3.1 RZ/7/2009 - Proposed Rezoning - 19-23 Geoffrey Road, Chittaway Point

TRIM REFERENCE: RZ/7/2009 - D03397504
MANAGER: Jari Ihalainen, Director Land Management
AUTHOR: Jenny Mewing; Strategic Planner

SUMMARY

A proposal has been received to rezone 19-23 Geoffrey Road, Chittaway Point from 1(c) Non-urban constrained lands to enable residential development and environmental conservation and management, in addition to removing a lot amalgamation provision affecting the subject land.

An assessment of the proposal has been undertaken, which has identified that the proposal has merit 'in principle', and that Council should initiate the rezoning process by preparing a Planning Proposal and referring it to the Department of Planning and Infrastructure (DoPI) for a 'Gateway' determination.

Real Description:	Lots 1-3 DP 21536, Lot 1 DP 1014033, Lot 1 DP 22467 and Lots 10-11 DP 1177776
Street Address:	19-23 Geoffrey Road, Chittaway Point
Owner/s:	IDA Safe Constructions Pty Ltd
Current Zoning:	1(c) Non-urban Constrained Land
Current Land use:	Non-intensive animal agriculture (grazing)

RECOMMENDATION

1 That Council prepare a Planning Proposal to amend Wyong Local Environmental Plan, 1991, (or pending timing, Wyong Standard Instrument Local Environmental Plan) pursuant to Section 55 of the Environmental Planning and Assessment (EP & A) Act, 1979, to enable residential development and environmental conservation/management.

2 That Council forward the Planning Proposal to the Department of Planning and Infrastructure (DoPI) accompanied by a request for a "Gateway Determination", pursuant to Section 56 of the EP & A Act, 1979.

3 That Council request the General Manager to apply to accept plan making delegations for the rezoning.

4 That Council require, subject to the "Gateway Determination," the proponent enter into a Funding Agreement with Council in accordance with Council's Planning Proposal Procedure to recover the costs involved in further progressing the proposal.

5 That Council authorise the General Manager (or delegate) to sign the Funding Agreement.

6 That Council note that additional information will need to be submitted prior to proceeding to public exhibition/consultation.

7 That Council undertake community and government agency consultation, in accordance with the requirements attached to the "Gateway Determination".

8 That Council consider a further report on results of community consultation.

BACKGROUND AND CURRENT STATUS

The site (Attachment 1) is predominantly vacant however a rural shed structure occupies a portion of the south-western corner of Lot 10 DP 1177776. The site is utilised primarily for non-intensive livestock grazing (sheep).

Lots 1, 2 and 3 DP 21536 and Lot 1 DP 1014033 are affected by lot amalgamation provisions and therefore have only one dwelling entitlement as a combined area.

Wyong LEP Amendment No.135 resulted in the rezoning of the front portion of former Lot 1 DP 134363 from 2(a) Residential zone to 1(c) Non-Urban Constrained Lands zone was believed to be a drafting error. Wyong LEP Amendment No.175 rezoned the front portion of former Lot 1 DP 134363 to 2(a) Residential Zone to rectify this error.

A Development Application (DA) for a 10-lot subdivision (DA 1406/2008) was subsequently lodged for the front portion of former Lot 1 DP 134363, and was approved on 25 June 2009. This 10-lot subdivision approved 8 lots (between 501m^2 and 717m^2 in size) within the 2(a) Residential Zone land at the front of the site, and 2 allotments(Lots 10-11 DP1177776) within the remaining 1(c) Non-Urban Constrained Lands Zone.

THE PROPOSAL

The proposal being considered was lodged in 2009 in response to Council's call for requests to be included within the draft Settlement Strategy. An assessment of the proposal at this time identified the need for additional studies, particularly in relation to traffic and transportation, flooding and flora and fauna.

The outcomes of these studies were submitted to Council in late 2012. The Proponent was requested to submit a revised proposal, consistent with the DoPI Planning Proposal criteria and format, which was submitted to Council in May 2013.

The proposal seeks to rezone Lots 1-3 DP 21536, Lot 1 DP 1014033, Lot 1 DP 22467 and Lots 10-11 DP 1177776 from 1(c) Non-Urban Constrained Lands to 2(a) Residential and 7(a) Conservation under Wyong Local Environmental Plan (LEP) 1991 or R2 Low Density Residential, E2 Environmental Conservation and E3 Environmental Management under Wyong Standard Instrument (SI) LEP. The proposal further seeks to remove the lot amalgamation provision applying to Lots 1, 2 and 3 DP 21536 and Lot 1 DP 1014033.

ISSUES ANALYSIS

The planning proposal submission has been assessed having regard for the following matters:

- Flora and fauna;
- Bushfire;
- Climate Change;
- Natural Resources;
- Aboriginal Archaeology and European Cultural Heritage;
- Contaminated Land and Acid Sulfate Soils;
- Odour;
- Flooding and Drainage;
- Noise and Acoustics;
- Social Impact and Amenity;
- Servicing; and
- Economic Feasibility.

The most significant issues for consideration relate to flora/fauna and flooding.

Flora and Fauna

The subject site has been utilised for the grazing of livestock for many years. The area proposed for development is predominantly cleared of native vegetation. However, some areas of the site remain heavily vegetated, particularly along the eastern boundary, eastern and northern slopes. The majority of these heavily vegetated areas are proposed for conservation purposes.

It has been past practice of Council to take ownership of environmentally significant land. This practice however has resulted in a significant financial burden for its upkeep, therefore it is not recommended in this instance provided measures are adopted to preserve environmentally significant land whilst they remain in private ownership.

Flora

Council's records indicate that the site includes the Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SSFCF) Endangered Ecological Community (EEC) and River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (REFCF) EEC under the *Threatened Species Conservation (TSC) Act* 1995. The presence of SSFCF has been confirmed by the Proponent's consultant however, the classification of the area mapped by Council as REFCF has been identified by the Proponent's consultant as SSFCF. This may need to be clarified if any of the area is proposed to be cleared as it may affect biodiversity offsetting requirements.

Additionally, 4.83 hectares of vegetation on the site is described as Blackbutt Canopy; however this is most likely disturbed Alluvial Riparian Blackbutt Forest. Although the report concludes that this vegetation type does not correspond to an EEC, it may correspond to REFCF EEC. A recently commissioned Council study assessed Alluvial Riparian Blackbutt Forest in Wyong LGA against REFCF EEC (Bell 2013). This study identifies that the species list is a poor indicator of EEC; therefore the Blackbutt on site could potentially qualify as REFCF. Further investigative work is recommended.

A wildlife corridor borders the western boundary of the subject site. This connective habitat linkage is an important biodiversity planning objective in the locality. This corridor will require considerable embellishment and restoration to provide a linkage from the floodplain wetlands in the Tuggerah/Chittaway Point area to remnant riparian vegetation along Ourimbah Creek. It is not proposed however that land within the subject site adjoining this corridor be transferred into Council ownership.

A number of additional matters are still required to be addressed which relate to:

- edge effects of development (housing, weed invasion, dumping etc) and the impacts on the integrity of the vegetation proposed to be retained;

- Mitigation and offset analysis for vegetation proposed to be cleared (including hollow bearing trees and hollows, foraging habitat for microbat species; and

- Detection of potential threatened flora species not targeted during original field surveys, including *Corunastylis* sp. Charmhaven (a recently discovered and described orchid that was provisionally listed on the TSC Act as Critically Endangered on 5 October 2012) and other orchid species.

It is recommended that these issues are addressed by the Proponent should the proposal be supported by Council and the Gateway.

Fauna

The field surveys undertaken on behalf of the Proponent identified the presence of five (5) threatened fauna species under the TSC Act and three (3) migratory bird species under the *Environment Protection and Biodiversity Conservation (EPBC) Act*, 1999. Despite these observations, the range of vegetation on the subject site has potential to provide suitable habitat for other protected species.

The field surveys also included targeted observations for koalas and squirrel gliders. No koalas or squirrel gliders were observed on site, with only one (1) koala food species tree, *Eucalyptus robusta*, being located on site.

The assessment of the observed threatened fauna concluded that the 'proposed development is not likely to have a significant effect on threatened species, populations or ecological communities', therefore a Species Impact Statement (SIS) is not required. The report further concluded that a referral to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPac) is not necessary.

Flooding

The eastern portion of the subject site, including large sections of Lots 2 & 3 DP 21536, Lot 1 DP 101433 and Lot 10 DP 1177776 and the entirety of Lot 1 DP 22467 are affected by the 1% AEP from both Ourimbah Creek (to the south) and Tuggerah Lake.

A flood study prepared on behalf of the Proponent by Paterson Consultants Pty Limited (May 2012) has identified a potential low risk development area for the site which:

- Includes fill to provide minimum required ground levels;
- Prevents loss of flood storage so that flood levels are not increased downstream; and
- Enables filling which wouldn't affect flood levels of Tuggerah Lake

A flood modelling exercise for the Ourimbah Creek Catchment (April 2013) undertaken for Council by Catchment Simulation Solutions has considered the impacts of flooding and water flow from the entire Ourimbah Creek Catchment, not just those from the Lower Ourimbah Creek and Tuggerah Lakes Area.

This modelling identified possible scenarios, including the 1% Annual Exceedance Probability (AEP) (Attachment 3), 0.5% AEP and Probable Maximum Flood (PMF) (Attachment 4). However, a number of alternative scenarios for the 1% AEP were also tested, including increased rainfall intensity (30%) produced as a result of climate change, as well as a blockage of Lees Bridge.

The 2013 modelled 1% AEP produced similar flooding impacts on the site to that model prepared by the Proponents consultant in 2012.

During the alternative 1% scenarios modelled by Council consultants however, (as well as during the 0.5% and PMF events), floodwaters 'break out' from Chittaway Creek and cross Wyong Road onto the subject site. As a result, a temporary flow path forms on the north-western side of the Knoll located above Oscar Drive.

The level of the site where the 'break out' occurs is approximately 4.2m Australian Height Datum (AHD). The variance between the water levels and ground level for the 1% AEP, 1% AEP (including Climate Change), 1% AEP (including a blockage at Lees Bridge) and PMF scenarios ranges from approximately 0.5m to 2.0m as demonstrated by the cross section in Attachment 5.

In order to more accurately assess the risk to life and property associated with the development of the site, an appropriate Flood Planning Level (FPL) is required to be established. The NSW Floodplain Development Manual (FDM) (2005) advises that in most instances, adoption of the PMF as the FPL is inappropriate and can unnecessarily sterilise land, otherwise suitable for development. The FDM further advises that the 1% AEP plus a 0.5m freeboard is an acceptable FPL for residential development.

The velocity of water associated with both the PMF and 1% AEP (subject to further issues analysis) may make it dangerous for overland evacuation. The result of this is that any future population may be isolated in-situ should such an event occur.

The adoption of the 1% AEP as the FPL in this instance is considered consistent with the FDM, however modification of the current concept plan to identify appropriate risk management and mitigation strategies, having regard for the higher risk (but less likely) flood events may be required.

LOCAL PLANS, POLICIES AND STRATEGIES

Wyong Local Environmental Plan 1991 and Wyong Standard Instrument Local Environmental Plan

The subject site is currently zoned 1(c) (Non-urban Constrained Lands) under Wyong LEP 1991. The objectives of this zone are:

(a) *To limit the development of land that may be affected by flooding, coastal erosion, slope, and other physical constraints (including lack of adequate water supply and sewerage), and*
(b) *To prohibit development that is likely to prejudice the present and future environmental quality of the land, and*
(c) *To ensure that development is carried out in a manner that minimises risks from natural hazards and does not detract from the scenic quality.*

Historically, the zoning was generally applied to land with flooding and ecological constraints. However, portions of the site could be considered free of both flooding and ecological constraints and therefore may be able to be zoned in a manner which enables greater development potential.

The site, specifically lots 1, 2 and 3 DP 21536 and Lot 1 DP 1014033 is also subject to Clause 18 – Lot Amalgamations of Wyong LEP 1991. This clause restricts development on the affected land to one dwelling house and further requires that where land is one of a number of adjoining lots within the same locality, the lots must be amalgamated as part of a condition of consent. It is proposed to remove this restriction as part of the rezoning.

Council's Standard Instrument LEP proposes to zone the site a combination of E2 Environmental Conservation and E3 Environmental Management.

Draft Wyong Settlement Strategy 2012

Council's draft Settlement Strategy (SS) was publicly exhibited between 9 January 2013 and 20 February 2013. The SS:

- *Establish*(es) *the strategic direction and framework for the Wyong (Local Government Area) LGA and inform the preparation of Wyong LEP 2012 and Wyong DCP 2012: Development Provisions for Wyong Shire;*
- *Provides a blueprint for the growth of the (Local Government Area) LGA with accessible and reliable transport, a strong regional economy, a vibrant community and a healthy natural environment; and*
- *Provides an analysis of demand, supply and nature of land and identifies where additional land may need to be set aside for residential, business and commercial development while retaining the LGA's enviable natural environment;*

Key planning considerations for the release of future urban land, including infill development as identified by the SS are that it will be:

- Undertaken in an orderly manner and shall be consistent with the timeframes of the North Wyong Shire Structure Plan (NWSSP) and Council's Settlement Strategy;
- Not occur until such time that adequate transportation, utility, community and recreational infrastructure can be guaranteed including matters for consideration identified in Part 6 of Wyong SI LEP;
- Facilitate the creation of social hubs that satisfy the needs of the community, including cultural, educational, health and recreation facilities;
- Incorporate the principles of Healthy Spaces and Places, Crime Prevention Through Environmental Design, and the Universal Design Principles for Accessible Environments;
- Provide for appropriate housing choice. This may be assisted by the incorporating the findings of the Affordable Housing study.

In addition to being considered consistent with the above planning considerations, the site and purpose of the current proposal are identified within the SS as being suitable for further investigation.

It should be noted however that although the draft Settlement Strategy has been endorsed by Council, it has not yet been endorsed by the DoPI.

Development Control Plan (DCP) 2005: Development Controls for Wyong Shire & Draft DCP 2012: Development Provisions for Wyong Shire

Any development of the subject site being undertaken as a result of the rezoning will be required to be consistent with relevant controls of DCP 2005, or pending timing of DCP 2012, in particular, the following Chapters:

DCP 2005	**DCP 2012**
- 61: Car Parking;	- Chapter 2.1: Dwelling Houses and Ancillary Structures
- 66: Subdivision;	- Chapter 2.3: Dual Occupancy Development
- 67: Engineering Requirements for Development;	- Chapter 2.11: Parking and Access
- 69: Controls for Site Waste Management;	- Chapter 3.1: Site Waste Management
- 58: Dual Occupancy Development;	- Chapter 3.2: Water Sensitive Urban Design
- 100: Quality Housing;	- Chapter 3.3: Floodplain Management
- 99: Building Lines;	
- Draft Chapter 97: Water Sensitive Urban Design.	

FEDERAL/STATE LEGISLATION, PLANS, POLICIES AND STRATEGIES

Environment Protection and Biodiversity Conservation Act 1999

Refer to Issues Analysis.

Threatened Species Conservation Act 1995

Refer to Issues Analysis.

Central Coast Regional Strategy

The Central Coast Regional Strategy (CCRS) was released by the DoPI in July 2008. The CCRS identifies the population potential of the Central Coast expected over the next 25 years, and expected employment capacity targets. The strategy also identifies actions to ensure ongoing growth and prosperity of the region, including actions for centres and housing, economy and employment, environment and natural resources, natural hazards, water supply, regional infrastructure and regional transport.

The population potential as expressed by the CCRS is expected to be an additional 71,100 people in the Shire at 2031, distributed through the Shire's Centres Hierarchy as defined by the Strategy. As a Shire, the strategy anticipates that Wyong will be required to create an additional 27,000 jobs. The proposal will generate a significant number of dwellings as infill development; therefore will contribute to achieving the overall target set by the Strategy.

Based on an average occupancy rate of 2.9 persons per dwelling, the current concept plan has the potential to provide for an additional population of 620 persons. Note that this potential additional population is subject to change based on any modifications to the current concept plan.

The proposal has been assessed against the sustainability criteria within the CCRS and in general is consistent with these criteria (see Attachment 6).

Regional Economic Development and Employment Strategy (REDES) 2010

The Regional Economic Development and Employment Strategy (REDES) is a partnership between the NSW Government, Regional Development Australia Central Coast (RDACC), Gosford City Council and Wyong Shire Council.

Whilst the proposal will not directly supply long term employment opportunities, short term opportunities would be created through associated planning and construction work.

Section 117 Directions

The proposal has been assessed against relevant Section 117 Ministerial Directions. The assessment in full is contained within Attachment 7 of this report. The proposal is considered to be consistent with the applicable Directions, subject to the outcomes of a number of further investigations.

The following table provides an overview of the consistency of the proposal against the applicable Section 117 Directions.

Number	Direction	Applicable	Consistent
Employment & Resources			
1.1	Business & Industrial Zones	N	N/A
1.2	Rural Zones	N	N/A
1.3	Mining, Petroleum Production and Extractive Industries	N	N/A
1.4	Oyster Aquaculture	N	N/A
1.5	Rural Lands	N	N/A
Environment & Heritage			
2.1	Environmental Protection Zones	Y	Y
2.2	Coastal Protection	Y	Y
2.3	Heritage Conservation	Y	Y
2.4	Recreation Vehicle Areas	Y	Y
Housing, Infrastructure & Urban Development			
3.1	Residential Zones	Y	Y
3.2	Caravan Parks and Manufactured Home Estates	Y	Y
3.3	Home Occupations	Y	Y
3.4	Integrating Land Use & Transport	Y	Y
3.5	Development Near Licensed Aerodromes	N	N/A
3.6	Shooting Ranges	N	N/A
Hazard & Risk			
4.1	Acid Sulfate Soils	Y	TBA
4.2	Mine Subsidence and Unstable Land	N	N/A
4.3	Flood Prone Land	Y	TBA
4.4	Planning for Bushfire Protection	Y	TBA
Regional Planning			
5.1	Implementation of Regional Strategies	Y	Y
5.2	Sydney Drinking Water Catchments	N	N/A
5.3	Farmland of State and Regional Significance on the NSW Far North Coast	N	N/A
5.4	Commercial and Retail Development along the Pacific Highway, North Coast	N	N/A
5.5	Development in the Vicinity of Ellalong, Paxton and Millfield (Cessnock LGA)	N	N/A
5.6	Second Sydney Airport: Badgerys Creek	N	N/A
Local Plan Making			
6.1	Approval and Referral Requirements	Y	Y
6.2	Reserving Land for Public Purposes	Y	Y
6.3	Site Specific Provisions	N	N/A
Metropolitan Planning			
7.1	Implementation of the Metropolitan Strategy	N	N/A

State Environmental Planning Policies

The proposal has been assessed having regard for relevant State Environmental Planning Policies (SEPPs) as follows:

- SEPP 44 – Koala Habitat
- SEPP 55 – Contaminated Land
- SEPP 71 – Coastal Protection Zone

It is considered that the proposal is consistent with the aims and objectives of the requirements of the above SEPPs. Assessment of the proposal against the relevant SEPPs is detailed in Attachment 8.

OPTIONS

Option 1 – Progression of Proposal as Proposed

This report recommends additional investigative studies are undertaken to assist in the development of a revised concept plan. Presently, it is proposed that such studies are delayed until a Gateway Determination to proceed with the progression of the proposal is received.

In order to provide some level of development and financial certainty for the Proponent, prior to the outlay of funds for these studies to be undertaken, this option is recommended.

Option 2 – Delay Progression until Additional Investigative Studies Completed

As an alternative to Option 1, Council could request additional updated investigative studies to be undertaken by the Proponent prior to a Planning Proposal being forwarded to the DoPI for consideration.

This would result in the potential outlay of funds and time by the Proponent without any certainty being available as to the potential outcomes. This option is therefore not recommended.

Option 3 – Refuse to Progress the Proposal

It is considered that this proposal has strategic merit, subject to the outcomes of further investigations and assessment.

This option is therefore not recommended

STRATEGIC LINKS

Wyong Shire Council Strategic/ Annual Plan

The proposal is consistent with Wyong Shire Council's Strategy Annual Plan.

Long term Financial Strategy and Asset Management Strategy

A significant portion of the site has been identified as being suitable for conservation purposes.

In the past, Council has identified that areas of significant conservation value should be transferred into Council ownership. This practice however has resulted in a significant financial burden for its upkeep, therefore is not recommended in this instance.

Subject to a positive determination being received from the Gateway, the Proponent will be requested to further investigate additional management options for any environmentally significant land.

Link to Community Strategic Plan (CSP) (2030)

The proposal can be directly linked to the following objectives of the plan:

1. Communities will be vibrant, caring and connected with a sense of belonging and pride in their local neighbourhood.
   (e) Developing and implementing the Wyong Shire-wide Settlement Strategy.

3. Communities will have access to a diverse range of affordable and coordinated facilities, programs and services.
   (f) Maximise the access to, and potential for, new and existing facilities/infrastructure to support growth.

4. Areas of natural value in public and private ownership will be enhanced and retained to a high level in the context of ongoing development.
   (a) Preserving threatened and endangered species as well as ecological communities and biodiversity.
   (c) Ensuring all development areas create or maintain tree covered ridgelines and waterways

The CSP identifies a number of Essential Services which must be provided. These are delivered by Council through a number of Principal Activity Areas. The assessment of the impacts of land use strategies and rezonings is incorporated within the Environment and Land Use 'Principal Activity Area' which aims to *support(s)the natural and built environment on both private and public land. This is done by providing strategic planning and policy as well as controls over land-use in order to maintain a high quality of life and natural environment. Through this activity Council seeks to promote sustainable use of natural resources on the Central Coast*.

Budget Impact

There are no immediate budget impacts, as progress of the Planning Proposal is being funded by the requisite accompanying Phase 1 fee. Further assessment work conducted by Council will be funded by the proponent.

CONSULTATION

The proposal was referred to the following internal Council units for comment:

- Development Assessment - Design Engineering
- Floodplain and Stormwater Management - Hydrology
- Strategic Development – Ecology
- Strategic Development - Bushfire
- Strategic Development – Transportation Engineering
- Strategic Development – Planning
- Strategic Development – Section 94
- Water and Sewer Planning

Those comments received were utilised to assess the proposal and determine the need for additional investigative studies.

Future community and government agency consultation requirements will be outlined by the Gateway Determination, should the proposal be supported.

GOVERNANCE AND POLICY IMPLICATIONS

Refer to discussion relating to Local Plans, Policies and Strategies

MATERIAL RISKS AND ISSUES

The assessment of the proposal has been undertaken having regard for the requirements of relevant and current legislation, regulations, assessment/survey methodologies, mapping and modelling (including available baseline information), demographics and best practices. This assessment is considered to fulfil Council's requirements under Section 733 of the *Local Government Act* 1993.

CONCLUSION

Having regard for the assessment of the proposal, it is recommended that a Planning Proposal be prepared to initiate the rezoning of Lots 1-3 DP 21536, Lot 1 DP 134363, Lot 1 DP 1014033, Lot 1 DP 22467 and Lots 10-11 DP 1177776 from 1(c) Non-Urban Constrained Lands to enable residential development and conservation. It is also recommended that the Planning Proposal address the lot amalgamation provision currently affecting the subject site.

Revision to the current concept plan may be required to be undertaken which reflects the findings of a number of additional investigative studies to be completed at the expense of the Proponent, should the proposal receive support from Council and the Gateway.

ATTACHMENTS

1	Locality Plan	Enclosure	D03455913
2	Draft Concept Plan	Enclosure	D03455914
3	1% AEP Floodwater Depths and Velocities	Enclosure	D03455916
4	PMF Floodwater Depths and Velocities	Enclosure	D03455917
5	Site Cross Section Showing Indicative Flooding Levels		D03476964
6	CC Regional Strategy Sustainability Criteria Assessment	Enclosure	D03455918
7	Section 117 Ministerial Directions Assessment	Enclosure	D03455919
8	State Environmental Planning Policy Assessment	Enclosure	D03455920

7/05/2013 jlmewing

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Wyong Shire Council
CENTRAL COAST

MAP EXTRACT

Scale 1:10000

Note: Data is not survey accurate.
Scale is representation only.

Projection: Transverse Mercator
Projected Co-Ordinate System: GDA_1994_MGA_Zone56
Geographic Co-Ordinate System: GCS_GDA_1994

Disclaimer

Base Cadastre is part of the Digital Cadastral Database supplied by the NSW Land and Property Management Information (LPI), a division of the Department of Finance and Services. Any person whose legal rights may be affected, or intends to act on any cadastral information shown on this plan should verify such information by consulting the LPMA before so acting.

Michael Whittaker
General Manager

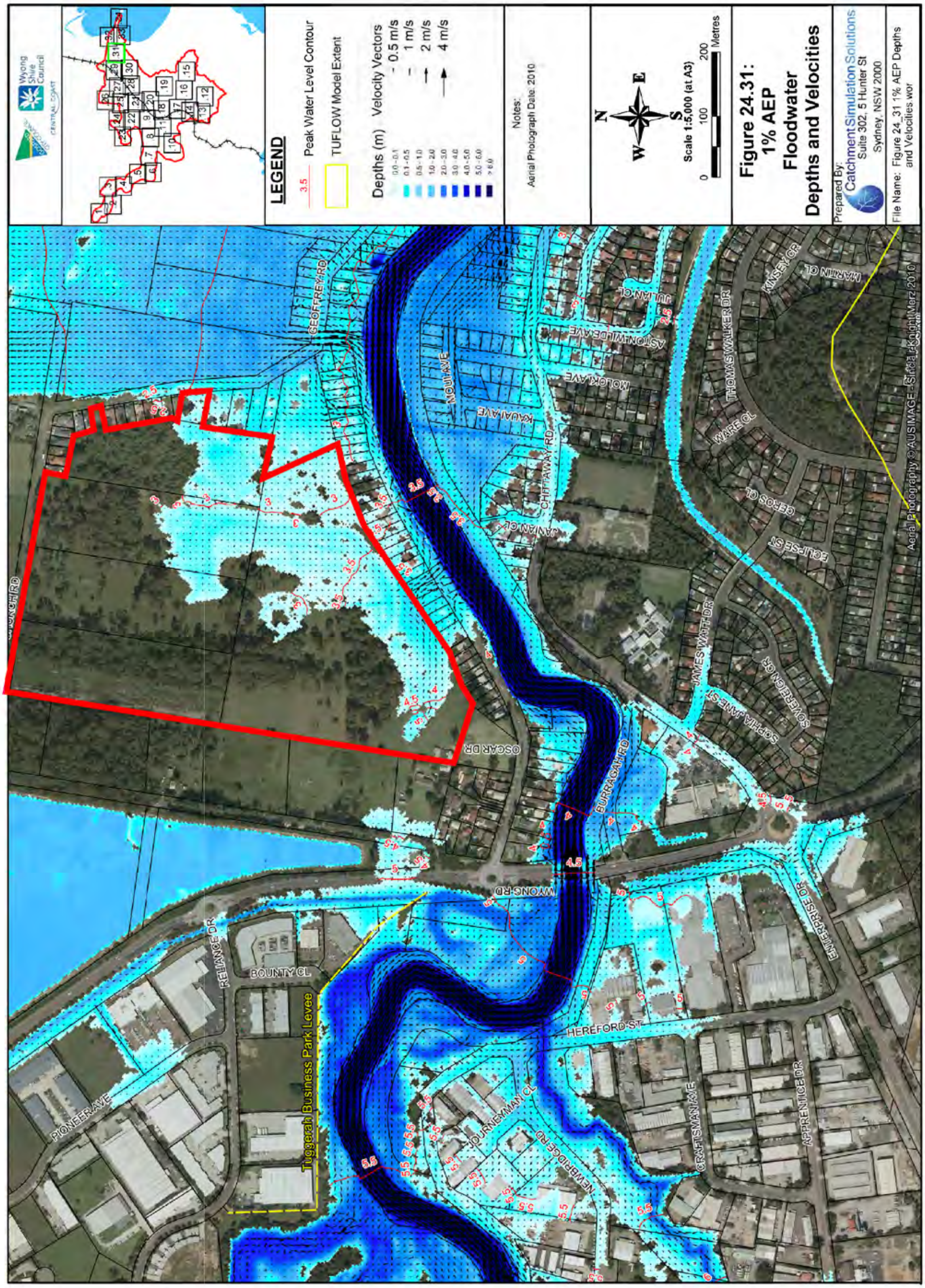
STAGE 1 - CONCEPT MASTERPLAN
Geoffrey Road, Chittaway Bay

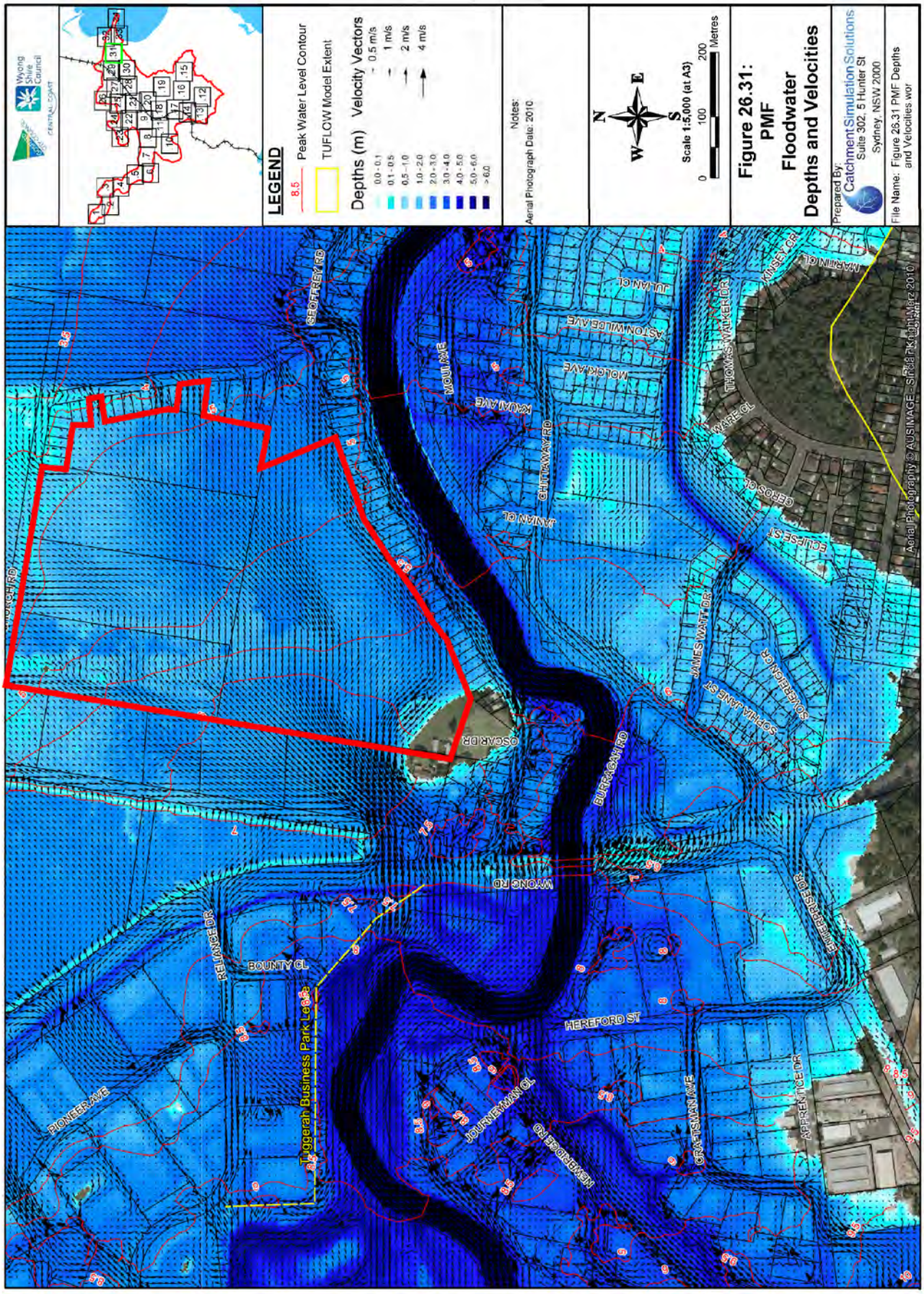
0 10 50 100 250

N

Date: 02 December, 2011 Scale 1 : 3000 @ A3 Project No: 11.040 Sheet: 1/1

THE DESIGNPARTNERSHIP
21 Justfute Drive West Gosford PO Box 6325 West Gosford NSW 2250 T - 02 43 24 3533 F - 02 43 226379 E - info@thedesignpartnership.com.au


LEGEND
Peak Water Level Contour
TUFLOW Model Extent
Depths (m)
Velocity Vectors
0.5 m/s
1 m/s
2 m/s
4 m/s
Notes:
Aerial Photograph Date: 2010
Scale 1:5,000 (at A3)
Metres
Figure 24.31:
1% AEP
Floodwater
Depths and Velocities
Prepared By:
Catchment Simulation Solutions
Suite 302, 5 Hunter St
Sydney, NSW 2000
File Name: Figure 24_31 1% AEP Depths and Velocities.wor
Tuggerah Business Park Levee


LEGEND
8.5 Peak Water Level Contour
TUFLOW Model Extent
Depths (m) Velocity Vectors
0.0 - 0.1
0.1 - 0.5
0.5 - 1.0
1.0 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
5.0 - 6.0
> 6.0
0.5 m/s
1 m/s
2 m/s
4 m/s
Notes:
Aerial Photograph Date: 2010
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Scale 1:5,000 (at A3)
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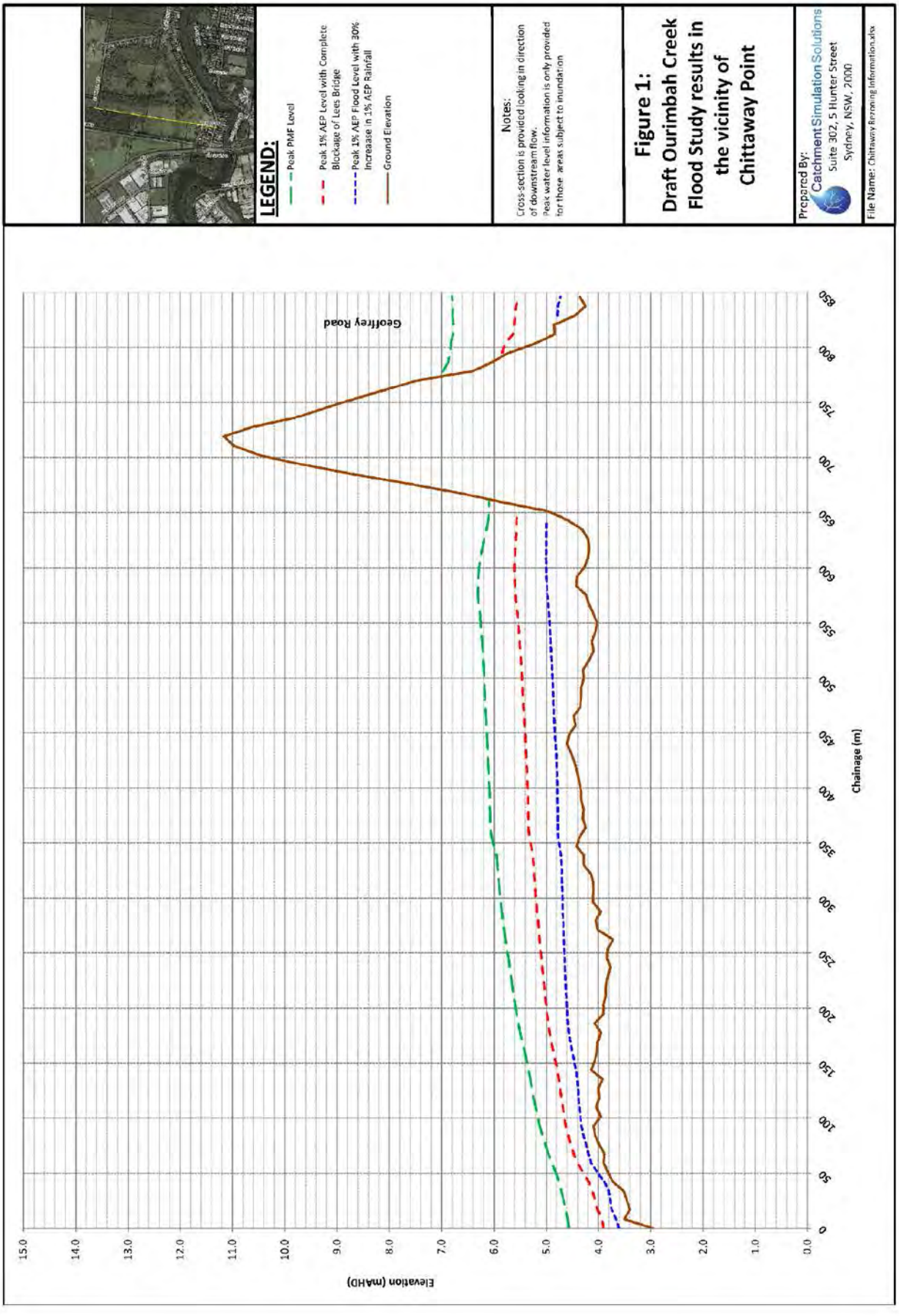
Metres
Figure 26.31:
PMF
Floodwater
Depths and Velocities
Prepared By:
CatchmentSimulationSolutions
Suite 302, 5 Hunter St
Sydney, NSW 2000
File Name: Figure 26.31 PMF Depths and Velocities.wor
Aerial Photography © AUSIMAGE - Sinclair Knight Merz 2010
Tuggerah Business Park Lease
BOUNTY CL
RELIANCE DR
PIONEER AVE
HEREFORD ST
JOURNEYMAN CL
CRAFTSMAN AVE
APPRENTICE DR
NEWBRIDGE RD
WYONG RD
BURRAGH RD
OSCAR DR
GEOFFREY RD
MOUI AVE
KAUAI AVE
MOLOKAI AVE
ASTON WILDE AVE
JULIAN CL
CHITTAWAY RD
JANIAN CL
THOMAS WALKER DR
WHARF CL
KINSEY CR
MARTIN CL
ECLIPSE ST
GEMINI CL
SOLAR RIDGE DR
SOPHIA JANE ST
JAMES WATT DR
EMERALD TERRACE DR


LEGEND:
Peak PMF Level
Peak 1% AEP Level with Complete Blockage of Lees Bridge
Peak 1% AEP Flood Level with 30% Increase in 1% AEP Rainfall
Ground Elevation
Notes:
Cross-section is provided looking in direction of downstream flow.
Peak water level information is only provided for those areas subject to inundation
Figure 1:
Draft Ourimbah Creek Flood Study results in the vicinity of Chittaway Point
Prepared By:
Catchment Simulation Solutions
Suite 302, 5 Hunter Street
Sydney, NSW, 2000
File Name: Chittaway Rezoning Information.xlsx
Geoffrey Road
Elevation (mAHD)
Chainage (m)

Sustainability Criteria for New Land Release – Central Coast Regional Strategy

Criteria	Requirements	Consistency (Y/N)	Comment
Infrastructure Provision Mechanisms in place to ensure utilities, transport, open space and communication are provided in a timely and efficient way.	Development is consistent with the CCRS, the relevant residential strategy, North Wyong Structure Plan (NWSSP), applicable regional infrastructure plan, Metropolitan Strategy and relevant section 117 directions. The provision of infrastructure (utilities, transport, open space and communications) is costed and economically feasible based on government methodology for determining infrastructure contribution. Preparedness to enter into development agreement	Y	The proposal is considered consistent with the CCRS and is expected to be able to be consistent with relevant s117 Directions, subject to additional studies/reports being prepared. The site is within an area with adequate water supply, sewerage, electricity and communications infrastructure and will only require minor augmentation of services.
Access Accessible transport options for efficient and sustainable travel between homes, jobs, services and recreation to be existing or provided.	Accessibility of the area by public transport and appropriate road access in terms of: Location/land use: to existing networks and related activity centres. Network: the areas potential to be serviced by economically efficient public transport services. Catchment: the area's ability to contain or form part of the larger urban area which contains adequate transport services. Capacity for land use/transport patterns to make a positive contribution to achievement of travel and vehicle use goals No net negative impact on performance of existing sub regional road, bus, rail, ferry and freight management.	Y	The planning proposal identifies an infill residential development within an existing residential area. Access is available to Church Road on the northern and eastern side of the site and flood free access is available to Geoffrey Road which then provides access to Wyong Road at an existing major roundabout. The proposal is located in close proximity to local schools, shops, recreation facilities and other services within a 2.5km radius. The proposal is located in close proximity to public transport stops for public transport services, in particular the close proximity to

Criteria	Requirements	Consistency (Y/N)	Comment
			public transport routes along Wyong Road.
Housing Diversity Provide a range of housing choices to ensure a broad population can be housed.	Contributes to the geographic market spread of housing supply, including any government targets established for housing for the aged or disabled or affordable housing.	Y	The development will provide new housing opportunities in an area which has almost no spare housing capacity and will therefore contribute significantly to geographic market spread
Employment Lands Provide regional/local employment opportunities to support the Central Coast's expanding role in the wider regional and NSW economies.	Maintains or improves the existing level of subregional employment self containment. Meets subregional employment capacity targets.	Y	The subject site is in close proximity to existing local employment opportunities such as local schools, shops and Business Parks. The proposed site is located in close proximity to existing employment areas (Tuggerah Business Park and Berkeley Vale Industrial Area). Other major employment land such as the Wyong Employment Zone is located within 10km of the subject site. The rezoning is a residential infill close to existing employment areas and is not appropriate for employment uses as it directly adjoins existing residential development to the east and south.
Avoidance of Risk Land use conflicts and risk to human health and life is avoided.	Where relevant, available safe evacuation route (flood and bushfire). No residential development within the 1:100 floodplain.	Y	The site of the proposal is constrained by risks associated with bushfire and flooding. By modifying the proposal concept to avoid these areas, and by undertaking further risk

Criteria	Requirements	Consistency (Y/N)	Comment
	Avoidance of physically constrained land. High Slope Highly erodible Avoidance of land use conflicts with adjacent, existing or future land use and rural activities planned under the Regional Strategy.		management plans, the proposal can be consistent with this criterion. The proposal is not considered to be significantly affected by the odours produced from the Wyong South Sewerage Treatment Plant.
Natural Resources Natural resource limits are not exceeded/environmental footprint minimised.	Demand for water does not place unacceptable pressure on infrastructure capacity to supply water and environmental flows. Demonstrates most efficient/suitable use of land Avoids identified significant agricultural land Avoids impacts on productive resource lands, extractive industries, coal, gas and other mining, fishing and aquaculture. Demand for energy does not place unacceptable pressure on infrastructure capacity to supply energy. Requires demonstration of efficient and sustainable supply solution.	Y	The proposal will be serviceable by existing water supply infrastructure. The proposal is not utilising land which would be better suited to other land uses such as agriculture and advice from the Mine Subsidence Board does not indicate that there are current or future plans for mineral extraction in the locality. Future dwelling construction will need to comply with Council policies, State policy and other legislation to ensure more sustainable utilisation of energy and water and place greater reliance on more sustainable options such as solar. The proposed rezoning does not impact on the sustainable use of water, agricultural land or energy supply infrastructure.
Environment Protection Protect and enhance biodiversity, air quality,	Consistent with the approved Regional Conservation Plan. Maintains or improves areas of regionally significant terrestrial and aquatic biodiversity. This includes regionally	Y	A Regional Conservation Plan has not been released. The flora and fauna study prepared for the

Criteria	Requirements	Consistency (Y/N)	Comment
heritage and waterway health.	significant vegetation communities, critical habitat, threatened species, populations, ecological communities and their habitat. Maintains or improves existing environmental conditions for air quality. Maintains or improves existing environmental conditions for water quality and quantity. Consistent with community water quality objectives for recreational water use and river health. Consistent with catchment and stormwater management planning. Protects areas of Aboriginal cultural heritage values.		proposal indicates there is no significant impact to the vegetation/fauna on site. The site is partially cleared and contains isolated pockets of known habitat and can be developed without impact on regional biodiversity. Further studies will be required in relation to environmental offset justification, , Acid Sulfate Soils and Contaminated Land and Stormwater and Drainage should the proposal be supported. The subject site is not known to contain and areas or objects of Aboriginal cultural significance.
Quality and Equity in Services Quality health, education, legal, recreational, cultural and community development and other government services are accessible.	Available and accessible services.	Y	It is considered that the proposal is provided with adequate available and accessible services. As infill development in an established area the proposal will make use of available capacity in existing services.

Section 117 Ministerial Directions Assessment

Direction	Comment
Employment & Resources	
1.1 Business & Industrial Zones	
Aims to encourage employment growth in suitable locations, protect employment land in business and industrial zones and to support the viability of identified strategic corridors. Applies when a planning proposal affects land within an existing or proposed business or industrial zone.	Not Applicable. The proposal does not affect land within an existing or proposed business or industrial zone.
1.2 Rural Zones	
Aims to protect the agricultural production value of rural land. Applies when a planning proposal affects land within an existing or proposed rural zone.	Not Applicable. The proposal does not affect land within an existing or proposed rural zone. Whilst the site is zoned 1(c) Non-urban constrained lands, the site is not considered to be a rural zone. The objectives of this zone are not consistent with those of a rural zone.
1.3 Mining, Petroleum Production and Extractive Industries	
Aims to ensure that the future extraction of State or regionally significant reserves of coal, other minerals, petroleum and extractive materials are not compromised by inappropriate development. Applies when a planning proposal would have the effect of prohibiting the mining of coal or other minerals, production of petroleum, or winning or obtaining of extractive materials, or restricting the potential of development resources of coal, other mineral, petroleum or extractive materials which are of State or regional significance by permitting a land use that is likely to be incompatible with such development.	Not Applicable. The proposal does not seek to prohibit mining of coal, other minerals, petroleum and extractive materials or restrict potential development of coal, other minerals, petroleum and extractive materials.
1.4 Oyster Aquaculture	
Aims to ensure that Priority Oyster Aquaculture Areas and oyster aquaculture outside such an	Not Applicable.

Direction	Comment
area are adequately considered, and to protect Priority Oyster Aquaculture Areas and oyster aquaculture outside such an area from land uses that may result in adverse impacts on water quality and the health of oysters and consumers. Applies when a planning proposal could result in adverse impacts on a Priority Oyster Aquaculture Areas or current oyster aquaculture lease in the national parks estate or results in incompatible use of land between oyster aquaculture in a Priority Oyster Aquaculture Area or current oyster aquaculture lease in the national parks estate and other land uses.	The Planning Proposal is not located in Priority Oyster Aquaculture Areas and oyster aquaculture outside such an area as identified in the *NSW Oyster Industry Sustainable Aquaculture Strategy* (2006)
1.5 Rural Lands	
Aims to protect the agricultural production value of rural land; and facilitate the orderly and economic development of rural lands for rural and related purposes. Applies to local government areas to which State Environmental Planning Policy (Rural Lands) 2008 applies and prepares a planning proposal that affects land within an existing or proposed rural or environment protection zone.	Not Applicable. This direction does not apply to the Wyong LGA.
Environment & Heritage	
2.1 Environmental Protection Zones	
Aims to protect and conserve environmentally sensitive areas. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The site of the proposal is zoned 1(c) Non-urban constrained land. An objective of this zone is *To prohibit development that is likely to prejudice the environmental quality of the land*. The proposal seeks to modify the land by rezoning it to residential, enabling higher density development than permitted under the current zoning. It is considered that modification of the proposal to avoid development of sensitive land results in the proposal being consistent with this Direction.

Direction	Comment
2.2 Coastal Protection	
Aims to implement the principles in the NSW Coastal Policy. Applies when a planning proposal applies to land in the coastal zone as defined in the *Coastal Protection Act* 1979.	Applicable. The proposal has been identified as being within the Coastal Zone. The proposal seeks a zoning amendment to Wyong LEP 1991 or Wyong Council SI (timing dependant). Given these plans are consistent with the principles with the NSW Coastal Policy; it is considered that this proposal is consistent with this Direction.
2.3 Heritage Conservation	
Aims to conserve items, areas, objects and places of environmental heritage significance and indigenous heritage significance. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The proposal does not identify an impact on any European or Indigenous heritage items or objects. It is therefore considered that the proposal is consistent with this Direction.
2.4 Recreational Vehicle Areas	
Aims to protect sensitive land or land with significant conservation values from adverse impacts from recreational vehicles. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The proposal does not seek to enable development for recreational vehicle use. It is therefore considered that the proposal is consistent with this Direction.
Housing, Infrastructure and Urban Development	
3.1 Residential Zones	
Aims to encourage a variety and choice of housing types to provide for existing and future housing needs, to make efficient use of existing infrastructure and services and ensure that new housing has appropriate access to infrastructure and services, and to minimise the impact of residential development on the environmental and resource lands. Applies when a planning proposal affects land	Applicable. The proposal seeks to rezone the site for residential purposes. The proposal is considered as infill development. It is located in close proximity to existing residential areas, therefore is able to access and augment existing services and infrastructure for any new dwellings constructed. This is confirmed by comments received during consultation with

Direction	Comment
within an existing or proposed residential zone, and any other zone in which significant residential development is permitted or proposed to be permitted.	Council's Design and Transport Engineers. It is therefore considered that the proposal is consistent with this Direction.
3.2 Caravan Parks and Manufactured Home Estates	
Aims to provide for a variety of housing types and provide opportunities for caravan parks and manufactured home estates. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The planning proposal does not seek to rezone land to provide for caravan parks or manufactured home estates It is therefore considered that the proposal is consistent with this Direction.
3.3 Home Occupations	
Aims to encourage the carrying out of low impact small business in dwelling houses. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The proposal does not seek to prohibit home occupations. It is therefore considered that the proposal is consistent with this Direction.
3.4 Integrating Land Use & Transport	
Aims to ensure that urban structures, building forms, land use locations, development designs, subdivision and street layouts to achieve: improving access to housing, jobs and services by walking, cycling and public transport; increasing choice of available transport and reducing transport on cars; reducing travel demand; supporting efficient and viable public transport services; and provide for efficient movement of freight. Applies when a planning proposal creates alters or moves a zone or provision relating to urban land, including land zoned for residential, business, industrial, village or tourist purposes.	Applicable. It is considered that the proposal is consistent with the aims, objectives and principles of Improving Transport Choice – Guidelines for Transport and Development. The site of the proposal is considered as an infill site and located in close proximity to local schools, shops, recreation facilities and other services. It is therefore considered that the proposal is consistent with this Direction.
3.5 Development Near Licensed Aerodromes	
Aims to ensure the effective and safe operation of aerodromes, their operation is not compromised by development which constitutes an obstruction, hazard or potential hazard to aircraft flying in the vicinity, development for residential purposes or	Not Applicable. The proposal does not seek to create, alter or remove a zone or provision relating to land in the vicinity of a licensed aerodrome.

Direction	Comment
human occupation (within the ANEF contours between 20 & 25) incorporates appropriate mitigation measures so that the development is not adversely affected by aircraft noise. Applies when a planning proposal creates, alters or removes a zone or provision relating to land in the vicinity of a licensed aerodrome.	
3.6 Shooting Ranges	
Aims to maintain appropriate levels of public safety and amenity when rezoning land adjacent to an existing shooting range, to reduce land use conflict arising between existing shooting ranges and rezoning of adjacent land, and to identify issues that must be addressed when giving consideration to rezoning land adjacent to an existing shooting range. Applies when a relevant planning authority prepares a planning proposal that will affect, create, alter or remove a zone or a provision relating to land adjacent to and/ or adjoining an existing shooting range.	Not Applicable. The proposal is does not propose to affect, create, alter or remove a zone or a provision relating to land adjacent to and/ or adjoining an existing shooting range.
Hazard & Risk	
4.1 Acid Sulfate Soils	
Aims to avoid significant adverse environmental impacts from the use of land that has a probability of containing acid sulfate soils. Applies when a planning proposal applies to land having a probability of containing acid sulfate soils on the Acid Sulfate Soils Planning Maps.	Applicable. A desktop mapping exercise has identified that the site contains Class 2, 3, 4 and 5 acid sulfate soils. Subject to the endorsement of the proposal by Council and the Gateway, the proponent will be required to undertake an acid sulfate soil assessment of the site. By undertaking these investigations, it is considered that the proposal will be able to consistent with this Direction.
4.2 Mine Subsidence & Unstable Land	

Direction	Comment
Aims to prevent damage to life, property and the environmental on land identified as unstable or potentially subject to mine subsidence. Applies when a planning proposal permits development on land which is within a mine subsidence district, or identified as unstable in a study or assessment undertaken by or on behalf of the relevant planning authority or other public authority and provided to the relevant planning authority.	Not Applicable. The site of the proposal is not located within a mine subsidence district.
4.3 Flood Prone Land	
Aims to ensure: development on flood prone land is consistent with NSW Government's Flood Prone Land Policy and principles of the Floodplain Development Manual 2005; and provisions of an LEP on flood prone land are commensurate with flood hazard and include consideration of the potential flood impacts both on and off the subject land. Applies when a planning proposal creates, removes or alters a zone or provision that affects flood prone land.	Applicable. The site of the proposal is identified as being flood prone land. Flood modelling undertaken by the proponent identifies that a revised development footprint and minor filling will enable the proposal to proceed with minimal risk to life and property. Subject to endorsement by Council and the Gateway, the Proponent will be required to prepare a Flood Risk Management Plan which identifies appropriate mitigation strategies to manage risk associated with higher risk (and less likely) flood events. By undertaking the above, it is considered that the proposal will be able to consistent with this Direction.
4.4 Planning for Bushfire Protection	
Aims to protect life, property and the environment from bushfire hazards, and encourage sound management of bushfire prone areas. Applies when a planning proposal affects or is in proximity to land mapped as bushfire prone land.	Applicable. The site of the proposal contains Category 2 bushfire prone vegetation and bushfire buffer zones. Subject to endorsement by Council and the Gateway, the Proponent will be required to undertake a bushfire assessment of the proposal, Bushfire Risk Management Plan which may require modification to the current concept plan. By undertaking the above, it is considered that

Direction	Comment
	the proposal will be able to consistent with this Direction.
Regional Planning	
5.1 Implementation of Regional Strategies	
Aims to give legal effect to the vision, land use strategy, policies, outcomes and actions contained within regional strategies. Applies when the relevant planning authority prepares a planning proposal that is located on land addressed within the Far North Regional Strategy, Lower Hunter Regional Strategy, Central Coast Regional Strategy, Illawarra Regional Strategy & South Coast Regional Strategy.	Applicable. The proposal is considered to be consistent with the Central Coast Regional Strategy. It is therefore considered that the proposal is consistent with this Direction.
5.2 Sydney Drinking Water Catchments	
Aims to protect water quality in the hydrological catchment. Applies when a relevant planning authority prepares a planning proposal that applies to Sydney's hydrological catchment.	Not Applicable. The proposal is not located within Sydney's hydrological catchment.
5.3 Farmland of State and Regional Significance on the NSW Far North Coast	
Aims to: ensure that the best agricultural land will be available for current and future generations to grow food and fibre; provide more certainty on the status of the best agricultural land, assisting councils with strategic settlement planning; and reduce land use conflict arising between agricultural use and non-agricultural use of farmland caused by urban encroachment into farming areas. Applies to Ballina, Byron, Kyogle, and Tweed Shire Councils, Lismore City Council and Richmond Valley Council.	Not Applicable. The proposal is not located within the Far North Coast Region.
5.4 Commercial and Retail Development along the Pacific Highway, North Coast	
Aims to manage commercial and retail development along the Pacific Highway, North Coast.	Not Applicable. The proposal is not located between Port

Direction	Comment
Applies to all councils between and inclusive of Port Stephens and Tweed Shire Councils.	Stephens and Tweed Shire Councils.
5.8 Second Sydney Airport: Badgerys Creek	
Aims to avoid incompatible development in the vicinity of any future second Sydney Airport at Badgerys Creek. Applies to land located within the Fairfield, Liverpool and Penrith City Council and Wollondilly Shire Council Local Government Areas.	Not Applicable. The proposal is not located within the Fairfield, Liverpool and Penrith City Council or Wollondilly Shire LGA.
Local Plan Making	
6.1 Approval and Referral Requirements	
Aims to ensure that LEP provisions encourage the efficient and appropriate assessment of development. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The planning proposal does not seek to include provisions which require concurrence from other agencies. It is therefore considered the proposal is consistent with this Direction.
6.2 Reserving Land for Public Purposes	
Aims to facilitate the provision of public services and facilities by reserving land for public purposes, and facilitate the removal of reservations of land for public purposes where land is no longer required for acquisition. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The proposal does not seek to alter or create land for public purposes. It is therefore considered the proposal is consistent with this Direction.
6.3 Site Specific Provisions	
Aims to discourage unnecessarily restrictive site specific planning controls. Applies when the relevant planning authority prepares a planning proposal to allow particular development to be carried out.	Not Applicable. The proposal does not seek to enable a specific use on the site which is not permissible under the proposed zone (2(a) Residential or R2 Low Density Residential). It is therefore considered the proposal is consistent with this Direction.

Direction	Comment
Metropolitan Planning	
7.1 Implementation of the Metropolitan Strategy	
Aims to give legal effect to the vision, land use strategy, policies, outcomes and actions contained in the Metropolitan Strategy. Applies when the planning authority within a Metropolitan Local Government Area prepares a planning proposal.	Not Applicable. This Direction does not apply to Wyong LGA.

State Environmental Planning Policy Assessment

SEPP	Comment
SEPP No. 44 – Koala Habitat	
Aims to encourage the proper 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 reverse the current trend of koala population decline: (a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and (b) by encouraging the identification of areas of core koala habitat, and (c) by encouraging the inclusion of areas of core koala habitat in environment protection zones	The flora and fauna report submitted by the Proponent identified that a targeted koala survey was undertaken as part of the investigation of the site. Only one food species tree was identified (*Eucalyptus robusta*) and there were no actual or indicative (scats, scratches etc) or sightings of koalas on the subject site.
SEPP No. 55 – Contaminated Land	
Aims: to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment (a) by specifying when consent is required, and when it is not required, for a remediation work, and (b) by specifying certain considerations that are relevant in rezoning land and in determining development applications in general and development applications for consent to carry out a remediation work in particular, and (c) by requiring that a remediation work meet certain standards and notification requirements.	Whilst the preliminary desktop mapping/ assessment exercise has not identified any contamination of the site, this issue still requires formal assessment. Should the proposal proceed beyond a Gateway determination, the proponent will be required to undertake a contaminated land assessment to comply with the provisions of this SEPP.
SEPP No. 71 Coastal Protection	
Aims: (a) to protect and manage the natural, cultural, recreational and economic attributes of the	The proposal is consistent with the aims and objectives of the SEPP 71 Policy. The proposal seeks to enable additional

SEPP	Comment
New South Wales coast, and (b) to protect and improve existing public access to and along coastal foreshores to the extent that this is compatible with the natural attributes of the coastal foreshore, and (c) to ensure that new opportunities for public access to and along coastal foreshores are identified and realised to the extent that this is compatible with the natural attributes of the coastal foreshore, and (d) to protect and preserve Aboriginal cultural heritage, and Aboriginal places, values, customs, beliefs and traditional knowledge, and (e) to ensure that the visual amenity of the coast is protected, and (f) to protect and preserve beach environments and beach amenity, and (g) to protect and preserve native coastal vegetation, and (h) to protect and preserve the marine environment of New South Wales, and (i) to protect and preserve rock platforms, and (j) to manage the coastal zone in accordance with the principles of ecologically sustainable development (within the meaning of section 6 (2) of the Protection of the Environment Administration Act 1991), and (k) to ensure that the type, bulk, scale and size of development is appropriate for the location and protects and improves the natural scenic quality of the surrounding area, and (l) to encourage a strategic approach to coastal management.	residential development within an existing residential area. In enabling additional population in the Shire, this is consistent as being described as infill development. The proposal does not affect access to and along coastal foreshores, nor is the site affected in a significant manner by coastal processes such as erosion. The proposal enables the protection of flora and fauna. Given the existing residential style development adjacent to the subject site, it is not considered that an increased density will adversely affect the scenic nature of the environment, particularly if the proposed scale of the development is reduced. Any progression of the proposal will be required to manage stormwater consistent with Council policy including draft Chapter 97 – Water Sensitive Urban Design.

Minutes

3.1 RZ/7/2009 - Proposed Rezoning - 19-23 Geoffrey Road, Chittaway Point

Councillor Taylor declared a non-pecuniary insignificant interest in the matter for the reason that the applicant is a family friend and participated in consideration of this matter.

Councillor Taylor stated:

> *"I choose to remain in the chamber and participate in discussion and voting as the conflict has not influenced me in carrying out my public duty."*

Mr Ian Adams, representing Paradigm Planning and Development Consultants Pty Ltd , addressed the meeting at 5.05 pm, answered questions and retired at 5.09 pm.

RESOLVED unanimously on the motion of Councillor BEST and seconded by Councillor NAYNA:

1 That Council prepare a Planning Proposal to amend Wyong Local Environmental Plan, 1991, (or pending timing, Wyong Standard Instrument Local Environmental Plan) pursuant to Section 55 of the Environmental Planning and Assessment (EP & A) Act, 1979, to enable residential development and environmental conservation/management.

2 That Council forward the Planning Proposal to the Department of Planning and Infrastructure (DoPI) accompanied by a request for a "Gateway Determination", pursuant to Section 56 of the EP & A Act, 1979.

3 That Council request the General Manager to apply to accept plan making delegations for the rezoning.

4 That Council require, subject to the "Gateway Determination," the proponent enter into a Funding Agreement with Council in accordance with Council's Planning Proposal Procedure to recover the costs involved in further progressing the proposal.

5 That Council authorise the General Manager (or delegate) to sign the Funding Agreement.

6 That Council note that additional information will need to be submitted prior to proceeding to public exhibition/consultation.

7 That Council undertake community and government agency consultation, in accordance with the requirements attached to the "Gateway Determination".

8 That Council consider a further report on results of community consultation.

FOR:	COUNCILLORS BEST, EATON, GRAHAM, GREENWALD, MATTHEWS, NAYNA, TAYLOR, TROY, VINCENT AND WEBSTER
AGAINST:	NIL

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WYONG SHIRE COUNCIL
building a better tomorrow!

CENTRAL COAST

Mark Greer/KC
25 June 2009

Paradigm Planning & Development Consultants Pty Lt
PO Box 4034
RATHMINES NSW 2283

COPY

Development Application Notice of Determination

Issued under the Environmental Planning and Assessment Act 1979
Sections 80, 80A & 81 (1)(a)

Development Application No:	DA/1406/2008
Property Address:	Lot 1 DP 134363 & Lot 43 DP 23810 19-27 Geoffrey Road, CHITTAWAY POINT NSW 2261
Description of Development:	Subdivision of 2 lots into 10 lots
Determination:	Approved
Determination Date:	24 June 2009
Consent to Operate From:	24 June 2009
Consent to Lapse On:	24 June 2011

Conditions

Approved Plans

1 The development is to be undertaken in accordance with the approved development plans and specifications, reference number 17030 except as modified by any conditions of consent and any amendments in red.

Certificates/Engineering Details

2 Prior to the issue of the Construction Certificate, the applicant must apply under Section 305 of the Water Management Act 2000 to Council as the Water Supply Authority for any works and contributions required for the obtaining of a Section 307 Certificate of Compliance. Note for a single dwelling the payment of the required plumbing and drainage inspection fees satisfies the requirements of the Water Management Act.

3 The submission to the Consent Authority of an application for a Subdivision Construction Certificate or for approval of designs for civil engineering works where Council is nominated as the Principal Certifying Authority or where approvals are required from Council as the Roads or Water Supply Authority.

4 A Construction Certificate is to be issued by the Principal Certifying Authority prior to commencement of any works. The application for this Certificate is to satisfy all of the requirements of the Environmental Planning and Assessment Regulation 2000.

Dilapidation

5 The applicant must supply the Consent Authority with a dilapidation report for the adjoining properties, which documents and photographs the condition of buildings and improvements. The report must be submitted to the Consent Authority prior to issue of a Construction Certificate and will be made available by the Consent Authority in any private dispute between the neighbours regarding damage arising from site and construction works.

6 A dilapidation report must be submitted to Council as the Roads Authority prior to the commencement of any works. The report must document and provide photographs that clearly depict any existing damage to the road, kerb, gutter, footpath, driveways, water supply, sewer works, street trees, street signs or any other Council assets in the vicinity of the development.

Other Requirements

7 The relocation of any underground or above ground services are to be undertaken by the developer subject to consultation with appropriate authorities. All works are the responsibility and cost of the developer. Engineering plans are to be submitted to Council prior to the issue of the Construction Certificate and include identification of service relocation and include approvals from appropriate authorities.

Erosion and Sediment Control – Building Sites

8 Prior to the issue of a Construction Certificate, the submission to the Principal Certifying Authority of design plans for the control of soil erosion on the site and the prevention of silt discharge into drainage systems and waterways in accordance with Council's Policy E1 - Erosion and Sediment Control from Building Sites or "Soils and Construction – Managing Urban Stormwater" (Blue Book) The design plans must be approved by the Principal Certifying Authority or an appropriately Accredited Certifier prior to issue of the Construction Certificate.

Filling and Haulage

9 Prior to the issue of a Construction Certificate, the submission to and approval by the Consent Authority of details for the disposal of any spoil gained from the site and / or details of the source of fill, heavy construction materials and proposed routes to and from the site.

Roads

10 Separate approval from the Roads Authority must be obtained under the Roads Act 1993 prior to the issue of a Construction Certificate for any works within a Council road reserve. Design plans must be submitted to and approved by the Roads Authority prior to issue of the Construction Certificate.

11 The provision of additional civil works necessary to ensure satisfactory transitions to existing work as a result of work conditioned for the development at no cost to Council. Design plans are to be approved by the Roads Authority prior to the issue of a Construction Certificate.

12 The submission of a plan of management to Council for approval under the Roads Act/Local Government Act for any works for the development that impact on any public roads or public land for the construction phase of the development, prior to that section of work commencing. The plan is to include a Traffic Control Plan and/or a Work Method Statement for any works or deliveries that impact the normal travel paths of vehicles, pedestrians or cyclists or where any materials are lifted over public areas. This plan must be certified by an appropriately accredited/qualified person.

13 The construction of kerb and gutter, 7.6 metres wide road carriageway and associated stormwater drainage systems for proposed Road No 1 in accordance with Austroads Guide to Traffic Engineering Practice – Part 5: Intersections at Grade and Council's Development Control Plan 2005, Chapter 66 – Subdivision, and 67 – Engineering Requirements for Development. The design plans must be approved by the Roads Authority (Council) prior to the issue of the Construction Certificate. The design plans must include:

- Amended vertical alignment of the turning head to ensure that the road pavement and gutters grade towards Geoffrey Road.
- Detailed design of the intersection with Geoffrey Road, featuring
    - A modified intersection configuration, incorporating traffic calming facilities. Note: The design speed not to exceed 30km/h. The intersection must be designed to accommodate the 8.8m design service vehicle, and ensure the 12.5m single unit truck/bus can negotiate the intersection.
    - The provision of advanced warning signage on intersection approaches within Geoffrey Road.
    - The provision of appropriate signage, pavement marking and line marking within the proposed Road No 1, and Geoffrey Road.
    - Standard perambulator crossings.

Additionally, the plan must be certified by a qualified and experienced consultant as providing adequate Intersection Sight Distance in accordance with the RTA Road Design Guide or Austroads Guide to Traffic Engineering Practice – Part 5: Intersections at Grade. Minor adjustments to lot boundaries may be required to achieve a satisfactory design.

- Street lighting in accordance with AS 1158.
- Amend the piped drainage system as shown on the plan prepared by Everitt & Everitt Consulting Surveyors, reference 17030, sheet 3 and dated 1/4/2009 to delete the pipe between Pit 1 and Pit 3. An additional road gully pit with extended kerb inlet must be provided at the tangent point in Geoffrey Road, immediately south of the intersection with proposed Road No 1. A suitably sized reinforced concrete stormwater pipe must connect the unnamed pit on the southern side of proposed Road No 1, the pit mentioned above and Pit No 3.
- Delete the proposed Solid Pollution Filter and replace with a single inline, below ground, propriety brand gross pollutant trap ie ("Ecosal in line").

14 The proposed retaining walls are to be designed by a practising Civil/Structural Engineer to cater for all expected loads in accordance with AS 4678, AS 3600, AS 1720, AS 1170 and other relevant codes and standards. The design of the retaining wall must be altered in accordance with the following:

- All retaining walls adjoining proposed Lot 4 shall be contained wholly within the property boundaries. The verge shall be reshaped to feature 4% slope from the top of kerb to the property boundary.
- The extent of the retaining wall must provide adequate intersection Stoping Sight Distance from the intersection of Geoffrey Road and proposed Road No 1.
- Detail the grade transition required to meet the existing ground levels.

Additionally, the retaining walls must be designed for possible surcharge loading from vehicles or structural improvements to the neighbouring properties. Details are to be submitted for approval to the Council/Accredited Certifier prior to issue of a Construction Certificate.

15 Submission to and approval by the Council/Accredited Certifier of a construction management plan for the demolition of the existing retaining wall and construction of the proposed retaining walls prior to the release of the Construction Certificate. The plan shall be certified by the design engineer and detail the construction methodology to ensure workers safety, public safety and the structural stability of the neighbouring properties. An authority to enter the adjoining property must be obtained prior to commencement of works if the construction methodology or temporary protection works encroach into the neighbouring property. Before excavation, the principal contractor must notify their intention to the adjoining owner/s and shall at the same time furnish to such owner/s particulars of the work proposed to be carried out.

16 The provision at no cost to Council of concrete paving for the full Geoffrey Road street frontage of the development, and concrete footpaving along one side of proposed Road No 1. The footpath design is to be 1.2 metres wide, 100mm thick with SL72 reinforcement and is to be constructed on 75mm compacted road base and on compacted sub grade, with Waranga Engineered Solutions Pty Ltd or approved equivalent kerb adaptor and the footpath width crossing of a galvanized RHS 0.15 x 0.075 x 0.004m. All other details are to be in Requirements for Development. The design plans must be approved by the Roads Authority prior to issue of a Construction Certificate.

17 The submission of a comprehensive road signage and pavement marking plan identifying parking restrictions, accesses and traffic management facilities to Council for approval by the Local Traffic/Development Committee prior to issue of the Construction Certificate.

Stormwater

18 Stormwater drainage works discharging from the site into a public system or public land require approval from Council under Section 68 of the Local Government Act. The extent of work must be determined by the Consent Authority prior to issue of a Construction Certificate. All works are to be designed and constructed in accordance with Council's Development Control Plan 2005, Chapter 67 - Engineering Requirements for Development. Design plans must be approved by Council prior to issue of a Construction Certificate.

19 The submission to and approval by the Consent Authority of a Soil and Water Management Plan and supporting calculations in accordance with Council's Development Control Plan 2005, Chapter 67 - Engineering Requirements for Development and the National Plumbing and Drainage Code AS/NZS3500.3 prior to issue of a Construction Certificate. The design must include;

a. The provision of a suitably sized surface inlet pit and pipe stub connection for each proposed lot
b. Interallotment drainage pipeline designed to convey the 20 year ARI design rainfall event
c. Overland flow path to convey the 100 year ARI design rainfall event, minus 50% of the piped system capacity, to the street drainage system.

Subdivision Works

20 The design and construction of all subdivision works in accordance with Council's Development Control Plan 2005, Chapter 67 - Engineering Requirements for Development, which are prescribed at the time of commencement of engineering works. The design plans, including an overlay of the vegetation plan identifying trees to be retained as per the approved development plans, and any trees to be removed must be approved by the Consent Authority prior to issue of a Construction Certificate.

21 The submission to the Council/Principal Certifying Authority of a report from a suitably qualified and practising Civil/Structural Engineer. The report shall certify that all retaining walls have been constructed in accordance with Construction Certificate, accepted practice, and that the structure is stable.

22 The submission to Council and approval of the proposed names for the roads under the Roads Act within the subdivision prior to issue of a Construction Certificate.

Water and Sewer Services/Infrastructure

23 All water and sewer works or works impacting on water and sewer assets are to be designed and constructed to the requirements of Wyong Shire Council as the Water Supply Authority under the Water Management Act 2000. The requirements of Section 306 of the Water Management Act, 2000 which apply to this development, are detailed in the Section 306 requirements letter attached to the consent. All works required in the Section 306 letter must be shown on the design plans. The design plans must be submitted to and approved by Council prior to the issue of a Construction Certificate.

24 All water and sewer services/infrastructure necessary to service the development must be provided in accordance with Council's requirements. All services are to be designed and constructed in accordance with Council's Development Control Plan 2005, Chapter 67 - Engineering Requirements for Development, AS/NZS3500 and Council's rainwater harvesting requirements. The design plans must be approved by Council as the Water Supply Authority under the Water Management Act prior to the issue of a Construction Certificate.

Erosion and Sediment Control – Building Sites

25 The provision of a single all weather access way incorporating a vehicle shake down device within the property, extending from the kerb and gutter to the building under construction, so as to provide appropriate access to the site which will reduce the potential for erosion to occur and for materials to be tracked onto the road by vehicles. A diversion drain is to be installed to divert runoff from the accessway into a silt fence. These works are to be in accordance with the requirements of Council's Policy E1 - Erosion and Sediment Control from Building Sites. **Note: On-the-spot fines may be imposed by Council for non-compliance with this condition.**

26 The provision of soil erosion and silt controls on the site in accordance with Council's Development Control Plan 2005, Chapter 67 – Engineering Requirements for Development and/or Construction - Managing Urban Stormwater (Blue book) and the approved development plans prior to any works commencing on the site. **Note: On-the-spot fines may be imposed by Council for non-compliance with this condition.**

27 Sand and other materials that could potentially be washed off the site during rain periods are to be stored behind the silt control barrier. **Note: On-the-spot fines may be imposed by Council for non-compliance with this condition.**

28 The provision of a metal groyne/s or kerb inlet trap/s to the downstream drainage pit/s of the street drainage system to prevent any silt that may have left the site from entering the drainage system. The build up of silt and debris must be removed from the site on a daily basis. **Note: On-the-spot fines may be imposed by Council for non-compliance with this condition.**

29 The display of an appropriate sign to promote the awareness of the importance of the maintenance of sediment control techniques on the most prominent sediment fence or erosion control device, for the duration of the project. **Note: On-the-spot fines may be imposed by Council for non-compliance with this condition.**

Filling and Haulage

30 The provision of a single all weather access way incorporating a vehicle shake down device within the property, extending from the kerb and gutter to the building under construction, so as to provide appropriate access to the site which will reduce the potential for erosion to occur and for materials to be tracked onto the road by vehicles. A diversion drain is to be installed to divert runoff from the accessway into a silt fence. These works are to be in accordance with the requirements of Council's Policy E1 - Erosion and Sediment Control from Building Sites. **Note: On-the-spot fines may be imposed by Council for non-compliance with this condition.**

31 All fill is to be placed on site in such a manner that surface water will not be diverted to adjoining land and so that natural drainage from adjoining land will not be obstructed or affected.

Approved Plans

32 A copy of the stamped approved plans must be kept on site for the duration of site works and be made available upon request to either the Principal Certifying Authority or an officer of the Council.

Demolition

33 Building demolition work is to be carried out in accordance with the requirements/provisions of the AS2601-2001 - The Demolition of Structures.

34 Prior to the demolition and/or removal of existing structures on site, all existing services are to be disconnected, sealed and made safe. The sewer and water service is to be disconnected by a licensed plumber and drainer. A Start Work Docket must be submitted to Council and Council's Plumbing and Drainage Inspector must certify that the works have been undertaken to the satisfaction of Council.

35 The disposal of any asbestos materials must be in accordance with the requirements of WorkCover NSW and AS2601-2001 - The Demolition of Structures.

Dust Control

36 Appropriate measures shall be employed by the applicant/owner during demolition, excavation and construction works to minimise the emission of dust and other impurities into the surrounding environment to the satisfaction of the Consent Authority

General

37 The developer is responsible for any costs relating to alterations and extensions of existing roads, drainage, Council services and other services for the purposes of the development.

Other Authorities

38 Other public authorities may have separate requirements and should be consulted prior to commencement of works in the following respects:

- Australia Post for the positioning and dimensions of mail boxes in new commercial and residential developments;
- AGL Sydney Limited for any change or alteration to gas line infrastructure;
- Energy Australia for any change or alteration to electricity infrastructure or encroachment within transmission line easements;
- Telstra, Optus or other telecommunication carriers for access to their telecommunications infrastructure.
- Utility services installation shall be carried out in accordance with Council's Development Control Plan 2005, Chapter 66 – Subdivision and E67 – Engineering Requirements for Development and each Utility Authority's requirements, generally the current Street Opening Guidelines Conference (SOC) guidelines.

Site Requirements

39 The provision of a temporary closet on site from the time of commencement of building work to ensure that adequate sanitary provisions are provided and maintained on the building site for use by persons engaged in the building activity. The temporary closet is to be a water closet connected to the sewerage system or approved septic tank or a chemical closet supplied by a licensed contractor.

40 All building materials, plant and equipment must be placed on the site of the development so as to ensure that pedestrian and vehicular access in public places is not restricted and to prevent damage to the road reserve. The storage of building materials on Council's recreation reserves and/or road reserves is prohibited. **Note: On the spot fines may be imposed by Council for non-compliance with this condition.**

Water and Sewer Services/Infrastructure

41 The submission of notification for the intention to commence works including the submission of all necessary pre-construction documentation to the Principal Certifying Authority.

Contributions

42 Prior to the issue of a Subdivision Certificate, the payment to Council of contributions (as contained in the attached Schedule) under Section 94 of the Environmental Planning and Assessment Act and Council's Contribution Plan. Council's contributions are adjusted on the first day of February, May, August and November. The amount of the contributions will be adjusted to the amount applicable at the date of payment.

Dilapidation

43 Any damage not shown in the Dilapidation Report submitted to Council before site works had commenced, will be assumed to have been caused as a result of the site works undertaken and must be rectified at the applicant's expense, prior to release of the Occupation/Subdivision Certificate.

Filling and Haulage

44 The making good to the satisfaction of Council, or payment of the costs incurred by Council in making good, any pavement damage or structural deterioration caused to Council's roads by the use of such roads as haulage routes for materials used in construction or the operation of the approved development, prior to issue of the Subdivision Certificate.

45 All filled areas are to be compacted in accordance with AS3798-1996. The submission to Council of test results and appropriate documentation in accordance with AS3798 prior to issue of the Occupation/Subdivision Certificate.

Roads

46 All additional civil works required to ensure satisfactory transitions to existing work as a result of work conditioned for the development works are to be approved by Council prior to issue of the Subdivision Certificate.

47 All works within a public road such as kerb and guttering, road pavement, drainage, footpaths, cycleways and vehicular access crossings must be in accordance with Development Control Plan 2005, Chapter 67 - Engineering Requirements for Development and approved by Council as the Roads Authority under the Roads Act 1993, prior to the issue of an Subdivision Certificate.

Stormwater

48 The stormwater system with water quality control facilities to treat stormwater runoff from the development discharging into Council's system or public land must be approved by Council under Section 68 of the Local Government Act prior to issue of the Subdivision Certificate.

49 The prevention of any obstruction of surface or sub surface drainage that could result in the disruption of the amenity, drainage or deterioration to any other property. Works are to be satisfactorily completed prior to issue of the Subdivision Certificate.

Englobo

50 No dwelling is to be connected to Council's future sewer main until Council's Development Construction Engineer has formally accepted the main. A pre-requisite for acceptance will be to successfully comply with Council's Development Control Plan 2005, Chapter 67 - Engineering Requirements for Development for air testing, visual inspection, manhole lid seal and the level of the lid 25-50mm above the proposed finished surface level. The manhole must be protected during dwelling construction by erecting a barrier around the manhole. Any alterations to the finished surface level requiring the raising or lowering of the manhole will require Council's approval.

51 No dwelling is to be connected to Council's future water main until Council's Development Construction Engineer has formally accepted the main. A pre-requisite for acceptance will be to successfully comply with Council's Development Control Plan 2005, Chapter 67 - Engineering Requirements for Development for pressure testing of the main, hydrants and valves at the correct height in relation to the finished footpath and markers placed. The hydrant, valves and markers must be protected during dwelling construction by erecting a barrier. Hydrant, valves and markers are to be clearly visible at the completion of the dwelling landscape works. Water meters will not be connected until the mains are accepted. Application can be made to Council's Development Engineer for a temporary water supply once the main is accepted.

Certificates/Engineering Details

52 An application for a Subdivision Certificate must be submitted to and approved by the Council/Principal Certifying Authority prior to endorsement of the plan of subdivision.

53 The submission to Council of documentation to demonstrate full compliance with all consent conditions in accordance with Section 157 Clause 2 (f) of the Environmental Planning and Assessment Regulations 2000 prior to issue of the Subdivision Certificate.

54 The provision of Works as Executed information as identified in Council's Development Control Plan 2005, Chapter 67 - Engineering Requirements for Development prior to issue of the Occupation Certificate. The information is to be submitted in hard copy and in electronic format in accordance with Council's "CADCHECK" requirements. This information is to be approved by Council prior to issue of the Subdivision Certificate.

55 The obtaining of a Section 307 Certificate of Compliance under the Water Management Act 2000 for water and sewer requirements for the development from Wyong Shire Council as the Water Supply Authority prior to issue of the Subdivision/Occupation Certificate. All works for the development must be approved by Council prior to the issue of a Certificate of Compliance.

Filling and Haulage

56 The making good to the satisfaction of Council, or payment of the costs incurred by Council in making good, any pavement damage or structural deterioration caused to Council's roads by the use of such roads as haulage routes for materials used in construction or the operation of the approved development, prior to issue of the Subdivision Certificate.

Landscaping

57 The provision and maintenance of landscaping in accordance with Council's Policy Number L1 - Landscape for a Category 2 Development in accordance with Plan reference No LDA.01. All landscaping works are to be completed prior to the issue of a Subdivision Certificate and a landscape implementation report from the approved landscape consultant is to be submitted to the Principal Certifying Authority.

Subdivision Works

58 The provision of a report to Council by a consulting engineer classifying each lot being created in accordance with AS2870-1996 - Residential Slabs and Footings, prior to issue of a Subdivision Certificate.

59 The provision of Works as Executed information as identified in Council's Development Control Plan 67 - Engineering Requirements for Development prior to issue of the Subdivision Certificate. The information is to be submitted in hard copy and in electronic format in accordance with Council's "CADCHECK" requirements. This information is to be approved by Council prior to issue of the Subdivision Certificate.

60 All roads are to be constructed and dedicated up to the boundaries of all adjoining properties prior to the issue of a Subdivision Certificate. The hammerhead cul-de-sac and associated road reserve area must be included in the road dedication. Details are to be incorporated in the plan of subdivision.

61 All subdivision works must be approved by Council prior to the issue of a Subdivision Certificate.

62 The certification by a Registered Surveyor, prior to issue of a Subdivision Certificate that all services domestic, drainage lines and accesses are wholly contained within the respective lots and easements.

63 The registration of the necessary restrictions as to user.

64 The plan of subdivision and Section 88B instrument shall establish the following restrictive covenants; with the Council having the benefit of these covenants and having sole authority to release vary or modify these covenants. Wherever possible the extent of the land affected by these covenants shall be defined by bearings and distances shown on the plan of subdivision.

- Vehicle access direct to Geoffrey Road from proposed lot 4 and 5 is denied.
- A positive covenant shall be registered on the title of Lots 1 to 9 requiring the provision of an on-site stormwater detention system in accordance with Council's Development Control Plan 2005, Chapter 67 – Engineering Requirements for Development.

65 All necessary easements for services and drainage are to be registered as part of the subdivision process.

66 The existing dwellings and outbuildings are to be demolished prior to the issue of the Subdivision Certificate.

Water and Sewer Services/Infrastructure

67 The submission of a survey prepared by a registered surveyor certifying that all lots have been filled to 600mm above (Warnervale/Wadalba) the 1% AEP flood level prior to the issue of the Subdivision Certificate.

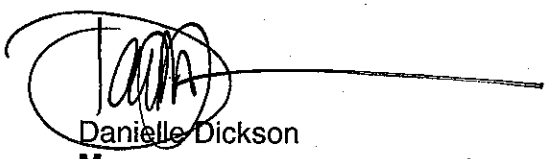
68 This consent does not provide for staging of the development. Any staging will require a separate consent or an amendment to this consent.

Right of Appeal

If you are dissatisfied with this decision, Section 97 of the Environmental Planning and Assessment Act 1979 gives you the right to appeal to the Land and Environment Court within 12 months after the date on which you receive this notice.

Section 82A of the Environmental Planning and Assessment Act 1979 provides that the applicant may request the Council to Review the determination, except where the application is Integrated or Designated development. The request must be made in writing (or on the review application form) within twelve (12) months from the date of this determination, together with payment of the appropriate fee.

Signed on behalf of the Consent Authority



25/6/09

Danielle Dickson
Manager
DEVELOPMENT ASSESSMENT

SCHEDULE OF CONTRIBUTIONS

Shire Wide Library Network	$2,263.10
Shire Wide Regional Open Space	$1,236.90
Shire Wide Performing Arts Centre & Public Art	$2,863.10
Shire Wide Administration	$549.60
Wyong District Community Facilities Works	$24,781.90
Wyong District Community Facilities Land	$8,064.00
Wyong District Open Space Works	$22,534.30
Chittaway point Sewer DSP	$16,142.80
Wyong Urban Sth Water DSP	$12,001.17

1406/08

CONTRIBUTIONS CALCULATION WORKSHEET

DA No: 1406/08	Contributions Plan No:				
Category	Catchment/ Precinct	Rate*	DU**	NDA(Ha)**	Amount
Shire Wide (See Matrix to determine what applied to)					
Library	SW02	282.89	8		2263.10
Regional Open Space	SW04	154.61	8		1236.90
Cycleway Network					
Performing Arts & Public Art	SW05	357.89	8		2863.12
Administration	SW01	68.70	8		549.60
Plan Specific Categories (every category may not apply to every site)					
Planning Studies/Co-ordinator					
Open Space – Land					
Open Space – Works	WYON09	2,816.79	8		22534.30
Community Facilities – Land	WYON12	1,008.02	8		8,064.00
Community Facilities – Works	WYON15	3097.74	8		24,781.92
Drainage – Land					
Drainage – Works					
Water Quality – Land					
Water Quality – Works					
Environmental Corridor – Land					
Environmental Corridor – Works					
Roads					
Carparking					
DSP No:					
Water	WYON77	2,017.85	7.44		16,142.80
Sewer	WYON67	1,643.06	8		12,001.17
TOTAL CONTRIBUTIONS (compare with total amount generated by PATHWAYS – the two should match)					

Basis of Calculations:		
No of DU:	10	**NDA Calculation (free text description):**
Credit:	2	
Total DU:	8	
Notes: CREDITS = 2 DU EXCEPT WATER WHICH HAS 2.56 DU CREDIT (AS PER ENGINEERS REVIEW)		

Details of Works In Kind or Land Dedication provided by development:

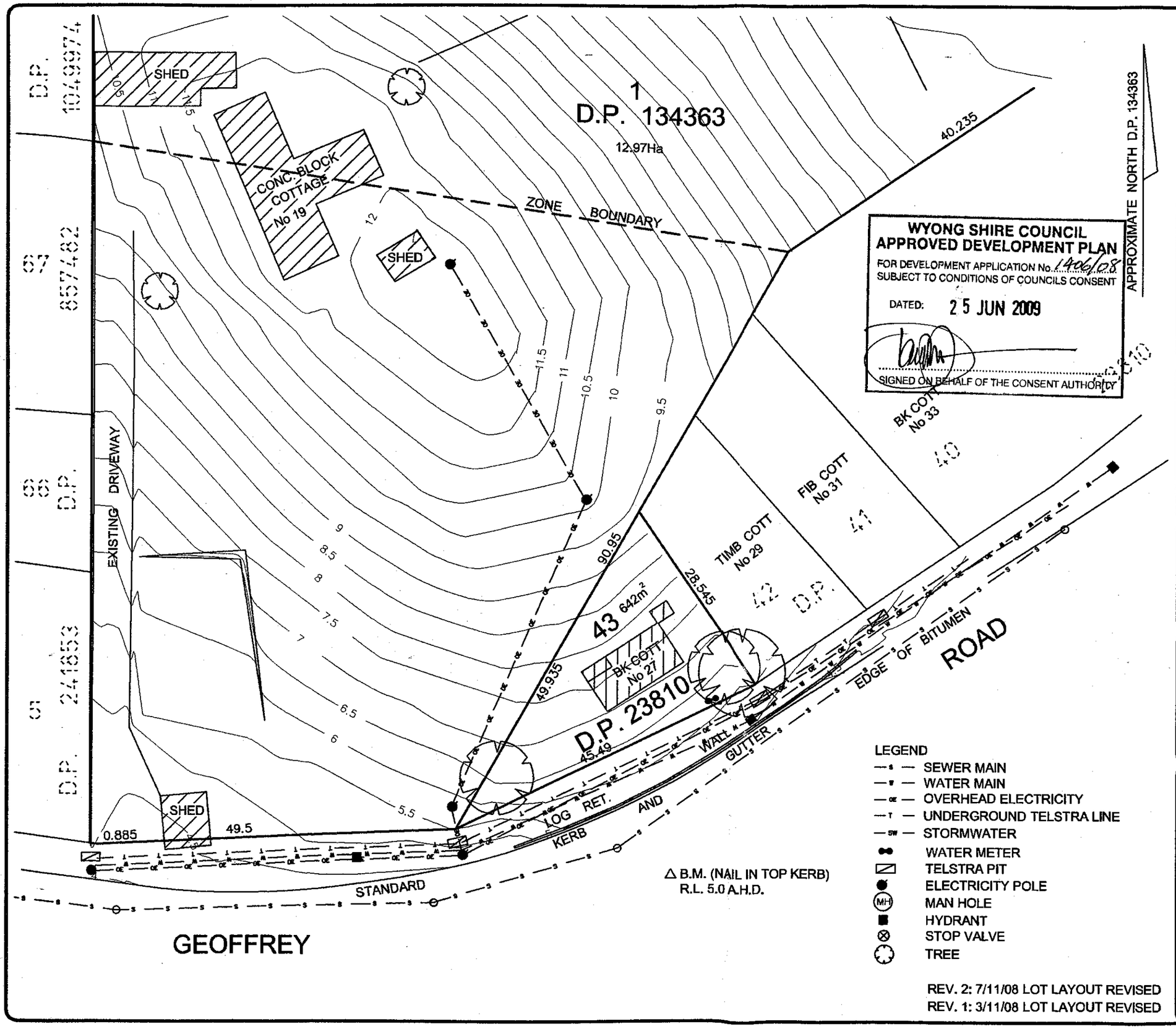
- NIL

Contributions calculated/added by:	"FUTURE PLANNING"	Date:	11/5/09
Contributions Checked by:		Date:	

* Latest rates are found on Council's website under *'Development'* tab, *'Section 94 Plans'* and *'Contribution Rates'*.

** See *'Contribution Factors for Different Types of Development'* Matrix for categories that apply to particular development and on what basis categories are applied.

transferred to contract security 25/6/09



WARNING NOTE:
THE PURPOSE OF THE FIELD SURVEY DEPICTED HEREON WAS TO LOCATE DETAIL, VISIBLE SERVICES, TREES, SPOT LEVELS, ETC., ALL IN THEIR APPROXIMATE RELATIONSHIP TO BOUNDARIES. THE BOUNDARIES SHOWN HEREON HAVE BEEN PLOTTED FROM INFORMATION CONTAINED IN D.P. 134363 & D.P. 23810.
NO FIELD RE-SURVEY OF BOUNDARIES HAS BEEN CARRIED OUT BY US AT THIS STAGE.
THIS NOTE IS AN INTEGRAL PART OF THIS PLAN.

WARNING NOTE:
THE ORIGIN BM HEIGHT WAS SUPPLIED BY OTHERS. EVERITT & EVERITT ARE NOT RESPONSIBLE FOR THIS ORIGIN HEIGHT VALUE.

WARNING NOTE:
UNDERGROUND SERVICES SHOWN HEREON ARE DEPICTED IN THEIR APPROXIMATE POSITION ONLY IN ACCORDANCE WITH INFORMATION PROVIDED VIA THE DIAL B4 U DIG SERVICE, AND IS ONLY VALID FOR THE PERIOD OF TIME SPECIFIED BY THE RELEVANT AUTHORITIES. THE DEVELOPER AND / OR CONTRACTORS ARE RESPONSIBLE FOR OBTAINING UP TO DATE PLANS FROM ALL SUCH AUTHORITIES IN REGARDS TO LOCATION AND DEPTH OF ALL UNDERGROUND SERVICES PRIOR TO ANY WORKS BEING CARRIED OUT ON OR ADJACENT TO THE SITE.

PROJECT

IDA SAFE CONSTRUCTIONS
LOT 43 D.P. 23810 &
LOT 1 D.P. 134363
GEOFFREY RD
CHITTAWAY

SHEET 1

EXISTING DETAIL

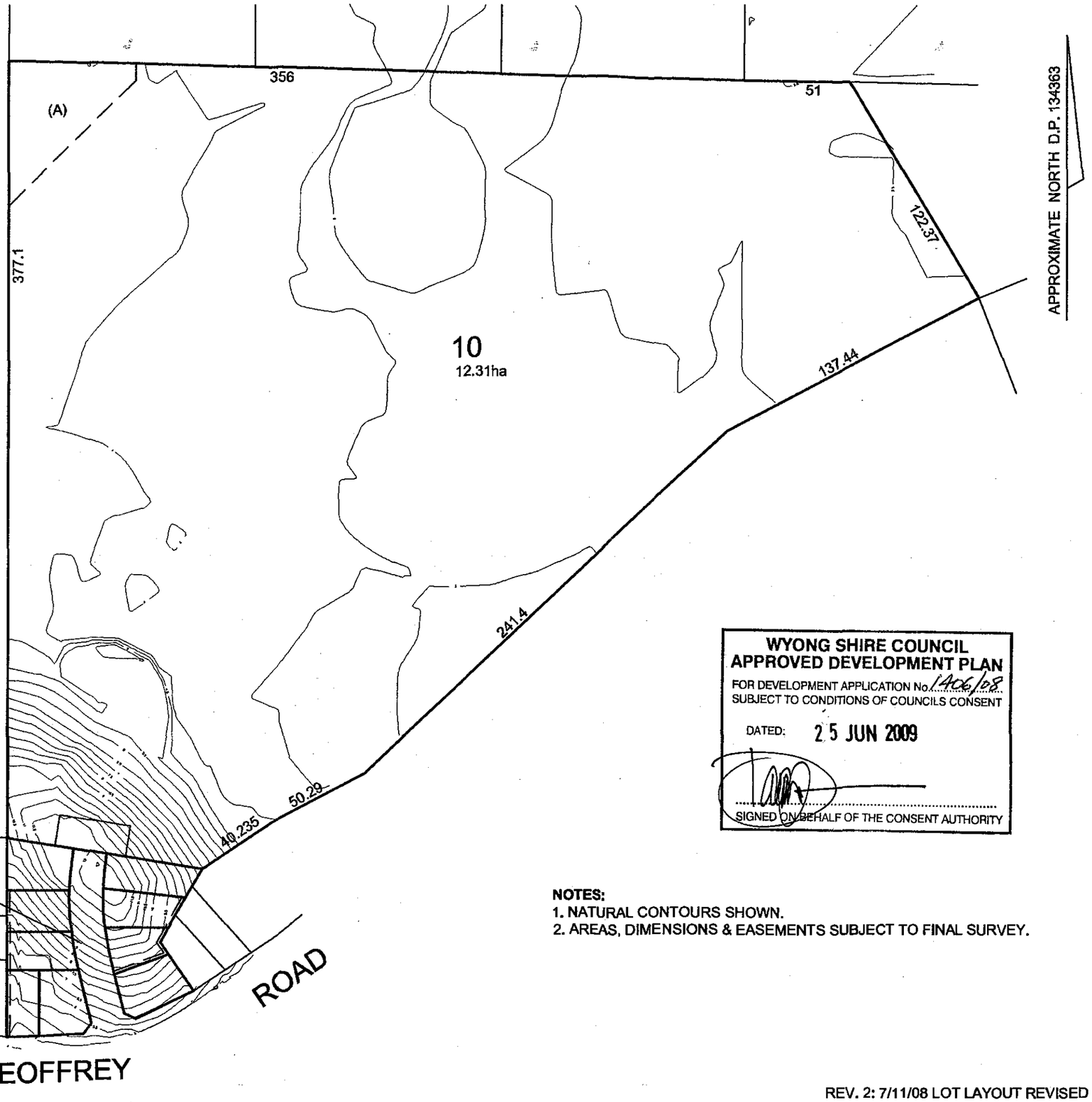
Scale: 1:500
Datum: A.H.D.
Reference: 17030 REV: 2
Drawn: MS
Checked: BE
Date: 7/10/08

Everitt & Everitt
Consulting Surveyors

"The Halton Rivers Business Centre"
34-36 Pacific Highway Wyong
PO Box 198 Wyong NSW 2259
Telephone: (02) 4352 1419
Fax: (02) 43512437
E-mail: admin@everittsurveyors.com.au

Surveying
Planning
Engineering Design
Project Management

(A) EASEMENT FOR TRANSMISSION LINE (2588341)



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WYONG SHIRE COUNCIL
APPROVED DEVELOPMENT PLAN
FOR DEVELOPMENT APPLICATION No. 1406/08
SUBJECT TO CONDITIONS OF COUNCILS CONSENT
DATED: 25 JUN 2009
SIGNED ON BEHALF OF THE CONSENT AUTHORITY

NOTES:
1. NATURAL CONTOURS SHOWN.
2. AREAS, DIMENSIONS & EASEMENTS SUBJECT TO FINAL SURVEY.

REV. 2: 7/11/08 LOT LAYOUT REVISED
REV. 1: 3/11/08 LOT LAYOUT REVISED

PROJECT

IDA SAFE CONSTRUCTIONS
LOT 43 D.P. 23810 &
LOT 1 D.P. 134363
GEOFFREY RD
CHITTAWAY

SHEET 2

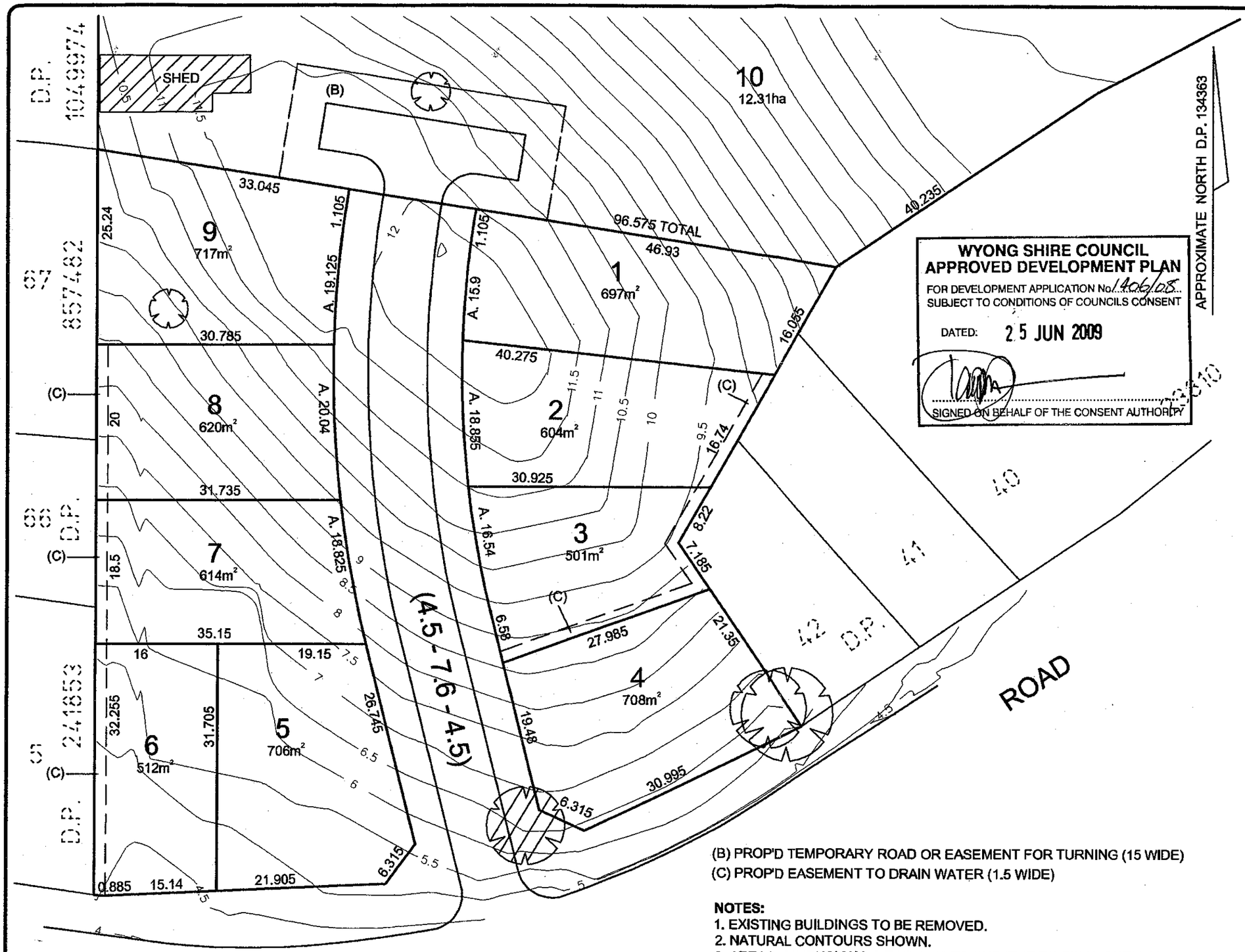
OVERALL SUBDIVISION PLAN

Scale: 1:2000
Datum: A.H.D.
Reference: 17030 REV: 2
Drawn: MS
Checked: BE
Date: 7/10/08

Everitt & Everitt
Consulting Surveyors

"The Halton Rivers Business Centre"
34-36 Pacific Highway Wyong
PO Box 198 Wyong NSW 2259
Telephone: (02) 4352 1419
Fax: (02) 43512437
E-mail: admin@everittsurveyors.com.au

Surveying
Planning
Engineering Design
Project Management



(B) PROP'D TEMPORARY ROAD OR EASEMENT FOR TURNING (15 WIDE)
(C) PROP'D EASEMENT TO DRAIN WATER (1.5 WIDE)

NOTES:
1. EXISTING BUILDINGS TO BE REMOVED.
2. NATURAL CONTOURS SHOWN.
3. AREAS, DIMENSIONS & EASEMENTS SUBJECT TO FINAL SURVEY.
4. TREES TO BE REMOVED SHOWN HATCHED.
5. T-HEAD IN ACCORDANCE WITH WSC DCP 67

REV. 2: 7/11/08 LOT LAYOUT REVISED
REV. 1: 3/11/08 LOT LAYOUT REVISED

WYONG SHIRE COUNCIL
APPROVED DEVELOPMENT PLAN
FOR DEVELOPMENT APPLICATION No. 406/08
SUBJECT TO CONDITIONS OF COUNCILS CONSENT
DATED: 25 JUN 2009
SIGNED ON BEHALF OF THE CONSENT AUTHORITY

WARNING NOTE:
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PROJECT

IDA SAFE CONSTRUCTIONS
LOT 43 D.P. 23810 &
LOT 1 D.P. 134363
GEOFFREY RD
CHITTAWAY

SHEET 3

PLAN OF PROPOSED SUBDIVISION

Scale: 1:500
Datum: A.H.D.
Reference: 17030 REV: 2
Drawn: MS
Checked: BE
Date: 7/10/08

Everitt & Everitt
Consulting Surveyors

"The Halton Rivers Business Centre"
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Surveying
Planning
Engineering Design
Project Management

Criteria	Requirements	Consistency (Y/N)	Comment
Infrastructure Provision Mechanisms in place to ensure utilities, transport, open space and communication are provided in a timely and efficient way.	Development is consistent with the CCRS, the relevant residential strategy, North Wyong Structure Plan (NWSSP), applicable regional infrastructure plan, Metropolitan Strategy and relevant section 117 directions. The provision of infrastructure (utilities, transport, open space and communications) is costed and economically feasible based on government methodology for determining infrastructure contribution. Preparedness to enter into development agreement	Y	The proposal is considered consistent with the CCRS and is expected to be able to be consistent with relevant s117 Directions, subject to additional studies/reports being prepared. The site is within an area with adequate water supply, sewerage, electricity and communications infrastructure and will only require minor augmentation of services.
Access Accessible transport options for efficient and sustainable travel between homes, jobs, services and recreation to be existing or provided.	Accessibility of the area by public transport and appropriate road access in terms of: Location/land use: to existing networks and related activity centres. Network: the areas potential to be serviced by economically efficient public transport services. Catchment: the area's ability to contain or form part of the larger urban area which contains adequate transport services. Capacity for land use/transport patterns to make a positive contribution to achievement of travel and vehicle use goals No net negative impact on performance of existing sub regional road, bus, rail, ferry and freight management.	Y	The planning proposal identifies an infill residential development within an existing residential area. Access is available to Church Road on the northern and eastern side of the site and flood free access is available to Geoffrey Road which then provides access to Wyong Road at an existing major roundabout. The proposal is located in close proximity to local schools, shops, recreation facilities and other services within a 2.5km radius. The proposal is located in close proximity to public transport stops for public transport services, in particular the close proximity to

Criteria	Requirements	Consistency (Y/N)	Comment
			public transport routes along Wyong Road.
Housing Diversity Provide a range of housing choices to ensure a broad population can be housed.	Contributes to the geographic market spread of housing supply, including any government targets established for housing for the aged or disabled or affordable housing.	Y	The development will provide new housing opportunities in an area which has almost no spare housing capacity and will therefore contribute significantly to geographic market spread
Employment Lands Provide regional/local employment opportunities to support the Central Coast's expanding role in the wider regional and NSW economies.	Maintains or improves the existing level of subregional employment self containment. Meets subregional employment capacity targets.	Y	The subject site is in close proximity to existing local employment opportunities such as local schools, shops and Business Parks. The proposed site is located in close proximity to existing employment areas (Tuggerah Business Park and Berkeley Vale Industrial Area). Other major employment land such as the Wyong Employment Zone is located within 10km of the subject site. The rezoning is a residential infill close to existing employment areas and is not appropriate for employment uses as it directly adjoins existing residential development to the east and south.
Avoidance of Risk Land use conflicts and risk to human health and life is avoided.	Where relevant, available safe evacuation route (flood and bushfire). No residential development within the 1:100 floodplain.	Y	The site of the proposal is constrained by risks associated with bushfire and flooding. By modifying the proposal concept to avoid these areas, and by undertaking further risk

Criteria	Requirements	Consistency (Y/N)	Comment
	Avoidance of physically constrained land. High Slope Highly erodible Avoidance of land use conflicts with adjacent, existing or future land use and rural activities planned under the Regional Strategy.		management plans, the proposal can be consistent with this criterion. The proposal is not considered to be significantly affected by the odours produced from the Wyong South Sewerage Treatment Plant.
Natural Resources Natural resource limits are not exceeded/environmental footprint minimised.	Demand for water does not place unacceptable pressure on infrastructure capacity to supply water and environmental flows. Demonstrates most efficient/suitable use of land Avoids identified significant agricultural land Avoids impacts on productive resource lands, extractive industries, coal, gas and other mining, fishing and aquaculture. Demand for energy does not place unacceptable pressure on infrastructure capacity to supply energy. Requires demonstration of efficient and sustainable supply solution.	Y	The proposal will be serviceable by existing water supply infrastructure. The proposal is not utilising land which would be better suited to other land uses such as agriculture and advice from the Mine Subsidence Board does not indicate that there are current or future plans for mineral extraction in the locality. Future dwelling construction will need to comply with Council policies, State policy and other legislation to ensure more sustainable utilisation of energy and water and place greater reliance on more sustainable options such as solar. The proposed rezoning does not impact on the sustainable use of water, agricultural land or energy supply infrastructure.
Environment Protection Protect and enhance biodiversity, air quality,	Consistent with the approved Regional Conservation Plan. Maintains or improves areas of regionally significant terrestrial and aquatic biodiversity. This includes regionally	Y	A Regional Conservation Plan has not been released. The flora and fauna study prepared for the

Criteria	Requirements	Consistency (Y/N)	Comment
heritage and waterway health.	significant vegetation communities, critical habitat, threatened species, populations, ecological communities and their habitat. Maintains or improves existing environmental conditions for air quality. Maintains or improves existing environmental conditions for water quality and quantity. Consistent with community water quality objectives for recreational water use and river health. Consistent with catchment and stormwater management planning. Protects areas of Aboriginal cultural heritage values.		proposal indicates there is no significant impact to the vegetation/fauna on site. The site is partially cleared and contains isolated pockets of known habitat and can be developed without impact on regional biodiversity. Further studies will be required in relation to environmental offset justification, , Acid Sulfate Soils and Contaminated Land and Stormwater and Drainage should the proposal be supported. The subject site is not known to contain and areas or objects of Aboriginal cultural significance.
Quality and Equity in Services Quality health, education, legal, recreational, cultural and community development and other government services are accessible.	Available and accessible services.	Y	It is considered that the proposal is provided with adequate available and accessible services. As infill development in an established area the proposal will make use of available capacity in existing services.

Direction	Comment
Employment & Resources	
1.1 Business & Industrial Zones	
Aims to encourage employment growth in suitable locations, protect employment land in business and industrial zones and to support the viability of identified strategic corridors. Applies when a planning proposal affects land within an existing or proposed business or industrial zone.	Not Applicable. The proposal does not affect land within an existing or proposed business or industrial zone.
1.2 Rural Zones	
Aims to protect the agricultural production value of rural land. Applies when a planning proposal affects land within an existing or proposed rural zone.	Not Applicable. The proposal does not affect land within an existing or proposed rural zone. Whilst the site is zoned 1(c) Non-urban constrained lands, the site is not considered to be a rural zone. The objectives of this zone are not consistent with those of a rural zone.
1.3 Mining, Petroleum Production and Extractive Industries	
Aims to ensure that the future extraction of State or regionally significant reserves of coal, other minerals, petroleum and extractive materials are not compromised by inappropriate development. Applies when a planning proposal would have the effect of prohibiting the mining of coal or other minerals, production of petroleum, or winning or obtaining of extractive materials, or restricting the potential of development resources of coal, other mineral, petroleum or extractive materials which are of State or regional significance by permitting a land use that is likely to be incompatible with such development.	Not Applicable. The proposal does not seek to prohibit mining of coal, other minerals, petroleum and extractive materials or restrict potential development of coal, other minerals, petroleum and extractive materials.
1.4 Oyster Aquaculture	
Aims to ensure that Priority Oyster Aquaculture	Not Applicable.

Direction	Comment
Areas and oyster aquaculture outside such an area are adequately considered, and to protect Priority Oyster Aquaculture Areas and oyster aquaculture outside such an area from land uses that may result in adverse impacts on water quality and the health of oysters and consumers. Applies when a planning proposal could result in adverse impacts on a Priority Oyster Aquaculture Areas or current oyster aquaculture lease in the national parks estate or results in incompatible use of land between oyster aquaculture in a Priority Oyster Aquaculture Area or current oyster aquaculture lease in the national parks estate and other land uses.	The Planning Proposal is not located in Priority Oyster Aquaculture Areas and oyster aquaculture outside such an area as identified in the *NSW Oyster Industry Sustainable Aquaculture Strategy* (2006)
1.5 Rural Lands	
Aims to protect the agricultural production value of rural land; and facilitate the orderly and economic development of rural lands for rural and related purposes. Applies to local government areas to which State Environmental Planning Policy (Rural Lands) 2008 applies and prepares a planning proposal that affects land within an existing or proposed rural or environment protection zone.	Not Applicable. This direction does not apply to the Wyong LGA.
Environment & Heritage	
2.1 Environmental Protection Zones	
Aims to protect and conserve environmentally sensitive areas. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The site of the proposal is zoned 1(c) Non-urban constrained land. An objective of this zone is *To prohibit development that is likely to prejudice the environmental quality of the land*. The proposal seeks to modify the land by rezoning it to residential, enabling higher density development than permitted under the current zoning. It is considered that modification of the proposal to avoid development of sensitive land results in

Direction	Comment
	the proposal being consistent with this Direction.
2.2 Coastal Protection	
Aims to implement the principles in the NSW Coastal Policy. Applies when a planning proposal applies to land in the coastal zone as defined in the *Coastal Protection Act* 1979.	Applicable. The proposal has been identified as being within the Coastal Zone. The proposal seeks a zoning amendment to Wyong LEP 1991 or Wyong Council SI (timing dependant). Given these plans are consistent with the principles with the NSW Coastal Policy; it is considered that this proposal is consistent with this Direction.
2.3 Heritage Conservation	
Aims to conserve items, areas, objects and places of environmental heritage significance and indigenous heritage significance. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The proposal does not identify an impact on any European or Indigenous heritage items or objects. It is therefore considered that the proposal is consistent with this Direction.
2.4 Recreational Vehicle Areas	
Aims to protect sensitive land or land with significant conservation values from adverse impacts from recreational vehicles. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The proposal does not seek to enable development for recreational vehicle use. It is therefore considered that the proposal is consistent with this Direction.
Housing, Infrastructure and Urban Development	
3.1 Residential Zones	
Aims to encourage a variety and choice of housing types to provide for existing and future housing needs, to make efficient use of existing infrastructure and services and ensure that new housing has appropriate access to infrastructure and services, and to minimise the impact of residential development on the environmental and resource lands.	Applicable. The proposal seeks to rezone the site for residential purposes. The proposal is considered as infill development. It is located in close proximity to existing residential areas, therefore is able to access and augment existing services and infrastructure for

Direction	Comment
Applies when a planning proposal affects land within an existing or proposed residential zone, and any other zone in which significant residential development is permitted or proposed to be permitted.	any new dwellings constructed. This is confirmed by comments received during consultation with Council's Design and Transport Engineers. It is therefore considered that the proposal is consistent with this Direction.
3.2 Caravan Parks and Manufactured Home Estates	
Aims to provide for a variety of housing types and provide opportunities for caravan parks and manufactured home estates. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The planning proposal does not seek to rezone land to provide for caravan parks or manufactured home estates It is therefore considered that the proposal is consistent with this Direction.
3.3 Home Occupations	
Aims to encourage the carrying out of low impact small business in dwelling houses. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The proposal does not seek to prohibit home occupations. It is therefore considered that the proposal is consistent with this Direction.
3.4 Integrating Land Use & Transport	
Aims to ensure that urban structures, building forms, land use locations, development designs, subdivision and street layouts to achieve: improving access to housing, jobs and services by walking, cycling and public transport; increasing choice of available transport and reducing transport on cars; reducing travel demand; supporting efficient and viable public transport services; and provide for efficient movement of freight. Applies when a planning proposal creates alters or moves a zone or provision relating to urban land, including land zoned for residential, business, industrial, village or tourist purposes.	Applicable. It is considered that the proposal is consistent with the aims, objectives and principles of Improving Transport Choice – Guidelines for Transport and Development. The site of the proposal is considered as an infill site and located in close proximity to local schools, shops, recreation facilities and other services. It is therefore considered that the proposal is consistent with this Direction.
3.5 Development Near Licensed Aerodromes	
Aims to ensure the effective and safe operation of aerodromes, their operation is not compromised by development which constitutes an obstruction,	Not Applicable. The proposal does not seek to create, alter or remove a zone or provision relating to land in the

Direction	Comment
hazard or potential hazard to aircraft flying in the vicinity, development for residential purposes or human occupation (within the ANEF contours between 20 & 25) incorporates appropriate mitigation measures so that the development is not adversely affected by aircraft noise. Applies when a planning proposal creates, alters or removes a zone or provision relating to land in the vicinity of a licensed aerodrome.	vicinity of a licensed aerodrome.
3.6 Shooting Ranges	
Aims to maintain appropriate levels of public safety and amenity when rezoning land adjacent to an existing shooting range, to reduce land use conflict arising between existing shooting ranges and rezoning of adjacent land, and to identify issues that must be addressed when giving consideration to rezoning land adjacent to an existing shooting range. Applies when a relevant planning authority prepares a planning proposal that will affect, create, alter or remove a zone or a provision relating to land adjacent to and/ or adjoining an existing shooting range.	Not Applicable. The proposal is does not propose to affect, create, alter or remove a zone or a provision relating to land adjacent to and/ or adjoining an existing shooting range.
Hazard & Risk	
4.1 Acid Sulfate Soils	
Aims to avoid significant adverse environmental impacts from the use of land that has a probability of containing acid sulfate soils. Applies when a planning proposal applies to land having a probability of containing acid sulfate soils on the Acid Sulfate Soils Planning Maps.	Applicable. A desktop mapping exercise has identified that the site contains Class 2, 3, 4 and 5 acid sulfate soils. Subject to the endorsement of the proposal by Council and the Gateway, the proponent will be required to undertake an acid sulfate soil assessment of the site. By undertaking these investigations, it is considered that the proposal will be able to consistent with this Direction.

Direction	Comment
4.2 Mine Subsidence & Unstable Land	
Aims to prevent damage to life, property and the environmental on land identified as unstable or potentially subject to mine subsidence. Applies when a planning proposal permits development on land which is within a mine subsidence district, or identified as unstable in a study or assessment undertaken by or on behalf of the relevant planning authority or other public authority and provided to the relevant planning authority.	Not Applicable. The site of the proposal is not located within a mine subsidence district.
4.3 Flood Prone Land	
Aims to ensure: development on flood prone land is consistent with NSW Government's Flood Prone Land Policy and principles of the Floodplain Development Manual 2005; and provisions of an LEP on flood prone land are commensurate with flood hazard and include consideration of the potential flood impacts both on and off the subject land. Applies when a planning proposal creates, removes or alters a zone or provision that affects flood prone land.	Applicable. The site of the proposal is identified as being flood prone land. Flood modelling undertaken by the proponent identifies that a revised development footprint and minor filling will enable the proposal to proceed with minimal risk to life and property. Subject to endorsement by Council and the Gateway, the Proponent will be required to prepare a Flood Risk Management Plan which identifies appropriate mitigation strategies to manage risk associated with higher risk (and less likely) flood events. By undertaking the above, it is considered that the proposal will be able to consistent with this Direction.
4.4 Planning for Bushfire Protection	
Aims to protect life, property and the environment from bushfire hazards, and encourage sound management of bushfire prone areas. Applies when a planning proposal affects or is in proximity to land mapped as bushfire prone land.	Applicable. The site of the proposal contains Category 2 bushfire prone vegetation and bushfire buffer zones. Subject to endorsement by Council and the Gateway, the Proponent will be required to undertake a bushfire assessment of the proposal, Bushfire Risk Management Plan which may

Direction	Comment
	require modification to the current concept plan. By undertaking the above, it is considered that the proposal will be able to consistent with this Direction.
Regional Planning	
5.1 Implementation of Regional Strategies	
Aims to give legal effect to the vision, land use strategy, policies, outcomes and actions contained within regional strategies. Applies when the relevant planning authority prepares a planning proposal that is located on land addressed within the Far North Regional Strategy, Lower Hunter Regional Strategy, Central Coast Regional Strategy, Illawarra Regional Strategy & South Coast Regional Strategy.	Applicable. The proposal is considered to be consistent with the Central Coast Regional Strategy. It is therefore considered that the proposal is consistent with this Direction.
5.2 Sydney Drinking Water Catchments	
Aims to protect water quality in the hydrological catchment. Applies when a relevant planning authority prepares a planning proposal that applies to Sydney's hydrological catchment.	Not Applicable. The proposal is not located within Sydney's hydrological catchment.
5.3 Farmland of State and Regional Significance on the NSW Far North Coast	
Aims to: ensure that the best agricultural land will be available for current and future generations to grow food and fibre; provide more certainty on the status of the best agricultural land, assisting councils with strategic settlement planning; and reduce land use conflict arising between agricultural use and non-agricultural use of farmland caused by urban encroachment into farming areas. Applies to Ballina, Byron, Kyogle, and Tweed Shire Councils, Lismore City Council and Richmond Valley Council.	Not Applicable. The proposal is not located within the Far North Coast Region.
5.4 Commercial and Retail Development along the Pacific Highway, North Coast	

Direction	Comment
Aims to manage commercial and retail development along the Pacific Highway, North Coast. Applies to all councils between and inclusive of Port Stephens and Tweed Shire Councils.	Not Applicable. The proposal is not located between Port Stephens and Tweed Shire Councils.
5.8 Second Sydney Airport: Badgerys Creek	
Aims to avoid incompatible development in the vicinity of any future second Sydney Airport at Badgerys Creek. Applies to land located within the Fairfield, Liverpool and Penrith City Council and Wollondilly Shire Council Local Government Areas.	Not Applicable. The proposal is not located within the Fairfield, Liverpool and Penrith City Council or Wollondilly Shire LGA.
Local Plan Making	
6.1 Approval and Referral Requirements	
Aims to ensure that LEP provisions encourage the efficient and appropriate assessment of development. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The planning proposal does not seek to include provisions which require concurrence from other agencies. It is therefore considered the proposal is consistent with this Direction.
6.2 Reserving Land for Public Purposes	
Aims to facilitate the provision of public services and facilities by reserving land for public purposes, and facilitate the removal of reservations of land for public purposes where land is no longer required for acquisition. Applies when the relevant planning authority prepares a planning proposal.	Applicable. The proposal does not seek to alter or create land for public purposes. It is therefore considered the proposal is consistent with this Direction.
6.3 Site Specific Provisions	
Aims to discourage unnecessarily restrictive site specific planning controls. Applies when the relevant planning authority prepares a planning proposal to allow particular	Not Applicable. The proposal does not seek to enable a specific use on the site which is not permissible under the proposed zone (2(a) Residential or R2 Low

Direction	Comment
development to be carried out.	Density Residential). It is therefore considered the proposal is consistent with this Direction.
Metropolitan Planning	
7.1 Implementation of the Metropolitan Strategy	
Aims to give legal effect to the vision, land use strategy, policies, outcomes and actions contained in the Metropolitan Strategy. Applies when the planning authority within a Metropolitan Local Government Area prepares a planning proposal.	Not Applicable. This Direction does not apply to Wyong LGA.

FLORA AND FAUNA ASSESSMENT REPORT

PROPOSED REZONING
LOTS 1-3 DP 21536 & LOT 1 DP 134363
GEOFFREY ROAD
TUGGERAH
&
LOT 1 DP 1014033 & LOT 1 DP 22467
CHURCH ROAD
CHITTAWAY POINT

MAY 2012
(REF: 1178)

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PREFACE

This Flora and Fauna Assessment Report has been prepared by *Conacher Environmental Group* to identify the flora and fauna characteristics of land within Lots 1-3 DP 21536 & Lot 1 DP 134363, Geoffrey Road, Tuggerah & Lot 1 DP 1014033 & Lot 1 DP 22467, Church Road, Chittaway Point.

This Report provides an assessment of existing habitats and the potential for the proposed development following rezoning to significantly impact on threatened species according to Section 5(A) of *the Environmental Planning and Assessment Act* (EP&A) 1979 and the *Threatened Species Conservation Act* (TSA) 1995.

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SECTION 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Conacher Environmental Group has been engaged to prepare a Flora and Fauna Assessment Report for a proposed residential development following the rezoning of Lots 1-3 DP 21536 & Lot 1 DP 134363, Geoffrey Road, Tuggerah & Lot 1 DP 1014033 & Lot 1 DP 22467, Church Road, Chittaway Point.

Previous ecological studies have been undertaken for the site including a Preliminary Ecological Assessment prepared by Andrews Neil (2004) and a Statement of Effect on Threatened Flora and Fauna prepared by Wildthing Environmental Consultants (1998).

This Flora and Fauna Assessment Report has been prepared to provide updated information, identify the flora and fauna characteristics of the site and to determine whether or not a Species Impact Statement should be prepared for the development according to the provisions of Section 5(A) of the *Environmental Planning & Assessment Act* 1979 (EP&A Act), the *Threatened Species Conservation Act* 1995 (TSC Act).

1.2 SITE CHARACTERISTICS

The planning and cadastral details of the subject site are provided in Table 1.1.

TABLE 1.1
SITE DETAILS

Location	Lots 1-3 DP 21536 & Lot 1 DP 134363, Geoffrey Road, Tuggerah & Lot 1 DP 1014033 & Lot 1 DP 22467, Church Road, Chittaway Point
Area	Approximately 28.95 ha
Topographic Map	Wyong 1:25 000
Grid Reference	354165E 6312245N
Local Government Area	Wyong
Existing Land Use	Rural and vacant land
Proposed development	Land rezoning for residential subdivision

1.3 PROPOSED DEVELOPMENT

The proposed development is for the rezoning of the subject site to allow for future residential development and areas of environmental protection. As part of the proposal, offsetting will be undertaken to compensate for the removal and modification of vegetation and habitats within the subject site. Possible offsetting arrangements are currently being considered and are not detailed in this report.

A Preliminary Concept Masterplan has been prepared for the proposed rezoning and is provided as Appendix 1.

The rezoning proposal has been designed to ensure the retention of the majority of high biodiversity value habitats within the site and the maintenance of existing habitat linkages to

the east and west of the site under an environmental protection zoning. Areas proposed for rezoning to allow future residential development are positioned mostly across the central disturbed sections of the site and will result in the retention of the majority of vegetation and habitats along the eastern and western boundaries of the site. Future development associated with the proposed rezoning is likely to result in the removal or modification and retention of the areas of vegetation and habitats listed in Table 1.2.

TABLE 1.2
VEGETATION TO BE REMOVED, MODIFIED AND RETAINED

Vegetation Community	Total within Site	Area to be Removed or Modified (ha)	Area to be Retained (ha)
Apple/Blackbutt/Swamp Mahogany Open Forest (SSFCF EEC)	6.91	1.41	5.50
Swamp Mahogany / Paperbark Canopy Only Vegetation (SSFCF EEC)	3.71	1.68	2.03
Blackbutt Canopy Only Vegetation	4.83	4.72	0.11
Cleared Land with Scattered Trees	12.83	9.05	3.78
Freshwater Vegetation	0.64	0.64	-
All Areas	28.92	17.50	11.42

SECTION 2

FLORA CHARACTERISTICS

2.1 THREATENED FLORA SPECIES

A search of the Bionet Atlas of NSW Wildlife (NSW OEH 2012) was undertaken to identify records of threatened flora species located within 10km of the site. This allowed for a specific search for threatened flora to be undertaken determining if any threatened flora species were present within the subject site. Details on threatened flora species as listed in Schedules 1 and 2 of the *TSC Act* (1995) with a known or possible occurrence within the local area are provided in Table 2.1.

TABLE 2.1
THREATENED FLORA SPECIES OF THE AREA

SPECIES	TSC ACT	EPBC ACT	GROWTH FORM AND HABITAT REQUIREMENTS	COMMENTS
Acacia bynoeana	E	V	Erect or spreading shrub to 0.3m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides.	No suitable habitat present.
Angophora inopina	V	V	Small tree in open sclerophyll forest growing on deep sandy soils with associated lateritic outcrops.	Suitable habitat present. Not observed during surveys.
Caladenia porphyrea	E	-	Terrestrial orchid. Coastal sclerophyll forest on sandy soils. Found in only two locations approximately 2km apart near Norah Head.	No suitable habitat present.
Caladenia tessellata	E	V	Terrestrial orchid. Grassy dry sclerophyll woodland on clay-loam or sandy soils and less commonly in heathland on sandy loam soils.	No suitable habitat present.
Callistemon linearifolius	V	-	Shrub to 4m high. Grows in dry sclerophyll forest on the coast and adjacent ranges.	No suitable habitat present.
Cryptostylis hunteriana	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils or Scribbly Gum Woodland.	Suitable habitat present. Not observed during surveys.
Diuris praecox	V	V	Terrestrial orchid. Grows in sclerophyll forest near the coast, most often found on clay graminoid heath on coastal headlands.	No suitable habitat present.
Epacris purpurascens var. *purpurascens*	V	-	Occurs in Sydney Sandstone Gully Forest (NPWS, 1997) and scrub with periodically poorly drained clay soil on sandstone or shale (Benson and McDougall 1996).	No suitable habitat present.
Eucalyptus camfieldii	V	V	Stringybark to 10 m high. Grows in coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone.	No suitable habitat present.

TABLE 2.1 THREATENED FLORA SPECIES OF THE AREA				
SPECIES	**TSC ACT**	**EPBC ACT**	**GROWTH FORM AND HABITAT REQUIREMENTS**	**COMMENTS**
Genoplesium insignis	E	-	A terrestrial orchid. Associated with *Themeda australis*. Occurs in heathland amongst sedges, or forest amongst shrubs from Charmhaven to Wyong. Flowers Aug – Sept.	No suitable habitat present.
Grevillea parviflora subsp. *parviflora*	V	V	Erect or spreading shrub. Preferred habitat is sandy or light clay soils, usually over thin shales often with lateritic ironstone gravels which are often infertile and poorly drained. Soils are mostly derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine grained sandstones. It is found on ridge crests, upper slopes or flat plains in both low-lying areas (particularly in the Lower Hunter Valley and Lake Macquarie) and on higher topography (particularly south of Sydney). It occurs in a range of vegetation types from heath and scrubby woodland to open forest.	Suitable habitat present. Not observed during surveys.
Lindsaea incisa	E	-	Creeping rhizome to 30cm. Grows in damp shady forests, in swamps and near creeks. Endemic to eastern Qld and north-eastern N.S.W.	No suitable habitat present.
Maundia triglochinoides	V	-	Perennial herb. Grows in swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay with low nutrients.	Suitable habitat present. Not observed during surveys.
Melaleuca biconvexa	V	V	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation.	Suitable habitat present. Not observed during surveys.
Prostanthera askania	E	E	Erect shrub. Grows in sclerophyll forest on ridges in or adjacent to Rainforest.	No suitable habitat present.
Rutidosis heterogama	V	V	Small perennial herb to 30cm tall. It Grows on moist sites in open forest and in sedgeland/heathland within shrubby open forest and woodland and at 860–1040m above sea level on granitic substrates in podsolic and lithosolic soils. Has been recorded from disturbed locations on roadsides.	No suitable habitat present.

TABLE 2.1 THREATENED FLORA SPECIES OF THE AREA				
SPECIES	**TSC ACT**	**EPBC ACT**	**GROWTH FORM AND HABITAT REQUIREMENTS**	**COMMENTS**
Senna acclinis	E	-	A shrub to 3m tall. Grows in or adjacent to subtropical and dry rainforest. Occurs in coastal districts and adjacent tablelands.	No suitable habitat present.
Syzygium paniculatum	V	V	Grows in subtropical and littoral rainforest on sandy soil.	Suitable habitat present. Not observed during surveys.
Tetratheca juncea	V	V	Prostrate shrub to 1 m high. Grows in dry sclerophyll forest and heath.	No suitable habitat present.
Thelymitra sp. *adorata*	CE	-	Grows in spotted gum ironbark forest, Flowers September to October.	No suitable habitat present.
CE = Critically Endangered E = Endangered Species V = Vulnerable Species *Species added to Schedules of TSC Act post December 2004				

Threatened flora species that are considered to have suitable habitat within the subject site have been assessed under the 7 part test of significance as detailed in Section 4 of this report.

No threatened flora species were observed within the subject site during surveys.

2.2 ENDANGERED FLORA POPULATIONS & ECOLOGICAL COMMUNITIES

2.2.1 Endangered Flora Populations

The endangered flora populations known to occur within the local government area:

- *Eucalyptus oblonga* population at Bateau Bay, Forresters Beach and Tumbi Umbi in the Wyong local government area; and
- *Eucalyptus parramattensis* subsp. *parramattensis* population in the Wyong and Lake Macquarie local government areas.

These species were not observed on the subject site. It is therefore considered that no endangered flora population is present on the subject site.

2.2.2 Endangered Ecological Communities

Details regarding the habitat attributes and indicative species for the endangered ecological communities known to be present in the local government area are provided in Table 2.2.

TABLE 2.2 ENDANGERED ECOLOGICAL COMMUNITIES OF THE AREA		
Name	**Habitat Requirements**	**Comments**
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions (CS)	**Geology / Soils:** Estuarine mud flats. **Topography:** Intertidal zone on the shores of estuaries and lagoons often inland of Mangrove stands. **Characteristic Species:** Variable with elevation; Lowest-*Sarcocornia quinqueflora*; Mid-*Sporobolus virginicus*; Upper-*Juncus krausii & Baumea juncea*	No suitable habitat present.
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregion (FWCF)	**Geology / Soils:** Silts, muds or humic loams. **Topography:** in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. **Characteristic Species:** *Carex appressa, Paspalum distichum, Baumea caniculata, Phylidrum lanuginosum, Ludwigia peploides ssp. montevidensis and Myriophyllum spp.*	No suitable habitat present.
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions	**Geology / Soils:** Coastal dune soils, shallow soils over bedrock, deep clay soils. **Topography:** Located near coastline in sheltered positions. Often found on coastal dunes, headlands or riparian locations. **Characteristic Species:** Rainforest type species; *Cupaniopsis anacardioides, Syzgium leuhmannii, Acacia hemilampra, Lophostemon confertus, Ficus sp., Liuistona australis.*	No suitable habitat present.
Low Woodland with Heathland on Indurated Sand at Norah Head	**Geology / Soils:** Indurated (hardsetting) sands with a range of local variation in drainage conditions. **Topography:** low rolling sandy hills – restricted to Norah Head east off Wilfred Barrett Drive. **Characteristic Species:** *Eucalyptus camfieldii, Melaleuca quinquenervia, Melaleuca thymifolia, Lambertia formosa, Corymbia gummifera, Acacia longifolia, Banksia oblongifolia, Allocasuarina distyla* and *Melaleuca sieberi.*	No suitable habitat present.
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	**Geology / Soils:** Typically of high nutrient geological substrates, notably basalts and fine-grained sedimentary rocks. **Topography:** Lower slopes and ranges below 600m above sea level in its northern range and below 350m sea level within the Sydney basin. **Characteristic Species:** Lowland Rainforest encompasses stands which fall principally within the following subtropical alliances and suballiances of: **Argyrodendron trifoliatum alliance** • 1. *Argyrodendron trifoliatum* suballiance • 5. *Castanospermum australe – Dysoxylum muelleri* suballiance • 6. *Archontophoenix – Livistonia* suballiance **Dendrocnide excelsa – *Ficus* spp. alliance** • 14. *Doryphora sassafras – Daphnandra micranthus – Dendrocnide excelsa – Ficus* spp. *– Toona* suballiance • 15. *Ficus* spp. *– Dysoxylum fraserianum – Toona – Dendricnide* suballiance	No suitable habitat present.

TABLE 2.2 ENDANGERED ECOLOGICAL COMMUNITIES OF THE AREA		
Name	**Habitat Requirements**	**Comments**
	***Drypetes australasica – Araucaria cunninghamii* alliance** • 21. *Araucaria cunninghamii* suballiance • 22. *Flindersia* spp. – *Araucaria* suballiance	
River-Flat Eucalypt Forest on Coastal Floodplains of the North Coast, Sydney basin and South East Corner bioregions (REFCF)	**Geology / Soils:** Silts, clay-loams and sandy loams. **Topography:** Periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains with a recurring flood interval of less than 1 in 100 years. **Characteristic Species:** *Eucalyptus tereticornis, E. amplifolia, E. botryoides, E. grandis, E. benthamii, Angophora floribunda, A. subvelutina, Melaleuca decora, M. stypheloides, Backhousia myrtifolia, Casuarina cunninghamiana* and *Casuarina glauca.*	No suitable habitat present.
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SOFF)	**Geology / Soils:** Alluvial soils of fluvial or estuarine origin, with significant salinity. **Topography:** Flood plains in areas with saline soils and flats adjoining estuaries. **Characteristic Species:** *Casuarina glauca.*	No suitable habitat present.
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SSFCF)	**Geology / Soils:** Waterlogged or periodically inundated humic clay loams and sandy loams. **Topography:** Alluvial flats and drainage lines of coastal floodplains with a recurring flood interval of less than 1 in 100 years. **Characteristic Species:** includes species such as *Eucalyptus robusta, Melaleuca quinquenervia and* E*ucalyptus botryoides.*	Suitable habitat present. Observed during surveys.
Sydney Freshwater Wetlands in the Sydney Basin Bioregion (SFW)	**Geology / Soils:** Generally on the Warriewood and Tuggerah Soil Landscapes. **Topography:** Swales and depressions on sand dunes and sandplain sites. **Characteristic Species:** *Eleocharis sphacelata*, *Baumea juncea*, *B. rubignosa*, *B. articulata*, *Gahnia sieberiana*, *Ludwigia peploides* and *Persicaria sp*	No suitable habitat present.

The endangered ecological community (EEC) Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SSFCF) was observed within the subject site and is mapped in Figure 2.1. This EEC is assessed under the 7 part test of significance as detailed in Section 4 of this report.

2.3 VEGETATION SURVEY METHODOLOGIY

To determine the likely and actual occurrence of flora species and plant communities on the subject site, field survey work was undertaken to supplement literature reviews and previous flora surveys of the area. The methods utilised for the flora survey are outlined as follows.

Literature Review

- A review of available literature for the area was undertaken to obtain reference material and background information for this study. These documents are listed in the References section of this Report. Documents which were utilised included the following:

- Andrews Neil (2004); and
- Wildthing Environmental Consultants (1998).

- A search of the Bionet Atlas of NSW Wildlife (NSW OEH 2012) was undertaken to identify records of threatened flora species located within 10km of the site. This enabled the preparation of a predictive list of threatened flora species that could possibly occur within the habitats found on the site.

Aerial Photograph Interpretation

- Aerial photographs were utilised to identify the extent of vegetation with respect to the site and surrounding areas.

Current Flora Survey

- A field survey which consisted of foot traverses within vegetated areas was conducted on 4 November 2011 according to Cropper (1993) to identify the occurrence of flora species and the extent and location of vegetation communities present across the subject site.

- Seasonal surveys were undertaken between August 2011 and March 2012 to search for seasonally flowering threatened flora species. Dates of targeted seasonal flora searches are listed in Table 2.3.

- Specimens of plants not readily identified in the field were collected for identification.

- Specimens of plants tentatively identified as threatened species are sent to the Sydney Royal Botanic Gardens for confirmation of the identification.

- All vascular plants were identified using keys and nomenclature in Harden (1994), Harden and Murray (2000) and Harden (2002). Wherever they were known, changes to nomenclature and classification have been incorporated into the results.

Previous Flora Surveys

- Andrews Neil (2004) conducted field surveys on 20 and 28 January 2004 which consisted of sampling three vegetation quadrats and undertaking random meander searches throughout the site. A species list was prepared for the 2004 surveys.

Vegetation Community Nomenclature

- Identification of vegetation formations and classes was undertaken in accordance with Keith (2004). Further classification was then applied according to species composition and the structural classifications of Specht *et al* (1995).

- Corresponding units of available vegetation mapping are identified where available.

- Corresponding Endangered Ecological Communities listed on both the *TSC Act* (1995) and *Environmental Protection and Biodiversity Conservation Act* (1999) (EPBC) are also provided if relevant.

Seasonality

As many threatened flora species are best observed during their flowering period, this survey was unable to detect species which flower at various other times of the year. In order to detect species that flower at other times of the year, additional targeted searches may be required. The flowering times of cryptic threatened flora and the dates of seasonally targeted searches are provided in Table 2.3.

TABLE 2.3
CRYPTIC FLORA FLOWERING TIMES

Species	Flowering Period	Surveyed
Caladenia porphorea	August - October	26 August 2011* 27 August 2011* 30 August 2011* 9 September 2011* 26 September 2011* 10 October 2011* 11 October 2011* 12 October 2011* 13 October 2011* 14 October 2011*
Caladenia tessellata	September – October	9 September 2011* 26 September 2011* 10 October 2011* 11 October 2011* 12 October 2011* 13 October 2011* 14 October 2011*
Cryptostylis hunteriana	November – February	20 January 2004^ 28 January 2004^ 4 November 2011* 17 December 2011 19 January 2012 14 February 2012
Diuris praecox	July – August	26 August 2011* 27 August 2011* 30 August 2011*
Genoplesium insignis	August – Sept	26 August 2011* 27 August 2011* 30 August 2011* 9 September 2011* 26 September 2011*
Grevillea parviflora subsp. *parviflora*	July - December	26 August 2011* 27 August 2011* 30 August 2011* 9 September 2011* 26 September 2011* 10 October 2011* 11 October 2011* 12 October 2011* 13 October 2011* 14 October 2011* 4 November 2011* 17 December 2011 19 January 2012 14 February 2012
Rutidosis heterogama	November - May	No suitable habitat present 20 January 2004^

TABLE 2.3 CRYPTIC FLORA FLOWERING TIMES		
Species	**Flowering Period**	**Surveyed**
		28 January 2004^ 4 November 2011* 17 December 2011 19 January 2012 14 February 2012
Tetratheca juncea	July – October	20 January 2004^ 28 January 2004^ 26 August 2011* 27 August 2011* 30 August 2011* 9 September 2011* 26 September 2011* 10 October 2011* 11 October 2011* 12 October 2011* 13 October 2011* 14 October 2011*
Thelymitra adorata	September - October	9 September 2011* 26 September 2011* 10 October 2011* 11 October 2011* 12 October 2011* 13 October 2011* 14 October 2011*
^ Previous surveys undertaken by Andrews Neil (2004) * Current surveys undertaken by Conacher Environmental Group Note: Flowering periods may differ (earlier or later) due to annual differences in seasonal intensity		

2.4 FLORA SPECIES AND VEGETATION COMMUNITY DESCRIPTIONS

The following vegetation communities were identified within the subject site:

- Apple / Blackbutt / Swamp Mahogany Open Forest;
- Swamp Mahogany / Paperbark Canopy Only Vegetation;
- Blackbutt Canopy Only Vegetation;
- Freshwater Vegetation; and
- Cleared Land with Scattered Trees.

Vegetation community descriptions are provided below while a detailed species list is provided in Table 2.4. The locations of vegetation communities are shown in Figure 2.1.

APPLE / BLACKBUTT / SWAMP MAHOGANY OPEN FOREST

Structure:
(Main Species Present)

Canopy: To 25 metres in height with 30-40% Projected Foliage Cover (PFC).

Sub-canopy: To 10 metres in height with 80% PFC.

Shrubs: To 2 metres in height with 30% PFC.

Groundlayer: To 1 metre in height with 60% PFC.

Floristics:

Canopy: *Angophora floribunda, Eucalyptus pilularis* and *Eucalyptus robusta.*

Sub-canopy: *Melaleuca nodosa, Melaleuca stypheloides, Callistemon salignus, Glochidion ferdinandi* and *Melaleuca quinquenervia.*

Shrubs: *Melaleuca nodosa, Callistemon salignus, Elaeocarpus reticulatus* and *Banksia spinulosa*.

Groundlayer: *Lomandra longifolia, Poa labillardieri, Gahnia clarkei, Entolasia stricta* and *Schoenus melanostachys.*

Exotics: *Stenotaphrum secundatum* and *Senecio madagascariensis*.

Classification:
This vegetation community is characteristic of the Coastal Swamp Forest class within the Forested Wetlands formation of Keith (2004).

This vegetation community corresponds to the endangered ecological community (EEC), Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (SSFCF).

Bell (2002) has mapped this community as three separate map units. Field surveys have determined that this vegetation community is most characteristic of Map Unit 20 Alluvial Shrub Swamp Forest with sub-dominant characteristics of Map Unit 19 Alluvial Woollybutt-Melaleuca Sedge Forest and Map Unit 43 Alluvial Riparian Blackbutt Forest.

Variation:
Variation in species distribution and dominance within this community was observed and is considered likely to be a result of variation in levels of periodic water inundation and past disturbance.

Disturbance:
This community has been disturbed previously by fire. The eastern section of the community has also been disturbed by grazing.

Weed Invasion:
Weed invasion is generally low and confined to tracks and edge areas.

Location and Distribution:
This community occupies the intact forested sections of the site and covers approximately 6.91 hectares as shown in Figure 2.1. The local occurrence of SSFCF EEC vegetation is shown in Figure 2.2.

SWAMP MAHOGANY / PAPERBARK CANOPY ONLY VEGETATION

Structure:

Canopy:	To 15 metres in height with 50% PFC.
Sub-canopy:	To 6 metres in height with 5% PFC.
Shrubs:	To 1 metre in height with 5% PFC.
Groundlayer:	To 1 metre in height with 95% PFC.

Floristics:

(Main Species Present)

Canopy:	*Eucalyptus robusta*
Sub-canopy:	*Melaleuca seiberi* and *Casuarina glauca.*
Shrubs:	*Kunzea ambigua*.
Groundlayer:	*Stenotaphrum secundatum* and *Andropogon virginicus.*
Exotics:	*Stenotaphrum secundatum, Andropogon virginicus* and *Senecio madagascariensis*.

Classification:

This vegetation community corresponds to a highly disturbed remnant of the endangered ecological community, Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

This vegetation community has not been mapped by Bell (2002), indicating that this community has been previously subjected to significant levels of clearing. It is considered that this community contains characteristics of the alluvial vegetation types mapped by Bell (2002) within the subject site and adjoining locality.

Variation:

Variation in species distribution and dominance was observed within this community. *Eucalyptus resinifera, Corymbia gummifera, Eucalyptus racemosa* and *Eucalyptus pilularis* occur as varying sub-dominant canopy and sub-canopy trees in areas of this community.

Disturbance:

This community has been disturbed by significant levels of previous clearing, pasture improvement works, slashing and grazing.

Weed Invasion:

Weed invasion is high particularly within the groundlayer vegetation.

Location and Distribution:

This community occurs in several patches throughout the site and covers approximately 3.71 hectares as shown in Figure 2.1. The local occurrence of SSFCF EEC vegetation is shown in Figure 2.2.

BLACKBUTT CANOPY ONLY VEGETATION

Structure:

Canopy:	To 20 metres in height with 75% Projected Foliage Cover (PFC).
Shrubs:	To 2 metres in height with 1% PFC.
Groundlayer:	To 0.5 metre in height with 5-80% PFC.

Floristics:

(Main Species Present)

Canopy:	*Eucalyptus pilularis*
Shrubs:	*Melaleuca nodosa and Callistemon salignus.*
Groundlayer:	*Pteridium esculentum, Microlaena stipoides, Centella asiatica, Poa labillardieri* and *Stenotaphrum secundatum.*
Exotics:	*Rubus ulmifolius, Stenotaphrum secundatum* and *Hypochaeris radicata*.

Classification:

This vegetation community does not correspond to a threatened ecological community listed within the *TSC Act* (1995) or the *EPBC Act* (1999).

This vegetation community has not been mapped by Bell (2002), indicating that this community has been previously subjected to significant levels of clearing. It is considered that this community is composed of mostly monospecific stands of *E. pilularis* canopy trees. It is considered that these trees are likely to have regrown following clearing of vegetation characteristic of Map Unit 43 Alluvial Riparian Blackbutt Forest.

Variation:

Syncarpia glomulifera and other non-dominant canopy trees occur very occasionally throughout this community. Groundcover is also patchy with some areas dominated by leaf litter.

Disturbance:

This community has been disturbed by significant levels of previous clearing, pasture improvement works, slashing and grazing.

Weed Invasion:

Weed invasion is high particularly within the groundlayer vegetation.

Location and Distribution:

This community occurs in several patches throughout the site and covers approximately 4.83 hectares as shown in Figure 2.1.

FRESHWATER VEGETATION

Structure:

Canopy: To 10 metres in height with 5% PFC.

Shrubs: Nil.

Aquatic Plants: To 2 metres in height with 20% PFC.

Floristics:

(Main Species Present)

Canopy: *Melaleuca quinquenervia, Casuarina glauca* and *Eucalyptus robusta.*

Aquatic Plants: *Juncus usitatus, Elaeocarpus reticulatus, Callitriche stagnalis , Nymphoides geminata, Azolla pinnata* and *Nymphae* sp.

Exotics: *Callitriche stagnalis* and *Nymphae* sp.

Classification:

This vegetation community has not been mapped by Bell (2002), however it is considered that this community corresponds to an artificial variant of Map Unit 14 Freshwater Wetlands as described by Bell (2002). This community is considered to be a dam created on previously dry land for farm production purposes. In accordance with the NSW Scientific Committee (2005) this community is not regarded as part of the endangered ecological community Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

Variation:

Small canopy trees are sparse within this community and generally have a clumped distribution.

Disturbance:

This community has been disturbed by weed invasion and trampling from stock.

Weed Invasion:

Weed invasion is moderate within this community.

Location and Distribution:

This community occurs in the wetland located within the central section of the site and covers approximately 0.64 hectares as shown in Figure 2.1.

CLEARED LAND WITH SCATTERED TREES

Areas of Cleared Land with Scattered Trees occur where native canopy and shrub layer vegetation has been predominantly removed and understorey vegetation is dominated by exotic species, particularly introduced pasture grasses. The subject site contains approximately 12.83 hectares of this vegetation type as shown in Figure 2.1.

TABLE 2.4 FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
Trees		
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Euphorbiaceae	*Glochidion ferdinandi*	Cheese Tree
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Lauraceae	*Endiandra sieberi*	Corkwood
Myrtaceae	*Angophora floribunda*	Rough-barked Apple
Myrtaceae	*Eucalyptus amplifolia*	Cabbage Gum
Myrtaceae	*Corymbia maculata*	Red Bloodwood
Myrtaceae	*Eucalyptus botryoides*	Bangalay / Southern Mahogany
Myrtaceae	*Eucalyptus grandis*	Flooded gum
Myrtaceae	*Eucalyptus pilularis*	Blackbutt
Myrtaceae	*Eucalyptus racemosa*	Narrow-leaved Scribbly Gum
Myrtaceae	*Eucalyptus resinifera* subsp. *resinifera*	Red Mahogany
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Myrtaceae	*Melaleuca linariifolia*	Snow in Summer
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree
Myrtaceae	*Syncarpia glomulifera*	Turpentine
Shrubs		
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax
Asteraceae	*Ozothamnus diosmifolius*	Ball Everlasting
Euphorbiaceae	*Phyllanthus gunnii*	Spurge
Faboideae	*Gompholobium latifolium*	Broad-leaf Wedge-pea
Mimosoideae	*Acacia irrorata*	Green Wattle
Mimosoideae	*Acacia ulicifolia*	Prickly Moses
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush
Myrtaceae	*Kunzea ambigua*	Tick Bush
Myrtaceae	*Melaleuca nodosa*	Ball Honey Myrtle
Myrtaceae	*Melaleuca sieberi*	-
Proteaceae	*Banksia spinulosa*	Hairpin Banksia
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung
Rosaceae	*Rubus anglocandicans**	Blackberry
Rosaceae	*Rubus ulmifolius**	Blackberry
Styphelioideae	*Epacris pulchella*	NSW Coral Heath
Groundcovers		
Apiaceae	*Centella asiatica*	Swamp Pennywort
Apiaceae	*Hydrocotyle peduncularis*	Pennywort
Asteraceae	*Hypochaeris radicata**	Flatweed

TABLE 2.4 FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
Asteraceae	*Senecio madagascariensis**	Fireweed
Callitrichaceae	*Callitriche stagnalis**	Common Starwort
Clusiaceae	*Hypericum gramineum*	Small St Johns Wort
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge
Cyperaceae	*Schoenus melanostachys*	Black Bog Rush
Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower
Faboideae	*Medicago sp**	
Faboideae	*Trifolium repens**	White Clover
Gentianaceae	*Centaurium erythraea**	Pink Stars
Juncaceae	*Juncus continuus*	-
Juncaceae	*Juncus planifolius*	Broad Rush
Juncaceae	*Juncus usitatus*	Common Rush
Lobeliaceae	*Pratia purpurascens*	Whiteroot
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Menyanthaceae	*Villarsia exaltata*	Yellow Marsh Flower
Myrsinaceae	*Anagallis arvensis**	Scarlet Pimpernel
Orchidaceae	*Calochilus sp*	Beard Orchid
Orchidaceae	*Cymbidium suave*	Native Cymbidium
Orchidaceae	*Microtis sp*	Onion Orchid
Phormiaceae	*Dianella caerulea*	Blue Flax Lily
Plantaginaceae	*Plantago lanceolata**	Ribwort
Poaceae	*Andropogon virginicus**	Whisky Grass
Poaceae	*Briza minor**	Shivery Grass
Poaceae	*Cynodon dactylon*	Common Couch
Poaceae	*Echinopogon caespitosus* var. *caespitosus*	Tufted Hedgehog Grass
Poaceae	*Entolasia marginata*	Bordered Panic
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Rice Grass
Poaceae	*Oplismenus aemulus*	Basket Grass
Poaceae	*Poa labillardieri* var. *labillardieri*	Tussock Grass
Poaceae	*Stenotaphrum secundatum* *	Buffalo Grass
Polygonaceae	*Rumex crispus**	Curled Dock
Ranunculaceae	*Ranunculus repens**	Creeping Buttercup
Restionaceae	*Baloskion tetraphyllum*	
Rubiaceae	*Pomax umbellata*	Pomax
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	Slender Rice Flower
Violaceae	*Viola hederacea*	Ivy-leaved Violet
Aquatics		
Azollaceae	*Azolla pinnata*	Ferny Azolla
Cyperaceae	*Chorizandra cymbaria*	Heron Bristle Rush
Cyperaceae	*Schoenoplectus mucronatus*	River Clubrush
Menyanthaceae	*Nymphoides geminata*	Entire Marshwort

TABLE 2.4 FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
Philydraceae	*Philydrum lanuginosum*	Woolly Frogmouth
Climbers		
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea-flower
Faboideae	*Desmodium rhytidophyllum*	Rusty Tick Trefoil (furry)
Faboideae	*Glycine clandestina*	Twining Glycine
Faboideae	*Vicia sativa* subsp. *sativa**	Common Vetch
Rubiaceae	*Morinda jasminoides*	-
Smilacaceae	*Smilax glyciphylla*	Sarsaparilla
Species name^{TS} = Threatened Species * = Introduced Species		

2.5 LOCATION AND DISTRIBUTION OF ADJOINING AND CONTIGUOUS HABITATS

An inspection of the available aerial imagery for the local area, review of available vegetation mapping (Bell 2002) and field surveys were undertaken to determine the extent and composition of vegetation within the subject site and immediately surrounding vicinity.

The subject site occurs at the southern extent of a large patch of vegetation which occurs along the south-western shores of Tuggerah Lake. Connectivity to the south is limited by existing residential subdivision and Ourimbah Creek. Other larger areas of vegetation occur within close proximity to the eastern and western boundaries of the site connected through the movement of birds, bats, insects and wind dispersed seed resulting in the exchange of genetic material across the boundary of the subject site. Some connectivity is present through the site between offsite areas to the east and west, however a more substantial habitat linkage is present between these areas to the north of the site.

The endangered ecological community (EEC), Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SSFCF) occurs within the subject site. The local occurrence of this EEC has been interpreted from a review of vegetation mapping undertaken by Bell (2002) and incorporates Map Unit 18 Alluvial Floodplain Swamp Paperbark Thicket and Map Unit 20 Alluvial Floodplain Shrub Swamp Forest. The total local occurrence of SSFCF EEC vegetation comprises a total area of approximately 248 hectares which includes 10.61 hectares of SSFCF EEC vegetation within the subject site, 223.6 hectares of SSFCF EEC vegetation adjoining the subject site to the north and east and 13.79 hectares of SSFCF EEC vegetation adjoining the subject site to the west.

SECTION 3

FAUNA AND FAUNA HABITATS

3.1 THREATENED FAUNA SPECIES

A search of the Bionet Atlas of NSW Wildlife (NSW OEH 2012) was conducted for threatened fauna species recorded within 10km of the subject site. This revealed a number of threatened species that have been recorded in the area. Details on threatened fauna species as listed in Schedule 1 and 2 of the *TSC Act* (1995) with a known or possible occurrence within the local area are provided in Table 3.1. Those species identified with suitable habitat present on site are assessed in the 7-part test in Section 4 of this report.

TABLE 3.1
THREATENED FAUNA SPECIES OF THE AREA

Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Green and Golden Bell Frog *Litoria aurea*	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris.	Suitable habitat present.
Green Thighed Frog *Litoria brevipalmata*	V	-	Found in rainforests and open forests within or at the edge of streams, swamps, lagoons, dams and ponds.	Suitable habitat present.
Wallum Froglet *Crinia tinnula*	V	-	Found in acidic paperbark swamps and wallum country with dense groundcover. Breeds in temporary and permanent pools and ponds of high acidity.	Suitable habitat present.
Stuttering Frog *Mixophyes balbus*	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests.	Suitable habitat present.
Giant Barred Frog *Mixophyes iteratus*	E	E	Terrestrial inhabitant of rainforest and open forests.	Suitable habitat present.
Red-crowned Toadlet *Pseudophryne australis*	V	-	Prefers sandstone areas, breeds in grass and debris beside non-perennial creeks or gutters. Individuals can also be found under logs and rocks in non breeding periods.	No suitable habitat present.
Pale-headed Snake *Hoplocephalus bitorquatus*	V		Occurs in a range of habitats from rainforest to open woodland. Usually occurs in hollow trees and beneath loose bark along watercourses. Partly arboreal and may use hollows in trees.	Suitable habitat present.
Stephens Banded Snake *Hoplocephalus stephensii*	V	-	A nocturnal and partly arboreal species that inhabits open and closed forest communities sheltering under bark, in hollows and under exfoliating slabs of granite.	Suitable habitat present.
Australasian Bittern *Botaurus poiciloptilus*	E		Inhabits shallow freshwater or brackish wetlands with tall dense beds of reeds, sedges or rush species and swamp edges.	Suitable habitat present.
Black Bittern *Ixobrychus flavicollis*	V	-	Freshwater & brackish streams & ponds.	Suitable habitat present.
Black-necked Stork *Ephippiorhynchus asiaticus*	V	-	Occurs in tropical to warm temperate terrestrial wetlands, estuarine and littoral habitats.	Suitable habitat present.

TABLE 3.1 THREATENED FAUNA SPECIES OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Square-tailed Kite *Lophoictinia isura*	V	-	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds.	Suitable habitat present.
Little Eagle *Hieraaetus morphnoides*	V	-	Inhabits a variety of habitats including woodland open forest, partially cleared areas, along watercourses and around wetlands.	Suitable habitat present.
Osprey *Pandion haliaetus*	V	-	Utilises waterbodies including coastal waters, inlets, lakes, estuaries and offshore islands with a dead tree for perching and feeding.	Suitable habitat present.
Bush Stone-curlew *Burhinus grallarius*	E	-	Utilises open forests, savannah woodlands, dune scrub, savannah and mangrove fringes.	Suitable habitat present.
Comb-crested Jacana *Irediparra gallinacea*	V	-	Deep and permanent vegetation-choked tropical and warm temperate wetlands.	Suitable habitat present.
Sooty Oystercatcher *Haematopus fuliginosus*	V	-	Exclusively coastal in distribution foraging along rocky coastlines and estuaries.	No suitable habitat present.
Pied Oystercatcher *Haematopus longirostris*	V	-	Inhabits coastal beaches and estuarine flats.	No suitable habitat present.
Wompoo Fruit-dove *Ptilinopus magnificus*	V	-	Inhabits large undisturbed patches of lowland and adjacent highland rainforest and moist eucalypt forests where it feeds on fruit.	Suitable habitat present.
Rose-crowned Fruit-dove *Ptilinopus regina*	V	-	Occurs in dense rainforests with a substantial understorey where it feeds entirely on fruit.	Suitable habitat present.
Superb Fruit-dove *Ptilinopus superbus*	V	-	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits.	Suitable habitat present.
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	-	Prefers wetter forests and woodlands from sea level to > 2000m on Divide, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens.	Suitable habitat present.
Glossy Black-Cockatoo *Calyptorhynchus lathami*	V	-	Open forests with Allocasuarina species and hollows for nesting.	Suitable habitat present.
Little Lorikeet *Glossopsitta pusilla*	V	-	Found in forests, woodlands, large trees in open country, timbered watercourses and street trees.	Suitable habitat present.
Swift Parrot *Lathamus discolor*	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts.	Suitable habitat present.

TABLE 3.1 THREATENED FAUNA SPECIES OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Turquoise Parrot *Neophema pulchella*	V	-	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands.	Suitable habitat present.
Powerful Owl *Ninox strenua*	V	-	Forests containing mature trees for shelter or breeding & densely vegetated gullies for roosting.	Suitable habitat present.
Barking Owl *Ninox connivens*	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting.	Suitable habitat present.
Masked Owl *Tyto novaehollandiae*	V	-	Open forest & woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting.	Suitable habitat present.
Sooty Owl *Tyto tenebricosa*	V	-	Tall, dense, wet forests containing trees with very large hollows.	No suitable habitat present.
Speckled Warbler *Phyrrholaemus sagittata*	V	-	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts.	No suitable habitat present.
Painted Honeyeater *Grantiella picta*	V	-	Found in open forest, woodland and scrubland feeding on mistletoe fruits.	Suitable habitat present.
Regent Honeyeater *Xanthomyza phrygia*	CE	E	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts.	Suitable habitat present.
Grey-crowned Babbler *Pomatostomus temporalis temporalis*	V	-	Found in dry open forests, woodland scrubland, and farmland with isolated trees. Distribution Limit mostly west of Great Divide except Hunter Valley.	No suitable habitat present.
Varied Sittella *Daphoenositta chrysoptera*	V	-	Prefers open eucalypt woodlands and forests, mallee, inland acacia, coastal tee-tree scrubs, parks and gardens.	Suitable habitat present.
Flame Robin *Petroica phoenicea*	V	-	Upland moist Eucalypt forests and woodlands during breeding season, disperses to open lowland habitats during winter.	Suitable habitat present.
Spotted-tailed Quoll *Dasyurus maculatus*	V	V	Dry and moist open forests containing rock caves, hollow logs or trees.	Suitable habitat present.
Long-nosed Potoroo *Potorous tridactylus*	V	-	Coastal heath and dry and wet sclerophyll forests with a dense understorey.	Suitable habitat present.
Parma Wallaby *Macropus parma*	V	-	Inhabits rainforests and wet and dry sclerophyll forests with a dense understorey and associated grassy patches.	Suitable habitat present.
Southern Brown Bandicoot *Isoodon obesulus*	E	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland.	Suitable habitat present.
Koala *Phascolarctos cinereus*	V	-	Inhabits both wet & dry eucalypt forest on high nutrient soils containing preferred feed trees.	Suitable habitat present.

TABLE 3.1 THREATENED FAUNA SPECIES OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Yellow-bellied Glider *Petaurus australis*	V	-	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees.	Suitable habitat present.
Squirrel Glider *Petaurus norfolcensis*	V	-	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees.	Suitable habitat present.
Eastern Pygmy Possum *Cercatetus nanus*	V	-	Found in a variety of habitats from rainforest through open forest to heath. Feeds on insects but also gathers pollen from banksias, eucalypts and bottlebrushes. Nests in banksias and myrtaceous shrubs.	Suitable habitat present.
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy.	Suitable habitat present. Observed during surveys.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	-	Rainforests, sclerophyll forests and woodlands. Roosts in tree hollows.	Suitable habitat present.
Eastern Freetail-bat *Mormopterus norfolkensis*	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings.	Suitable habitat present.
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals.	Suitable habitat present.
Eastern Bentwing-bat *Miniopterus schreibersii oceansis*	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well timbered areas.	Suitable habitat present. Observed during surveys.
Little Bentwing-bat *Miniopterus australis*	V	-	Roosts in caves, old buildings and tree hollows in the higher rainfall forests along the south coast of Australia. Distribution Limit - N-Border Ranges National Park. S-Sydney.	Suitable habitat present. Observed during surveys.
Golden-tipped Bat *Kerivoula papuensis*	V		Inhabits rainforest and adjoining moist open forest habitats. Roosts in tree hollows and dense vegetation.	No suitable habitat present.
Southern Myotis *Myotis macropus*	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water.	Suitable habitat present. Observed during surveys.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	-	Inhabits sclerophyll forests. Recorded roosting in caves, old buildings and tree hollows.	Suitable habitat present. Observed during surveys.

TABLE 3.1 THREATENED FAUNA SPECIES OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	Prefers gully areas containing moist mature coastal forest or rainforest. Also associated with gullies with open woodland, and wet and dry sclerophyll forests.	Suitable habitat present.
Giant Dragonfly *Petalura gigantean*	E	-	Inhabits permanent swamps and bogs with some free water and open vegetation.	Suitable habitat present.
CE = Critically Endangered E = Endangered Species V = Vulnerable Species				

The following threatened fauna species were observed within the subject site during surveys:

- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Southern Myotis (*Myotis macropus*); and
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*).

Threatened fauna species identified in Table 3.1 as having suitable habitat within the subject site have been assessed under the 7 part test of significance as detailed in Section 4 of this report.

3.2 ENDANGERED FAUNA POPULATIONS

There are no Endangered Fauna Populations within the local government area.

3.3 FAUNA HABITATS

A range of fauna habitats are present throughout the site. These include:

- Areas of open forest and canopy only vegetation;
- Nectar and seed producing trees and shrubs;
- Leaf litter leaf litter and fallen timber;
- Cleared areas;
- Dams and areas of ponded water; and
- Hollow bearing trees.

The following broad vegetation units of relevance to fauna habitats have been identified within the subject site:

- Coastal Swamp Forest (Apple / Blackbutt / Swamp Mahogany Open Forest);
- Freshwater vegetation;
- Canopy Only Vegetation (Swamp Mahogany / Paperbark & Blackbutt);
- Cleared Land with Scattered Trees.

Thirty three hollow bearing trees were observed within the subject site. Hollow types observed were broken trunk, trunk and branch hollows of various sizes from 1-40cm. Specific habitat attributes within the site for each fauna group are described below.

Amphibians
Amphibian habitat is present within the Coastal Swamp Forest and Freshwater Vegetation communities, the farm dams and several seasonally inundated areas within Canopy Only Vegetation and Cleared Land with Scattered Trees communities. These areas provide a variety of habitats for shelter, breeding and foraging.

Reptiles
Suitable foraging habitat occurs within the site for locally occurring reptile species. Suitable shelter and breeding habitats are provided under fallen logs, in tree hollows and within leaf litter. Wetland habitats and inundated areas are also likely to be utilised for foraging and shelter.

Birds
The flower, nectar, fruit and seed producing tree and shrub species provide a seasonal foraging resource for bird species. The groundlayer vegetation throughout the site and areas of bare earth also provide suitable areas of foraging habitat for locally occurring bird species. The wetland area provides habitat for water foraging birds. Hollow bearing trees observed provide small to large sized hollows (up to 40cm) which may be utilised for nesting and roosting sites.

Mammals
The flower, nectar, fruit and seed producing tree and shrub species provide a seasonal foraging resource for arboreal mammals and bat species. Hollow bearing trees observed provide small to large sized hollows (up to 40cm) which may be utilised for den sites for arboreal mammals and microchiropteran bats. The Coastal Swamp Forest vegetation contains suitable foraging and refuge habitat for a number of terrestrial mammal species.

3.4 FAUNA SURVEY METHODOLOGY

In order to detect the possible occurrence of threatened fauna species specific methods targeting these species were employed.

Literature Review

- A review of available literature for the area was undertaken to obtain reference material and background information for this study. These documents are listed in the References section of this Report. Documents which were utilised included the following:

  - Andrews Neil (2004); and
  - *Wildthing Environmental Consultants* (1998).

- A search of the Bionet Atlas of NSW Wildlife (NSW OEH 2012) was undertaken to identify records of threatened fauna species located within 10km of the site. This enabled the preparation of a predictive list of threatened fauna species that could possibly occur within the habitats found on the site.

Fauna Survey

A detailed fauna survey of the subject site was undertaken generally incorporating the methodologies outlined by Wyong Shire Council (1999).

The methods that were utilised consisted of:

- Targeted Amphibian searches;
- Targeted Reptile searches;

- Diurnal and nocturnal bird surveys;
- Call playback survey for threatened owls and mammals;
- Nocturnal spotlighting;
- Bat echolocation call detection;
- Arboreal mammal Elliot trapping;
- Terrestrial mammal Elliot trapping;
- Wire cage trapping;
- Hollow bearing tree assessment (See appendix 2); and
- Habitat searches.

Fauna survey details are shown in Table 3.2 and fauna survey locations are shown in Figure 3.1. Thirty three hollow bearing trees were observed within the site, a hollow bearing tree assessment is provided as Appendix 2. A summary of the weather conditions during fauna surveys is provided in Appendix 3.

TABLE 3.2 FAUNA SURVEY DETAILS			
Survey Type	**Date**	**Survey Method**	**Survey Effort/Time**
Diurnal Surveys	20 January 2004^	Reptile and amphibian habitat surveys Diurnal bird surveys Opportunistic observation	1hr 0800-0900
	26 August 2011	Diurnal reptile and amphibian searches Diurnal bird census Opportunistic fauna observation	1hr 1600-1700
	26 August 2011	Diurnal reptile and amphibian searches Diurnal bird census Opportunistic fauna observation	1hr 1600-1700
	27 August 2011	Diurnal reptile and amphibian searches Diurnal bird census Opportunistic fauna observation	0.5hrs 1900-1930
	30 August 2011	Diurnal reptile and amphibian searches Diurnal bird census Opportunistic fauna observation	0.75 hrs 1730-1815
	9 September 2011	Diurnal reptile and amphibian searches Diurnal bird census Opportunistic fauna observation	1.5hrs 0900-1030
	26 September 2011	Diurnal reptile and amphibian searches Diurnal bird census Opportunistic fauna observation	1hr 0930-1030
	10 October 2011	Diurnal reptile and amphibian searches Diurnal bird census Opportunistic fauna observation	4hrs 1230-1630
	11 October 2011	Diurnal reptile and amphibian searches Diurnal bird census Opportunistic fauna observation	6.5hrs 0745-1415
	12 October 2011	Diurnal reptile and amphibian searches Diurnal bird census Opportunistic fauna observation	2hrs 0730-0930
	13 October 2011	Diurnal reptile and amphibian searches X 2 persons Diurnal bird census X 2 persons Opportunistic fauna observation X 2 persons	3.5hrs 0730-1100
	14 October 2011	Diurnal reptile and amphibian searches Diurnal bird census Opportunistic fauna observation	2.25hrs 0800-1015

TABLE 3.2 FAUNA SURVEY DETAILS			
Survey Type	**Date**	**Survey Method**	**Survey Effort/Time**
	4 November 2011	Diurnal reptile and amphibian searches Diurnal bird census Opportunistic fauna observation	2hrs 1030-1230
Trapping Surveys	10-11 October 2011 11-12 October 2011 12-13 October 2011 13-14 October 2011	Small terrestrial mammal Elliot trapping 5 mixed Elliot A & B size traps per transect x 5 transects x 4 nights	100 small terrestrial mammal trap nights
	10-11 October 2011 11-12 October 2011 12-13 October 2011 13-14 October 2011	Medium terrestrial mammal cage trapping 5 cage traps x 4 nights	20 medium terrestrial mammal trap nights
	10-11 October 2011 11-12 October 2011 12-13 October 2011 13-14 October 2011	Arboreal mammal Elliot trapping 5 Elliot B size traps per transect x 5 transects x 4 nights	100 arboreal mammal trap nights
Nocturnal Surveys	28 January 2004^	Nocturnal bird, amphibian and mammal call playback survey Targeted nocturnal reptile, bird and mammal spotlight search Targeted amphibian spotlight search Opportunistic observation and call detection	1hr 15min 2000-2115
	28 January 2004^	Bat echolocation call detection x 1 unit	1hr 15min 2000-2115
	26 August 2011	Nocturnal bird, amphibian and mammal call playback survey Targeted nocturnal reptile, bird and mammal spotlight search Targeted amphibian spotlight search Opportunistic observation and call detection	2hrs 1730-1930
	26 August 2011	Bat echolocation call detection x 2 units	2hrs 1730-1930
	30 August 2011	Nocturnal bird, amphibian and mammal call playback survey Targeted nocturnal reptile, bird and mammal spotlight search Targeted amphibian spotlight search Opportunistic observation and call detection	1.5hrs 1800-1930
	30 August 2011	Bat echolocation call detection x 2 units	1.5hrs 1800-1930
	13 October 2011	Nocturnal bird, amphibian and mammal call playback survey Targeted nocturnal reptile, bird and mammal spotlight search X 2 persons Targeted amphibian spotlight search X 2 persons Opportunistic observation and call detection X 2 persons	1.5hrs 1830-2000
	13 October 2011	Bat echolocation call detection x 2 units	1.5hrs 1830-2000

TABLE 3.2 FAUNA SURVEY DETAILS			
Survey Type	**Date**	**Survey Method**	**Survey Effort/Time**
	16 February 2012	Nocturnal bird, amphibian and mammal call playback survey Targeted nocturnal reptile, bird and mammal spotlight search Targeted amphibian spotlight search Opportunistic observation and call detection	2hrs 2000-2200
	16 February 2012	Bat echolocation call detection x 2 unit	2hrs 2000-2200
^ Previous surveys undertaken by Andrews Neil (2004)			

3.5 FAUNA OBSERVED

The fauna species observed within the subject site are listed in Table 3.3.

The following threatened fauna species were recorded within the site:

- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Little Bentwing-bat (*Miniopterus australis*);
- Southern Myotis (*Myotis macropus*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*); and
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*).

The following species listed as migratory within the *EPBC Act* (1999) were observed within the subject site during surveys.

- Lathams Snipe (*Gallinago hardwickii*);
- Cattle Egret (*Ardea ibis*); and
- Eastern Great Egret (*Ardea modesta*).

All other fauna species observed are considered relatively common within the local area.

TABLE 3.3
FAUNA OBSERVED AND RECORDED

Common Name	Scientific Name	Observation Type Previous Surveys
Amphibians		
Common Eastern Froglet	*Crinia signifera*	C
Brown-striped Frog	*Limnodynastes peronii*	C
Green Tree Frog	*Litoria caerulea*	C, *ANE*
Bleating Tree Frog	*Litoria dentata*	C
Eastern Dwarf Tree Frog	*Litoria fallax*	C
Broad-palmed Frog	*Litoria latopalmata*	*ANE*
Peron's Tree Frog	*Litoria peronii*	C
Tyler's Tree Frog	*Litoria tyleri*	C
Reptiles		
Land Mullet	*Egernia major*	*ANE*
Dark-flecked Garden Sunskink	*Lampropholis delicata*	O
Eastern Blue-tongue	*Tiliqua scincoides*	*ANE*
Red-bellied Black Snake	*Pseudechis porphyriacus*	O
Birds		
Chestnut Teal	*Anas castanea*	O
Pacific Black Duck	*Anas superciliosa*	O
Australasian Grebe	*Tachybaptus novaehollandiae*	O
Crested Pigeon	*Ocyphaps lophotes*	O C
Tawny Frogmouth	*Podargus strigoides*	Sp
Little Pied Cormorant	*Microcarbo melanoleucos*	O C
Little Black Cormorant	*Phalacrocorax sulcirostris*	O C
Australian Pelican	*Pelecanus conspicillatus*	O
Eastern Great Egret[M]	*Ardea modesta*	O
Cattle Egret[M]	*Ardea ibis*	O
White-faced Heron	*Egretta novaehollandiae*	O C
Australian White Ibis	*Threskiornis molucca*	O

TABLE 3.3 FAUNA OBSERVED AND RECORDED		
Common Name	**Scientific Name**	**Observation Type Previous Surveys**
Yellow-billed Spoonbill	*Platalea flavipes*	*ANE*
Whistling Kite	*Haliastur sphenurus*	O
Purple Swamphen	*Porphyrio porphyrio*	O C
Masked Lapwing	*Vanellus miles*	O C
Latham's Snipe[M]	*Gallinago hardwickii*	O C
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	O C
Little Corella	*Cacatua sanguinea*	O C
Sulphur-crested Cockatoo	*Cacatua galerita*	O C
Rainbow Lorikeet	*Trichoglossus haematodus*	O C
Eastern Rosella	*Platycercus eximius*	O C
Channel-billed Cuckoo	*Scythrops novaehollandiae*	O C
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	O C
Laughing Kookaburra	*Dacelo novaeguineae*	O C
Dollarbird	*Eurystomus orientalis*	O C
Satin Bowerbird	*Ptilonorhynchus violaceus*	O C
Brown Thornbill	*Acanthiza pusilla*	O C
Spotted Pardalote	*Pardalotus punctatus*	O C
Yellow-faced Honeyeater	*Lichenostomus chrysops*	O C
Bell Miner	*Manorina melanophrys*	C
Noisy Miner	*Manorina melanocephala*	O C
Little Wattlebird	*Anthochaera chrysoptera*	O C
Red Wattlebird	*Anthochaera carunculata*	O C
Scarlet Honeyeater	*Myzomela sanguinolenta*	C
Noisy Friarbird	*Philemon corniculatus*	C
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O C
Rufous Whistler	*Pachycephala rufiventris*	O C
Australasian Figbird	*Sphecotheres vieilloti*	O C
Olive-backed Oriole	*Oriolus sagittatus*	O C
White-breasted Wood swallow	*Artamus leucorynchus*	O C
Grey Butcherbird	*Cracticus torquatus*	O C
Pied Butcherbird	*Cracticus nigrogularis*	O C
Australian Magpie	*Cracticus tibicen*	O C
Pied Currawong	*Strepera graculina*	O C
Grey Fantail	*Rhipidura albiscapa*	O C
Willie Wagtail	*Rhipidura leucophrys*	O C
Australian Raven	*Corvus coronoides*	O C
Magpie-lark	*Grallina cyanoleuca*	O C
Common Myna*	*Sturnus tristis*	O C
Red-browed Finch	*Neochmia temporalis*	*ANE*
Mammals		
Brown Antechinus	*Antechinus stuartii*	E
Common Ringtail Possum	*Pseudocheirus peregrinus*	Sp
Sugar Glider	*Petaurus breviceps*	E
Black Rat *	*Rattus rattus*	E
Rabbit *	*Oryctolagus cuniculus*	O
European cattle *	*Bos taurus*	O
Sheep (feral) *	*Ovis aries*	O
Fox *	*Vulpes vulpes*	*ANE*
Dog *	*Canis lupus familiaris*	C

TABLE 3.3
FAUNA OBSERVED AND RECORDED

Common Name	Scientific Name	Observation Type Previous Surveys
Grey-headed Flying-fox [TS1/TS2]	*Pteropus poliocephalus*	*ANE/WT*
Undescribed Freetail Bat	*Mormopterus "Species 2"*	A
Little Bentwing-bat [TS1]	*Miniopterus australis*	*WT*
Eastern Bentwing-bat [TS1]	*Miniopterus schreibersii oceanensis*	*WT*
Gould's Wattled Bat	*Chalinolobus gouldii*	A
Chocolate Wattled Bat	*Chalinolobus morio*	*ANE*
Southern Myotis [TS1]	*Myotis macropus*	*WT*
Eastern False Pipistrelle [TS1]	*Falsistrellus tasmaniensis*	A
Eastern Broad-nosed Bat	*Scotorepens orion*	A
Eastern Forest Bat	*Vespadelus pumilus*	*ANE*
Little Forest Bat	*Vespadelus vulturnus*	A

Key to Observation Type

O	-	Observation	S	-	Search
C	-	Call identification	A	-	Anabat II
Sp	-	Spotlight	Sc	-	Scat, Track or Sign
E	-	Elliott Trap	K	-	Kill

ANE = Observed by Andrews Neil (2004) / Not observed during current surveys
WT = Observed by Wildthing Environmental Consultants (1998) / Not observed during current surveys
Note: * indicates introduced species. [TS1] indicates threatened species *TSC Act* NSW.
[TS2] indicates threatened species EPBC Act [M] indicates migratory species EPBC Act

SECTION 4

ASSESSMENTS AND CONCLUSIONS

4.1 EPBC ACT ASSESSMENT

The *Environment Protection and Biodiversity Conservation Act* (1999) (EPBC Act) is a nationally applicable act administered by the Australian Government. The Act provides a legal framework to protect matters of National Environment Significance. These include:-

- World heritage sites;
- National heritage places;
- Wetlands of international importance;
- Nationally threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park; and
- Nuclear actions.

Under the *EPBC Act* (1999) an action will require approval from the minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance.

Matters of National Environmental Significance, observed within the subject site, are assessed detail in accordance with the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* (DEWHA 2009) provided as Appendix 4 to this report. The assessments undertaken have been prepared based on the concept plan prepared for the rezoning of the subject site.

These assessments specifically cover threatened species, threatened ecological communities and migratory species listed within the *EPBC Act* (1999). Results of surveys and assessments undertaken are summarised below.

EPBC Act Listed Threatened Species
No threatened flora species listed within the *EPBC Act* (1999) were observed within the subject site.

One threatened fauna species listed within the *EPBC Act* (1999), Grey-headed Flying-fox, was observed within the subject site.

The proposal is considered not likely to have a significant impact on threatened flora of threatened fauna species listed within the *EPBC Act* (1999).

EPBC Act Listed Migratory Species
Three migratory fauna species listed within the *EPBC Act* (1999), Lathams Snipe (*Gallinago hardwickii*), Cattle Egret (*Ardea ibis*) and Eastern Great Egret (*Ardea modesta*) were observed within the subject site.

The proposal is considered not likely to have a significant impact on migratory species listed within the *EPBC Act* (1999).

EPBC Act Listed Threatened Ecological Communities
No threatened ecological communities, as listed within the *EPBC Act* (1999), were observed within the subject site.

The proposal is considered not likely to have a significant impact on threatened ecological communities listed within the *EPBC Act* (1999).

EPBC Act Significant Impact Determination
It is considered that the proposed action does not constitute a matter of National Environmental Significance and a referral of this project to the Department of the Environment, Water, Heritage and Arts is not required as the proposed action is not likely to impact on a significant population of nationally listed threatened or migratory species or on any nationally listed endangered ecological community.

4.2 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT (1979)

The *Environmental Planning and Assessment Act* (1979) is a state applicable act administered by the NSW State Government. Section 5(A) of the *EP&A Act* 1979 provides seven factors (referred to as the assessment of significance or 7 part test) which must be taken into account by a consent authority in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities or their habitats, listed within the *Threatened Species Conservation Act* (1995).

An assessment of significance has been undertaken for threatened species, populations and ecological communities listed within the *TSC Act* (1995), observed or with suitable habitat contained within the subject site. The assessment is provided as Appendix 5 to this report and results of the assessment are summarised below.

The assessment undertaken has been prepared based on the concept plan prepared for the rezoning of the subject site.

TSC Act Listed Threatened Species
No threatened flora species listed within the *TSC Act* (1995) were observed within the subject site during surveys.

The threatened fauna species listed within the *TSC Act* (1995), Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bentwing-bat (*Miniopterus australis*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), Southern Myotis (*Myotis macropus*) and Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) were observed within the subject site during surveys.

The proposed development is not likely to have a significant impact on threatened species listed within the *TSC Act* (1995).

TSC Act Listed Threatened Populations
No threatened populations were observed within the subject site;

The proposed development is not likely to have a significant impact on threatened populations listed within the *TSC Act* (1995).

TSC Act Listed Threatened Ecological Communities
One endangered ecological community listed within the *TSC Act* (1995), Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions was observed within the subject site.

The proposed development is not likely to have a significant effect on threatened ecological communities listed within the *TSC Act* (1995);

4.3 STATE ENVIRONMENTAL PLANNING POLICIES

SEPP 14 - Coastal Wetlands
The subject site is not included within an area mapped as a wetland in SEPP 14.

SEPP 26 - Littoral Rainforest
The subject site is not included within any area mapped as a littoral rainforest in SEPP 26. The vegetation on-site does not correspond to Littoral Rainforest with respect to species composition and substrate.

SEPP 44 - Koala Habitat Assessment
The subject site was assessed for activity by Koalas using the following methods:

i. A search of the BioNet Atlas of NSW Wildlife (NSW OEH 2012) was undertaken to identify records of Koalas in the area;

ii. The site was surveyed on foot with any species of Koala food trees being inspected for signs of Koala usage. Trees were inspected and identified for presence of Koalas, scratch and claw marks on the trunk and scats around the base of each tree. The proportion of any trees showing signs of Koala use was calculated for the whole of the site. Additionally the location and density of droppings if found were documented;
iii. Koalas were also targeted during spotlight surveys;

iv. Identification and assessment of the density of tree species listed as Koala food trees in State Environmental Planning Policy No. 44 - Koala Habitat Protection was undertaken across the site.

TABLE 4.1
SEPP-44 KOALA FEED TREE SPECIES
(From SEPP-44 Schedule 2)

Scientific Name	**Common Name**	**Observed On Site**	**Percentage within survey plots**
Eucalyptus tereticornis	Forest Red Gum	No	0%
Eucalyptus microcorys	Tallowwood	No	0%
Eucalyptus punctata	Grey Gum	No	0%
Eucalyptus viminalis	Ribbon or Manna Gum	No	0%
Eucalyptus camaldulensis	River Red Gum	No	0%
Eucalyptus haemastoma	Broad-leaved Scribbly Gum	No	0%
Eucalyptus signata	Scribbly Gum	No	0%
Eucalyptus albens	White Box	No	0%
Eucalyptus populnea	Bimble Box or Poplar Box	No	0%
Eucalyptus robusta	Swamp Mahogany	Yes	>15%

One Koala food tree species as listed on Schedule 2 of State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44), *Eucalyptus robusta*, was observed within the subject site. Therefore the subject site is considered to form potential koala habitat as defined by SEPP 44.

No Koalas were observed during the fauna survey and no evidence of Koala habitation, such as scats, claw and scratch marks, were located on the site. Therefore the subject site is considered to not form core koala habitat as defined by SEPP 44.

4.4 SPECIFIC LOCAL GOVERNMENT AREA ASSESSMENTS

Wyong Shire Council Squirrel Glider Conservation (Petaurus norfolcensis) Management Plan

The subject site is not within an Interim Conservation Area for Wyong Shire identified within DCP 13 and no Squirrel Gliders (*Petaurus norfolcensis*) were observed within the subject site, therefore an assessment according to the Interim Ecological Assessment Information Required to Assess Clearing Impacts within Squirrel Glider Habitat in Wyong Shire (2000) is not required.

4.5 CONCLUSIONS

Based on the detailed field survey and information provided in this report it is concluded that:

i. No threatened flora species listed within the *TSC Act* or the *EPBC Act* were observed within the subject site;

ii. The threatened fauna species, the Grey-headed Flying-fox (*Pteropus poliocephalus*) as listed within the *TSC Act* and the *EPBC Act* and the threatened fauna species, Little Bentwing-bat (*Miniopterus australis*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), Southern Myotis (*Myotis macropus*) and Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), as listed within the *TSC Act,* were observed within the subject site;

iii. No endangered populations listed within the *TSC Act* were observed within the subject site;

iv. The migratory species, Lathams Snipe (*Gallinago hardwickii*), Cattle Egret (*Ardea ibis*) and Eastern Great Egret (*Ardea modesta*), listed within the *EPBC Act*, were observed within the subject site;

v. The endangered ecological community, Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions, as listed within the *TSC Act* was observed within the subject site;

vi. A referral to the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) is considered unnecessary;

vii. The proposed development is not likely to have a significant effect on threatened species, populations or ecological communities or their habitats.

viii. A Species Impact Statement is not required for the proposed development.

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APPENDIX 1

PRELIMINARY CONCEPT MASTERPLAN

BLOCK SUMMARY TABLE

REGULAR SHAPED BLOCKS	
450m²	21
480m²	9
510m²	12
540m²	14
548m²	2
570m²	62
584m²	7
658m²	24
660m²	2
TOTAL	153
IRREGULAR SHAPED BLOCKS	
400-499m²	23
500-599m²	14
600-699m²	13
700m²+	11
TOTAL	61

STAGE 1 - CONCEPT MASTERPLAN

Geoffrey Road, Chittaway Bay

0 10 50 100 250

N

Date: 02 December, 2011 Scale 1 : 3000 @ A3 Project No: 11.040 Sheet: 1/1

THE DESIGNPARTNERSHIP

21 Justfrute Drive West Gosford PO Box 6325 West Gosford NSW 2250 T - 02 43 24 3633 F - 02 43 226379 E - info@thedesignpartnership.com.au

APPENDIX 2

HOLLOW BEARING TREE ASSESSMENT

1. HOLLOW BEARING TREE SURVEYS

Hollow bearing tree surveys were undertaken during October 2011. Systematic searches were conducted throughout the subject site on foot to assess and detect the presence of hollow bearing trees. Inspection of trees was undertaken by encircling trees from ground level from vantage points which allowed inspection from each cardinal point.

A pair of binoculars was utilised to assist with the detection of tree hollows. Observation of fauna use was also recorded and included searches for scratches on the truck of trees and evidence of nesting material, signs of chewing, rubbing, scratching or droppings on hollow entrances, presence of fauna inside hollows and fauna entering or exiting hollows.

Each hollow bearing tree observed was numbered and tagged and its location was recorded either by GPS or on an aerial photograph of the site.

The following Information was recorded for each hollow bearing observed:

- Tree tag number;
- Tree species name;
- DBH (diameter of trunk at 1.4 metres above ground);
- Canopy spread;
- Topographical location (ridge, slope, gully etc);
- Tree health as a percentage of healthy growth compared to dead limbs;
- Hollow aperture in increments (<10cm/10-30cm/>30cm);
- Position of the hollow in the tree (broken trunk, trunk, basal and branch);
- Presence and size of any split wood, cracked bark or hollow arboreal termite nests; and
- Species of any fauna observed utilising the hollows observed.

Visual inspection from ground level has inherent limitations and can result in observer bias where actual tree hollows are not visible to the observer or false hollows are recorded. Hollows can be obscured due to the location within the tree and the angle of observation by the surveyor and not all tree hollows present may have been identified. False hollows can be recorded due to variables such as dark stains, wounds or marks on trees, poor visibility, solid branch ends or the presence of shallow cavities. In instances where the observer was uncertain as to the presence of a tree hollow the precautionary principle was applied and a hollow was assumed to be present.

2. HOLLOW BEARING TREE ASSESSMENT RESULTS

Details of hollow bearing trees observed within the subject site are provided in Table A2.1 and locations of hollow bearing trees observed are shown in Figure 3.1. A total of 33 hollow bearing trees were observed within the subject site. Analysis of the rezoning concept plan for the site has determined that six hollow-bearing trees will be required for removal and 27 hollow bearing trees will be retained.

TABLE A2.1
HOLLOW BEARING TREE ASSESSMENT RESULTS

Tag No	Species / Type	Proposed Status	DBH (cm)	Spread (m)	Height (m)	Health (%)	Comment	Hollows																		
								Broken Trunk 0-10cm	Broken Trunk 10-15cm	Broken Trunk 15-20cm	Broken Trunk 20-40cm	Broken Trunk >40cm	Trunk 0-10cm	Trunk 10-15cm	Trunk 15-20cm	Trunk 20-40cm	Trunk >40cm	Branch 0-10cm	Branch 10-15cm	Branch 15-20cm	Branch 20-40cm	Branch >40cm	Splits 0-10cm	Splits 10-15cm	Splits 15-20cm	Splits 20-40cm	Splits >40cm
HT1	Stag	Retained	75	1	2	0												2	1								
HT2	Rough Bark	Retained	105	5	12	40															1	1					
HT3	Rough Bark	Retained	110	7	12	30	Scratches										1	2	1		1						
HT4	Rough Bark	Retained	95	5	9	40											1	1									
HT5	Rough Bark	Retained	120	7	8	40											1	2	1								
HT6	Stag	Retained	90	1	3	0											1										
HT7	Stag	Retained	85	1	4	0											1					1					
HT8	Stag	Retained	25	1	6	0										1			1								
HT9	Stag	Retained	95	1	6	0						1				1	1										
HT10	Stag	Retained	35	1	7	0						2															
HT11	Rough Bark	Retained	25	5	7	10												3									
HT12	Stag	Retained	25	1	11	10							1				1	5									
HT13	Roughbark	Retained	110	12	14	60											1										
HT14	Stag	Retained	55	1	4	0						1															
HT15	Roughbark	Retained	45	5	9	40												3	1								
HT16	Stag	Retained	60	1	4	0						1															
HT17	Stag	Retained	80	1	7	0						1										1					
HT18	Roughbark	Retained	95	5	9	20						1								1							
HT19	Stag	Retained	30	1	4	0					1																
HT20	Stag	Retained	25	1	6	0												2	2								
HT21	Roughbark	Retained	105	8	12	10				1								2		1	1	2					
HT22	Stag	Retained	120	1	8	0						2															
HT23	Stag	Retained	60	1	7	0												1	1	1							
HT24	Stag	Retained	50	1	7	0												2	1								
HT25	Stag	Retained	110	1	8	0						1															
HT26	Stag	Retained	65	1	11	0					1					1					1						
HT27	Stag	Retained	135	1	12	0																4					

TABLE A2.1
HOLLOW BEARING TREE ASSESSMENT RESULTS

Tag No	Species / Type	Proposed Status	DBH (cm)	Spread (m)	Height (m)	Health (%)	Comment	Hollows																			
								Broken Trunk 0-10cm	Broken Trunk 10-15cm	Broken Trunk 15-20cm	Broken Trunk 20-40cm	Broken Trunk >40cm	Trunk 0-10cm	Trunk 10-15cm	Trunk 15-20cm	Trunk 20-40cm	Trunk >40cm	Branch 0-10cm	Branch 10-15cm	Branch 15-20cm	Branch 20-40cm	Branch >40cm	Splits 0-10cm	Splits 10-15cm	Splits 15-20cm	Splits 20-40cm	Splits >40cm
HT28	Stringybark	Removed	70	10	18	70												1		2							
HT29	Stag	Removed	85	1	11	0						1								1							
HT30	Blackbutt	Removed	105	10	18	80													1								
HT31	Blackbutt	Removed	125	14	20	90												1	1								
HT32	Blackbutt	Removed	125	14	20	90												3									
HT33	Blackbutt	Removed	120	14	18	80								1				2	1								

APPENDIX 3

WEATHER CONDITIONS DURING SURVEY PERIODS

Norah Head, New South Wales
August 2011 Daily Weather Observations

Observations from Norah Head automatic weather station.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	10.9	22.7	0			NNE	31	19:05	16.3	67		NNW	9	1022.7	18.8	70		NE	13	1019.8
2	Tu	10.6	21.8	0			NNW	20	23:36	16.1	62		WSW	2	1023.2	20.4	68		NE	9	1021.0
3	We	11.3	21.6	0.2			NW	22	08:58	16.4	67		NW	15	1023.3	20.1	64		N	19	1022.2
4	Th	12.1	21.7	0.2						18.1	72		NNW	7	1026.7	19.7	74		NNE	22	1024.6
5	Fr	11.9	23.4				NE	31	17:45	17.9	74		N	9	1026.1	21.2	50		N	15	1022.2
6	Sa	12.7	24.0	0			WNW	30	12:21	18.4	58		NNW	17	1021.7	21.4	49		NW	15	1017.2
7	Su	14.3	19.7	1.2			NNE	37	16:00	15.1	92		NNE	24	1017.3	17.6	78		NE	30	1012.5
8	Mo	10.2	17.8	7.6			WSW	37	01:39	13.5	66		WNW	7	1011.0	17.5	49		NW	9	1007.7
9	Tu	9.1	15.2	0			SSW	26	14:04	11.3	68		WNW	9	1008.1	14.1	55		SSW	11	1006.0
10	We	7.6	18.1	0			NW	28	13:01	12.1	58		WNW	13	1007.6	15.3	46		WNW	9	1005.1
11	Th	8.2	17.0	0			S	20	18:06	11.5	64		WNW	11	1009.0	15.2	56		SSW	11	1008.2
12	Fr	10.6	17.2	7.6			SSE	70	06:39	16.1	65		S	50	1016.8	16.1	63		S	37	1017.7
13	Sa	10.6	18.4	0.6			ESE	26	20:00	13.2	78		W	9	1023.9	16.6	67		SE	7	1022.3
14	Su	12.4	15.0	2.4			NE	31	01:13	13.7	92		NE	11	1025.4	14.9	80		SSE	19	1023.8
15	Mo	10.1	17.1	6.6			SSW	22	11:41	12.2	87		W	7	1026.2	16.3	74		S	13	1022.8
16	Tu	10.9	18.8	0			SSE	22	13:31	13.8	86		WSW	9	1021.8	16.6	74		SE	11	1018.6
17	We	11.7	17.0	0			NNE	72	21:13	16.2	86		NNE	30	1018.0	14.8	94		N	22	1014.3
18	Th	11.1	17.7	8.6			N	67	01:27	12.6	80		NW	20	1009.6	17.4	39		WNW	11	1009.3
19	Fr	8.3	16.8	0			SSE	87	16:35	11.3	67		WNW	9	1014.0	16.2	82		S	63	1012.7
20	Sa	11.2	17.4	11.8			SSE	69	03:43	14.8	83		SSE	44	1027.7	16.5	67		SSE	41	1027.4
21	Su	14.3	17.8	0.6			SSE	56	17:59	15.9	71		SSE	33	1033.8	15.5	80		S	31	1033.4
22	Mo	14.2	16.9	0			SSE	52	11:12	15.7	67		SSE	35	1037.1	14.9	79		S	20	1035.9
23	Tu	13.1	18.2	4.0			SSE	41	02:17	14.7	90		S	7	1035.6	17.4	76		SE	9	1031.7
24	We	11.6	19.7	0			NE	24	19:48	14.1	81		W	7	1030.5	17.0	69		E	15	1026.8
25	Th	10.1	18.5	0			NE	37	14:51	15.1	77		N	13	1026.0	17.7	77		NNE	30	1021.1
26	Fr	11.5	21.2	0			SSW	24	11:02	17.4	55		W	7	1025.5	19.3	75		SSE	9	1023.0
27	Sa	11.5	16.3	0.4			WSW	19	23:44	13.8	98		SSW	13	1021.5	15.9	92			Calm	1017.9
28	Su	12.0	20.1	0			SSW	43	03:22	15.3	81		WSW	11	1020.9	17.9	74		SE	15	1017.5
29	Mo	12.3	23.1	0.2			SE	22	14:32	18.7	64		NW	7	1017.6	19.3	65		SE	19	1015.4
30	Tu	13.9	18.2	8.6			SSW	41	04:44	16.2	80		S	24	1022.3	17.2	72		SSE	24	1020.6
31	We	12.5	18.9	1.8			SSW	24	10:16	15.6	84		SW	9	1023.4	17.8	69		ESE	11	1021.6
Statistics for August 2011																					
Mean		11.4	18.9							14.9	74			15	1021.8	17.3	68			18	1019.4
Lowest		7.6	15.0							11.3	55		WSW	2	1007.6	14.1	39			Calm	1005.1
Highest		14.3	24.0	11.8			SSE	87		18.7	98		S	50	1037.1	21.4	94		S	63	1035.9
Total				62.4																	

Observations were drawn from Norah Head AWS (station 061366)
The closest station with cloud observations is at Peats Ridge, about 31 km to the northwest. The closest station with sunshine observations is at Williamtown, about 60 km to the northeast.

IDCJDW2099.201108 Prepared at 16:01 UTC on 7 Mar 2012

Norah Head, New South Wales
September 2011 Daily Weather Observations

Observations from Norah Head automatic weather station.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Th	12.9	20.0	0			S	39	23:43	16.4	84		SSW	9	1024.1	18.4	72		ESE	15	1022.1
2	Fr	15.4	16.8	0			S	46	09:00	16.5	71		S	37	1028.6	15.7	71		S	33	1028.3
3	Sa	11.1	20.6	1.0			NNE	46	19:16	16.5	76		NNW	2	1030.8	17.7	68		NE	24	1027.6
4	Su	11.3	19.5	0			NNE	44	19:49	17.5	69		N	13	1028.4	18.7	70		NE	28	1024.4
5	Mo	12.8	22.5	0			NNE	43	20:01	17.4	79		N	11	1026.9	18.7	76		NE	24	1023.5
6	Tu	13.5	23.8	0			NNE	44	19:37	19.4	69		N	26	1020.9	22.3	50		N	24	1015.6
7	We	14.1	17.8	0.2			SSW	37	06:43	15.0	58		SSW	15	1019.3	16.8	54		SE	26	1017.6
8	Th	13.7	19.4	0			N	22	23:36	14.6	74		W	11	1020.8	17.9	72		SE	15	1017.1
9	Fr	13.4	14.4	10.8			SSW	43	10:21	13.8	94		NNW	13	1008.6	13.7	58		SW	20	1006.3
10	Sa	7.8	17.2	5.8			WSW	46	11:27	12.3	50		WSW	19	1010.6	16.3	39		W	17	1008.7
11	Su	10.1	19.0	0.2			SW	39	23:00	15.3	52		WNW	11	1013.5	16.4	53		E	13	1011.1
12	Mo	10.2	16.1	1.4			S	56	01:52	13.2	64		SW	20	1022.9	15.8	66		SSE	24	1022.9
13	Tu	8.8	22.2	0			N	35	16:08	14.5	56		WNW	7	1026.3	21.6	34		NNW	19	1020.3
14	We	11.0	25.5	0			NW	35	12:27	19.8	41		NW	13	1023.2	25.2	21		WNW	9	1017.7
15	Th	15.8	20.1	0			SSW	41	00:45	18.3	72		SSW	2	1022.5	17.9	73		E	19	1018.4
16	Fr	12.8	23.7	0			NNE	26	17:58	19.9	46		WNW	6	1018.4	19.1	77		ENE	15	1012.9
17	Sa	15.8	23.2	0			WSW	26	05:40	17.9	79		SSW	15	1017.6	19.7	78		NE	13	1013.9
18	Su	14.6	31.1	0			SSW	52	13:23	23.1	51		N	6	1014.4	19.0	84		SSW	30	1015.0
19	Mo	15.2	23.4	0			NE	50	16:58	19.9	79		N	7	1021.0	19.8	82		NE	35	1014.3
20	Tu	16.2	28.2	0			NNW	70	10:39	21.4	62		N	39	1006.3	23.6	33		WSW	20	1005.2
21	We	11.2	20.6	0			SSW	26	09:11	17.4	44		WSW	9	1020.6	18.1	52		ENE	15	1018.1
22	Th	12.6	24.5	0			NE	41	17:28	18.4	59		SSW	6	1023.9	18.7	72		NE	28	1019.2
23	Fr	12.6	30.1	0			SSW	70	17:25	24.4	56		NNW	11	1016.7	29.4	20		NW	9	1013.7
24	Sa	16.3	18.6	0			NE	37	18:28	17.8	77		NNE	6	1020.8	18.1	77		ENE	22	1017.0
25	Su	12.9	17.6	42.2			SE	72	10:06	15.7	82		E	44	1016.6	13.7	93		SSE	31	1018.9
26	Mo	12.3	19.2	52.4			S	57	00:43	17.2	64		SE	33	1023.8	17.0	66		ESE	26	1021.9
27	Tu	12.5	21.3	1.0			NNE	50	21:49	17.8	64		N	4	1023.1	17.9	63		NE	28	1018.8
28	We	12.3	18.4	0			NNE	44	00:05	17.0	70		NNE	20	1015.6	16.3	90		NNE	17	1011.4
29	Th	14.5	22.3	23.6			NNW	54	11:06	16.3	91		N	28	998.9	18.6	36		W	30	996.5
30	Fr	10.7	20.8	0.2			WNW	39	13:52	16.2	52		WNW	17	1004.9	20.1	32		WNW	17	1003.3
Statistics for September 2011																					
Mean		12.8	21.3							17.4	66			15	1019.0	18.7	61			21	1016.1
Lowest		7.8	14.4							12.3	41		#	2	998.9	13.7	20		#	9	996.5
Highest		16.3	31.1	52.4			SE	72		24.4	94		E	44	1030.8	29.4	93		NE	35	1028.3
Total				138.8																	

Observations were drawn from Norah Head AWS (station 061366)
The closest station with cloud observations is at Peats Ridge, about 31 km to the northwest. The closest station with sunshine observations is at Williamtown, about 60 km to the northeast.

IDCJDW2099.201109 Prepared at 13:01 UTC on 20 Mar 2012

Norah Head, New South Wales
October 2011 Daily Weather Observations

Observations from Norah Head automatic weather station.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Sa	9.9	20.9	0			N	24	16:09	17.0	55		ESE	4	1006.6	18.3	62		ENE	9	1004.3
2	Su	11.2	16.0	12.0			SSE	89	10:06	13.9	88		SE	52	1011.3	15.7	67		S	59	1014.6
3	Mo	11.3	16.1	18.0			S	63	23:16	13.0	82		SW	17	1022.4	15.7	69		SSW	35	1020.7
4	Tu	11.7	17.3	0			S	41	14:27	13.3	77		SW	11	1024.2	16.8	68		S	30	1022.9
5	We	11.3	20.2	0			NE	24	22:03	13.8	77		W	7	1022.4	18.2	56		ESE	9	1018.5
6	Th	13.6	18.2	0			SSE	13	09:22	15.5	72		W	4	1016.4	17.1	75			Calm	1013.6
7	Fr	14.0	20.5	2.2			SSE	20	21:16	15.5	91		WSW	7	1013.7	18.8	78		E	15	1010.5
8	Sa	15.3	21.3	7.6			SSE	19	09:49	16.0	93		W	4	1011.1	20.2	75		SSE	11	1009.2
9	Su	13.7	23.5	0.2			WSW	31	17:57	17.1	81		WNW	7	1008.6	22.6	39		W	11	1004.9
10	Mo	12.4	20.5	0			ENE	24	15:36	16.1	77		WNW	6	1010.1	18.5	65		ENE	20	1006.5
11	Tu	12.3	20.8	0			WSW	24	07:55	15.7	46		SW	11	1011.7	19.9	49		SSE	19	1009.8
12	We	12.2	19.6	0			SSE	41	16:27	16.8	64		SSW	6	1017.0	19.5	62		SSE	26	1016.4
13	Th	15.8	19.8	0			ENE	31	20:20	17.2	67		ESE	15	1023.1	18.0	63		ENE	20	1021.6
14	Fr	16.8	19.2	0			NE	44	16:53	17.4	75		ENE	28	1020.4	18.5	79		ENE	35	1016.5
15	Sa	17.1	24.9	0			NE	39	01:16	18.7	84		N	13	1010.7	21.4	76		ENE	19	1007.9
16	Su	16.6	21.6	0			SSE	41	20:47	20.7	55		SSW	11	1013.8	21.3	65		SE	20	1014.6
17	Mo	14.1	18.0	7.6			S	46	07:32	15.4	69		S	30	1030.9	17.4	60		S	28	1032.0
18	Tu	13.1	20.5	0			NE	30	21:14	16.6	70		S	9	1034.8	19.1	54		ESE	13	1032.0
19	We	13.0	22.6	0			NNE	37	21:10	18.1	66		N	2	1031.8	19.9	63		ENE	22	1028.3
20	Th	12.8	24.3	0			NNE	48	17:27	19.1	69		N	11	1028.4	21.1	70		NE	31	1023.8
21	Fr	14.7	26.0	0			NNE	28	16:29	21.0	79		NNW	6	1024.2	22.6	78		NE	19	1021.8
22	Sa	17.4	23.2	0			SSW	39	00:44	19.9	82		S	15	1024.5	21.7	76		E	11	1021.7
23	Su	16.9	24.1	0.2			NNE	35	18:40	19.2	93		SSW	2	1022.0	22.5	75		NE	17	1018.5
24	Mo	16.5	31.0	0			N	52	15:44	22.8	75		N	4	1014.7	28.8	45		N	31	1009.0
25	Tu	18.8	21.4	0.6			S	74	15:00	20.6	87		SSW	4	1010.0	18.6	89		SSW	33	1012.0
26	We	14.2	18.4	2.8			SSE	52	23:31	15.5	79		SSE	33	1021.6	17.2	67		SSE	31	1021.6
27	Th	14.6	20.4	0.8			ESE	39	23:03	18.1	68		ESE	24	1023.5	19.1	63		ESE	20	1021.8
28	Fr	16.3	24.5	0			NNE	44	18:57	18.9	75		NNE	17	1019.8	20.7	72		NE	26	1015.9
29	Sa	16.0	26.1	0			NNE	31	15:26	20.0	82		NNE	24	1011.4	25.1	73		NNW	13	1009.3
30	Su	18.3	21.4	0			SSW	63	20:53	18.8	91		SSW	24	1012.1	20.5	88		SE	6	1010.1
31	Mo	14.8	18.9	4.6			S	44	22:48	17.4	69		SSW	28	1020.6	18.5	68		S	31	1019.7
Statistics for October 2011																					
	Mean	14.4	21.3							17.4	75			14	1018.5	19.8	67			21	1016.5
	Lowest	9.9	16.0							13.0	46		#	2	1006.6	15.7	39			Calm	1004.3
	Highest	18.8	31.0	18.0			SSE	89		22.8	93		SE	52	1034.8	28.8	89		S	59	1032.0
	Total			56.6																	

Observations were drawn from Norah Head AWS (station 061366)

The closest station with cloud observations is at Peats Ridge, about 31 km to the northwest. The closest station with sunshine observations is at Williamtown, about 60 km to the northeast.

Norah Head, New South Wales
November 2011 Daily Weather Observations

Observations from Norah Head automatic weather station.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Tu	14.6	21.0	1.4			S	39	23:20	16.9	79		SW	7	1019.9	19.4	64		SSE	13	1016.6
2	We	13.6	23.8	0			S	46	13:50	18.1	77		S	6	1011.4	19.4	77		S	39	1008.9
3	Th	13.0	19.2	6.0			SE	46	05:40	13.4	94		SSE	30	1013.0	17.2	70		SE	17	1013.9
4	Fr	13.0	20.7	2.0			SE	22	14:38	18.9	70		S	7	1019.4	20.0	59		ESE	15	1018.2
5	Sa	15.1	24.1	0			NNE	41	18:14	19.1	74		N	4	1020.2	21.7	73		NE	30	1015.6
6	Su	16.9	25.0	0			NNE	44	16:03	20.8	82		NNE	6	1013.7	21.2	84		NE	26	1009.8
7	Mo	19.1	30.2	0			N	33	20:32	22.8	73		NNE	15	1014.0	24.3	73		ENE	24	1011.5
8	Tu	19.1	25.8	0.2			SSW	46	20:24	22.9	86		NE	2	1014.9	22.6	83		NNE	30	1009.8
9	We	19.1	26.4	2.6			NNE	41	16:37	22.6	82		N	4	1014.8	24.5	75		ENE	20	1011.6
10	Th	20.8	29.6	0			SSE	43	18:30	26.2	54		WNW	7	1011.5	28.2	50		WNW	11	1011.8
11	Fr	16.7	23.8	0			ENE	35	19:06	20.2	64		ESE	11	1024.8	21.4	64		E	22	1022.4
12	Sa	18.5	23.5	0			NNE	31	08:02	18.9	87		N	20	1018.8	22.4	79		ENE	11	1015.2
13	Su	18.3	23.8	3.6			SSW	24	23:39	20.0	91		S	11	1018.1	21.8	83		E	11	1014.1
14	Mo	18.4	30.6	0			SSW	63	21:20	20.5	93		NNE	22	1010.5	23.5	75		NNE	30	1005.8
15	Tu	18.2	24.3	0			SSW	44	23:01	21.6	73		SSW	11	1019.6	22.9	67		ENE	7	1017.5
16	We	18.4	22.1	0			S	54	17:08	21.6	83		NW	4	1015.9	19.7	89		SSW	22	1017.7
17	Th	16.9	19.6	15.6			SE	28	08:23	17.7	95		SE	19	1020.2	18.1	95		ESE	17	1018.1
18	Fr	17.5	22.9	4.6			NNE	30	22:29	19.5	92		SSW	11	1019.0	21.7	82		ENE	13	1016.5
19	Sa	17.9	25.0	0.2			NNE	48	17:21	19.6	96		NNE	11	1015.8	22.5	85		NE	30	1011.3
20	Su	18.7	35.4	0			NW	48	12:57	20.8	95		NE	7	1010.4	34.5	28		WNW	19	1006.9
21	Mo	18.4	25.0	2.4			S	46	01:03	20.0	75		SE	13	1018.5	21.5	75		NE	17	1015.5
22	Tu	16.6	21.5	8.0			S	67	15:50	19.2	91		SE	2	1011.0	20.5	87		SE	15	1008.4
23	We	15.2	18.6	36.2			S	69	15:26	16.7	93		SSE	35	1015.3	16.4	93		S	41	1018.3
24	Th	15.6	18.6	13.2			SSE	52	03:27	18.4	74		SE	33	1025.6	17.5	76		SE	35	1025.0
25	Fr	15.7	20.5	9.4			ENE	46	20:44	18.0	93		ENE	28	1022.0	18.9	95		E	19	1019.8
26	Sa	17.8	23.4	24.0			NE	57	02:34	19.6	98		NNE	31	1007.8	21.5	88		NE	28	1005.2
27	Su	15.6	30.0	0.8			SSE	41	19:19	23.4	53		W	9	1007.8	23.4	62		SSE	24	1007.5
28	Mo	16.7	25.4	0			NE	50	18:46	21.0	82		NNE	9	1018.1	22.4	81		NE	24	1016.1
29	Tu	18.9	24.0	0			NE	56	16:30	22.5	84		NNE	20	1017.2	22.6	85		NE	43	1014.2
30	We	19.2	28.0	0			NNE	48	09:33	20.7	90		NNE	22	1011.9	22.1	78		NNE	9	1009.5
Statistics for November 2011																					
	Mean	17.1	24.4							20.1	82			13	1016.0	21.8	75			22	1013.8
	Lowest	13.0	18.6							13.4	53		#	2	1007.8	16.4	28		ENE	7	1005.2
	Highest	20.8	35.4	36.2			S	69		26.2	98		SSE	35	1025.6	34.5	95		NE	43	1025.0
	Total			130.2																	

Observations were drawn from Norah Head AWS (station 061366)

The closest station with cloud observations is at Peats Ridge, about 31 km to the northwest. The closest station with sunshine observations is at Williamtown, about 60 km to the northeast.

Norah Head, New South Wales
February 2012 Daily Weather Observations

Observations from Norah Head automatic weather station.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	We	18.5	19.4	12.6			SSE	50	12:02	18.9	89		SE	35	1013.7	17.8	92		SSE	37	1013.4
2	Th	17.5	20.1	12.4			SSE	48	18:19	18.9	87		SSE	30	1011.2	17.7	89		S	33	1010.0
3	Fr	16.9	21.2	25.4			SE	37	23:22	17.9	93		SSW	11	1006.9	19.8	92		SSW	11	1004.7
4	Sa	17.8	25.0	2.0			SSE	24	14:21	21.1	85		W	6	1005.2	24.7	74		SSE	15	1003.9
5	Su	18.7	25.5	0.2			N	31	21:56	22.3	84			Calm	1003.8	24.8	77		ENE	20	1001.1
6	Mo	19.9	22.7	0			S	54	16:21	22.4	86		SSW	15	1001.6	21.7	83		SSW	31	1002.7
7	Tu	19.9	23.3	0.8			S	46	04:31	20.9	86		S	33	1007.1	22.4	78		SSE	28	1006.8
8	We	19.8	25.5	0			SE	39	07:21	19.8	84		SE	19	1011.2	23.9	68		SE	17	1011.5
9	Th	19.8	25.7	0.2			ENE	44	15:17	23.4	77		ESE	17	1013.6	24.6	70		E	20	1012.3
10	Fr	20.6	24.9	0.2			NNE	54	18:50	22.7	82		NNE	24	1012.2	23.3	75		NE	37	1009.9
11	Sa	17.8	24.4	18.0			SSW	63	14:35	19.7	92		NE	2	1011.1	21.9	79		ESE	20	1008.9
12	Su	16.4	25.4	24.6			S	30	16:52	21.3	76			Calm	1015.4	25.1	73		ENE	15	1014.0
13	Mo	19.0	25.0	0.8			NNE	43	21:11	20.9	87		WSW	11	1017.9	24.6	75		SE	9	1016.6
14	Tu	18.1	26.1	5.8			SE	28	16:23	21.8	77		SSE	17	1020.9	25.2	63		SSE	15	1020.1
15	We	19.6	24.7	0.6			ESE	31	02:48	20.4	89		N	9	1021.7	24.1	63		E	13	1020.1
16	Th	19.2	27.4	0.2			NNE	41	20:53	22.3	83		NW	6	1020.2	25.5	61		ENE	22	1018.5
17	Fr	17.9	26.6	0			NNE	37	20:14	21.4	75		N	6	1018.1	24.5	73		NE	28	1015.5
18	Sa	19.1	24.3	0			S	26	12:31	22.1	83		SSW	7	1017.3	23.6	81		S	19	1016.7
19	Su	19.8	27.3	0			SW	46	22:32	23.0	80		SSW	2	1018.2	25.2	75		ENE	15	1014.9
20	Mo	19.6	25.9	15.0			S	44	23:22	21.6	87		SSW	13	1012.1	24.2	78		S	19	1010.5
21	Tu	18.7	22.4	34.0			S	59	07:45	19.0	94		S	44	1009.8	21.8	88		SSW	30	1010.6
22	We	18.0	23.0	17.0			SW	33	03:07	20.1	77		SW	17	1015.5	22.7	75		S	20	1015.6
23	Th	18.2	26.6	0			N	26	20:30	21.4	83		W	4	1019.8	25.9	69		ENE	19	1018.8
24	Fr	19.3	28.0	0			NNE	33	22:43	22.6	84			Calm	1022.6	27.5	68		NE	15	1022.9
25	Sa	19.3	27.5	0.2			NE	46	21:31	23.1	80		NE	15	1023.6	25.9	70		ENE	26	1021.8
26	Su	21.4	25.6	0			NNE	44	23:34	23.1	81		NNE	26	1020.7	23.4	81		NE	19	1018.7
27	Mo	20.4	25.1	0			NE	28	13:42	21.6	85		NNE	13	1017.8	24.1	76		NE	22	1015.6
28	Tu	20.9	28.7	0			SW	28	22:33	22.3	89		N	4	1014.1	26.1	75		E	13	1011.5
29	We	20.8	23.9	0			SSW	31	10:53	20.9	93		SSW	20	1013.9	22.8	82		SSW	24	1012.1
Statistics for February 2012																					
	Mean	19.1	24.9							21.3	84			14	1014.4	23.6	75			21	1013.1
	Lowest	16.4	19.4							17.9	75			Calm	1001.6	17.7	61		SE	9	1001.1
	Highest	21.4	28.7	34.0			SSW	63		23.4	94		S	44	1023.6	27.5	92		#	37	1022.9
	Total			170.0																	

Observations were drawn from Norah Head AWS (station 061366)

The closest station with cloud observations is at Peats Ridge, about 31 km to the northwest. The closest station with sunshine observations is at Williamtown, about 60 km to the northeast.

APPENDIX 4

ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT (1999) SIGNIFICANT IMPACT ASSESSMENT

ENVIRONMENT PROTECTION & BIODIVERSITY CONSERVATION ACT (1999)
SIGNIFICANT IMPACT ASSESSMENT

Criteria identified within the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* (DEWHA 2009), have been addressed below to determine whether there is a real chance or possibility, that the proposed action is likely to have a significant impact on threatened species, migratory species and/or threatened ecological communities observed within the subject site.

The assessments provided below has been prepared based on the concept plan prepared for the rezoning of the subject site.

1.1 EPBC Act Listed Threatened Species

The threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*), as listed within the *EPBC Act* (1999), was observed during surveys.

Significant Impact Assessment for Vulnerable Species

Grey-headed Flying-fox
Criteria identified within the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* (DEWHA 2009), have been addressed below to determine whether there is a real chance or possibility, that the proposed action is likely to impact on a migratory species, the Grey-headed Flying-fox.

Vulnerable Species Important Population Criteria
For the purposes of assessment of a threatened species under the *EPBC Act* (1999) an assessment as to whether the species comprises an important population is required.

An *"important population"* is one that is necessary for a species' long-term survival and recovery. Questions (**in bold**) to determine whether a population is an *"important population"* are as follows:

- **Whether the population has been identified within a recovery plan;**

A draft recovery plan exists for this species at state level (DECCW 2009). An important population of this species has not been identified as occurring within the subject site within any recovery plan.

- **Whether the population constitutes a key source population for breeding or dispersal;**

Grey-headed Flying-foxes were observed flying over and foraging adjacent to the south of the subject site during previous surveys undertaken in 2004 by Andrews Neil (2004). The Grey-headed Flying-fox was also observed during previous surveys by Wildthing Environmental Consultants (1998). No Grey-headed Flying Fox roost or camp sites were observed within the subject site. It is considered that the specimens observed within the subject site are part of a larger population and do not alone constitute a key source population for breeding or dispersal.

- **Whether the population constitutes a population necessary for maintaining genetic diversity; or**

No Grey-headed Flying Fox roost or camp sites were observed within the subject site. It is considered that while the specimens observed foraging within the subject site may be part of a larger population, they do not alone constitute a population necessary for maintaining genetic diversity.

- **Whether the population is at the limit of its known distribution.**

The Grey-headed Flying-fox is known to occupy the coastal lowlands and slopes of south-eastern Australia from Bundaberg to Geelong and are usually found at altitudes < 200 m. Areas of repeated occupation extend inland to the tablelands and western slopes in northern New South Wales and the tablelands in southern Queensland. Sightings in inland areas of southern New South Wales and Victoria are uncommon. There are rare records of individuals or small groups west to Adelaide, north to Gladstone and south to Flinders Island (DECCW 2009).

This species is therefore not at the limit of its distribution within the subject site.

From the above information and details it is considered that the Grey-headed Flying-fox observed within the subject site is not:

- Identified in a recovery plan for this species;
- A key source population for breeding or dispersal;
- A population necessary for maintaining genetic diversity;
- A population which is near this species range.

Therefore it is considered that the threatened species observed does not satisfy the criteria of an important population as identified by the DEWHA (2009) guidelines.

Notwithstanding the above conclusions if the precautionary approach is adopted, further consideration as to whether the proposed action is likely to have a significant impact on this species needs to assess the significant impact criteria (DEWHA 2009) for a vulnerable species.

Threatened Species Significant Impact Criteria

Questions (in bold) to determine whether the proposal is likely to have a significant impact on an important population of a vulnerable species are as follows:

- **Lead to a long-term decrease in the size of an important population of a species;**

This species utilised rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops (DECC 2005).

While the proposal may result in a small reduction in forging habitat within the subject site, there are larger areas of suitable habitat for this species within the locality.

It is therefore considered that the proposal is not likely to lead to the long-term decrease in the size of an important population of the Grey-headed Flying-fox.

- **Reduce the area of occupancy of an important population;**

The proposed development may require the removal of some potential habitat for this species, however there are larger areas of suitable habitat for this species within the locality.

It is therefore considered that the proposal is not likely to reduce the area of occupancy of an important population.

- **Fragment an existing important population into two or more populations;**

Due to the mobile nature of this species and the fact that it is nomadic and migratory it is considered that the proposed development is not of a type that is likely to result in the fragmentation an existing important population into two or more populations.

- **Adversely affect habitat critical to the survival of a species;**

There has currently been no critical habitat for this species declared under the *EPBC Act* (1999) or listed within a recovery plan for this species.

Due to the large areas of suitable habitat for this species present within the locality it is considered that the subject site does not contain habitat necessary for foraging, breeding, roosting, or dispersal.

Furthermore the proposal is not likely to adversely affect an area necessary for the long term maintenance of the species essential to the survival of the species or an area necessary to maintain genetic diversity and long term evolutionary development or an area necessary for the reintroduction of populations or recovery of the species, critical to the survival of the species.

Therefore the proposed action is not likely to adversely affect habitat critical to the survival of this species.

- **Disrupt the breeding cycle of an important population;**

No Grey-headed Flying Fox roost or camp sites were observed within the subject site.

It is therefore considered that the proposal will not disrupt the breeding cycle of an important population of this species.

- **Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that a species is likely to decline;**

There are larger areas of many different suitable habitat types that support this species within the locality. It is therefore considered not likely that the proposed action will 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;**

The proposed development is not of a type that is likely to result in the establishment in invasive species that are harmful to this species, becoming established in this species habitat.

- **Introduce disease that may cause the species to decline; or**

The proposed development is not of a type that is likely to introduce disease that may cause this species to decline.

- **Interferes substantially with recovery of the species.**

It is considered that the proposed action is not likely to interfere substantially with the recovery of the species.

It is considered that the proposal is not likely to significantly affect any threatened species listed within the EPBC Act (1999).

1.2 EPBC Act Listed Threatened Ecological Communities

No threatened ecological communities, listed within the EPBC Act (1999), were observed within the subject site.

The proposal is not likely to have a significant impact on threatened ecological communities listed within the *EPBC Act* (1999).

1.3 EPBC Act Listed Migratory Species

The following migratory fauna species, listed within the *EPBC Act* (1999), were observed within the subject site:

- Lathams Snipe (*Gallinago hardwickii*);
- Cattle Egret (*Ardea ibis*); and
- Eastern Great Egret (*Ardea modesta*).

Significant Impact Assessment for Migratory Species

Latham's Snipe (*Gallinago hardwickii*)
Criteria identified within the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* (DEWHA 2009), have been addressed below to determine whether there is a real chance or possibility, that the proposed action is likely to impact on this species.

Determining Important Habitat for a Migratory Species
For the purposes of assessment of a migratory species under the *EPBC Act* (1999) an assessment as to whether the subject site provides an area of *"important habitat"* is required.

Questions (in bold) to determine whether the subject site provides *"important habitat"* are as follows:

- **Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or**

Due to the presence of larger areas of suitable habitat within adjoining lands it is considered that the subject site does not support an ecologically significant proportion of the population of the species.

- **Habitat that is of critical importance to the species at particular life-cycle stages; and/or**

The subject site is considered to provide mainly foraging habitat for this species. The subject site has not been registered as critical habitat for this species within the provisions of the *EPBC Act* (1999). Larger areas of suitable foraging habitat for this species are present within the adjoining areas and therefore the subject site is considered to not be habitat that is of critical importance to the species at particular life-cycle stages.

- **Habitat utilised by a migratory species which is at the limit of the species range;**

In Australia this species is a non-breeding migrant widespread from Queensland to Victoria on the mainland and west in New South Wales as far as the Western Plains. Therefore the subject site is considered to not contain habitat utilised by a migratory species which is at the limit of the species range.

- **Habitat within an area where the species is declining.**

The subject site has not been registered as critical habitat for this species within the provisions of the *EPBC Act* (1999). The population demographics for this species within the local area are not known. Further studies are required in order to ascertain whether the species is declining within the local area. These studies are beyond the scope of this assessment.

From the above information and details it is considered that the habitats for this species within the subject site are not:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
- Habitat that is of critical importance to the species at particular life-cycle stages; and/or
- Habitat utilised by a migratory species which is at the limit of the species range; or
- Habitat within an area where the species is declining.

Therefore it is considered that the habitat within the subject site for this migratory species does not satisfy the criteria of *"important habitat"* as identified by the DEWHA (2009).

Notwithstanding the above conclusions if the precautionary approach is adopted, further consideration as to whether the proposed action is likely to have a significant impact on this species needs to assess the significant impact criteria (DEWHA 2009) for a migratory species.

Migratory Species Significant Impact Criteria
Questions (**in bold**) to determine whether the proposal is likely to have a significant impact on important habitat for a migratory species are as follows:

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 and area of important habitat for a migratory species;**

While the proposal may result in a small reduction in suitable habitat available for this species within the subject site, there are larger areas of suitable habitat for this species within the locality. Therefore it is considered that the proposed action is unlikely to substantially modify, destroy or isolate and area of important habitat for this 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**

The proposed action is not of a type of development that is likely to result in the establishment of an invasive species that is harmful to this species becoming established in an area of important habitat for this species.

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

The proposal will result in the retention of some areas of suitable habitat for this species within the subject site and is not likely to result in significant disturbance to the available habitats for this species within the local area. It is therefore considered that the proposed development is not likely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

It is therefore considered that the proposal is not likely to have a significant impact on Lathams Snipe within the meaning of the *EPBC Act* (1999).

Cattle Egret (*Ardea ibis*)
Criteria identified within the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* (DEWHA 2009), have been addressed below to determine whether there is a real chance or possibility, that the proposed action is likely to impact on this species.

Determining Important Habitat for a Migratory Species
For the purposes of assessment of a migratory species under the *EPBC Act* (1999) an assessment as to whether the subject site provides an area of *"important habitat"* is required.

Questions (in bold) to determine whether the subject site provides *"important habitat"* are as follows:

- **Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or**

This species is widespread and common according to migrations, movements and breeding localities between approximately Bundaberg in Queensland from the coast south-west to Port Augusta South Australia (Marchant and Higgins 1990). It is considered that the proportion of the population of this species utilising the subject site is likely to be similar within the other areas of suitable habitat available within the region. It is therefore considered that the subject site does not support an ecologically significant proportion of the population of the species.

- **Habitat that is of critical importance to the species at particular life-cycle stages; and/or**

The Cattle Egret is a partial migrant which winters in Australia and New Zealand, and travels to breeding colonies in south-east Queensland and north-east New South Wales, with some birds staying within wintering areas to breed (Marchant and Higgins 1990).

The subject site is considered to provide mainly foraging habitat for this species. The subject site has not been registered as critical habitat for this species within the provisions of the *EPBC Act* (1999). Larger areas of suitable habitat for this species are present within the locality and therefore the subject site is considered to not be habitat that is of critical importance to the species at particular life-cycle stages.

- **Habitat utilised by a migratory species which is at the limit of the species range; and/or**

In Australia this species is widespread and common in north-eastern Western Australia, across the Top End, Northern Territory, and in south-eastern Australia from Bundaberg, Queensland to Port Augusta, South Australia, including Tasmania. Therefore the subject site is considered to not contain habitat utilised by a migratory species which is at the limit of the species range.

- **Habitat within an area where the species is declining.**

The subject site has not been registered as critical habitat for this species within the provisions of the *EPBC Act* (1999). The population demographics for this species within the local area are not known. Further studies are required in order to ascertain whether the species is declining within the local area. These studies are beyond the scope of this assessment.

From the above information and details it is considered that the habitats for this species within the subject site are not:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
- Habitat that is of critical importance to the species at particular life-cycle stages; and/or
- Habitat utilised by a migratory species which is at the limit of the species range; or
- Habitat within an area where the species is declining.

Therefore it is considered that the habitat within the subject site for this migratory species does not satisfy the criteria of *"important habitat"* as identified by the DEWHA (2009).

Notwithstanding the above conclusions if the precautionary approach is adopted, further consideration as to whether the proposed action is likely to have a significant impact on this species needs to assess the significant impact criteria (DEWHA 2009) for a migratory species.

Migratory Species Significant Impact Criteria
Questions (**in bold**) to determine whether the proposal is likely to have a significant impact on important habitat for a migratory species are as follows:

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; or**

This species is mostly associated with disturbed agricultural grazing land habitats. While the proposal may result in a small reduction in suitable habitat available for this species within the subject site, there are larger areas of suitable habitat for this species within the locality. Therefore it is considered that the proposed action is unlikely to substantially modify, destroy or isolate and area of important habitat for this 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**

The proposed action is not of a type of development that is likely to result in the establishment of an invasive species that is harmful to this species becoming established in an area of important habitat for this species.

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

According to Marchant and Higgins (1990) this species is widespread and common according to migrations, movements and breeding localities between approximately Bundaberg in Queensland from the coast south-west to Port Augusta South Australia. The range of the Cattle Egret has expanded to include every continent except Antarctica and is widely distributed across Australia. Genetically birds within Australia have come from Asian origins. The Cattle Egret is a partial migrant which winters in Australia and New Zealand, and travels to breeding colonies in south-east Queensland and north-east New South Wales, with some birds staying within wintering areas to breed. It is therefore considered that the modification of a relatively small amount of foraging habitat is not likely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

It is therefore considered that the proposal is not likely to have a significant impact on the Cattle Egret within the meaning of the *EPBC Act* (1999).

Eastern Great Egret (*Ardea alba*)
Criteria identified within the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* (DEWHA 2009), have been addressed below to determine whether there is a real chance or possibility, that the proposed action is likely to impact on this species.

Determining Important Habitat for a Migratory Species
For the purposes of assessment of a migratory species under the *EPBC Act* (1999) an assessment as to whether the subject site provides an area of *"important habitat"* is required.

Questions (in bold) to determine whether the subject site provides *"important habitat"* are as follows:

- **Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or**
  Due to the low numbers of this species observed and the presence of larger areas of suitable habitat within the Tuggerah Lake area it is considered that the subject site does not support an ecologically significant proportion of the population of the species.

- **Habitat that is of critical importance to the species at particular life-cycle stages; and/or**

The subject site is considered to provide potential foraging and breeding habitat for this species. The subject site has not been registered as critical habitat for this species within the provisions of the *EPBC Act* (1999). Larger areas of suitable foraging habitat and breeding for this species are present within the Tuggerah Lakes area and therefore the subject site is considered to not be habitat that is of critical importance to the species at particular life-cycle stages.

- **Habitat utilised by a migratory species which is at the limit of the species range;**

The Eastern Great Egret is widespread throughout Australia with the exception of drier parts of the western interior (Marchant and Higgins 1990). Therefore the subject site is considered to not contain habitat utilised by a migratory species which is at the limit of the species range.

- **Habitat within an area where the species is declining.**

The subject site has not been registered as critical habitat for this species within the provisions of the *EPBC Act* (1999). The population demographics for this species within the local area are not known. Further studies are required in order to ascertain whether the species is declining within the local area. These studies are beyond the scope of this assessment.

From the above information and details it is considered that the habitats for this species within the subject site are not:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
- Habitat that is of critical importance to the species at particular life-cycle stages; and/or
- Habitat utilised by a migratory species which is at the limit of the species range; or
- Habitat within an area where the species is declining.

Therefore it is considered that the habitat within the subject site for this migratory species does not satisfy the criteria of *"important habitat"* as identified by the DEWHA (2009).

Notwithstanding the above conclusions if the precautionary approach is adopted, further consideration as to whether the proposed action is likely to have a significant impact on this species needs to assess the significant impact criteria (DEWHA 2009) for a migratory species.

Migratory Species Significant Impact Criteria
The consideration as to whether the proposed action is likely to have a significant impact on a migratory species needs to assess the significant impact criteria (DEWHA 2009) for a migratory species.

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;**

Due to the low numbers of this species observed, the presence of larger areas of suitable habitat within the Tuggerah Lake area and the retention of areas of suitable habitat for this species as part of the development proposal, it is considered that the proposed action is not to substantially modify, destroy or isolate and area of important habitat for this 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**

The proposed action is not of a type of development that is likely to result in the establishment of an invasive species that is harmful to this species becoming established in an area of important habitat for this species.

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

The proposal will result in the retention of some areas of suitable habitat for this species within the subject site and is not likely to result in significant disturbance to the available habitats for this species within the local area. It is therefore considered that the proposed development is not likely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

It is therefore considered that the proposal is not likely to have a significant impact on the Eastern Great Egret within the meaning of the *EPBC Act* (1999).

Migratory Species Impact Assessment Conclusion
It is considered that the proposal is not likely to significantly affect any migratory species listed within the EPBC Act (1999).

1.4 Determination of Impact Significance on EPBC Act Listed Threatened Species, Threatened Ecological Communities and Migratory Species.

It is considered that the proposal is not likely to have a significant impact on threatened species, threatened ecological communities or migratory species listed within the *EPBC Act* (1999).

It is considered that a referral of this project to SEWPAC is not required, as assessment in accordance with the criteria provided by DEWHA (2009) has determined that the proposal is not likely to have a significant impact on a matter of national environmental significance.

APPENDIX 5

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT (1979)
SECTION 5(A) ASSESSMENT

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT (1979)
SECTION 5(A) ASSESSMENT

As identified in Section 5(A) of the *EP&A Act* 1979 the following matters need to be addressed to determine whether or not a significant effect on threatened species, populations or ecological communities or their habitats is likely to result from the proposed development.

The assessment provided below has been prepared based on the concept plan prepared for the rezoning of the subject site.

1.1 ASSESSMENT OF SIGNIFICANCE / 7 – PART TEST

For the purposes of the following assessments the definitions of specific terminology and interpretations of the key terms used are as per the DECC (2007) Threatened species assessment guidelines. Further clarification is also provided where deemed appropriate.

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,

FLORA

Angophora inopina
This species occurs mainly in heath and dry sclerophyll forest on very infertile and well-drained substrate of sand and sandy clay, often with ironstone gravels. It prefers open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt open patches. The flowering period is from September to March (DECC 2005).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

***Cryptostylis hunteriana* (Leafless Tongue Orchid)**
This species favours swamp fringes or steep hillsides in tall eucalypt forests. It flowers between December and February and is generally restricted to coastal areas (Bishop 2000). The preferred habitat of *Cryptostylis hunteriana* in the Central Coast region is Scribbly Gum and Smooth-barked Apple Woodlands (Bell 2001).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Grevillea parviflora* ssp. *parviflora
Grevillea parviflora ssp. *parviflora* is a low spreading dense to erect shrub. This species grows in heath or shrubby woodland, usually over thin shales. Flowers appear mainly in spring but also sporadically throughout the year. This species is easily identifiable when not in flower (DECC 2005).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Maundia triglochinoides
A perennial herb with rhizomes and emergent tufts of leaves. Flowers during warmer months. Grows near the coast in permanent swamps and wetlands, shallow fresh water on heavy clay on the central and north coasts of New South Wales. The current southern limit is near Wyong and it is known to extend to Queensland (DECC 2005).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Melaleuca biconvexa
This species is a paperbark shrub or small tree which prefers poorly drained habitats near swamps and along drainage lines. This species occurs in disjunct populations from near Jervis Bay to Port Macquarie with the main concentration of records on the Central Coast in the Gosford and Wyong local government areas (NSW Scientific Committee 1998).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Syzygium paniculatum
It is usually found growing in or near subtropical and littoral rainforests on sandy soils, stabilised dunes near the sea or sheltered gullies, especially near watercourses (Fairly and Moore 1989; Harden 1994).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

FAUNA

Green and Golden Bell Frog *(Litoria aurea)*
The Green and Golden Bell Frog is a predominantly aquatic species, found among vegetation within or at the edges of permanent water. The males call mainly after rain from spring to autumn while afloat among vegetation, usually in larger permanent dams, swamps and lagoons. Breeding often peaks after heavy rains in January to February (Cogger 2000).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Green-thighed Frog (*Litoria brevipalmata*)
The Green-thighed frog utilises a variety of habitats including rainforest, moist eucalypt forest, dry eucalypt forest, heath, coastal swamp Forest and the perimeter of paddocks, particularly in areas where surface water gathers after rain. This species breeds in late spring or summer, with individuals aggregating around the margins of grassy semi-permanent and permanent ponds and flood-prone grassy areas (DECC 2005).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Wallum Froglet *(Crinia tinnula)*
The Wallum Froglet is mainly confined to acid paperbark swamps and wallum areas with poor drainage (Barker et al. 1995). This species breeds in late winter and is restricted to coastal areas of southern Qld and NSW (Cogger 2000).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Stuttering Frog (*Mixophyes balbus*)
This species inhabits rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. They feed principally on insects and small frogs. Adults breed in rocky streams during summer after heavy rain. Outside of the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor (DECC 2005).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Giant Barred Frog (*Mixophyes balbus)*
This large frog inhabits the coast and ranges from south-eastern Qld to mid northern NSW. It is associated with flowing streams in wet sclerophyll forest or rainforest. Males call during spring and summer from the ground, often on leaf litter, near streams or ponds (Anstis 2002).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Pale-headed Snake *(Hoplocephalus bitorquatus)*
The Pale-headed Snake is found in a wide variety of habitats, from rainforest or moist hardwood forest to the drier eucalypt forests and open woodland in New South Wales and inland Queensland. The species is usually found beneath loose bark, or in hollow trunks and limbs of dead timber, especially along watercourses (Wilson & Knowles, 1988).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Stephen's Banded Snake *(Hoplocephalus stephensii)*
Stephen's Banded Snake frequents coastal rainforests and wet sclerophyll forests (Cogger 2000). This species shelters beneath loose bark, among epiphytes, in hollow trunks, limbs and rock crevices (Wilson & Swan 2003). This species is nocturnal and partly arboreal.

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Australasian Bittern (*Botaurus poiciloptilus*)
The Australasian Bittern is a large brown heron that inhabits freshwater and brackish wetlands, ponds and streams with tall dense reed beds (Lindsey 1992). It is a solitary and secretive bird that hunts mainly at night for invertebrates, frogs, fish and mice. The Australasian Bittern occurs in or over water in tall reedbeds, sedges, rushes Cumbungi and Lignum. Also occurs in drains in tussocky paddocks and occasionally in saltmarshes or brackish wetlands. Specific microhabitat vegetation examples include *Phragmites, Eleocharis, Juncus, Typha, Baumea, Gahnia,* and *Bolboshoenus* species.

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Black Bittern (*Ixobrychus flavicollis*)
The Black Bittern inhabits freshwater and brackish wetlands, ponds and streams with tall dense reed beds (Lindsey 1992). They usually forage at the edge of running or still water, usually in permanent wetlands fringed by dense vegetation (Marchant & Higgins 1998).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Black-necked Stork *(Ephippiorhynchus asiaticus)*
The Black-necked Stork usually forages singly but also forages in large family groups in fresh or saline waters up to 0.5 metres deep (Marchant & Higgins 1990). This species feeds mainly on fish but will also eat reptiles, frog's crabs, insects, rodents and carrion (Schodde & Tiedemann 1986). The Black-necked Stork occurs throughout tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats and occasionally in grassland and wooded lands (Marchant & Higgins 1990).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Square-tailed Kite *(Limosa limosa)*
The Square-tailed Kite inhabits the coastal forested and wooded lands of tropical and temperate Australia (Marchant & Higgins 1993). The Square-tailed Kite is a specialist hunter of passerines, especially honeyeaters, and insects in the tree canopy, picking most prey items from the outer foliage (Marchant & Higgins 1993).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Little Eagle (*Hieraaetus morphnoides*)
This species forages in a variety of habitats including woodland open forest, partially cleared areas, along watercourses and around wetlands, avoiding large areas of dense forest. This species nests in mature living trees in open forest, woodland and remnant areas including farmland and areas close to urban development (Marchant and Higgins 1993).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Eastern Osprey (*Pandion cristatus*)
The Eastern Osprey is generally found in association with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers (Schodde and Tidemann 1986; Clancy 1991; Olsen 1995). These habitat locations usually have a sufficient supply of fish for food and possible nesting sites (Clancy 1991). The Eastern Osprey may nest on the ground on sea cliffs or in trees. Eastern Ospreys generally prefer emergent trees, often dead or partly dead with a broken off crown (Olsen 1995).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Bush Stone-curlew (*Burhinus grallarius*)
The Bush Stone-curlew occurs in open woodland with fallen branches, leaf-litter, sparse grass, timber along dry watercourses, sand plains with spinifex and mallee, sandy scrub near beaches, mangrove-fringes, country golf courses, timber remnants on roadsides, plantations and urban.

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Comb-crested Jacana *(Irediparra gallinacea)*
This species inhabits freshwater wetlands, lagoons, billabong, swamps, rivers, generally with abundant floating and emergent vegetation, especially water-lilies. Within NSW this species ranges from Queensland to the Hunter Valley wherever suitable habitat is found. This species is dispersive and moves in response to the condition of wetlands (Marchant & Higgins 1993).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Wompoo Fruit-dove *(Ptilinopus magnificus)*
The Wompoo Fruit-dove mainly inhabits large undisturbed patches of tall tropical or subtropical evergreen rainforest. In NSW the Wompoo Fruit-dove is widespread east of the Great Dividing Range from the Northern Rivers Region, North of Lismore South to the Hunter Valley (Higgins & Davies 1996). The Wompoo Fruit-dove is an obligate frugivore, taking fruits of many species of rainforest trees, palms, vines and epiphytes, feeding mostly in the canopy (Higgins & Davies 1996).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Rose-crowned Fruit-dove *(Ptilinopus regina)*
The Rose-crowned Fruit-dove inhabits tall tropical and subtropical, evergreen or semi-deciduous rainforest, especially with dense growth of vines. In NSW this species is widespread in north-east, in Northern Rivers, Northern Tablelands, and Mid-North Coast Regions. This species is a frugivore, taking fruits of many species of rainforest trees, palms, and vines, feeding mainly in the canopy but also in low trees and undergrowth (Higgins & Davies 1996).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Superb Fruit-dove *(Ptilinopus superbus)*
This species inhabits mostly closed forests, occasionally near streams or lakes within rainforest. Breeding most commonly occurs within dense forests. They are a regular autumn and winter migrant to the Hunter, Sydney, Illawarra and South Coast regions. This species is frugivorous, taking fruits of many species of rainforest trees, vines and palms (Higgins & Davies 1996).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Gang-gang Cockatoo (*Callocephalon fimbriatum*)
The Gang-gang Cockatoo is associated with a variety of woodland and forest habitats, and occasionally more open areas in south–eastern New South Wales and Victoria (NSW Scientific Committee, 2005). This species utilises eucalypt forests and exotic trees, and is known to feed on the seeds of native shrubs and trees, in addition to some exotic species such as the Hawthorn and Cupressus species (Schodde & Tideman 1986).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Glossy Black-Cockatoo (*Calyptorhynchus lathami*)
The Glossy Black-Cockatoo inhabits mountain forests, coastal woodland, open forest and trees bordering watercourses where there are substantial stands of Allocasuarina. They choose trees with larger cone crops but show no sign of selecting trees on the basis of cone size – concentrating foraging in trees with a high ratio of total seed weight to cone weight (Clout 1989). They breed in hollow trees or stumps usually in Eucalypts.

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Little Lorikeet (*Glossopsitta pusilla*)
Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Lorikeets are gregarious, usually foraging in small flocks, often with other species of lorikeet. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including, melaleucas and mistletoes (Courtney & Debus 2006).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Swift Parrot *(Lathamus discolor)*
This species feeds mainly on nectar and lerp from eucalypt flowers, particularly Blue Gum (*Eucalyptus globulus*). On the mainland, the Swift Parrot congregates where winter flowering species such as Red Ironbark (*Eucalyptus sideroxylon*), White Box (*Eucalyptus albens*), Yellow Gum (*Eucalyptus leucoxylon*) and Swamp Gum (*Eucalyptus ovata*) (Brown, 1989). This species also occurs within Swamp Mahogany *(Eucalyptus robusta)* or Spotted Gum *(Corymbia maculata)* dominated communities along the coast. The Swift Parrot is a migratory species that breeds in Tasmania and its offshore islands in summer. In late March almost the entire population migrates to mainland Australia spreading from Victoria through to central and coastal NSW and south east Queensland (Schodde & Tidemann, 1986).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Turquoise Parrot (*Neophema pulchella*)
The Turquoise Parrot is a sedentary species inhabiting the foothills of the Great Divide, including steep rocky ridges and gullies, rolling hills, valleys and river-flats, sometimes nearby plains (Higgins 1999). This species feeds on the ground among seeding grasses or weeds usually beneath trees. This species is endemic to eastern Australia, and is known from south-east Queensland through eastern New South Wales to north-east Victoria (Higgins 1999).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Powerful Owl (*Ninox strenua*)
The Powerful Owl breeds in open or closed sclerophyll forests and woodlands, including wet sclerophyll forest and dry sclerophyll forest and woodlands. They nest in hollows in large old trees; usually living Eucalyptus, within or below canopy – rarely in dead stags, stumps or broken-off trunks (Higgins 1999). Powerful Owls are sedentary within home ranges of about 1,000 hectares within open eucalypt, Casuarina or Callitris pine forest and woodlands, though they often roost in denser vegetation, including rainforest or exotic pine plantations (Garnett & Crowley, 2000). Powerful Owls feed mainly on those medium-sized species of arboreal marsupials that are most readily available at any given locality (Lavazanian *et al.* 1994).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Barking Owl *(Ninox connivens)*
The Barking Owl utilises Dry sclerophyll forests and woodlands of tropical, temperate and semi-arid zones, often dominated by *Eucalyptus,* and containing many large trees suitable for roosting or breeding. This species feeds mainly on insects outside of the breeding season and on birds and mammals when breeding (Higgins 1999).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Masked Owl (*Tyto novaehollandiae*)
The Masked Owl is widespread through forests and woodlands. The Masked Owl is known to utilise forest margins and isolated stands of trees within agricultural land. This species is often found in heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained. The Masked Owl is dependent upon hollow bearing trees all year round requiring old mature trees with large hollows for breeding and as diurnal roosting sites.

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Painted Honeyeater *(Grantiella picta)*
The Painted Honeyeater inhabits dry forests and woodlands. Its primary food is the fruit of the mistletoes in the genus *Amyema* though it will also take nectar and insects (Garnett & Crowley 2000). The Painted Honeyeater is nomadic moving north in the winter and south in the summer over eastern Australia, usually traveling in pairs, families or small flocks. Breeding takes place between October and March.

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Regent Honeyeater *(Xanthomyza phrygia)*
The Regent Honeyeater inhabits mostly dry eucalypt woodlands and forests dominated by box ironbark eucalypts; on inland slopes of Great Divide, especially associations in moister more fertile sites, along creeks, broad river valleys and on lower slopes of foothills (Higgins *et. al.,* 2001). Nectar is the principle food but sugary exudates from insects are also used (Oliver 1998, 2000). The Regent Honeyeater is known to breed along the western Slopes of the Great Dividing Range in New South Wales.

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Varied Sittella (*Daphoenositta chrysoptera*)
This species inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland (Higgins & Peter 2002).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Flame Robin (*Petroica phoenicea*)
This species inhabits upland wet to moist eucalypt forests and woodlands woodlands with an open understorey, often on ridges and slopes to 1800m asl. during the spring-summer breeding season. During the autumn to winter non breeding season this species disperses to open lowland habitats including grasslands, farmland dry sclerophyll forests and woodlands (Higgins and Peter 2002).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Spotted-tailed Quoll (*Dasyurus maculatus*)
The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry open forest and rainforest. It appears to prefer moist forest types and riparian habitat. It has been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in inland riparian areas, it also ranges over dry ridges (NPWS 1999).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Long-nosed Potoroo (*Potorus tridactylus)*
The Long-nosed Potoroo occupies a wide range of habitats, from heath to dry and moist hardwood forests usually where rainfall exceeds 760mm. It requires thick groundcover and may be commoner on light sandy soils (Johnston, 1991; Newsome and Catling, 1979). The Long-nosed Potoroo has a diet consisting of sporocarps of hypogeal fungi, seeds, arthropods, fleshy fruits and leaves (Bennett and Baxter, 1989; Claridge *et al* 1993). Home ranges have been found to vary considerably, from 1.5 to 19 hectares, and may depend upon suitable habitat availability (Seebeck *et al.* 1989).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Parma Wallaby *(Macropus parma)*
The Parma Wallaby's optimum habitat appears to be wet sclerophyll forest with a thick, shrubby understorey associated with grassy patches. Primarily nocturnal, taking cover among shrubs during the day. It feeds on grasses and herbs.

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is

considered that the action proposed is not 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.

Southern Brown Bandicoot (*Isodon obesulus obesulus*)
The Southern Brown Bandicoot has also been detected in forests and woodlands with a heathy or shrubby understorey characterised by *Acacia*, *Banksia*, *Daviesia, Epacris, Hakea*, *Leptospermum*, *Melaleuca* and *Platylobium* species as well as in agricultural land and urban areas. The Southern Brown Bandicoot prefers areas with thick ground cover which provide protection from predators (Braithwaite 1988). Environment Australia (2000) found that although this species was found over a range of habitat types it was more typically associated with heathland environments on sandy friable soils.

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Koala *(Phascolarctos cinereus)*
Koalas inhabit forested areas with acceptable Eucalypt food trees, also utilising some other non-Eucalypt species as a food source. Koalas inhabit both wet and dry Eucalypt forest that contain a canopy cover of between 10 and 70% as well as suitable feed trees (Reed *et al.* 1991).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Yellow-bellied Glider (*Petaurus australis*)
The Yellow-bellied Glider is an arboreal tree-dwelling mammal. The Yellow-bellied Glider is restricted to tall mature eucalypt forests found within high rainfall regions of temperate through to sub-tropical eastern Australia (Russell 1988). The bulk of the diet of the Yellow-bellied Glider consists of plant and insect exudates including sap, nectar, honeydew and manna while arthropods and pollen are also eaten. Yellow-bellied Gliders occupy home ranges between 30 and 65 hectares in size (Goldingay & Kavanagh 1991).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Squirrel Glider (*Petaurus norfolcensis*)
The Squirrel Glider inhabits dry sclerophyll forest and woodland nesting in small tree hollows. The presence of mature, hollow-bearing eucalypts is a critical characteristic of habitat occupied by Squirrel Gliders as they are utilised for nesting and breeding (Suckling 1995).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Eastern Pygmy Possum (*Cercartetus nanus*)
The Eastern Pygmy-possum is found from rainforest through sclerophyll forest to tree heath. Banksia and myrtaceous shrubs and trees are favoured (Turner & Ward, 1995). Eastern Pygmy-possums usually shelter alone in tree cavities, rotten stumps, holes in the ground, disused bird nests and possum dreys and in vegetation thickets such as *Xanthorrhoea* species (Menkhorst, 1996). The home ranges of males, about 0.65 hectares are larger than those of females, about 0.35 hectares and not exclusive with home ranges broadly overlapping. Apart from females with young in the nest, individuals may utilise a number of nest sites within the home range (Turner & Ward, 1995; Menkhorst, 1996).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Grey-headed Flying-fox *(Pteropus poliocephalus)*
Grey-headed Flying-foxes roost in camps during the day, which may contain tens of thousands of individuals, and then disperse to surrounding areas to forage at night. This species inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and urbanised and agricultural areas. Camps are commonly formed in gullies, typically not far from water and usually in vegetation with a dense canopy. Camps may also be formed in urban parkland areas (Tidemann 1998).

The Grey-headed Flying-fox is considered to be a nomadic and migratory species and therefore the local population constitutes those individuals that are likely to occur in the study area from time to time (DECC 2007).

Grey-headed Flying-foxes were observed flying over and foraging adjacent to the south of the subject site during previous surveys undertaken in 2004 by Andrews Neil (2004). The Grey-headed Flying-fox was also observed during previous surveys by Wildthing Environmental Consultants (1998). No Grey-headed Flying Fox roost or camp sites were observed within the subject site. The nearest camp sites for this species occur at Watanobbi, within Wambina Nature Reserve and at North Avoca.

Suitable foraging habitat for this species is provided within the Apple / Blackbutt / Swamp Mahogany Open Forest, Swamp Mahogany / Paperbark Canopy Only Vegetation, Blackbutt Canopy Only Vegetation and Cleared Land with Scattered Trees communities. The areas of proposed future residential subdivision within the site will occupy approximately 17.5 hectares of suitable foraging habitat for this species. A large proportion of this area is made up of highly disturbed habitats contained within the Canopy Only and Cleared Land with Scattered Trees vegetation communities. Offsetting to compensate for removal and likely impacts to vegetation and habitats within the site will be undertaken as part of the proposal (details of offsetting arrangements are provided within a separate offsetting report).

The proposed development is not likely to significantly reduce the area of suitable habitat available to the local population of this species due to the retention of approximately 11.42 hectares of suitable habitat within the subject site and the occurrence of several larger areas of suitable habitat within the locality, including areas reserved for long term conservation within Tuggerah State Conservation Area and Tuggerah Nature Reserve.

It is therefore considered that the proposed development is not 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.

Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
The Yellow-bellied Sheathtail-bat inhabits a wide variety of habitats from wet and dry sclerophyll forest, to open woodland, shrubland, mallee, grassland and desert. They fly fast and straight usually over the canopy, and lower over open spaces and at forest edges. This species roosts in large tree hollows (Churchill 2008).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Eastern Freetail Bat (*Mormopterus norfolkensis*)
The Eastern Freetail-bat utilises dry eucalypt forest and woodland on the coastal side of the Great Dividing Range. They show a preference for open spaces in woodland or forest, and are more active in the upper slopes of forest areas rather than in riparian zones. They also forage over large waterways. This species roosts in hollow trees (usually in hollow spouts), under exfoliating bark and in various man-made structures (Churchill 2008).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Large-eared Pied Bat (*Chalinolobus dwyeri*)
In the Sydney Basin this species is most commonly recorded in areas of high fertility soils in wet sclerophyll forest along the edges of sandstone escarpments. This species is also recorded in dry sclerophyll forest and woodlands, sub-alpine woodland, at the edges of rainforest, Callitris forest and within sandstone outcrop country. Large-eared Pied Bats roost in clusters in fairy martin nests and on the ceilings of caves, crevices in cliffs and mines in twilight areas (Churchill 2008).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
Preferred habitats for this species include rainforest, wet and dry sclerophyll forest, open woodland, Melaleuca forests and open grassland. The Eastern Bentwing-bat forages high in forested areas from just above canopy height to many times canopy

height. In more open areas such as grasslands, flight may be within a few metres of the ground. Eastern Bentwing-bats are cave dwellers, but will also roost in man-made structures such as road culverts and mines (Churchill 2008).
The Eastern Bentwing-bat is a highly mobile species within populations centred around maternity caves, dispersing to other caves during the non-breeding season. One bat is recorded to have moved over 1300 km. (Churchill 2008). Within its home range this species is considered to be nomadic and therefore the local population constitutes those individuals that are likely to occur in the study area from time to time (DECC 2007).

The Eastern Bentwing-bat was observed within the subject site during previous surveys undertaken by Wildthing Environmental Consultants (1998).

Suitable foraging habitat for this species is provided throughout the entire site. The areas of proposed future residential subdivision within the site will occupy approximately 17.5 hectares of suitable foraging habitat for this species. A large proportion of this area is made up of highly disturbed habitats contained within the Canopy Only and Cleared Land with Scattered Trees vegetation communities and offsetting to compensate for removal and likely impacts to vegetation and habitats within the site will be undertaken as part of the proposal (details of offsetting arrangements are provided within a separate offsetting report).

The proposed development is not likely to significantly reduce the area of suitable habitat available to the local population of this species due to the retention of approximately 11.42 hectares of suitable habitat within the subject site and the occurrence of several larger areas of suitable habitat within the locality, including areas reserved for long term conservation within Tuggerah State Conservation Area and Tuggerah Nature Reserve.

It is therefore considered that the proposed development is not 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.

Little Bentwing-bat (*Miniopterus australis*)
The Little Bentwing-bat forages below the canopy within well timbered areas including rainforest, vine thicket, wet and dry melaleuca swamps and coastal forests.
This species is a cave dweller with individuals congregating during the summer months in maternity colonies and disperse during the winter. Other roost sites used by this species include abandoned mines, tunnels, stormwater drains and occasionally in buildings, banana trees and tree hollows (Churchill 2008).

The Little Bentwing-bat was observed within the subject site during previous surveys undertaken by Wildthing Environmental Consultants (1998).

Suitable foraging habitat for this species is provided throughout the entire site. The areas of proposed future residential subdivision within the site will occupy approximately 17.5 hectares of suitable foraging habitat for this species. A large proportion of this area is made up of highly disturbed habitats contained within the Canopy Only and Cleared Land with Scattered Trees vegetation communities and offsetting to compensate for removal and likely impacts to vegetation and habitats within the site will be undertaken as part of the proposal (details of offsetting arrangements are provided within a separate offsetting report).

The proposed development is not likely to significantly reduce the area of suitable habitat available to the local population of this species due to the retention of

approximately 11.42 hectares of suitable habitat within the subject site and the occurrence of several larger areas of suitable habitat within the locality, including areas reserved for long term conservation within Tuggerah State Conservation Area and Tuggerah Nature Reserve.

It is therefore considered that the proposed development is not 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.

Southern Myotis *(Myotis macropus)*
The Large-footed Myotis has a strong association with streams and permanent waterways, most commonly within vegetated areas at lower elevations and in flat undulating country. This species forages over water for small insects, fish and invertebrates and have a preference for large pools rather than flowing streams. Roost habitats for this species are near water and include caves, tree hollows, abandoned fairy martin nests, among vegetation, in clumps of Pandanus, and man-made structures including under bridges, in mines, tunnels, road culverts and stormwater drains (Churchill 2008).

The Southern Myotis is considered to be a resident species according to movements and therefore the local population constitutes those individuals likely to occur in the study area, as well as any individuals occurring in adjoining areas that are likely to utilise habitats in the study area (DECC 2007).

The Southern Myotis was observed within the subject site during previous surveys undertaken by Wildthing Environmental Consultants (1998).

Suitable habitat for this species is provided throughout the entire site. The areas of proposed future residential subdivision within the site will occupy approximately 17.5 hectares of suitable foraging habitat for this species. A large proportion of this area is made up of highly disturbed habitats contained within the Canopy Only and Cleared Land with Scattered Trees vegetation communities and offsetting to compensate for removal and likely impacts to vegetation and habitats within the site will be undertaken as part of the proposal (details of offsetting arrangements are provided within a separate offsetting report).

The proposed development is not likely to significantly reduce the area of suitable habitat available to the local population of this species due to the retention of approximately 11.42 hectares of suitable habitat within the subject site and the occurrence of several larger areas of suitable habitat within the locality, including areas reserved for long term conservation within Tuggerah State Conservation Area and Tuggerah Nature Reserve.

It is therefore considered that the proposed development is not 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.

Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
The Eastern False Pipistrelle inhabits wet sclerophyll forest, open forest, rainforest and coastal mallee. They generally prefer tall and wet forests where the trees are more than 20 metres high and the understorey is dense. This species predominantly roosts in hollow trunks of eucalypts, however have also been reported to roost in caves and old buildings (Churchill 2008).

The Eastern False Pipistrelle is a highly mobile species, radio tracked individuals

have been reported to change roost almost every night and returned to roosts on different nights. Roosts on consecutive nights were usually less than 750m apart and up to 3.5km. They have a home range of up to 136 hectares (Churchill 2008). Within its home range this species is considered to be nomadic and therefore the local population constitutes those individuals that are likely to occur in the study area from time to time (DECC 2007).

This species was recorded within the subject site during current surveys by *Conacher Environmental Group* on 13 October 2011.

Suitable foraging, roosting and linkage habitat for this species is provided throughout the entire site. The areas of proposed future residential subdivision within the site will occupy approximately 17.5 hectares of suitable foraging habitat for this species. A large proportion of this area is made up of highly disturbed habitats contained within the Canopy Only and Cleared Land with Scattered Trees vegetation communities and offsetting to compensate for removal and likely impacts to vegetation and habitats within the site will be undertaken as part of the proposal (details of offsetting arrangements are provided within a separate offsetting report).

The proposed development is not likely to significantly reduce the area of suitable habitat available to the local population of this species due to the retention of approximately 11.42 hectares of suitable habitat within the subject site and the occurrence of several larger areas of suitable habitat within the locality, including areas reserved for long term conservation within Tuggerah State Conservation Area and Tuggerah Nature Reserve.

It is therefore considered that the proposed development is not 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.

Greater Broad-nosed Bat (*Scoteanax rueppellii*)
A wide variety of habitats are utilised by this species including moist gullies in mature coastal forest, rainforest, open woodland, Melaleuca swamp woodland, wet and dry sclerophyll forest, cleared areas with remnant trees and tree-lined creeks in open areas. The Greater Broad-nosed Bat forages about 5m from the edge of isolated trees, forest remnants or along forest crowns with a slow direct flight pattern. This species is known to roost in tree hollows, cracks and fissures in trunks and dead branches, under exfoliating bark, as well as in man-made structures including roofs of old buildings (Churchill 2008).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

Giant Dragonfly (*Petalura gigantea*)
This species inhabits permanent swamps and bogs with some free water and open vegetation and is known from eastern New South Wales (DECC 2005).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed within the subject site during surveys. It is considered that the action proposed is not 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.

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,

No flora or fauna specimens belonging to any endangered population were observed within the subject site. Therefore the proposed action will not have an adverse effect on the life cycle of any species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

c) In the case of a critically endangered or 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

The endangered ecological community (EEC), Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SSFCF) occurs within the subject site.

There are approximately 10.62 hectares of SSFCF EEC within the subject site, composed of approximately 6.91 hectares of Apple / Blackbutt / Swamp Mahogany Open Forest and approximately 3.71 hectares of Swamp Mahogany / Paperbark Canopy Only Vegetation as mapped in Figure 2.1.

For assessment purposes the local occurrence of this EEC has been interpreted in accordance with DECC (2007) as the ecological community that occurs within the study area and adjacent larger contiguous areas of that ecological community within which the movement of species and exchange of genetic material across the boundary of the study area is likely.

The local occurrence of this EEC has been interpreted from a review of vegetation mapping undertaken by Bell (2002) and incorporates Map Unit 18 Alluvial Floodplain Swamp Paperbark Thicket and Map Unit 20 Alluvial Floodplain Shrub Swamp Forest. It is considered that these areas form parts of the local occurrence of this EEC due to either direct connectivity with the subject site or the likely movement of birds, mammals and wind dispersed seed resulting in the likely exchange of genetic material across the boundary of the study area.

The total local occurrence of SSFCF EEC vegetation comprises a total area of approximately 248 hectares which includes 10.61 hectares of SSFCF EEC vegetation within the subject site, 223.6 hectares of SSFCF EEC vegetation adjoining the subject site to the north and east and 13.79 hectares of SSFCF EEC vegetation adjoining the subject site to the west.

The proposed development will require the removal or modification of approximately 3.09 hectares of SSFCF EEC vegetation. The total extent of the local occurrence of SSFCF EEC vegetation remaining following clearing for the proposed development will be approximately 244.91 hectares including approximately 7.53 hectares of SSFCF EEC within the subject site.

Offsetting to compensate for removal and likely impacts to the SSFCF EEC vegetation within the site will be undertaken as part of the proposal. Details of offsetting arrangements are provided within a separate offsetting report.
It is therefore considered that the proposed development is not likely to result in an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

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

The proposed development will require the removal of approximately 3.09 hectares of the local occurrence of the SSFCF EEC within the subject site. The majority of the local occurrence of this EEC will be retained and only a relatively small area will be removed. It is therefore considered that direct impacts associated with the proposal are likely to be limited to the removal of habitat for this EEC and are not likely to result in substantial and adverse modification to the composition of the SSFCF EEC such that its local occurrence is likely to be placed at risk of extinction.

There is potential for the proposal to result in indirect degradation to the SSFCF EEC present, associated with increased human presence and associated impacts of residential development within the site. It is recommended that suitable management is undertaken to ensure the long-term viability of the SSFCF EEC vegetation is not affected by indirect impacts associated with the proposed future residential use of the site.

Offsetting to compensate for removal and likely impacts to the SSFCF EEC vegetation within the site, will be undertaken as part of the proposal. Details of offsetting arrangements are provided within a separate offsetting report.

It is therefore considered that the proposal is not likely to substantially and adversely modify the composition of the REFCF EEC such that its local occurrence is likely to be placed at risk of extinction.

d) In relation to the habitat of threatened species, populations or ecological community:

i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed development is likely to result in the removal or modification and retention of the following vegetation types listed below in Table A5.1

TABLE A5.1
VEGETATION TO BE REMOVED, MODIFIED AND RETAINED

Vegetation Community	Total within Site	Area to be Removed or Modified (ha)	Area to be Retained (ha)
Apple/Blackbutt/Swamp Mahogany Open Forest (SSFCF EEC)	6.91	1.41	5.50
Swamp Mahogany / Paperbark Canopy Only Vegetation (SSFCF EEC)	3.71	1.68	2.03
Blackbutt Canopy Only Vegetation	4.83	4.72	0.11
Cleared Land with Scattered Trees	12.83	9.05	3.78
Freshwater Vegetation	0.64	0.64	-
All Areas	28.92	17.50	11.42

Offsetting to compensate for removal and likely impacts to the SSFCF EEC vegetation within the site, will be undertaken as part of the proposal. Details of offsetting arrangements are provided within a separate offsetting report.

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 subject site occurs at the southern extent of a large patch of vegetation which occurs along the south-western shores of Tuggerah Lake. Connectivity to the south is limited by existing residential subdivision and Ourimbah Creek. Other larger areas of vegetation occur within close proximity to the eastern and western boundaries of the site connected through the movement of birds, bats, insects and wind dispersed seed resulting in the exchange of genetic material across the boundary of the subject site. Some connectivity is present through the site between offsite areas to the east and west, however a more substantial habitat linkage is present between these areas to the north of the site.

Therefore considering the position of the subject site in the context of the surrounding landscape and the layout and nature of the proposed development, it is not likely that any area of habitat will become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The threatened fauna species Grey-headed Flying-fox, Little Bentwing-bat, Eastern Bentwing-bat, Southern Myotis and Eastern False Pipistrelle have been observed within the subject site. Suitable habitats for several other locally occurring threatened species is also present.

The site provides an area of habitat for a relatively small proportion of a larger identified local occurrence of SSFCF EEC. Areas of intact habitats for this EEC occur throughout the Apple/Blackbutt/Swamp Mahogany Open Forest vegetation community mapped in Figure 2.1.

Areas of the site proposed for future residential development containing Swamp Mahogany / Paperbark Canopy Only Vegetation, Blackbutt Canopy Only Vegetation, Cleared Land with Scattered Trees and Freshwater Vegetation have been extensively disturbed and degraded by previous clearing and agricultural land use. These disturbances have resulted in removal of the majority of endemic native understorey vegetation, significant thinning of native canopy vegetation and the introduction and establishment of exotic species.

Offsetting to compensate for removal and likely impacts to vegetation and habitats within the site will be undertaken as part of the proposal. Details of offsetting arrangements are provided within a separate offsetting report.

Due to the presence of other areas of suitable habitat within the local area contained areas managed for long term conservation such as Tuggerah State Conservation Area and Tuggerah Nature Reserve, the proposal is considered not likely to significantly affect the stages of the species' life cycles and reproductive success in the locality.

It is therefore considered that the removal or modification of disturbed habitat for locally occurring threatened species and the SSFCF EEC within the subject site is not of importance to the long-term survival of threatened species or ecological communities within the locality.

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

The subject site has not been classed as critical habitat within the provisions of the *Threatened Species Conservation Act* (1995). Therefore it is considered that the proposed development will not have an adverse effect on critical habitat either directly or indirectly.

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

There are draft or final recovery plans for the following threatened species with potential habitat within the subject site:

- Green and Golden Bell Frog (DEC 2005);
- Wallum Froglet (Meyer *et al.,* 2006);
- Bush Stone-curlew (DEC 2006);
- Barking Owl (NSW NPWS 2003);
- The Large Forest Owls (Powerful Owl and Masked Owl) (DEC 2006);
- Southern Brown Bandicoot (DEC 2006);
- Yellow-bellied Glider (NSW NPWS 2003); and
- Grey-headed Flying Fox (DECCW 2007).

There are currently no listed threat abatement plans or priorities action statements of direct relevance to the proposed development.

It is considered that the proposed development is not inconsistent with the broader recovery or threat abatement objectives or actions identified.

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.

An assessment of the likely impact of the proposal on Key Threatening Processes is provided in Table A5.2.

TABLE A5.2
ASSESSMENT OF KEY THREATENING PROCESSES

Key Threatening Processes Listed under the *TSC Act* (1995)	Evidence of Current or Previous Occurrence Observed Within Subject Site	Likely to Occur as a Result of the Proposal	Impact or Occurrence Likely to be Mitigated or Reduced as a Result of the Proposal
Alteration of habitat following subsidence due to longwall mining	No	No	No
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	No	No	No
Anthropogenic climate change	No	No	No

TABLE A5.2 ASSESSMENT OF KEY THREATENING PROCESSES			
Key Threatening Processes Listed under the *TSC Act* (1995)	**Evidence of Current or Previous Occurrence Observed Within Subject Site**	**Likely to Occur as a Result of the Proposal**	**Impact or Occurrence Likely to be Mitigated or Reduced as a Result of the Proposal**
Bushrock removal	No	No	No
Clearing of native vegetation	Yes	Yes	Yes
Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)	Yes	No	No
Competition and habitat degradation by feral goats (*Capra hircus*)	No	No	No
Competition from feral honey bees (*Apis mellifera*)	No	No	No
Death or injury to marine species following capture in shark control programs on ocean beaches	No	No	No
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	No	No	No
Forest Eucalypt dieback associated with over-abundant psyllids and bell miners	No	No	No
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition	No	No	No
Herbivory and environmental degradation caused by feral deer	No	No	No
Importation of red imported fire ants (*Solenopsis invicta*)	No	No	No
Infection by psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations	No	No	No
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	No	No	No
Infection of native plants by *Phytophthora cinnamomi*	No	No	No
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	No	No	No
Introduction of the large earth bumblebee (*Bombus terrestris*)	No	No	No
Invasion and establishment of exotic vines and scramblers	No	No	No
Invasion and establishment of Scotch broom (*Cytisus scoparius*)	No	No	No
Invasion and establishment of the cane toad (*Bufo marinus*)	No	No	No
Invasion of native plant	No	No	No

TABLE A5.2 ASSESSMENT OF KEY THREATENING PROCESSES			
Key Threatening Processes Listed under the *TSC Act* (1995)	**Evidence of Current or Previous Occurrence Observed Within Subject Site**	**Likely to Occur as a Result of the Proposal**	**Impact or Occurrence Likely to be Mitigated or Reduced as a Result of the Proposal**
communities by African Olive *Olea europaea* L. subsp. *cuspidata*			
Invasion, establishment and spread of *Lantana camara*	No	No	No
Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed)	No	No	No
Invasion of native plant communities by exotic perennial grasses	Yes	No	No
Invasion of the yellow crazy ant (*Anoplolepis gracilipes* (Fr. Smith)) into NSW	No	No	No
Loss of hollow-bearing trees	Yes	Yes	Yes
Loss or degradation (or both) of sites used for hill-topping by butterflies	No	No	No
Predation and hybridisation of feral dogs (*Canis lupus familiaris*)	No	No	No
Predation by the European red fox (*Vulpes vulpes*)	No	No	No
Predation by the feral cat (*Felis catus*)	No	No	No
Predation by *Gambusia holbrooki* (plague minnow or mosquito fish)	No	No	No
Predation by the ship rat (*Rattus rattus*) on Lord Howe Island	No	No	No
Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)	No	No	No
Removal of dead wood and dead trees	Yes	Yes	Yes

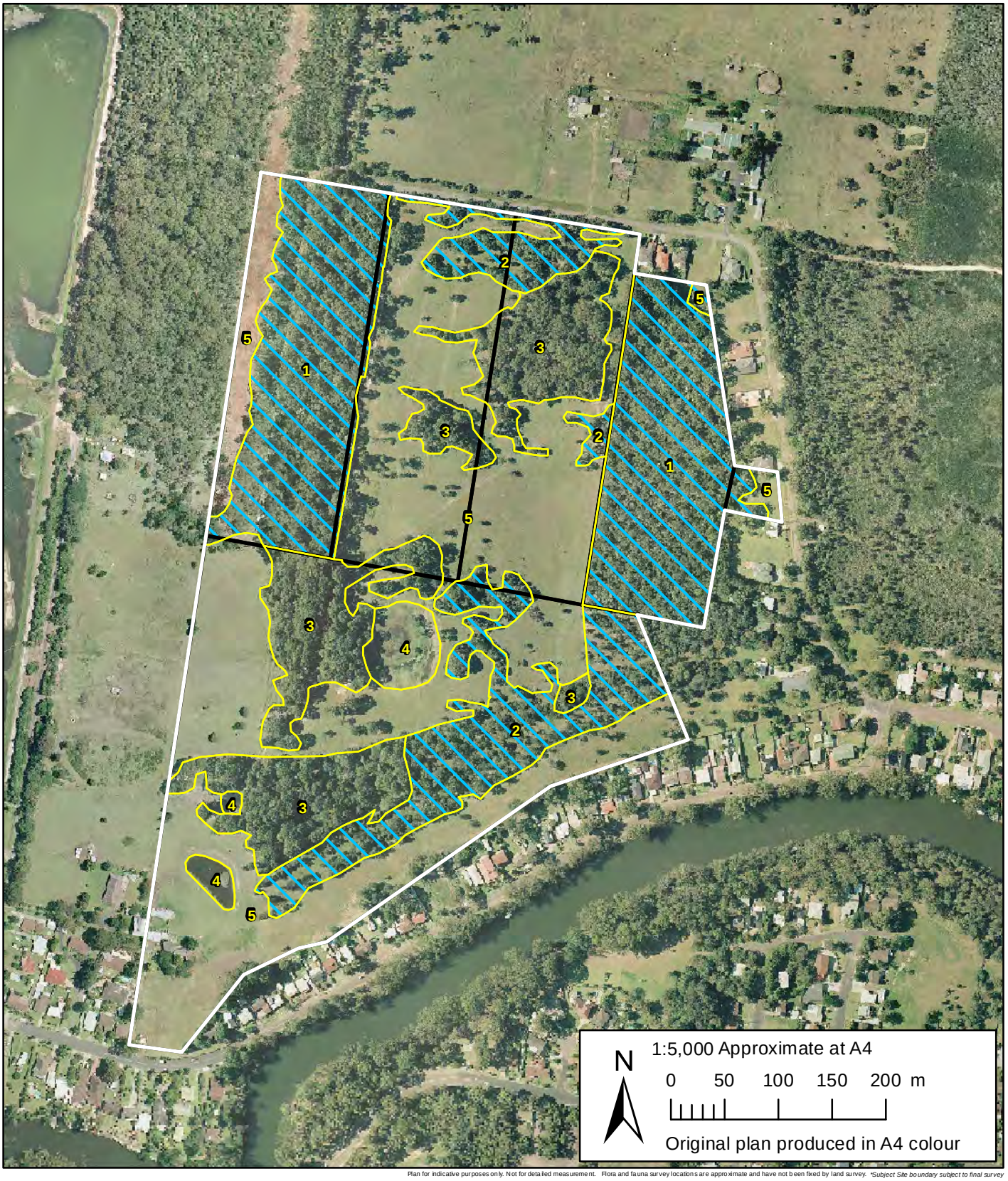
The proposal is likely to increase the impact of the key threatening processes Clearing of native vegetation, Loss of hollow-bearing trees, Removal of dead wood and dead trees within the subject site.

Offsetting to compensate for increase impacts resulting from an increase in the operation of these key threatening processes will be undertaken as part of the proposal. Details of offsetting arrangements are provided within a separate offsetting report.

1.2 ASSESSMENT OF SIGNIFICANCE CONCLUSION

i. The proposed development is not likely to have a significant effect on threatened species, populations or ecological communities or their habitats;

ii. A Species Impact Statement is not required for the proposed development.



Plan for indicative purposes only. Not for detailed measurement. Flora and fauna survey locations are approximate and have not been fixed by land survey. *Subject Site boundary subject to final survey

Legend

- Subject Site Boundary
- 1 Apple/Blackbutt/Swamp Mahogany Open Forest
- 2 Swamp Mahogany/Paperbark Canopy Only Vegetation
- 3 Blackbutt Canopy Only Vegetation
- 4 Fresh Water Vegetation
- 5 Cleared Land with Scattered Trees
- Lot Boundaries
- Swamp Sclerophyll Forest on Coastal Floodplains EEC

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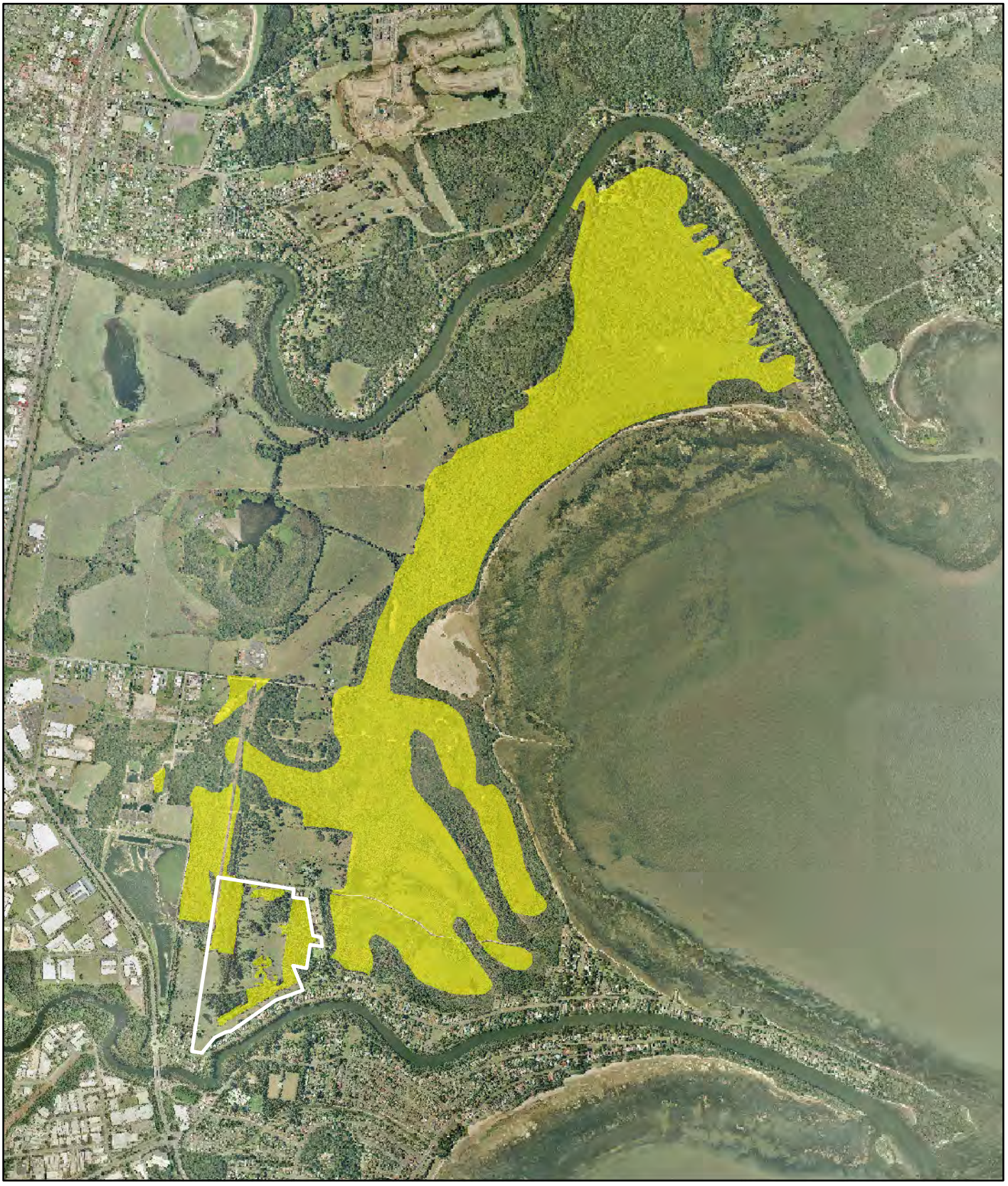
Figure 2.1
Flora Survey Locations

Geoffery Rd, Chittaway Bay

By:DC
07/11/11
Ref No. 1178

Source: Aerial © Department of Lands (2011)



*Subject Site boundary subject to final survey. Plan for indicative purposes only. Not for detailed measurement.

N

1:25,000 Approximate at A4

0 250 500 750 1,000 m

Original plan produced in A4 colour

Legend

Subject Site Boundary

Local Occurrence of Swamp Sclerophyll Forest on Coastal Floodplain EEC Vegetation

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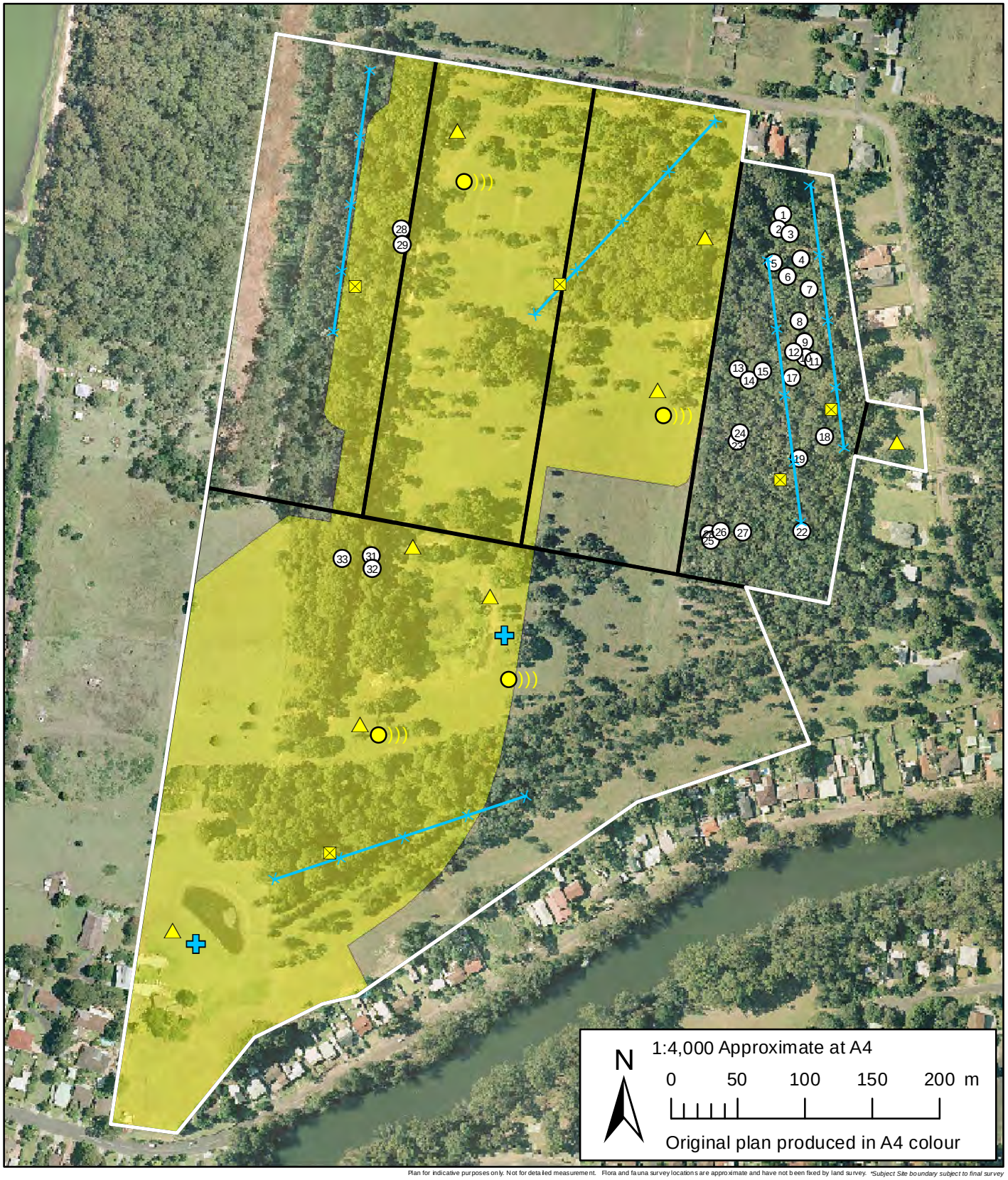
Drawing No. 1178	Date 28/03/12
Drawn By DC	
Amendment	Date
A	
B	
C	

Figure 2.2

Local Occurrence of Swamp Sclerophyll Forest on Coastal Floodplain EEC Vegetation

Geoffrey Road, Chittaway Bay

Source: Aerial © Department of Lands (2012)



Plan for indicative purposes only. Not for detailed measurement. Flora and fauna survey locations are approximate and have not been fixed by land survey. *Subject Site boundary subject to final survey

Legend

- Subject Site Boundary
- Lot Boundaries
- Proposed Development Area
- Frog Call Playback Station
- Owl Call Playback Station
- Anabat Location
- Cage Trap Location
- Arboreal and Terrestrial Trap Line (200m)
- Hollow Bearing Tree Location

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Figure 3.1
Fauna Survey Locations
Geoffery Rd, Chittaway Bay

By:DC
27/02/12
Ref No. 1178

Source: Aerial © Department of Lands (2011)

McCardle Cultural Heritage Pty Ltd

Paradigm Planning & Development Consultants Pty Ltd

Chittaway Bay Rezoning

LGA: Wyong

Indigenous Archaeological Due Diligence Assessment

November 2011

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Report No: J11038

Approved by:	**Penny McCardle**
Position:	**Project Manager**
Signed:	
Date:	**November 2011**

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Executive Summary

McCardle Cultural Heritage Pty Ltd (MCH) was commissioned by Paradigm Planning and Consultants prepare an Indigenous Archaeological Assessment for the proposed rezoning of land at Chittaway Bay. The study area included Lots 1-3 DP 21536, Lot 1 DP 134363, Lot 1 DP 1014003 and Lot 1 DP 22467 along Geoffrey Road and Church Road, Chittaway Bay from 1(c) Non-Urban to 2(a) Residential.

The objective of the assessment was to identify areas of indigenous cultural heritage value, to determine possible impacts on any indigenous cultural heritage identified (including potential subsurface evidence) and to develop management recommendations where appropriate. The assessment employed a regional approach, taking into consideration both the landscape of the study area (landforms, water resources, soils, geology etc) and the regional archaeological patterning identified by past studies.

The study area was situated on the Quaternary alluvium, gravel, sand, silt and clay ands at t its closest point, was located approximately 80 metres north of Ourimbah Creek (3rd order) that flowed east into Tuggerah Lake that was approximately 1 kilometre to the southeast at its closest point. Thus, the study area was considered moderately resourced in terms of water availability and associated resources. The grass ground cover throughout the study area was expected to result in limited visibility, hence reducing the detection of surface cultural materials.

The specific study area had been cleared and primarily used for pastoral purposes (grazing), involving the wholesale clearance of native vegetation, the introduction of pasture grass, the construction of dams, housing, fencing, numerous tracks and associated infrastructure (water, electricity, telephone). Past excavation works required for dam construction and the laying of infrastructure (water, telephone) required the removal of soils thus displacing and destroying any cultural materials that may have been present. As fence construction and the erection of telegraph poles required the removal of soils for the holes, this would also have resulted in the disturbance and possible destruction of any cultural materials.

A search was undertaken of the OEH AHIMS register has showed 31 previously recorded Aboriginal sites within five kilometres of the study area and included 15 AFT, 5 middens, 2 GDG, 2 Bora/ceremonial, 1 AFT/PAD, 1 STQ, Shelter/art, 1 shelter/art/deposit, 1 GDG/AFT, 1 GDG/WTR, 1 TRE and 1 PAD. Based on archaeological sites registered in the region and the results of past archaeological studies, two sites types were considered likely to occur throughout the study area, being artefact scatters and isolated finds.

The survey focused on areas of high ground surface visibility and exposures (erosional features, tracks, cleared areas). For ease of management, the study area was divided into three Survey Units (SUs) that were based on landforms. No sites or PADs were identified and this was not considered surprising given that the only area with archaeological potential was the crest that overlooked Ourimbah Creek, which had been highly disturbed due to road construction. As no sites or PADs were identified, further investigation is not justified. The following general recommendations were made:

1) The persons responsible for the management of on-site works will ensure that all staff, contractors and others involved in construction and maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010, under the National Parks and Wildlife Act 1974;

2) In order to determine the cultural significance of the study area, consultation with the Aboriginal community musty be undertaken as per the OEH Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010); and

3) If any artefacts are uncovered during any works, work must stop in that area and the OEH notified.

Glossary

Activity area: a pattern of artefacts in a site indicating that a specific activity took place.

Aeolian deposits: sediments transported by wind (sand dunes, loess).

Alluvial: sediment mass that is deposited from transport by channelled stream flow or over-bank flow.

Aboriginal Cultural Heritage Values: traditional values of Aboriginal people, handed down in spiritual beliefs, stories and community practices and may include local plant and animal species, places that are important and ways of showing respect for other people.

Aboriginal Place: are locations that have been recognised by the Minister for Climate Change and the Environment (and gazetted under the *National Parks and Wildlife Act1974*) as having special cultural significance to the Aboriginal community. An Aboriginal Place may or may not include archaeological materials.

Aboriginal Site: an Aboriginal site is the location of one or more Aboriginal archaeological objects, including flaked stone artefacts, midden shell, grinding grooves, archaeological deposits, scarred trees etc.

Artefact: any object that is physically modified by humans.

Artefact scatter: a collection of artefacts scattered across the surface of the ground. Also referred to as open camp sites.

Assemblage: a collection of artefacts associated by a particular place or time and assumed generated by a single group of people and can comprise different artefact types.

Association: the co-occurrence of an artefact with other archaeological remains, usually in the same matrix.

Axe: a stone-headed axe usually having two ground surfaces that meet at a bevel.

Backed artefact: a stone tool where the margin of a flake is retouched at a steep angle and that margin is opposite a sharp edge.

Background scatter: a term used to describe low density scatter of isolated finds that are distributed across the landscape without any obvious focal point.

B.C: abbreviation for the term Before Christ. In academic, historical and archaeological professions, this term is now generally replaced by Before Common Era (B.C.E).

B.C.E: Before Common Era. See B.C.

Biface: a stone artefact flaked on both faces.

Bipolar flake: a stone artefacts produced by striking into an anvil with a hammer stone. These flakes usually display crushing at either end.

Blade: a flake that is at least twice as long as it is wide.

Bondi point: a small asymmetrical backed artefact with a point at one end and backing retouch.

B.P: Before Present, used in age determination instead of B.C or B.C.E. Present is academically defined as the year 1950 (the year the term was invented).

Calcined bone: burned bone reduced to white or blue mineral constituents.

Ceremonial Sites: Included in the OEH AHIMS database are sites which were associated with the spiritual beliefs and activities of Aboriginal people. They may be natural places in the landscape, or places where structures were made as part of particular ceremonies. Structures include bora rings, stone arrangements etc.

Conjoin: a physical link between artefacts broken.

Contact site: a site that displays interaction between early colonists and Aboriginal Australians.

Context: the position and associations of an artefact, feature, or archaeological find in space and time. Noting where the artefact was found and what was around it assists archaeologists in determining chronology and interpreting function and significance. Loss of context removes the artefacts meaning and make sit more difficult to determine function.

Core: a chunk of stone from which flakes are removed and will have one or more negative flake scars but no positive flake scars. The core itself can be shaped into a tool or used as a source of flakes to be formed into tools.

Cortex: the rough outer weathered surface of a rock, usually chemically altered and removed during knapping.

Cultural deposit: sediments and materials laid down by, or heavily modified by human activity.

Cultural Heritage Sensitivity: This term is used to denote not just the value of a place in the landscape to Aboriginal people, but also the vulnerability of the value. For instance, places with important spiritual values may be very sensitive because the rocks, pools or trees are easily damaged by the activities of others, or only a very few examples remain.

Debitage: small pieces of stone debris that break off during the manufacturing of stone tools. These are usually considered waste and are the by product of production (also referred to as flake piece).

Distal: the terminating end of a flake opposite the bulb.

Edge damage: the removal of small flakes, or crushing, from the edge of an artefact.

Elders: Older Aboriginal people in the local community for whom there is great respect because of their knowledge, dignity or communication skills. These people are not necessarily the descendents of traditional Aboriginal people from the area.

Elouera: a type of backed blade, triangular sectioned and resembling an orange segment in shape.

Exposure: an area of land surface where the ground surface is visible, usually as a result of thinner vegetation cover, erosion or human caused disturbances. In archaeological surveys, the percentage of ground surface exposed is recorded and the used to calculate effective survey coverage.

Flake: any piece of stone struck off a core and has a number of characteristics including ring cracks showing where the hammer hit the core and a bulb of percussion. May be used as a tool with no further working, may be retouched or serve as a platform for further reduction.

Flaked piece/waste flake: an unmodified and unused flake, usually the by product of tool manufacture or core preparation (also referred to as debitage).

Fluvial deposit: sediments laid down by running water.

Formation processes: human caused (land uses etc) or natural processes (geological, animal, plant growth etc) by which an archaeological site is modified during or after occupation and abandonment. These processes have a large effect on the provenience of artefacts or features.

Grinding Grooves: Aboriginal people made a range of edge ground implements such as 'axes' and 'hatchets'. The sharp edge of these tools was maintained by grinding it on sandstone outcrops, most often in stream beds where pools of water were available to wet the grindstone. Spear shafts were also sometimes shaped by grinding. The grinding sites can be identified by elongated grooves in the sandstone surface in sets of 2 to more than 100. Some portable grindstones are also reported from Aboriginal sites.

Grinding stone: an abrasive stone used to abrade another artefact or to process food.

Ground edge hatchet: a stone axe that is oval or rounded in shape and has edges formed by grinding and sharpening and were hafted to wooden handles using resin, wax or a combination of materials.

Hafting: the process of attaching a stone artefact onto a handle or spear.

Hammer stone: a stone that has been used to strike a core to remove a flake, often causing pitting or other wear on the stone's surface.

Harm: is defined as an act that may destroy, deface or damage an Aboriginal object or place. In relation to an object, this means the movement or removal of an object from the land in which it has been situated

Holocene: the post-glacial period, beginning about 10,000 B.P.

In situ: archaeological items are said to be "in situ " when they are found in the location where they were last deposited.

Isolated find: a single artefact not ;located with any other.

Microlith: small backed stone artefacts.

Midden:a type of archaeological site that is dominated by shell deposits that may have been sourced by Aboriginal people from fresh water, estuarine or open coastline habitats. The long-term disposal of refuse can result in stratified deposits, which are useful for relative dating.

Pleistocene: the latest major geological epoch, colloquially known as the "Ice Age" due to the multiple expansion and retreat of glaciers. Ca. 3.000,000-10,000 years B.P.

Post-depositional: after deposition.

Retouched flake: a flake that has been flaked again in a manner that modified the edge for the purpose of resharpening that edge.

Salvage archaeology: archaeological research carried out to preserve or rescue sites, materials and data from areas threatened by man-made or natural disturbance.

Scarred tree: a tree that bears a scar or scars which are wounds formed from the deliberate removal of bark or wood by Aboriginal people and are usually an indicator of an activity area.

Scraper: stone tool made on a flake or core with steep retouch along one or more edges.

Sedimentation: the accumulation of geological or organic material deposited by air, water, or ice.

Stone arrangement: an arrangement of stones into a shape or pattern and often used for ceremonial purposes or place markers.

Spiritual Significance: the importance of a place in the landscape that is valued by Aboriginal people because it is part of their spiritual culture. Examples include places associated with totem species or places that are the subject of traditional cultural stories.

Stratified Archaeological Deposits: Aboriginal archaeological objects may be observed in soil deposits and within rock shelters or caves. Where layers can be detected within the soil or sediments, which are attributable to separate depositional events in the past, the deposit is said to be stratified. The integrity of sediments and soils are usually affected by 200 years of European settlement and activities such as land clearing, cultivation and construction of industrial, commercial and residential developments.

Surface collection: archaeological materials obtained from the ground surface.

Surface scatter: archaeological materials found distributed over the ground surface.

Taphonomy: the study of processes which have affected organic materials such as bone after death; it also involves the microscopic analysis of tooth-marks or cut marks to assess the effects of butchery or scavenging activities.

Test excavation: excavation of small sections (a sample) of an area to determine the archaeological remains and significance.

Toe-hold: small scar on tree trunks and branches used to facilitate climbing.

Traditional Aboriginal Owners: Aboriginal people who are listed in the Register of Aboriginal owners pursuant to Division 3 of the *Aboriginal Land Register Act (1983)*. The Registrar must give priority to registering Aboriginal people for lands listed in Schedule 14 of the *National Parks and Wildlife Act 1974* or land subject to a claim under 36A of the *Aboriginal Land Rights Act 1983*.

Traditional Knowledge: Information about the roles, responsibilities and practices set out in the cultural beliefs of the Aboriginal community. Only certain individuals have traditional knowledge and different aspects of traditional knowledge may be known by different people, e.g. information about men's initiation sites and practices, women's sites, special pathways, proper responsibilities of people fishing or gathering food for the community, ways of sharing and looking after others, etc.

Use wear: the wear displayed on an artefact as a result of use.

Weathering: the natural chemical or physical alteration of an object or deposit through time.

Abbreviations and Acronyms

ACHMP	Aboriginal Cultural Heritage Management Plan
AHIMS	Aboriginal Heritage Information Management System. Data base of recorded sites across NSW managed by OEH
OEH	Office of Environment and Heritage

OEH AHIMS Site Acronyms

ACD	Aboriginal ceremonial and dreaming
AFT	Artefact (stone, bone, shell, glass, ceramic and metal)
ARG	Aboriginal resource and gathering
ART	Art (pigment or engraving)
BOM	Non-human bone and organic material
BUR	Burial
CFT	Conflict site
CMR	ceremonial ring (stone or earth)
ETM	Earth mound
FSH	Fish trap
GDG	Grinding groove
HAB	Habitation structure
HTH	Hearth
OCQ	Ochre quarry
PAD	Potential archaeological Deposit. Used to define an area of the landscape that is believed to contain subsurface archaeological deposits.
SHL	Shell
STA	Stone arrangement
STQ	stone quarry
TRE	Modified tree (carved or scarred)
WTR	Water hole

1 INTRODUCTION

1.1 INTRODUCTION

McCardle Cultural Heritage Pty Ltd (MCH) has been commissioned by Paradigm Planning and Consultants prepare an Indigenous Archaeological Assessment for the proposed rezoning of land at Chittaway Bay that includes Lots 1-3 DP 21536, Lot 1 DP 134363, Lot 1 DP 1014003 and Lot 1 DP 22467 along Geoffrey Road and Church Road, Chittaway Bay from 1© Non-Urban to 2(a) Residential.

The assessment has been undertaken to meet the NSW Office of Environment and Heritage (OEH) Due Diligence Code of Practice for the protection of Aboriginal Objects in New South Wales and the Brief. It does not meet the OEH Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010).

1.2 PROPONENT DETAILS

IDA Safe Constructions Pty Ltd

1.3 STUDY AREA& HOW IT IS DEFINED

The study area is defined by the proponent and is located approximately 3 kilometres south of Wyong. The location and extent of the study area is illustrated in *Figures 1.1* to *1.3*.

1.4 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The project is only in the rezoning stage and as such there is no development or plans at this stage.

1.5 DESCRIPTION OF IMPACTS

The project is only in the rezoning stage and as such there is no development or impacts at this stage.

1.6 PROJECT FRAMEWORK

The EP&A Act establishes the statutory framework for planning and environmental assessment in New South Wales and the implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils. The EP&A Act contains three parts which impose requirements for planning approval:

- Part 3 relates to the preparation and making of Environmental Planning Instruments, including Local Environmental Plans (LEP) which zone land for particular purposes.
- Part 4 generally provides for the control of local development that requires development consent from the local Council.
- Part 5 provides for the control of 'activities' that do not require development consent and are undertaken or approved by a determining authority.

The applicable approval process is determined by reference to the relevant environmental planning instruments and other controls including local environmental plans (LEPs) and State Environmental Planning Policies (SEPPs). Pursuant to section 36 of the EP&A Act there is a general presumption that a SEPP prevails over a LEP in the event of an inconsistency.

This project falls under Part 3.

Source: 1:100 000 Topo Series: Gosford

Figure 1.1 Regional location of the study area

MCH:

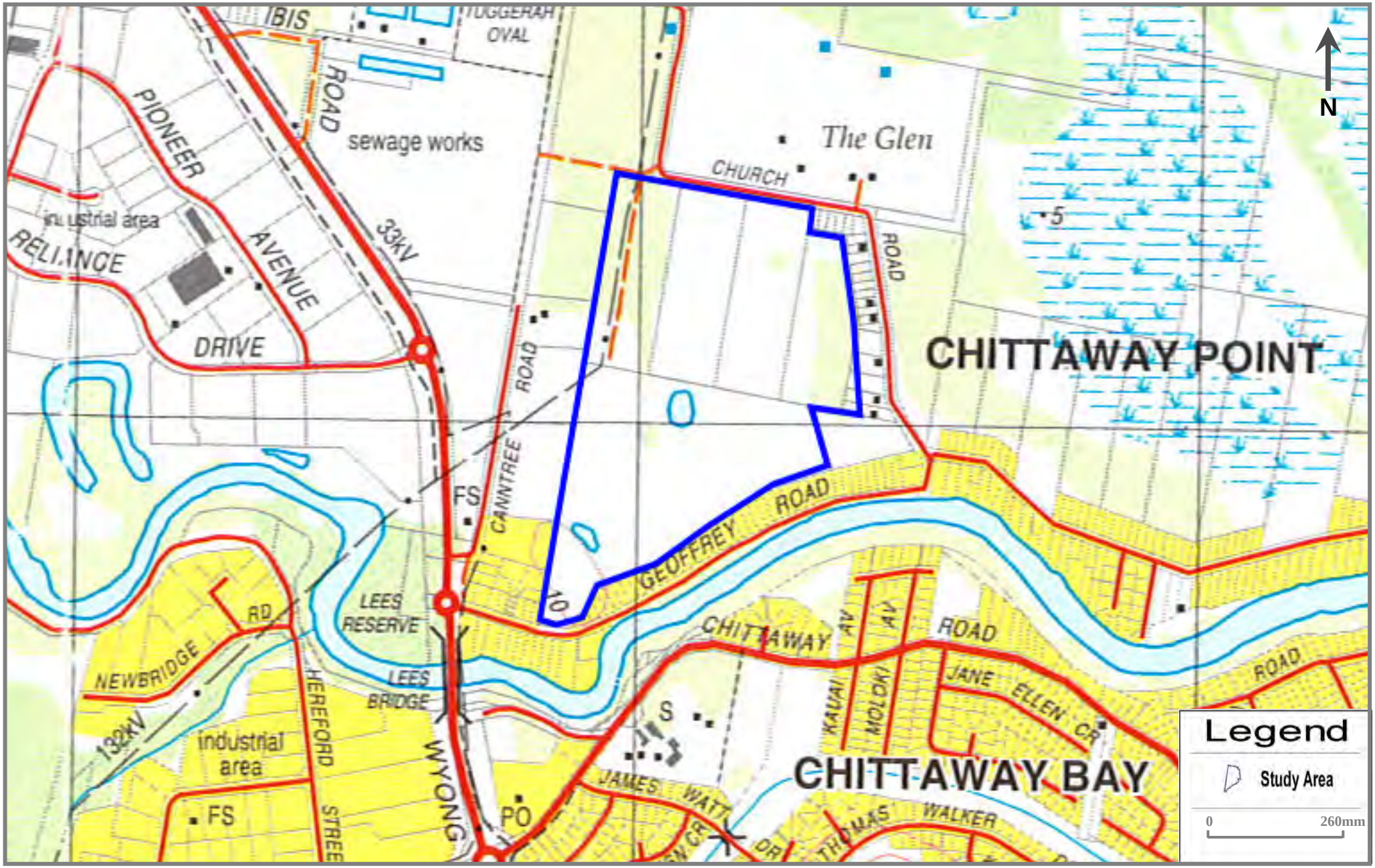

Figure 1. 2 Local location of the study area

Source: 1:25 000 Topo Series: Wyong

MCH:

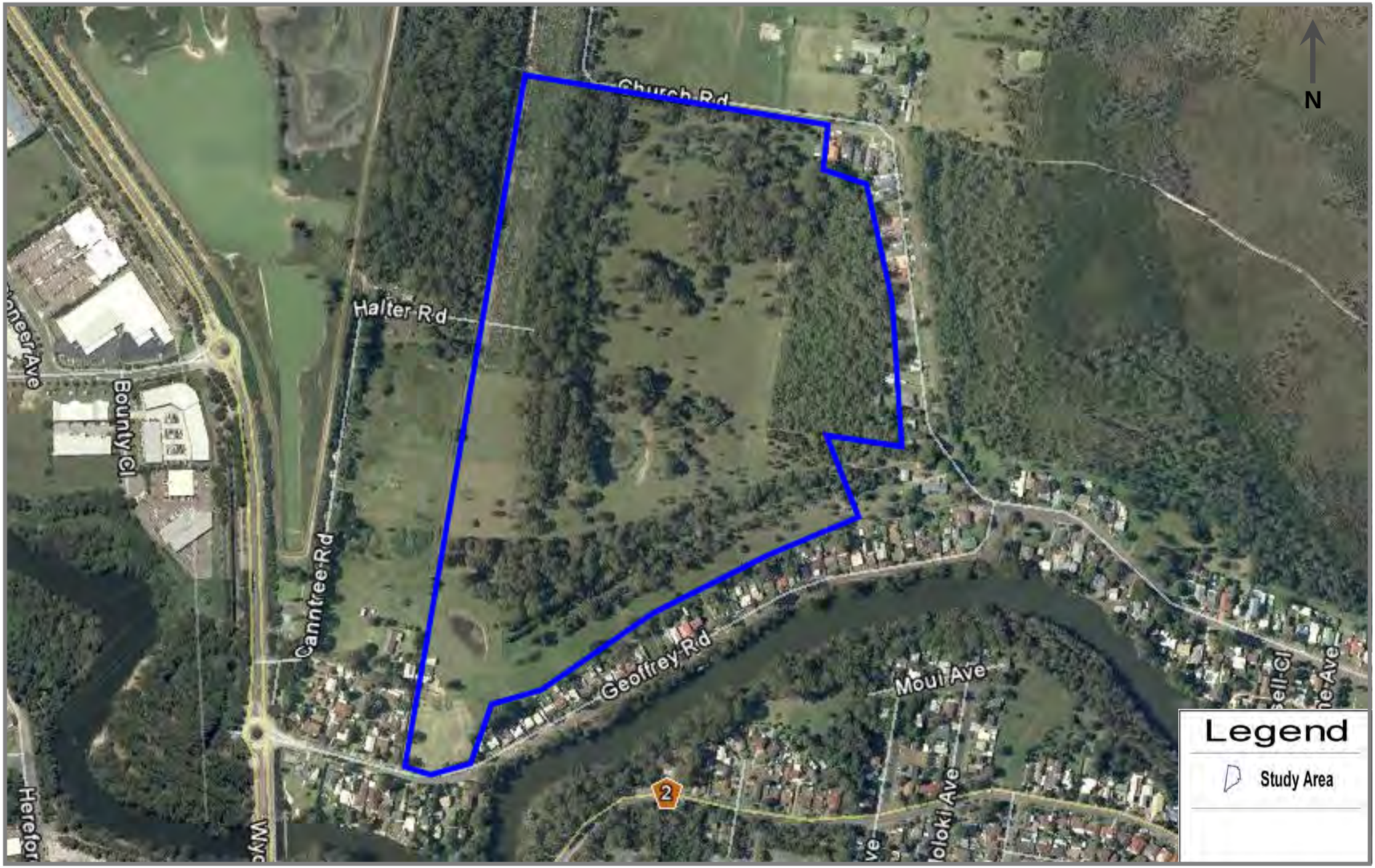

Figure 1. 3 Aerial location of the study area

Source: Google earth

1.7 PURPOSE OF THE ARCHAEOLOGICAL ASSESSMENT

The purpose of the assessment is to assess any archaeological constraints to support the rezoning and to provide opportunities and options to ensure any cultural materials present are protected.

1.8 OBJECTIVES OF THE ASSESSMENT

The objective of the assessment is to identify areas of indigenous cultural heritage value, to determine possible impacts on any indigenous cultural heritage identified (including potential subsurface evidence) and to develop management recommendations where appropriate.

The assessment employs a regional approach, taking into consideration both the landscape of the study area (landforms, water resources, soils, geology etc) and the regional archaeological patterning identified by past studies.

1.9 PROJECT BRIEF/SCOPE OF WORKS

The following tasks were carried out:

- a review of relevant statutory registers and inventories for indigenous cultural heritage including the NSW Office of Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS) for known archaeological sites, the State Heritage Register, the Australian Heritage Database (includes data from the World Heritage List UNESCO, National Heritage List, Commonwealth Heritage List, Register of the National Estate) and the Wyong Local Environmental Plan;
- a review of local environmental information (topographic, geological, soil, geomorphological and vegetation descriptions) to determine the likelihood of archaeological sites and specific site types, prior and existing land uses and site disturbance that may effect site integrity;
- a review of previous cultural heritage investigations to determine the extent of archaeological investigations in the area and any archaeological patterns;
- the development of a predictive archaeological statement based on the data searches and literature review;
- identification of human and natural impacts in relation to known and recorded archaeological sites and predicted archaeological potential of the study area;
- undertake a site inspection, and
- the development of mitigation and conservation measures.

1.10 STATUTORY CONTROLS

Land managers are required to consider the affects of their activities or proposed development on the environment under several pieces of legislation. Indigenous cultural heritage in NSW is protected and managed under both Commonwealth and State legislation. The appropriate legislation is summarised below.

- *New South Wales National Parks and Wildlife Act* 1974, Amendment 2010

The National Parks and Wildlife Act (1974), Amended 2010, administered by the OEH is the primary legislation for the protection of Aboriginal cultural heritage in New South Wales.

Part 6 of the Act provides protection for Aboriginal objects and declared Aboriginal places through the establishment of offences of 'harm' to these objects and places. Under the Act, it is an offence to knowingly harm or desecrate an Aboriginal object or Aboriginal place. If harm to

an object or place is anticipated, an Aboriginal Heritage Impact Permit (AHIP) must be applied for and OEH may issue and AHIP under the s90 of the Act.

Previously, the NPW Act required two permits for the majority of activities and included one for test excavations (s87) and one for the activity itself (s90). The new provisions collapse these requirements into a single regulatory provision.

A permit is no longer required to undertake test excavations (providing the excavations are in accordance with the Code of Practice for Archaeological Investigations in NSW).Where an AHIP s90 is required, they can now be issued in relation to specific parcels of land, deal with multi stage developments, and there are clear provisions for variation, transfer, suspension and revocation.

Linked to the NPW Act (amendment 2010) are the Due Diligence Code of Practice and the Archaeological Code of Practice. The Due Diligence Code of Practice explains and provides guidance about what due diligence means. It also provides steps in which individuals or organisations that own, use or manage land can identify if Aboriginal objects are or likely to be there, determine if their activities will harm Aboriginal objects and determine of an AHIP is required. The code enables people to take reasonable steps or precautions to consider if Aboriginal objects may be present and avoid harm to them. If harm cannot be avoided, then an AHIP is required. The Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW assists in establishing the requirements for undertaking test excavations as part of an archaeological investigation without an AHIP and to establish the requirements that must be followed when undertaking an archaeological investigation in NSW where an AHIP application is likely to be made.

- *Environmental Planning and Assessment Act* 1979, (EP&A Act, NSW)

Consideration of potential impacts of a development on Aboriginal heritage is a key component of the environmental impact assessment process under the EP&A Act.

In NSW the Environmental Planning and Assessment Act (EP&A Act) is the principal law overseeing the assessment and determination of development proposals which are considered under the following different parts of the Act (DoP 2010):

Part 3 Part 3 relates to the preparation and making of Environmental Planning Instruments, including LEPs which zone land for particular purposes

Part 4: for other proposals that require consent, usually by the local council (but by the Minister in limited circumstances). Under Part 4, minor or routine development may also be complying development approval by accredited certifiers.

Part 5: for proposals that do not fall under Part 4. These are often infrastructure proposals approved by local councils or State agencies which are undertaking them.

The standards of the OEH Due Diligence Code may be used or adapted by proponents to inform the initial assessment of the environmental impacts of an activity on Aboriginal heritage. An environmental assessment that meets all the requirements of the Due Diligence Code will satisfy the Due Diligence test.

- *The Heritage Act* 1977 (NSW)

The Heritage Act 1977 protects the natural and cultural history of NSW with emphasis on non-indigenous cultural heritage through protection provisions and the establishment of a Heritage

Council. While Aboriginal heritage sites and objects are protected primarily by the NPW Act 1974, if an Aboriginal site, object or place is of great significance it can be protected by a heritage order issued by the Minister on the advice of the Heritage Council.

- *The Aboriginal and Torres Strait Islander Heritage Protection Act* 1984, Amendment 1987 (Commonwealth)

The Aboriginal and Torres Strait Islander Heritage Protection Act 1984 protects areas and/or objects which are of significance to Aboriginal people and which are under threat of destruction. A significant area or object is defined as one that is of particular importance to Aboriginal people according to Aboriginal tradition. The Act can, in certain circumstances override state and territory provisions, or it can be implemented in circumstances where state or territory provisions are lacking or are not enforced. The Act must be invoked by or on behalf of an Aboriginal or Torres Strait Islander or organisation.

- *The Australian Heritage Commission Act* 1975 (Commonwealth)

The Australian Heritage Commission Act 1975 established the Australian Heritage Commission, which assesses places to be included in the National Estate and maintains a register of these places, which are significant in terms of their association with particular community or social groups for social, cultural or spiritual reasons. The Act does not include specific protective clauses.

1.11 QUALIFICATIONS OF THE INVESTIGATOR

Penny McCardle: Principal Archaeologist & Forensic Anthropologist has 10 years experience in Indigenous archaeological assessments, excavation, research, reporting, analysis and consultation. Six years in skeletal identification, biological profiling and skeletal trauma identification.

- BA (Archaeology and Palaeoanthropology, University of New England 1999
- Hons (Archaeology and Palaeoanthropology): Physical Anthropology), University of New England 2001
- Forensic Anthropology Course, University of New England 2003

1) Armed Forces Institute of Pathology Forensic Anthropology Course, Ashburn, VA 2008
2) Analysis of Bone trauma and Pseudo-Trauma in Suspected Violent Death Course, Erie College, Pennsylvania, 2009

- Currently undertaking a PhD, University of Newcastle, 2010

1.12 REPORT STRUCTURE

The report includes *Chapter 1* which outlines the project, *Chapter 2* provides the consultation, *Chapter 3* presents the environmental context, *Chapter 4* presents ethno historic context, *Chapter 5* provides the archaeological background, *Chapter 6* provides the results of the fieldwork, analysis and discussion; *Chapter 7* presents the development impact assessment, *Chapter 8* presents the mitigation strategies and *Chapter 9* presents the management recommendations.

2 LANDSCAPE CONTEXT

2.1 INTRODUCTION

The nature and distribution of Aboriginal cultural materials in a landscape are strongly influenced by environmental factors such as topography, geology, landforms, climate, geomorphology, hydrology and the associated soils and vegetation (Hughes and Sullivan 1984). These factors influence the availability of plants, animals, water, raw materials, the location of suitable camping places, ceremonial grounds, burials, and suitable surfaces for the application of rock art. As site locations may differ between landforms due to differing environmental constraints that result in the physical manifestation of different spatial distributions and forms of archaeological evidence, these environmental factors are used in constructing predictive models of Aboriginal site locations.

Environmental factors also effect the degree to which cultural materials have survived in the face of both natural and human influences and affect the likelihood of sites being detected during ground surface survey. Site detection is dependent on a number of environmental factors including surface visibility (which is determined by the nature and extent of ground cover including grass and leaf litter etc), the survival of the original land surface and associated cultural materials (by flood alluvium and slope wash materials), and the exposure of the original landscape and associated cultural materials (by water, sheet and gully erosion, ploughing, vehicle tracks etc), (Hughes and Sullivan 1984). Combined, these processes and activities are used in determining the likelihood of both surface and subsurface cultural materials surviving and being detected.

It is therefore necessary to have an understanding of the environmental factors, processes and activities, all of which affect site location, preservation, detection during surface survey and the likelihood of subsurface cultural materials being present. The environmental factors, processes and disturbances of the surrounding environment and specific study area are discussed below.

2.2 TOPOGRAPHY

The topographical context is important to identify potential factors relating to past Aboriginal land use patterns. Story *et al* (1963) divided the Hunter Valley into eight main sub-regions including the Southern Mountains, Central Goulburn Valley, Merriwa Plateau, Liverpool and Mt Royal Ranges, Barrington tops, North-Eastern Mountains, Central lowlands and the Coastal Zone.

The study area is located within the broad poorly drained flood plains and alluvial flats of Quaternary sediments on the Central Coast lowlands. The specific study area includes a crest to the south, a slope and flats (Refer to *Figure 2.1*).

2.3 GEOLOGY

The geology of a region is not only reflected in the environment (landforms, topography, geomorphology, vegetation, climate etc), it also influences past occupation and its manifestation in the archaeological record.

The nature of the surrounding and local geology along with the availability and distribution of stone materials has a number of implications for Aboriginal land use and archaeological implications. The implications for past Aboriginal land use mainly relate to location of stone resources or raw materials and their procurement for manufacturing and modification for stone tools. Evidence of stone extraction, and manufacture, can be predicted to be concentrated in the areas of stone availability. However, stone can be transported for manufacture and/or trading across the region.

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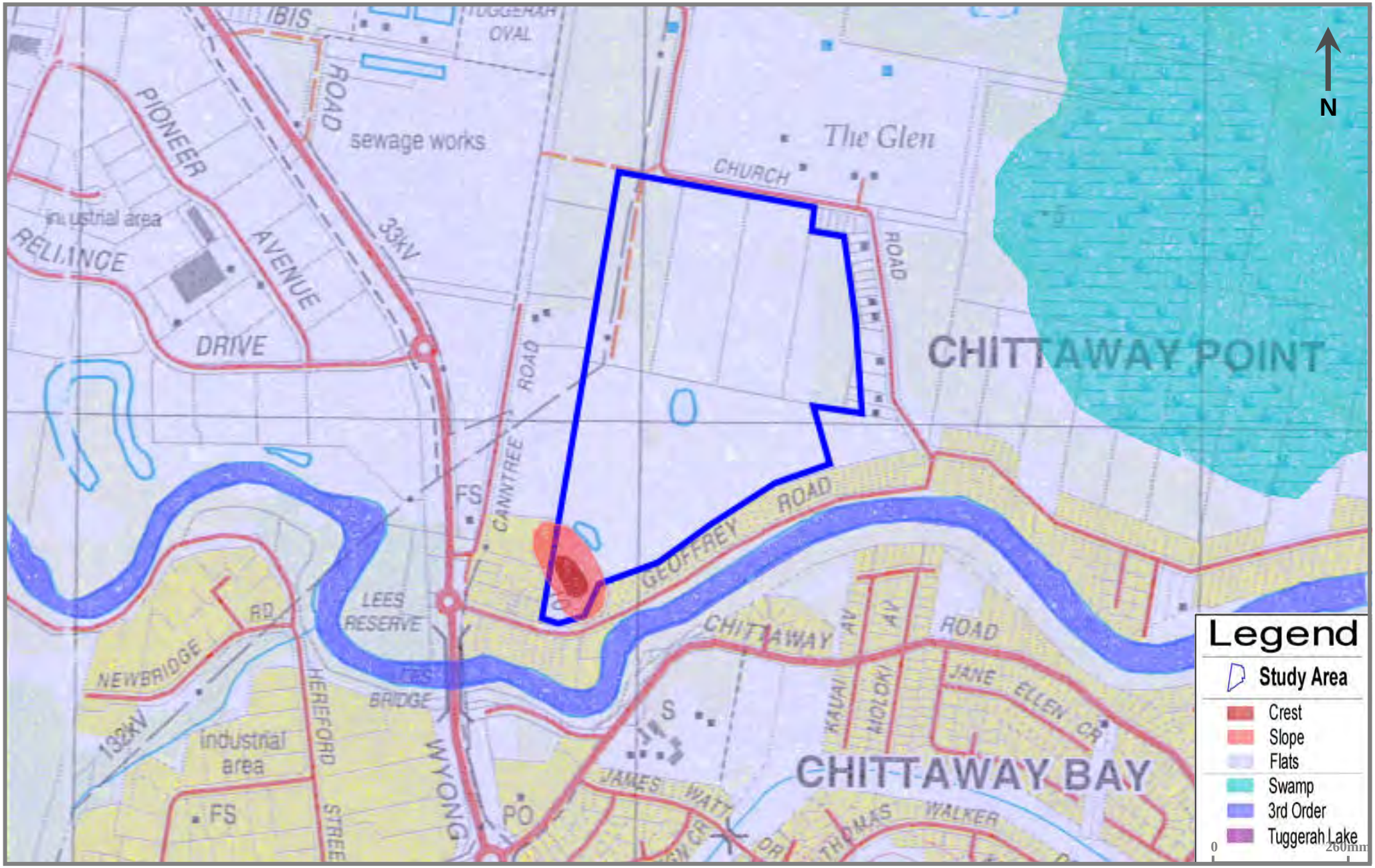


Figure 2.1 Landforms of the study area

Source: 1:25 000 Topo Series: Wyong

The study area is situated on the Quaternary alluvium, gravel, sand, silt and clay (Sydney Geological Map 1966). Materials most dominant raw material used in stone tool manufacture throughout the area is tuff (NPWS 2010).

2.4 *SOILS*

The nature of the surrounding soil landscape also has implications for Aboriginal land use and site preservation, mainly relating to supporting vegetation and the preservation of organic materials and burials.

The study area is situated on the Wyong soil landscape which is a broad poorly drained flats or floodplains and occasional low lying, slightly elevated terraces on Quaternary Alluvium sediments in areas of the Central Coast Lowlands (Matthei 1995: 259-260; Murphy 1993: 81-83) comprising sand, silt, gravel and clay. Slope gradients are less than 3% with local relief less than 10 metres. Small areas of Tacoma Swamp are sometimes found within this soil landscape (Murphy 1993:81-83).

Soils are deep yellow podzolic soils, brown podzolic soils, soloths and some humus podzols around lake edges (Murphy 1993:81-83). Dominant soil materials include brownish black pedal loam to silty clay loam which forms the topsoil or A Horizon, and mottled brownish grey plastic clay subsoil which forms the B Horizon. The A Horizon is generally friable but can be hard setting when dry, and depth ranges from 10-40 centimetres. The pH ranges from strongly to slightly acidic but generally has a pH of 6.0. Charcoal and rock fragments are absent but roots may be present. The B Horizon ranges from brownish silty to heavy clays which develops massive structure when wet, but becomes angular and blocky when dry. The pH ranges from strongly to slightly acidic (pH of 4.0-6.0). Charcoal and rock fragments are absent but roots are rare. The soils of the B Horizon underlie the A Horizon black pedal loam to depths of >200 metres. In some areas there are associated soils comprising a bleached greyish yellow brown to dull yellow orange sandy clay loam which form an A2 Horizon and lenses and splays of yellow brown sand can occur throughout the soil profile (Matthei 1995: 259-260; Murphy 1993: 81-83).

The area is subject to flooding, water-logging and bank erosion. It is strongly acidic with saline subsoils and has localised acid sulphate potential. Soils are poorly drained and impermeable with very low fertility (Matthei 1995: 259-260; Murphy 1993: 81-83).

2.5 *CLIMATE*

Climatic conditions would also have played a part in occupation of an area as well as impacted upon the soils and vegetation and associated cultural materials. The study area is situated in a warm temperate zone with a marine influence. Rainfall is generally higher during summer with the average annual rainfall along the coast with 1,310 at Gosford and decreases westwards. Temperatures are generally mild with the average maximum temperature on the coast with 17.20C in January with 15.20Cin June. Average minimum temperatures are along the coast with 19.70C in February and 4.20C in July (Murphy 1993: 3-4).

Rainfall is known to impact upon soils through runoff and rain splash, resulting in further disturbance of the landscape through erosion and the associated movement of cultural materials.

2.6 *WATERWAYS*

The availability of water (and the associated faunal and floral resources) is one of the most important factors influencing patterns of past Aboriginal land use. This assertion is undisputedly supported by the regional archaeological investigations carried out in the Hunter Valley.

Stream order assessment is one way of determining the reliability of streams as a water source. Stream order is determined by applying the Strahler method to 1:25 000 topographic maps.

Based on the climatic analysis (see *Section 2.5*), the study area will typically experience comparatively reliable rainfalls under normal conditions and thus it is assumed that any streams above a third order classification will constitute a relatively permanent water source.

The Strahler method dictates that upper tributaries do not exhibit flow permanence and are defined as first order streams. When two first order streams meet they form a second order stream. Where two-second order streams converge, a third order stream is formed and so on. When a stream of lower order joins a stream of higher order, the downstream section of the stream will retain the order of the higher order upstream section (Anon 2003; Wheeling Jesuit University 2002).

The study area (at its closest point) is located approximately 80 metres north of Ourimbah Creek (3rd order) that flows east into Tuggerah Lake that is approximately 1 kilometres to the south east at its closest point. Thus, the study area may be considered moderately resourced in terms of water availability and associated resources.

2.7 *FLORA AND FAUNA*

The availability of flora and associated water sources affect fauna resources, all of which are primary factors influencing patterns of past Aboriginal land use and occupation. The preservation and detection of surface cultural materials from of past Aboriginal land uses are also influenced by flora and fauna.

European settlers extensively cleared the original native vegetation in the 1800's. Prior to clearing native vegetation would have included forest oak with some river oak (Kovac and Lawrie 1991:425). Presently, the specific study area is primarily covered in grasses with a sparse scattering of trees. The drainage throughout the study area would have supported a moderate range of faunal populations including kangaroo, wallaby, goanna, snakes and a variety of birds.

Typically, due to vegetation cover, most artefacts identified through surface inspection are identified when they are visible on exposures created by erosion or ground surface disturbances (Dean-Jones and Mitchell 1993; Kuskie and Kamminga 2000). The grass ground cover throughout the study area expected to result in limited visibility, hence reducing the detection of surface cultural materials.

2.8 *PAST LAND USES AND DISTURBANCES*

Based upon archaeological evidence, the occupation of Australia extends back some 40,000 years (Mulvaney and Kamminga 1999) whilst Aboriginal people have been present within the Hunter Valley for at least 20,000 years (Koettig 1987). Although the impact of past Aboriginal occupation on the natural landscape is thought to have been relatively minimal, it cannot simply be assumed that 20,000 years of land use have passed without affecting various environmental variables.

The practice of 'firestick farming' whereby the judicious setting of fires served to drive game from cover, provide protection and alter vegetation communities significantly influenced seed germination, thus increasing diversity within the floral community.

Following European settlement of the Hunter Valley in the 1820s, the landscape has been subjected to a range of different modifactory activities including extensive logging and clearing, agricultural cultivation (ploughing), pastoral grazing, residential developments and mining (Turner 1985). The associated high degree of landscape disturbance has resulted in the alteration of large tracts of land and the cultural materials contained within these areas.

The specific study area has been cleared and primarily used for pastoral purposes (grazing), involving the wholesale clearance of native vegetation, the introduction of pasture grass, the construction of dams, housing, fencing, numerous tracks and associated infrastructure (water, electricity, telephone).

Although pastoralism is a comparatively low impact activity, it does result in disturbances due to vegetation clearance and the trampling and compaction of grazed areas. These factors accelerate the natural processes of sheet and gully erosion, which in turn can cause the horizontal and lateral displacement of artefacts. Furthermore, grazing by hoofed animals can affect the archaeological record due to the displacement and breakage of artefacts resulting from trampling (Yorston *et al* 1990). Pastoral land uses are also closely linked to alterations in the landscape due to the construction of dams, fence lines and associated structures.

As a sub-set of agricultural land use, ploughing typically disturbs the top 10-12 centimetres of topsoil (Koettig 1986b) depending on the method and machinery used during the process. Ploughing increases the occurrence of erosion and can also result in the direct horizontal and vertical movement of artefacts, thus causing artificial changes in artefact densities and distributions. In fact, studies undertaken on artefact movement due to ploughing (e.g. Roper 1976; Odell and Cowan 1987) has shown that artefact move between one centimetre up to 18 metres laterally depending on the equipment used.

Ploughing may also interfere with other features and disrupt soil stratigraphy (Lewarch and O'Brien 1981). Ploughing activities are typically evidenced through 'ridges and furrows' however a lengthy cessation in ploughing activities dictates that these features may no longer be apparent on the surface.

Whilst the impacts of vehicular movements on sites have not been well documented, based on general observations it is expected that the creation of dirt tracks for vehicle access would result in the loss of vegetation and therefore will enhance erosion and the associated relocation of cultural materials.

Excavation works required for dam construction and the laying of infrastructure (water, telephone) would require the removal of soils thus displacing and destroying any cultural materials that may have been present. As fence construction and the erection of telegraph poles require the removal of sols for the holes, this would also have resulted in the disturbance and possible destruction of any cultural materials.

2.9 NATURAL DISTURBANCES

It must be recognised that the disturbance of cultural materials can also be a result of natural processes. The patterns of deposition and erosion within a locality can influence the formation and/or destruction of archaeological sites. Within an environment where the rate of sediment accumulation is generally very high, artefacts deposited in such an environment will be buried shortly after being abandoned. Frequent and lengthy depositional events will also increase the likelihood of the presence of well-stratified cultural deposits (Waters 2000:538,540).

In a stable landscape with few episodes of deposition and minimal to moderate erosion, soils will form and cultural materials will remain on the surface until they are buried. Repeated and extended periods of stability will result in the compression of the archaeological record with multiple occupational episodes being located on one surface prior to burial (Waters 2000:538-539). Within the Hunter Valley duplex soils artefacts typically stay within the A horizon on the interface between the A and B horizons (Refer to *Section 2.4*).

If erosion occurs after cultural material is deposited, it will disturb or destroy sections of archaeological sites even if they were initially in a good state of preservation. The more frequent and severe the episodes of erosional events, the more likely it is that the archaeological record in that area will be disturbed or destroyed (Waters 2000:539; Waters and Kuehn 1996:484). Regional erosional events may entirely remove older sediments, soils and cultural deposits so that archaeological material or deposits of a certain time interval no longer exist within a region (Waters and Kuehn 1996:484-485).

The severe rain and flooding in recent times has had a significant impact of soils and cultural materials within the soils. MCH have noted that throughout the Hunter Valley previously recorded sites have been completely moved with nothing remaining or a significant reduction in artefacts numbers as well as erosion. Thus, the archaeological record had been greatly altered in some areas along with the soils and landscapes.

The role of bioturbation is another significant factor in the formation of the archaeological record. Post-depositional processes can disturb and destroy artefacts and sites as well as preserve cultural materials. Redistribution and mixing of cultural deposits occurs as a result of burrowing and mounding by earthworms, ants and other species of burrowing animals. Artefacts can move downwards through root holes as well as through sorting and settling due to gravity. Translocation can also occur as a result of tree falls (Balek 2002:41-42; Peacock and Fant 2002:92). Depth of artefact burial and movement as a result of bioturbation corresponds to the limit of major biologic activity (Balek 2002:43). Artefacts may also be moved as a result of an oscillating water table causing alternate drying and wetting of sediments, and by percolating rainwater (Villa 1982:279).

Experiments to assess the degree that bioturbation can affect material have been undertaken. In abandoned cultivated fields in South Carolina, Michie (summarised in Balek 2002:42-43) found that over a 100 year period 35% of shell fragments that had been previously used to fertilise the fields were found between 15 and 60 centimetres below the surface, inferred to be as a result of bioturbation and gravity. Earthworms have been known to completely destroy stratification within 450 years (Balek 2002:48). At sites in Africa, conjoined artefacts have been found over a metre apart within the soil profile. The vertical distribution of artefacts from reconstructed cores did not follow the order in which they were struck off (Cahen and Moeyersons 1977:813). These kinds of variations in the depths of conjoined artefacts can occur without any other visible trace of disturbance (Villa 1982:287).

However, bioturbation does not always destroy the stratigraphy of cultural deposits. In upland sites in America, temporally-distinct cultural horizons were found to move downwards through the soil as a layer within minimal mixing of artefacts (Balek 2002:48).

2.10 DISCUSSION

The regional environment provided resources, including raw materials, fauna, flora and water, that would have allowed for sustainable occupation of the area. Within the study area, the landforms of a floodplain prone to water logging and over 100 metres from reliable water may have not been suitable for occupation as closer proximity to reliable water ion elevated landforms would have been preferred.

In relation to modern alterations to the landscape, the use of the majority of the study area for agricultural purposes can be expected to have had low to moderate impacts upon the archaeological record. European land uses such as clearing, grazing, ploughing, and the construction of dams, housing and fences may have displaced cultural materials, however in less disturbed areas, it is likely that archaeological deposits may remain relatively intact.

Vegetation cover across the study area consists of grasses with open woodland to the northwest, north east and through the centre. This will affect visibility and thereby reduce the potential for identifying archaeological evidence. Typically, due to vegetation cover, most artefacts identified through surface inspection are identified when they are visible on exposures created by erosion or ground surface disturbances (Kuskie and Kamminga 2000).

Because of the natural and cultural processes discussed above, site integrity cannot be assumed for the study area.

3 ETHNO-HISTORIC BACKGROUND

Unfortunately, due to European settlement and associated destruction of past Aboriginal communities, their culture, social structure, activities and beliefs, little information with regards to the early traditional way of life of past Aboriginal societies remains.

3.1 USING ETHNO-HISTORIC DATA

Anthropologists and ethnographers have attempted to piece together a picture of past Aboriginal societies throughout the Hunter Valley. Although providing a glimpse into the past, one must be aware that information obtained on cultural and social practices were commonly biased and generally obtained from informants including white settlers, bureaucrats, officials and explorers. Problems encountered with such sources are well documented (e.g. Barwick 1984; L'Oste-Brown *et al* 1998). There is little information about who collected information or their skills. There were language barrier and interpretation issues, and the degree of interest and attitudes towards Aboriginal people varied in light of the violent settlement history. Access to view certain ceremonies was limited. Cultural practices (such as initiation ceremonies and burial practices) were commonly only viewed once by an informant who would then interpret what he saw based on his own understanding and then generalise about those practices.

3.2 LAKE MACQUARIE ETHNO-HISTORIC ACCOUNTS

With regard to the written history and records relating to the Lake Macquarie area it was commented in 2002 that "on the whole, Aboriginal people have not rated highly among the interests and concerns of local history, being entirely neglected in many works, badly misunderstood in others" (Roberts, *et al*, 2002). The first European to make their way to Lake Macquarie, Captain William Reid, made reference to Aboriginal inhabitants he encountered in the area. He described members of the Awabakal tribe, occupying the area from the bank of the Lower Hunter to the southern and western shores of Lake Macquarie. During his journey in 1800 Reid asked the Awabakal people he encountered where he could find coal and was directed to some embedded in the Lake Macquarie headland (Collins, 1804; SMH, 2008). The use of the Lake Macquarie area for a penal colony in the early 1800s meant that local Aboriginal people were often employed as trackers to hunt down escaped convicts, and the terror of Aboriginal attacks were used by the penal colony administrators as propaganda to dissuade desertion (Wallis, 1816; Roberts, 2002). From 1822 to 1826 the land and waterways of the Hunter River were opened to European colonists through the occupation of Crown Land Grants. Conflict between settlers and the Indigenous inhabitants of the area increased at Lake Macquarie in the early 1830s as more colonists came to the region to occupy Crown Land Grants around the lake shores (Blyton, 2002).

The Awabakal territory was described as covering the area from the southern edge of the lower Hunter River, including Lake Macquarie and its surrounds. The other surrounding territories of the region were inhabited by the Worimi, Geawegal, Wonnarua, Darkinung and Kuring-gai Aboriginal groups (Tindale, 1974; Belshaw, 2009). The Awabakal tribe consisted of four clans, being the Pambalong, Ash Island, Kurungbong and Lake Macquarie clans. Each had their own tribal territory, with each clan scattering in search of food and generally only gathering in larger groups on social or ceremonial occasions. The most common size grouping recorded during hunting and food gathering was three or four people, possibly being family groupings (Sokoloff, 1970). After the impacts of European colonisation increased in the area the usual social customs and orders of the Awabakal began to break down, with references to abandonment of initiation practices and the taking up of wearing European clothes noted in 1830s sources (Keary, 2009).

Ethnohistoric information about the Awabakal people within the Lake Macquarie area was recorded by Lancelot Threlkeld, founder of a mission in 1825 for Aboriginal people at Lake

Macquarie (Clouten, 1967: 21). Threlkeld referred to the Awabakal diet being predominantly focussed on coastal life at Lake Macquarie, taking advantage of the variety of resources available from the sea. This included food resources such as crayfish, fish and cockles, but further included the hunting of larger sea animals such as porpoise and whale. Tools for hunting were gathered from both land and sea resources (Gunson 1974).

Threlkeld also refers to the fact that the Awabakal people of the Lake Macquarie area were adaptable to changes in conditions. Since they utilised both land and sea resources, if food became scarce at any time they were able to seek a change in diet. This included, for example, moving from the coast to the mountains to seek alternative sources during times of scarcity. Some of the food resource animals that Threlkeld records the Awabakal people hunting included snakes, lizards, geese, pigeons, witchetty grubs, wild dogs, wild ducks, bandicoots and kangaroos (Gunson 1974: 55).

The Burwood Beach area has been identified as being an important source of stone for tools manufactured and traded by the Awabakal people, and the area was extensively quarried by them. Rhyolitic tuff was a particularly utilised stone from this area; being hard, smooth and fine grained it was used to make sharp-edged tools, including chisels, rasps, scrapers, and gravers. These stone tools were then utilised in the manufacture of wooden implements such as clubs, boomerangs, shields, spear throwers, food and water containers, canoes and paddles (NPWS, 2010). The trade of axe heads from the Awabakal people has been demonstrated as reaching as far inland as Quirindi, showing that extensive trade and communication routes were utilised prior to the European colonisation of the Lake Macquarie area (Kamminga, 2003).

4 ARCHAEOLOGICAL CONTEXT

A review of the archaeological literature of the Wyong area and the results of a OEH AHIMS search provide essential contextual information for the current assessment. Thus, it is possible to obtain a broader picture of the wider cultural landscape highlighting the range of site types throughout the region, frequency and distribution patterns and the presence of any sites within the study area. It is then possible to use the archaeological context in combination with the review of environmental conditions to establish an archaeological predictive model for the study area.

4.1 SUMMARY OF REGIONAL ARCHAEOLOGICAL PATTERNING

Within the region, a broad range of site types are represented including isolated artefacts, open campsites, shelters, grinding grooves, engravings and shelters with art and/or deposit. Within the areas covered by regional studies (Vinnicombe 1980 Attenbrow 1987; McDonald 1984; Dallas *et al* 1987; MCH 2005) the range of available landforms has been sampled. In regional terms, site distribution is extremely closely linked to topography, with ridge sides, ridge tops and valley bottoms with access to reliable water exhibiting the highest concentrations of sites.

However, it must be emphasised that the vast majority of the areas assessed by the afore-mentioned regional studies are in a variety of topographic and geological contexts and some vary considerably from the specific study area which is located in an alluvial context. Thus, whilst a number of trends have been identified, the relevance of these patterns for the specific study area is limited.

There are a number of factors which affect site location and that are beyond human control. Shelter sites, grinding grooves and engravings are site types typical of the "sandstone country" however, their presence is limited to areas containing suitable sandstone outcrops and therefore such sites are not expected within an alluvial context.

In regard specifically to valley formations, Attenbrow (1987) identified high concentrations of sites in valley bottoms surrounding major creeks within the Mangrove Creek catchment. However, the valley formations included in the Mangrove Creek survey are topographically and structurally very different to that of the Wyong Creek Valley and therefore, archaeological comparability cannot be assumed. Of far more relevance is Vinnicombe's (1980) work within the adjacent Dooralong Valley area, in which she suggests that the sub-surface testing will reveal the presence of open campsites within landforms of this type.

4.2 OEH ABORIGINAL HERITAGE INFORMATION MANAGEMENT SYSTEM

It must be noted that there are many limitation with an AHIMS search. Firstly site coordinates are not always correct due to errors and changing of computer systems at OEH over the years that failed to correctly translate old coordinate systems to new systems. Secondly, OEH will only provide up to 100 sites per search, thus limiting the search area surrounding the study area and enabling a more comprehensive analysis and finally, few sites have been updated on the OEH AHIMS register to notify if they have been subject to a s87 or s90 and as such what sites remain in the local area and what sites have been destroyed is unknown.

In addition to this, other limitations include the number of studies in the local area. Fewer studies suggests that sites have not been recorded, ground surface visibility also hinders site identification and the geomorphology of the majority of NSW soils and high levels of erosion have proven to disturb sites and site contents, and the extent of those disturbances is unknown (i.e. we do not know if a site identified at the base of an eroded slope derived from the upper crest, was washed along the bottom etc: thus altering our predictive modelling in an unknown

way). Thus the OEH AHIMS search is limited and provides a basis only that aids in predictive modelling.

The new terminology for site names including (amongst many) an 'artefact' site encompasses stone, bone, shell, glass, ceramic and/or metal and combines both open camps and isolated finds into the one site name. Unfortunately this greatly hinders in the predictive modelling as different sites types grouped under one name provided inaccurate data.

A search of the OEH AHIMS register has shown that 31 known Aboriginal sites are currently recorded within five kilometres of the study area and include 15 AFT, 5 middens, 2 GDG, 2 Bora/ceremonial, 1 AFT/PAD, 1 STQ, Shelter/art, 1 shelter/art/deposit, 1 GDG/AFT, 1 GDG/WTR, 1 TRE and 1 PAD. The AHIMs results are provided in *Annex B* and the location of sites is shown in *Figure 4.1*.

4.3 LOCAL ARCHAEOLOGICAL CONTEXT

All archaeological surveys throughout the local area have been undertaken in relation to environmental assessments for developments. The most relevant investigations indicate differing results and observations based on surface visibility and exposure, alterations to the landscape (including mining, industrial and residential development), proximity to water sources and geomorphology. The reports available from OEH are discussed below and their location illustrated in *Figure 4.2*.

Dyall (1980) undertook an assessment for a proposed power station location at Cittaway Point. The proposed works included vegetation clearance, power station construction, storage yards, switchyard, and a corridor for pipelines and transmission lines. The total study area was approximately 12 square kilometres.

The topography of the study area consisted of flats bordered by sandstone ridges and marshlands bordered by Tuggerah Lake and a sandy plain. Other water courses in the area included Wyong River and Ourimbah Creek. These creeks were noted as regularly cutting new channels when in flood and a number of billabongs in the area marked their former courses. Past land use impacts in the area included vegetation clearance, modern drainage ditches, roads, residential development, cattle grazing and dairying. Vegetation in the study area included such species as melaleuca and casuarina scrub as well as tea-tree and paperbark scrub.

No reference was made to any NPWS sites search or review of past surveys, however discussion was made in the report as to likely material to be found during the survey. Based on landform it was predicted that shell middens were likely along the foreshore, temporary camps were possible in low sandy ridges, canoe trees were possible where mature vegetation remained extant, and rock shelters were possible on the sandstone scarps along with rock art and engravings. It was also cited that there had been a historic recording made of a camp site/corroboree ground located near the mouth of the Wyong River.

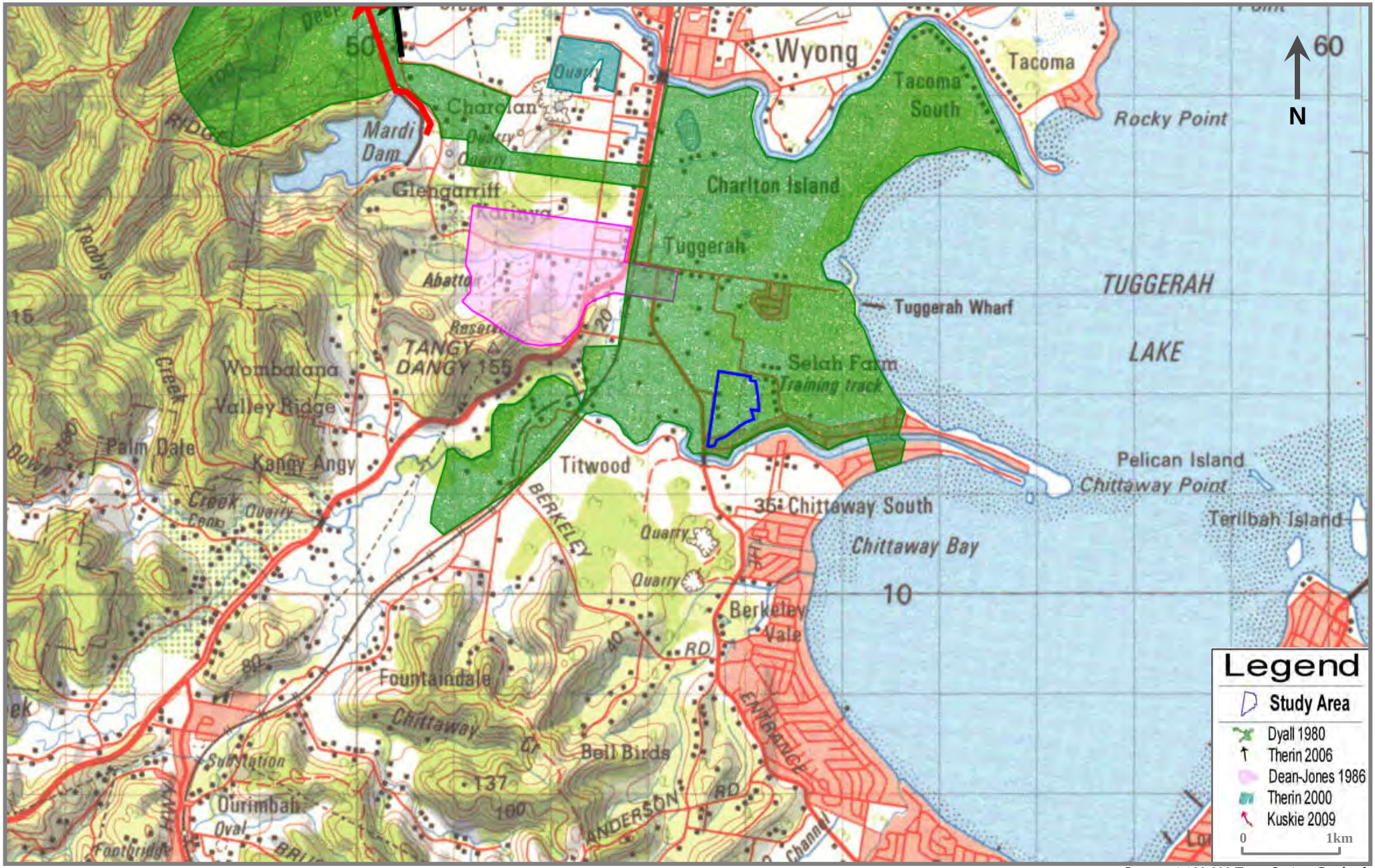
The survey showed that the majority of the area was marshy and was assessed as having been underwater prior to modern drainage of the area. A total of 15 sites were identified within the study area, as well as three sites (two middens and one rock shelter) outside the study area. No areas of PAD were identified. The site types and locations were consistent with the expectations predicted prior to the survey. The 15 study area sites are summarised in *Table 4.1*.

MCH:

Source: 1:100 000 Topo Series: Gosford

Figure 4.1 Known sites

MCH:



Source: 1:100 000 Topo Series: Gosford

Figure 4.2 Previous studies

Table 4.1 Summary of sites (Dyall 1980)

Site Name	Site type	Landform	Distance to Water	Stream Order	Artefacts/ Features	Disturbance	Subsurface potential
45-3-1108	artefact scatter	ridge	not noted	minor creek	4 flakes	erosion	not noted
513,111	artefact scatter	billabong edge	not noted	billabong	23 flakes	bulldozed track	not noted
45-3-1101	artefact scatter	ridge	not noted	pond	2 waste flakes	not noted	not noted
547,135	artefact scatter	sandy "eminence"	not noted	water table	3 flakes, 3 cores	ploughing	not noted
553,147	artefact scatter	"Rocky Knob"	not noted	water table	15 waste flakes; 1 flake, 1 split cobble & 2 cockles	not noted	not noted
507,151	isolated find	creek bank	not noted	minor creek	1 flake	dredging	not noted
511,148	isolated find	dam	not noted	dam	1 rhyolite flake	farming and dam	not noted
519,120	isolated find	creek bank	not noted	Ourimbah Creek	1 waste flake, 1 core	dredging	not noted
534,125	isolated find	sandy area	not noted	water table	1 waste flake	not noted	not noted
538,116	isolated find	not noted	not noted	dam	1 waste flake	farming and dam	not noted
548,133	isolated find	Foreshore/ mudflat	not noted	Tuggerah Lake	1 waste flake	not noted	not noted
553,149	isolated find	"Rocky Knob"	not noted	not noted	1 waste flake, 1 broken sandstone piece with groove	not noted	not noted
45-3-1104	grinding grooves	creek channel	not noted	minor creek	1 grinding groove	not noted	not noted
554,149	grinding grooves	scarp	not noted	not noted	40+ grinding grooves	not noted	not noted
45-3-1103	rock shelter	not noted	not noted	Deep Creek	rock art/broken ground edge axe	possible defacement	not noted

It was recommended that further archaeological inspection be allowed after scrub clearance and that grinding groove site 554,149 be protected from possible damage. It was recommended that permits should be sought for destruction of minor sites in consultation with NPWS. It was also recommended that an archaeologist inspect sandstone outcrops and ridges prior to the construction of roads in the area.

Therin Archaeological Consulting (2006) undertook an Aboriginal Heritage Assessment of an area of land proposed to be utilised for the Wyong River to Mardi Dam pipeline. The pipeline, designed to top up Mardi Dam during peak flows of the Wyong River, was proposed to be approximately 1.9 kilometres in length. The proposed pipeline alignment crossed areas of open pasture between an existing pumping station on the banks of the Wyong River and old Maitland

Road as well as within the bed of the southbound lane of Old Maitland Road. The width of the trench for laying the pipe was between 1.5 and 2 metres along the entire length of the alignment.

The study area had already been disturbed by road works and use along Old Maitland Road; this was also the case with vegetation clearance and pump house construction/use in the area closest to Wyong River. The topography of the study area crossed the Wyong River floodplain, lower slopes and ridge lines. The main drainage line in proximity to the study area was the Wyong River. The majority of the vegetation had been cleared from the study area meaning there were no mature trees at the time of inspection and only infrequent scattered native trees and pasture grasses.

A search of the AHIMS database revealed that a total of 40 sites were located within a 132 square kilometre radius of the study area. These included open artefact scatters, grinding grooves, rock shelters with art, rock shelters with deposit, isolated finds, a scarred tree, a quarry and a midden. There were no previously recorded sites located within the study area itself. Based on the AHIMS search results as well as analysis of past archaeological surveys in the area a predictive model was compiled. The following site types were considered likely to be in the study area:

- A consistent spread of artefact scatters over the entire floodplain with artefact densities differing in relation to proximity to different geographic and topographic contexts.
- High to moderate density artefact scatters in proximity to drainage lines, most likely in a subsurface context.
- Low to moderate density artefact scatters over areas away from permanent or semi permanent water.
- A general absence of the presence of site types that require the presence of sandstone outcrops (rock shelters, grinding grooves, rock engravings).
- A low potential for the presence of scarred trees due to extensive vegetation clearance.

One isolated find site was located 20 metres from the proposed water pipeline alignment, located between Wyong River and Old Maitland Road. No areas of PAD were identified. The site that was identified is summarised in *Table 4.2*.

Table 4.2 Summary of site (Therin 2006)

Site Name	Site type	Landform	Distance to Water	Stream Order	Artefacts/ Features	Disturbance	Subsurface potential
WRMD1	isolated find	dam bank/ floodplain	not noted	Wyong River	1 silcrete artefacts	high	No

It was recommended that a Section 90 Consent to Destroy permit be sought for the entirety of the pipeline's extent. It was further recommended that the archaeological salvage required for WRMD1 be undertaken by a suitably qualified archaeologist and that representatives of GLTAC also be invited to attend.

Dean-Jones (1986) undertook an archaeological survey of 170 hectares of land comprised of urban, rural and bush areas. The overall study area was located at Tuggerah on the Central Coast between the old Pacific Highway and the F3. Past land use in the study area at the time of inspection included rural activities and services. Foot slopes and upper slope areas that had been

used for rural purposes were proposed to become residential areas under the Wyong Shire Council's proposed plan.

The topography of the area consisted of upper slopes, hillcrests, central valley fill, valley side slopes, ridge crests and foot slopes. Water sources included drainage lines, alluvial fans, small streams and minor tributaries of Wyong River and Ourimbah Creek. An area of occasionally inundated fresh water wetland was noted along with estuarine wetland and tidal delta deposition areas.

The three principal types of native vegetation in the area included freshwater wetland, including melaleuca and leptospermum thicket, blackbutt/angophera/casuarina woodland and wet selerophyll, including *Syncarpia glomulifera*. Areas that had been subjected to vegetation clearance were noted to have become encroached upon by thick grasses, lantana and bracken fern.

A review of past archaeological recordings in the area revealed that site types previously recorded in the area included several middens and an open site at Chittaway Point, axe grinding grooves along creek lines, rock shelters along Ourimbah ridge and an open campsite at Tangy Dangy. It was noted that the available literature and recordings had little specific description about the previously recorded sites. Based on the available data it was predicted that within the study area there was the possibility for open sites, axe grinding grooves and possible shelters with associated art. Although vegetation clearance meant that scarred trees were unlikely overall, it was noted that there were forested sections of Tangy Dangy Hill and on the rise of the northern side of the study area where scarred trees were possible.

The survey was split up into areas of ridge crest, the western and southern slopes of the northern hill, footslope/valley fill interface, central valley fill, exposures of sandstone slabs and upper valley fills, and the upper slopes of Tangy Dangy Hill. The survey was hampered by poor ground visibility. One quarry site and three isolated finds were located on the survey. No areas of PAD were noted in the survey results. The third isolated find site (consisting of one grey quartz scraper) was located just outside the study area. The fact that more site types identified in the predictive model were not located during the survey was most likely due to the low ground surface visibility. The identified sites are summarised in *Table 4.3*.

Table 4.3 Summary of sites (Dean-Jones 1986)

Site Name	Site type	Landform	Distance to Water	Stream Order	Artefacts/ Features	Disturbance	Subsurface potential
Unnamed	quarry	not noted	not noted	not noted	quarry area	not noted	not noted
Unnamed	isolated find	not noted	not noted	drainage line	1 joint block	not noted	not noted
Unnamed	isolated find	not noted	not noted	not noted	1 yellow chert flake	not noted	not noted
Unnamed	isolated find	not noted	not noted	not noted	1 grey quartz scraper	not noted	not noted

It was recommended that further archaeological work be conducted in the study area to determine the significance of the quarry site as a source of raw material and artefact manufacture. Although no campsites were identified it was observed that further archaeological material could have been obscured by vegetation cover. As such it was recommended that developers stop work and notify the appropriate authorities immediately should work be uncovered during any of the proposed clearing, subdivision or construction works.

Therin Archaeological Consulting (2000) undertook an archaeological surface survey in the Woodbury Park Estate-Stage 4 area. This study area comprised Lots 1, 2 and 3 DP 3368. It was proposed that Lots 1 and 2 of this area be rezoned for residential development and this survey was undertaken as part of the Local Environmental Study required for this rezoning. The proposed works included diving up the land into 178 separate lots and the development of services including sewerage, water, roads and power. The remaining portion of the study area was proposed to be used as parkland, with the area proposed to be raised and an existing billabong at the centre of the area deepened and widened. Past impacts in the study area included vegetation clearance and cattle grazing in pasture land. Heavy erosion, the introduction of fill and use of the area for an orchard were all noted as additional past disturbances.

The topography of the area included hill slope and floodplain areas, with the Wyong River feeding the study areas floodplain regions. Two billabongs were present within the bounds of the study area along with two main drainage features. The northern section of the study area consisted of open paddocks with widely scattered mature trees including Grey Gum (*Eucalyptus punctata*). Short cropped pasture grass, blackberry bushes and sedges were noted. Modestly dense regrowth was noted in the southern section of the study area, with sedges, grasses and blackberry bushes intertwined with Grey Gum regrowth there.

A search of the NPWS Aboriginal sites database revealed 23 previously recorded sites within a 121 square kilometre radius. This comprised nine open camp sites, five grinding grooves, one quarry, four middens, two rock shelters with art, two rock shelters with deposit and two ceremonial sites. Based on the previously recorded sites and past survey work in the area a predictive model was compiled stating that low density artefact scatters or isolated finds were likely to be located around the creeks, billabongs and swamps in the area. Habitation sites were likely to be found at the base of hills, represented by medium to high density artefact scatters resulting from knapping. It was also predicted that grinding grooves would occur where sandstone outcrops occurred near to water sources.

Four sites were identified and included two open camp sites and two isolated finds. The site types were consistent with the predictive model and it was noted that further artefacts were probably located in subsurface deposits since those sites that were identified were all located in areas of erosion. The prediction of a low density artefact scatter in proximity to water sources such as billabongs led to the identification of an area of PAD (PAD WP) within the study area. It was noted that the sites discovered in the survey should not be considered a representative sample of what was actually present in the area. The four sites that were identified are summarised in *Table 4.4*.

Table 4.4 Summary of sites (Therin 2000)

Site Name	Site type	Landform	Distance to Water	Stream Order	Artefacts/Features	Disturbance	Subsurface potential
WP1	artefact scatter	hill slope	not noted	billabong	12 flakes, 1 broken flake, 1 core	moderate (gravel dumping)	not noted
WP2	artefact scatter	floodplain	not noted	billabong	2 flakes	not noted	not noted
WP3	isolated find	floodplain	not noted	billabong	1 broken flake	not noted	not noted
WP4	isolated find	floodplain	not noted	billabong	1 broken flake	not noted	not noted

In addition, an area of PAD was also identified, thought to contain a low density artefact scatter deposited as a result of past use of the billabong as a resource (refer to *Table 4.5*).

Table 4.5 Summary of PAD (Therin 2000)

Site Name	Area	Landform	Water source	Disturbance	Potential
PAD WP	not noted	billabong bank	billabong	not noted	Yes

It was recommended that applications for Consent to Destroy be sought for sites WP2, WP3 and WP4, and consent for Partial Destruction be sought for PAD WP. It was further recommended that the Darkinjung Local Aboriginal Land Council (DLALC) should be contacted prior to permit applications being submitted so that if they wished to collect the artefacts prior to development a Collection Permit could also be submitted. It was further recommended that all works for proposed development be monitored by a qualified archaeologist and member of DLALC.

Kuskie (2009) was commissioned to undertake an impact assessment of areas proposed to be used as part of a system of water supply infrastructure for Wyong Shire Council and Gosford City Council. The proposed works included pumping stations, water intakes, pipelines and reservoir modifications. The overall project was referred to as the Mardi to Mangrove Link Project. The study area surveyed here covered the route for the project's proposed pipeline.

The topography of the study area covered low gradient valley flats of the Yarramalong Valley which was drained by the Wyong River and numerous tributaries. The area also included foothills of the coastal region and a generally hilly terrain. Vegetation in the area included grass area used for pastoral and agricultural use as well as moderately forested areas. Some sections of the route were used for rural and residential purposes.

A search of the AHIMS register identified a total of 34 previously recorded sites located within a 192 square kilometre radius of the study area. Site types included artefact scatters, isolated finds, grinding grooves, rock shelter with art, rock shelter with art and deposit and a grinding groove/rock shelter/midden complex. Based on the AHIMS search results and past archaeological surveys in the region it was predicted that middens may occur on sand in proximity to water, rock shelters were concentrated above valley floors or below ridge tops, art sites would occur more frequently in large shelters, artefact scatter and isolated find sites may occur in flat areas in proximity to water, grinding grooves would occur in proximity to water where sandstone exposures occurred and engravings would occur on ridge crests and plateaus.

Approximately 82% of the proposed pipeline route was inspected by foot survey, as were other areas of earlier route options, with overall an approximate length of 21.7 kilometres surveyed. Three sites were identified and recorded during the survey inspection, including one rock shelter with art and potential deposit site, an isolated find site and an artefact scatter site. The site Mardi to Mangrove 1 was identified as outside the study area and would not be impacted by the proposed works. The site types identified on the survey tallied with the possible site types listed in the predictive model; the small number of sites identified may be due to the low ground surface visibility encountered during the survey. The three identified sites are summarised in *Table 4.6*.

Table 4.6 Summary of sites (Kuskie 2009)

Site Name	Site type	Landform	Distance to Water	Stream Order	Artefacts/ Features	Disturbance	Subsurface potential
Mardi to Mangrove 1	rock shelter / art/ deposit	not noted	not noted	not noted	rock shelter with art	not noted	Yes
Mardi to Mangrove 2	isolated find	low rise	not noted	drainage depression	1 stone artefact	moderate	not noted

Mardi to Mangrove 3	artefact scatter	level bench/dam wall	not noted	Mardi Dam	2 tuff flakes	not noted	Negligible

Two previously recorded PAD sites were noted to be located within close proximity to the study area (being sites 45-3-3312 and 45-3-3228). It was recommended that the proponent seek a Section 90 Consent with Salvage permit and a program of excavation be implemented for the sites 45-3-3312 and 45-3-3228. The proposed methodology included collection of identified surface material, systematic exposure of the A Unit soils along the length of the proposed pipeline trench, hand excavation on features of potential significance and the sieving, analysis and recording of deposits. It was noted that the salvage should only be undertaken by a qualified archaeologist, who should also inspect those sections of the route that were not able to be accessed during this survey. In the event that any previously unrecorded Aboriginal cultural material or archaeological deposits be encountered during the proposed works it was recommended that works cease and the appropriate authorities be notified.

4.4 LOCAL & REGIONAL CHARACTER OF ABORIGINAL LAND USE & ITS MATERIAL TRACES

The following is a summary and discussion of previous investigations detailed in *Section 4.3*.Of the 31 sites recorded within a 5 kilometre radius of the study area, none contained sufficient information in associated reports to be able to determine their distance from water, the landform on which they were located and contents. It must be remembered, however, that there are various factors which will have skewed the results. These include but are not limited to:

- the landform on which a site area is observed is not necessarily its origin, for example, artefacts which would have originated on a crest may be located eroding down the slope;
- biases due to differential sampling of landforms based on decisions made by archaeologists and as a result of restrictions due to the locations of proposed development areas, levels of exposure on different landforms, and the variable level of reporting by archaeologists will affect the count of sites on each landform type. For example, the large percentage of sites found along creek lines may be, at least partially, representative of how many cultural heritage surveys focused on these landforms, and
- artefact counts can be skewed due to factors such as differing levels of fragmentation of material and levels of ground surface visibility. A very large number of sites/ artefacts were located on exposures with either no or very few artefacts visible away from the exposures.

Therefore these results provide merely an indication of what may be expected in terms of site location and distribution. Based on previous work it is also clear that the majority of sites contain stone artefacts. This is to be expected due to stone's high preservation qualities.

By far, the highest percentage of sites appears to be located within 50 metres of a water source. Taking into consideration sites within in all distance to water categories, the majority of small and medium artefact scatters are located within 50 metres of a water source. Based on previous reports the likelihood of finding sites of any size increases with proximity to water and the likelihood of finding large artefact scatters also increases markedly with proximity to water.

Of the main sites types (artefact scatters and isolated finds) in relation to distance from water and landforms, artefact scatters are mainly located on slopes and creeks.

Variations between archaeologists' classifications of raw material types (for example tuff and indurated mudstone) will have an effect on the results of this count. Raw material type was not indicated in most reports and as such general comments are made. Again, this information is presented merely as an indication of what may be expected.

Mudstone, silcrete and tuff are by far the most common raw material types represented at sites in the region. Quartz and chert are the next most frequently in artefact assemblages followed by volcanic materials, porphyry and petrified wood. Siltstone, rhyolite and porcellanite are relatively rare. However it must be remembered that raw materials may have been incorrectly classified, and not all site descriptions provided in reports and on site cards contained detailed information.

Due to differences in recording techniques it is difficult to determine how many of each artefact type is represented across the region though types include flakes, broken flakes, retouched flakes, multi-platform cores, single platform cores, bipolar cores, flaked pieces, 'waste' pieces, 'chips', debitage, 'geometric microliths', 'backed blades', 'bondi points', 'scrapers', 'eloueras', 'burrins', 'blades', 'hatchets', 'unifacial choppers', 'bifacial choppers', 'pebble tools', a 'slice', edge-ground axes, anvils, hammer stones and heat. Due to variations in both the amount of data that is included in reports, and the terms different archaeologists used to describe artefact types, it is not practicable to provide a count of the different artefact types. However, it is evident that flakes, broken flakes and flaked pieces are the most common artefact types recorded.

The vast majority of artefactual material in the region was observed on exposures with good to excellent ground surface visibility. The likelihood of finding artefacts surrounding these exposures is reduced due to poor visibility. The site area is often given as the area of exposure. Hence, it is inappropriate to attempt to draw any conclusions regarding site extent based on current information.

Based on information gained from previous studies within a five to seven kilometre radius of our study area, it can be expected that:

- the likelihood of locating sites increases with proximity to water;
- the likelihood of finding large sites increases markedly with proximity to water;
- large artefact scatters can occur more than 50 metres from a watercourse but infrequently;
- a variety of raw materials will be represented though the majority of sites will be predominated by mudstone and silcrete;
- a variety of artefact types will be located though the majority will be flakes, flaked pieces and debitage;
- grinding grooves will be located along or near water sources;
- the likelihood of finding scarred trees is dependent on the level of clearing in an area' and
- the majority of sites will be subject to disturbances including human and natural.

These findings are consistent with models developed for the area.

4.5 PREDICTIVE MODEL FOR THE STUDY AREA

Due to issues surrounding ground surface visibility and the fact that the distribution of surface archaeological material does not necessarily reflect that of sub-surface deposits, it is essential to establish a predictive model.

Previous archaeological studies undertaken throughout the region, the OEH AHIMS register and the environmental context provide a good indication of site types and site patterning in the area. This research has shown that occupation sites (artefact scatters and isolated finds) are the most frequently recorded site type and are commonly located along or adjacent to watercourses, and on relatively flat to gently sloping topography in close proximity to reliable water. Sites with higher artefact densities are similarly concentrated within fifty metres of watercourses.

Within the local area, previous assessments within a similar environmental context indicate that, within a well-watered context, there is high potential for archaeological material to be present on level, typically well-elevated landforms that provide ready access to low-lying waterlogged areas and the associated resources.

The majority of the land between the river and the study areas southern boundary has been greatly disturbed through residential development and as such that area has little to no archaeological potential (Refer to *Figure 4.3*). A small section of lands along the river appears to remain undisturbed and this area has the highest potential (refer to *Figure 4.3*). Within the actual study area, there is low potential for archaeological deposits due to its distance from water and landforms. As the study area (at its closest point) is located approximately 80 metres north of Ourimbah Creek (3rd order) it is possible that isolated finds and small density artefacts scatters maybe located within the study area.

The refinement of this predictive model will be dependent upon an investigation of the range of landforms and the occurrence of modern disturbances within the study area.

4.6 ARCHAEOLOGICAL POTENTIAL IN THE STUDY AREA

Based on archaeological sites registered in the region and the results of past archaeological studies, two sites types are likely to occur throughout the study area:

- Artefact scatters

Also described as open campsites, artefact scatters and open sites, these deposits include archaeological remains such as stone artefacts, shell, and sometimes hearths. These sites are usually identified as surface scatters of artefacts in areas where ground surface visibility is increased due to lack of vegetation. Erosion, agricultural activities (such as ploughing) and access ways can also expose surface campsites.

- Isolated finds

Isolated artefacts are usually identified in areas where ground surface visibility is increased due to lack of vegetation. Erosion, agricultural activities (such as ploughing) and access ways can also expose surface artefacts.

4.7 HERITAGE REGISTER LISTINGS

the State Heritage Register, the Australian Heritage Database (includes data from the World Heritage List UNESCO, National Heritage List, Commonwealth Heritage List, Register of the National Estate) and the Lake Macquarie Local Environmental Plan. However, not all indigenous places are listed, and the Heritage Commission is consulting with Traditional Owners to gradually include indigenous information. There are no indigenous heritage items listed on the lake Macquarie Local Environment Plan.

4.8 MODELS OF PAST ABORIGINAL LAND USE

The main aim of this project is to attempt to define both the nature and extent of occupation across the area. As a result, the nature of the analysis will focus on both the landform units and sites. The purpose of this strategy is to highlight any variations between sites and associated

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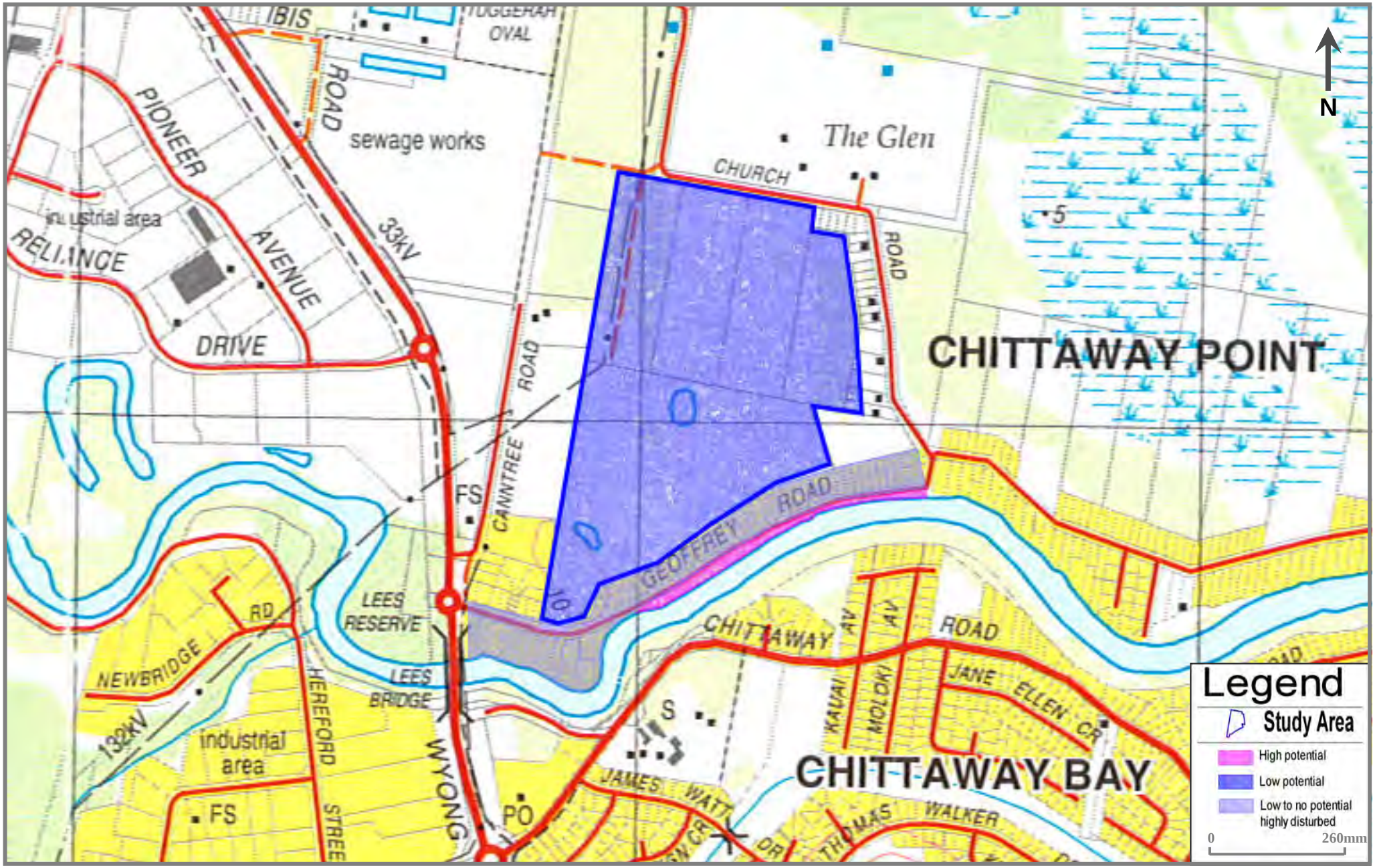


Figure 4.3 Archaeological potential

Source: 1:25 000 Topo Series: Wyong

assemblages, landforms and resources across the area treating assemblages as a continuous scatter of cultural material across the landscape.

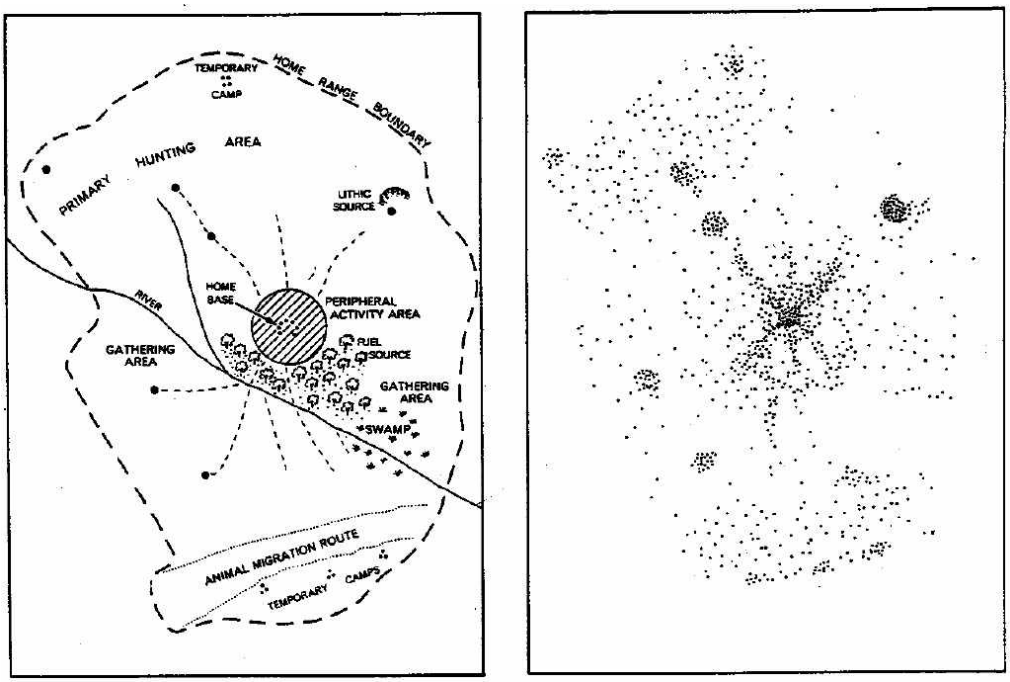
In doing this, it is possible to identify variation across the landscape, landforms and assemblages that correspond with variation in the general patterns of landscape use and occupation. Thus the nature of activities and occupation can be identified through the analysis of stone artefact distributions across a landscape.

A general model of forager settlement patterning in the archaeological record has been established by Foley (1981). This model distinguishes the residential 'home base' site with peripheral 'activity locations'. Basically, the home base is the focus of attention and many activities and the activity locations are situated away from the home base and are the focus of specific activities (such as tool manufacturing). This pattern is illustrated in *Figure 4.4.*

Home base sites generally occur in areas with good access to a wide range of resources (reliable water, raw materials etc). The degree of environmental reliability, such as reliable water and subsistence resources, may influence the rate of return to sites and hence the complexity of evidence. Home base sites generally show a greater diversity of artefacts and raw material types (which represent a greater array of activities performed at the site and immediate area).

Activity locations occur within the foraging radius of a home base camp (approximately 10 km); (Renfrew and Bahn 1991). Based on the premise that these sites served as a focus of a specific activity, they will show a low diversity in artefacts and are not likely to contain features reflecting a base camp (such as hearths). However, it is also possible that the location of certain activities cannot be predicted or identified, adding to the increased dispersal of cultural material across the landscape. If people were opting to carry stone tools during hunting and gathering journeys throughout the area rather than manufacturing tools at task locations, an increased number of used tools should be recovered from low density and dispersed assemblages.

Figure 4.4 Foley's model (left) and its manifestation in the archaeological record (right), (from Foley 1981).



4.8.1 Model of occupation for the Hunter Valley

Work in the Hunter Valley has aimed to understand the nature of Aboriginal occupation and determine the nature of land use. This theme often aims to identify and explain archaeological

patterning in site type, content and distribution. General theories have been developed outlining the relationship between land use patterns and the resulting archaeological evidence. A number of models developed for the Hunter Valley have been reviewed (Koettig 1994; Dean-Jones and Mitchell 1993; Rich 1995; Kuskie and Kamminga 2000) and the most commonly accepted model is summarised below.

Kuskie and Kamminga (2000) established a general model of occupation strategies based primarily upon ethnographic research. Used as a starting point, it makes a general set of predictions for the Hunter that is consistent with other studies (e.g. Nelson 1991, Thomas 1983). The model distinguishes between short-term or extended long-term occupation and makes some predictions about the likely location of different foraging and settlement activities. Combining this information with a general review of assemblage contents from a sample of excavated sites within the Hunter Valley, a baseline of settlement activities may be determined (Barton 2001). The model provides a number of archaeological expectations that may be tested. For example, the presence of features requiring a considerable labour investment such as stone-lined ovens or heat-treatment pits are likely to occur at places where occupation occurred for extended periods of time. The presence of grindstones is also a reliable indicator of low mobility and extended occupation. Seed grinding requires a large investment of time and effort (Cane 1989). In most ethnographic examples, seed grinding is an activity that takes place over an entire day to provide adequate energetic returns (Cane 1989; Edwards and O'Connell 1995).

Where group mobility was high and campsites frequently shifted throughout the landscape, artefact assemblages are not expected to contain elements such as grindstones, heat-treatment pits, ovens and the diversity of implements frequently discarded at places of extended residential occupation. It may also have been the case that the location of particular activities could not be predicted by tool users, adding to the increased low-density scattering of artefacts over the landscape. Also, if individuals were opting to carry a number of stone tools during hunting and gathering activities and maintaining these tools rather than manufacturing new tools at each task location, the ratio of used tools to unworn flakes in these assemblages should be high. *Table 4.7* has been adapted from Kuskie and Kamminga (2000). To identify the specific activity areas through analysis of the composition of patterning of lithic assemblages, is utilised. However, this is applied to excavated materials as they provide more realistic data due to the lesser degree of disturbances, removal and breakages.

Table 4.7 Site descriptions (Kuskie & Kamminga 2000)

Occupation Pattern	Activity Location	Proximity to water	Proximity to food	Archaeological expectations
Transitory movement	All landscape zones	Not important	Not important	• Assemblages of low density & diversity Evidence of tool maintenance & repair, knapping
Hunting &/or gathering without camping	All landscape zones	Not important	Near food resources	• Assemblages of low density & diversity • Evidence of tool maintenance & repair • Evidence for stone knapping • High frequency of used tools
Camping by small groups	Associated with permanent & temporary water	Near (within 100m)	Near food resources	• Assemblages of moderate density & diversity • Evidence of tool maintenance & repair • Evidence for stone knapping & hearths
Nuclear family base camp	Level or gently undulating ground	Near reliable source (within 50m)	Near food resources	• Assemblages of high density &diversity • Evidence of tool maintenance, repair, casual knapping • Evidence for stone knapping • Heat treatment pits, stone lined ovens • grindstones
Community base camp	Level or gently undulating ground	Near reliable source (within 50m)	Near food resources	• Assemblages of high density &diversity • Evidence of tool maintenance & repair & casual knapping • Evidence for stone knapping • Heat treatment pits, stone lined ovens • Grindstones & ochre • Large area >100sqm with isolated camp sites

5 RESULTS

5.1 METHODOLOGY

The survey areas were surveyed on foot in transects at approximately 2 metres apart. The study area was surveyed with a focus on areas of high ground surface visibility and exposures (erosional features, tracks, cleared areas).

5.2 LANDFORMS

McDonald *et al* (1998) describes the categories of landform divisions. This is a two layered division involving treating the landscape as a series of 'mosaics'. The mosaics are described as two distinct sizes: the larger categories are referred to as *landform patterns* and the smaller being *landform elements* within these patterns. Landform patterns are large-scale landscape units, and landform elements are the individual features contained within these broader landscape patterns. There are forty landform pattern units and over seventy landform elements. However, of all the landform element units, ten are morphological types. For archaeological investigations they divide the landscape into standardised elements that can be used for comparative purposes and predictive modelling. As outlined in *Chapter 2*, the study area includes three landforms: crest, a slope and flats.

5.3 SURVEY UNITS

For ease of management, the study area was divided into 3 Survey Units (SUs) that were based on landforms (Refer to *Figure 5.1*).

Survey Unit 1: crest
This transect includes what remains of the crest to the south. This SU has been cleared and effected by previous excavation works to form the access road. Vegetation is grass along side the road and exposures were high.

Survey Unit 2: slope
This SU transect includes a small slope formed from the crest down to the flats. This SU has been subject to previous clearing, grazing, fencing, tracks, a chicken coop located on the western border and a large dam to the north. The land is currently used for grazing, vegetation is pasture grass which contributed to reduced ground surface visibility but exposures were high in the form of the dam and grazing hooves exposures throughout.

Survey Unit 3: flats
This SU, the largest of the study area, has been subject to previous clearing, grazing, fencing, tracks, a large dam to the north, electricity easement to the north west and the land is currently used for grazing. Open woodlands are present to the northwest, north east and through the centre and the remainder are open paddocks with pasture grass, all of which contributed to reduced ground surface visibility. Erosion was low to moderate and included tracks and grazing hooves imprints and the dam.

5.4 EFFECTIVE COVERAGE

Effective coverage is an estimate of the amount of ground observed taking into account local constraints on site discovery such as vegetation and soil cover. There are two components to determining the effective coverage: visibility and exposure.

Visibility is the amount of bare ground on the exposures which may reveal artefacts or other cultural materials, or visibility refers to 'what conceals'. Visibility is hampered by vegetation, plant or leaf litter, loose sand, stony ground or introduced materials (such as rubbish). On its

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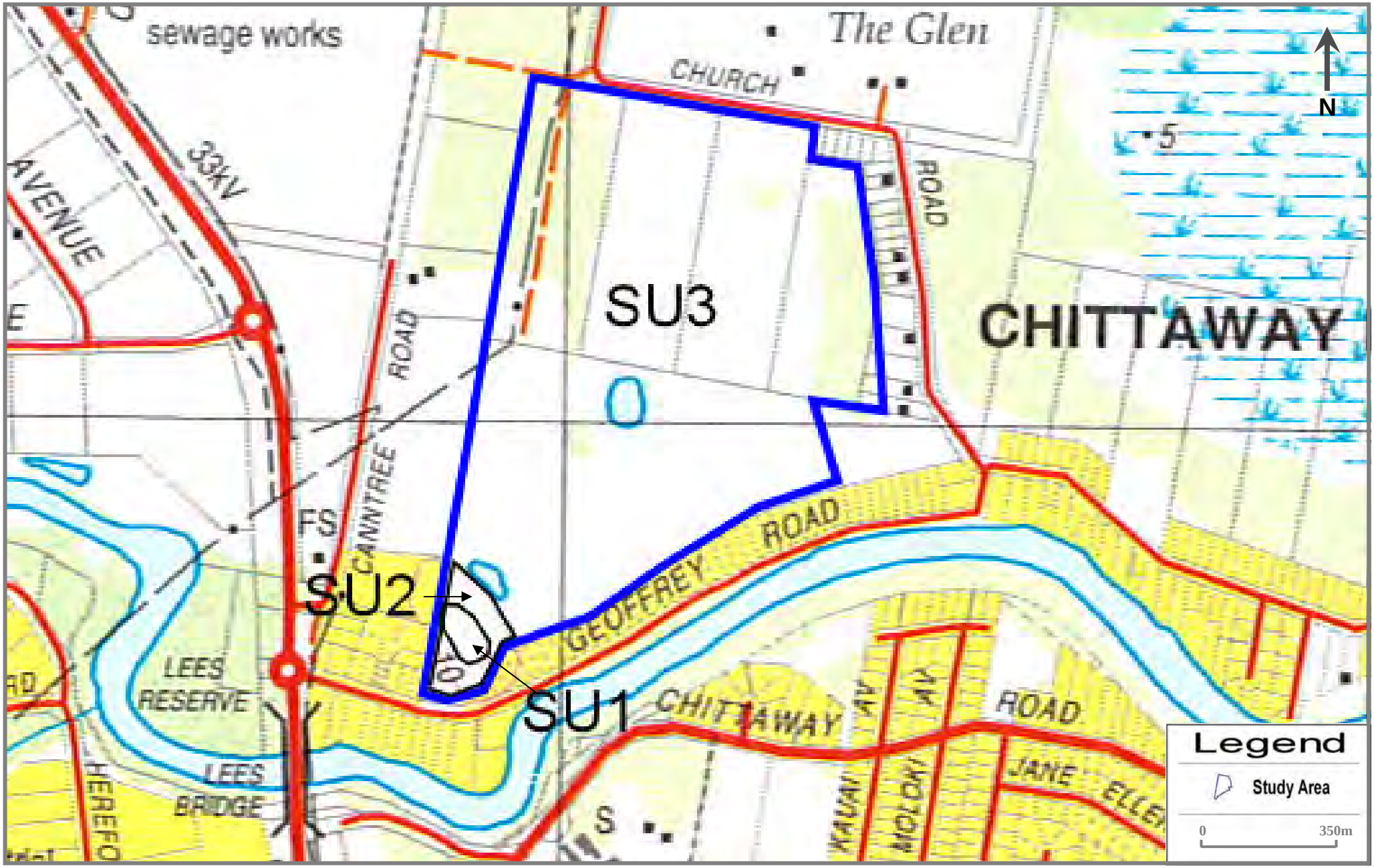

Figure 6.1 Survey Units

Source: 1:25 000 Topo Series: Wyong

own, visibility is not a reliable factor in determining the detectability of subsurface cultural materials (DECCW 2010/783:39).

The second component in establishing effective coverage is exposure. Exposure refers to 'what reveals'. It estimates the area with a likelihood of revealing subsurface cultural materials rather than just an observation of the amount of bare ground. Exposure is the percentage of land for which erosion and exposure is sufficient to reveal cultural materials on the surface (DECCW 2010/783:37).The effective coverage for the study area was determined for both visibility and exposure ratings and *Table 5.1* details the visibility rating system used.

Table 5.1 Ground surface visibility rating

Description	GSV Rating %
Very Poor – heavy vegetation, scrub foliage or debris cover, dense tree of scrub cover. Soil surface of the ground very difficult to see.	0-9%
Poor – moderate level of vegetation, scrub, and / or tree cover. Some small patches of soil surface visible in the form of animal tracks, erosion, scalds, blowouts etc, in isolated patches. Soil surface visible in random patches.	10-29%
Fair – moderate levels of vegetation, scrub and / or tree cover. Moderate sized patches of soil surface visible, possibly associated with animal, stock tracks, unsealed walking tracks, erosion, blow outs etc, soil surface visible as moderate to small patches, across a larger section of the study area.	30-49%
Good – moderate to low level of vegetation, tree or scrub cover. Greater amount of areas of soil surface visible in the form of erosion, scalds, blowouts, recent ploughing, grading or clearing.	50-59%
Very Good – low levels of vegetation / scrub cover. Higher incidence of soil surface visible due to recent or past land-use practices such as ploughing, grading, mining etc.	60-79%
Excellent – very low to non-existent levels of vegetation/scrub cover. High incidence of soil surface visible due to past or recent land use practices, such as ploughing, grading, mining etc.	80-100%
Note: this process is purely subjective and can vary between field specialists, however, consistency is achieved by the same field specialist providing the assessment for the one study area/subject site.	

As indicated in *Table 5.2*, the effective coverage for study area illustrates that visibility is very low at 1-5%with overall effective coverage being 4.45% with grass being the limiting factor.

Table 5.2 Effective coverage

SU	Landform	Area (m2)	Vis. %	Exp. %	Exposure type	Previous disturbances	Present disturbances	Limiting visibility factors	Effective coverage (m2)
1	crest	1,200	60%	90%	erosion., road construction	clearing, grazing	road	grass	648
2	slope	1,500	60%	90%	erosion, dam, grazing	clearing, grazing, dam, fencing	erosion, grazing	grass	810
3	flats	300,000	10%	40%	erosion, tracks, dam	clearing, tracks, dam, grazing, power, fencing	grazing	grass, leaf litter	12,000
Totals		**302,700**							**13,458**
								Effective coverage %	**4.45%**

The disturbances included clearing, fences, grazing, all of which have impacted upon the landscape and associated cultural materials. As described in detail in *Chapter 2*, these disturbances result in the lateral and horizontal movement of materials. In particular, the crest, which is the highest point with a view and access to Ourimbah Creek, has been subject to

clearing and excavation works for the road. The disturbances and vegetation are shown in *Figure 5.2*.

Landforms include a crest, slope and flats. Although the crest is considered conductive to occupation as indicated by the predictive model and sites identified, it has been disturbed by road construction. As indicated in *Table 5.3*, the most common landform in this study area is flats (300,000m^2) which are not considered great areas for occupation due to the low lying nature of the landform and water logging. With the crest being the most likely landform to contain evidence of past occupation (as it has a vantage point), and given it is also the smallest area within the study area (1,200m^2), the presence of evidence is reduced within the study area. Added to this is the fact that the crest has been greatly disturbed, further reducing the likelihood of evidence remaining.

Table 5.3 Landform summary

Landform	Landform area (m2)	Area effectively surveyed (m2)	% landform effectively surveyed	Number of sites
crest	1,200	45	3.8	0
slope	1,500	810	54.0	0
flats	300,000	12000	4.0	0

5.5 ARCHAEOLOGICAL SITES

Sites were labelled according to the project title, e.g. CB/1 where CB represents Chittaway bay, and 1 indicates the site number allocated consecutively.

5.5.1 Definition of a Site

A 'site' can be defined by various factors. For this study a 'site' was defined on the combination of the following inter-related factors:

- landform;
- exposure and visibility;
- visible boundaries of artefacts; and
- a feature identified by the Aboriginal community on the basis of their own cultural knowledge and significance.

The 'site area' was defined as the area in which artefacts were observed on a landform, though it must be remembered that this may not represent an accurate picture of site size. Visibility of artefacts is affected by differences in vegetation cover and hence ground surface visibility, as well as the degree of natural and human-induced disturbance.

5.5.2 Definition of site complex

Site complex refers to sites that occur in groups. For example, complexes may consist of burial grounds and carved trees, artefact scatters that represent different stages of procurement and manufacture or artefact scatters and shell middens. Complexes may also consist of artefact scatters that are connected across a landscape with the scatters being either specific activity centres (such as tool manufacturing sites) or larger base camp areas (with more artefacts and a variety of artefacts).

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Figure 5.2 Aerial location of the study area

Source: Google earth

5.5.3 Mapping identified sites

MCH use topographic maps with MGA system 1994 (unless they are new maps produced after 1999 that have used the MG94 system) and our hand held Global Positioning System (GPS) units use MGA.

It is important to note that the Global Positioning System is operated by the United States and is subject to changes that may affect the accuracy and performance of all GPS equipment. At present, the hand held unit operated by MCH have an estimated error of approximately 5-10 metres though this is also dependant on the number of satellites available and detected and other factors such as tree coverage/interference.

5.5.4 Sites identified

No sites were identified. This is not surprising given that the only area with some potential was the crest that overlooks Ourimbah Creek but has been highly disturbed due to road construction.

5.6 POTENTIAL ARCHAEOLOGICAL DEPOSIT (PAD)

The terms 'Potential Archaeological Deposit (PAD)' and 'area(s) of archaeological sensitivity' are used to describe areas that are likely to contain sub-surface cultural deposits. These sensitive landforms or areas are identified based upon the results of fieldwork, the knowledge gained from previous studies in or around the subject area and the resultant predictive models. Any or all of these attributes may be used in combination to define a PAD.

The likelihood of a landscape having been used by past Aboriginal societies and hence containing archaeologically sensitive areas is primarily based on the availability of local natural resources for subsistence, artefact manufacture and ceremonial purposes. The likelihood of surface and subsurface cultural materials surviving in the landscape is primarily based on past land uses and preservation factors.

No PADs were identified. This is not surprising given that the only area with potential was the crest that overlooks Ourimbah Creek. However, as this landform been highly disturbed due to road construction, no potential archaeological deposit remains.

5.7 REGIONAL &LOCAL CONTEXT

No sites or PADs were identified that would allow a comparison to the local and regional archaeological context.

5.8 INTERPRETATION

As no sites have been identified no interpretation of the study area can be undertaken at this stage.

5.9 DISCUSSION

Sites provide valuable information about past occupation, use of the environment and its specific resources including diet, raw material transportation, stone tool manufacture, and movement of groups throughout the landscape.

Proximity to water was an important factor in past occupation of the area, with sites reducing in number significantly away from water with most sites located within 50 metres of the tributaries. The surrounding area contains no raw materials that are typically used in the manufacture of stone tools, and as such it can be assumed that any artefacts identified would be of materials traded and/or transported from other locations. The access to water close by

would have provided the necessary resources for occupation of the area in particular on the crest overlooking Ourimbah Creek.

6 ASSESSMENT OF IMPACTS

The archaeological record is a non-renewable resource that is affected by many processes and activities. As outlined in *Chapter 2*, the various natural processes and human activities may impact on archaeological deposits through both site formation and taphonomic processes. *Chapter 4*describes the impacts within the study area, showing how these processes and activities have disturbed the landscape and associated cultural materials in varying degrees.

6.1 IMPACTS

Detailed descriptions of the impacts are provided in *Section 1.5* and as this is a re-zoning application only, the study area will not be impacted on at this time.

The OEH Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (2010:21) describes impacts to be rated as follows:

- Type of harm: is either direct, indirect or none
- Degree of harm is defined as either total, partial or none
- Consequence of harm is defined as either total loss, partial loss, or no loss of value

Table 6.1 Impact summary

Study area	Type of harm	Degree of harm	Consequence of harm
	indirect	none	no loss of value

Mitigation measures to minimise these impacts are outlined in the following chapter.

7 MITIGATION AND MANAGEMENT STRATEGIES

Specific strategies, as outlined through the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DDCOPPAC) and the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (COPAIAO), (DECCW 10011a,b), are considered below for the management of identified sites and potential archaeological deposits within the study area.

One of the most important considerations in selecting the most suitable and appropriate strategy is the recognition that Aboriginal cultural heritage is very important to the local Aboriginal community. Decisions about the management of sites and potential archaeological deposits should be made in consultation with the appropriate local Aboriginal community.

7.1 CONSERVATION/PROTECTION

The OEH is responsible for the conservation/protection of Indigenous sites and they therefore require good reason for any impact on an indigenous site.

Conservation is the first avenue and is suitable for all sites, especially those considered high archaeological significance and/or cultural significance. Conservation includes the processes of looking after an indigenous site or place so as to retain its cultural significance and are managed in a way that is consistent with the nature of peoples' attachment to them.

No sites or PADs were identified and as such conservation is not justified.

7.2 FURTHER INVESTIGATION

An Aboriginal Heritage Impact Permit (AHIP) is no longer required to undertake test excavations (providing the excavations are in accordance with the Code of Practice for Archaeological Investigations in NSW).

Subsurface testing is appropriate when a Potential Archaeological Deposit (PAD) has been identified, and it can be demonstrated that sub-surface Aboriginal objects with potential conservation value have a high probability of being present, and that the area cannot be substantially avoided by the proposed activity. However, testing may only be undertaken as per the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2011) and discussions/consultation with the local Aboriginal community.

As no PADs were identified, nor any sites, further investigation is not justified

7.3 AHIP

If harm will occur to an Aboriginal object or Place, then an AHIP is required form the OEH.

An AHIP is required when a site is identified but its extent, the nature of its contents, level of integrity and/or its significance cannot be adequately assessed through a surface survey. In this case, if a systematic excavation of the known site could provide benefits and information for the Aboriginal community and/or archaeological study of past Aboriginal occupation, a salvage program may be an appropriate strategy to further assess the site to determine its extent, nature, content, integrity and significance. The AHIP may also include surface collection of artefacts.

As no sites or PADs were identified an AHIP is not required.

7.4 MONITORING

An alternative strategy for areas where archaeological deposits are predicted to occur is was to monitor development works for cultural materials, predominantly during the initial earth moving and soil removal works. This was the main strategy for managing the possible occurrence of Aboriginal skeletal remains.

However, with the legislative changes, due diligence process and AHIP restructuring, monitoring is not an option as if there is even a slight possibility of cultural materials being present this must be addressed through the due diligence process and Code of Practice.

8 RECOMMENDATIONS

8.1 GENERAL

1) The persons responsible for the management of an on site will ensure that all staff, contractors and others involved in construction and maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010, under the National Parks and Wildlife Act 1974;

2) No further investigations are required for rezoning, however, in order to determine the cultural significance of the study area, consultation with the Aboriginal community musty be undertaken as per the OEH Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010) as part of any future development application following rezoning; and

3) If any artefacts are uncovered during any works, work must stop in that area and the OEH notified.

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ANNEX A

AHIMS Search Results

AHIMS Web Services (AWS)
Search Result

Your Ref Number : Chittaway bay
Client Service ID : 51737

Penny Mccardle
Po Box 166
Adamstown New South Wales 2289
Attention: Penny Mccardle
Email: mcheritage@iprimus.com.au

Date: 20 September 2011

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 56, Eastings : 334900 - 335900, Northings : 6306000 - 6316000 with a Buffer of 0 meters.Additional Info : assessment conducted by Penny Mccardle on 20 September 2011

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

2	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : Chittaway bay

Client Service ID : 51737

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-3-3105	Mangrove Mountain	AGD	56	335520	6315120	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	1333
	Contact	**Recorders**	Warren Bluff					**Permits**		
45-3-0095	Central Mangrove;	AGD	56	334884	6315151	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	308
	Contact	**Recorders**	I.M Sim					**Permits**		

Report generated by AHIMS Web Service on 20/09/2011 for Penny Mccardle for the following area at Datum :GDA, Zone : 56, Eastings : 334900 - 335900, Northings : 6306000 - 6316000 with a Buffer of 0 meters.Additional Info : assessment. Number of Aboriginal sites and Aboriginal objects found is 2

IDA SAFE CONSTRUCTIONS PTY LTD

PROPOSED LAND RE-ZONING
GEOFFREY ROAD, CHITTAWAY BAY

FLOODING ISSUES

FINAL REPORT

May 2012

IDA SAFE CONSTRUCTIONS PTY LTD

PROPOSED LAND RE-ZONING
GEOFFREY ROAD, CHITTAWAY BAY

FLOODING ISSUES

FINAL REPORT

May 2012

Prepared By:

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Version 2
Authorised for Release

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Job Name: Proposed Land Re-Zoning, Geoffrey Road, Chittaway Bay - Flooding Issues

Job No.: 12-021

Original Date of Issue: 27 April 2012

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Client Contact:	Mr Ian Adams

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1. INTRODUCTION

This report has been prepared by Paterson Consultants for IDA Safe Constructions Pty Ltd (identified for the purpose of this report as "IDA").

IDA own 6 parcels of land between Geoffrey Road, Church Road and Canntree Road, Chittaway Bay.

The subject land is indicated on Figure 1 and identified as:

- Lot 1, DP 21536
- Lot 2, DP 21536
- Lot 3, DP 21536
- Lot 1, DP 134363
- Lot 1, DP 1014033
- Lot 1, DP 22467

The various land parcels form a contiguous land holding of 28.531 ha.

IDA wishes to re-zone the site from its current zoning of "Zone 1c – Non urban constrained land" to allow different land uses, broadly as indicated on Figure 2.

This report addresses the flooding issues for the site and proposed land uses as part of a series of specialist reports to accompany IDA's submission for re-zoning of the site.

2. THE DEVELOPMENT SITE

Ground levels across the site vary between RL 2.5 m AHD to RL 8.5 m AHD. (Refer ground survey by Everitt & Everitt in the re-zoning application document). Ground survey indicates the bulk of the site is at or below RL 4.0 m AHD. Approximately one third of the site, located in the south eastern corner of the site, has ground levels in the range of RL 2.5 m AHD to RL 3.0 m AHD.

Figure 3 illustrates the ALS data (provided to Wyong Shire Council by NSW Land and Property Information) as a colour representation of ground levels. There are approximately 1,050 ground survey points. Comparison between the ground survey points and the ALS data shows:

- the median difference in the two data sets is 92 millimetres (that is, the ALS data is about 100 millimetres above the ground survey points);

- the standard deviation of the differences between the ALS and ground data is 250 millimetres (that is, only 60 percent of the ALS data points are within 250 millimetres of the ground survey points).

There appears to be no consistency in variations between the ALS and ground survey data.

Wyong Shire Council's flood studies near the subject site are:

- Lower Ourimbah Creek Floodplain Management Study (Reference 1);
- Tuggerah Lake Floodplain Management Study (draft only, Reference 2).

The Lower Ourimbah Creek Study shows flood hazard on the development site as "Flood Fringe" or "Low Hazard, Flood Storage".

Figure 4 illustrates the "adopted 1% flood hazard" for Ourimbah Creek overlaying the site aerial photograph.

It should be noted that the Lower Ourimbah Creek Floodplain Management Study:

- was based on a one-dimensional model or Ourimbah Creek. As such, the study will create higher than actual design flood levels on the site, given the methods used to extend the one-dimensional model results.

- defined flood fringe as areas where flood depths were less than 300 millimetres and negligible flood velocity would be experienced.

- examined a number of scenarios for the co-incidence of a design 1% AEP flood on Ourimbah Creek co-incident with water levels in Tuggerah Lake of 0.9 m, 1.1 m and 2.2 m AHD. Under these conditions, the flood hazard of the site remained as "Low Hazard".

- indicated the PMP flood levels across the site up to RL 5.5 m AHD.

It is clear from the flood hazard maps in the Lower Ourimbah Creek Floodplain Risk Management Review (Reference 1) that:

- the subject site is classed as low hazard;
- the subject site adjoins the high hazard areas of Tuggerah Lake;
- there are few land holdings of this size along the flood fringes of Tuggerah Lake.

It is noted, from Figure 3, that there is a potential flood runner leaving Ourimbah Creek and crossing Geoffrey Road and entering the subject site.

Given the differences between the ALS and ground data (noted above) and the potential for a flood runner to occur across the site from Ourimbah Creek, the original MIKE-11 hydrodynamic model for Ourimbah Creek was modified to include a separate link for the possible flood runner across the site. The modified MIKE-11 model was tested for current estimated 1% AEP flood discharge in Ourimbah Creek with prevailing tailwater levels in Tuggerah Lake of RL 0.5 m, RL 0.9 m and RL 2.2 m AHD. The tailwater levels represent the same conditions as addressed by the Lower Ourimbah Creek Flood Study Review (Reference 1).

The MIKE-11 model runs indicated:

- design 1% AEP flood levels at the eastern boundary of the site as less than RL 2.7 m AHD;

- design 1% AEP flood levels at the flood break-out of RL 3.7 m AHD.

In the above conditions, flood depths across the southern block of the site vary between 0.4 and 0.1 metres. The estimated discharge across the site (at peak) is some 7 cu. m/sec compared to the total discharge of some 870 cu. m/sec in Ourimbah Creek. Thus, (given the small contribution of the flood runner compared to the total Ourimbah Creek flow), the flood runner across the site from Ourimbah Creek could be closed without creating a measurable increase in flood levels in Ourimbah Creek.

The conclusion that can be drawn is that the site could be filled without creating a precedent or causing significant reduction in flood storage either along Ourimbah Creek or in Tuggerah Lake

The draft Tuggerah Lake Floodplain Management Study has identified “flood hazard” using a “risk” terminology as “low” and “medium” across the site, as illustrated on Figure 5. The draft Floodplain Management Plan unconventionally links “flood risk” to particular flood levels, namely:

- High Risk: RL 1.8 m AHD
- Medium Risk: RL 3.13 m AHD
- Low Risk: RL 3.63 m AHD

The logic of the flood levels adopted appears related to inclusion of climate change induced increases in mean sea level, as demonstrated in Table 1 below.

Table 1

Design Flood Levels – Tuggerah Lake

Event	**Design Flood Level (m AHD)**		
Year	**2011**	**2050**	**2100**
Sea Level Rise	**0**	**0.4**	**0.9**
PMF	2.70	3.10	3.60
1% AEP	2.23	2.63	3.13
5% AEP	1.80	2.20	2.70
20% AEP	1.36	1.76	2.26

In the classification of the floodplain into hydraulic categories of floodway, flood storage and flood fringe, the draft Tuggerah Lake Study has adopted criteria:

- *Floodways* as land that fronts Tuggerah Lakes where ground levels are less than RL 1.0 m AHD.

- *Flood Storage* as land beyond the perimeter of the lakes and within the floodplains of Wyong River and Ourimbah Creek;

- *Flood Fringe* as land on the perimeter of the lakes, which is not flood storage.

The draft report acknowledges that, at Tuggerah Lakes, filling of the existing floodplains will have negligible impact on flood levels and thus can be permitted, provided other constraints (such as ecological issues, maintenance of drainage and the like) are overcome (Refer Paragraph 7.4.3 of draft Tuggerah Lakes report).

3. CONCLUSIONS

The nature of the development site being located on the boundary of areas affected by Ourimbah Creek flooding and elevated flood levels in Tuggerah Lake presents some difficulties in providing a reasonable, prudent and logical set of development conditions for the subject sites.

The draft Tuggerah Lakes Floodplain Risk Management Study has a de-facto inclusion of climate change induced increases in Tuggerah Lake flood levels. The Lower Ourimbah Creek Floodplain Risk Management Study Review indicates parts of the site as "flood fringe" or "flood storage" in the design 1% AEP flood event.

The possible development proposal is indicated on Figure 2.

Development considerations are as follows:

- Flood hazard across the proposed development are is low risk;
- The development area could be filled to provide minimum required ground levels
- The object of preventing loss of flood storage is so that flood levels are not increased downstream;
- The Tuggerah Lakes Floodplain Risk Management Plan acknowledges that, because of the size of Tuggerah Lake compared to the peripheral areas, the peripheral areas could be filled without affecting Tuggerah Lake flood levels;
- The development site adjoins the flood liable periphery of Tuggerah Lake and thus, it can be filled without affecting flood levels.

In the areas affected by Tuggerah Lake, a minimum lot and road level of RL 2.7 m AHD and a minimum floor level (flood planning level) of RL 3.2 m AHD will provide:

- protection against current PMF (RL 2.7 m AHD);
- protection against sea level rise for dwellings for the next 40 years, albeit with reduced freeboard.

For the areas affected by Lower Ourimbah Creek flooding, grading the minimum fill levels and minimum floor levels from east to west across the site (as shown on Figure 6) will provide protection against the current 1% design flood even (varying from 2.7 m AHD to 3.7 m AHD).

Comparison of the specified minimum lot and road levels above versus existing ground levels shows that only 2.7 ha of the total 16.7 ha involved in the proposed development area (refer to road and lot layout on Figure 2) will require filling to achieve the minimum levels.

It should be noted that the elevated area at the south western corner of the site reaches RL 12 m AHD and thus provides a refuge area of some 1.9 ha against the Probable Maximum Flood of RL 5.75 m AHD (see Reference 1).

Figure 6 depicts the minimum lot levels and flood planning levels (minimum floor levels) as an appropriate response to flood risk.

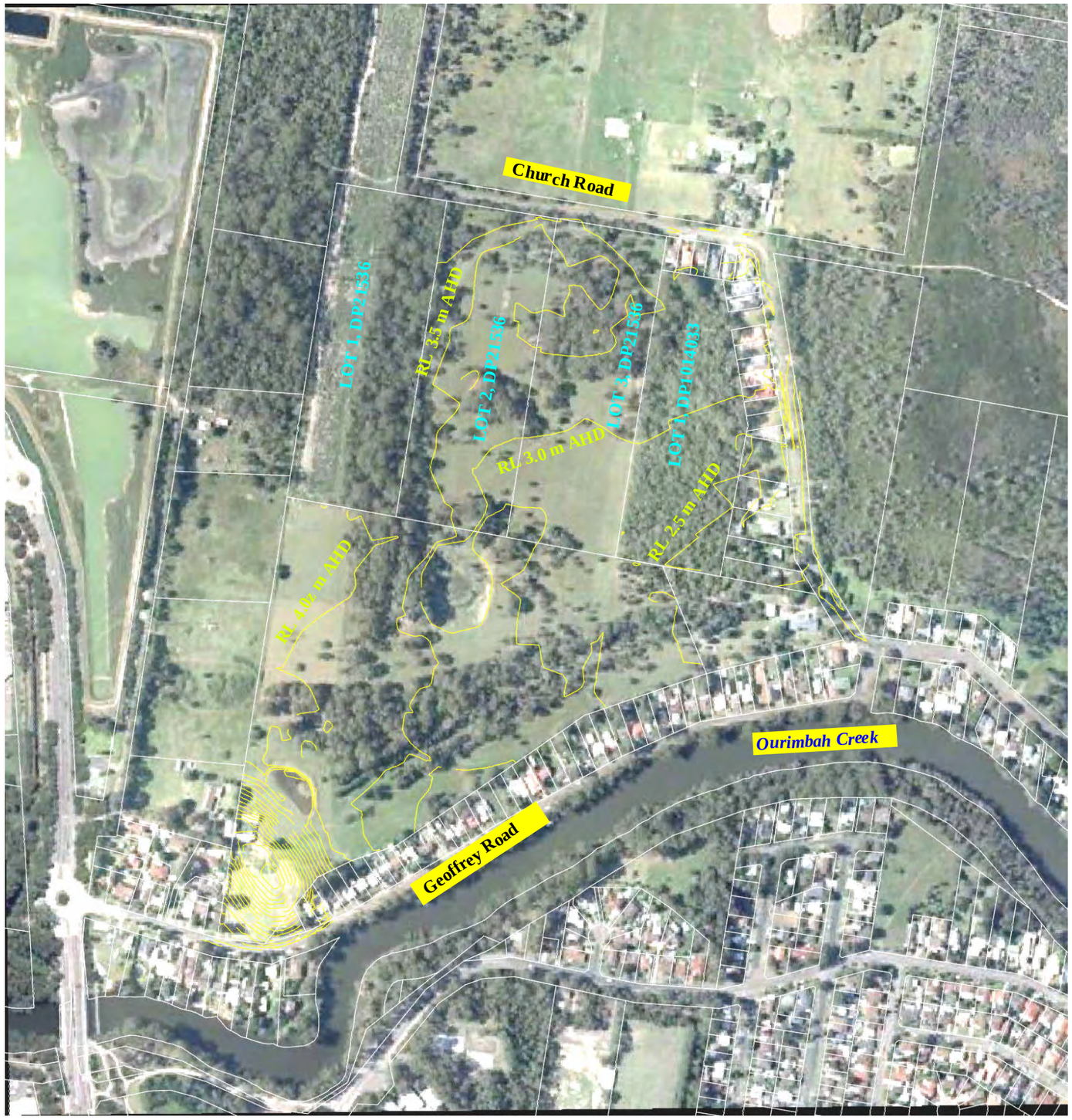
REFERENCES

1. Wyong Shire Council, "Lower Ourimbah Creek Floodplain Risk Management Study Review and Plan", July 2011 (prepared by Paterson Consultants Pty Ltd)

2. Wyong Shire Council, "Tuggerah Lakes Floodplain Risk Management Study, Public Exhibition Draft", November 2011 (prepared by WMA Water Pty Ltd

FIGURES

IDA SAFE CONSTRUCTIONS PTY LTD
LAND RE-ZONING, CHITTAWAY



Notes

1. Ground contours shown deriveved from ground survey by Everitt & Everitt in November 2011

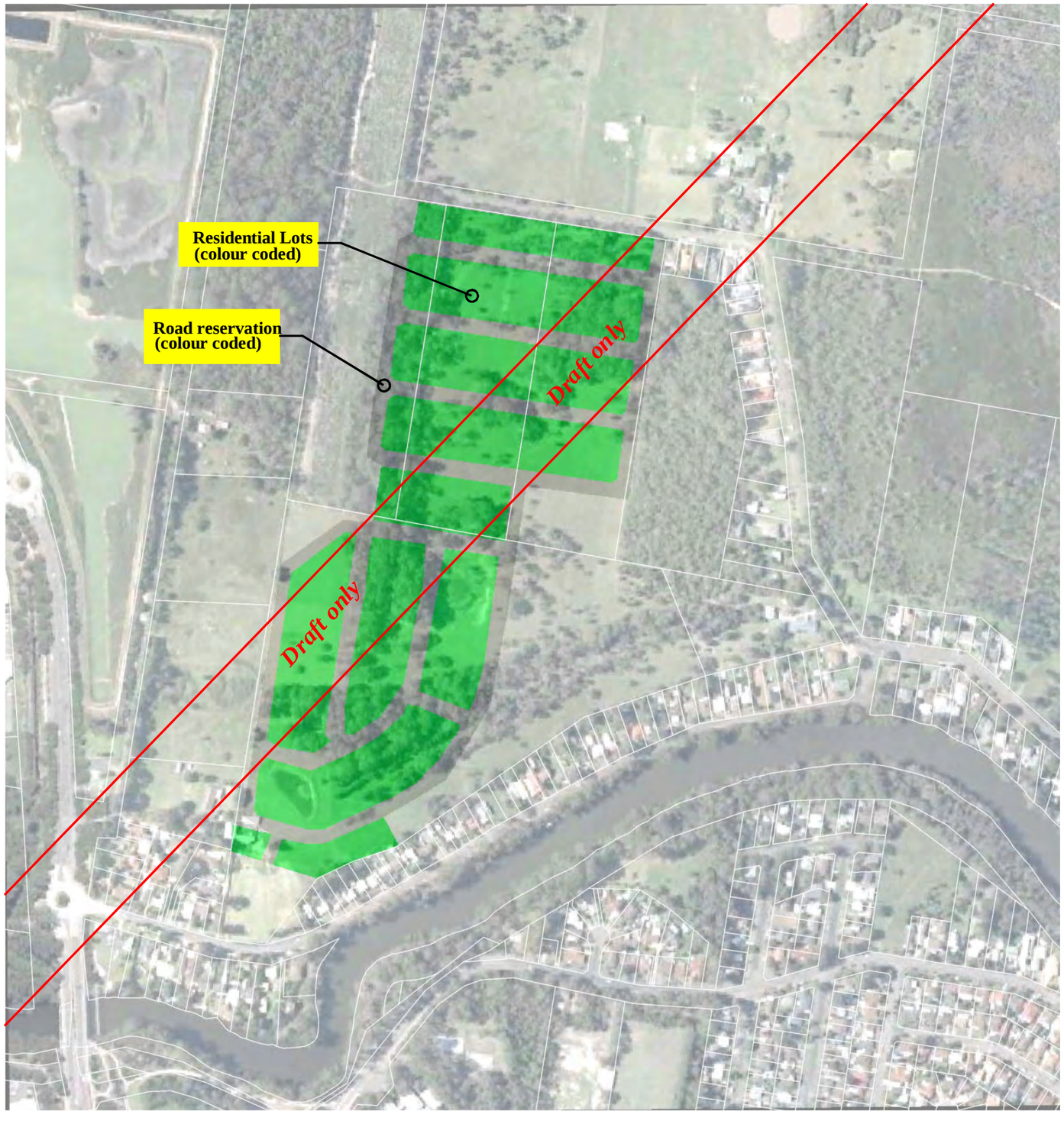
0 100 200

Metres

DATE: 13 April 2012
DISK REF: 12-021
FIG REF: 12-021_1_Subject_site_V3

FIGURE 1
SUBJECT SITE

IDA SAFE CONSTRUCTIONS PTY LTD
LAND RE-ZONING, CHITTAWAY

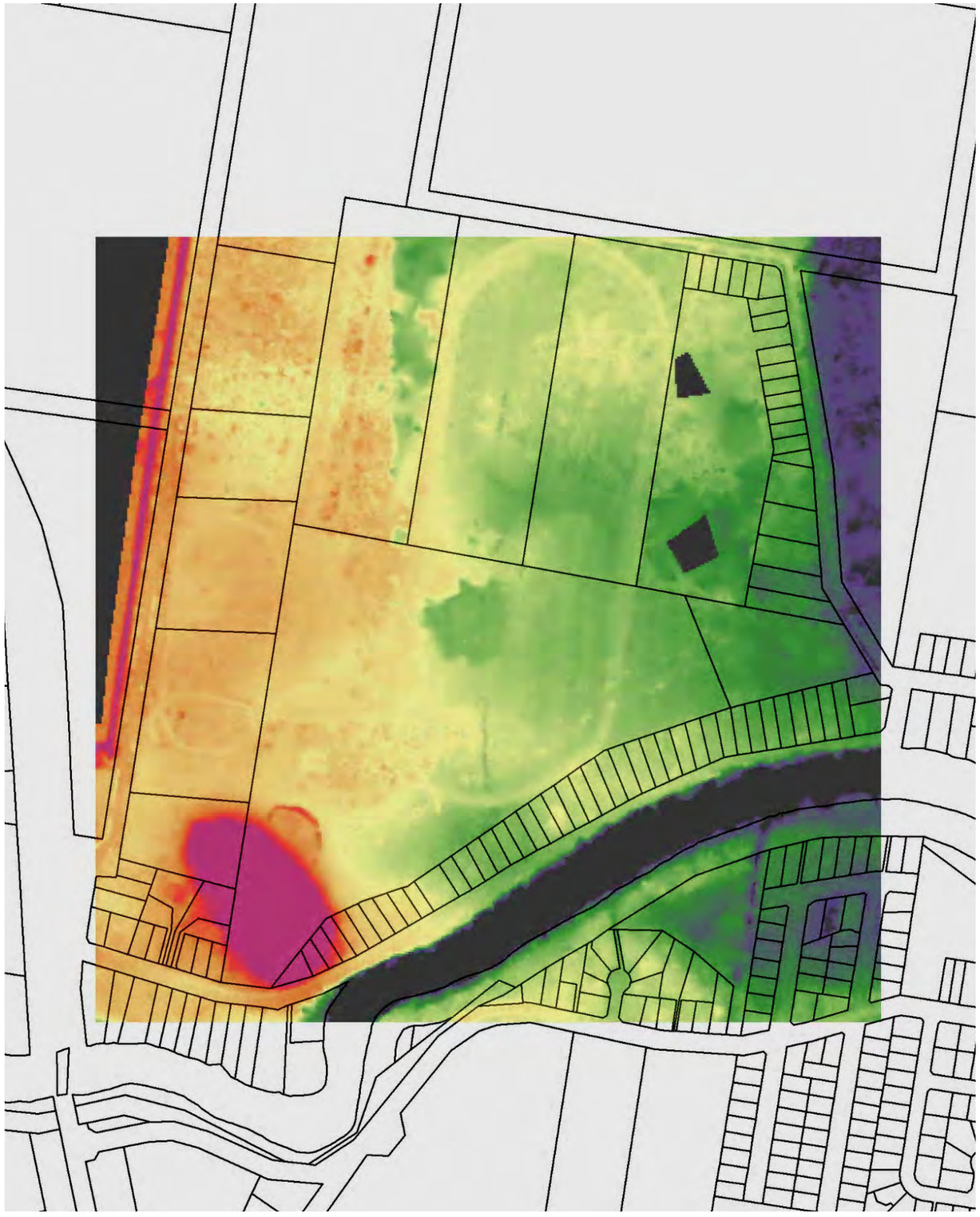


0 100 200
Metres

FIGURE 2
Possible Sub-division

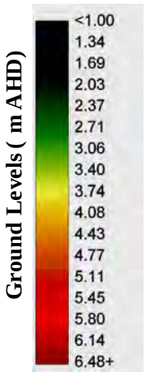
DATE: 4 April 2012
DISK REF: 12-021
FIG REF: 12-021_2_Possible sub-division_v2

IDA SAFE CONSTRUCTIONS PTY LTD
LAND RE-ZONING, CHITTAWAY



LEGEND

Ground Levels (Colour coded)



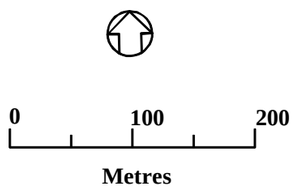
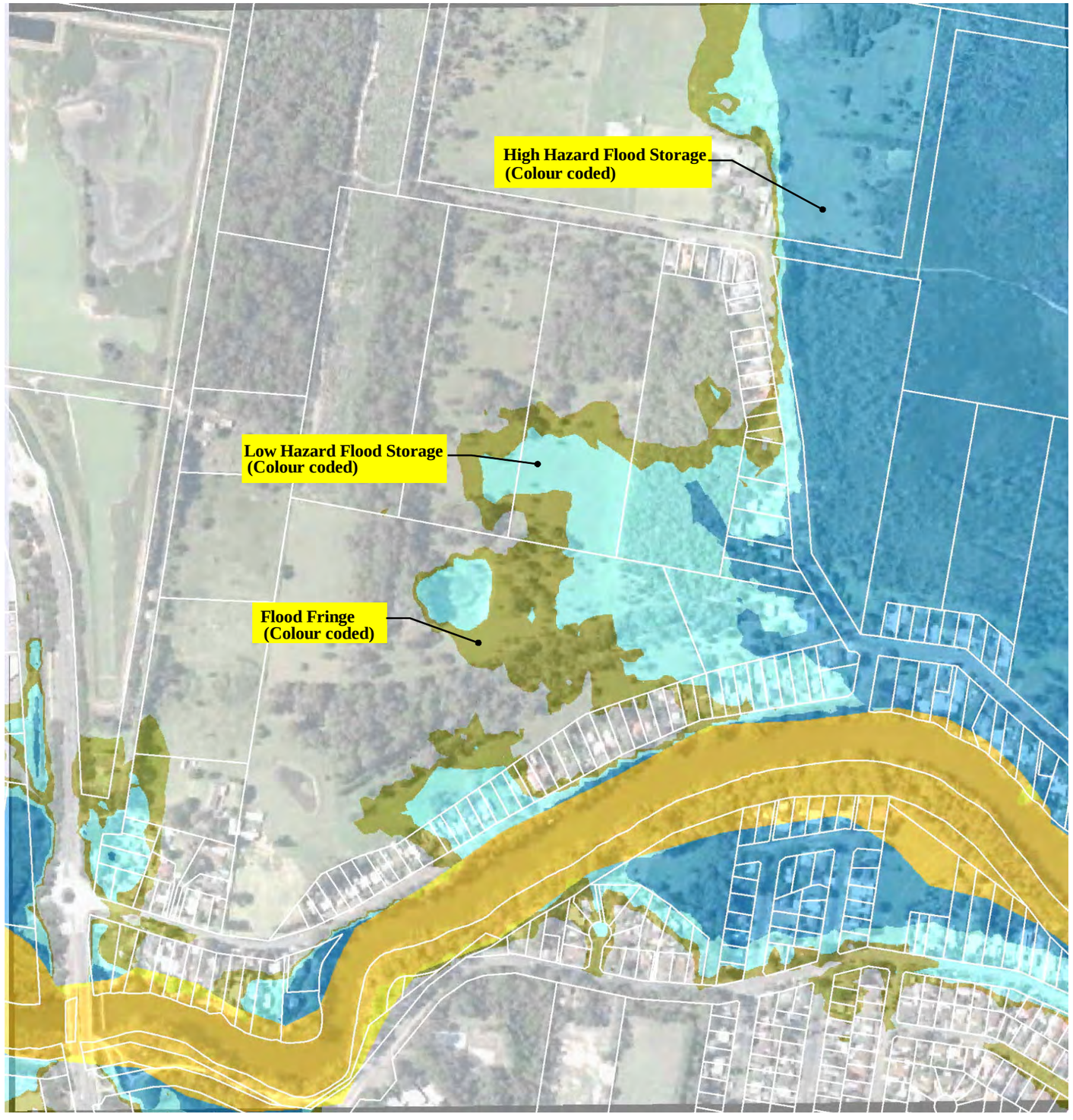


FIGURE 3

Site Ground Levels (ALS data)

DATE: 13 April 2012
DISK REF: 12-021
FIG REF: 12-021_3_Site_Ground_levels (ALS data)_v2

IDA SAFE CONSTRUCTIONS PTY LTD
LAND RE-ZONING, CHITTAWAY



0 100 200

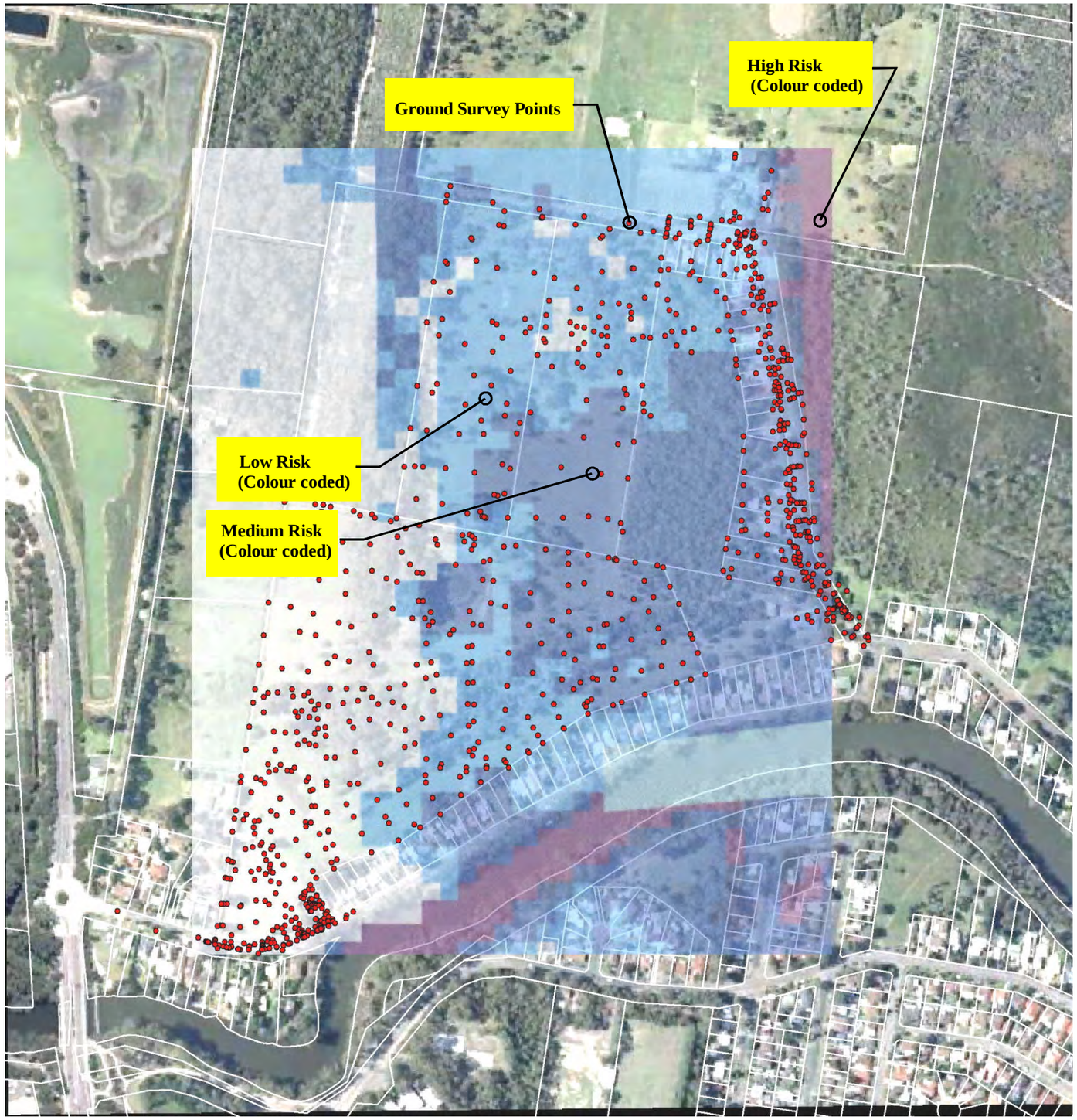
Metres

FIGURE 4

Flood Hazard (Lower Ourimbah Study)

DATE: 13 April 2012
DISK REF: 12-021
FIG REF: 12-021_4_Flood Hazard (Lower Ourimbah)_ V2

IDA SAFE CONSTRUCTIONS PTY LTD
LAND RE-ZONING, CHITTAWAY



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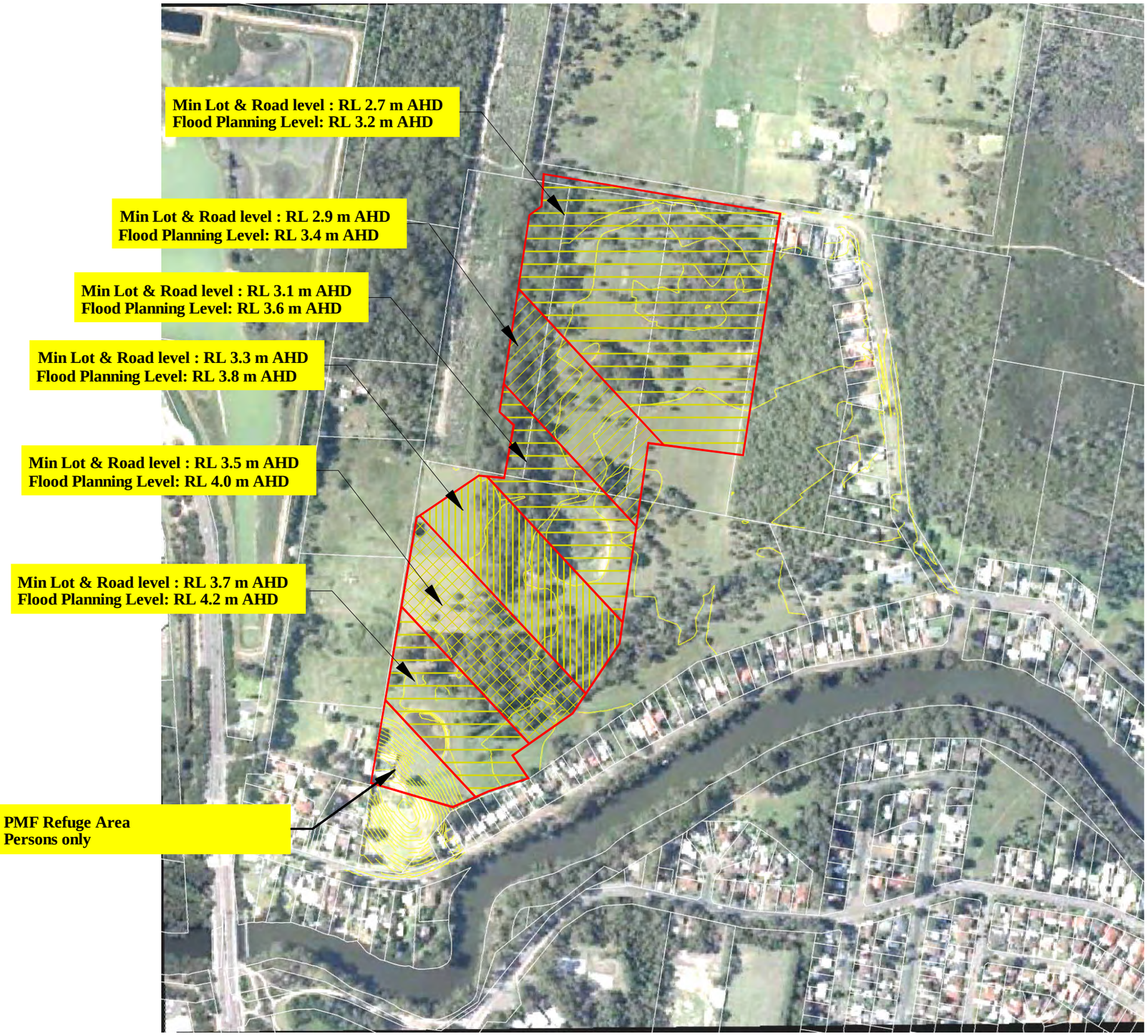
Metres

DATE: 13 April 2012
DISK REF: 12-021
FIG REF: 12-021_5_Tuggerah_lake_hazard_v2

FIGURE 5

Tuggerah Lake Flooding Hazard

IDA SAFE CONSTRUCTIONS PTY LTD
LAND RE-ZONING, CHITTAWAY



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Metres

DATE: 4 April 2012
DISK REF: 12-021
FIG REF: 12-021_6_Development Controls_ V1

FIGURE 6
DEVELOPMENT CONTROLS - FLOODING

22 October 2012
Our Ref: 12-021

The Manager
Paradigm Planning & Development Consultants Pty Ltd
P O Box 4034
Rathmines NSW 2283

Attention: Mr Ian Adams

Dear Sir

Re: Subdivision, Geoffrey Road, Chittaway

We refer to telephone conferences between your Mr Adams and our Mr Paterson regarding the proposed re-zoning of land at Geoffrey Road, Chittaway Bay.

In May 2012, we prepared a report on flooding issues with respect to the proposed re-zoning of six parcels of land between Geoffrey Road, Church Road and Camtree Road Chittaway Bay, which are held under a single ownership.

The site has the potential to be flooded by either or a combination of:

- a flood along Ourimbah Creek;
- elevated flood levels in Tuggerah Lake.

Given that Tuggerah Lake becomes elevated from runoff from all its catchments (not only from Ourimbah Creek), the Lower Ourimbah Creek Floodplain Management Study adopted a combination of boundary conditions of:

- 1% AEP flood in Ourimbah Creek coincident with a prevailing water level in Tuggerah Lake of RL 1.1 m AHD;

- 1% AEP elevated flood levels from Tuggerah Lake (RL 2.2 m AHD).

Flood levels at the site are derived from the highest predicted flood levels from either of the above flooding scenarios.

Testing with the Ourimbah Creek model, developed for the Lower Ourimbah Creek Floodplain Management Study (circa 2001), showed that the influence of Tuggerah Lake levels on flood levels in Ourimbah Creek extended only to approximately Church Street for the range of prevailing Tuggerah Lake levels tested (namely RL 0.5, RL 0.9, RL 1.1, RL 1.9 and RL 2.2 m AHD).

…/2

In our report of May 2012 on Flood Issues, we opined that the proposed filling of the site would not affect flood levels along Ourimbah Creek, given that the potential flood flows near the site that would be redistributed and thus affect surrounding properties were so small compared to the total flow in Ourimbah Creek that any changes would simply be not measurable.

We understand that Wyong Council have, in discussions with yourselves, raised the issues of :

- the impact of this fill on surrounding properties;

- the combined effect of Lower Ourimbah Creek flooding with Tuggerah Lake flooding, including a potential permanent increase in Tuggerah Lake levels induced by a climate change rise in ocean levels.

We have addressed the issues raised by Wyong Council below.

The impact of this fill on surrounding properties

We noted in our May 2012 report that we had extended the Lower Ourimbah Creek flood model to include a flood link past the proposed fill areas. This addition to the model was the source of our opinion in that report.

We have sought to quantify the likely changes to flood levels after the proposed development as a way of indication of the flood impact on surrounding properties.

We have tested the two scenarios of "Existing conditions" and "After proposed fill" for the 1% AEP flood along Ourimbah Creek and prevailing Tuggerah Lake levels of RL 0.9, RL 1.9 and RL 2.2 m AHD. The differences in predicted flood levels between the "Existing conditions" and "After proposed fill" scenarios is less than 10 millimetres. Differences of this magnitude are smaller than the scale of resolution and are neither measurable nor significant in the "real" world".

Our conclusion is that the fill will have no measurable impact on surrounding properties during floods.

The combined effect of Lower Ourimbah Creek flooding with Tuggerah Lake flooding including climate change

Wyong Council have raised the query of changes to design flood levels if the typical water levels in Tuggerah Lake were to be raised permanently by a climate change induced increase in mean sea level.

In the analysis above, we have noted:

- The Lower Ourimbah Creek Flood Study presumed that the current level of Tuggerah Lake co-incident with Ourimbah Creek flooding was RL 0.9 m AHD (while the Tumbi Umbi Flood Study used RL 1.1 m AHD);

…/3

- The testing above of prevailing water levels in Tuggerah Lake of RL 0.9, RL 1.9 and RL 2.2 m AHD showed no measurable difference in the flood levels along Ourimbah Creek;

- Prevailing water level in Tuggerah Lake of RL 1.9 and RL 2.2 m AHD can be viewed as representing a climate change increase of up to 1 metre;

- Our conclusion is that the design flood levels at the site will not be affected by the climate change induced increase in mean sea levels, as predicted over the next 100 years.

Following our review of the impact of climate change, we have noted that the minimum fill levels in our report of May 2012 were based on a combination of the Lower Ourimbah Creek flood model and engineering judgement. We suggest it would be prudent to set the fill levels based on the prevailing flood levels along the Ourimbah Creek main channel. We have attached revised recommended fill levels where:

- Minimum road levels are set at the design 1% AEP flood level;

- Minimum lot levels are set at the Flood Planning Level, namely the design 1% AEP flood level plus 0.5 m freeboard.

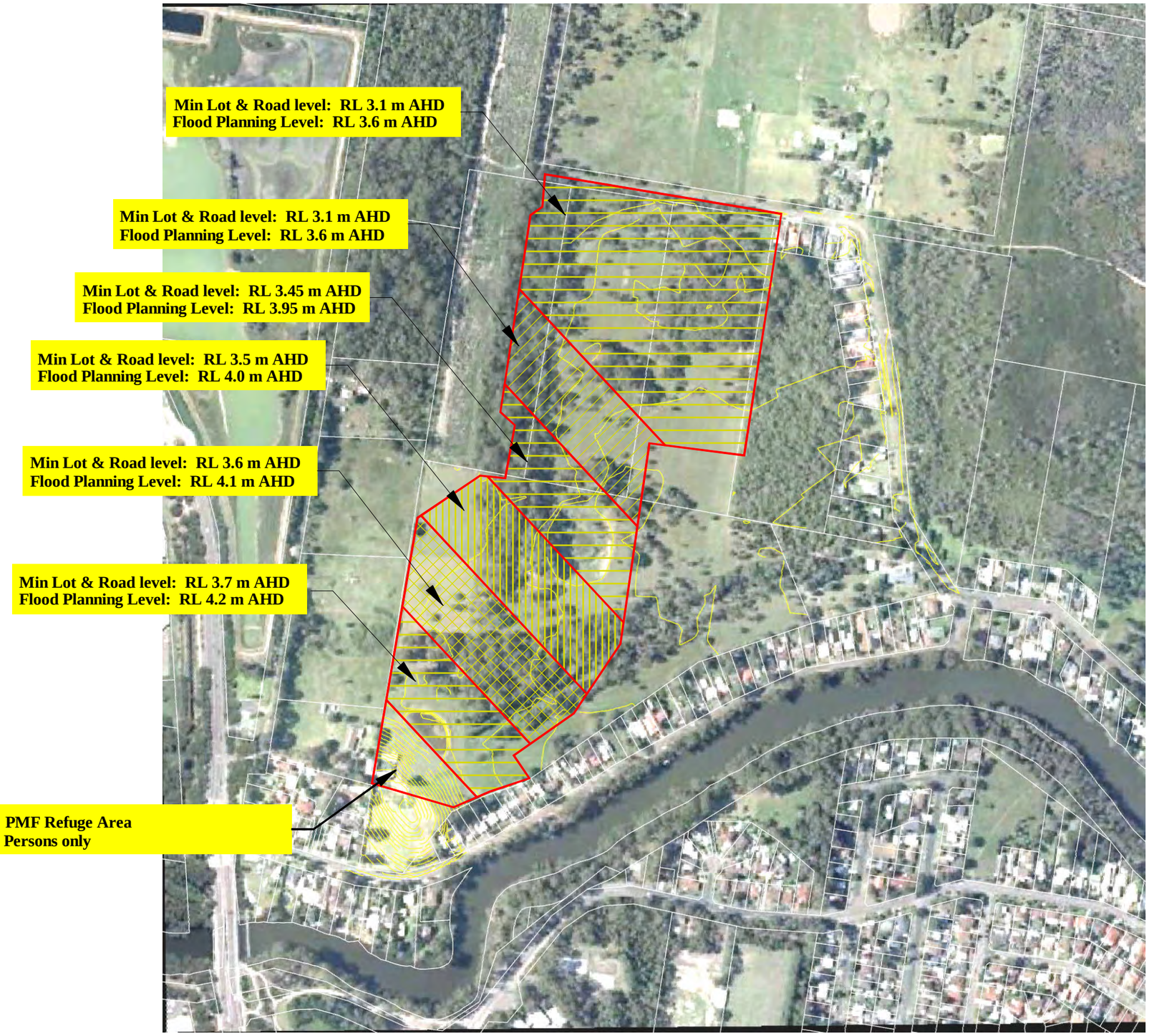
We would be happy to answer any queries you may have

Yours faithfully

K W Paterson.
Director

Encl: Figure R1 – Development Controls - Flooding

IDA SAFE CONSTRUCTIONS PTY LTD
LAND RE-ZONING, CHITTAWAY



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Metres

FIGURE R1

DEVELOPMENT CONTROLS - FLOODING
(Revised 22 October 2012)

DATE: 22 October 2012
DISK REF: 12021
FIG REF: 12021_R1_Development Controls_Flooding_Revisions_V1

Better Transport Futures

Mark Waugh Pty Limited
ABN 67 106 169 180
Transport Planning & Engineering

Rezoning of land, Geoffrey Road, Chittaway Bay,

Traffic Impact Assessment

May 2011

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Contents

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Document History and Status

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Final	Rev02	Ian Adams ï Paradigm Planning	1	13th October 2011	M Waugh

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Author:	Sean Morgan
Name of Organisation:	Paradigm Planning
Name of Project:	Proposed Residential development, Chittaway Bay, NSW
Name of Document:	Traffic and Parking Impact Assessment
Document Version:	Final
Project Number:	P0815

1. Introduction

Background
Better Transport Futures has been commissioned by Paradigm Planning and Development Consultants Pty Ltd on behalf of IDA Safe Constructions Pty Ltd to prepare a Traffic Impact Assessment for the proposed rezoning of Lots 1-3 DP 21536, Lot 1 DP 134363, Lot 1 DP 1014033 and Lot 1 DP 22467 Geoffrey Road and Church Road, Chittaway Bay from 1(c) Non-Urban to 2(a) Residential. Due to the size of the development and its location adjacent to Wyong Road (MR335) the Roads and Traffic Authority for NSW (RTA) will be required to review the proposal prior to formal rezoning.

Scope of Report
The scope of this report is to review the traffic implications for the proposed development including identifying any constraints in the surrounding road system which might limit the development of the site from a traffic and transport perspective. The report will also provide advice on access issues, internal car park layout and issues relating to service vehicles.

Issues and Objectives of the study
The issues relevant to the proposal are:

- Assess impact on the arterial and local road network due to the additional traffic flows;
- Assess the capacity of the roundabout intersection of Wyong Road and Geoffrey Road;
- Review the access arrangements for the development; and
- Assess any other transport impacts associated with the development.

The objective of the report is to document the impacts of the proposed development, provide advice on any infrastructure work required as part of the development and to determine the extent of the capacity of the existing road network and in particular any constraints which might limit the development.

Planning Context
As part of the development of this document, the following guides and publications were used:

- RTA Guide to Traffic Generating Developments, Version 2.2 Dated October 2002;
- Australian / New Zealand Standard ï Parking Facilities Part 1 : off-street car parking (AS2890.1:2004);
- Accident Data for the locality by the RTA (Hunter Office)
- Wyong Shire Council DCP 2005 Chapter 61 Carparking and Chapter 66 Subdivision
- Wyong Shire Council On-road Bicycle and Shared Pathway Strategy 2010

2. Existing Situation

2.1 Site Description and Proposed Activity

2.1.1 Site Location and Access

The site boundary is shown in the aerial photograph below (**Figure 2-1**).

The approximate areas of the lots making up the subject site are listed below and have a total area of 28.53 hectares.

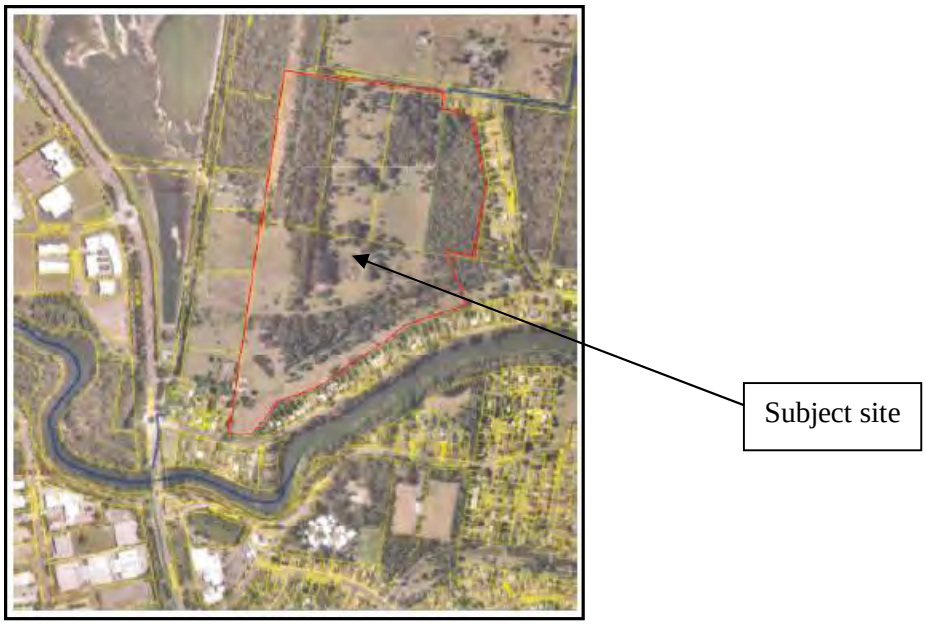
- Lot 1 DP 21536 3.986 ha
- Lot 2 DP 21536 4.050 ha
- Lot 3 DP 21536 4.042 ha
- Lot 1 DP 134363 12.97 ha
- Lot 1 DP 1014033 3.277 ha
- Lot 1 DP 22467 0.2063 ha

Lots 1-3 DP 21536, Lot 1 DP 134363, Lot 1 DP 1014033 and Lot 1 DP 22467 Geoffrey Road and Church Road, Chittaway Bay are currently zoned 1(c) Non-Urban with the proposal to rezone to 2(a) Residential .

The site is bounded to the east by existing residential development along Church Road and to the south by existing residential development along Geoffrey Road. The north-west corner of the site adjoins the buffer area of the Wyong South Sewerage Treatment Plant and the western and northern boundaries abut larger rural-residential blocks.

Access to the site is currently available off Geoffrey Road. This access has been approved for upgrade as part of the approved development for a residential subdivision in the south fronting Geoffrey Road. (Appendix A). Access is also available off Church Road.

The location of the site is shown below in **Figure 2.1.**



Source: Paradigm Planning

- **Figure 2.1 - Site Location**

2.2 Existing Traffic Conditions

2.2.1 Road Hierarchy

Wyong Road

The major road through the locality is Wyong Road which is a classified main road (MR335) providing a road link between the F3, Wyong and Tuggerah to the north and Berkely Vale, Tumbi Umbi and Shelleys Beach to the south. As a classified main road Wyong Road requires RTA concurrence for any works on or adjacent to the road. To the south of the site it connects with Enterprise Drive which provides a westerly connection to the Pacific Highway at Ourimbah.

In the locality of the subject site, it provides two lanes of travel in both directions with a raised central median island and operates under a posted speed limit of 70 km/h. It connects with Geoffrey Road via a four leg, dual lane roundabout and to the south crosses over Ourimbah Creek on a two deck bridge (the 4th leg provides access to the adjacent Lees Reserve area). There is a sealed shoulder and kerb and guttering along the majority of its length with provision for emergency stopping adjacent to the kerb. Parking along Wyong Road is prohibited along the majority of its length and within the vicinity of Geoffrey Road.

There is a separate shared footway / cycleway path provided along both sides of the road that continues over the river bridge. On its western side the shared pathway continues north in its built form to form part of the Wyong Shire Council off-road shared pathway for both cycling and pedestrian use.

- **Photo 1** View south along Wyong Road showing typical cross section and bridge over Ourimbah Creek.

■ **Photo 2** Roundabout at intersection of Wyong Road and Geoffrey Road.

Geoffrey Road

Geoffrey Road to the south of the site is a local Council road providing access to residential lots located along the peninsula forming Chittaway Point. It connects with Church Road for access north to rural blocks. In the vicinity of the subject site it provides an overall width in the order of 10.5 metres with a single lane of travel in both directions. The posted speed limit in the vicinity of the site is 50 km/h and in this locality there are no footpaths or shoulders. There are street lights along the length of Geoffrey Road and parking is permitted along both sides of the road subject to normal restrictions adjacent to intersections.

Development is generally along the northern side of Geoffrey Road due to Ourimbah Creek running south of the roadway. There are limited residential lots at the western end of Geoffrey Road on both sides. East of its intersection with Church Road the residential development does occur along both sides of the road. There are few intersections along its length. The intersection of Church Road provides give way priority to the western leg of Geoffrey Road with give way signs on both Church and Geoffrey Road (east). Other intersections are simple, give way controlled.

■ **Photo 3** View along Geoffrey Road showing typical cross section

Church Road

Church Road is a local Council road and provides an alternate connection between the subject site and Tuggerah to the north. It runs along the northern side and eastern side of the site. It provides a single lane of travel with an overall width in the order of 5.0 metres. There are no footpaths or kerb and guttering along its length with grass verges generally provided to both sides. Church Road provides access to a number of individual residential lots and a number of rural users as well as connecting with the road network north of the site providing a route to Tuggerah. Parking is permitted along both sides of the road.

■ **Photo 4** View along Church Road showing typical cross section.

2.2.2 Road works

As part of the approved subdivision development on the southern portion of the site fronting Geoffrey Road, a new access has been approved by Council (**Appendix A**). It is understood that other than routine maintenance by the road authorities this is the only plan for any major road network changes in the immediate vicinity of the subject site. Given the low traffic flows along Geoffrey Road it can be seen that there is minimal requirements to upgrade the roads in this location.

2.2.3 Traffic Management Works

It is understood that there are no planned traffic management works in the immediate vicinity of the subject site. Currently Wyong Shire Council is holding discussions with the RTA to assess the intersection of Wyong Road and Enterprise Drive. This roundabout currently suffers from delays along Wyong Road in the morning and afternoon peak and acts as a constraint to the road network. The State Government nominated this upgrade as part of a funding announcement for the area.

Wyong Road provides an important link in the road network in the locality and as such carries a high daily traffic and suffers from delays / congestion during the critical morning and afternoon peak periods. There have been a number of upgrades along this length of road completed by the RTA to reduce these delays and congestion.

2.2.4 Cycling Facilities

There is a well developed shared pathway on the western side of Wyong Road and some lengths of formed pathways on the eastern side including a crossing over the Ourimbah Creek which then connects under the bridge over Ourimbah Creek. These then join an off-road pathway along

Chittaway Road to the Tuggerah Lakeôs edge which meanders around Chittaway Bay to The Entrance. (see **Figure 2-1 below**).

■ **Figure 2-1 Shared Pathway Projects in the Chittaway Bay area**

The Wyong Shire Council On-Road Bicycle and Shared Pathway Strategy has identified further priority projects within this general vicinity including along Enterprise Drive although there are no identified pathways nominated in the vicinity of the subject site.

Table 3: Proposed Priority Roads for Bicycle Lane Improvements within the Wyong Shire (not listed in priority order)

No	Road	From	To	Responsible authority
1	Central Coast Highway	Bateau Bay (Shire Boundary)	Scenic Road, Budgewoi	Roads and Traffic Authority
2	Elizabeth Bay Drive.	Ourringo Street	Pacific Hwy	Roads and Traffic Authority
3	Sparks Road	F3 on/off ramps, Warnervale	Sparks Road / Pacific Hwy	Roads and Traffic Authority
4	Main Road	Wallarah Point Bridge	Central Coast Highway	Roads and Traffic Authority
5	Wallarah Road	Sparks Road / Pacific Hwy	Wallarah Point Bridge	Roads and Traffic Authority
6	Pacific Highway	Ourimbah (Shire Boundary)	Crangan Bay (Shire Boundary)	Roads and Traffic Authority
7	Wyong Road	F3 on/off ramps, Tuggerah	Central Coast Highway	Roads and Traffic Authority
8	Enterprise Drive / Chittaway Road	Pacific Hwy, Ourimbah	Wyong Road / Chittaway Road	Roads and Traffic Authority

■ **Table 2-1 Extract from the Wyong Shire Council On-Road Bicycle and Shared Pathway Strategy with proposed priority roads for improvement.**

2.3 Traffic Flows

The proposed rezoning is for a residential subdivision development. Access will be provided via connections to Geoffrey Road. Traffic flows would be typical of residential development, with distinct peaks during the morning and afternoon periods associated with commuting trips, school trips etc.

2.3.1 Daily Traffic Flows

There is limited data available with regard to daily traffic flows in the immediate vicinity of the subject site. However observations on site indicate that overall the traffic flows adjacent to the subject site are low along Geoffrey Road and well within acceptable limits for these local roads. It can be seen that Geoffrey Road provides limited access along the stretch of the peninsula and limited development to the immediate north of the site.

Peak hour surveys completed by Better Transport Futures at the roundabout intersection of Wyong Road and Geoffrey Road on Wednesday 6th April 2011 in the morning and afternoon peaks indicate that the two-way traffic flow along Geoffrey Road is in the order of 210 vehicles during the peak hours. Allowing for a typical value of 10% of daily flows representing the peak flows, this would indicate the daily flows along Geoffrey Road are in the order of 2,100 per day.

Wyong Road is a major road throughout the area providing a connection to the F3 Sydney to Newcastle Freeway. This road carries traffic flows reflecting its classification as a State Main Road. Surveys in the AM and PM peak indicate that the two way flow along Wyong Road at this location is 2206 in the AM peak and 2336 in the PM peak.

The RTA Count Station (05049) north of the site provides AADT data for the 2008 year of 33,706 vehicles per day reflecting the more consistent flow of traffic along this main road and the peak traffic hour volumes reflecting closer to 8% of the daily flows.

STATION	ROAD	LOCATION	1998	2001	2004	2005	2006	2007	2008	07 & 08
			AADT	AADT	AADT	AADT	AADT	AADT	AADT	Flag
05.049	WYONG RD,MR335	TUGGERAH-E OF SH10,PACIFIC HWY	30223	--	35266	--	--	--	33706	Axle Pair

- **Table 2-2 Extract from Hunter Region 2007 and 2008 Annual Average Daily Traffic**

2.3.2 Daily Traffic Flow Distribution

Based on the observed traffic movements during both the morning and afternoon peak periods, it can be seen that there is an equal desire for traffic to turn left and right out of Geoffrey Road onto Wyong Road during the morning peak and then the reverse movement into Geoffrey Road during the PM peak.

It is considered that the subject development site with residential development would show a similar bias with the majority of traffic turning right out of the subject site and then being evenly split both north and south bound onto Wyong Road, in the morning peak and the reverse inbound trips in the afternoon.

2.3.3 Vehicle Speeds

No vehicle speed measurements have been taken as part of the study work. Observations on site would indicate that the majority of traffic appears to travel within the posted speed limits, with no obvious signs of excessive speed. Geoffrey Road provides a relatively straight alignment and with limited development to one side of the road only, could potentially encourage drivers to speed. However, it is noted that as part of the construction for the approved residential subdivision at this location that there will be a raised pavement provided on Geoffrey Road that will help to constrain vehicle speeds to the posted limit of 50 km/h. This would indicate there is potentially some issues with speeding traffic in this location.

2.3.4 Existing Site Flows

The site is currently unoccupied and as such there is no current traffic generation from the site.

2.3.5 Heavy Vehicle Flows

Heavy goods vehicles representing 2-3% of traffic flows were observed along Wyong Road during the site visits. This reflects the classification of Wyong Road as a main road and would be representative of this road type. A number of heavy vehicles were observed turning into and out of Geoffrey Road during the survey period. These were associated with local deliveries and Council refuse collection vehicles.

2.3.6 Current Road Network Operation

Observations on site indicate the current road network operates well with minimal delays for the majority of traffic movements.

The roundabout intersection of Geoffrey Road and Wyong Road can create short delays for the right turn out of Geoffrey Road due to the constant flow of south bound traffic however the right turn into Geoffrey Road creates turning opportunities for outbound vehicles.

2.4 Traffic Safety and Accident History

Accident data for the locality is collected by the RTA. Data from the RTA reveals that there have been 14 accidents with the vicinity of the roundabout in the past 5 years, three involving injuries but none fatal. 50% of accidents involved single vehicles travelling north along Wyong Road and running off the road.

The new subdivision road being constructed to connect with Geoffrey Road is on the inside of a slight bend on the southern edge of the site. This intersection has been designed to incorporate a traffic calming device (speed table) to ensure that traffic speeds in this location are contained to the posted speed of 50km/h.

Overall it is considered that the road in this location provides a safe and acceptable layout for existing road users.

2.5 Parking Supply and Demand

2.5.1 On-street Parking Provision

Currently vehicles can park on the verges on the local streets in the general vicinity of the subject site. There are no parking controls restricting the general use of this parking as required.

The construction of the new approved access point into the site will require general restrictions in accordance with standard road rules each side of the new road way to ensure adequate site lines are maintained.

2.5.2 Off-Street Parking Provision

Off-street parking in the general locality of the subject site is provided within the residential lots.

2.5.3 Parking Demand and Utilisation

During the site work there was minimal on-street parking demand observed. The majority of the parking demand was satisfied within the site boundaries of the various lots with very little demand for on-street parking in the locality of the subject site.

2.5.4 Set down or pick up areas

There are no formal set down or pick up areas in the locality of the site.

2.6 Public Transport

Chittaway Bay is well serviced with public transport having access to both regular rail and bus services.

2.6.1 Rail Station Locations

Tuggerah Railway Station is located 2.5 kilometres north of the site. It provides access to the Hunter and Central Coast Intercity Rail line providing regular services both north to Newcastle and Lake Macquarie and south to Gosford and Sydney.

Tuggerah Commuter Car Park and Bus Interchange was upgraded in 2009 and now provides over 500 parking spaces, kiss and ride facilities and motor bike and bicycle parking. Observations on site indicate that these facilities are well used.

2.6.2 Bus Stops and Associated Facilities

Red Bus Services provide a number of bus routes which travel along Wyong Road with Route 27 providing a dedicated service along Geoffrey Road. This service is infrequent and focussed on the non peak periods of 10am ï 3pm offering 5 services per day. It is not available during the peak commuter periods although alternate routes pick up along Wyong Road and provide commuter connection to Tuggerah Station to connect with trains at this station (Refer Appendix for Red Bus Services timetable).

■ **Figure 2-2** Red Bus Services Bus Routes in the Chittaway Bay area.

School services are available along Geoffrey Road servicing students travelling to local primary and high schools.

2.6.3 Pedestrians

There are currently no pedestrian facilities in the vicinity of the site however there is an extensive shared pathway on the western side of Wyong Road forming part of the Wyong Shire Off-Road Cycle and Pathway network. On the eastern side there are portions of pedestrian pathways including access across the Ourimbah Creek adjacent to Wyong Road. The western pathway connects with the shared pathway that meanders around Chittaway Bay south towards the The Entrance.

2.7 Other Proposed Developments

The southern portion of the site, zoned for residential use has been approved for the development of a residential subdivision. This development includes 9 residential sites (8 new and 1 existing) and the construction of a roadway and access point onto Geoffrey Road.

Discussions with Council indicate that there are currently no other significant developments proposed in the immediate vicinity of the subject site.

3. Proposed Development

3.1 The Development

The proposed rezoning application is being prepared by Paradigm Planning and Development Consultants Pty Ltd for Lots 1-3 DP 21536, Lot 1 DP 134363, Lot 1 DP 1014033 and Lot 1 DP 22467 Geoffrey Road and Church Road, Chittaway Bay and the land is to be rezoned from 1(c) Non-Urban to 2(a) Residential.

3.1.1 Nature of Development

The proposal is to rezone Lots 1-3 DP 21536, Lot 1 DP 134363, Lot 1 DP 1014033 and Lot 1 DP 22467 Geoffrey Road and Church Road, Chittaway Bay to 2(a) Residential to enable a residential subdivision providing some 200 residential lots, with a variety of lot sizes. Access to the site will be via a single access off Geoffrey Road as well as the option for additional secondary access (one or two) off Church Road.

3.1.2 Access and Circulation Requirements

The primary access to the site will be via a new access point being developed in conjunction with an approved sub-division on the southern end of the site, fronting Geoffrey Road. This access point will allow for all turning movements. Additional accesses may also be developed along the eastern and northern sides of the site onto Church Road. There will be an internal network of residential estate roads, the design and construction of which will be in accordance with Council DCP 2005 Chapter 66 Subdivisions.

3.2 Access

3.2.1 Driveway Location

The primary access point will be located as an extension to the approved access off Geoffrey Road (Appendix B). This approved access is on the inside of a slight bend and is being constructed to include a speed table to contain traffic speeds in this location. Additional access points may be considered from the site onto Church Road north or east of the site.

3.2.2 Sight Distances

An important issue with relation to the access point is the provision of adequate sight visibility splays for traffic entering and exiting the site as well as through drivers being able to see the intersection and adjust their vehicle as required. For the posted speed limit of 50 km/h the required visibility splay is 80 metres.

The location of the access point provides adequate site visibility for the posted speed limit of 50km/h however a speed table is included in the design to contain speeds in this location, providing further safety at this point. This recognises the existing issue of some vehicles speeding along Geoffrey Road in this location.

Church Road provides a straight alignment of over 330 metres on both the northern and eastern sides of the site which will provides adequate visibility for the development of potential access points.

3.2.3 Service Vehicle Access

The site will allow for access for typical service vehicle requirements associated with residential subdivisions. This will include Council refuse collection vehicles as well as occasional large delivery vehicles. All service vehicles will enter and exit the site in a forward direction. The detailed design stage will allow for normal Council requirements and it is considered that the future internal layout will be designed to allow for safe and appropriate access as required for service vehicles.

3.2.4 Queuing at entrance to site

Given the comparatively low traffic flows on the external road network adjacent to the subject site it is considered that there will be minimal queuing at the site entry points. It can be seen that the majority of traffic will have an origin / destination west of the site towards Wyong Road and for the access point on Geoffrey Road this will require a left turn in and right turn out, which will mean any queue will be contained within the site. Thus there will be minimal impact upon the traffic movements along the external road link.

3.2.5 Comparison with existing site access

The existing site is currently served by a number of driveways providing access to individual lots including the eastern and northern edges of the site onto Church Road as well as the southern edge fronting Geoffrey Road. It is anticipated (and is addressed later in this report) that the future development will be able to access the road network through an access onto Geoffrey Road and possibly secondary access onto Church Road. All redundant existing driveway access points will be removed as part of the development of the site.

3.2.6 Access to Public Transport

There are currently limited services for buses in the immediate vicinity of the site with five bus services per day along Geoffrey Road plus school bus runs. There are however alternate and more frequent bus routes that travel along Wyong Road within 200 metres of the subject site. It can be seen that with 200 lots there may be a demand for public transport, for access to the local facilities and connection to the rail network. However it is considered that access for buses within the subject site will not be required as adequate access is currently provided along the Geoffrey Road route.

In accordance with the Wyong Shire Council DCP 2005 (Section 3.5 Footpaths and Cycleways) the site will however need to provide adequate shared pedestrian and cycle access to public transport along Geoffrey Road.

3.3 Circulation

3.3.1 Pattern of circulation

Traffic will enter the site in a forward direction with manoeuvring available within the site on the internal roads to allow for traffic to be able to exit in a forward direction.

3.3.2 Road width

The internal roads will be designed and constructed in accordance with Council Residential Subdivision guidelines. All roads must allow for two-way traffic movements. The road that will provide access to the proposed site has been designed in accordance with Council guidelines to allow for the existing approved development as well as future development on the subject site and will accommodate the flows associated with 200 residential lots.

3.3.3 Internal Bus Movements

It is considered that there would not be the demand for an internal bus route through the site to provide access for future residents to local facilities and the rail network. Any increase in demand for bus travel generated by this development may increase demand along Geoffrey Road for the current services.

Bus services in the vicinity of the site previously included Church Road - however this route was modified following community consultation in December 2009 and is now restricted to Geoffrey Road.

3.4 Parking

3.4.1 Proposed Supply

All parking for this proposed development will be contained within the site.

3.4.2 Authority Parking Requirements

RTA Parking Requirements

The RTA Guide to Traffic Generating Developments indicates that a single space is required per residential dwelling but that two spaces are preferable.

Wyong Shire Council DCP Car Parking Requirements

The Wyong Shire Council Development Control Plan requires two parking spaces per dwelling where the gross floor area of the proposed dwelling is 125 square metres of more and 1 space per dwelling for smaller dwellings.

Given the size of the development area it is considered that parking provision on site can be accommodated within the site footprint with no impacts upon the external road network. Visitor parking can be accommodated on driveways or within the internal road network with no external impacts.

3.4.3 Parking Layout

The design of the dwellings and the associated parking will be provided in accordance with Council design requirements and will be detailed during the detailed design stage of the development.

3.4.4 Parking Demand

The development will have its peak parking demand over night and the provision of parking in accordance with the Council DCP will ensure the normal peak demand can be accommodated within the development site with no impact upon the external road network.

3.4.5 Service Vehicle Parking

As a proposed residential subdivision there will be no requirement or demand for a dedicated service area.

3.4.6 Bicycle Parking

Bicycle parking can be provided within the overall site footprint and will be determined as part of the detailed design of the future subdivision. Typically, parking for bicycles can be satisfied within the garages provided for each dwelling.

4. Impact of Proposed Development

4.1 Traffic Generation

As a worst case scenario this assessment has been based on the proposed development having all access onto Geoffrey Road only.

4.1.1 Daily and Seasonal Factors

It is considered that a future residential development will have minimal daily and seasonal variation in traffic flows. Weekend flows may be slightly lower than the working week Monday to Friday but overall the flows will be reasonably consistent.

4.1.2 Pedestrian Movements

Pedestrian access and movements to the subject site is an important consideration in the development of the site. It is considered that access will be required internal to the site throughout the development and that off road paths should be provided to cater for the demands of the future residents in and around the subdivision. The use of paths connecting between residential roads or at the end of cul de sacs allows for ease of movement through the site with reduced distance for pedestrians (and cyclists) providing a distinct benefit.

The internal design of the development will be in accordance with Councilôs DCP which includes requirements for pedestrians in accordance with óSafer by Designô (CPTED) principles and will be considered during the DA Stage. The design of the internal roads and paths for pedestrians will be completed during the detailed design stage of the project.

It can also be seen that there will be potential pedestrian (and cyclists) desire lines for movements towards the shared pathway along Wyong Road. This matter will be reviewed at the development application stage and is not relevant to the rezoning application.

4.2 Traffic Distribution and Assignments

4.2.1 Hourly Distribution of Trips

The level of traffic generated by the proposed development has been assessed in accordance with the RTA Guide to Traffic Generating Developments. This guide indicates that typically residential developments such as this generate some 0.85 trips per dwelling during the peak hours and 9 trips per day. For the proposed rezoning of a maximum lot yield of 200 lots has been allowed. This gives 170 trips during the peaks and potentially 1800 trips per day.

Outside of the peak hours, the flows associated with the residential development would be much lower. Typically flows at night are negligible for suburban residential subdivisions such as the subject site.

4.2.2 Origin / destinations assignment

It is considered that nearly all of the traffic associated with the development will desire access towards Wyong Road. Access onto Geoffrey Road will be via the approved new intersection being constructed. Traffic will then enter the roundabout intersection on Wyong Road where it is expected to have a destination of 50% north and 50% south, consistent with current traffic movements observed during the survey.

4.3 Impact on Road Safety

The additional traffic flows associated with the development of the subject site will have an acceptable impact upon the overall traffic safety in the general vicinity of the subject site. The key intersections of the site and Geoffrey Road and Geoffrey Road and Wyong Road are well laid out and provide an adequate carriageway width to allow for turning movements. Visibility splays at both intersections are good and allow for safe traffic movements. The inclusion of a traffic calming platform at the new intersection of the site and Geoffrey Road will further reinforce appropriate driver behaviour.

The review of accident data for the locality indicates that there have been limited accidents in the general vicinity of the subject site involving turning movements from Geoffrey Road. This indicates that there are no inherent safety issues associated with the current layout of this intersection.

Overall it is considered that there will be a minimal impact upon road safety in the locality.

4.4 Impact of Generated Traffic

4.4.1 Impact on daily Traffic Flows

The daily level of traffic generated by the proposed development has been assessed in accordance with the RTA Guide to Traffic Generating Developments. Typical peak hour flows would be in the order of 170 vehicles whilst daily flows will be in the order of 1,800 trips per day (giving 900 inbound and 900 outbound per day).

As a local collector street, Geoffrey Road can carry between 3,000 and 5,000 vehicles per day (based on the environmental capacity performance of standards on residential streets, RTA Guide to Traffic Generating Development, dated October 2002). With the current AADT being in the order of 2,100 vehicles per day there is scope for up to an additional 2,900 vehicles per day to use this road. This is greater than the potential daily flows predicted from the proposed rezoned site (1800 two-way).

For the local roads immediately surrounding the site, it can be seen that there will be increased movements in and out of the site but that the overall flows will be acceptable upon the overall capacity of the road network. The key issue will be the impact at the intersection and the capacity of these intersections.

4.4.2 Peak Hour Impacts on Intersections

One of the critical intersections is that of the site and Geoffrey Road. Advice from the study team is that this approved intersection has been designed with this potential rezoning in mind. Both this intersection and the intersection of Geoffrey Road and Wyong Road have been assessed using the SIDRA modelling tool to consider the impacts of future development on these intersections.

The Sidra modelling shows that the additional traffic associated with the proposed development will have an acceptable impact upon the road network in the immediate vicinity of the subject site. The Sidra analysis has been completed for both the AM and PM peak periods for the intersection of Geoffrey Road and Wyong Road as well as the site access off Geoffrey Road.

The Sidra analysis has been completed for both the current 2011 traffic conditions as well as the future scenario. In accordance with normal RTA requirements, the assessment has been completed for the future design year of 2021, allowing for background growth of 2% per annum along Wyong Road and Geoffrey Road.

The results of the Sidra analysis for the 3 base case (without development flows) are presented below in **Table 4-1** below:

- **Table 4-1 – Base Scenario, NO development flows**

Scenario	Approach	Level of service	Delay (secs)	Queue (m)
2011 AM base	Wyong Rd South	A	6.0	24.1
	Geoffrey Road	A	11.3	2.4
	Wyong Rd North	A	4.7	15.2
2011 PM base	Wyong Rd South	A	6.1	15.8
	Geoffrey Road	A	12.1	2.2
	Wyong Rd North	A	4.9	28.3
2021 AM base	Wyong Rd South	A	6.2	33.6
	Geoffrey Road	A	12.0	3.3
	Wyong Rd North	A	4.7	20.4
2021 PM base	Wyong Rd South	A	6.2	33.6
	Geoffrey Road	A	12.0	3.3
	Wyong Rd North	A	4.7	20.4

The intersection was then assessed for the future scenario with the additional traffic associated with the subject development site. The results of this analysis are presented in **Table 4-2** below.

- **Table 4-2 Future Scenario, WITH development flows**

Scenario	Approach	Level of service	Delay (secs)	Queue (m)
2011 AM base+dev	Wyong Rd South	A	6.5	27.2
	Geoffrey Road	A	11.5	5.3
	Wyong Rd North	A	4.7	16.6
2011 PM base+dev	Wyong Rd South	A	6.5	17.9
	Geoffrey Road	A	12.4	3.0
	Wyong Rd North	A	5.5	34.2
2021 AM base+dev	Wyong Rd South	A	6.8	38.9
	Geoffrey Road	A	12.2	7.5
	Wyong Rd North	A	4.8	22.7
2021 PM base+dev	Wyong Rd South	A	6.6	24.2
	Geoffrey Road	A	13.7	5.1
	Wyong Rd North	A	6.0	52.1

The above results confirm that the additional traffic associated with the proposed development will have a minimal impact upon the intersection of Wyong Road and Geoffrey Road.

The site access allows for all turning movements, and the operation of this intersection has been assessed with Sidra. The results of this Sidra analysis are presented below in **Table 4-3:**

- **Table 4-3 – Site Access on Geoffrey Road**

Scenario	Approach	Level of service	Delay (secs)	Queue (m)
2011 AM base+dev	Geoffrey Rd east	A	1.0	4.3
	Site access	A	7.4	3.4
	Geoffrey Rd west	A	1.8	0.0
2011 PM base+dev	Geoffrey Rd east	A	4.0	4.8
	Site access	A	7.6	0.6
	Geoffrey Rd west	A	3.2	0.0
2011 AM base+dev	Geoffrey Rd east	A	1.1	5.3
	Site access	A	7.6	3.5
	Geoffrey Rd west	A	1.6	0.0
2011 PM base+dev	Geoffrey Rd east	A	4.3	6.0
	Site access	A	7.7	0.6
	Geoffrey Rd west	A	2.9	0.0

The above analysis demonstrates that the proposed single vehicle access to the full residential development has adequate capacity with minimal delays for all road users.

4.4.3 Impact of Construction Traffic

The majority of the construction work will be located on site and as such will have a minimal impact upon the adjacent road network. The works on site will require some specialist machinery e.g. cranes, excavators as well as construction workers to access the site. Typically site construction work occurs between 7.00 AM and 4.00 AM and thus will have little impact upon the traditional peak periods.

All works on site will be governed by the relevant EP&A rules and as stipulated within any development consent granted by Wyong Shire Council. This will include hours of work. As part of the development approval process, a Traffic Control Plan (TCP) may be required.

4.4.4 Other Developments

The approved development to the south of the site will not impact upon this proposed development.

4.4.5 Assessment of Traffic Noise

An assessment of traffic noise is beyond the scope of work and expertise of Better Transport Futures.

4.5 Public Transport

4.5.1 Options for improving services

It is considered that the proposed development will not create a need to improve local public transport services as there is considered adequate spare capacity on current routes.

4.5.2 Pedestrian Access to Bus Stops

All of the internal residential roads will allow for pedestrian access in accordance with Councilôs residential subdivision guide.

4.6 Recommended Works

4.6.1 Improvements to Access and Circulation

It is considered that the approved site access provides a safe and appropriate access arrangement for the site. All access points and internal roads will be designed and constructed in accordance with Councilôs Residential Subdivision guidelines. Due to the low speed environment within the site, internal movements will be able to operate in a safe and appropriate manner.

4.6.2 Improvements to External Road Network

It is considered that there is no need to improve the external road network as the newly approved intersection provides appropriate access to the site.

4.6.3 Improvements to Pedestrian Facilities

It is considered that there are no improvements necessary to pedestrian facilities in support of this rezoning application.

4.6.4 Effect of Recommended Works on Adjacent Developments

There will be no effect on adjacent developments.

4.6.5 Effect of Recommended Works on Public Transport Services

There will be no effect on public transport services.

4.6.6 Provision of LATM Measures

There are no other LATM measures required as part of this development.

4.6.7 Funding

There are no measures requiring funding as part of this rezoning.

4.6.8 Noise Attenuation

Any noise attenuation measures will be assessed by others.

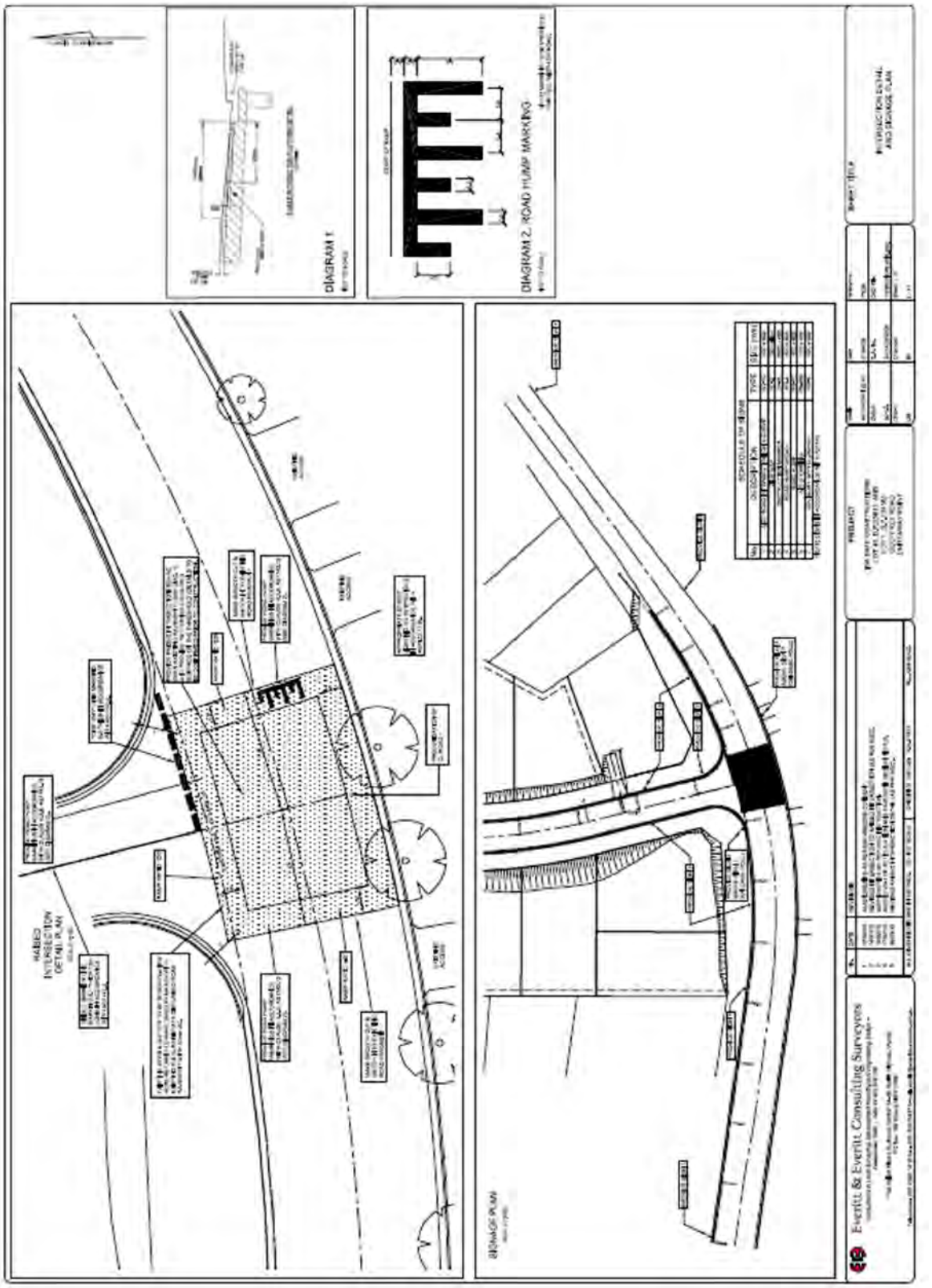
5. Summary and Conclusions

The following conclusions are drawn from the investigations into the proposed rezoning of Lots 1-3 DP 21536, Lot 1 DP 134363, Lot 1 DP 1014033 and Lot 1 DP 22467 Geoffrey Road and Church Road, Chittaway Bay from 1(c) Non-Urban to 2(a) Residential:

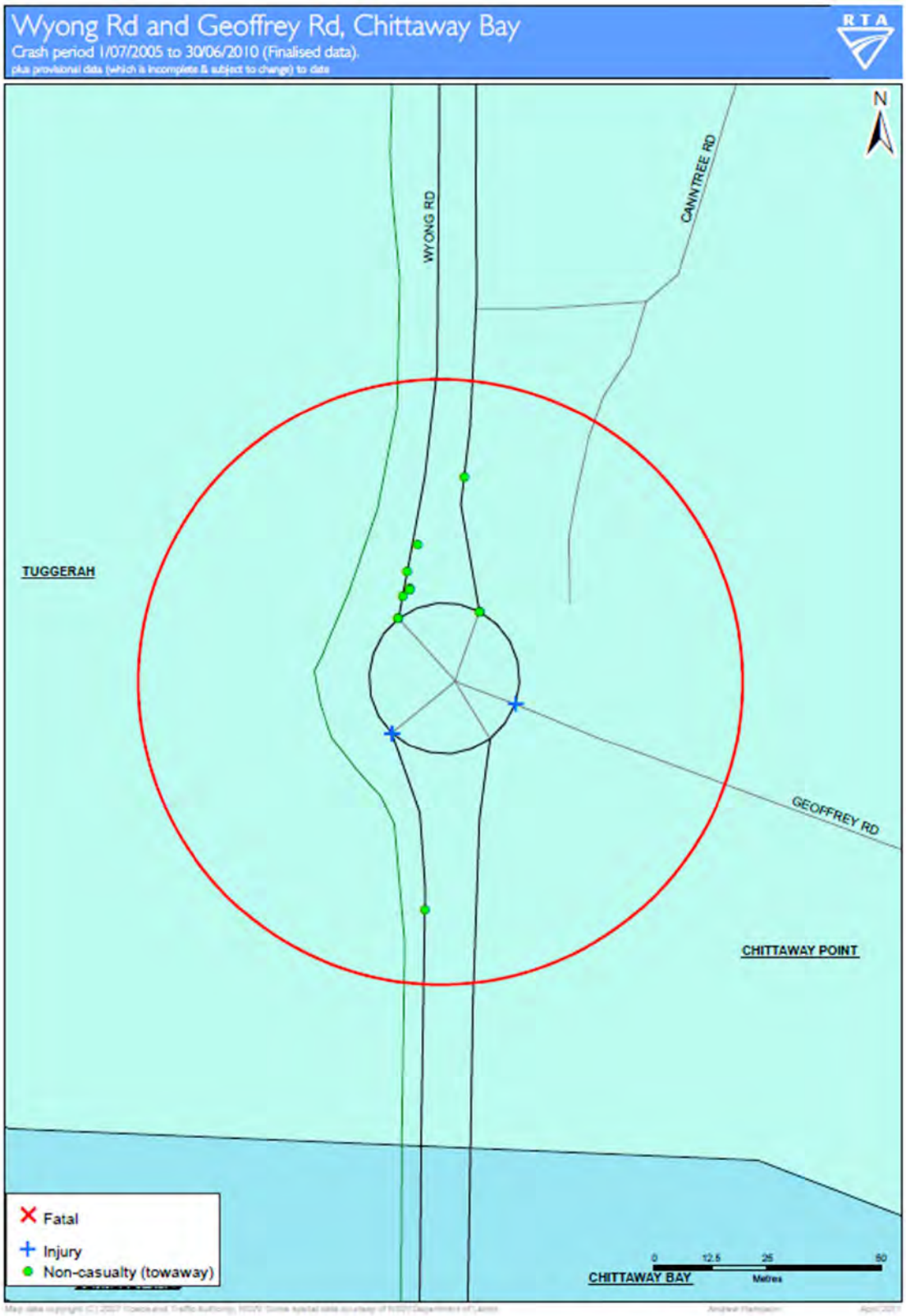
1. The proposed rezoning is to consider a future residential subdivision providing in the order of 200 lots. Primary access will be provided via a newly approved and constructed intersection off Geoffrey Road. Secondary access may be considered north or east of the site onto Church Road. All parking can be contained on site.
2. The site is currently occupied by a number of rural holdings.
3. The major road though the locality providing access to the subject site is Wyong Road. It provides two lanes of travel in both directions and suffers from minimal delays and congestion in the general locality of the site although does suffer from delays further south at its intersection with Enterprise Drive.
4. Geoffrey Road is a local Council road providing access to the local residents primarily along the peninsula to Chittaway Point. This road provides a wide pavement width in the order of 10.5 metres with no footpaths.
5. As part of the study, traffic data was collected at the key intersection of Wyong Road and Geoffrey Road as the majority of the traffic generated by the proposed rezoning will access the broader road network through this intersection. The on-site observations show that the current traffic flows are low in the vicinity of the site along Geoffrey Road. They are much higher along Wyong Road, consistent with its classification as a State Main Road. There is minimal delay for existing road users along Geoffrey Road. The intersection of Geoffrey Road and Wyong Road also performs well during the morning and afternoon peak periods.
6. Based on advice from the RTA Guide to Traffic Generating Developments, the proposed development of up to 200 lots could generate some 170 vehicle movements during the peak periods and 1,800 throughout the day. It is considered that the majority of traffic will turn right onto Geoffrey Road and then will be equally split between north and south travelling along Wyong Road.
7. The existing road network in the general vicinity of the subject site currently operates with minimal delays and congestion for the existing road users. There are minimal delays for the existing road users and it is considered that the additional traffic flow associated with development of the subject site will have a minimal impact upon the overall operation of the road network. The Sidra analysis for the site access as well as for the intersection of Wyong Road and Geoffrey Road indicates that the additional traffic associated with the development will have an acceptable impact upon both of these intersections.
8. A review of the accident data provided by the RTA indicates that there have been 14 accidents in the general vicinity of the subject site over the last 5 years. Half of these accidents occurred north bound on Wyong Road with through traffic running off the road to the left, reflecting possibly excessive speed and inadequate vehicle control through the roundabout. Only two accidents involved vehicles turning out of Geoffrey Road and given the good road layout in the locality it is considered that this will not alter considerably due to the proposed development.
9. The main access point for the site will be via the newly built intersection approved as part of the development of the existing 2(a) Residential zoned portion of the site. This access has been assessed using SIDRA and is considered adequate for the site and its potential development. This design of this intersection includes a traffic calming platform to ensure traffic remains within the sign posted speed limit of 50 km/h.

The overall conclusion from the investigations is that traffic and parking arrangements for the rezoning proposal are satisfactory and that there is no traffic or parking impediments to the application.

Appendix A Approved Intersection on Geoffrey Road



Appendix B Accident Data



RTA

Detailed Crash Report - sorted

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors	S F
Hunter Region			Natural Lighting	Wyong LGA		Chittaway Bay			Wyong Rd												
484053	09/07/2005	Sat	08:20	10m N	GEOFFREY RD	RDB	CRV	Overcast	Wet	70	2	UTE	M18	N in WYONG RD	60	Proceeding in lane	N	0	0	S	
E24404034				Daylight		DCA: 305		Same - Lane side swipe				CAR	M67	N in WYONG RD	50	Proceeding in lane					
Hunter Region				Wyong LGA		Tuggerah			Wyong Rd												
520413	15/05/2006	Mon	09:10	20m N	GEOFFREY RD	DIV	CRV	Raining	Wet	70	1	CAR	F51	N in WYONG RD	60	Proceeding in lane	N	0	0	S	
E27083846				Daylight		DCA: 803	L	Off right bend,into obj				Treebush									
Hunter Region				Wyong LGA		Chittaway Bay			Wyong Rd												
587101	19/05/2007	Sun	16:00	10m N	GEOFFREY RD	RDB	STR	Raining	Wet	70	1	CAR	F46	N in WYONG RD	40	Proceeding in lane	N	0	0	F	
E30920730				Daylight		DCA: 701		Off carriageway to left													
Hunter Region				Wyong LGA		Chittaway Poin			Wyong Rd												
629900	29/06/2008	Sun	16:18	at	GEOFFREY RD	RDB	STR	Fine	Dry	70	1	M/C	M52	W/in WYONG RD	40	Proceeding in lane	I	0	1	F	
E34805242				Daylight		DCA: 705		Out of control on cway													
Hunter Region				Wyong LGA		Berkeley Vale			Wyong Rd												
633053	24/07/2008	Thu	11:36	at	GEOFFREY RD	RDB	STR	Overcast	Dry	70	2	CAR	M26	S in WYONG RD	Unk	Other forward	N	0	0		
E34384328				Daylight		DCA: 300		Same - other				4WD	F50	S in WYONG RD	Unk	Other forward					
Hunter Region				Wyong LGA		Chittaway Bay			Wyong Rd												
638109	29/07/2008	Tue	17:30	at	GEOFFREY RD	RDB	STR	Fine	Dry	70	2	CAR	F62	N in WYONG RD	Unk	Turning right	N	0	0		
E36478230				Darkness		DCA: 202		Opp - Right-thru				CAR	F62	S in WYONG RD	Unk	Proceeding in lane					
Hunter Region				Wyong LGA		Chittaway Bay			Wyong Rd												
641012	02/10/2008	Thu	15:51	at	GEOFFREY RD	RDB	STR	Fine	Dry	Unk	2	CAR	F64	W/in GEOFFREY RD	20	Turning right	I	0	2		
E68022101				Daylight		DCA: 102		Adj - Right-thru from left				BDBL	M60	N in WYONG RD	25	Proceeding in lane					
Hunter Region				Wyong LGA		Tuggerah			Wyong Rd												
642270	29/10/2008	Wed	12:00	30m N	CANNTREE RD	DIV	CRV	Raining	Wet	70	2	UTE	F52	N in WYONG RD	50	Incorrect side	N	0	0	S	
E35551712				Daylight		DCA: 201		Opp - Head on				CAR	M46	S in WYONG RD	40	Proceeding in lane					
Hunter Region				Wyong LGA		Chittaway Bay			Wyong Rd												
666166	19/04/2009	Sun	20:30	at	GEOFFREY RD	RDB	STR	Overcast	Wet	70	1	CAR	F19	N in WYONG RD	45	Proceeding in lane	N	0	0		
E39857688				Darkness		DCA: 703		Left off cway,into object				Treebush									
Hunter Region				Wyong LGA		Tuggerah			Wyong Rd												
668555	23/05/2009	Sat	08:20	5 m N	GEOFFREY RD	RDB	STR	Overcast	Wet	70	1	WAG	F18	N in WYONG RD	40	Proceeding in lane	N	0	0		
E12308208				Daylight		DCA: 701		Off carriageway to left													

Rep ID: DCR02 Office: Hunter User ID: hampsone

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RTA

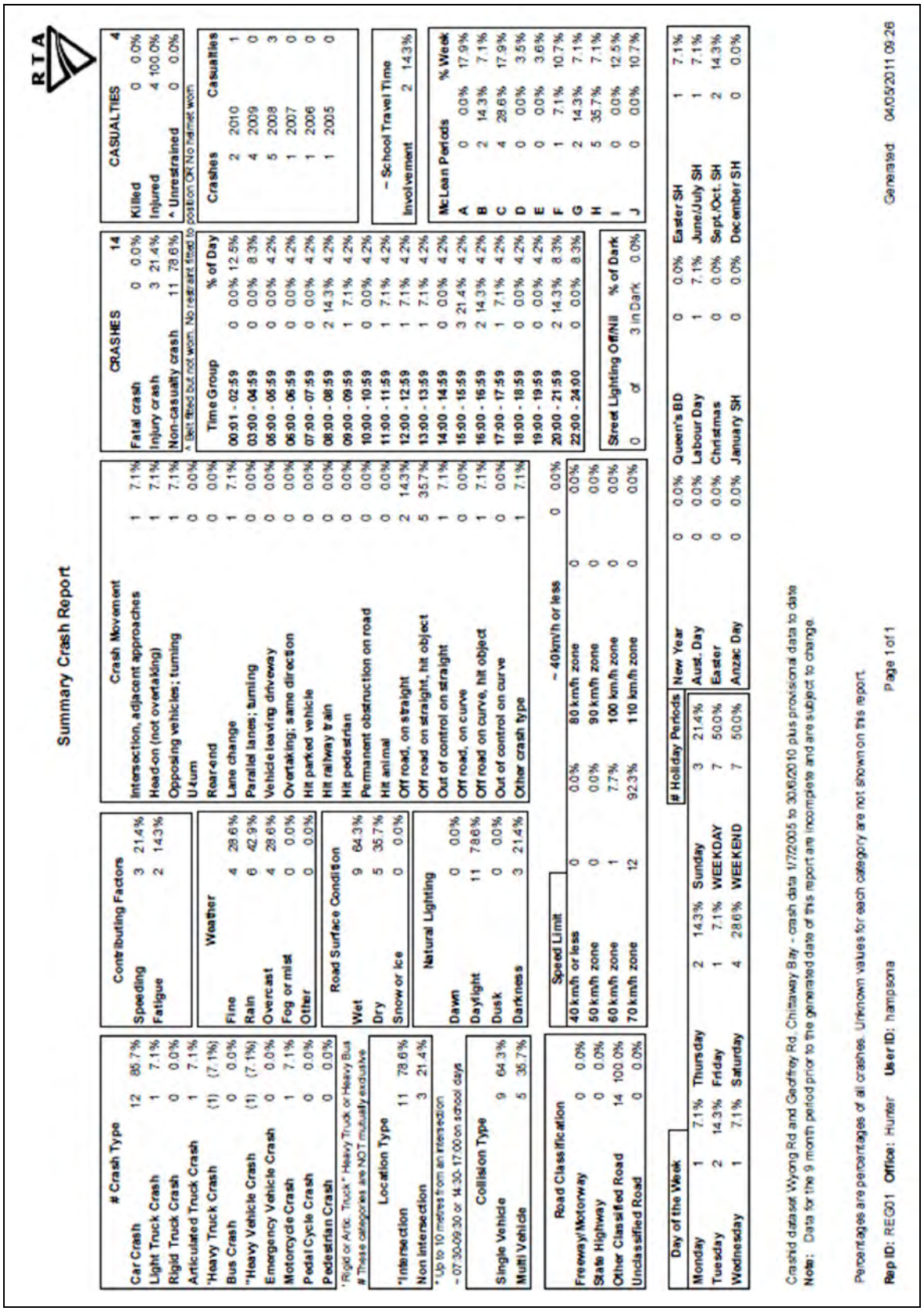
Detailed Crash Report - sorted

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	S F Factors
Hunter Region				**Wyong LGA**	**Natural Lighting**	**Chittaway Bay**			**Wyong Rd**											
683883	03/10/2009	Sat	15:10	at	GEOFFREY RD	RDB	STR	Raining	Wet	70	1	CAR	M20	N in WYONG RD	40	Proceeding in lane	N	0	0	
E174059563					Daylight	DCA: 703		Left off cway into object				Treebuin								
Hunter Region				**Wyong LGA**		**Chittaway Bay**			**Wyong Rd**											
693751	18/12/2009	Fri	15:30	40m S	GEOFFREY RD	DIV	STR	Fine	Dry	60	1	TRK	M63	W in WYONG RD	Unk	Proceeding in lane	N	0	0	
E40461965					Daylight	DCA: 703		Left off cway into object				Treebuin								
Hunter Region				**Wyong LGA**		**Chittaway Bay**			**Wyong Rd**											
706341	30/03/2010	Tue	13:15	at	GEOFFREY RD	RDB	STR	Raining	Wet	70	1	CAR	F19	N in WYONG RD	30	Proceeding in lane	I	0	1	
E40234275					Daylight	DCA: 703		Left off cway into object				Treebuin								
Hunter Region				**Wyong LGA**		**Chittaway Bay**			**Wyong Rd**											
731277	23/10/2010	Sat	20:30	10m N	GEOFFREY RD	RDB	STR	Raining	Wet	70	1	CAR	M25	N in WYONG RD	40	Proceeding in lane	N	0	0	
E25491492					Darkness	DCA: 703		Left off cway into object				Treebuin								
Report Totals:				Total Crashes: 14		Fatal Crashes: 0			Injury Crashes: 3						Killed: 0		Injured: 4			

Crashid dataset Wyong Rd and Godfrey Rd, Chittaway Bay - crash data 1/7/2005 to 30/6/2010 plus provisional data to date
Note: Ordered by: Crash Date,Crash Time,Crash No. Data for the 9 month period prior to the generated date of this report are incomplete and are subject to change.

Rep ID: DCR02 **Office:** Hunter **User ID:** hampsonk

Generated: 04/05/2011 09:20



Summary Crash Report

RTA

# Crash Type		
Car Crash	12	85.7%
Light Truck Crash	1	7.1%
Rigid Truck Crash	0	0.0%
Articulated Truck Crash	1	7.1%
*Heavy Truck Crash	(1)	(7.1%)
Bus Crash	0	0.0%
*Heavy Vehicle Crash	(1)	(7.1%)
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	1	7.1%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	0	0.0%

* Rigid or Artic. Truck * Heavy Truck or Heavy Bus
# These categories are NOT mutually exclusive

Location Type		
*Intersection	11	78.6%
Non Intersection	3	21.4%

* Up to 10 metres from an intersection
- 07:30-09:30 or 14:30-17:00 on school days

Collision Type		
Single Vehicle	9	64.3%
Multi Vehicle	5	35.7%

Contributing Factors		
Speeding	3	21.4%
Fatigue	2	14.3%

Weather		
Fine	4	28.6%
Rain	6	42.9%
Overcast	4	28.6%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	9	64.3%
Dry	5	35.7%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	0	0.0%
Daylight	11	78.6%
Dusk	0	0.0%
Darkness	3	21.4%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	14	100.0%
Unclassified Road	0	0.0%

Crash Movement		
Intersection, adjacent approaches	1	7.1%
Head-on (not overtaking)	1	7.1%
Opposing vehicles; turning	1	7.1%
U-turn	0	0.0%
Rear-end	0	0.0%
Lane change	1	7.1%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	2	14.3%
Off road on straight, hit object	5	35.7%
Out of control on straight	1	7.1%
Off road, on curve	0	0.0%
Off road on curve, hit object	1	7.1%
Out of control on curve	0	0.0%
Other crash type	1	7.1%

Speed Limit				
40 km/h or less	0	0.0%	80 km/h zone	0	0.0%
50 km/h zone	0	0.0%	90 km/h zone	0	0.0%
60 km/h zone	1	7.7%	100 km/h zone	0	0.0%
70 km/h zone	12	92.3%	110 km/h zone	0	0.0%

~ 40km/h or less: 0 0.0%

Day of the Week					
Monday	1	7.1%	Thursday	2	14.3%
Tuesday	2	14.3%	Friday	1	7.1%
Wednesday	1	7.1%	Saturday	4	28.6%
Sunday	3	21.4%			
WEEKDAY	7	50.0%			
WEEKEND	7	50.0%			

# Holiday Periods			
New Year	0	0.0%	Queen's BD	0	0.0%
Aust. Day	0	0.0%	Labour Day	1	7.1%
Easter	0	0.0%	Christmas	0	0.0%
Anzac Day	0	0.0%	January SH	0	0.0%

CRASHES		
Fatal crash	0	0.0%
Injury crash	3	21.4%
Non-casualty crash	11	78.6%

^ Belt fitted but not worn. No restraint fitted to position ON No Helmet worn

Time Group		% of Day
00:01 - 02:59	0	0.0%
03:00 - 04:59	0	0.0%
05:00 - 05:59	0	0.0%
06:00 - 06:59	0	0.0%
07:00 - 07:59	0	0.0%
08:00 - 08:59	2	14.3%
09:00 - 09:59	1	7.1%
10:00 - 10:59	0	0.0%
11:00 - 11:59	1	7.1%
12:00 - 12:59	1	7.1%
13:00 - 13:59	1	7.1%
14:00 - 14:59	0	0.0%
15:00 - 15:59	3	21.4%
16:00 - 16:59	2	14.3%
17:00 - 17:59	1	7.1%
18:00 - 18:59	0	0.0%
19:00 - 19:59	0	0.0%
20:00 - 21:59	2	14.3%
22:00 - 24:00	0	0.0%

Street Lighting Off/Nil		% of Dark
0 of	3 in Dark.	0.0%

CASUALTIES		
Killed	0	0.0%
Injured	4	100.0%
^ Unrestrained	0	0.0%

Crashes	Casualties
2	2010	1
4	2009	0
5	2008	3
1	2007	0
1	2006	0
1	2005	0

~ School Travel Time		
Involvement	2	14.3%

McLean Periods		% Week
A	0	0.0%	17.9%
B	2	14.3%	7.1%
C	4	28.6%	17.9%
D	0	0.0%	3.5%
E	0	0.0%	3.6%
F	1	7.1%	10.7%
G	2	14.3%	7.1%
H	5	35.7%	7.1%
I	0	0.0%	12.5%
J	0	0.0%	10.7%

Easter SH		
June/July SH	1	7.1%
Sept./Oct. SH	1	7.1%
December SH	2	14.3%
	0	0.0%

Crashes dataset Wyong Rd and Geoffrey Rd, Chittaway Bay - crash data 1/7/2005 to 30/6/2010 plus provisional data to date
Note: Data for the 9 month period prior to the generated date of this report are incomplete and are subject to change.

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Rep ID: REG01 Office: Hunter User ID: hampsonia Page 1 of 1 Generated: 04/05/2011 09:26

Appendix C Traffic Survey Results

Curtis Traffic Surveys

Turning movement count

Job:
Day, date: Wed 6 Apr 11
Location: Wyong Rd & Geoffrey Rd
Weather: Fine
Client: Better Transport Futures

Peak Hour Volumes: 962, 23, 57, 58, 1151, 35

Time Period	From Wyong Rd south: Through Light vehicles	Through Heavy vehicles	Right Light vehicles	Right Heavy vehicles	From Geoffrey Rd: Left Light vehicles	Left Heavy vehicles	Right Light vehicles	Right Heavy vehicles	From Wyong Rd north: Left Light vehicles	Left Heavy vehicles	Through Light vehicles	Through Heavy vehicles	Total	
07:30 to 07:45	239	3	3	0	6	0	4	0	2	0	178	5	440	
07:45 to 08:00	265	7	9	0	4	0	9	0	5	0	212	3	514	
08:00 to 08:15	291	4	5	2	12	0	17	0	9	0	235	7	582	
08:15 to 08:30	287	4	7	0	15	1	11	0	4	0	227	5	561	
08:30 to 08:45	283	6	11	1	17	0	15	1	7	0	242	4	587	peak
08:45 to 09:00	267	9	8	1	13	0	13	0	3	0	236	6	556	
09:00 to 09:15	296	5	13	0	7	1	17	0	6	0	219	4	568	
09:15 to 09:30	263	5	9	0	12	0	17	1	3	0	230	2	542	
Total	2191	43	65	4	86	2	103	2	39	0	1779	36		
Hourly summary														
07:30 to 08:30	1082	18	24	2	37	1	41	0	20	0	852	20	2097	
07:45 to 08:45	1126	21	32	3	48	1	52	1	25	0	916	19	2244	
08:00 to 09:00	1128	23	31	4	57	1	56	1	23	0	940	22	2286	peak hour
08:15 to 09:15	1133	24	39	2	52	2	56	1	20	0	924	19	2272	
08:30 to 09:30	1109	25	41	2	49	1	62	2	19	0	927	16	2253	

Curtis Traffic Surveys

Turning movement count

Job:
Day, date: Wed 6 Apr 11
Location: Wyong Rd & Geoffrey Rd
Weather: Fine
Client: Better Transport Futures

Peak Hour Volumes: 1393, 63, 35, 49, 829, 65

Time Period	From Wyong Rd south: Through Light vehicles	Through Heavy vehicles	Right Light vehicles	Right Heavy vehicles	From Geoffrey Rd: Left Light vehicles	Left Heavy vehicles	Right Light vehicles	Right Heavy vehicles	From Wyong Rd north: Left Light vehicles	Left Heavy vehicles	Through Light vehicles	Through Heavy vehicles	Total	
14:30 to 14:45	197	4	11	0	9	0	6	0	10	0	267	8	512	
14:45 to 15:00	211	7	13	1	12	1	9	0	13	1	315	12	595	
15:00 to 15:15	226	10	16	1	16	0	5	0	17	1	354	15	661	peak
15:15 to 15:30	202	2	14	0	13	0	7	1	10	0	336	9	594	
15:30 to 15:45	164	7	20	0	7	0	12	1	19	2	348	4	584	
15:45 to 16:00	179	2	17	0	19	1	5	0	11	0	355	3	592	
16:00 to 16:15	156	9	12	2	9	0	14	0	9	1	363	8	583	
16:15 to 16:30	148	5	15	0	9	1	8	0	13	0	327	6	532	
16:30 to 16:45	165	6	17	3	16	0	6	1	18	0	275	8	515	
16:45 to 17:00	121	7	14	0	22	0	4	0	14	0	256	3	441	
17:00 to 17:15	117	3	12	2	20	0	10	1	12	1	281	7	466	
17:15 to 17:30	134	2	7	1	18	1	5	0	9	0	288	4	469	
17:30 to 17:45	115	2	10	0	19	0	2	0	11	0	230	3	392	
17:45 to 18:00	126	3	6	0	21	1	4	0	7	0	245	3	416	
18:00 to 18:15	105	5	3	1	16	0	2	0	9	0	236	5	382	
18:15 to 18:30	94	2	3	0	9	0	3	0	6	0	216	2	335	
Total	2460	76	190	11	235	5	102	4	188	6	4692	100		
Hourly summary														
14:30 to 15:30	836	23	54	2	50	1	27	1	50	2	1272	44	2362	
14:45 to 15:45	803	26	63	2	48	1	33	2	59	4	1353	40	2434	peak hour
15:00 to 16:00	771	21	67	1	55	1	29	2	57	3	1393	31	2431	
15:15 to 16:15	701	20	63	2	48	1	38	2	49	3	1402	24	2353	
15:30 to 16:30	647	23	64	2	44	2	39	1	52	3	1393	21	2291	
15:45 to 16:45	648	22	61	5	53	2	33	1	51	1	1320	25	2222	
16:00 to 17:00	590	27	58	5	56	1	32	1	54	1	1221	25	2071	
16:15 to 17:15	551	21	58	5	67	1	28	2	57	1	1139	24	1954	
16:30 to 17:30	537	18	50	6	76	1	25	2	53	1	1100	22	1891	
16:45 to 17:45	487	14	43	3	79	1	21	1	46	1	1055	17	1768	
17:00 to 18:00	492	10	35	3	78	2	21	1	39	1	1044	17	1743	
17:15 to 18:15	480	12	26	2	74	2	13	0	36	0	999	15	1659	
17:30 to 18:30	440	12	22	1	65	1	11	0	33	0	927	13	1525	

Appendix D Bus Timetable

Wyong Rd Corridor

The Entrance to Wyong
via Bay Village, Berkeley Vale & Tuggerah

Red Bus Services

Monday to Friday

map ref	Route	16	24	16	15	24	16	15	24	16	15	24	16	15	24
		am	am	am	am	am	am	am	am	am	am	am	am	am	am
A	**The Entrance** (Torrens Av)	4.33	4.49	5.12	....	5.20	5.43	....	5.47	6.11	....	6.15	6.42	....	6.46
B	Central Coast Hwy & Pacific St	4.37	....	5.16	....	....	5.47	....	....	6.15	....	....	6.47	....	....
C	Stella St & Bay Rd	....	4.55	....	....	5.26	....	....	5.53	....	....	6.21	....	....	6.52
D	**Bay Village**	....	....	....	5.17	....	....	5.49	....	....	6.17	....	....	6.48	....
E	Wyong Rd & South St	4.43	5.03	5.21	....	5.34	5.53	....	6.02	6.21	....	6.30	6.53	....	7.02
F	Eastern Rd & Sherry St	....	5.07	....	5.22	5.38	....	5.54	6.06	....	6.22	6.34	....	6.53	7.06
G	**Mingara Recreation Club**	....	....	....	....	....	....	....	....	....	....	....	....	....	....
H	Wyong Rd & Pindarri Av	....	....	....	5.28	....	....	6.00	....	....	6.28	....	....	7.00	....
I	Jubilee Pde & Kilkenny Pde	4.50	5.15	5.28	....	5.46	6.00	....	6.14	6.28	....	6.42	7.00	....	7.14
J	**Berkeley Vale Retirement Village**	....	....	....	....	....	....	....	....	....	....	....	....	....	....
K	Wyong Rd & Berkeley Rd	....	5.18	....	5.29	5.49	....	6.01	6.17	....	6.29	6.45	....	7.01	7.17
L	Berkeley Rd & Bundeena Av	....	5.19	....	5.30	5.50	....	6.02	6.18	....	6.30	6.46	....	7.02	7.18
M	Bottlebrush Dr & Torrellia Wy	....	....	....	....	....	....	....	....	....	....	....	....	....	....
N	Lakedge Av & Albatross Rd	4.54	5.24	5.32	....	5.55	6.04	....	6.23	6.32	....	6.51	7.04	....	7.23
O	Albatross Rd & Platypus Rd	....	....	....	....	....	....	....	....	....	....	....	....	....	....
P	Kalua Dr & Aloha Dr	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Q	Wyong Rd & Chittaway Rd	4.57	5.27	5.35	5.35	5.58	6.07	6.07	6.26	6.35	6.35	6.54	7.07	7.07	7.26
R	Geoffrey Rd & Henry St	....	....	....	....	....	....	....	....	....	....	....	....	....	....
S	**Tuggerah Station East**	5.02	5.32	5.40	5.40	6.03	6.12	6.12	6.31	6.40	6.40	6.58	7.12	7.12	7.31
	Train to Sydney departs	*5.07*	*5.38*	*N5.45*	*N5.45*	*6.08*	*N6.17*	*N6.17*	*6.38*	*N6.45*	*N6.45*	*7.03*	*N7.17*	*N7.17*	*7.41*
	Train to Newcastle departs	*5.35*	....	....	....	*6.09*	*6.33*	*6.33*	....	*6.50*	*6.50*	....	*7.17*	*7.17*	....
T	**Westfield Tuggerah**	....	....	....	....	....	....	....	....	....	....	7.03	7.17	....	7.36
U	Woodbury Park Dr & Brickendon Av	5.07	5.37	....	....	6.08	....	....	6.36	6.45	....	7.08	7.22	....	7.41
V	**Tuggerah Station West**	....	....	....	....	....	....	6.16	....	....	....	....	....	7.16	....
W	**Wyong Station**	5.13	5.43	....	....	6.13	....	6.20	6.42	6.51	....	7.14	7.28	7.20	7.47
X	**Wyong Plaza**	....	....	....	....	....	....	....	....	....	....	....	T7.32	....	T7.51
Y	**Wyong Hospital**	....	....	....	....	....	....	....	....	....	....	....	7.44	....	....

Explanations

G – Route 19 operates between Gosford and Bay Village as per Route 23 then continues to Wyong as per Route 26.
N – Train operates to or from North Sydney.
R – Bus operates via Reliance Dr and Pioneer Av (Tuggerah Business Park) in lieu of Wyong Rd.
T – Bus operates via Wyong TAFE.
.... – Bus does not operate past this timing point.

Appendix E Sidra Output

INTERSECTION SUMMARY

Site: 2011 Site access AM peak

Site access on Geoffrey Road AM peak
Giveway / Yield (Two-Way)

Intersection Performance - Hourly Values				
Performance Measure	Vehicles		Persons	
Demand Flows (Total)	364	veh/h	437	pers/h
Percent Heavy Vehicles	0.0	%		
Degree of Saturation	0.116			
Practical Spare Capacity	590.7	%		
Effective Intersection Capacity	3144	veh/h		
Control Delay (Total)	0.40	veh-h/h	0.48	pers-h/h
Control Delay (Average)	3.9	sec	3.9	sec
Control Delay (Worst Lane)	7.5	sec		
Control Delay (Worst Movement)	7.5	sec	7.5	sec
Geometric Delay (Average)	P	sec		
Stop-Line Delay (Average)	P	sec		
Intersection Level of Service (LOS)	NA			
95% Back of Queue - Vehicles (Worst Lane)	0.6	veh		
95% Back of Queue - Distance (Worst Lane)	4.3	m		
Total Effective Stops	119	veh/h	142	pers/h
Effective Stop Rate	0.33	per veh	0.33	per pers
Proportion Queued	0.23		0.23	
Performance Index	5.7		5.7	
Travel Distance (Total)	208.9	veh-km/h	250.7	pers-km/h
Travel Distance (Average)	574	m	574	m
Travel Time (Total)	4.7	veh-h/h	5.6	pers-h/h
Travel Time (Average)	46.3	sec	46.3	sec
Travel Speed	44.6	km/h	44.6	km/h
Cost (Total)	141.22	$/h	141.22	$/h
Fuel Consumption (Total)	18.8	L/h		
Carbon Dioxide (Total)	47.1	kg/h		
Hydrocarbons (Total)	0.076	kg/h		
Carbon Monoxide (Total)	2.87	kg/h		
NOx (Total)	0.092	kg/h		

P: You need to Process this Site (F9) for this variable to be computed.

Level of Service (LOS) Method: Delay (RTA NSW).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2011 Site access AM peak

Site access on Geoffrey Road AM peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Geoffrey Road east											
5	T	121	0.0	0.066	0.9	LOS A	0.6	4.3	0.33	0.00	46.0
6	R	3	0.0	0.066	7.4	LOS A	0.6	4.3	0.33	0.81	43.1
Approach		124	0.0	0.066	1.0	NA	0.6	4.3	0.33	0.02	46.0
North: Site access											
7	L	15	0.0	0.034	6.6	LOS A	0.0	0.3	0.15	0.56	42.8
9	R	140	0.0	0.116	7.5	LOS A	0.5	3.4	0.30	0.63	42.0
Approach		155	0.0	0.116	7.4	LOS A	0.5	3.4	0.29	0.62	42.1
West: Geoffrey Road west											
10	L	24	0.0	0.044	6.4	LOS A	0.0	0.0	0.00	0.80	43.3
11	T	61	0.0	0.044	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		85	0.0	0.044	1.8	NA	0.0	0.0	0.00	0.23	47.9
All Vehicles		364	0.0	0.116	3.9	NA	0.6	4.3	0.23	0.33	44.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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INTERSECTION SUMMARY

Site: 2011 Site access PM peak

Site access on Geoffrey Road PM peak
Giveway / Yield (Two-Way)

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	402	veh/h	483	pers/h
Percent Heavy Vehicles	1.7	%		
Degree of Saturation	0.144			
Practical Spare Capacity	455.1	%		
Effective Intersection Capacity	2790	veh/h		
Control Delay (Total)	0.42	veh-h/h	0.50	pers-h/h
Control Delay (Average)	3.7	sec	3.7	sec
Control Delay (Worst Lane)	7.6	sec		
Control Delay (Worst Movement)	9.6	sec	9.6	sec
Geometric Delay (Average)	P	sec		
Stop-Line Delay (Average)	P	sec		
Intersection Level of Service (LOS)	NA			
95% Back of Queue - Vehicles (Worst Lane)	0.7	veh		
95% Back of Queue - Distance (Worst Lane)	4.8	m		
Total Effective Stops	129	veh/h	155	pers/h
Effective Stop Rate	0.32	per veh	0.32	per pers
Proportion Queued	0.16		0.16	
Performance Index	6.1		6.1	
Travel Distance (Total)	231.0	veh-km/h	277.2	pers-km/h
Travel Distance (Average)	574	m	574	m
Travel Time (Total)	5.1	veh-h/h	6.1	pers-h/h
Travel Time (Average)	45.7	sec	45.7	sec
Travel Speed	45.3	km/h	45.3	km/h
Cost (Total)	155.16	$/h	155.16	$/h
Fuel Consumption (Total)	21.0	L/h		
Carbon Dioxide (Total)	52.6	kg/h		
Hydrocarbons (Total)	0.082	kg/h		
Carbon Monoxide (Total)	3.02	kg/h		
NOx (Total)	0.100	kg/h		

P: You need to Process this Site (F9) for this variable to be computed.

Level of Service (LOS) Method: Delay (RTA NSW).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2011 Site access PM peak

Site access on Geoffrey Road PM peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Geoffrey Road east											
5	T	88	3.0	0.071	3.0	LOS A	0.7	4.8	0.53	0.00	43.7
6	R	15	0.0	0.071	9.6	LOS A	0.7	4.8	0.53	0.82	41.8
Approach		103	2.6	0.071	4.0	NA	0.7	4.8	0.53	0.12	43.4
North: Site access											
7	L	3	0.0	0.008	6.9	LOS A	0.0	0.1	0.23	0.55	42.5
9	R	24	0.0	0.021	7.6	LOS A	0.1	0.6	0.32	0.62	41.9
Approach		27	0.0	0.021	7.6	LOS A	0.1	0.6	0.31	0.61	42.0
West: Geoffrey Road west											
10	L	137	0.0	0.144	6.4	LOS A	0.0	0.0	0.00	0.73	43.3
11	T	135	3.0	0.144	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		272	1.5	0.144	3.2	NA	0.0	0.0	0.00	0.37	46.4
All Vehicles		402	1.7	0.144	3.7	NA	0.7	4.8	0.16	0.32	45.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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INTERSECTION SUMMARY

Site: 2021 Site access AM peak

Site access on Geoffrey Road AM peak 2021
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

Intersection Performance - Hourly Values				
Performance Measure	Vehicles		Persons	
Demand Flows (Total)	401	veh/h	481	pers/h
Percent Heavy Vehicles	0.0	%		
Degree of Saturation	0.120			
Practical Spare Capacity	566.0	%		
Effective Intersection Capacity	3335	veh/h		
Control Delay (Total)	0.42	veh-h/h	0.50	pers-h/h
Control Delay (Average)	3.7	sec	3.7	sec
Control Delay (Worst Lane)	7.7	sec		
Control Delay (Worst Movement)	7.7	sec	7.7	sec
Geometric Delay (Average)	P	sec		
Stop-Line Delay (Average)	P	sec		
Intersection Level of Service (LOS)	NA			
95% Back of Queue - Vehicles (Worst Lane)	0.8	veh		
95% Back of Queue - Distance (Worst Lane)	5.3	m		
Total Effective Stops	121	veh/h	145	pers/h
Effective Stop Rate	0.30	per veh	0.30	per pers
Proportion Queued	0.26		0.26	
Performance Index	6.2		6.2	
Travel Distance (Total)	229.8	veh-km/h	275.7	pers-km/h
Travel Distance (Average)	574	m	574	m
Travel Time (Total)	5.1	veh-h/h	6.2	pers-h/h
Travel Time (Average)	46.2	sec	46.2	sec
Travel Speed	44.7	km/h	44.7	km/h
Cost (Total)	154.77	$/h	154.77	$/h
Fuel Consumption (Total)	20.6	L/h		
Carbon Dioxide (Total)	51.5	kg/h		
Hydrocarbons (Total)	0.083	kg/h		
Carbon Monoxide (Total)	3.10	kg/h		
NOx (Total)	0.100	kg/h		

P: You need to Process this Site (F9) for this variable to be computed.

Level of Service (LOS) Method: Delay (RTA NSW).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2021 Site access AM peak

Site access on Geoffrey Road AM peak 2021
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Geoffrey Road east											
5	T	145	0.0	0.079	1.0	LOS A	0.8	5.3	0.36	0.00	45.7
6	R	3	0.0	0.079	7.6	LOS A	0.8	5.3	0.36	0.81	43.1
Approach		148	0.0	0.079	1.1	NA	0.8	5.3	0.36	0.02	45.7
North: Site access											
7	L	15	0.0	0.034	6.7	LOS A	0.0	0.3	0.16	0.56	42.7
9	R	140	0.0	0.120	7.7	LOS A	0.5	3.5	0.33	0.64	41.9
Approach		155	0.0	0.120	7.6	LOS A	0.5	3.5	0.32	0.64	42.0
West: Geoffrey Road west											
10	L	24	0.0	0.051	6.4	LOS A	0.0	0.0	0.00	0.81	43.3
11	T	73	0.0	0.051	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		97	0.0	0.051	1.6	NA	0.0	0.0	0.00	0.20	48.1
All Vehicles		401	0.0	0.120	3.7	NA	0.8	5.3	0.26	0.30	44.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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INTERSECTION SUMMARY

Site: 2021 Site access PM peak

Site access on Geoffrey Road PM peak
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	447	veh/h	536	pers/h
Percent Heavy Vehicles	1.8	%		
Degree of Saturation	0.158			
Practical Spare Capacity	405.6	%		
Effective Intersection Capacity	2824	veh/h		
Control Delay (Total)	0.45	veh-h/h	0.54	pers-h/h
Control Delay (Average)	3.6	sec	3.6	sec
Control Delay (Worst Lane)	7.8	sec		
Control Delay (Worst Movement)	10.0	sec	10.0	sec
Geometric Delay (Average)	P	sec		
Stop-Line Delay (Average)	P	sec		
Intersection Level of Service (LOS)	NA			
95% Back of Queue - Vehicles (Worst Lane)	0.8	veh		
95% Back of Queue - Distance (Worst Lane)	6.0	m		
Total Effective Stops	131	veh/h	157	pers/h
Effective Stop Rate	0.29	per veh	0.29	per pers
Proportion Queued	0.18		0.18	
Performance Index	6.7		6.7	
Travel Distance (Total)	256.6	veh-km/h	307.9	pers-km/h
Travel Distance (Average)	574	m	574	m
Travel Time (Total)	5.7	veh-h/h	6.8	pers-h/h
Travel Time (Average)	45.6	sec	45.6	sec
Travel Speed	45.4	km/h	45.4	km/h
Cost (Total)	171.88	$/h	171.88	$/h
Fuel Consumption (Total)	23.3	L/h		
Carbon Dioxide (Total)	58.2	kg/h		
Hydrocarbons (Total)	0.090	kg/h		
Carbon Monoxide (Total)	3.29	kg/h		
NOx (Total)	0.109	kg/h		

P: You need to Process this Site (F9) for this variable to be computed.

Level of Service (LOS) Method: Delay (RTA NSW).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2021 Site access PM peak

Site access on Geoffrey Road PM peak
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Geoffrey Road east											
5	T	106	3.0	0.081	3.5	LOS A	0.8	6.0	0.57	0.00	43.3
6	R	15	0.0	0.081	10.0	LOS A	0.8	6.0	0.57	0.84	41.6
Approach		121	2.6	0.081	4.3	NA	0.8	6.0	0.57	0.10	43.1
North: Site access											
7	L	3	0.0	0.008	7.0	LOS A	0.0	0.1	0.26	0.55	42.4
9	R	24	0.0	0.022	7.8	LOS A	0.1	0.6	0.36	0.63	41.8
Approach		27	0.0	0.022	7.7	LOS A	0.1	0.6	0.34	0.62	41.9
West: Geoffrey Road west											
10	L	137	0.0	0.158	6.4	LOS A	0.0	0.0	0.00	0.74	43.3
11	T	162	3.0	0.158	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		299	1.6	0.158	2.9	NA	0.0	0.0	0.00	0.34	46.7
All Vehicles		447	1.8	0.158	3.6	NA	0.8	6.0	0.18	0.29	45.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

Project: M:\MW Pty Ltd\Active Projects\P0815 PP Chittaway Bay\SIDRA\Wyong Rd-Geoffry Rd.sip
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INTERSECTION SUMMARY

Site: AM 2011 Wyong Rd - Geoffrey Road

Current Wyong Road - Geoffrey Road
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	2409	veh/h	2891	pers/h
Percent Heavy Vehicles	5.6	%		
Degree of Saturation	0.432			
Practical Spare Capacity	96.6	%		
Effective Intersection Capacity	5573	veh/h		
Control Delay (Total)	3.82	veh-h/h	4.59	pers-h/h
Control Delay (Average)	5.7	sec	5.7	sec
Control Delay (Worst Lane)	14.6	sec		
Control Delay (Worst Movement)	14.6	sec	14.6	sec
Geometric Delay (Average)	P	sec		
Stop-Line Delay (Average)	P	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	3.3	veh		
95% Back of Queue - Distance (Worst Lane)	24.1	m		
Total Effective Stops	1074	veh/h	1289	pers/h
Effective Stop Rate	0.45	per veh	0.45	per pers
Proportion Queued	0.24		0.24	
Performance Index	38.9		38.9	
Travel Distance (Total)	1476.2	veh-km/h	1771.4	pers-km/h
Travel Distance (Average)	613	m	613	m
Travel Time (Total)	29.0	veh-h/h	34.9	pers-h/h
Travel Time (Average)	43.4	sec	43.4	sec
Travel Speed	50.8	km/h	50.8	km/h
Cost (Total)	1141.73	$/h	1141.73	$/h
Fuel Consumption (Total)	256.6	L/h		
Carbon Dioxide (Total)	643.0	kg/h		
Hydrocarbons (Total)	0.638	kg/h		
Carbon Monoxide (Total)	44.98	kg/h		
NOx (Total)	1.979	kg/h		

P: You need to Process this Site (F9) for this variable to be computed.

Level of Service (LOS) Method: Delay (RTA NSW).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: AM 2011 Wyong Rd - Geoffrey Road

Current Wyong Road - Geoffrey Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Wyong Road											
2	T	1215	6.0	0.432	5.9	LOS A	3.3	24.1	0.27	0.45	50.4
3	R	37	1.0	0.432	11.6	LOS A	3.2	23.7	0.27	0.77	46.3
Approach		1252	5.9	0.432	6.0	LOS A	3.3	24.1	0.27	0.46	50.2
East: Geoffry Road											
4	L	61	1.0	0.064	8.0	LOS A	0.3	2.0	0.60	0.70	48.1
6	R	60	1.0	0.080	14.6	LOS B	0.3	2.4	0.62	0.83	43.6
Approach		121	1.0	0.080	11.3	LOS A	0.3	2.4	0.61	0.77	45.7
North: Wyong Road											
7	L	24	1.0	0.337	5.7	LOS A	2.1	15.2	0.16	0.51	51.2
8	T	1013	6.0	0.337	4.6	LOS A	2.1	15.2	0.16	0.38	52.3
Approach		1037	5.9	0.337	4.7	LOS A	2.1	15.2	0.16	0.39	52.3
All Vehicles		2409	5.6	0.432	5.7	LOS A	3.3	24.1	0.24	0.45	50.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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INTERSECTION SUMMARY

Site: PM 2011 Wyong Rd - Geoffrey Road

Current Wyong Road - Geoffrey Road
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	2562	veh/h	3075	pers/h
Percent Heavy Vehicles	5.6	%		
Degree of Saturation	0.513			
Practical Spare Capacity	65.5	%		
Effective Intersection Capacity	4990	veh/h		
Control Delay (Total)	4.00	veh-h/h	4.80	pers-h/h
Control Delay (Average)	5.6	sec	5.6	sec
Control Delay (Worst Lane)	16.4	sec		
Control Delay (Worst Movement)	16.4	sec	16.4	sec
Geometric Delay (Average)	P	sec		
Stop-Line Delay (Average)	P	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	3.8	veh		
95% Back of Queue - Distance (Worst Lane)	28.3	m		
Total Effective Stops	1142	veh/h	1370	pers/h
Effective Stop Rate	0.45	per veh	0.45	per pers
Proportion Queued	0.26		0.26	
Performance Index	41.6		41.6	
Travel Distance (Total)	1570.2	veh-km/h	1884.2	pers-km/h
Travel Distance (Average)	613	m	613	m
Travel Time (Total)	30.9	veh-h/h	37.1	pers-h/h
Travel Time (Average)	43.4	sec	43.4	sec
Travel Speed	50.8	km/h	50.8	km/h
Cost (Total)	1216.25	$/h	1216.25	$/h
Fuel Consumption (Total)	273.6	L/h		
Carbon Dioxide (Total)	685.7	kg/h		
Hydrocarbons (Total)	0.679	kg/h		
Carbon Monoxide (Total)	47.94	kg/h		
NOx (Total)	2.114	kg/h		

P: You need to Process this Site (F9) for this variable to be computed.

Level of Service (LOS) Method: Delay (RTA NSW).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: PM 2011 Wyong Rd - Geoffrey Road

Current Wyong Road - Geoffrey Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Wyong Road											
2	T	873	6.0	0.316	5.7	LOS A	2.1	15.8	0.18	0.44	51.0
3	R	68	1.0	0.316	11.4	LOS A	2.1	15.4	0.19	0.78	46.4
Approach		941	5.6	0.316	6.1	LOS A	2.1	15.8	0.18	0.47	50.6
East: Geoffry Road											
4	L	52	1.0	0.065	9.1	LOS A	0.3	2.2	0.70	0.78	47.5
6	R	37	1.0	0.066	16.4	LOS B	0.3	2.0	0.71	0.89	42.3
Approach		88	1.0	0.066	12.1	LOS A	0.3	2.2	0.71	0.82	45.1
North: Wyong Road											
7	L	66	1.0	0.513	5.9	LOS A	3.8	28.2	0.27	0.51	50.6
8	T	1466	6.0	0.513	4.9	LOS A	3.8	28.3	0.28	0.41	51.3
Approach		1533	5.8	0.513	4.9	LOS A	3.8	28.3	0.28	0.41	51.3
All Vehicles		2562	5.6	0.513	5.6	LOS A	3.8	28.3	0.26	0.45	50.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

Processed: Monday, 16 May 2011 3:33:06 PM
SIDRA INTERSECTION 5.1.5.2006

SIDRA INTERSECTION

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INTERSECTION SUMMARY

Site: AM 2021 Wyong Rd - Geoffrey Road

Current Wyong Road - Geoffrey Road 2021
Roundabout
Design Life Analysis (Practical Capacity): Results for 10 years

Intersection Performance - Hourly Values				
Performance Measure	Vehicles		Persons	
Demand Flows (Total)	2891	veh/h	3470	pers/h
Percent Heavy Vehicles	5.6	%		
Degree of Saturation	0.525			
Practical Spare Capacity	61.9	%		
Effective Intersection Capacity	5506	veh/h		
Control Delay (Total)	4.69	veh-h/h	5.63	pers-h/h
Control Delay (Average)	5.8	sec	5.8	sec
Control Delay (Worst Lane)	15.5	sec		
Control Delay (Worst Movement)	15.5	sec	15.5	sec
Geometric Delay (Average)	P	sec		
Stop-Line Delay (Average)	P	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	4.6	veh		
95% Back of Queue - Distance (Worst Lane)	33.6	m		
Total Effective Stops	1315	veh/h	1578	pers/h
Effective Stop Rate	0.45	per veh	0.45	per pers
Proportion Queued	0.29		0.29	
Performance Index	47.7		47.7	
Travel Distance (Total)	1771.4	veh-km/h	2125.7	pers-km/h
Travel Distance (Average)	613	m	613	m
Travel Time (Total)	35.1	veh-h/h	42.2	pers-h/h
Travel Time (Average)	43.7	sec	43.7	sec
Travel Speed	50.4	km/h	50.4	km/h
Cost (Total)	1379.89	$/h	1379.89	$/h
Fuel Consumption (Total)	309.6	L/h		
Carbon Dioxide (Total)	775.9	kg/h		
Hydrocarbons (Total)	0.777	kg/h		
Carbon Monoxide (Total)	54.68	kg/h		
NOx (Total)	2.389	kg/h		

P: You need to Process this Site (F9) for this variable to be computed.

Level of Service (LOS) Method: Delay (RTA NSW).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: AM 2021 Wyong Rd - Geoffrey Road

Current Wyong Road - Geoffrey Road 2021
Roundabout
Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Wyong Road											
2	T	1458	6.0	0.525	6.0	LOS A	4.6	33.6	0.34	0.46	49.9
3	R	44	1.0	0.525	11.7	LOS A	4.5	33.0	0.35	0.75	46.2
Approach		1502	5.9	0.525	6.2	LOS A	4.6	33.6	0.34	0.47	49.8
East: Geoffry Road											
4	L	73	1.0	0.083	8.6	LOS A	0.4	2.6	0.65	0.75	47.8
6	R	72	1.0	0.108	15.5	LOS B	0.5	3.3	0.67	0.89	43.0
Approach		145	1.0	0.108	12.0	LOS A	0.5	3.3	0.66	0.82	45.2
North: Wyong Road											
7	L	29	1.0	0.407	5.7	LOS A	2.8	20.4	0.19	0.50	51.0
8	T	1215	6.0	0.407	4.7	LOS A	2.8	20.4	0.20	0.39	52.0
Approach		1244	5.9	0.407	4.7	LOS A	2.8	20.4	0.20	0.39	52.0
All Vehicles		2891	5.6	0.525	5.8	LOS A	4.6	33.6	0.29	0.45	50.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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INTERSECTION SUMMARY

Site: PM 2021 Wyong Rd - Geoffrey Road

Current Wyong Road - Geoffrey Road 2021
Roundabout
Design Life Analysis (Practical Capacity): Results for 10 years

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	3075	veh/h	3689	pers/h
Percent Heavy Vehicles	5.6	%		
Degree of Saturation	0.623			
Practical Spare Capacity	36.3	%		
Effective Intersection Capacity	4932	veh/h		
Control Delay (Total)	4.96	veh-h/h	5.95	pers-h/h
Control Delay (Average)	5.8	sec	5.8	sec
Control Delay (Worst Lane)	18.0	sec		
Control Delay (Worst Movement)	18.0	sec	18.0	sec
Geometric Delay (Average)	P	sec		
Stop-Line Delay (Average)	P	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	5.6	veh		
95% Back of Queue - Distance (Worst Lane)	41.6	m		
Total Effective Stops	1413	veh/h	1696	pers/h
Effective Stop Rate	0.46	per veh	0.46	per pers
Proportion Queued	0.33		0.33	
Performance Index	51.4		51.4	
Travel Distance (Total)	1884.2	veh-km/h	2261.1	pers-km/h
Travel Distance (Average)	613	m	613	m
Travel Time (Total)	37.5	veh-h/h	45.0	pers-h/h
Travel Time (Average)	43.9	sec	43.9	sec
Travel Speed	50.2	km/h	50.2	km/h
Cost (Total)	1473.83	$/h	1473.83	$/h
Fuel Consumption (Total)	330.9	L/h		
Carbon Dioxide (Total)	829.2	kg/h		
Hydrocarbons (Total)	0.831	kg/h		
Carbon Monoxide (Total)	58.61	kg/h		
NOx (Total)	2.558	kg/h		

P: You need to Process this Site (F9) for this variable to be computed.

Level of Service (LOS) Method: Delay (RTA NSW).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: PM 2021 Wyong Rd - Geoffrey Road

Current Wyong Road - Geoffrey Road 2021
Roundabout
Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Wyong Road											
2	T	1047	6.0	0.382	5.8	LOS A	2.9	21.0	0.22	0.44	50.7
3	R	82	1.0	0.382	11.5	LOS A	2.8	20.5	0.23	0.76	46.3
Approach		1129	5.6	0.382	6.2	LOS A	2.9	21.0	0.22	0.47	50.3
East: Geoffry Road											
4	L	62	1.0	0.091	10.1	LOS A	0.5	3.3	0.78	0.84	47.0
6	R	44	1.0	0.097	18.0	LOS B	0.4	3.1	0.77	0.93	41.0
Approach		106	1.0	0.097	13.4	LOS A	0.5	3.3	0.78	0.88	44.2
North: Wyong Road											
7	L	80	1.0	0.623	6.1	LOS A	5.6	41.3	0.36	0.51	50.1
8	T	1760	6.0	0.623	5.1	LOS A	5.6	41.6	0.37	0.43	50.6
Approach		1839	5.8	0.623	5.1	LOS A	5.6	41.6	0.37	0.43	50.6
All Vehicles		3075	5.6	0.623	5.8	LOS A	5.6	41.6	0.33	0.46	50.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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INTERSECTION SUMMARY

Site: AM 2011 Wyong Rd - Geoffrey Road+dev

Current Wyong Road - Geoffrey Road plus development traffic
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	2571	veh/h	3085	pers/h
Percent Heavy Vehicles	5.3	%		
Degree of Saturation	0.477			
Practical Spare Capacity	78.4	%		
Effective Intersection Capacity	5394	veh/h		
Control Delay (Total)	4.49	veh-h/h	5.39	pers-h/h
Control Delay (Average)	6.3	sec	6.3	sec
Control Delay (Worst Lane)	14.9	sec		
Control Delay (Worst Movement)	14.9	sec	14.9	sec
Geometric Delay (Average)	5.5	sec		
Stop-Line Delay (Average)	0.8	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	3.7	veh		
95% Back of Queue - Distance (Worst Lane)	27.2	m		
Total Effective Stops	1274	veh/h	1529	pers/h
Effective Stop Rate	0.50	per veh	0.50	per pers
Proportion Queued	0.35		0.35	
Performance Index	43.2		43.2	
Travel Distance (Total)	1577.4	veh-km/h	1892.9	pers-km/h
Travel Distance (Average)	614	m	614	m
Travel Time (Total)	31.6	veh-h/h	38.0	pers-h/h
Travel Time (Average)	44.3	sec	44.3	sec
Travel Speed	49.8	km/h	49.8	km/h
Cost (Total)	1227.40	$/h	1227.40	$/h
Fuel Consumption (Total)	270.6	L/h		
Carbon Dioxide (Total)	678.1	kg/h		
Hydrocarbons (Total)	0.701	kg/h		
Carbon Monoxide (Total)	48.24	kg/h		
NOx (Total)	2.070	kg/h		

Level of Service (LOS) Method: Delay (RTA NSW).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: AM 2011 Wyong Rd - Geoffrey Road+dev

Current Wyong Road - Geoffrey Road plus development traffic
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Wyong Road											
2	T	1215	6.0	0.477	6.3	LOS A	3.7	27.2	0.42	0.51	49.3
3	R	48	1.0	0.477	12.0	LOS A	3.6	26.7	0.43	0.76	46.1
Approach		1263	5.8	0.477	6.5	LOS A	3.7	27.2	0.42	0.52	49.2
East: Geoffry Road											
4	L	129	1.0	0.137	8.2	LOS A	0.6	4.4	0.62	0.72	48.0
6	R	128	1.0	0.172	14.9	LOS B	0.8	5.3	0.65	0.89	43.5
Approach		258	1.0	0.172	11.5	LOS A	0.8	5.3	0.63	0.80	45.5
North: Wyong Road											
7	L	37	1.0	0.348	5.7	LOS A	2.3	16.6	0.19	0.50	51.0
8	T	1013	6.0	0.348	4.7	LOS A	2.3	16.6	0.20	0.39	52.0
Approach		1049	5.8	0.348	4.7	LOS A	2.3	16.6	0.20	0.39	51.9
All Vehicles		2571	5.3	0.477	6.3	LOS A	3.7	27.2	0.35	0.50	49.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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INTERSECTION SUMMARY

Site: PM 2011 Wyong Rd - Geoffrey Road+dev

Current Wyong Road - Geoffrey Road plus development
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	2723	veh/h	3268	pers/h
Percent Heavy Vehicles	5.3	%		
Degree of Saturation	0.577			
Practical Spare Capacity	47.4	%		
Effective Intersection Capacity	4722	veh/h		
Control Delay (Total)	4.66	veh-h/h	5.60	pers-h/h
Control Delay (Average)	6.2	sec	6.2	sec
Control Delay (Worst Lane)	16.5	sec		
Control Delay (Worst Movement)	16.5	sec	16.5	sec
Geometric Delay (Average)	5.4	sec		
Stop-Line Delay (Average)	0.8	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	4.7	veh		
95% Back of Queue - Distance (Worst Lane)	34.2	m		
Total Effective Stops	1357	veh/h	1629	pers/h
Effective Stop Rate	0.50	per veh	0.50	per pers
Proportion Queued	0.37		0.37	
Performance Index	46.1		46.1	
Travel Distance (Total)	1671.5	veh-km/h	2005.7	pers-km/h
Travel Distance (Average)	614	m	614	m
Travel Time (Total)	33.6	veh-h/h	40.3	pers-h/h
Travel Time (Average)	44.4	sec	44.4	sec
Travel Speed	49.7	km/h	49.7	km/h
Cost (Total)	1311.50	$/h	1311.50	$/h
Fuel Consumption (Total)	291.9	L/h		
Carbon Dioxide (Total)	731.3	kg/h		
Hydrocarbons (Total)	0.748	kg/h		
Carbon Monoxide (Total)	52.19	kg/h		
NOx (Total)	2.250	kg/h		

Level of Service (LOS) Method: Delay (RTA NSW).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: PM 2011 Wyong Rd - Geoffrey Road+dev

Current Wyong Road - Geoffrey Road plus development
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Wyong Road											
2	T	873	6.0	0.346	5.8	LOS A	2.4	17.9	0.22	0.44	50.6
3	R	137	1.0	0.346	11.5	LOS A	2.4	17.4	0.23	0.74	46.2
Approach		1009	5.3	0.346	6.5	LOS A	2.4	17.9	0.22	0.48	50.0
East: Geoffry Road											
4	L	63	1.0	0.086	9.1	LOS A	0.4	3.0	0.74	0.80	47.2
6	R	49	1.0	0.096	16.5	LOS B	0.4	3.0	0.74	0.92	42.2
Approach		113	1.0	0.096	12.4	LOS A	0.4	3.0	0.74	0.86	44.8
North: Wyong Road											
7	L	135	1.0	0.577	6.4	LOS A	4.7	34.2	0.43	0.55	49.6
8	T	1466	6.0	0.577	5.4	LOS A	4.7	34.2	0.44	0.48	50.0
Approach		1601	5.6	0.577	5.5	LOS A	4.7	34.2	0.44	0.48	50.0
All Vehicles		2723	5.3	0.577	6.2	LOS A	4.7	34.2	0.37	0.50	49.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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INTERSECTION SUMMARY

Site: AM 2021 Wyong Rd - Geoffrey Road+dev

Current Wyong Road - Geoffrey Road 2021 plus development
Roundabout
Design Life Analysis (Practical Capacity): Results for 10 years

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	3085	veh/h	3702	pers/h
Percent Heavy Vehicles	5.3	%		
Degree of Saturation	0.586			
Practical Spare Capacity	45.0	%		
Effective Intersection Capacity	5261	veh/h		
Control Delay (Total)	5.62	veh-h/h	6.74	pers-h/h
Control Delay (Average)	6.6	sec	6.6	sec
Control Delay (Worst Lane)	15.8	sec		
Control Delay (Worst Movement)	15.8	sec	15.8	sec
Geometric Delay (Average)	5.5	sec		
Stop-Line Delay (Average)	1.0	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	5.3	veh		
95% Back of Queue - Distance (Worst Lane)	38.9	m		
Total Effective Stops	1605	veh/h	1926	pers/h
Effective Stop Rate	0.52	per veh	0.52	per pers
Proportion Queued	0.43		0.43	
Performance Index	53.5		53.5	
Travel Distance (Total)	1892.9	veh-km/h	2271.4	pers-km/h
Travel Distance (Average)	614	m	614	m
Travel Time (Total)	38.4	veh-h/h	46.1	pers-h/h
Travel Time (Average)	44.8	sec	44.8	sec
Travel Speed	49.3	km/h	49.3	km/h
Cost (Total)	1488.31	$/h	1488.31	$/h
Fuel Consumption (Total)	327.4	L/h		
Carbon Dioxide (Total)	820.3	kg/h		
Hydrocarbons (Total)	0.858	kg/h		
Carbon Monoxide (Total)	58.95	kg/h		
NOx (Total)	2.505	kg/h		

Level of Service (LOS) Method: Delay (RTA NSW).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: AM 2021 Wyong Rd - Geoffrey Road+dev

Current Wyong Road - Geoffrey Road 2021 plus development
Roundabout
Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Wyong Road											
2	T	1458	6.0	0.586	6.6	LOS A	5.3	38.9	0.53	0.55	48.6
3	R	58	1.0	0.586	12.4	LOS A	5.2	38.0	0.54	0.75	46.0
Approach		1516	5.8	0.586	6.8	LOS A	5.3	38.9	0.53	0.55	48.5
East: Geoffry Road											
4	L	155	1.0	0.178	8.7	LOS A	0.8	6.0	0.68	0.77	47.6
6	R	154	1.0	0.235	15.8	LOS B	1.1	7.5	0.71	0.91	42.7
Approach		309	1.0	0.235	12.2	LOS A	1.1	7.5	0.69	0.84	45.0
North: Wyong Road											
7	L	44	1.0	0.421	5.8	LOS A	3.1	22.7	0.24	0.50	50.7
8	T	1215	6.0	0.421	4.8	LOS A	3.1	22.7	0.25	0.40	51.6
Approach		1259	5.8	0.421	4.8	LOS A	3.1	22.7	0.25	0.40	51.5
All Vehicles		3085	5.3	0.586	6.6	LOS A	5.3	38.9	0.43	0.52	49.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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SIDRA INTERSECTION

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INTERSECTION SUMMARY

Site: PM 2021 Wyong Rd - Geoffrey Road +dev

Current Wyong Road - Geoffrey Road 2021 plus development
Roundabout
Design Life Analysis (Practical Capacity): Results for 10 years

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	3268	veh/h	3921	pers/h
Percent Heavy Vehicles	5.3	%		
Degree of Saturation	0.708			
Practical Spare Capacity	20.0	%		
Effective Intersection Capacity	4615	veh/h		
Control Delay (Total)	5.94	veh-h/h	7.13	pers-h/h
Control Delay (Average)	6.5	sec	6.5	sec
Control Delay (Worst Lane)	18.1	sec		
Control Delay (Worst Movement)	18.1	sec	18.1	sec
Geometric Delay (Average)	5.4	sec		
Stop-Line Delay (Average)	1.2	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	7.1	veh		
95% Back of Queue - Distance (Worst Lane)	52.1	m		
Total Effective Stops	1735	veh/h	2082	pers/h
Effective Stop Rate	0.53	per veh	0.53	per pers
Proportion Queued	0.49		0.49	
Performance Index	57.9		57.9	
Travel Distance (Total)	2005.7	veh-km/h	2406.9	pers-km/h
Travel Distance (Average)	614	m	614	m
Travel Time (Total)	41.0	veh-h/h	49.2	pers-h/h
Travel Time (Average)	45.2	sec	45.2	sec
Travel Speed	48.9	km/h	48.9	km/h
Cost (Total)	1597.81	$/h	1597.81	$/h
Fuel Consumption (Total)	354.6	L/h		
Carbon Dioxide (Total)	888.4	kg/h		
Hydrocarbons (Total)	0.925	kg/h		
Carbon Monoxide (Total)	64.45	kg/h		
NOx (Total)	2.737	kg/h		

Level of Service (LOS) Method: Delay (RTA NSW).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: PM 2021 Wyong Rd - Geoffrey Road +dev

Current Wyong Road - Geoffrey Road 2021 plus development
Roundabout
Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Wyong Road											
2	T	1047	6.0	0.419	5.8	LOS A	3.3	24.2	0.27	0.45	50.3
3	R	164	1.0	0.419	11.6	LOS A	3.2	23.5	0.28	0.73	46.1
Approach		1211	5.3	0.419	6.6	LOS A	3.3	24.2	0.27	0.49	49.6
East: Geoffry Road											
4	L	76	1.0	0.127	10.2	LOS A	0.7	4.9	0.83	0.89	46.7
6	R	59	1.0	0.150	18.1	LOS B	0.7	5.1	0.82	0.95	41.0
Approach		135	1.0	0.150	13.7	LOS A	0.7	5.1	0.82	0.92	43.9
North: Wyong Road											
7	L	162	1.0	0.708	6.8	LOS A	7.1	52.1	0.58	0.58	48.8
8	T	1760	6.0	0.708	5.9	LOS A	7.1	52.1	0.60	0.53	48.9
Approach		1921	5.6	0.708	6.0	LOS A	7.1	52.1	0.60	0.53	48.9
All Vehicles		3268	5.3	0.708	6.5	LOS A	7.1	52.1	0.49	0.53	48.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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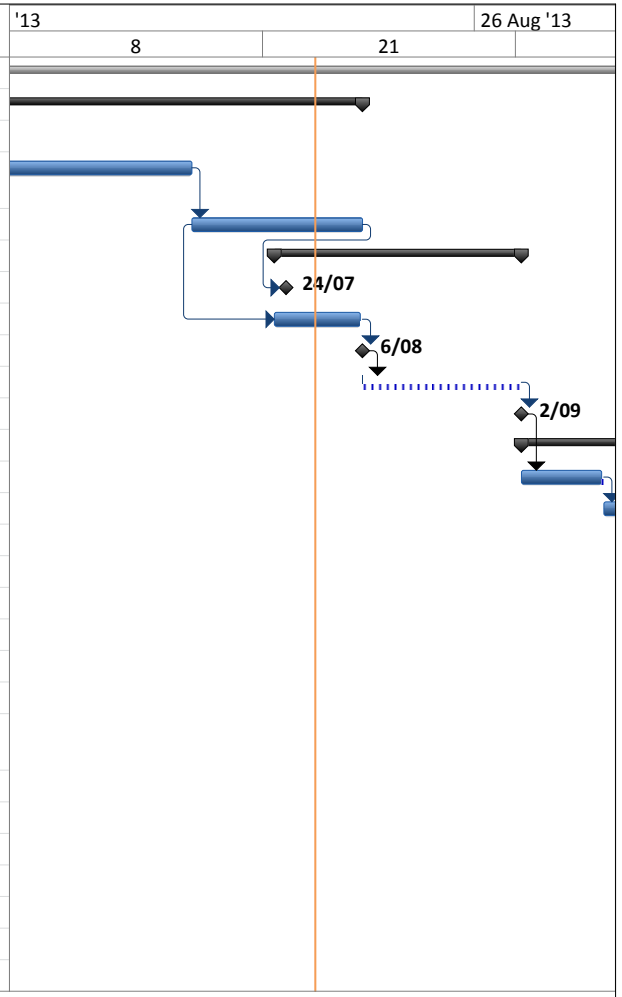
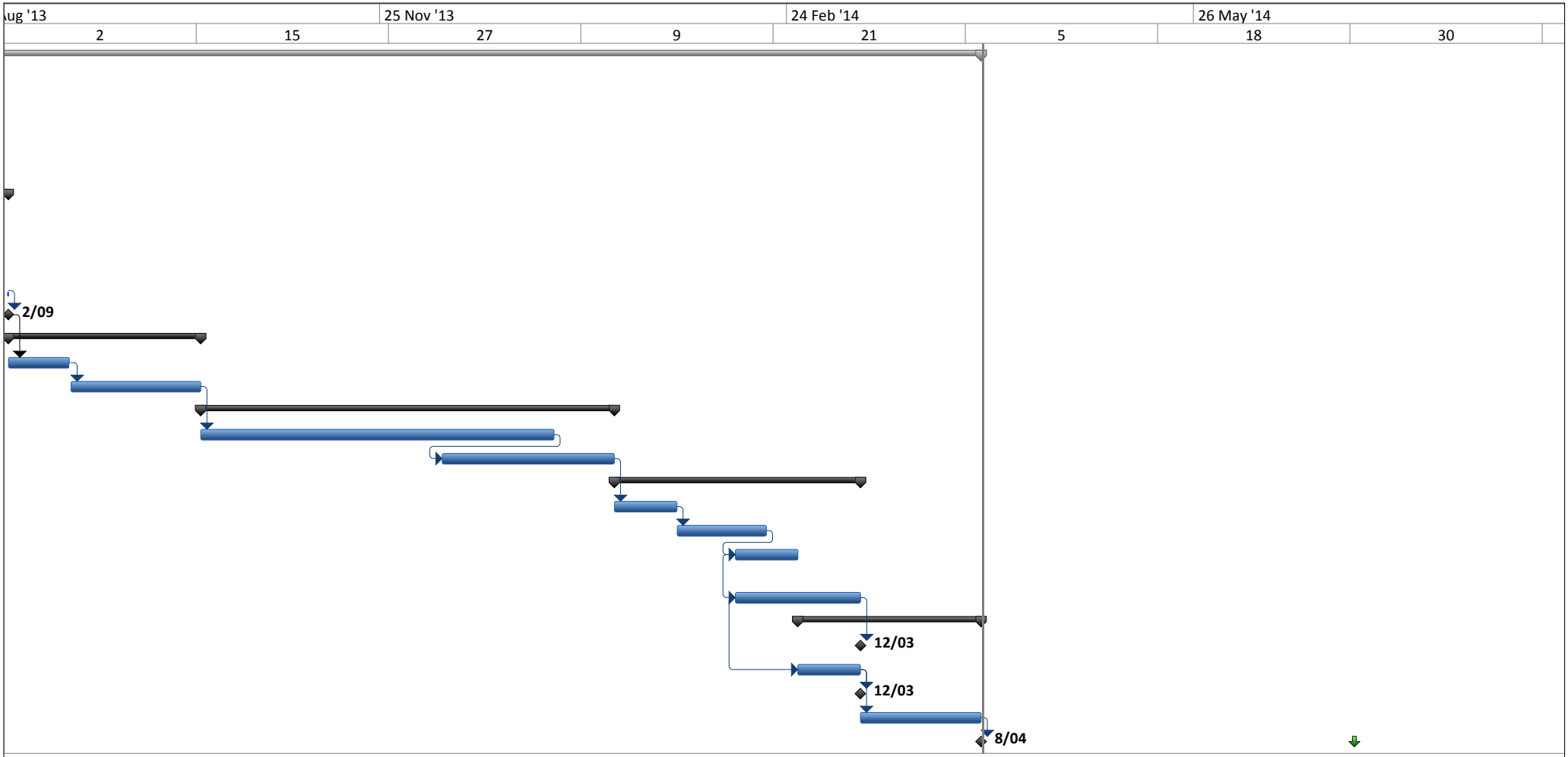
10 Project Gantt Chart

ID	WBS	Task Name	Duration	Work	Start	Finish	WBS Predecessors	Predecessors
0	**0**	**Chittaway Rezoning**	**244.57 days**	**250.5 hrs**	**29/04/2013**	**8/04/2014**		
1	**1**	**Phase 1 - Assessment**	**70 days**	**98 hrs**	**29/04/2013**	**6/08/2013**		
2	1.1	File Review and Internal Consulatation	25 days	29 hrs	29/04/2013	31/05/2013		
3	1.2	Desktop Assessment and management signoff	5 wks	55 hrs	3/06/2013	8/07/2013	1.1	2
4	1.3	Council Report Preparation and signoff	20 days	14 hrs	8/07/2013	6/08/2013	1.2	3
5	**2**	**Phase 2 - Preliminary Endorsement**	**29 days**	**10 hrs**	**22/07/2013**	**2/09/2013**		
6	2.1	Council Determination	0 days	0 hrs	24/07/2013	24/07/2013	1.3	4
7	2.2	Planning Proposal Preparation	2 wks	10 hrs	22/07/2013	6/08/2013	1.3[SS+2 wks]	4SS+2 wks
8	2.3	Planning Proposal submission	0 wks	0 hrs	6/08/2013	6/08/2013	2.2	7
9	2.4	Gateway Assessment	1 mon	0 hrs	6/08/2013	2/09/2013	2.3	8
10	2.5	Gateway Determination	0 mons	0 hrs	2/09/2013	2/09/2013	2.4	9
11	**3**	**Phase 2a - Referral**	**31 days**	**15 hrs**	**2/09/2013**	**15/10/2013**		
12	3.1	Government Agency Referral Preparation	2 wks	15 hrs	2/09/2013	16/09/2013	2.5	10
13	3.2	Government Agency Referral	21 days	0 hrs	17/09/2013	15/10/2013	3.1	12
14	**4**	**Phase 3 - Investigative Studies**	**66.57 days**	**43 hrs**	**16/10/2013**	**16/01/2014**		
15	4.1	Undertake investigative studies	3 mons	0 hrs	16/10/2013	2/01/2014	3.2	13
16	4.2	Review Study Outcomes & Amend Proposal	1.5 mons	43 hrs	9/12/2013	16/01/2014	4.1[FS-1 mon]	15FS-1 mon
17	**5**	**Phase 4 - Consultation**	**39 days**	**63.5 hrs**	**16/01/2014**	**12/03/2014**		
18	5.1	Community Consultation Preparation	2 wks	15 hrs	16/01/2014	30/01/2014	4.2	16
19	5.2	Community Consultation	14 days	0 hrs	30/01/2014	19/02/2014	5.1	18
20	5.3	Submission Consideration and proposal amendment	2 wks	37 hrs	12/02/2014	26/02/2014	5.2[FS-5 days]	19FS-5 days
21	5.4	Council Report Preparation and signoff	20 days	11.5 hrs	12/02/2014	12/03/2014	5.3[SS]	20SS
22	**6**	**Phase 5 - Plan Signoff, Making & Notification**	**29 days**	**21 hrs**	**26/02/2014**	**8/04/2014**		
23	6.1	Council Determination	0 days	0 hrs	12/03/2014	12/03/2014	5.4	21
24	6.2	Planning Proposal Preparation	2 wks	10 hrs	26/02/2014	12/03/2014	5.4[SS+2 wks]	21SS+2 wks
25	6.3	Planning Proposal Submission	0 days	0 hrs	12/03/2014	12/03/2014	6.2	24
26	6.4	Plan Drafting and PC Opinion	1 mon	11 hrs	12/03/2014	8/04/2014	6.2	24
27	6.5	Plan Notification	0 days	0 hrs	8/04/2014	8/04/2014	6.4	26



Project: Chittaway Rezoning
Date: 30/07/2013

Task	External Tasks	Manual Task	Finish-only		
Split	External Milestone	Duration-only	Deadline		
Milestone	Inactive Task	Manual Summary Rollup	Progress		
Summary	Inactive Milestone	Manual Summary			
Project Summary	Inactive Summary	Start-only			



Project: Chittaway Rezoning
Date: 30/07/2013

Task		External Tasks		Manual Task		Finish-only	
Split		External Milestone		Duration-only		Deadline	
Milestone		Inactive Task		Manual Summary Rollup		Progress	
Summary		Inactive Milestone		Manual Summary			
Project Summary		Inactive Summary		Start-only			