: Mean monthly rainfall and evaporation data was sourced from the BoM Cessnock (Nulkaba) Station 061242. Rainfall data was available from 1966 - 2012 whilst evaporation was available from 1973 - 2012. The BoM station is approximately 10km to the south of the Site and is considered representative. Mean annual rainfall for Nulkaba is 767mm; ranging from an average of 32.6mm in July to 105mm in February. Mean annual pan evaporation is	**Minor**

Parameter	Constraint
1,317.5mm for the Site, ranging from an average of 45mm in June to 177mm in December and January. On average, there is a net evaporation deficit (soil moisture surplus) in only one month of the year (June), which is considered to be typical for temperate regions. Climate is expected to pose a minor constraint to OSSM.	
Aspect and Exposure: The Site has a gentle north east facing aspect. Wind and solar exposure is high as the Site is extensively cleared. Aspect and exposure is expected to pose a minor constraint to OSSM.	**Minor**
Vegetation: The majority of the Site has been largely cleared of native bushland and is now open pasture. There are isolated mature native trees and sparse stands of mature native trees scattered throughout the property, particularly around the riparian regions.	**Minor**
Landform and Slope: The Site contains undulating low hills, with gentle slopes typically less than ~5% in a north east direction. Elevations lie between 60m-40m AHD. Slope poses a minor constraint to OSSM.	**Minor**
Groundwater and Site Drainage: A search of the Department of Primary Industries - Water database was undertaken. There are two exploration bores identified within 500m of the Site. The two bores are located on the western side of Wine Country Drive, approximately 100m and 150m from the Site. The bores are 25 and 44m deep respectively. This is expected to pose a minor constraint to OSSM.	**Moderate**
Proximity to Surface Waters: The Site primarily drains via Black Creek and a number of unnamed intermittent drainage lines and dams in a north-easterly direction. Black Creek traverses south east to north west along the east and north boundary of the Site. With appropriate buffers applied, waterways are expected to pose a minor constraint to OSSM.	**Minor**
Flood Potential The extent of the 5% AEP flood level is presented in Figure 2. Effluent land application must not occur below this flood level. Flood potential is expected to pose a minor constraint to OSSM.	**Minor**

4.1 Soil Landscape

We reviewed the Soil Landscapes of the Singleton 1:250,000 Sheet (Kovac and Lawrie, 1991) which indicates that Site soils belong almost entirely to the Branxton (bx) soil landscape. A small parcel of land in the south west corner belongs to the Rothbury (ro) landscape. The descriptions below are taken from Kovac and Lawrie (1991).

The ‘bx’ soil landscape is located on undulating low hills with numerous creek flats and slopes from 3-5%. Elevations range from 50-80m and local relief is 10-40m. The underlying geology includes sandstone, siltstone, mudstone, shale, tuff, coal, conglomerate and limestone.

Soils vary from red podzolic soils at hill crests, yellow podzolic and yellow soloths on slopes, to alluvial sands in and around drainage lines. General soil descriptions for each soil facet type are provided below:

Yellow podzolic soils (crests):

Topsoils: Brown sandy loam with weak structure, overlying bleached dull yellow-orange loamy sand (sharp horizon boundary), overlying;

Subsoils: bright brown light to medium clay, overlying bright reddish brown medium clay (gradual horizon boundary).

Red podzolic soils (upper slopes):

Topsoils: dark reddish-brown fine sandy loam, overlying brown sandy loam (gradual horizon boundary), overlying;

Subsoils: reddish-brown medium clay, overlying yellowish-brown light to medium clay (gradual horizon boundary).

Yellow Soloths (lower slopes):

Topsoils: brown loamy sand, overlying bleached-brown or yellow to orange loamy sand or fine sandy loam (gradual to sharp horizon boundary), overlying;

Subsoils: bright brown light to medium clay with strong structure.

Alluvial Soils (creek lines and flats):

Topsoils: brown loamy sand, overlying dull yellow to yellowish-brown loamy sand to sandy loam, overlying;

Subsoils: massive brown loamy sand.

5 Wastewater Generation and Quality

5.1 Wastewater Volume

A wastewater generation rate of 220L/person/day for the hotel and short-stay villas and 150L/person/day for the permanent dwellings correspond to those recommended in Table H1 and H4 of AS/NZS 2012: 1547. For restaurants and the community hub, a generation rate of 30L/person/day was adopted. The hotel and short-stay villas will vary in capacity and therefore generated wastewater loads.

For the permanent residential dwellings, an occupancy rate of seven (7) person equivalents (EP) for a house with four (4) bedrooms is recommended by the Cessnock City Council's Site and Soil Assessment Report for domestic systems and Table J1 of AS/NZS 1547:2012. This EP was adopted for design purposes which results in a daily wastewater load of 1,050 L/dwelling/day.

Table 2 Estimated Wastewater Generation

Accommodation Type	Number	Occupancy Rate	Wastewater Generation (L/day)
5-Star Hotel	50	90% of rooms expected to hold 3 guests with the remaining 10% holding up to 4 guests.	34,100
Luxury Short-Stay Villas	250	70% of rooms will have 1 bedroom, with the remaining 30% having 2 bedrooms. Occupancy rates of 2 and 3 persons were adopted.	126,500
Permanent Residential Dwellings	300	All permanent residential buildings will have a minimum of 4 bedrooms. An occupancy rate of 7 persons per house was adopted	315,000
Restaurants	3	The total occupancy of all 3 restaurants is 250 guests and 27 staff members.	8,310
Community Hub	1	No data was provided to W&A on the number of people the Community Hub will host. W&A estimates approximately 200 people per day and up to 8 staff will be at the Hub each day.	6,240
		Total Site Wastewater Generation (L/day)	490,150
		Total Wastewater Generation (ML/Year)	178.9

5.2 Wastewater Quality

Wastewater generated at the Site is expected to be of a stronger nature than that of a typical household due to the expected higher strengths of organics (BOD_5), total suspended solids (TSS) and fats, oils and grease (FOG) from the restaurants. The untreated wastewater characteristics is expected to have characteristics similar to that described in Table 3; which incorporates information taken from the DLG (1998) and previous investigations by W&A.

Table 3 Typical Characteristics of Untreated Wastewater

Parameter	Loading	Greywater %	Blackwater %
Biochemical Oxygen Demand (BOD_5)	200-1,500mg/L	35	65
Total Suspended Solids (TSS)	200-800mg/L	40	60
Total Nitrogen (TN)	20-300mg/L	20-40	60-80

Total Phosphorus (TP)	10-25mg/L	50-70	35-50
Faecal Coliforms (FC)	10^3-10^{10} cfu/100 mL	Medium-high	high
Fats, Oils and Grease (FOG)	150-300mg/L	High	Low

(Source: DLG 1998 p.80)

It will be critical to have grease traps that are properly designed, sized, installed and maintained at the outlets of all commercial kitchens. Provided grease traps are properly maintained and frequently pumped out (recommended monthly) it would be expected that the influent constituent concentrations may be at the lower end of the ranges given above, or possibly lower.

The procedures in the DWE (2009), which provides guidelines for sizing grease traps should be followed to appropriately size a greases trap. The DWE (2009) provides guidelines for sizing according to the type of restaurant and expected wastewater loads.

5.3 Water and Nutrient Balance

Water and nutrient balance modelling was undertaken to determine a sustainable application rate and hydraulic load of the Site for the proposed development. The procedures for this generally follow the DLG (1998) guidelines. Appendix A contains the modelling outputs.

The water balance used is a (lumped) monthly model adapted from the "Nominated Area Method" described in DLG (1998). The water balance can be expressed by the following equation:

Precipitation + Effluent Applied = Evapotranspiration + Percolation + Storage

For the water balance, the maximum hydraulic load the Site can safely accommodate is based on the climate data for the location, the soil type and the maximum irrigation area. The maximum hydraulic load was calculated to achieve no net excess of water and hence zero storage for all months. The water balance conservatively assumes a retained rainfall coefficient of 0.9; that is, an estimated 90% of rainfall will percolate into the soil within the EMA and 10% will run off. The rainfall hydraulic load is incorporated into the water balance to ensure that effluent surcharge or runoff from the EMA will not occur under typical (design) climate conditions. No site and soil investigation was carried out by W&A, therefore percolation rates are estimated from published data and previous studies undertaken by W&A in the area. The maximum irrigation area was determined from a Geographical Information Systems (GIS) analysis of the Site. The GIS analysis involves determining the possible irrigation area by subtracting the unusable areas (buffers, development areas and non-viable areas) from the total area of the Site. Figure 2 presents a layout of the Site with buffers applied. The maximum hydraulic load was then also determined based on a nutrient balance for nitrogen and phosphorus. Nitrogen and Phosphorus concentrations in the effluent were based on published data. The uptake rates of the two nutrients by the soil were based on published data and previous studies by W&A in the area. Table 4 contains the inputs for the water balance.

Table 4 Water and Nutrient Balance

Parameter	Units	Value	Comments
Total Possible Irrigation Area	m^2	936,235m^2	Area available for irrigation based on the Site plan provided to W&A on the 1st of June 2016, with buffers applied and the 5% AEP flood extent excluded. The client made it known to W&A that no plans are final yet and may be subject to change.
Precipitation	mm/month	Mean Monthly	Nulkaba BoM Station
Pan Evaporation	mm/month	Mean Monthly	Nulkaba BoM Station
Runoff Coefficient	unit less	0.9	Proportion of rainfall that remains on-site and infiltrates the soil, allowing for runoff
Crop Factors	unit less	0.5-0.8	Conservative monthly, adjusted for season
Design Irrigation Rate (DIR)	mm/day	2	Based on medium clay sub soil from Kovac and Lawrie (1991).
Effluent Total Nitrogen Concentration	mg/L	20	(Conservative) expected value based on typical domestic secondary treatment system
Effluent Total Phosphorus Concentration	mg/L	15	(Conservative) input value increased from expected concentration after treatment in a domestic secondary treatment system.
Nitrogen Conversion Rate (Soil Processes)	Annul Percentage	20	Conservative estimate of soil in conversion processes
Nitrogen Plant Uptake	Kg/ha/yr	130	Roughly 25% of that expected of effluent irrigated pasture (NSW DECCW, 2004) to account for potential use of N-sensitive native plants in EMA
Phosphorus Plant Uptake	Kg/Ha/yr	25	Roughly half that expected of effluent irrigated pasture (NSW DECCW, 2004)
Soil Depth	m	0.6	
Parameter	**Units**	**Value**	**Comments**
Limiting	L/day	864,000	Maximum Hydraulic load from water balance based on available irrigation area
	L/day	979,000	Maximum Hydraulic load from phosphorus balance based on available irrigation area
	L/day	2,080,000	Maximum Hydraulic load from nitrogen balance based on available irrigation area

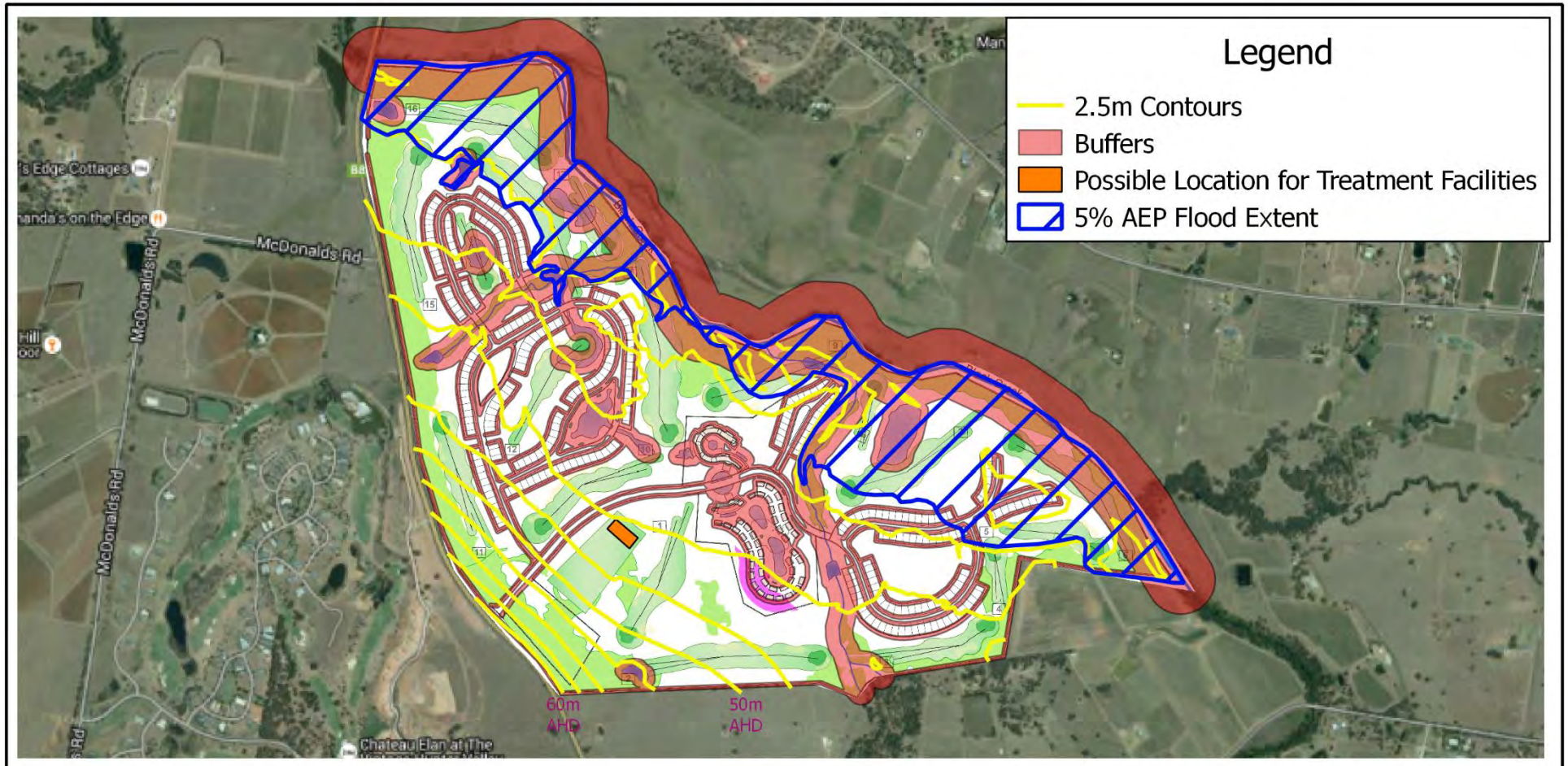

Figure 2: Site Location with Applied Buffers

Wastewater Options Concept for Proposed Golden Bear Residential / Tourist Golf Course Resort, Pokolbin, NSW

Whitehead & Associates
Environmental Consultants

Revision	A
Drawn	BC
Approved	MS

6 Complete (Individual) On-Site Solutions

Complete on-site wastewater management involves treating generated wastewater from each lot within each of the individual lot boundaries. Individual treatment and land applications systems would be paid for by property owners and installed at the time the lots are built upon. Responsibility for obtaining approvals and ongoing operation of these systems would reside with individual property owners.

Council regulate the operation of individual OWM systems through the Section 68 approval process, with an 'Approval to install' issued during development consent and an annual 'Approval to operate' issued for the life of the system.

Servicing the hotel, short stay villas, restaurants and community hub with individual systems would not be a cost effective solution. Wastewater management for these facilities would involve the use of a decentralised system as outlined in Section 7, however on a smaller scale as the private residences would not be connected.

6.1 Wastewater Contribution

On-site (domestic) wastewater solutions may comprise all-waste and split-waste designs.

All-Waste systems collect, treat and reuse (land apply) all wastewater generated from household fixtures including blackwater (toilet, kitchen and composting leachate) and greywater (bath/shower, basin and laundry). Appropriately treated wastewater from all-waste systems may only be used for landscaping purposes.

Split-Waste systems collect and treat household blackwater and greywater streams separately before reuse via various mechanisms. Treated blackwater may only be used for landscaping purposes. Appropriately treated (and disinfected) greywater may be used as a recycled water resource within the dwelling for cold-water washing machine supply and toilet flushing, as well as external landscaping uses.

6.2 On-site Treatment Options

6.2.1 All Waste Treatment Systems

All-waste treatment options suitable for (large lot) rural residential subdivision can include primary or secondary treatment systems.

Primary treatment systems traditionally comprise an appropriately sized septic tank for collection and minimum 24-hour retention of wastewater generated from the dwelling (minimum 3,000L). In NSW, septic tanks (and collection wells) must be accredited by NSW Health and in conformance with the Australian Standard (AS1546.1:2008). Modern septic tanks may be of concrete or polymer construction and will include a central baffle and inlet/outlet controls (t-pieces) to prevent solids carryover. Properly functioning septic tanks produce consistent 'primary' effluent quality with the following characteristics (from DLG, 1998):

- BOD – 150 mg/L
- TSS – 50 mg/L
- TN – 50-60 mg/L
- TP – 10-15 mg/L
- FC – 10^5-10^7 cfu/100mL

Primary treatment systems may also include incinerating toilet and pump-out systems. However, for the purposes of this review, we have assumed that these types of systems would not be either appropriate or warranted. Thus, they are not considered further in this document.

Secondary treatment technologies include (but are not limited to) Aerated Wastewater Treatment Systems (AWTS); Sand Filter Systems, Media Filter Systems, Wetland Systems and Mound Systems. Disinfection units are typically installed as a standard component of proprietary secondary treatment systems, or can be installed as an add-on by the system supplier. Disinfection units typically use one or a combination of the following disinfection methods: Ultra Violet (UV) irradiation; Chlorination and Ozone.

Properly functioning secondary treatment systems should be capable of consistently producing effluent quality with the following characteristics (from NSW Health):

- BOD – 20 mg/L
- TSS – 30 mg/L
- TN – <30 mg/L
- TP – <10 mg/L
- FC – <100 cfu/100mL

6.2.1.1 Description of Technology and Costs

Septic Tanks

A septic tank is generally described as a single or multiple chambered tank through which wastewater is allowed to flow slowly to permit suspended matter to settle and be retained, so that organic matter contained therein can be decomposed (digested) by bacterial action in the liquid. Both anaerobic and facultative treatment processes occur within a septic tank and serve to reduce the contaminant load and produce a stable end-product (sludge). Septic tanks require periodic de-sludging (pump out) at intervals between 3-5 years. To improve performance, septic tank may be fitted with an outlet filter to improve solids retention performance and reduce the risk of carryover to land application areas.

Septic tank effluent is NOT disinfected; therefore, strict controls must be placed on end uses. NSW Health requires un-disinfected wastewater to be applied to land at depths >0.3m below ground surface to prevent contact.

Current pricing for supply and installation of a 3,500L septic tank in Sydney areas is **~$3,200-$5,000** (depending on material and supplier). Ongoing costs would include (5 yearly) pump out costs of approximately **$200-$300** (contractor). Additional maintenance costs may be necessary in event of damage or blockage.

Aerated Wastewater Treatment System (AWTS)

An aerated wastewater treatment system uses both primary and secondary treatment processes to treat wastewater. Wastewater enters the anaerobic chamber (septic tank) where solids settle. The wastewater then enters the aerobic chamber where organic matter is oxidised and consumed by biological processes. The wastewater stream is then passed into a clarifier where it undergoes secondary settling. Finally the wastewater undergoes disinfection via processes such as chlorine dosing or UV exposure (Figure 7).

There are currently 17 AWTS (some with multiple models) accredited by NSW Health for installation within NSW. Each system may use multiple (and differing) treatment processes; however, the final effluent quality would be expected to be equivalent to (or better than) that described in Section 6.2.1 above. Good maintenance of AWTS is essential to ensure a

consistently high level of performance. By regulation, AWTS systems are required to be serviced by an appropriately qualified service technician at 3-monthly intervals in NSW.

Current pricing for supply and installation of a domestic (<2,000L/day) AWTS in Sydney areas is **~$6,000-$10,000** (depending on supplier). The wider range in capital pricing will also reflect system performance reliability and effluent quality. Ongoing costs would include (quarterly) servicing costs of approximately **$300-$400** per annum and periodic (5 yearly) pump out costs of approximately **$200-$300** (contractor). Additional maintenance costs may be necessary in event of damage or blockage.

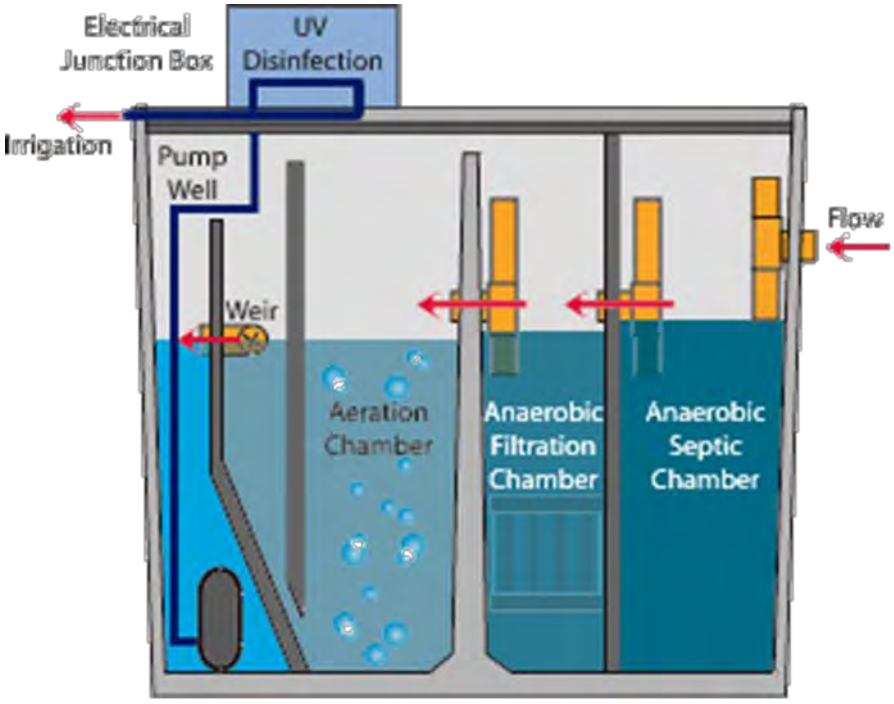

Figure 3 AWTS Operational Layout

Sand Filters

Sand filters provide advanced secondary treatment to water that has already undergone primary treatment in a septic tank or similar device. They typically contain approximately 600mm depth of filter media (usually medium to coarse sand, but other media can be incorporated) within a lined excavation containing an underdrain system (Figure 3).

Selection of the filter media is critical and a carefully designed distribution network is necessary to ensure even distribution across the media surface. A dosing well and pump (or flout/siphon) is normally used to allow periodic dosing. Depending on the desired level of treatment, sand filters can be single-pass (SF) or may incorporate a recirculation function (RSF).

Sand filters are proven to be an effective and reliable secondary treatment device, consistently capable of achieving BOD < 10 mg/L and SS < 10 mg/L. Although they are able to remove the majority of pathogenic organisms, subsequent disinfection is required to enable effluent irrigation. Currently there are two (2) aerobic sand filter systems accredited by NSW Health, with detailed sizing and design of these systems is generally undertaken by the chosen supplier/installer.

Indicative pricing for design and installation of a site-specific sand filter system (<2,000L/day) in Sydney areas is **~$10,000** (depending on supplier). Ongoing costs would include (6-monthly) servicing costs of approximately **$400** per annum and periodic (5 yearly) primary tank pump out

costs of approximately **$200-$300** (contractor). Additional maintenance costs may be necessary in event of damage or blockage.

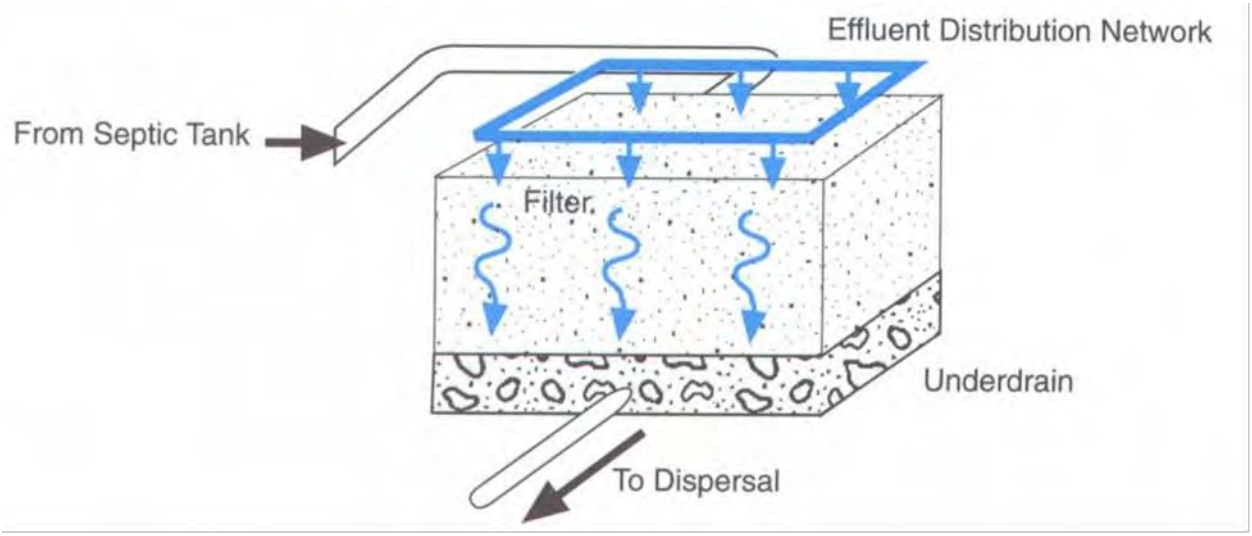

Figure 3 Sand Filter Operational Layout

Media Filter Systems

Media filters operate under the same principles as sand filters but utilise a proprietary textile media in replacement of the sand. This allows higher loading rates and therefore a smaller footprint with a unit approximately 1.2 m x 1 m x 0.8 m required for a typical dwelling. These systems are typically more capable of overcoming a lot of the constraints of AWTS listed above, and have significantly lower operating costs and arguably better performance (Figure 4).

Media (textile) filters generally consist of a watertight fibreglass basin filled with suspended vertical sheets of an engineered textile material. Recirculated wastewater is distributed evenly over the end surface of the hanging sheets by a pressure distribution manifold. The textile material has a complex fibre structure that provides a high water holding capacity, porosity and surface area for biomass attachment. The surface area of the textile media is approximately 4 to 8 times greater than a recirculating sand or gravel filter. The high water holding capacity of the media provides high retention times when coupled with timed, pressure dosing and enables consistently high treatment.

Treatment is facilitated by the aerobic conditions present in the filter unit, which reduce the levels of both BOD (aerobic digestion by micro-organisms) and by the filtering action of the textile material to reduce total suspended solids (TSS). Recirculation of up to 80% of the effluent back over the textile further improves effluent quality, particularly in terms of nitrogen reduction. Long-term monitoring of many domestic and community-scale textile filter systems (in New Zealand, USA and to a lesser extent Australia) indicate that effluent quality can consistently achieve BOD <5 mg/L, TSS <10 mg/L, TN <15 mg/L and TP <10 mg/L. Currently

there is one (1) media filter system accredited by NSW Health, with detailed sizing and design of these systems is generally undertaken by the chosen supplier/installer.

Indicative pricing for design and installation of a (domestic AX-20) media filter system (<2,000L/day) in Sydney areas is **~$18,000** (including irrigation). Ongoing costs would include (6-monthly) servicing costs of approximately **$500** per annum and periodic (5 yearly) primary tank pump out costs of approximately **$200-$300** (contractor). Additional maintenance costs may be necessary in event of damage or blockage.

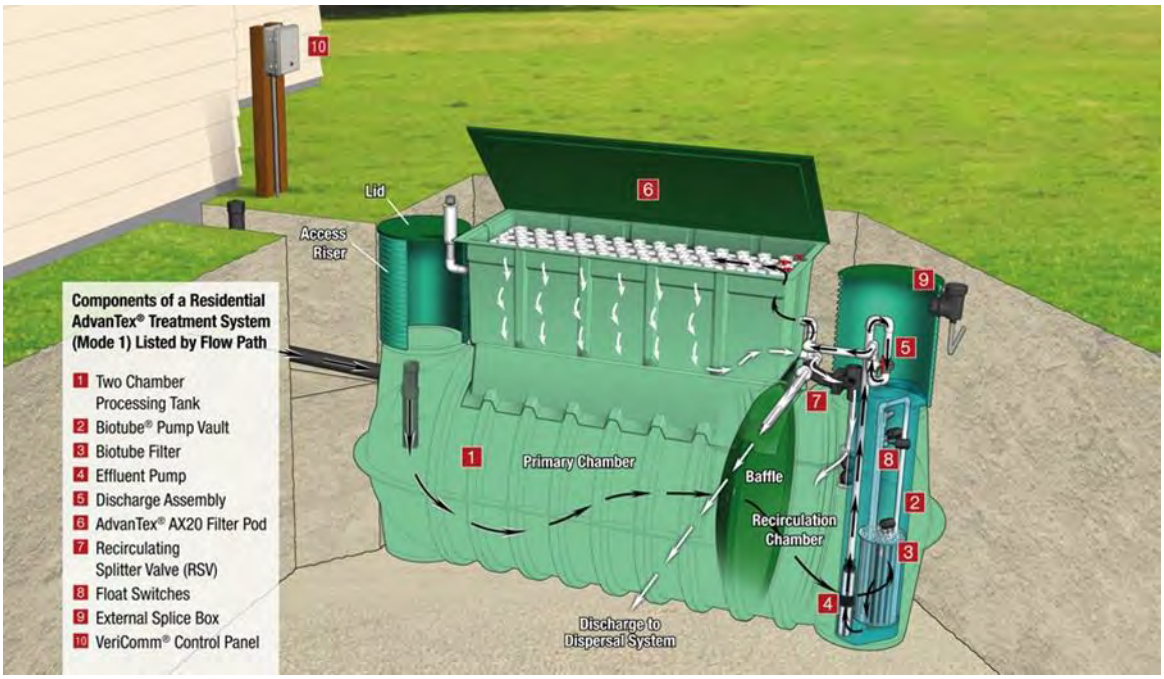

Figure 4: Media Filter System (Innoflow Wastewater Specialists)

Wetland Systems

Wetland (or Reed bed) treatment systems are designed to ensure that effluent flows beneath a gravel media surface, within the root zone of wetland plants, to ensure there is no standing water in the system. The system is lined with an impermeable membrane and constructed so that effluent flows horizontally through the media, via gravity (Figure 5). The wetland plants (macrophytes) and microbiological biofilms that develop on roots and gravel surfaces remove contaminants and pathogens from the effluent as it passes through. The treated effluent drains to a collection sump, from which it is pumped or discharged by gravity to the land application area system.

Reed beds are generally much more effective at nitrogen removal than phosphorus removal, with phosphorus removal expected to decline over time as the substrate becomes P-saturated. Although they are often touted as 'maintenance-free,' periodic replacement of the filter media assists in ongoing phosphorus removal. Reed beds are suitable for intermittent use and low-flow scenarios; however very high strength wastes (particularly BOD_5 and nutrients) can overwhelm the system and lead to poor treatment.

Wetland systems are a reliable secondary treatment device, consistently capable of achieving BOD < 10 mg/L and SS < 10 mg/L. Although they are able to remove the majority of pathogenic organisms, subsequent disinfection is required to enable effluent irrigation. Currently there is one (1) constructed wetland treatment system accredited by NSW Health, with detailed sizing and design of these systems is generally undertaken by the chosen supplier/installer.

Indicative pricing for design and installation of a site-specific sand filter system (<2,000L/day) in Sydney areas is **~$10,000-$14,000** (depending on site conditions). Ongoing costs would include (3-monthly) servicing costs of approximately **$500** per annum and periodic (5 yearly) primary tank pump out costs of approximately **$200-$300** (contractor). Additional maintenance costs may be necessary in event of damage or blockage.

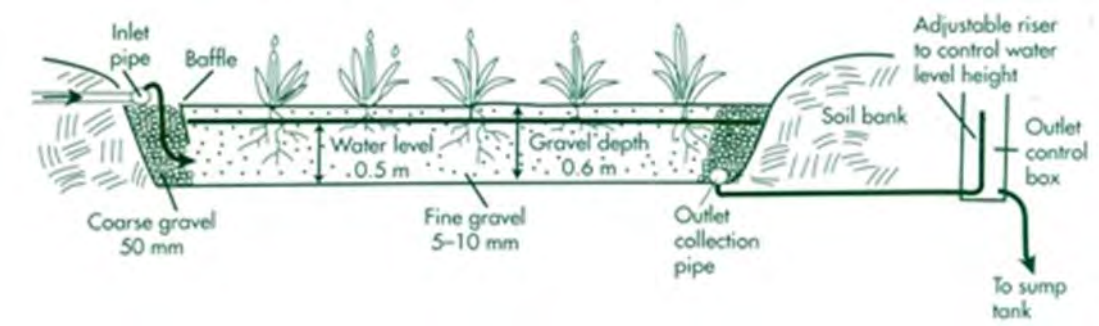

Figure 5 Reed Bed Processes (Queensland Government Wetland Info, 2015)

Mound Systems

Sand mounds, also known as Wisconsin mounds, are often an appropriate on-site solution for lots with limited space, shallow soil profiles, and poor drainage or high water tables. Mounds are effectively raised soil absorption systems comprising layered fill, into which effluent is dosed (Figure 6). Effluent receives further treatment as it percolates down through the mound and is then absorbed by the natural soils below the mound. A properly designed mound can have a higher evapotranspiration potential than an ETA bed of equivalent size, further enhancing effluent disposal on constrained lots.

The basal footprint of a domestic mound is typically in the order of 7m wide by at least 20m long, and there are considerable up-front cost in the materials and construction of mounds. Mounds are suitable for primary or secondary treated effluent, and provide further treatment of effluent as it moves through the sand profile.

Mound systems are consistently capable of producing secondary effluent quality (primary systems) and better for secondary systems (10/10/10). Because mounds are both a treatment and land application system, there can be considerable savings in both land area requirements and capital costs. NSW Health does not provide accreditation of Mound treatment systems, with each requiring individual design and installation by a skilled contractor. Currently there is one (1) known installer of proprietary mound systems in NSW.

Indicative pricing for design and installation of a site-specific mound system (<2,000L/day) in Sydney areas is **~$12,000-$15,000** (depending on site conditions). Ongoing costs would include (annual) servicing costs of approximately **$300** per annum. If either a primary (septic tank) or secondary (AWTS) system is used for pre-treatment, refer to previous detail in this report for cost information.

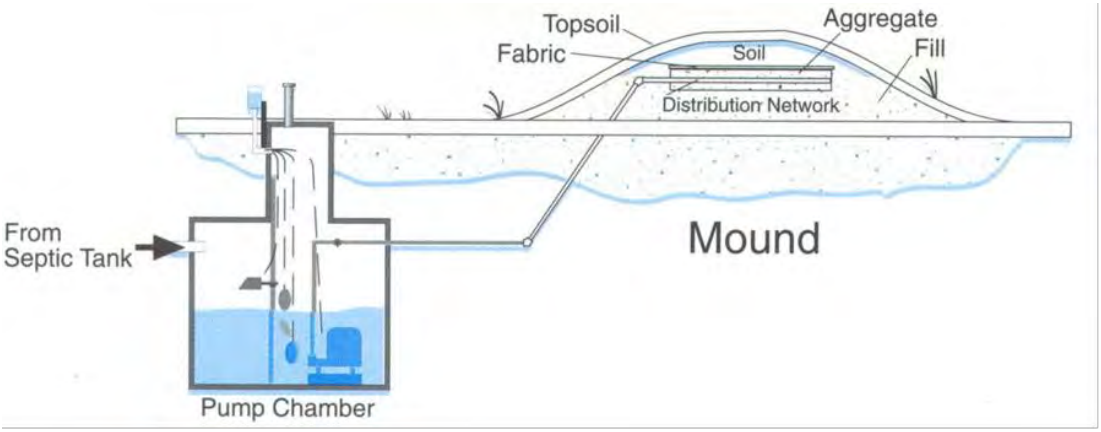

Figure 6 'Wisconsin' Mound System (NSFC)

6.2.2 Split Waste Systems

Split-waste treatment options suitable for (large lot) rural residential subdivision can include primary or secondary treatment systems. As described, blackwater is treated separately using various treatment measures and must be applied to land under controlled conditions to meet compliance objectives. Greywater may be captured and treated to a standard suitable for internal reuse within each individual dwelling.

6.2.2.1 Description of Technology and Costs

Septic Tanks

Blackwater (only) septic tanks may be used for primary treatment of household blackwater wastes. AS/NZS 1547:2012 recommends operational capacities of between 1,500L and 1,800L for 5EP and 8EP household respectively. In NSW, septic tanks (and collection wells) must be accredited by NSW Health and in conformance with the Australian Standard (AS1546.1:2008).

In blackwater only systems, de-sludging is also recommended at 5 year intervals, although typically this tends to be too often and 6-8 years is common.

Refer to previous detail in this report for installation, maintenance and cost information.

Composting Toilet Systems

NSW Health refers to dry (waterless) composting toilets; however, low-flush models are also available, although they are less common. Composting toilets are generally installed for water saving or lifestyle reasons (e.g. ‘eco homes’ or remote homes with limited water supply). They are rarely chosen as the preferred solution for new homes on large lots. They require a separate greywater treatment system to treat all greywater streams (including kitchen greywater).

Composting toilet systems receive and treat human excreta, domestic organic matter and bulking agents using natural, aerobic stabilisation processes to produce a product that is suitable for on-site disposal (burial). Large proportions of the solid (TSS), organic material (BOD) and nutrient (N&P) load are removed from the total waste stream with separate blackwater treatment. We expect to reduce the concentration of these parameters by approximately 60-65% for TSS, BOD, total nitrogen (TN) and by 40% for total phosphorous (TP) in the final effluent produced. These values are in agreement with the middle range identified in the DLG guidelines (1998). Any liquid in the system (including urine) forms a concentrated leachate which requires disposal.

There are currently two (2) waterless composting toilet systems (some with multiple models) accredited by NSW Health for installation within NSW. As a primary treatment system, effluent is NOT disinfected; therefore, strict controls must be placed on generated leachate. Further, NSW Health requires composted solids to be buried (at depths >0.1m below ground surface) safely on the property to prevent contact. There are no ongoing maintenance requirements required by the NSW Health accreditation.

Current pricing for supply and installation of a domestic composting toilet system Sydney areas is **~$4,500-$6,000** (depending on model/supplier). Additional maintenance costs may be necessary in event of damage or blockage.

Greywater Treatment System (GTS)

Greywater treatment systems are accredited to treat laundry, shower, bath, hand-basin (and in some cases kitchen) greywater only. Blackwater (toilet waste) must never be treated in a greywater treatment system. It is preferable that kitchen water is kept separate from the other greywater streams and treated with the blackwater system, as kitchen greywater can be relatively high in contaminants compared to other streams.

In most cases, greywater treatment systems are essentially AWTS (see below) with modifications to allow for reduced organic loading and elevated fats & oils concentration. In GTS, effluent is typically treated to 'advanced secondary' (tertiary) standard (BOD <10, TSS <10 and FC <10) that can be used for toilet flushing, cold water supply to clothes washing machines, and unrestricted surface and subsurface irrigation. Disinfection is a requirement for treated greywater if it is to be used in the dwelling. The nutrient removal performance can vary considerably between and within greywater treatment system types.

There are currently six (6) GTS accredited by NSW Health for installation within NSW. Each system may use multiple (and differing) treatment processes; however, the final effluent quality would be expected to be equivalent to (or better than) that described above. Good maintenance of GTS is essential to ensure a consistently high level of performance. By regulation, GTS systems are required to be serviced by an appropriately qualified service technician at 3-monthly intervals in NSW.

Current pricing for supply and installation of a domestic (<1,800L/day) GTS in Sydney areas is **~$5,000-$8,000** (depending on supplier). The wider range in capital pricing will also reflect system performance reliability and effluent quality. Ongoing costs would include (quarterly) servicing costs of approximately $200-$300 per annum. Additional maintenance costs may be necessary in event of damage or blockage.

6.3 On-site Effluent Management Options

6.3.1 Effluent Land Application

Depending on the treatment standard (effluent quality), treated wastewater from All-waste and Split-Waste treatment options may be used in a number of ways on each property. The key principle of on-site wastewater management being that:

"all wastewater must be capable of being retained within the lot boundaries and must not present an undue hazard to public/environmental health or off-site receptors".

6.3.1.1 Description of Technology and Costs

Subsurface Irrigation (SSI)

The preferred land application option for subdivision lots is pressure-compensating, subsurface drip irrigation. SSI is suitable within lawn and landscaped areas and applies effluent within the

root-zone of plants for optimum irrigation efficiency. It is an ideal option for ensuring even, widespread coverage of the proposed irrigation area. SSI installation does not require any bulk materials or heavy machinery and irrigation lines can be simply installed with a small trench digger or “ditch-witch”.

Proprietary, pressure-compensating drip irrigation pipe designed for use with treated effluent should be used that will ensure distribution of effluent at uniform, controlled application rates. These products have been specifically designed for use with effluent and allow for the higher BOD_5, suspended solids, nutrient and biological loads usually present in effluent compared to potable water. They contain specially designed emitters that reduce the risk of blockage, typically incorporating chemicals that provide protection against root intrusion and biofilm development (e.g. Trifluralin). The dripper lines are coloured lilac to clearly identify that they are irrigating treated effluent.

Irrigation pipes (laterals) should be spaced to provide good and even coverage of the area they service. Generally they should be no more than 0.6m apart, roughly parallel and along the contour as close as possible.

An in-line 120µm disc filter may be installed to minimise the amount of solids entering the pipelines and emitters. This must be removed and cleaned regularly (at least at 3-monthly intervals). Alternately, a flush main may be installed to periodically clean-out the irrigation lines to provide effective long term performance. Either manual or automatic flush valves may be installed, with flush water directed back to the treatment system. Air release valves will be installed at the high points in individual irrigation areas to prevent soil particles being sucked into the lines at the end of pump cycles as pipelines depressurise.

Figure 7 provides a schematic representation of a generic subsurface irrigation system, courtesy of Netafim Australia. Specialist advice must be obtained for designing and installing the irrigation system.

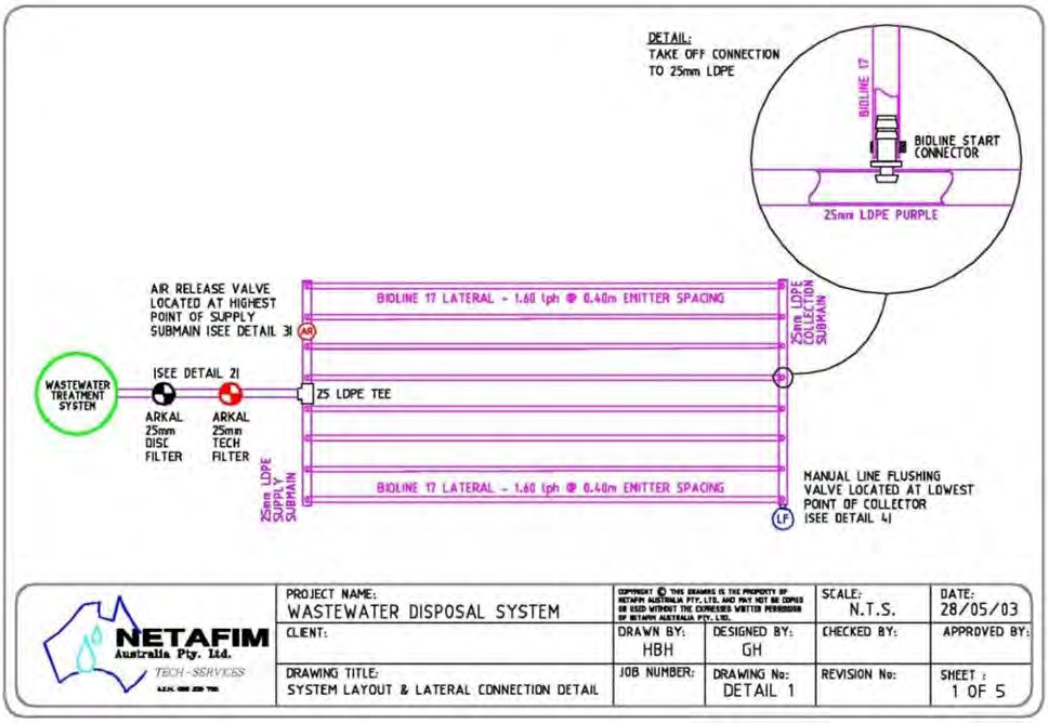

Figure 7 Typical Subsurface Irrigation Detail

Current pricing for supply and installation of SSI systems up to 800m^2 in Sydney areas is **~$1,500-$3,000** (depending on supplier). The wider range in capital pricing will also reflect material quality, system performance reliability and controls. Ongoing costs should be included within (quarterly) servicing costs for accredited treatment systems. Additional maintenance costs may be necessary in event of damage or blockage.

6.4 Limitation/Disadvantages

Under an on-site servicing scenario, a typical residential dwelling in the proposed subdivision would be required to install an individual treatment system (secondary recommended) along with up to 256m^2 of subsurface irrigation area. Depending on the system(s) selected, capital costs for the system could range from **$6,000-$20,000** for treatment with a further **$3,000** for irrigation (if required). Ongoing (maintenance) costs for the system(s) could range from **$300-$500** per annum. These costs would be borne exclusively by the home owner.

7 Decentralised (Community) Wastewater Solutions

Historically, centralised (conventional) wastewater management has been the only option considered for providing sanitary wastewater (sewage) servicing of developing residential areas. It typically refers to large-scale municipal sewerage systems where individual households are connected to a gravity driven reticulated collection network (sewer) which transfers combined (black and grey) wastewaters to a central treatment facility for processing (or transfer to another network). Disposal or reuse of the treated effluent and other by-products usually occur remote from the point of wastewater origin.

Decentralised, non-conventional wastewater management refers to the collection and treatment of wastewater from individual homes, clusters of homes, isolated communities, industries or institutional facilities and disposal/reuse at or near the point of wastewater generation (Crites and Tchobanoglous, 1998). Apart from the proximity of disposal/reuse, a key point of differentiation between centralised and decentralised wastewater management systems is the frequent use of alternative collection networks and treatment systems. These may include reduced pipe size or grade sewers, pressure or vacuum sewers, waste stream separation and recycled water systems.

The proposed development at Rothbury is common to many rural areas throughout Australia. Typical responses to dealing with such developments in the past involved a two-way decision between a conventional centralised approach (i.e. reticulated sewerage, local or offsite treatment and remote disposal/reuse) and traditional on-site wastewater management systems such as septic tanks with absorption trenches. However, over the last fifteen years or more, innovative wastewater service providers have increasingly adopted a more decentralised approach that draws technology from a wide spectrum of options ranging from traditional centralised sewerage through to individual on-site technologies.

Decentralised wastewater servicing solutions may involve partial (primary) treatment of generated wastewater on each lot, or maceration (slurrying), before conveyance of effluent via a reticulated sewer network to a common treatment facility.

Effluent sewer systems utilise smaller diameter, flexible reticulation pipes that can be laid at shallower depths and without the need for uniform or minimum grades for self-cleansing. This leads to greater ease of installation and substantially reduced construction costs, especially when working with challenging ground conditions (e.g. undulating country, shallow soils, and high watertables). By design, they greatly reduce or even eliminate stormwater inflow and groundwater ingress (I/I) in wet weather. These factors impact heavily on traditional gravity

sewer design, resulting in frequent wet weather overflows that pollute the environment, requiring network designers to use much larger pipes and additional storages to manage the increased flows.

7.1 Reticulation (Collection) Options

A wide variety of sewer reticulation options are available for a decentralised servicing approach. These differ in terms of their general mode of operation, infrastructure requirements, construction methods, maintenance procedures and frequency. These factors affect the suitability of the different options for different physical and socioeconomic settings, as well as the life cycle costs of installing, operating and maintaining the sewer network.

Aside from conventional gravity sewers (CGS), a number of alternatives are now available. Alternative collection systems have historically been defined as any system other than conventional gravity reticulation (USEPA, 1991) and can be broadly broken down into three categories: pressure sewers (PS); vacuum sewers (VS); and common effluent systems (CES) or effluent sewers. The categories are based on the primary force behind conveyance. However, each type of collection system can utilise different configurations and technologies.

PS and CES are often used in combination rather than isolation, such as in septic tank effluent pump/septic tank effluent gravity (STEP/STEG) systems. Some common design principles for these systems include:

- additional on-lot storage and in some cases preliminary on-lot treatment infrastructure (e.g. septic tank with outlet filter in STEP/STEG systems);
- the use of lightweight, flexible, small diameter polyvinyl chloride (PVC) or polyethylene (PE) pipe buried at shallower depths with fewer joints than conventional gravity sewers, (socketed and glued or welded joints limit infiltration); and
- remote monitoring. It is common practice in the U.S.A and New Zealand to install remote monitoring systems throughout the collection system that allow the efficient monitoring and manipulation of individual interceptor tank (IT) operation and the reticulation system.

This last principle is an important one when considering alternative collection systems. Just like a conventional sewer, a centralised management program is a vital component of alternative collection systems. Alternative collection systems have demonstrated that they require significantly less maintenance than conventional systems but still require some maintenance and supervision.

The perception of some system designers and operators is that ‘scattered’ interceptor tanks and/or pump units have the potential to create increased maintenance and supervision requirements. However, any resulting disadvantage is outweighed by having greater control over the system, reduction of dry / wet weather overflows (and their associated environmental impacts), and the reduced need for cleaning of the large, deep pipes associated with conventional systems.

7.1.1 Conventional (Gravity) Reticulation Systems

7.1.1.1 Description of Technology

Conventional gravity sewers (CGS) are the traditional method of sewer reticulation. Raw sewage is delivered via a (typically 100mm) house drain line to a reticulated sewer network (typically located in the road reserve) that relies on gravity drainage supplemented with lift (pumping) stations where pipes get too deep or need to traverse topographic rises.

Modified gravity sewer (MGS) (may also be referred to as low infiltration gravity sewer) works similarly to CGS but can achieve savings in cost and construction by relaxing traditional design standards, such as by reducing minimum cover requirements and having fewer inspection points. MGS usually require greater maintenance than CGS because of the reduced redundancy in network design (i.e. fewer manholes). MGS are usually only applicable to small rural communities where the costs of CGS are prohibitive and a reduced level of service is acceptable to the community.

Unit rates for installation of CGS and MGS systems are difficult to approximate given the inherent complexity of subsurface construction (e.g. rock) and the need for detailed hydraulic design and network analysis. However, general rule-of-thumb pricing ranges from **$200-$300** per metre installed (including pipes, fittings, manholes and house connections). Pump station and rising main costs (if required) would be additional.

7.1.1.2 Limitations/Disadvantages

CGS systems can be relatively expensive and difficult to install, particularly in areas of shallow soils, heavy rock, undulating terrain and high groundwater. This is due to the need for deep trenching to maintain the minimum grades required for self-cleansing. Large pipes are required to convey peak wet weather flows as pipes have a tendency to crack and leak, often allowing substantial groundwater and stormwater ingress during wet weather.

Both CGS and MGS will require significant upfront costs that may not be recovered for some time as the development progresses over a 10+ year timeframe. Upfront capital costs would include reticulated services (mains, sub-mains, manholes, pump stations etc.) as well as a treatment system capable of managing both current and expected (future) loads from the development. Additionally this type of system would be subject to a much larger hydraulic load due to required design allowances for storm inflows and groundwater infiltration (I/I), adding substantially to upfront capital costs.

7.1.2 Pressure Sewer Systems (Vacuum and Low-Pressure)

7.1.2.1 Description of Technology and Costs

Vacuum sewers (VS) and low-pressure grinder pump (GP) sewers overcome some of the limitations of traditional gravity sewers by providing a driving force to convey wastewater, allowing shallower, smaller diameter pipes. They require more on-lot infrastructure than CGS and MGS systems as both options temporarily store sewage on-lot before transfer to the reticulation system.

In the case of GP systems, a lot contains a small tank (commonly referred to as a ‘pot’) with grinder pump and level sensors/controls that collect sewage. The grinder pump breaks up the gross solids and converts sewerage to something more akin to a slurry that possesses different physical and hydraulic properties to raw sewage. The macerated effluent is then pumped through low pressure reticulation lines to a central location for storage and treatment. The on-lot and reticulation pipes are lightweight, flexible and small diameter, constructed of polyvinyl chloride (PVC) or high density polyethylene (HDPE). The pipes are installed at shallower depths than CGS and can closely follow the ground surface profile, removing the need for deep trenching. Furthermore, they have significantly fewer joints than CGS, and the joints are socketed and glued to limit infiltration. Figure 8 (below) presents a schematic of a ‘typical’ household low-pressure sewer connection. Generally, household ownership and management obligation extends to the property boundary (upstream of the boundary kit).

In the case of vacuum sewers, vacuum pumps provide the conveyance force by sucking sewage through the lines under a negative-pressure (vacuum). A small collection chamber (pot) is placed either on or near the lot to receive wastewater from the household – in some designs small clusters of houses are linked to a single collection chamber. When liquid levels in the collection chamber rise to a pre-determined level a normally closed valve is opened that connects the collection chamber to the vacuum sewer and as a result the liquid (with some air) is sucked into the sewer. When the collection chamber is empty the interface valve closes and the cycle is repeated. Flushing velocities are taken care of by the vacuum applied and pipelines do not have to be laid to achieve minimum grades. VS on-lot infrastructure looks very similar to that presented in Figure 8 (below) for GP applications, with the exception that no pump is fitted within the 'pot'.

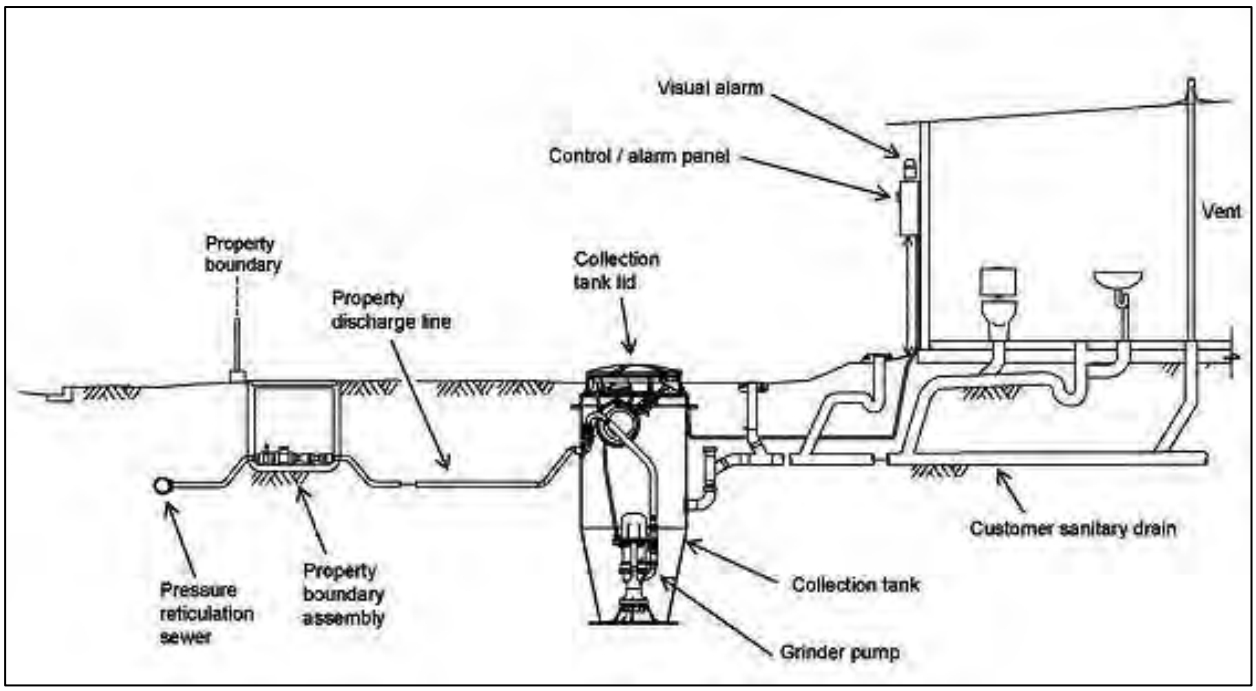

Figure 8 On-Lot Components of Low Pressure Sewer (Sydney Water)

Depending on the size of the reticulation scheme, most or all of the pumping pressure is provided by the on-lot grinder pumps (GP) or centralised vacuum facility (VS). However, in larger schemes additional pumping stations may be required. The system is designed so the pressurised pipes are self-cleaning; however, maintenance ports are installed along the system at predetermined locations.

Unit rates for installation of PS systems range from **$190-$220** per metre installed (including pipes, fittings, service laterals and project management). On-lot storage vessels (pots) vary in price depending on supplier and number of installations (volume). Typical pricing (per unit) is **~$6,000-$8,000** including boundary kit.

7.1.2.2 Limitations/Disadvantages

Generally speaking, pressure sewerage systems can overcome many of the limitations of traditional (conventional) gravity reticulation systems. However, there are still situations or design considerations that may become limiting for the application of pressure sewer (reticulation) systems, these may include:

- GP systems require higher energy macerating/grinding pumps with typically higher servicing and maintenance requirements.

- On-lot storage vessels (pots) have limited storage capacity (typically <1,000L) to cope with adverse service conditions such as power loss, pump failure or blockage.
- Availability of service/maintenance personnel in regional areas can cause delays in operational support.
- GP and VS systems transport all solids and liquids (slurry) and therefore are limited by minimum velocity requirements and can be more susceptible to crowning solids than effluent sewer systems.
- Due to full-strength organic (BOD) and suspended solid concentrations within the macerated effluent, treatment requirements are generally larger scale and more complex than those required for effluent sewer schemes.

At the Site, application of a pressure sewer technology would significantly reduce the risk of contamination of sensitive (environmental) features such as the dams, intermittent waterways and Black Creek. The network can be arranged such that all generated wastewater is directed away from these features (towards the south/west) and all off-lot infrastructure could be installed within the proposed road reserve (reticulation).

Pressure sewer systems are suited to staged implementation assuming sufficient hydraulic design has been completed to include ultimate design flow conditions. Pressure sewer reticulation systems can reduce (or delay) some upfront capital costs by staging the installation of on-lot components (i.e. pots) as buildout of the development occurs. This would remain the responsibility of the individual property owner for the proposed dwellings and the developer for the other facilities. However, a proportion of the off-lot infrastructure would require construction prior to the dwelling release and accommodation use. This would include the variable-grade reticulation network, boundary (connection) kits, pressure (booster) stations and wastewater treatment/land application system(s). Note; these can also be staged to meet growing demand as subdivision buildout proceeds.

Finally, pressure sewer systems require ongoing monitoring, management and control. This is typically undertaken by a central body such as a water authority (i.e. Hunter Water). However, there are instances where a private entity such as a strata body (community title) or private network operator (WICA) can assume management responsibility for such a network. Remote monitoring using telemetry is often used with pressure sewer systems, and local alarms are normally fitted on-lot to alert the resident of problems.

7.1.3 Common Effluent Systems (Effluent Sewers)

7.1.3.1 Description of Technology and Costs

CES utilise partial on-lot treatment and conveyance of (primary) treated effluent only away from the individual connections to a centralised location for further treatment (or in some cases disposal). This type of system has been adopted widely in the USA and New Zealand for servicing isolated villages that cannot practically or economically be connected to a municipal wastewater treatment plant using conventional gravity sewers.

CES systems collect and convey treated effluent (not raw wastewater) loads from individual residences and the public facilities to a central location for further handling. Primary treatment facilities (i.e. septic/interceptor tanks) servicing each allotment provide partial treatment and most solids are retained within the tanks, creating the opportunity for substantial savings in cost and infrastructure of the reticulation and centralised treatment. Many of the harmful and corrosive elements of domestic sewage (i.e. solids, gases) that cause major wear and tear on concrete sewer pipes are eliminated from the reticulation system. CES often combine pressure

sewer and small diameter gravity sewer technologies, with STEP/STEG systems identified as the preferred technology for this discussion.

STEP and STEG

Septic Tank Effluent Pump (STEP) and Septic Tank Effluent Gravity (STEG) systems are variable-grade effluent sewer systems. STEG systems may also be referred to as small diameter gravity sewers or effluent drain systems.

STEP systems are used for houses below the hydraulic line of the sewer, while STEG systems are used where a gravity drain is achievable to the sewer. In some cases a single STEP/STEG tank may be installed to treat and convey effluent from multiple lots in localised areas.

STEP/STEG systems offer many advantages over larger diameter, deep, conventional gravity sewers. Installation involves substantially less disturbance due to smaller diameter pipes and shallower depths. They require smaller hydraulic gradients and do not employ manholes. These characteristics result in significant cost savings. Effluent sewer mains are buried at a shallow depth following the contours of the terrain (variable-grade). The vertical and horizontal alignment requirements are not as stringent, removing the need for time consuming and expensive surveying. Typically, effluent sewers can be installed using standard shallow trenching techniques or horizontal directional drilling (HDD). There is no need to consider minimum velocities and gradients. Figure 9 provides a diagrammatic representation of a typical STEP/STEG system arrangement.

STEG collection systems operate like conventional gravity sewers and are employed where gravity drainage is achievable from the property to the effluent sewer. STEP collection systems incorporate a pump vault that is either enclosed within the septic tank itself or outside the tank in a separate pump basin. Liquid level sensors (or float switches) in the pump vault turn the pump on and off as levels rise and fall or signal an alarm if levels become too high. STEP system effluent pumps are typically 0.4kW (0.5 horsepower) and use minimal electricity.

Due to the use of pressurised conveyance of primary treated effluent, STEP systems provide for the greatest flexibility in design, materials (i.e. pipe) and construction when considering alternative collection systems. They are used to service lots below the hydraulic line of gravity mains.

Each house/community facility is connected to the effluent main line via a service connection. This service connection protects the house from back-pressure and allows the house to be isolated from the effluent sewer in an emergency. These connections are an important part of the system and it is normal for the service connections to be installed at the same time as the main sewer line, even on vacant lots.

Remote monitoring (using telemetry) can allow a system operator to control pump operation from an office or workshop without having to access the site unless some form of manual repair is required.

A summary of the key features of on-lot components include:

- The wastewater from each house (or clusters of houses where appropriate) or community facility is plumbed into an on-lot septic tank (also known as an interceptor tank), with a recommended (minimum) operating capacity of 4,500L.
- Each interceptor tank (IT) is connected by small diameter flexible pipeline to the reticulated effluent sewer pipeline at the property boundary (service connection).

- The IT can be constructed of concrete, fibreglass or plastic, and provides primary treatment, with the solids accumulating at the bottom of the tank and the liquid effluent passing through a screened outlet before being discharged to the effluent sewer.
- The majority of retained solids are degraded (anaerobic digestion) over time, thereby significantly reducing pump-out frequency (typically 7-10 years, depending on occupancy).
- The on-lot interceptor tanks are relatively large (compared to traditional septic tanks in NSW) and thereby provide several days' emergency wastewater storage, if required.

Figure 9 Diagrammatic STEP/STEG Arrangement (Orenco Systems Inc.)

Advantages of the STEP/STEG system include:

- Only liquid effluent is being pumped which means the energy required to pump is low, therefore reducing electricity costs.
- Small-bore (50mm - 100mm) pipe sizes for the effluent sewer, using lightweight, flexible polyvinyl chloride (PVC) or high density polyethylene (HDPE).
- It is common practice in New Zealand to install remote monitoring systems throughout the collection system that allow the efficient monitoring and manipulation of individual interceptor tank operation and the broader reticulation system.
- A reduction and, in most cases, elimination of the need for manholes and pump stations within the system.
- Fewer joints than conventional gravity sewers (socketed and glued/welded joints) and provision of a largely watertight collection system thereby reducing (or effectively eliminating) infiltration and inflow (I/I). This means the treatment plant can be

considerably smaller since it doesn't have to cope with large wet weather flows. Similarly, sewers and pump stations do not need to be sized for wet weather flows.

- The cost and maintenance of all on-lot equipment is taken care of by the owner and disposal of chemicals will only affect the individual lot and not the whole system.

Unit rates for installation of CES systems range from **$210-$240** per metre installed (including pipes, fittings, service laterals and project management).

7.1.3.2 Limitations/Disadvantages

Effluent sewer systems have one minor disadvantage when compared to conventional and pressure/vacuum sewerage systems; that is, the need for on-site treatment (interceptor) tanks on individual lots. With proper design, installation and management, this should not pose a problem for the overall system. Effluent sewer systems almost exclusively include external management of the system by a responsible entity. Remote monitoring technology is often incorporated into on-lot and community components of effluent sewer systems to facilitate third-party management.

An important factor in the efficient operation of a reticulated effluent sewerage system is the need to take large scale management decisions out of the homeowners' hands. Reducing the responsible management entities from hundreds (property owners) to one (water authority/private operator) has many benefits. The advent of remote monitoring technology for application in decentralised, non-conventional wastewater treatment has ensured a considerable level of risk control exists. In most cases this risk control is far greater than that provided for centralised systems.

STEP/STEG effluent sewers are tailor-made for staged implementation in-line with expected community growth (subdivision buildout). Because of their relative freedom from minimum velocity requirements, system hydraulics are not often limiting and the effluent sewer can absorb large fluctuations between initial and ultimate design flow conditions (volume and velocity). Combination STEP/STEG systems provide positive pressure throughout the reticulation network and, combined with modern jointing techniques, substantially reduces the risk of inflow and infiltration. Alternate water supply (town/tank) scenarios will have minimal impact on the design, operation and estimated cost of STEP/STEG, primarily due to the capacity for modulation of daily flows using the balance capability of large on-lot interceptor tanks.

7.2 Treatment Options

Regardless of the reticulation option selected, collected wastewater (either raw or primary) will require additional treatment to achieve a standard suitable for land application (as a minimum) in line with regulatory standards and community expectations.

This presents a number of considerations when selecting an appropriate treatment technology because the quality and consistency of the wastewater stream can have a significant bearing on the size of the wastewater treatment system required, as well as the reliability and performance of the treatment processes employed. Therefore, not all treatment systems are suitable for the range of reticulation options considered. Common treatment technologies/systems are discussed here along with the applicability for the system with a selected reticulation option.

7.2.1 Treatment System Positioning

7.2.2 Extended Aeration

Extended aeration, suspended growth (activated sludge) treatment systems are one of the most common types of small-scale wastewater treatment systems installed throughout Australia. They have been shown to achieve high organic load (BOD) and SS reductions of 85-95% and up to 50% phosphorus removal (principally through solids capture). As for most other wastewater treatment systems, nitrogen reduction is more difficult due to the complex chemical reactions in the nitrogen cycle; however, these types of systems can achieve up to 75% nitrification, through the conversion of ammonia to nitrate, which is biologically available for plant uptake in the land application (irrigation) area.

7.2.2.1 Applicability

Extended aeration treatment systems are suitable for receiving raw wastewater loads from community reticulation (CGS, GP and VS) systems, as designs tend to be significantly robust to accommodate the expected fluctuations in wastewater quality (strength) and volume. A typical design for the proposed development would comprise:

- large primary treatment capacity (~491kL – 550kL) to provide a minimum 24-hr residence period for the peak (dry-weather) flow from the subdivision, allowing sufficient sludge storage volume;
- an (aerated) treatment reactor (~491-550kL) to provide reliable treatment to a 'secondary' effluent quality, including >80% nitrification;
- secondary settling (clarification) capacity (~300-350-kL) to provide reliable effluent clarity (TSS <30mg/L) suitable for restricted land application (irrigation) of treated effluent; and
- disinfection or pathogen control facilities suitable to achieve desired control limits (as determined by consent authority).

With an increased storage requirement (i.e. tanks) the land area (footprint) for this type of treatment system would be 2,500-3,000m^2. This area would be expected to be accommodated with the identified Secondary Treatment Plant (STP) location.

7.2.2.2 Costs

Capital cost estimates for extended aeration treatment systems are varied, given the range of technologies, processes and providers available in the Australian market. Based on W&A experience, a preliminary (ballpark) estimate of cost for such a system would be in the range of **$8,000 - $12,000 per kL** treated. Therefore, based on the design loading values presented, the cost of a community (extended aeration) STP for the development would be in the vicinity of **$3.9M-$5.9M** (491kL/day) to **$4.4M-$6.6M** (550kL/day). This cost would be borne exclusively by the developer (proponent).

Expected operational costs are also heavily dependent upon the system selected. Typically, extended aeration treatment systems require operator input (management/maintenance) daily. This may be found to be equivalent to a full-time staff (or contract) position with an annual value of **$100K-$120K**. This cost would be borne by the developer (proponent) and/or management entity.

7.2.3 Sequencing Batch Reactor

Sequencing Batch Reactors (SBRs) also use the activated sludge treatment process, but in a 'fill-and-draw' process (from a balance tank) in order to provide all of the wastewater treatment steps in sequential order within the same reactor vessel. This technology uses a smaller

footprint than traditional suspended growth systems. However, SBRs can be more sensitive to shock loads as the microbiological populations within the reactor vessel become conditioned to the background sewage inflows. An SBR variant, known as Intermittently Decanted Extended Aeration (IDEA), which continually feeds raw wastewater to a baffled compartment of the reactor is also available. This system can remove the need for flow equalisation and make the system less susceptible to shock loads.

7.2.3.1 Applicability

SBR (and IDEA) treatment systems are also suitable for receiving raw wastewater loads from community reticulation (CGS, GP and VS) systems for the same reasons as extended aeration systems. However, because treatment occurs as a discrete volume ('batch'), additional flow equalisation (balancing) facilities may also be required.

The land area requirement (footprint) for this type of treatment system would be marginally reduced ~300-400m^2. This area would be expected to be accommodated with the identified STP location.

7.2.3.2 Limitations/Disadvantages

SBR systems overcome some of the 'scalability' issues associated with extended aeration systems by allowing for multiple treatment reactors, which can be constructed in a staged approach as development progresses. Subsequently, upfront capital expenditure can be minimised, with additional treatment capacity only added as needed until the ultimate condition is reached. This approach would also address the potential under-loading problem identified earlier.

As with extended aeration systems, SBR systems can also struggle when used with common effluent sewer (i.e. STEP/STEG) applications. Again, this issue can be readily addressed with cautious consideration in the design and selection of the preferred treatment system.

7.2.3.2 Costs

The capital cost estimates for a SBR (or IDEA) treatment system for the development would be similar to the extended aeration values (**$8,000 - $10,000** per kL treated). Therefore, based on the design loading values presented, the cost of a community (SBR/IDEA) STP for the development would be in the vicinity of **$3.9M-$4.9M** (491kL/day) to **$4.4M-$5.5M** (550kL/day). This cost would be borne exclusively by the developer (proponent).

Expected operational costs are also heavily dependent upon the system selected. Typically, SBR systems require operator input (management/maintenance) daily. This may be found to be equivalent to a full-time staff (or contract) position with an annual value of **$100K-$120K**. This cost would be borne by the developer (proponent) and/or management entity.

7.2.4 Textile Filters

As described under the On-site treatment options (Section 6.2), media or 'textile' filters use proven packed bed reactor (PBR) technology to treat domestic wastewater to better than secondary effluent standards. In addition to proving highly effective at the single lot scale, this technology has been found to be highly suitable to cluster (community) scale wastewater treatment, particularly on sites with limitations to construction and land availability or staged development.

Figure 10 (below) illustrates several examples of Textile Filter STP's in community situations. Note that compact design and enhanced odour control allow for the STP to be directly integrated into the development setting with minimal impact.

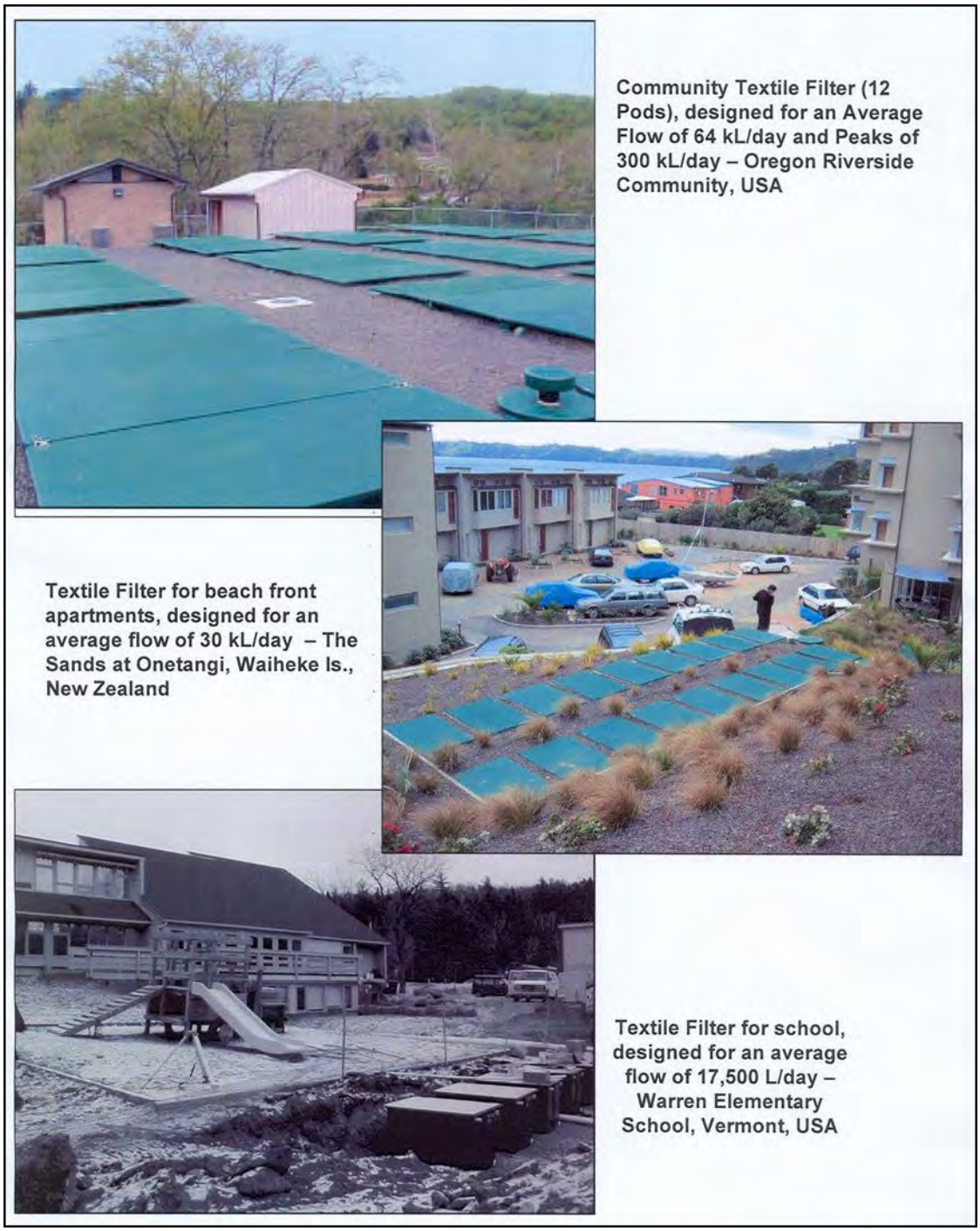

Figure 10 Modular Textile Filter Arrangements for a Community System

Recirculating textile filters can be loaded at rates much higher than traditional packed bed reactors (e.g. sand or gravel filters) and do not have the same issues associated with sourcing consistent quality media materials as sand or gravel filters. The loading rate depends on the organic loading and the required effluent quality. The filters are lightweight and modular in form allowing systems to be expanded when required with minimal difficulty. Textile filters have a small footprint when compared to other treatment system options and do not smell or produce potentially harmful aerosols, so buffer requirements from residences and other types of development are minimal.

Recirculating textile filters generally comprise a watertight fibreglass basin filled with suspended vertical sheets of an engineered textile material. Recirculated wastewater is distributed evenly over the end surface of the hanging sheets by a pressure distribution manifold.

The textile material has a complex fibre structure that provides a high water holding capacity, porosity and surface area for biomass attachment. Porosity of the textile media is several times greater than that of sand not only increasing hydraulic conductivity but also allowing the passive input of oxygen into the system and providing more space for solid retention and breakdown by the biomass. Surface area of the various textile media is approximately 4 to 8 times greater than a recirculating sand or gravel filter. The high water holding capacity of the media provides high retention times when coupled with timed, pressure dosing and enables consistently high treatment.

7.2.4.1 Applicability

Whilst Textile Filter treatment systems can be designed for receiving raw wastewater loads from community reticulation (CGS, GP and VS) systems, usually incorporating large primary treatment and flow equalisation (balancing) facilities, they are ideally suited to common effluent sewer (i.e. STEP/STEG) applications.

The use of on-lot primary treatment (interceptor) tanks greatly reduces the need for large primary facilities at the centralised treatment location and utilising a 'recirculating' treatment process results in exceptional treatment performance (high quality effluent) and significant flexibility in nutrient removal. Long term monitoring of many domestic and community-scale textile filter systems indicates that effluent quality as described in Table 5 is consistently achievable. Additional treatment processes can be incorporated to provide enhanced treatment (e.g. further nutrient stripping or active disinfection).

Table 5 Typical 'Textile Filter' Effluent Quality

Parameter	Concentration	%Reduction
Biochemical Oxygen Demand (BOD_5)	< 5 mg/L	90-99
Suspended Solids (TSS)	< 5 mg/L	90-99
Total Nitrogen (TN)	10-15 mg/L	65-90
Total Phosphorus (TP)	5-10 mg/L	25-75
Faecal Coliforms	<1,000 cfu/100 mL	99.99

Textile filter systems can overcome most of the scalability issues associated with other 'fixed-capacity' systems. A commercial (AX100) treatment pod can treat average and peak design wastewater flows of 12,000L to 19,000L/day respectively (Orenco Systems ®, 2013), meaning that treatment capacity can be iteratively expanded as development proceeds. For the development this equates to approximately 27 (AX100) pods (based on treating an average of 15,000 L/day.

Alternately, the larger (AX-MAX) treatment system (Figure 11) can treat average and peak design wastewater flows of 20,000L to 40,000L/day respectively (Orenco Systems ®, 2013), or approximately 17 (AX-MAX225) pods (based on treating an average of 30,000 L/day).

The land area requirement (footprint) for this type of treatment system is also significantly reduced ~500-1,000m^2. This area would be expected to be accommodated with the identified STP location.

Figure 11 AX-MAX (225) Modular Textile Filter STP

7.2.4.2 Limitations

On-site pre-treatment still requires individual householders to be educated about the system, particularly to be mindful of preventing harmful substances from entering the system. However, if a contamination event were to occur, the impact would be localised to the subject household, with minimal impact on community treatment system integrity.

7.2.4.3 Costs

Capital costs for a textile filter (PBR) treatment system for the development would be split between on-lot costs (interceptor tanks) and off-lot costs (STP). Depending on hydraulic requirements, on-lot costs would range between **$8,500** and **$10,500** per lot, borne exclusively by the property owner. Off-lot (STP) costs, comprising fixed infrastructure (flow balancing/recirculation tanks, pumping etc.) and treatment units (pods) would be **~$6,800** per kL treated. This cost would be borne by the developer (proponent) and/or management entity.

Therefore, based on the design loading values presented, the cost of a community (textile filter) STP for the development would be in the vicinity of **$3.2M** for on-lot works and between **$3.4M** (491kL/day) and **$3.7M** (550kL/day) for the off-lot components.

To aid in system/network management, remote monitoring capability for each new (on-lot) connection is also recommended. The capital cost for this additional item is **~$1,500** per lot.

Operational costs for a textile filter treatment system are expected to be substantially lower than both extended aeration and SBR options. This is due in part to shifting part of the maintenance requirement to the home owner, but also due to an increased level of automatic monitoring of system operational conditions (remote monitoring). This allows for the timely identification, reporting and resolution of system problems (both on and off-lot) before they cause serious fault or damage. Also, remote monitoring and management requires less on-site time for a system operator, meaning annual running costs can be significantly reduced.

Textile filter (PBR) technology is very robust and maintenance requirements are substantially reduced. Studies of operational systems in the U.S. and New Zealand have demonstrated combined operational and maintenance costs of **<$500** per connection. These costs would be borne equally by the homeowner and the developer (proponent) and/or management entity.

7.2.5 Enhanced (Tertiary) Treatment Option

Each of the previously described community treatment system options is capable of producing 'secondary' effluent quality suitable for 'restricted' land application (irrigation) on dedicated land within the property. Disinfection or pathogen controls will be required if surface irrigation techniques are preferred (as determined by consent authority).

Under certain circumstances, it is possible to utilise treated wastewater for internal (household) uses within the development. On single lots this is only possible using treated greywater; however, with large-scale commercial treatment systems, such as that proposed here, it is possible to treat the combined (all-waste) wastewater load to a standard acceptable for reuse (both internally and externally) for the facilities.

This could be achieved by providing a dual reticulation (third-pipe) network to distribute 'recycled water' to households and public open space, whilst any unused recycled water would continue to be irrigated.

To achieve 'tertiary' recycled water quality it is typical for providers to utilise advanced membrane bioreactor (MBR) processes. MBR systems effectively combine two proven wastewater treatment processes (i.e. microbial digestion and membrane separation) into a single process where suspended solids and microorganisms responsible for biodegradation are separated from the treated water by an ultra-filtration (UF) system. The process typically also includes advanced disinfection technologies, potentially producing a high quality (Class A) effluent. MBR's are well suited to greenfield development sites where reuse reticulation can be designed into the system rather than brownfield sites where costs of retrofitting are often prohibitively high. MBR systems are modular so they are easily expandable for staged development or to cater for any increased loads if any further development at the Site is desired in the future.

The estimated capital cost to upgrade a community treatment system to produce 'tertiary' recycled water quality suitable for third-pipe reticulation to dwellings (MBR or similar) would be between **$10,000 and $12,000 per kL** treated. This cost would be borne by the developer (proponent) and/or management entity.

Therefore, based on the design loading values presented, the cost of a community (MBR) STP for the Site would be in the vicinity of **$7.1M -$8.5M** (705.7kL/day)

However, economies of scale apply to this type of advanced treatment system with cost decreasing proportionally with the number of connections. Recent projects have shown capacity to produce high quality 'recycled' water for a 2,500-lot subdivision at an estimated cost of $2,000-$3,000 per kL treated.

Other costs associated with this approach would include:

- Recycled Water storage facilities (sufficient to meet peak non-potable water demand and potentially fire-fighting needs).
- Delivery headworks (tanks, pumps etc.).

- Third-pipe (dual) reticulation network1.
- On-lot infrastructure (metering, cross-flow controls etc.)

1.

[1] For PS and CES reticulation options (see Section 7.1), third-pipe reticulation can often be installed simultaneously, and within the same excavation, providing substantial savings in both time and capital expenditure

8 Connection to Sewer

8.1 Description and Costs

There is an opportunity for the proposed development to connect to the Hunter Water's Cessnock Waste Water Treatment Works (WWTW). Hunter Water made it known to the Client that there is enough capacity at the Cessnock WWTW to cater for the loads the development produces. The Cessnock WWTW is located approximately 13 km to the south east of the Site.

Connection to the Cessnock WWTW would require a conventional Pressure Sewer System as described in Section 7.1.1 to be constructed at the Site along the proposed roadways at the development. The sewer line would then head south along Wine Country Drive and connect to the existing sewer pipes that service the Vintage site. This would require approximately 2km of pipeline to from the development site to the existing sewer line at a cost of approximately **$200-$300** per metre.

8.2 Limitations/Disadvantages

Connection to the sewer will take away the opportunity for wastewater produced at the Site to be used to irrigate the Site. As mentioned in Section 5, the Site will produce 178.9 ML of wastewater each year which could be used to meet the Site's non-potable water demand of 258ML/year (See Section 9). For the recycled water to be returned to the Site, a 13km return line from the Cessnock WWTW would have to be constructed. The cost to build a 200mm PVC return pipeline would be approximately **95$/m** return line Furthermore the water from the WWTW does not meet the quality requirements for irrigation and would have to undergo further advanced treatment on-site by a MBR.(See Section 7.2.5).

9 Recycled Water Reuse

9.1 Recycled Water Demand

The Site will require a non-potable water supply of approximately 258ML/year for internal household uses such as toilet flushing and cold laundry washes and external uses such as irrigation of private lawns, landscaped areas and the golf course. A break up of the non-potable water demand is presented in Table 7. There is an opportunity to source this water from alternate sources other than the water main. Possible sources of a non-potable supply are discussed in further in this Section.

Basix and Water Efficiency

In NSW, the Building & Sustainability Index (BASIX), implemented under the NSW State Environmental Planning Policy Sustainability Index 2004 (BASIX SEPP), mandates water and energy saving targets for all new residential construction. BASIX requires fixtures, fittings and appliances to have minimum ratings in accordance with AS/NZS 6400:2005 (Water Efficient Products) under the Water Efficiency Labelling and Standards (WELS) scheme.

For BASIX approval a new residential development is required to demonstrate up to 40% less potable water usage than the average 'pre BASIX' benchmark home of 90.34kL/person/year or 247L/person/day. The 'pre BASIX' benchmark home was determined from data collated by the then NSW Department of Water and Energy (DWE) and included regional data reflecting both demographic and climate considerations.

The Site is located within the Cessnock Local Government Area BASIX Water Target Zone which has been prescribed a 40% reduction target. The BASIX reduction targets were

determined from data provided by state and federal water and energy utilities as well as long-term climate data obtained from the Bureau of Meteorology. It is noted that the reduction targets are currently under review, with a proposal to increase to 50% reduction in areas prescribed with a 40% reduction target.

BASIX encourages reductions in the consumption of potable water through any of the following strategies: landscape uses, fixtures, alternative water, pools and spas, and central systems. The development could utilise an alternative water source through the reticulation of recycled water, for garden and lawns, toilets and laundry (cold water) use, to meet the BASIX reduction targets. Additional listed strategies, i.e. fixtures, may also need to be used in addition to the alternative water source to meet the target.

Design Household

An ET occupancy value (capita per new residence) was determined based on population density information collated by W&A from the most recent ABS Census of Population and Housing (2011) for the development region and house data from the Client. The neighbouring suburbs of Rothbury and North Rothbury have occupancy rates of 2.6 and 2.7 respectively. However, the Client has indicated that the 'design' household for the development will comprise 4 bedrooms. Therefore, a conservative occupancy rate of 7 persons was adopted to follow the requirements of Cessnock City Council's Site and Soil Assessment Report for domestic systems.

Household Water Usage

Toilets

Based on the installation of retrofitted flush valves for single flush toilets only, 5.5L/full flush is the maximum WELS scheme registered water consumption for toilets. The maximum water consumption for dual flush toilets, which will likely be installed, is 4L/flush (6L full flush / 3L half flush). We have assumed an average of 4 flushes/person/day (13 per weekend and 3 per weekday, averaged over the week). This equates to approximately 6.5% of the total household water demand.

Showers

The minimum NSW requirement, as per the Building Code Australia, for showerheads in new developments is a 3-star rating with a water consumption ranging between 4.5-9L/min. As per BASIX calculations, for an assumed shower duration of 8 minutes (one shower a day), with a maximum allowable showerhead flow rate of 9L/min, the total water consumption for showers would be 72L/person/day. This equates to approximately 29.1% of the total household water demand.

Washing Machines

BASIX requires the following WELS scheme (star) ratings to be met for washing machines: a load capacity greater than 5kg requires a greater than 3-star rating and for capacities less than 5kg a rating greater than 2.5-star is required. The maximum consumption per load for a 2.5-star and a 3-star washing machine is 76 and 97L/load, respectively. We have assumed that only the permanent residences would use recycled water for washing and that a larger machine would be installed in each new residence and also that a 'typical' 5-person household would do six (8) loads per week. Based on this, we estimate that, at 97L/load, the total household water consumption for washing machines would be 110L/ET/day. This equates to approximately 11.2% of the total household water demand. Approximately one-third of washing machine water

usage is assumed to be hot water (28L/ET/day) with the remaining two-thirds being cold water (55L/ET/day).

Kitchen, Laundry, Bathroom Taps and Leaks

The minimum BASIX requirements for taps are 3-star outlet tap sets with a maximum water consumption of 9.5L/min and an average of 8.4L/min. Assuming a 'typical' resident uses the taps for approximately 4min/day at 8.4L/min, then the estimated water consumption for taps is approximately 33.6L/person/day. This equates to approximately 13.5% of the total household water demand.

The water consumption of a dishwasher as a proportion of the total 'kitchen, laundry, bathroom taps and leaks' component was also determined. The minimum WELS scheme rating for dishwashers is 1.5-star, with a maximum water consumption of 18.6L/wash. We have assumed a typical 7-person household does at least one wash per day. Therefore, the total water consumption for dishwashers is 18.6L/day. This equates to approximately 2.5% of the total household water demand. When combined with expected tap uses, this results in an estimated 16.2% total household water demand for 'kitchen, laundry, bathroom taps and leaks'.

The estimate of 16.2% for this particular household demand is validated by Sydney Water (2008) and Brisbane Water (QLD Department of Housing and Public Works, 2006) figures.

Pool, Car Washing and Hosing Down

An approximate demand of 4% was adopted for (non-garden) external uses such as pool, car washing and hosing down. This equates to approximately 30L/person/day of the total household water demand. This was based on figures adopted by both Sydney Water (2008) and Brisbane Water (QLD Department of Housing and Public Works, 2006). (Note that we have not assumed any reuse of recycled water for this purpose at this stage).

Lawn and Garden Watering

As lawn and garden watering can include seasonal variability, it was the most difficult type of water demand to estimate. By adopting the aforementioned proportions, the remaining 33% of on-lot usage is assigned for lawn and garden watering, which equates to approximately 244L/person/day. This value compares to an (approximate) average of other published values from Brisbane Water 42% (QLD Department of Housing and Public Works, 2006) and Sydney Water 24% (2008), respectively.

Using this information, it is possible to develop estimates of potential recycled water demand from new dwellings within the development. As discussed, permissible internal uses of recycled water include toilet flushing (6.5%) and cold-water washing machine supply (7.4%), while permissible external uses are limited to lawn and garden watering (33%). It is acknowledged that these values are annualised 'averages' and actual demand will change throughout the year (both daily and seasonally).