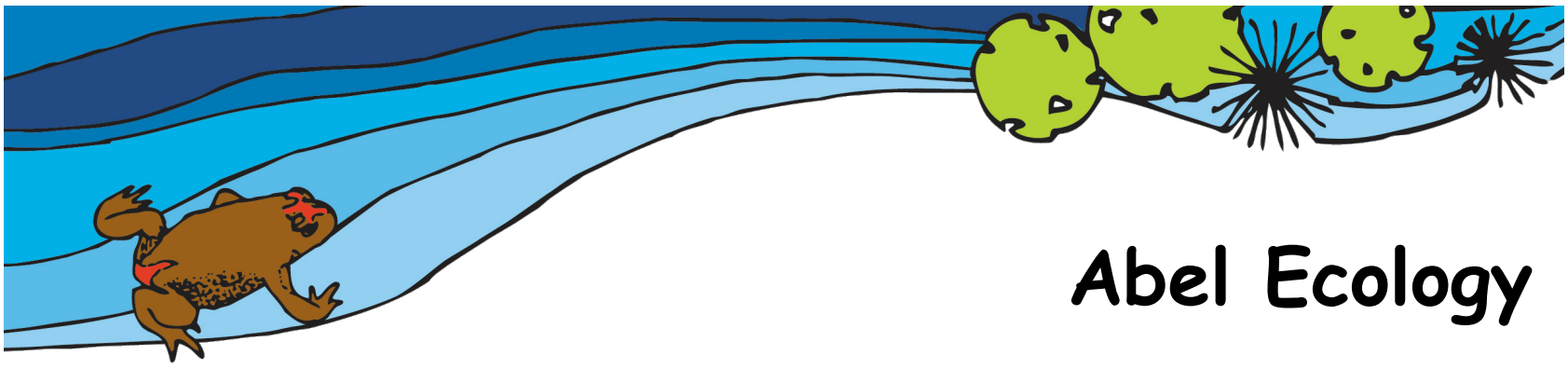


Abel Ecology

Review of Planning Proposal

for

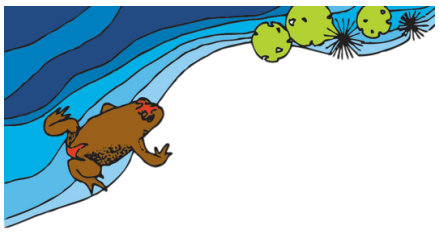
Glenmore Park Stage 3

Prepared for: Penrith City Council
Report No: AE18-REP-1953-ISS 3
Prepared by: Abel Ecology
Date: 13 March 2019

Abel Ecology Pty Ltd
2 Samuel 20:18 ACN 079 079 762 – ABN 72 516 253 751

PO Box 495
Unit 2, 10-11 Ferguson Road
Springwood NSW 2777

T (02) 4751 9487
E info@abelecology.com.au
www.abelecology.com.au



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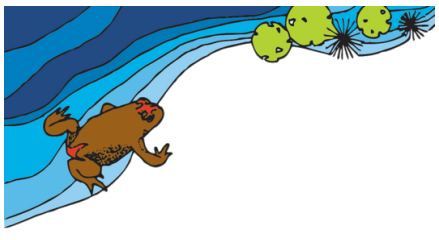
Document History

Report	Version	Prepared by	Proofread by	Submission	
				Method	Date
Peer Review	Draft A	Dr Danny Wotherspoon Dr Daniel McDonald Dr Stephanie Clark Mark Mackinnon	Steven Smith	Dropbox	16 Oct 18
Peer Review	Issue 1	Dr Danny Wotherspoon	Steven Smith	Penrith City Council SharePoint	16 Nov 18
Peer Review	Issue 2	Dr Danny Wotherspoon	Steven Smith	Penrith City Council SharePoint	9 Jan 19
Peer review	Issue 3	Dr Danny Wotherspoon	Steven Smith	Dropbox	13 Mar 19



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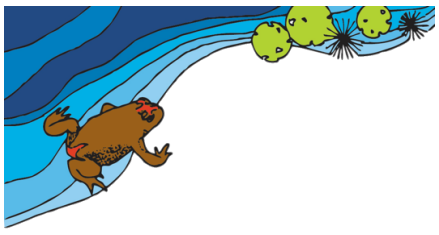

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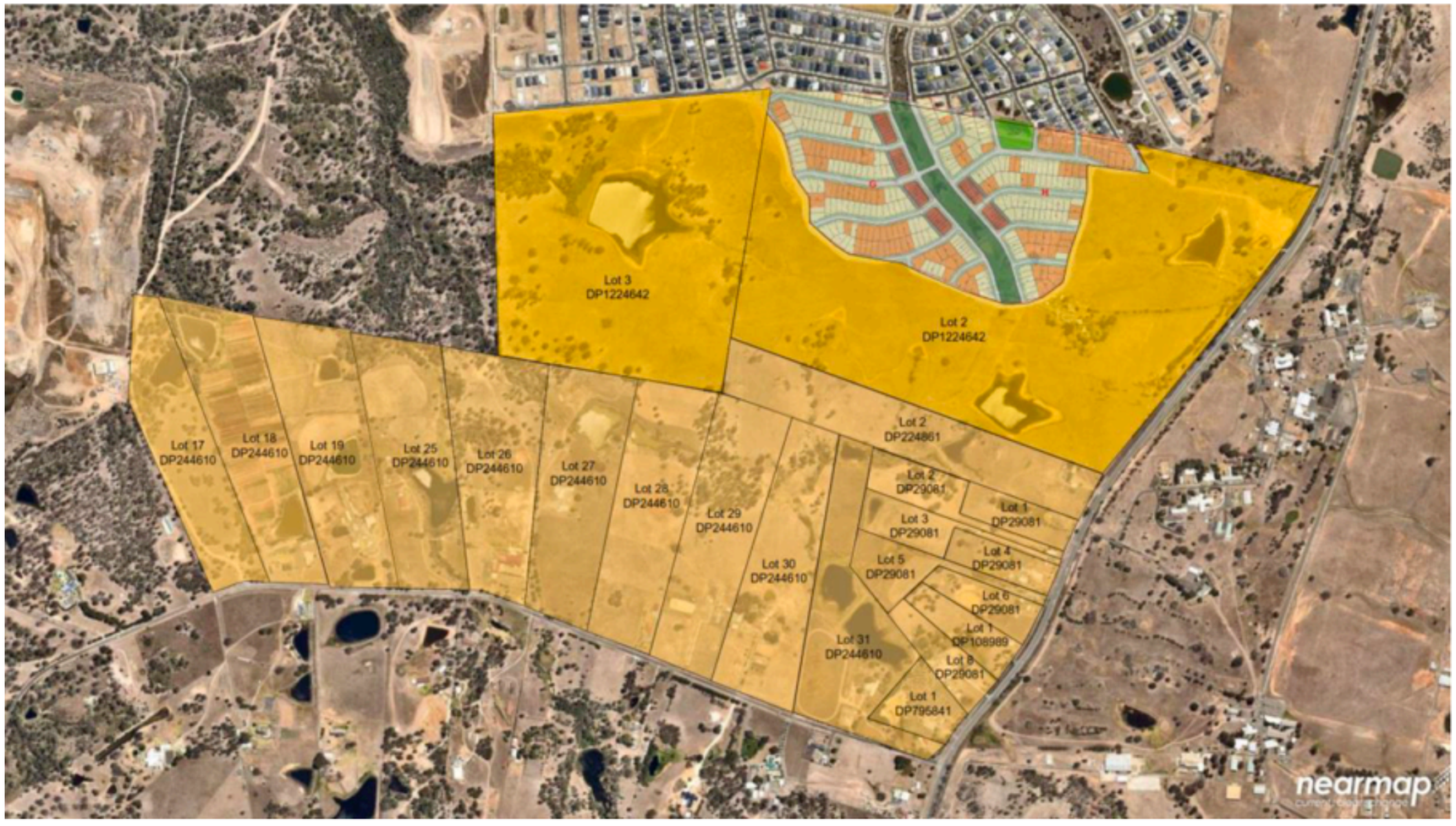


Figure 1: Glenmore Park Stage 3 area (aerial photo courtesy NearMap 2018).

Figure 2: Subdivision concept plan.

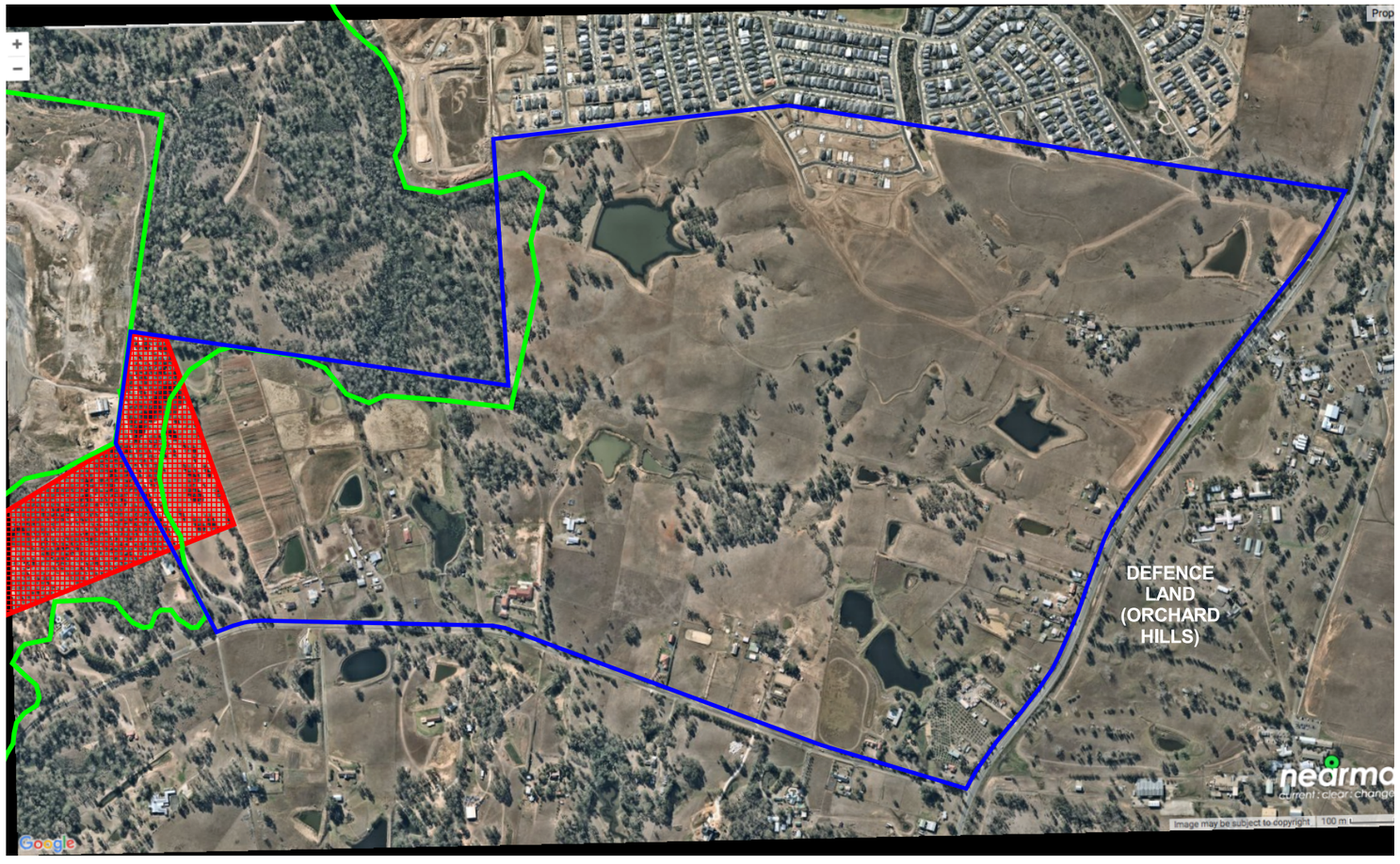


Figure 3: Priority Conservation Lands overlay (aerial photo courtesy NearMap 2018).

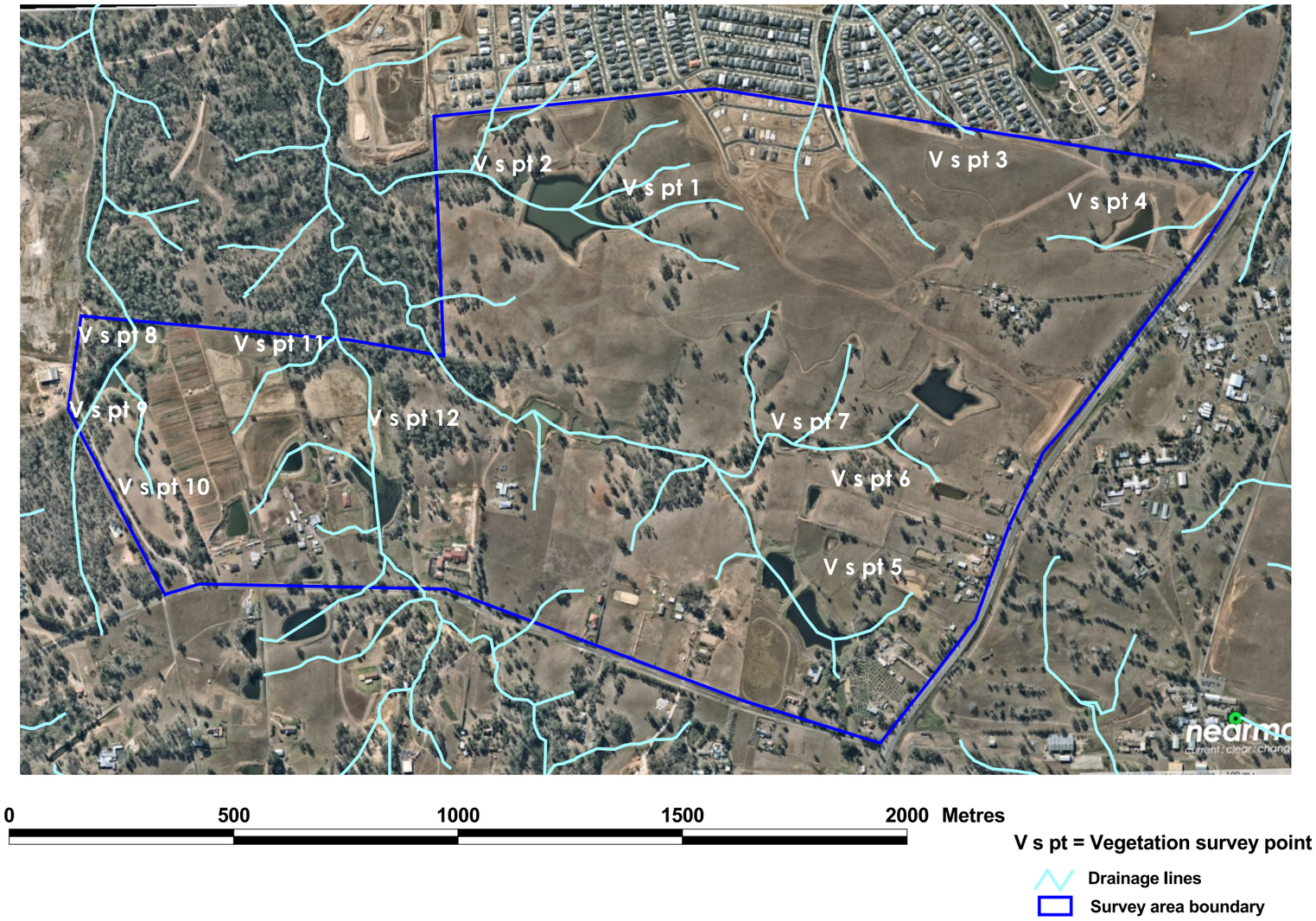


Figure 4: Abel Ecology vegetation survey points (aerial photo courtesy NearMap 2018).

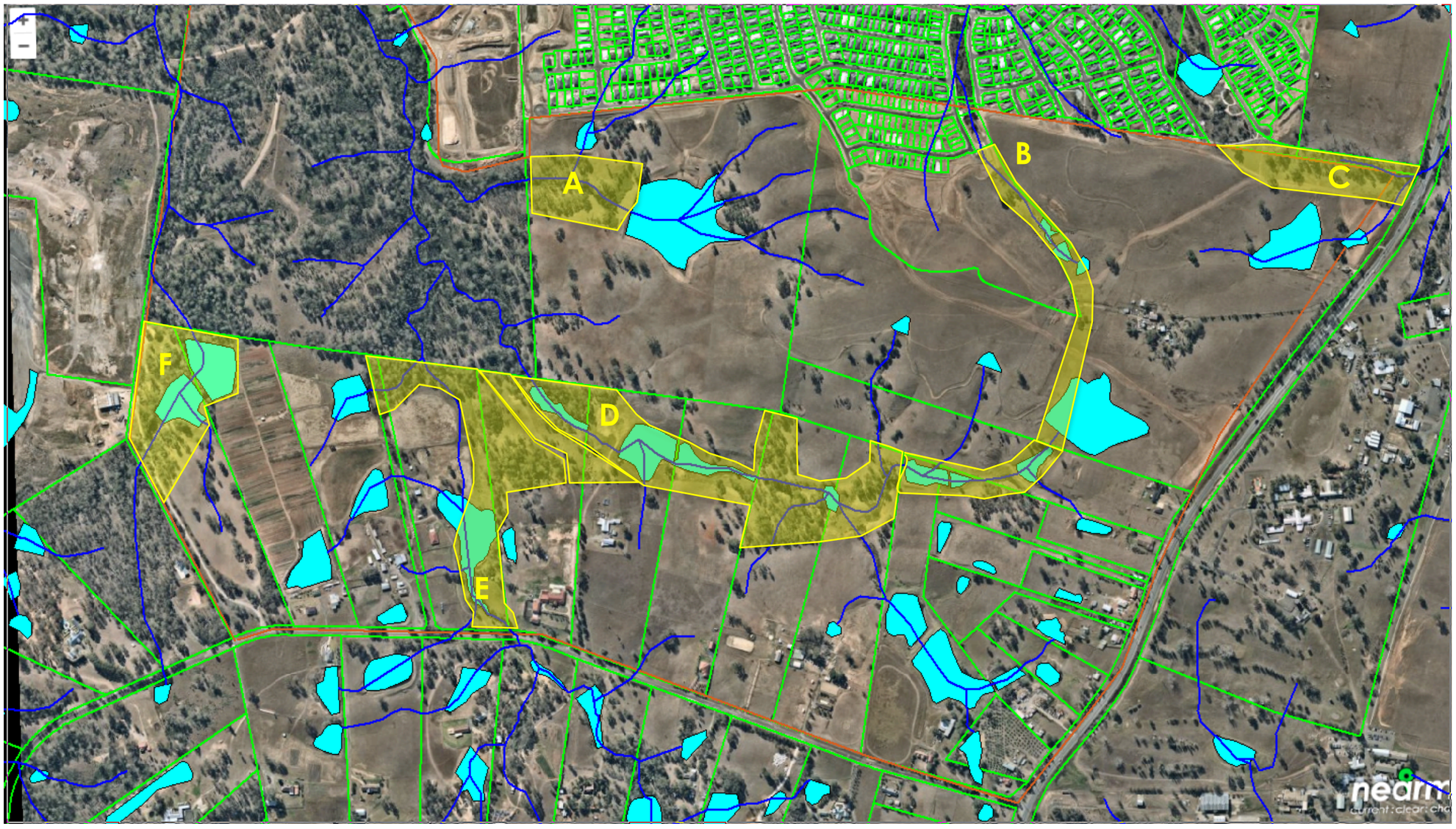


Figure 5: Abel Ecology Indicative E2/RE1 zone map.
E2/RE1 yellow colour. Additional E2 and RE1 areas may be added as desired or required.
Drainage lines are labelled A to F. (aerial photo courtesy NearMap 2018)

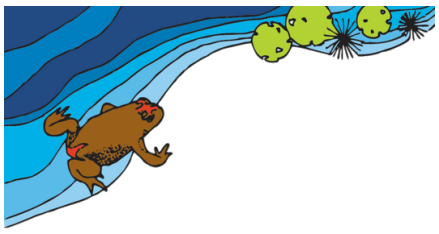
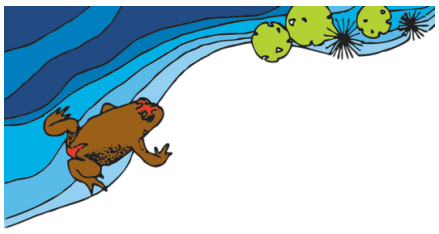


Figure 6: Riparian features survey map.



1. Introduction

A Planning Proposal has been submitted to Penrith City Council for an extension of Glenmore Park southwards into the Mulgoa area. This report is to review the proposal and the ecological report that has been submitted in support of the Planning Proposal.

The Planning Proposal has been considered in the context of:

- Mulgoa nature Reserve Plan of Management (NPWS 2008)
- Greater Sydney Region Plan,
- Western City District Plan and
- Future Transport 2056
- OEH Priority Conservation Lands mapping.

An Ecological Issues & Assessment Report (April 2018) has been submitted by Gunninah Pty Ltd (Gunninah) for the proposal as follows:

- Glenmore Park Extension, Mulgoa Planning Proposal Flora and Fauna Issues & Assessment Report. April 2018.

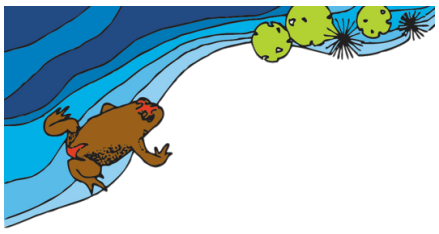
Lisa Harrold of the Mulgoa Landcare group met with Dr Danny Wotherspoon (Abel Ecology) and Carlie Ryan (Penrith Council) at the Penrith Council offices on 4 October 2018. Lisa Harrold provided valuable insights and input that enabled us to focus our attention for our site visit and address issues in our report. The Mulgoa Landcare group has also provided some local fauna records for me to consider in this review (Appendix 1).

The species occurring at the "Wallaroo" property are indicative of an intact vegetation community with good connectivity to the nearby national park and nature reserve. Over time, more species will be added. Some common species such as bearded dragon are very difficult to find so not expected on a list such as this. There are some surprising missing species that are very active and obvious such as fence skink and blue-tongued skink but they will be found in due course.

Some threatened species are in the area that will possibly occur in the "Wallaroo" property. Examples include square-tailed kite, red-crowned Toadlet, gang-gang cockatoo, glossy-black cockatoo, eastern pygmy possum, yellow-bellied glider and greater glider.

The farmland at Glenmore Park stage 3 is not sufficiently intact for many of those species. The more robust and cosmopolitan flying species will occur in connected copses of trees and will likely eventually move into regenerated riparian corridors.

The purpose of the peer review is to evaluate the survey methodology implemented by Gunninah and also to comment on the findings of Gunninah in the submitted report.

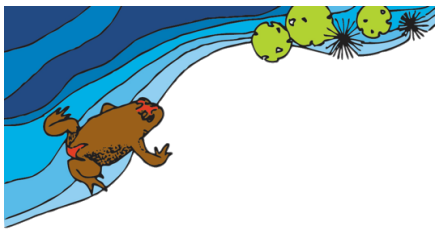


2. Scope of this Peer Review report

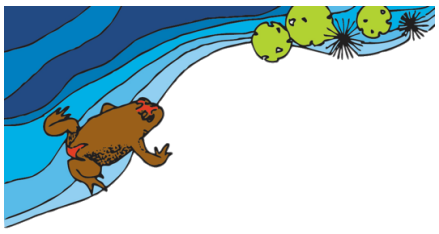
The Brief from Penrith City Council requested the following tasks to be completed (Table 1).

Table 1: Itemised review points.

Item	Notes
1. Review Ecological Assessment by Gunninah ("Report") together with the Planning Proposal for Glenmore Park South.	Completed. The Gunninah Report is very generic and fails to justify recommendations with data.
2. Advice on whether the Report demonstrates the appropriate allocation of land uses and the achievement of meaningful biodiversity conservation, particularly in the context of the Mulgoa Valley including the Mulgoa Nature Reserve, ecological corridors and any identified flora or fauna habitats. In this context, specific advice is needed in relation to whether the proposed RE1 and E2 zones are appropriate.	The Gunninah Report failed to address the local context in a meaningful way such that proposed zoning of the site was shown to be appropriate for the purposes of the zones.
3. Advice on whether the Report's reasoning is appropriate to result in the enhancement of native vegetation and habitats, supplemented by existing conserved habitat in the locality and region.	The Gunninah Report was illogical in that reasoning was not given to link site condition claims with data and thus was unable to justify site use proposals.
4. Advice on whether the Report and the proposed development outcome in the Planning Proposal, including the management of the Western boundary of the site adjoining Mulgoa Nature Reserve is appropriate given the outcomes of the Report as outlined in the Planning Proposal, including proposed site controls.	The proposed zone boundaries in relation to the western boundary had no relationship to existing site vegetation and dams. Asset protection zones that require a wide setback can require a larger lot size so that is appropriate. A perimeter road to Mulgoa NR and all E2 zones is required for ecological management.
5. Advice on whether the Report justifies the modification of existing dams/waterways and the impact of the Planning Proposal on adjoining residential development.	The proposal ignored dams as lakes as required under the *Water Management Act 2000*. No justifications were given for either removing dams or reshaping dams to reduce their sizes.



Item	Notes
6. Particular advice is needed in relation to the proposed modification of the dam on the northern portion of the site area.	The dam is a significant body of water with ecological values and potential for enhancement. The dam also offers potential for active and passive recreation such as fishing, boating, swimming and sailing.
7. Advice on whether the proposed zoning of existing vegetated areas (RE1 and E2 zoning) is appropriate.	An alternate zone map is provided. The RE1 zone needs to be clarified for permissible uses and controlled by a management plan.
8. One meeting coordinated by Council with interested stakeholders including the local Landcare Group as part of the preparation of this advice.	Completed. The Fauna List for "Wallaroo" property, Mulgoa was received from Lisa Harrold, President of Mulgoa Landcare Group and some recent Koala locations.



3. The Planning Proposal

For the purposes of the *Planning Proposal* and LEP drafting, the rezoning will be known as **Glenmore Park Stage 3** and it proposes to change the existing zoning from E3 Environmental Management and RU2 Rural Landscape, to R1 General Residential, RE1 Public Recreation, E2 Environmental Conservation and B2 Local Centre.

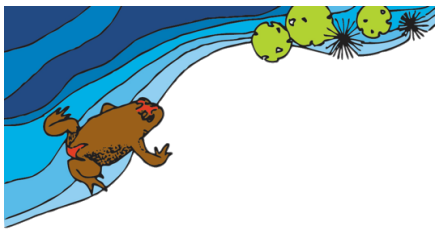
The features of the master plan as proposed include:

- Approximately 3,200 lots allowing for a mix of lot sizes from executive living to small lot housing.
- Open spaces linkages looping through the site to connect to the Mulgoa Nature Reserve in the west and the existing suburb of Glenmore Park in the north. The linkages follow and connect riparian corridors and new open space areas, providing a green spine through the release.
- 5 playing fields positioned to serve walkable neighbourhoods and local parks within 400m walking distance of all residents adjacent to the central green spine.
- Identification of vegetation with conservation value to be preserved within passive open space areas.
- A new neighbourhood centre that includes a primary school site, a retail centre, playgrounds and sports grounds. This mixed-use site will be carefully designed to maximise the integration between the uses around a village green to create a focal point for the new community. The open space has been sited to maintain the primary view line from The Northern Road to the Blue Mountains escarpment.
- Collector Road connections from the existing Glenmore Park to the approved intersection with The Northern Road and to link with Chain-O-Ponds Road. All residents will be within 400m of the collector road and The Northern Road providing access to bus services.
- A commitment to deliver 3% of affordable housing.

The following land use zones are proposed for Glenmore Park Stage 3 (page 14):

- B2 Local Centre
- R1 General Residential
- RE1 Public Recreation
- E2 Environmental Conservation.

Figure 5 Land Zoning Map – Sheet LZN_007 shows the proposed zones (page 15). The largest RE1 green patch includes the largest area of remnant Cumberland Plain Woodland on Lot 29 (Figure 1, page 3) that is identified in the Gunninah ecological report (page 25 and Drawing VPo2-D) as to be retained and regenerated. That patch needs to be zoned E2 to enable CPW to be retained. Similarly, the westernmost patch of CPW in Lot 17 is shown as RE1 rather than E2. Lot 17 will enable and provide linkage from Mulgoa NR to the Mulgoa Valley Natural Resources Sensitivity Land Map Sheet NRL_007 (Figure 8, page 17). The vegetated land on the north of Lot 17 is not suitable for clearing to build any "*Development for the purposes of a temporary sales and marketing suite on land zoned RE1 Public Recreation Zone*" as proposed in Schedule 1 Additional Permitted Uses 35 (1) on page 20.



General considerations

The Planning Proposal Report addresses various planning policy documents such as the Greater Sydney Region Plan and the Western City District Plan so those will not be addressed in detail here. Comments will be in relation to ecological matters as relevant to the Planning Proposal. For example, (page 30) "The proponent has submitted detailed urban capability, physical suitability, ecological and water cycle management investigations to ensure the development minimises its impacts on the environment".

A Water Cycle Management Strategy has been prepared to conform with the statutory requirements and industry best practice for stormwater management in this catchment. The *Water Cycle Management Strategy* consists of a treatment train consisting of on lot treatment, street level treatment and subdivision / development treatment measures. The provision of the proposed water quality treatment devices within the development will ensure that the post development stormwater discharges will meet Penrith City Council's water quality objectives for the Glenmore Park Extension site.

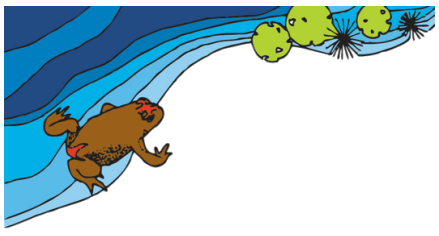
Outflow to receiving waters in Mulgoa Nature Reserve and the Surveyors Creek watercourses north east of the site is expected to conform with the statutory requirements and industry best practice for stormwater management in this catchment.

Scenic impact is a consideration made for the proposal, with various factors addressed. As I have observed over decades in western Sydney between Blacktown and Kingswood, urban development is eventually and at least partly obscured to some extent by an urban forest, as trees grow up in streets and gardens.

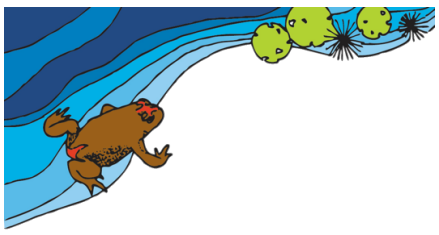
In our work with RMS for road widening on Windsor Road and Old Windsor Road, remnant native trees are commonly all removed, leaving no visual screen to urban development. Hawkesbury Council enabled a wide verge along Industry Road at Mulgrave incorporating remnant trees and additional planting to soften the visual impact of new development. Along The Northern Road on Glenmore Park Stage 3, an extended verge would setback all dwellings an additional 5m. This setback should be provided for most of The Northern Road frontage to create a consistent visual buffer. A clear view over the playing fields is proposed for the Blue Mountains escarpment backdrop so a planted strip is not appropriate there.

The concept from Urbaine of planting deciduous trees to provide seasonal views to the west requires use of local native drought tolerant species such as Lacebark *Brachychiton discolour,* white cedar *Melia azedarach* and red cedar *Toona australis*. That might be a variation from use of locally occurring remnant tree species. However, western Sydney in the 1800s was so denuded of trees of any sort that fence posts had to be brought from west of the mountains. What we have now is regrowth of a subset of the original vegetation diversity so additional species can only be a benefit to enhance biodiversity.

Urban forest creation is an excellent means to enhance local ecological values as well as ameliorate heat island and atmospheric pollutant effects. There is sufficient potential in road reserves to provide enough tree canopy to provide that outcome and environmental benefits.



However, that is to be considered in relation to views within, from and into the area, as raised on page 14 of the *Planning Proposal*. If the value of urban forest is greater than views at some points, with a potential tree height of 20 m to 25m, then building heights in the B2 zone can be raised to three stories, being more than 15 metres.



4. Peer review of the Gunninah ecological report

4.1 Introduction

In order to consider the methodology of the reports we have considered the relevant guidelines as follows:

- Department of Environment and Conservation NSW (2004). *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)*. Hurstville, NSW, Department of Environment and Conservation. (TBSA 2004).
- State of NSW and Office of Environment and Heritage (2017) DRAFT Threatened Species Test of Significance Guidelines. OEH 2017/634.

The vegetation description and plant species lists have been compared to Tozer *et al.* (2010) and the Scientific Committee 2005 Final Determinations for:

- Cumberland Plain Woodland
- Swamp Oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions – *endangered ecological community listing.*
- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions – *endangered ecological listing.*

M.G. Tozer, K. Turner, D.A. Keith, D. Tindall, C. Pennay, C. Simpson, B. MacKenzie, P. Beukers and S. Co (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11(3): 359-406.
https://www.rbgsyd.nsw.gov.au/science/Scientific_publications/cunninghamia/contents_by_volume/volume_11#eleventhree

Expected fauna and threatened species in the locality have been compared to Bionet records.

Local vegetation mapping (Figure 7) is taken from the SEED web site
https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU

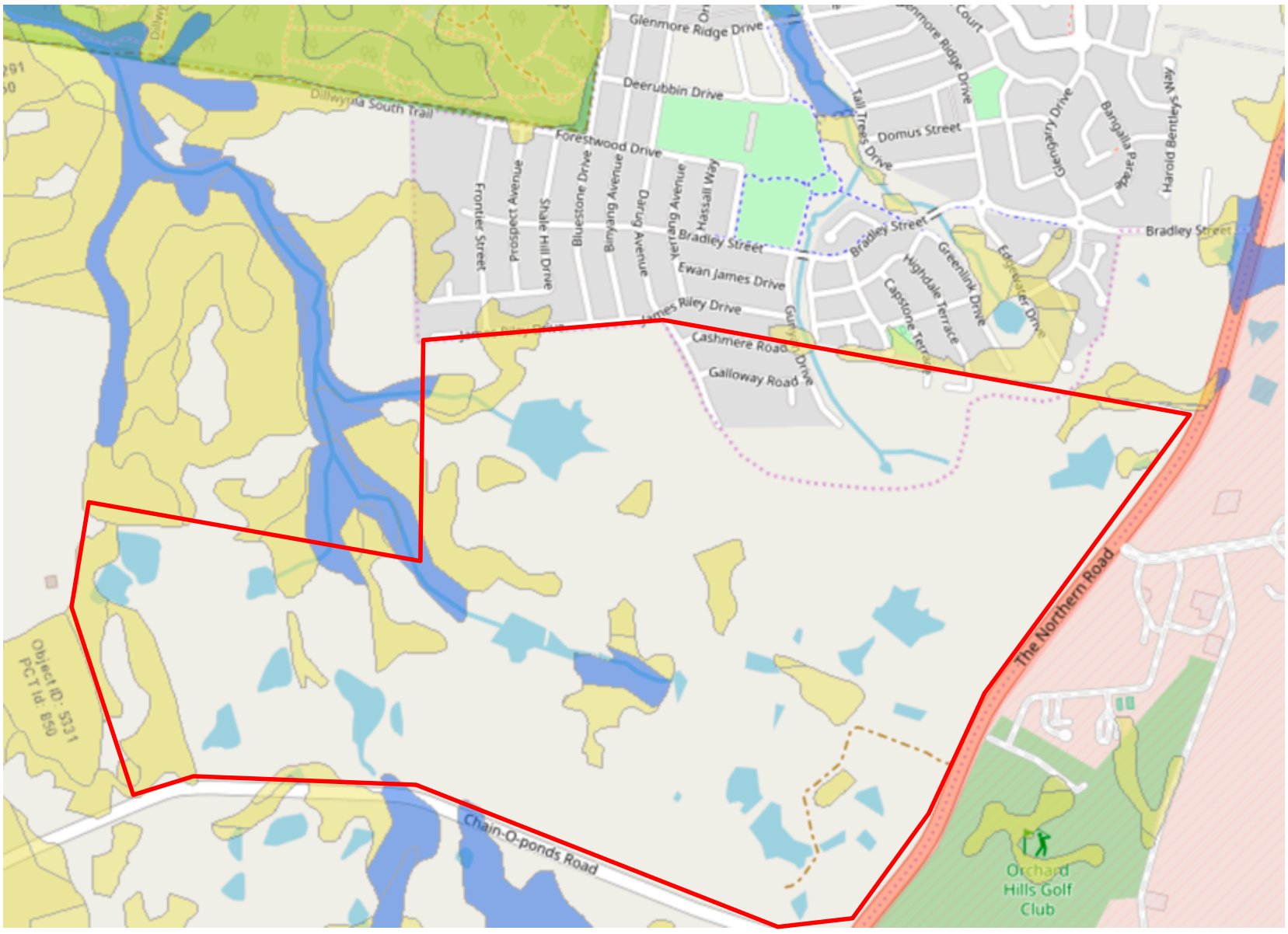
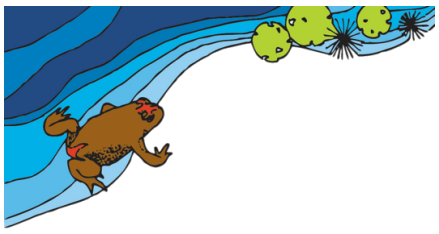


Figure 7: OEH mapped vegetation community patches.

Key: Red line shows the approximate Stage 3 area.

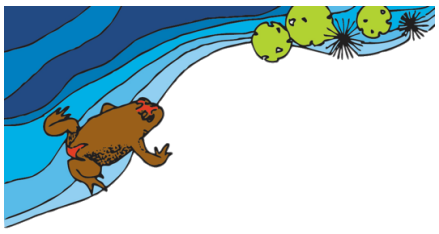


4.2 Review of the report

Table 2: Summary of the review.

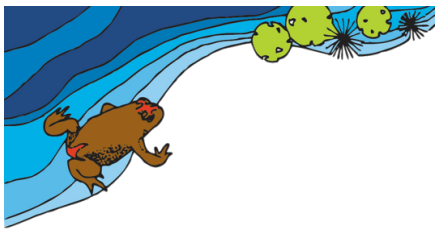
Section number	Heading	Comments
1.2	The subject land	Adjacent land is OEH so requires the relevant consideration under OEH policy.
1.3	The planning proposal	The proposal is clear and concise. Whether it is appropriate is another question.
1.4	Purpose of the report	Environmental effects are proposed to be addressed under various environmental planning instruments. *National Parks & Wildlife Act 1974* (NP&W Act) is not addressed in the body of the Report; The *Biodiversity Conservation Act 2016* No. 63 is referenced as 2017. The process of assessment under the BC Act 2016 is mentioned as being applicable when Das are prepared for Stages. The EPBC Act 1999 is used to minimise the significance of CPW on the site and justify removal. The *Water Management Act 2000* is addressed in the Report. The *Penrith Local Environmental Plan 2010* is addressed in the Report.
2	Information base	Night survey for owls and bitterns excluded Anabat recordings of microbats. The large dams on the site make ideal habitat for microbats so excluding that survey is puzzling. Data from OEH and EPBC MNES are provided as appendices. The database searches are adequate from both OEH and EPBC. The Bibliography on page 30 does not mention any "Published scientific information and data" to provide additional background for the Report. Reports of environmental investigations for The Northern Road upgrade are relied upon later in the Report but not referenced, so the significance and relevance of surrounding ecological conditions are not made clear. No mention is made of the OEH Priority Conservation. Lands map (Figure 3) in order to inform design of a potential E2 zone across the site. Local database records were not used to inform the Report.
3.1	Description of the subject land	Clear cadastral description, tenure and topography is presented.

Section number	Heading	Comments
3.2	Ecological characteristics of the subject land	The term 'regrowth" is used to describe the vegetation throughout the report but not defined or referenced so the relative value of the CPW patches has no comparison. Penrith LGA is listed in the Vegetation SEPP (State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017) so the definition of 'regrowth' under the *Native Vegetation Act 2003* does not apply. OEH did in fact undertake a ground truthing process to benchmark western Sydney vegetation mapping so the claim in the Report that the mapping of this site is purely from air photo interpretation is not sustainable. The derived native grasslands mentioned are not mapped nor referenced from any other report. Offsetting through the BAM process is appropriate as a mechanism to deal with loss of CPW. The mention of "grey gum" (*E. punctata*) is probably an error, since the co-dominant tree in CPW is grey box (*E. moluccana*). The assertion that a degraded stand of vegetation can be so bad that it is no longer the CPW community (page 9) is in error. The descriptions of watercourses and dams is quite vague, so is unhelpful. *Grevillea juniperina* and *Marsdinea viridiflora* are very obvious species so would have been clearly seen in the larger better patches of trees (Grevillea) and at the edge of dams (Marsdinea). The "minimal shrub layer" would have made such observations quite easy. A personal inspection of the larger better CPW patches would have thus enabled recording of *Grevillea juniperina* and *Marsdinea viridiflora* had they been present. Photos of the site do not show any old growth trees suitable as owl nest sites. The author asserts (page 13) "there is no likelihood of this latter species (Peregrine Falcon) being present on the Glenmore Park Extension site". The Peregrine Falcon actually has been recorded on the OEH Bionet Atlas east in St Clair residential area, north east at Riverstone Meat Works and 4.3km south of the site at Mulgoa, so is probable to occur on site. It will be very wise of Council to require that "further detailed fauna surveys will be undertaken in respect of all future *Development Applications* (Das) for residential and/or other development of the Glenmore Park Extension site" (page 13).



Section number	Heading	Comments
3.3	Ecological values and significance	Assertions are made without supporting data, for example: "the understorey is less than 50% … native species"; "Most of the patches of woodland … are of low to moderate biodiversity conservation value at best" "patches of degraded woodland … do not satisfy the criteria for the CPW community pursuant to either the BC Act or the EPBC Act" "threatened species recorded on or likely to occur or be present on" (page 14). Microbats have been recorded all around the site, including Large-eared Pied Bat at St Thomas Church Mulgoa and others in open grazing land and Glenmore Park residential area.
4	Threatened and migratory biota	The Yellow Wagtail is resident in northern Australia. There is one Bionet record for Newcastle in 2000 and twitchers travel to the Newcastle wetlands to see it. No, it is not recorded, nor in Penrith. Koalas are recorded nearby in similar habitat from Mulgoa to Silverdale in 2018 so a koala habitat survey is required.
4.1	New South Wales – BC Act	The OEH Bionet Atlas records a range of species on or adjacent to the site: Koala was recorded in April and June 2018 only 1,100m west of the site so is highly likely to occur on or near the site. Koala records for Silverdale are in February and June 2018. Cumberland Plain Land Snail is recorded in 2015 and 2016 in the east end of the site and on the northern and western edges of the site. At least six species of microbats and grey-headed flying-fox are recorded immediately adjacent to the site. Masked Owl and Varied Sitella occur near the northern boundary of the site. Powerful Owl has been recorded near the western end of the site. The Report does not mention the detail of those occurrences, but merely suggests that some species could appear sporadically.
4.2	Commonwealth of Australia – EPBC Act	In regard to occurrence of threatened plants "no evidence of the presence" must be read in the context of a very brief visit on the 19th and two evening visits on 20th and 21st. Consequently, the assertion, without having performed the relevant tests "project is not "likely" to impose a "significant impact" " is not sustainable. Similarly no data are presented to support the contention that

Section number	Heading	Comments
		CPW may not actually be present on site, being "too degraded to satisfy the criteria in the EPBC Act for the CPW TEC". For migratory species, no data are presented to substantiate the claim that the "site could not conceivably be of any significance for any such species".
4.3	Penrith Local Environment Plan 2010	The relevance of the LEP is noted but application is a cursory treatment. The patches of site vegetation are discounted for value and consideration of offsetting for clearing is removed to a future development application. The potential for such matters as a strategic approach is best made at the Planning Proposal stage.
5	Potential ecological impacts	Four outcomes are identified as: Residential development Recreational open space (active) Recreational open space (passive) Biodiversity and environmental protection and management. Some ecological impacts are anticipated as inevitable but not "significant". "Significance" can only be determined by means of a five part test under the *EP&A Act 1979* and section 7.3 of the *Biodiversity Conservation Act 2016*. No such test is presented in the Report so the comment is not sustainable. Furthermore the proposed habitat conservation and enhancement is included in the assessment, but that is specifically excluded by ***DRAFT Threatened Species Test of Significance Guidelines*** (OEH 2017, page 10). The principles of Avoid, Mitigate and Offset are best addressed, at least in principle, at the Planning proposal stage, being in this Report. Application of the Biodiversity Assessment Method (BAM) in the future may be inappropriate since suitable opportunities may be lost from the site in the rezoning process. The site has numerous dams along drainage lines, marked on the topographic map as blue lines and thus to be assessed to determine their status as a 'river' within the meaning of the *Water Management Act 2000*. The Report claims that few of those are a 'river' due to condition or small size. Dams are 'lakes' under the WMA 2000 but are not addressed at all in this context in this Report.
6.1	Water Management Act	The Report fails to include the defining characteristics of a 'river' as having bed and banks and aquatic or riparian vegetation. The Report also fails to include 'lakes' as being covered by the



Section number	Heading	Comments
		WMA and that farm dams are 'lakes' that trigger assessment.
6.2	Relevance of the subject land	Discussion of the streams mentioned defining characters of bed and banks, riparian vegetation and stream orders. The Report indicates that streams will be 'retained' and 'rehabilitated', presuming on the content of future development applications and consequent consent conditions.
7	Impact amelioration and environmental outcomes	Patches of CPW are mentioned as being of value to be retained and regenerated and shown on the preliminary vegetation map drawings VP01-C (page 11) and VP02-D (page 25). However some areas such as Lot 29 are shown as RE1 rather than E2 on proposed zone maps.

The form and content of the Report are of a generic descriptive nature rather than presentation of a survey, results as a data set and conclusions validly drawn from the data.

4.3 Discussion

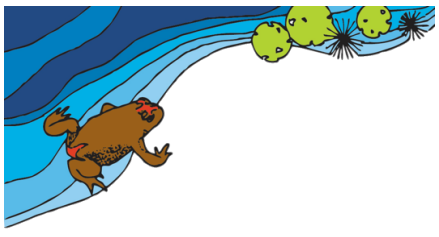
The description of the site conditions, in terms of habitat, both floristic and structural, are inadequate so a suitable survey design was not implemented. Survey effort was described as a one day walk over and two evenings of spotlighting for mammals, without any bat call recording or call playback used. The consequent findings of the field survey are thus unreliable.

Vegetation is categorised in condition classes without data to substantiate the coding. The concept plan proposed to retain some patches of vegetation and remove others on the basis of the purported condition of the vegetation patches. A more robust vegetation survey method such as BAM plots would enable an informed decision process for keeping or removing vegetation and subsequently enable an informed peer review.

Offsets and mitigating measures are proposed without any basis in survey or site analysis. A robust opportunities and constraints analysis is required before subdivision layout design proceeds.

The effect of the proposal in terms of fragmentation and species dispersal is not discussed or justified. Key threatening processes are not considered relevant when native vegetation and hollow bearing trees are to be removed.

No assessment of significance (seven part test or five part test) is provided. Thus, the finding of 'no significant effect' is not able to be substantiated.



4.4 Summary

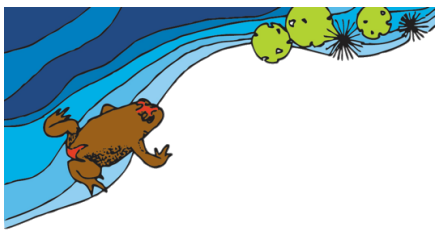
There are a number of inadequacies in the Gunninah report. The nature and extent of the proposal described in the Report is not suitably defined as either direct effects or indirect effects. The vegetation community type and structure are not suitably described and the assessment of potential fauna habitat is inadequate. The survey effort and design are inadequate for the purpose of the Report for the proposal and inconsistent with the requirements of the TBSA Guidelines 2004. The report submitted is brief and unsubstantial and does not conform to the requirements provided in the DECC 2007 Guidelines.

I recommend that an assessment that is consistent with the NSW Biodiversity Assessment Method be undertaken prior to the development of the final zoning layout.

The NSW Biodiversity Assessment Method (BAM) has been developed by the NSW government and is a product of their biodiversity reforms. The following extract is from page 2 the BAM:

> "2 Overview of the Biodiversity Assessment Method
> 2.1.1.1 The BAM sets out the requirements for a repeatable and transparent assessment of terrestrial biodiversity values on land in order to:
> (a) identify the biodiversity values on land subject to proposed development, clearing, or land in a biodiversity certification assessment area, or land proposed as a biodiversity stewardship site
> (b) determine the impacts of proposed development, or clearing or biodiversity certification on biodiversity values"

In the absence of a rigorous and robust submission there is doubt about the nature and extent of the impact of the proposal. I recommend that a BAM assessment be used to characterise the biodiversity values of the site and that this information be used to guide detailed design within the proposed re-zoning.



5. Abel Ecology Field Investigations

5.1 Methods

A site survey was conducted by Abel Ecology as a walk over from 0700 hours to 1700 hours on Monday 8th of October.

The team comprised:

1. Dr Danny Wotherspoon, ecologist, bushfire scientist and Certified Practising Ecological Consultant;
2. Dr Daniel McDonald, botanist, BAM accredited surveyor;
3. Dr Stephanie Clark, BAM accredited expert for Cumberland Plain Land Snail;
4. Mark Mackinnon, bushfire scientist and aquatic ecologist.

The weather was fine, cool to mild and cloudy and mostly dry under foot.

Most patches of trees were inspected for condition and age. Areas of pasture were inspected for proportion of native species in the herb layer. Areas of vegetation with woody debris were searched for snails. Incidental observations of fauna were recorded.

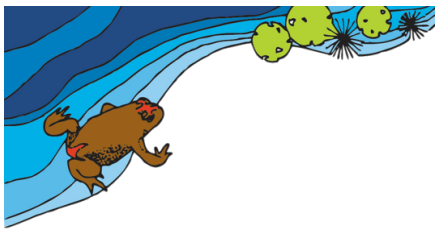
Each reach of the watercourses (Figure 6) was noted for bed and banks and riparian aquatic vegetation. Dams were noted for presence of aquatic vegetation both at the margins and within the water body. Botanical notes were made at 12 locations across the site (Figure 4) to enable vegetation descriptions to be prepared.

The site has numerous farm dams and drainage lines, marked on the topographic map as blue lines (Figure 6). The defining characteristics of a 'river' within the meaning of the *Water Management Act 2000* (WMA 2000) is having bed and banks and aquatic or riparian vegetation. The Gunninah Pty Ltd (Gunninah) Report fails to include this definition and also fails to include 'lakes' as being covered by the WMA 2000 and that farm dams are 'lakes' and that they trigger an assessment.

The watercourses have been assessed by Abel Ecology to determine their status as a 'river' within the meaning of the *Water Management Act 2000* and to determine the likely ecological impact of the proposal on them. The Gunninah Report claims that few of these watercourses are 'rivers' due to their condition or small size.

An assessment was made of each of the 38 stream reaches and 37 farm dams (outside the proposed extension to Mulgoa Nature Reserve) to determine:

- The stream order, using the Strahler stream ordering method,
- The existence of 'bed and bank' to confirm the status of each watercourse to be a 'river' under the WMA 2000, and
- The presence of riparian and or aquatic vegetation in both stream reaches and farm dams.



5.2 Findings

5.2.1 Vegetation

The site is mostly heavily grazed with very little ground cover of pasture or other herbs. There is very little shrub cover, being mostly grazed or browsed by cattle and horses. Very few areas had leaf litter cover to the soil. Trees are generally very young, being scattered paddock trees and patches of young regrowth. Very few mature trees are present.

Large areas of the site have been sown with oats as a pasture crop. Some areas are sown with oats and Rhodes Grass as a hay crop for baling.

Contrary to the Gunninah Report, we did not observe either Grey Gum *Eucalyptus punctata* (page 9) or Broad-leaved Apple *Angophora subvelutina* (page 10).

The site can be characterised broadly into three vegetation units. Each vegetation unit is described below. Each unit is discussed in relation to the NSW Biodiversity Assessment Method (BAM). While no formal assessment of vegetation was undertaken, all indigenous trees and where present, associated indigenous shrubs and ground covers within the site, are likely to represent forms of either the Critically Endangered Ecological Community Cumberland Plain Woodland or the Endangered Ecological Community River-Flat Eucalypt Forest. Both of these communities are protected and listed by the NSW government under the *NSW Biodiversity Conservation Act 2016*. The Commonwealth Government has listed Cumberland Plain Woodland as Critically Endangered under the *Environmental Protection and Biodiversity Conservation* (EPBC) *Act*.

All areas of native local indigenous vegetation that includes tree species, included scattered paddock trees on the site are likely to be forms of either Cumberland Plain Woodland or River-Flat Eucalypt Forest as defined by the NSW government. A few areas described below have the characteristics of the EBPC Act listed Critically Endangered Ecological Community Cumberland Plain Woodland.

The three vegetation units

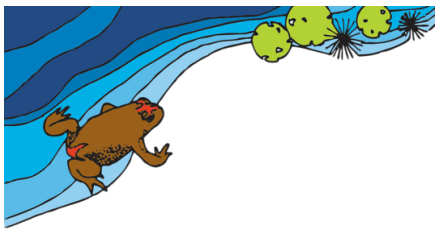
1. Pasture, cropping areas and gardens.

The majority of the site consists of this vegetation unit. The pastures are dominated by exotic species. This is cleared land and would not be considered native vegetation under the BAM. This degraded area has very little chance of regeneration to original native vegetation.

2. Indigenous trees with primarily and exotic pasture understorey.

This vegetation unit includes scattered individual trees as well as clumps of indigenous trees. The indigenous trees are considered native vegetation under the BAM. This degraded area has very little chance of regeneration to original native vegetation.

3. Indigenous trees with an indigenous understorey that often includes indigenous shrubs. There are some mature trees present, with the vast majority being quite young regrowth from historical clearing.



This indigenous vegetation is considered native vegetation under the BAM. This area has some chance of regeneration to original native vegetation but with significant effort in perpetuity.

Weeds

Tree and shrub weeds are generally rare on the site. African Olive *Olea europaea* subsp. cuspidata was observed in small numbers at a few locations. Exotic groundcovers were also observed across the site including areas of remnant vegetation. Common exotic groundcover species included African Love Grass *Eragrostis curvula,* Plantain *Plantago lanceolata* and Scarlet Pimpernel *Lysimachia* (*Anagallis*) arvensis.

Vegetation survey points

A detailed vegetation survey was not made but descriptive motes taken for a range of locations across the site. The survey points were chosen to provide a broad description of the range of vegetation condition across the site. Brief descriptions of the vegetation at various survey points displayed in Figure 4 are described below:

V s pt 1

The trees present in this area were remnants of the Critically Endangered Ecological Community Cumberland Plain Woodland. Red Forest Gum *Eucalyptus tereticornis* was the most common species at this location. Some local indigenous species occurred near the base of trees. A hollow tree was observed at this location and it appeared that it may be used by Eastern Rosellas for nesting. The nearby open/cleared areas (pasture) were dominated by exotic species.

Native aquatic species observed on the dam were Ribbonweed *Vallisneria* sp. and Tall Spike-rush *Elaeocarpus sphacelata.*

V s pt 2

West of the large dam the vegetation was generally less disturbed. Common trees include Forest Red Gum *Eucalyptus tereticornis* and Rough-barked Apple *Angophora floribunda.* Indigenous shrubs, such as Blackthorn *Bursaria spinosa* were relatively common in some places and there were patches where indigenous groundcovers were greater than 50% of the groundcover layer. Other indigenous species observed included bipinnate *Acacia* sp., Blue Trumpet *Brunoniella australis,* Love Creeper *Glycine* sp. Kidney Plant *Dichondra repens,* Tufted Bluebell *Wahlenbergia communis* and Weeping Grass *Microlaena stipoides.*

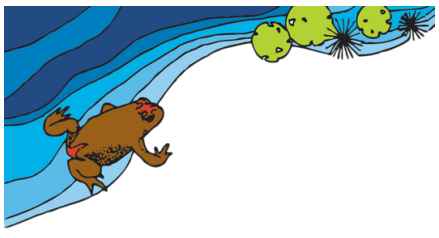
Part of this patch, adjacent to the western boundary is likely to meet the criteria and be considered the EPBC Act listed Cumberland Plain Woodland.

V s pt 3

This area was typical of the open cleared areas. It was dominated by exotic pasture.

V s pt 4

Scattered indigenous trees, including at least one with a hollow were observed. The understorey was primarily exotic pasture.



V s pt 5
This area was dominated by exotic pasture, primarily Kikuyu *Cenchrus clandestinus* (*Pennisetum clandestinum*).

V s pt 6
Narrow-leaf Ironbark *Eucalyptus crebra* and Rough-barked Apple *Angophora costata* were common in this area.

V s pt 7
A few scattered patches of Prickly-leaved Tea Tree *Melaleuca styphelioides* were present along drainage lines around this location.

V s pt 8 and V s pt 9
These two areas were similar. Narrow-leaved Ironbark *Eucalyptus crebra* was common in this location, Forest Red Gum *Eucalyptus tereticornis* and Grey Box *Eucalyptus moluccana* were also present. Other indigenous species recorded include Blackthorn *Bursaria spinosa,* Kidney Weed *Dichondra repens* and Kangaroo Grass *Themeda triandra*.

Part of this patch, adjacent to the northern boundary is likely to meet the criteria and be considered the listed EPBC Act Cumberland Plain Woodland.

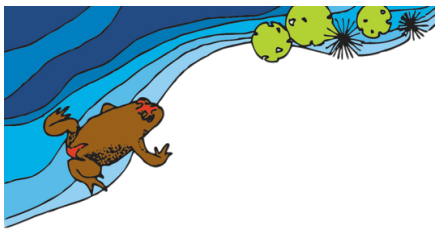
V s pt 10
This area consisted of scattered paddock trees or clumps of paddock trees. Narrow-leaf Ironbark *Eucalyptus crebra* was probably the most common species. Indigenous species were primarily found at the base of trees. The pasture had recently been oversown with a cereal (possibly Oats *Avena* sp.), presumably to be grazed.

V s pt 11
Narrow-leaved Ironbark *Eucalyptus crebra* and Blackthorn *Bursaria spinosa* were common at this locality.

Part of this patch, adjacent to the northern boundary is likely to meet the criteria and be considered the EPBC Act listed Cumberland Plain Woodland.

V s pt 12
This patch of vegetation was surveyed visually from an adjoining property. It appeared to be in relatively good condition and included indigenous shrubs and ground covers. Narrow-leaved Ironbark *Eucalyptus crebra* was observed.

Biodiversity Assessment Method (BAM)
The indigenous canopy species whether present as scattered individuals or larger clumps of the indigenous trees would require assessment by the BAM, ideally for the purpose of rezoning and certainly in any future development proposals.



The relationship of the *NSW Biodiversity Conservation Act 2016* and the BAM and the planning proposal is described below:

Part 6 Division 2 of *The Biodiversity Conservation Act 2016* states:

> *Division 2 Biodiversity assessment method*
> *6.7 Minister may establish biodiversity assessment method*
> *(1) The Minister is to establish a biodiversity assessment method in connection with the biodiversity offsets scheme.*
> *(2) The biodiversity assessment method is also established for the purpose of assessing the impact of actions on threatened species and threatened ecological communities, and their habitats, and the impact on biodiversity values of other actions prescribed by the regulations (whether or not the biodiversity offsets scheme applies to the impact of those actions on biodiversity values).*

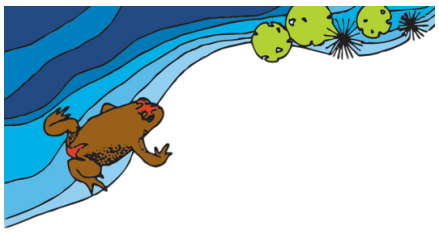
The NSW Minister has established the Biodiversity Assessment Method (BAM). An objective of the BAM is described in an extract below (page 1 of the BAM):

> *1 Background to the Biodiversity Assessment Method*
> *1.1.1.1 The NSW biodiversity offsets scheme (the offsets scheme) is established under Part 6 of the NSW Biodiversity Conservation Act 2016 (BC Act).*
> *1.1.1.2 The Biodiversity Assessment Method (BAM) is established under section 6.7 of the BC Act. The BAM is established for the purpose of assessing certain impacts on threatened species and threatened ecological communities (TECs), and their habitats, and the impact on biodiversity values, where required under the BC Act, Local Land Services Act 2013 (LLS Act) or the State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017).*

The NSW Biodiversity Conservation Regulation 2017 states:

> *Part 7 Biodiversity assessment and approvals under Planning Act*
> *…*
> *(3) If proposed development is or involves the subdivision of land, the subdivision is taken to involve the clearing of native vegetation that, in the opinion of the relevant consent authority or other planning approval body, is required or likely to be required for the purposes for which the land is to be subdivided. Once that clearing has been taken into account, the clearing for the purposes of the subsequent development of the land for which it was subdivided is not to be taken into account when determining whether the subsequent development exceeds the threshold.*

Thus, prior to the approval or ideally the preparation of any rezoning application or associated subdivision layout, it is appropriate to use the NSW Biodiversity Assessment Method (BAM). Such a rezoning application is displayed in Appendix A of the Gunninah (April 2018) *Glenmore Park Extension, Mulgoa Planning Proposal – Ecological Issues and Assessment Report*.



Use of the BAM will inform the consent authority about impacts that may occur on any threatened biodiversity by the proposal. An approach consistent with the NSW government's legislation and policies is to use the BAM to assist in the development of the rezoning/proposed subdivision layout.

Failure to use the BAM during the development of the re-zoning application or potential subdivision layout may result in the planning proposal not achieving a standard of "no net loss of biodiversity in New South Wales". The stated purposes of the *NSW Biodiversity Conservation Act* as stated in Section 1.3 such as:

> *(f) to assess the extinction risk of species and ecological communities, and identify key threatening processes, through an independent and rigorous scientific process, and*
>
> *(k) to establish a framework to avoid, minimise and offset the impacts of proposed development and land use change on biodiversity,*

It is difficult to have confidence that the planning proposal has achieved the objectives of the *NSW Biodiversity Conservation* (BC) *Act 2016* as the site analysis is not consistent with the BAM.

Biodiversity Stewardship Site

Use of the BAM allows some of the retained areas of remnant vegetation particularly those connected to Mulgoa Nature Reserve to become Biodiversity Stewardship sites. An advantage of a Biodiversity Stewardship Site is that funding for maintenance works is available. The relevant phrases in the paragraph below have been underlined.

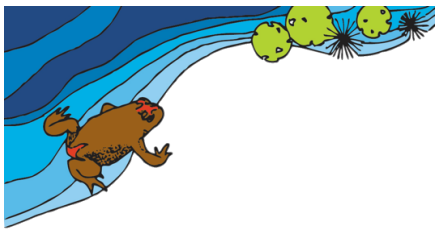
The BC Act 2016 (Section 6.2) states:

> *6.2 Biodiversity offsets scheme*
> *The biodiversity offsets scheme under this Act and related legislation has the following key elements:*
>
> *(a) The establishment of biodiversity stewardship sites on land by means of biodiversity stewardship agreements entered into between the Minister and the owners of the land concerned. Management actions will be required to be carried out on the sites by the owners under those agreements and will be funded from the Biodiversity Stewardship Payments Fund.*

Thus the establishment of a Biodiversity Stewardship agreement on some of the site will reduce the ongoing maintenance costs for Council in those areas that Council agrees to ownership.

5.2.2 Watercourses and Dams

Water courses were generally dry with very few areas of free water (Table 3) on the day of our inspection. The water level in dams was very low and some dams were dry (Table 4).



Overall, the presence of 'bed and bank' of all stream reaches was very limited (Table 3). This included assessment of the most downstream sections of each of the five catchments. Gully erosion was present in all stream reaches across the site and in some watercourses was severe (Figure 8). The only two stream reaches, which appeared to have natural 'bed and bank' were E8 and the western section of A9 (Figure 9). There was extensive evidence of stock (cattle and horse) access and movement through all watercourses and this may have contributed to the total loss of 'bed and bank' of some sections through trampling, grazing of riparian vegetation and erosion. The nutrient loading of surface water due to stock faeces was also noticeably high, with some water bodies having extensive algal blooms. The property owner of Lot 19, DP 244610, 133-145 Chain-O-Ponds Road, Mulgoa, claimed in conversation that the water in his dams (30 and 32) was unfit for crop or stock use. No running water was observed in any watercourse, however there was evidence of surface water from recent rainfall and all farm dams had low water levels or were dry.

The two dominant riparian vegetation species were *Typha* sp. and *Juncus* sp. (Figure 10). There was minimal evidence of remnant riparian vegetation, and a large extent of trees was regrowth. The best example of remnant riparian vegetation was along stream reach A1, D1, D3, D9, D10, and around dams 5 and 31. Stream reaches D10 and D12 had large mature *Melaleucas.* Only five farm dams recorded aquatic vegetation. The dams with recorded aquatic vegetation were dams 1, 12, 16, 17, and 31.

Where a dam has fluctuating water levels and broad shallow edges there is very high habitat value for migratory wading birds. Most of those are protected under international agreements such as JAMBA, CAMBA and ROKAMBA. Dam 31 on reach E4 is an example of such a water body.

Due to the lack of a defined 'bed and bank' across most stream reaches it could be argued there are no defined 'rivers' under the WMA 2000 onsite, and it is all considered 'overland flow' as per Sec. 4A of the WMA 2000. However, all site farm dams can be considered 'lakes' under the WMA 2000.

Using assessed stream order (Table 3), extent of tree vegetation, condition of farm dams (Table 4) and location of farm dams I have ranked the importance of the reaches of watercourses for consideration of corridors in an appropriate planning zone (Table 5). Either E2 or RE1 zone may be applied to the corridors (Figure 5) with the significant consideration being the zone objectives being clearly applied for ecological management of urban runoff, passive recreation and conservation purposes.

Figure 8. Evidence of gully erosion.

Figure 9. Stream reach E8, an example of bed and bank on site.

Figure 10. Evidence of the best riparian vegetation (stream reach D3 and E8).

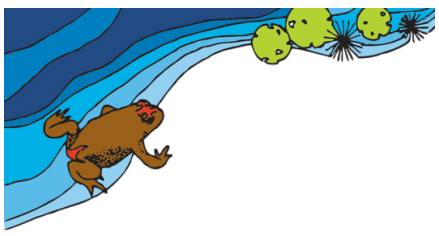


Table 3: Stream Order notes.

Reach number	Reach Order	Bed & banks	Vegetation	Notes
A1	3	Not at the fence	Yes	Gully erosion, swale. Litoria fallax - reed frog.
A2	2	No	No	
A3	1	No	No	Constructed over.
A4	1	No	No	
A5	2	Yes	Yes	It is not the original landform.
A6	1	No	No	Eroded gully / swale.
A7	1	No	No	Swale.
A8	1	No	No	Swale.
A9	1	Yes	Yes	Some gully erosion, extending 100m from dam 1.
B1	1	No	No	
B2	1	No	No	Non-existent.
C1	1	No	No	
C2	1	No	No	Swale.
D1	4	Didn't see		
D2	1	No	No	
D3	4	No	No	
D4	1	No	No	
D5	2	No	Yes	
D6	1	No	No'	
D7	1	No	No	
D8	1	Couldn't see		
D9	3	No	Yes	
D10	1	No	Yes	Large mature Melaleucas.
D11	2	No	Yes	
D12	1	No	Yes	Swale with mature tussock.
D13	2	No	Yes	
D14	1	No	Yes	Swale with mature tussock.
D15	1	Doesn't exist		
E1	1	No	No'	
E2	1	No	No	
E3	4	No	Yes	
E4	1	No	No	
E5	1	No	No	
E6	1	No	No'	
E7	1	No	No	
E8	4	Yes	Yes	The best watercourse today.
F1	1	No	No	
F2	1	No	No	

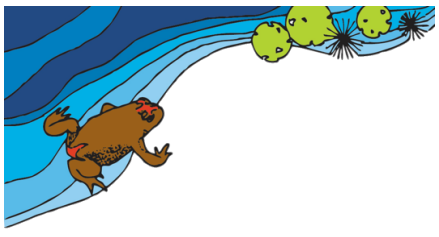


Table 4: Dam condition notes.

Reach number	Dam number	Bank vegn	Dam vegn	Notes
A5	1	Yes	Yes	
A2	2	Yes	Yes	Observed dotterel.
C1	3	No	No	Doesn't exist.
C1	4	Yes	Yes	
D1	5	Yes	Yes	
D1	6	Yes	No	
D1	7	Yes	No	Healthy dam native grass surrounding.
D3	8	Yes	No	
D11	9	Yes	Yes	
D11	10	Yes	No	
D13	11	Yes	Yes	
D15	12	Yes	Yes	Approx. 100 waterbirds, but otherwise an over grazed destroyed dam.
D14	13	Yes	No	Almost empty.
D12	14	Didn't see		
D10	15	No	No	A very sick dam.
D5	16	Yes	Yes	
D5	17	Yes	Yes	
D5	18	Yes	Yes	
D8	19	Yes	Yes	
D8	20	Couldn't see		
D7	21	No	No	Freshly excavated.
D8	22	No	Yes	
D5	23	No	No	
D5	24	Yes	No	
D5	25	No	No	
D6	26	No	No	
B1	27	Yes	Yes	
B1	28	No	No	
B1	29	No	No	
E1	30	No	No	
E3	31	Yes	Yes	Broad shallow dam suitable for wading birds
E4	32	No	No	
E5	33	No	No	
E3	34	No	Yes	
E6	35	No	No	
F1	36	No	No	
F1	37	No	No	

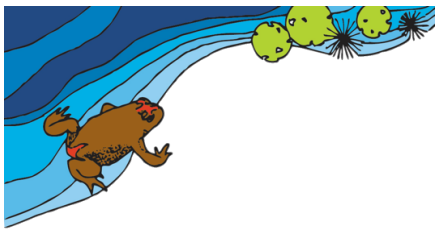


Table 5: Area ranking of ecological importance

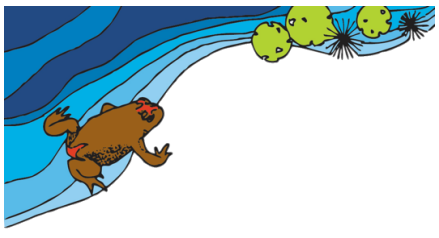
Drainage line label	Reach numbers	Tree canopy	Dams	Importance	Rank
A	A1, A2, A5	Good	Yes	Buffer to Mulgoa NR.	High
A	A9	No	No	Connects Stream A to Stream D.	Low
B	B1	Sparse	Yes	Connects Stream D to Surveyors Creek.	Moderate
C	C1, C2	Sparse	Yes	Low	Low
D	D1, D3, D9, D13	Good	Yes	Main drainage line across the site, carrying the majority of urban runoff into Mulgoa NR. The patches north of reaches D3 and D1 provide a wider corridor at good tree canopy areas.	High
D	D10	Moderate	Yes	Connects Stream D to Stream A.	Low
D	D15	No	Yes	Point of connection north to Surveyors Creek.	Moderate
E	E1, E3, E8	Good	Yes	Connects land south of Chain O Ponds Road north to Mulgoa NR. Dam 31 is an important component of the drainage line.	High
F	F1	Good	Yes	Connects Mulgoa NR to intact vegetation to the south.	High

5.2.3 Northern Dam

The Northern Dam (Farm Dam 1) is the largest water body onsite (2.8 Ha). The dam wall is approximately 10 metres high. From an ecological perspective, it was degraded. There was extensive evidence of stock (cattle) access and movement at the water's edge and through the watershed. There was evidence of the cattle wading into the water as deep as they dared to graze emergent vegetation - emergent vegetation out of their reach was evident. Riparian vegetation was minimal in extent, in poor condition and heavily grazed. The waterline has a ring of aquatic vegetation that appears to be in good to excellent condition, especially away from where cattle have been targeting emergent vegetation.

No aquatic invertebrates or fauna (except birds) were detected. There was a large number (+30 each) of Eurasian Coot and Hoary-headed Grebe observed, as well as White-faced Heron, Pacific Black and Wood Ducks, Grey Teal, and Hardhead. A pair of Black-fronted Dotterels, one Black Swan and an Australian Pelican was also observed. The feral mosquito fish *Gambusia* sp. was not observed. Likely fauna in the dam include long-necked turtle *Chelodina longicollis* and eels. The size of the dam makes it attractive as a drinking and foraging site for both grey-headed flying-fox and microbats.

The ecological value of the Northern Dam appears to be in the large extent of aquatic vegetation hugging the water's edge. The open water of the dam is likely to be an ecological desert and does not give significant ecological value to the dam.



If the large extent of aquatic vegetation with a smaller proportion of open (deep) water could be re-created in a replacement Lake, then the justification of the Northern Dam's removal would be ecologically fulfilled.

5.2.4 Fauna Observations across the site

Cumberland Plain Land Snail was found at the site. Suitable habitat is present within the site and specimens of the species, both living and empty shells were observed at three different locations within the north western portion of the study area. In addition, suitable habitat is present near the centre of the study area about 400m north of Chain of Ponds Rd and about 800m west of The Northern Rd along reach D3.

Kangaroos use most of the site and a range of common bird species occur on site according to habitat preference.

No turtles were seen, probably due to the weather on the day of survey and low water in the dams. Turtles are very likely to range across the entire site and use most of the dams at some time. Since turtles feed on a variety of live food such as insects, tadpoles and fish they will be more common in dams with better aquatic vegetation habitat. Small garden skinks and a red-bellied black snake as a live animal and a shed skin were found.

Frogs were not very enthusiastic about calling on a cool dry day but common froglet *Crinia signifera* and reed frog *Litoria fallax* were heard around Dam 1 and reach A1.

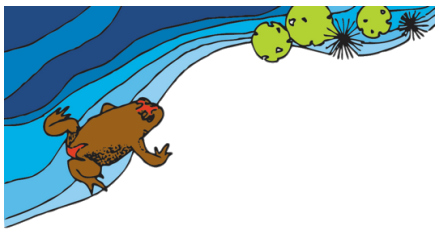
5.3 Discussion

The site has very little ecological integrity due to a history of grazing and market gardens. Some of the area is included in the Priority Conservation lands map (Figure 3) and all of that land is included in our suggestion for zoned conservation reserved lands on the site (Figure 5).

The main watercourse has discontinuous fringing vegetation and dense and extensive weed invasion. However, there is significant potential for a valuable and functional ecological corridor to be maintained along the main reach of the watercourse and some tributaries. Very few dams apart from those on the main watercourse have high ecological value.

There is connectivity and corridor value on the western fringe of the site and potentially from the watercourse D1 to D15 north into watercourse B1 as a tributary of Surveyor's Creek. The features and potential value of the drainage lines enable ranking of the value of those watercourses (Table 5).

Fauna was not surveyed but casual observations were made. One raptor, Australian Hobby was observed. Other raptors such as peregrine falcon and various microbat species are expected to occur on the site.



The Gunninah Report made a range of recommendations that had no justification in recorded data or analysis. I find that the site itself has internal features and topography that renders it more suitable for residential development than reconstruction as a native forest.

6. Regional planning documents

6.1 SREP13 Mulgoa and LEP 2010

The western side of the subject land that is part of "Mulgoa Valley" is Lot 17 DP 244610, 161-173 Chain-O-Ponds Road, Mulgoa. The NSW Department of Planning Property Report for that Lot indicates that SREP13 does not apply to the land, nor any other land in Penrith LGA.
https://legislation.nsw.gov.au/#/view/EPI/1987/014
The provisions of SREP13 are included in LEP 2010, Clause 7.18.

The zone is E3, which permits "extensive agriculture" as a use without consent which would potentially compromise any remnant natural values of Lot 17. Under the LEP minimum lot size is 20 hectares. In any rezoning, a smaller lot size of sufficient dimensions will allow a transition from the Mulgoa Valley landscape to the RE1 area. That may be applied all along the western boundary of the Glenmore Park Stage 3 area.

The Lot is also covered in part by the Sensitive Land mapping under LEP 2010, including the area under cultivation for a pasture crop.

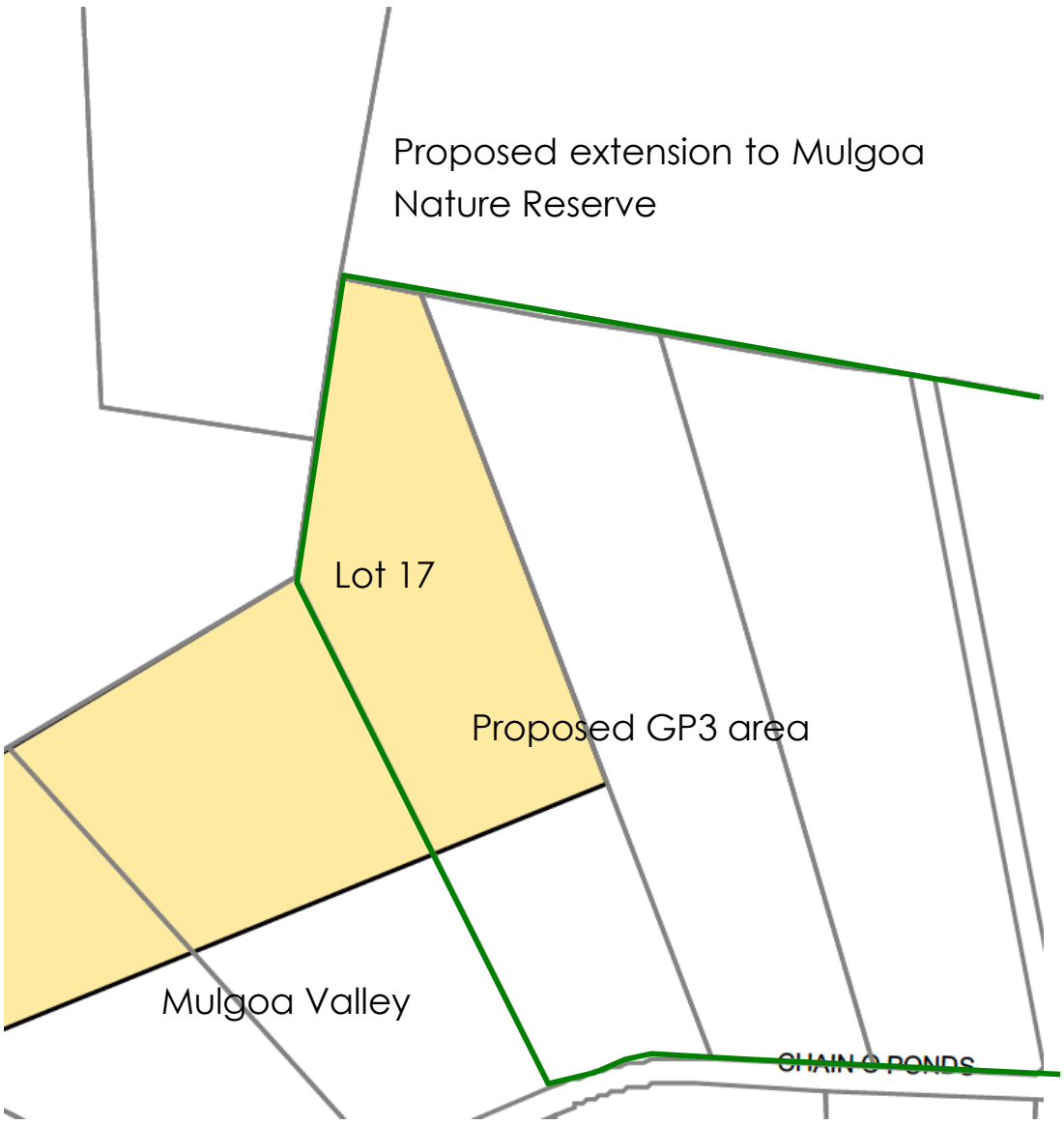


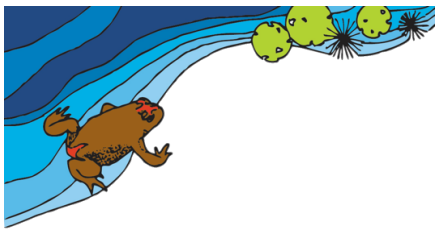
Figure 11: Natural Resources Sensitivity Land Map - Sheet NRL_007.

There is no apparent basis for the area mapped as "Natural Resources Sensitivity" (Figure 11) in that it largely comprises both cropped land and farm dams of relatively recent construction.

There is little or no intact ecological community on Lot 17. Ecologically Lot 17 is consistent with the land use of the majority of the GP3 area, comprising crops, improved pasture and scattered canopy trees. The farm dams are relatively recent construction and have very little aquatic vegetation so are ecologically not of a form comparable to natural 'chain of ponds' that occur along natural watercourses around the Cumberland Plain. Lot 17 has an historical land use and clearing that makes it a better fit with the GP3 area than the sensitive area mapped to the west. On that basis I recommend that Lot 17 be removed from the Mulgoa Valley Clause application map (formerly the SREP 13 boundary).

The north end of Lot 17 including the dams may be zoned as an E2 corridor (Figure 5). Regeneration and reconstruction of the natural vegetation community will be required in order to improve the corridor connectivity for fauna and flora across the north of Lot 17. For the purpose of management a Principal Development Area for a dwelling and bushfire asset protection zone and perimeter road may be attached to the E2 corridor at the north end of Lot 17 but not intrude into the E2 area.

The south end of Lot 17 is suitable for residential development without compromising the corridor connectivity across the north end of the Lot.



A perimeter road that approximately follows the existing road track will provide bushfire protection to any residential development with suitable Asset Protection Zone setbacks. The western perimeter bushland strip may be included in a very wide road reserve for the public road. *Planning for Bushfire Protection 2018* will be applied to all of the Glenmore Park stage 3 area.

Consistent with the provisions of Clause 18 of SREP13 (repealed), a buffer of 20m to the western boundary of Lot 17 will enable an environmental and visual transition between a perimeter road and the western boundary of Lot 17. Similarly, a buffer of 20 metres to top of bank of the dams on the north end of Lot 17 and adjacent Lot 18, will enable a suitable functional width of the corridor connection from Mulgoa Nature Reserve on the north and the Sensitive Land of Mulgoa Valley on Lot 15 to the west.

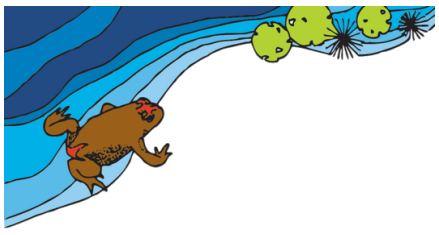
6.2 Mulgoa Nature Reserve Plan of Management (NPWS 2008)

Nature reserves are reserved under the *National Parks and Wildlife Act 1974* to protect and conserve areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena.

Under the Act, nature reserves are managed to:
- conserve biodiversity, maintain ecosystem functions, and protect geological and geomorphological features and natural phenomena;
- conserve places, objects, features and landscapes of cultural value;
- promote public appreciation, enjoyment and understanding of the reserve's natural and cultural values; and
- provide for appropriate research and monitoring.

Nature reserves differ from national parks in that they do not have as a management principle the provision of opportunities for visitor use. (Mulgoa Nature Reserve Plan of Management page 1)

In addition to the general objectives for nature reserves above, the management of Mulgoa Nature Reserve is subject to the following specific objectives:
- Protection and rehabilitation of the Mulgoa Nature Reserve's biodiversity, with an emphasis on the threatened species, populations and ecological communities of the Cumberland Plain;
- protection and preservation of key geological features and formations found within the Mulgoa Nature Reserve, with a focus on the protection of the shale cliffs;
- protection and preservation of Aboriginal sites and historic places found within Mulgoa Nature Reserve, particularly the conservation of the fabric of the Regentville ruins and associated cultural landscape and protection of all Aboriginal objects; and
- making accessible to the public the significance of the Mulgoa Nature Reserve, without compromising its conservation values, through interpretation programs and the provision of learning opportunities for the public benefit with an emphasis on the above conservation issues. (page 6).



There are five main vegetation types in Mulgoa NR, being:
- Shale Plains Woodland;
- Shale Hills Woodland;
- Moist Shale Woodland;
- Alluvial Woodland; and
- Western Sydney Dry Forest.

(Mulgoa nature Reserve Plan of Management page 8)

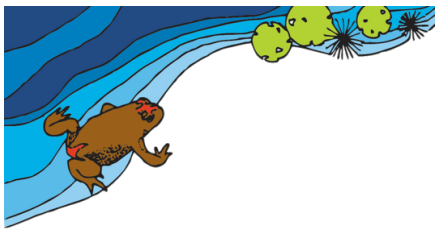
Introduced plant species within Mulgoa Nature Reserve, and on adjoining land, are of concern because they have the potential to have detrimental effects on ecological values and can spread to and from neighbouring land.
In addition, the *Noxious Weeds Act 1993* places an obligation upon public authorities to control noxious weeds on land that they occupy to the extent necessary to prevent such weeds spreading to adjoining lands.
Factors such as the past agricultural use of area, and its current proximity to urban and rural residential development, mean that a large number of introduced species are found within the reserve. (Nature Reserve Plan of Management page 10)

All native animals, including possums, snakes and termites, are protected in the reserve. Occasionally some of these animals are perceived as a nuisance and/or adversely affecting property or public safety. As these animals are part of the natural ecosystem, they should not be removed from the reserve. (Mulgoa Nature Reserve Plan of Management page 13)

There is inevitable conflict between human safety and wildlife such as possums, termites, wallabies, snakes and magpies at the interface of urban and bushland areas. Conversely, domestic animals that are allowed to roam freely are a significant threat to native fauna, particularly threatened species. The PoM recognises those management issues and threats in the Nature Reserve with a specific high priority activity being to control domestic animals in the NR. Council may consider a management response from the urban side of the interface.

Bushfire is a clear threat to residential areas at the bushland interface. The next edition of *Planning for Bushfire Protection 2018* is available as a draft and due for release in May 2019. Any subdivision design will be recommended to be designed under the provisions of *Planning for Bushfire Protection 2018*.

In order to stop or minimise fire within the reserve affecting the adjacent Glenmore Park housing estate, slashing and/or other forms of fuel reduction will be carried out in strategic locations. High priority will be given to areas where houses are directly adjacent to the reserve (Mulgoa Nature Reserve Plan of Management page 15).



Fire is managed in Mulgoa Nature Reserve to ensure:

- protection of life and property;
- the conservation of native plant and animal communities, particularly rare and threatened species and sensitive habitats; and
- protection of Aboriginal and historic heritage and landscape values. (Nature Reserve Plan of Management page 15).

Any extension of Glenmore Park residential area has the potential to affect the Mulgoa Nature Reserve by urban Stormwater runoff and other urban water flows that drain into the watercourses on site. Development of the subject land will be required to mitigate such impacts by both design and engineering of any development.

6.3 Greater Sydney Regional Plan

The Greater Sydney Region Plan, *A Metropolis of Three Cities* is built on a vision of three cities where most residents live within 30 minutes of their jobs, education and health facilities, services and great places.

The Planning Proposal sits within the Western Parkland City vision (page 16) of the Plan, with population projected to about double to more than 1.5 million people by 2056 AD. The Greater Sydney Green Grid will be a core element of the amenity of the Western Parkland City, so Mulgoa NR is possibly part of that concept.

Under the heading of sustainability (page 16), the Plan proposes that Increased tree canopy cover will provide shade and shelter for walkable neighbourhoods within easy reach of shops and services. The parkland character will be enhanced by the national parks and rural areas framing the city. Penrith City Council has an opportunity to require the design of the Planning Proposal to include elements at a neighbourhood scale that are consistent with the Plan objectives.

The Proposal is on The Northern Road so fits the infrastructure plan for the City. Expansion of Western Sydney University and Nepean Hospital are indicative of major structural requirements necessary for an increasing population, as shown in Figure 35 of the Plan (page 111).

A range of housing strategies are raised (page 64) that may apply to the site. Zoning for medium density by dual occupancy can enable increased green corridor widths and possibly permit domestic food production by crops or chickens. Dual occupancy provides a basis for multi-generational residential use as well as enabling newly married couples and new migrants to be supported by a local community. Such measures can possibly reduce the ecological footprint of a new community on a per capita basis.

6.4 Western City District Plan

In his introduction to the Plan Interim Western City District Commissioner Geoff Roberts wrote:

> "The development of Australia's first 21st century international airport will drive population growth, improve transport links and create new jobs and economic opportunities. This is a unique chance to grow new markets in international and domestic tourism, advanced logistics, aerospace industries freight, transport, health, education and the knowledge economy. The Western Sydney City Deal between the Australian, the NSW Governments and local governments will drive this growth.
>
> With such change, the Western City District Plan works to protect and enhance the character of our places and make it easier for residents to access services and facilities. With more jobs, more residents will be working locally and experiencing shorter commutes.
>
> To support this, we will work towards a greater diversity of homes so that people can afford to live here and can choose a home that better suits their lifestyle."
>
> https://www.greater.sydney/western-city-district-plan/introduction

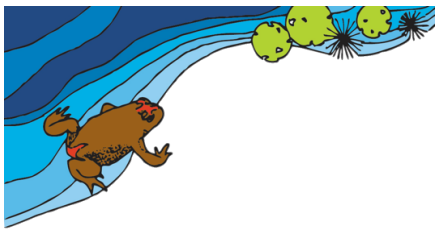
The Plan proposes a number of relevant objectives that Council can consider for the Glenmore Park extension as follows:

- Enhancing and protecting … Hawkesbury-Nepean river system(s)
- Mitigating the heat island effect and providing cooler places by extending urban tree canopy and retaining water in the landscape
- Protecting the District's natural landscapes, heritage and tourism assets, unique rural areas and villages
- Protecting the environmental, social and economic values of the Metropolitan Rural Area.

The site has a range of ecological assets that add value to the locality. The proposal offers an opportunity for Council to require the developer to align the design with the objectives above.

For example, there are local drought tolerant tree species with good shade canopy that are rare in the locality. Council could specify such trees for use in urban streetscapes and parks to significantly boost amenity, aesthetics, biodiversity and habitat value of the urban forest. The outcome can be a more liveable environment for people.

The Retail Assessment by Urbis is explained in the Planning Proposal (page 10). The proposed design of the eastern side along The Northern Road appears to be capable of a local village community atmosphere. The Richmond Village Green with cricket oval, churches, community hall and shops is a great example.



6.5 Future Transport 2056

Do all roads lead to the hub of the community? When residents return home, the entry point to the village can be welcoming if the design is right and commercially sustainable if the transport infrastructure guides the flow to and from home. That is a feature of the proposed access design.

A fractured community will fail at various levels. The purpose of the transport plan is to enable people to enjoy their family and community more rather than spend time travelling. Critical population mass for Glenmore Park will enable the transport strategy to be successful. Glenmore Park lies between Mulgoa Road and The Northern Road, providing an opportunity for a village community to develop, and best if people are able to be at home more than being away. The principles of the Future Transport 2056 report can be integrated with the urban design of the present Planning Proposal by means of creative internal road layout. The bushfire principle of perimeter roads is one that is unavoidable. The internal riparian corridor need not be a barrier but a focus as the Penrith River Walk has become.

The proposal provides an opportunity to develop the site using best practice urban design transport features.

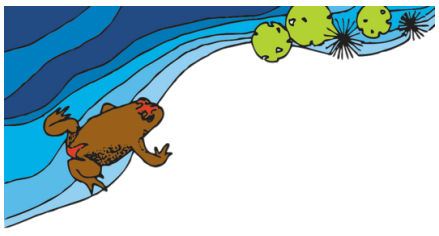
7. Assessment of the Planning Proposal rezoning options

7.1 The present proposal

The proposal as presented provides for extensive residential urban development areas, recreation space and areas of conservation and ecological management purposes. Areas for ecological restoration and management occur along the central east-west watercourse and connections north to Surveyors Creek and south across Chain O Ponds Road. The northern connection to Surveyors Creek will require reconstruction of a vegetation community since the line is closely grazed cleared land. The other potential ecological reconstruction areas are along watercourses with a varying presence and absence of trees. The dominant riparian herb vegetation is weed species of rushes and exotic herbs.

Recreational areas are proposed as RE1 zones both connected to the E2 zones and as isolated areas in the residential matrix. Areas of best quality Cumberland Plain Woodland with a population of Cumberland Plain Land Snail are proposed for RE1 use, apparently to be cleared as open space. Other areas of RE1 are both bare cleared land and tree cover of varying density and age.

The application of zones as E2 and RE1 are inconsistent in that there do not appear to be any criteria for either zone. Similarly, there is no relation of E2 zones to the NSW Government SEED vegetation mapping (Figure 7).



Areas of R1 residential zone are largely cleared grazing, sown pasture and market garden land with very little ecological value. Farm dams and drainage lines are of very low quality so use for residential land or urban infrastructure is of trivial impact.

Comments by location

Dam 1 on reach stream A1 has immediate connection to intact natural vegetation proposed as the addition to Mulgoa NR. The patch is mapped as natural vegetation (Figure 7) by OEH. The Planning Proposal fragments that patch of CPW and failed to encompass the sections capable of being retained to add value to the subdivision.

There are two purposes available for Dam 1. Firstly the dam may be used as a recreational area for local residents, in the form of boating, sailing, swimming and fishing. Appropriate edge infrastructure will enable such uses. Secondly the dam functions as an existing water quality control device for water discharged to Mulgoa Nature Reserve. Water quality can be significantly improved by adding fringing vegetation and addition of local species of mussels, which are bivalve filter feeders.

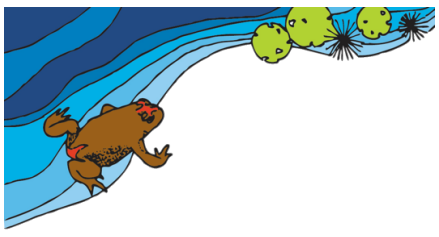
I recommend that the dam may be retained and the fringe and downstream be revegetated as appropriate so that some recreational activity can be permitted. If the dam is demolished and replaced with a smaller pond downstream, Council will need to be satisfied that it will act as a water quality control to Council's standards for discharge off site, particularly since outflow will discharge directly to Mulgoa Nature Reserve. Both options are ecologically acceptable.

The central drainage line running east to west is shown in the Planning Proposal as a narrow strip of E2 zone with some peripheral RE1 lands. The strip is generally too narrow to provide comprehensive ecological functions for the site after development. The central drainage line with dams numbered 6 to 11 inclusive can be retained and enhanced as an ecologically functional riparian zone.
Even though it is a Strahler First Order Stream, a wide and variable strip of vegetation for the reach of stream D will be highly valuable both ecologically and to manage stormwater flowing to Mulgoa NR (Figure 5).

A drainage line flowing north under Chain O Ponds Road as reach E includes a large dam, number 31. The topographic map (Figure 6) has the blue line incorrectly located. The stream is likely a 4th Order stream so requires 40 metres either side of top of bank. Dam 31 can be managed as a 'Lake' with appropriate buffers. There is potential to narrow the western side of the dam with minimal impact on ecological functions. Drainage line E from the south includes dam 31 with a side extension as reach E4. Reach E4 has no riparian structure, vegetation or ecological function so it may be removed.

Western drainage line values of reach F are included within the perimeter to dams 36 and 37 as well as the largely intact CPW vegetation patch.

An area of largely clear land with a few scattered trees on the western boundary north of dam 5 and south of reach A1 is shown in the Planning Proposal as RE1 zone. Such use is appropriate as a buffer between the CPW to the west and R1 land to the east.



The corridor along drainage line D has some patches of dense canopy trees that provide high value width to the corridor. The patch north of reach D3 is in a natural depression with Koala food trees. The better quality soil and ground water are suitable to enable trees there to be more healthy and resilient for fauna habitat. For example Koalas will find such foliage more sustaining and a range of fauna species such as threatened bats will find the flowering of those trees more abundant and reliable.

The patch north of reach D1, between dam 5 and dam 6 enables a suitable broad buffer to the riparian area of both reach D1 and dam 5 as a Vegetated Riparian Zone. Dam 5 is the final pond for water quality control before water is discharged into Mulgoa Nature Reserve.

7.2 Alternate options

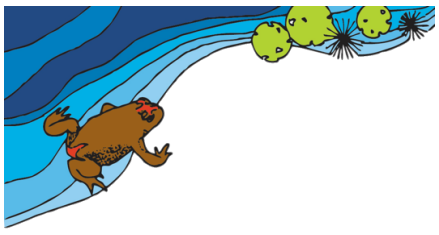
The considerations that underpin our Abel Ecology development of planning options include

- Location and condition of vegetation.
- Condition of drainage lines and dams.
- Legal context of dams and watercourses.
- OEH Priority Conservation Lands mapping.
- Council Sensitive Lands mapping and SREP13 boundary.
- Ecological corridor connectivity to surrounding areas.
- Future potential use of surrounding lands.
- Controls for applied zones as allowed in the range of permissible uses and prohibitions.

The importance of any part of the site for biodiversity in a degraded site, is ultimately only an outcome of extensive detailed work using the BAM. However, using tree canopy as a crude surrogate the two most useful criteria will be connection to Mulgoa Nature Reserve, location in relation to a drainage line, size of a patch of trees, and separation of scattered trees from patches and drainage lines.
There is so little in the form of patches of trees on the site that there is no point in any attempt to prescribe an area extent as a threshold of importance.

For the purpose of this report, land use zone objectives may be broadly regarded as
Recreation clear open space for playing fields, active recreation, car parks and picnic areas.
Conservation areas are for ecological reconstruction or regeneration, Stormwater management and passive recreation such as walking paths. Cycle paths may be integrated into roads along vegetated areas so as to avoid conflict with walkers and wildlife.

Those considerations were integrated into an alternative zone plan for the site (Figure 5).
Council has an opportunity to vary zone objectives and controls in terms of permissible uses and prohibitions. For example, E2 may prohibit use as a bushfire asset protection zone. Zone RE1 may prohibit any clearing of existing trees and require regeneration of native vegetation. Those examples are not recommendations but illustrate potential options for zone objectives for Glenmore Park South available to Council.



Consequently, the most important areas for biodiversity and ecological functions are the three main drainage lines as corridors on the site, being that passing through Dam 1, the main east to west drainage line and the southern drainage line from Chain O Ponds Road flowing north to Mulgoa NR. Any zone objectives applied to those three corridors will best enable long term funded restoration and active management. A minimum dimension that can be applied to those corridors is 40 metres from "top of bank", consistent with the provisions of the *Water Management Act 2000*. Farm dams along those drainage lines are significant features for both fauna habitat and improving water quality before discharge to Mulgoa NR.

A corridor is only of value when a connection is made to other areas so vegetation reconstruction for two connections is viable, being to Surveyors creek to the north and to join the two internal drainage lines (Figure 5). Dual use of corridors as passive recreation for walking paths and swimming in dams is appropriate for the nature of the site.

On that basis, the drainage lines may be zoned RE1 with objectives of environmental management and passive recreation.

Areas of land suitable for construction of playing fields occur both adjacent to drainage lines and on large clear level areas of the site.

7.3 Mulgoa landfill site

Landfill sites are required to be capped, revegetated and monitored for the life of the landfill.

> "… a revegetation layer at least 1000 millimetres thick and comprising clean soils and vegetation with root systems that will not penetrate into lower layers; the upper 200 millimetres should be a topsoil layer, which can include compost to help with vegetation establishment and growth." (NSW Environment Protection Authority *Environmental Guidelines: Solid Waste Landfills*, Second edition 2016, section 9, page 53)

Alternate capping ("phytocaps") with deep rooted vegetation for evapotranspiration dewatering is possible where the transpiration rate is higher than the rainfall (section 9.4).

> "Phytocaps use a vegetation community containing deep-rooted species that can draw water from the full depth of the soil storage layer. This contrasts with the typical barrier cap, which uses shallow-rooting species so as not to penetrate the barrier layer. Phytocaps may be able to use locally available soils that do not have the engineering properties required for use in the sealing layer of a conventional barrier cap" (section 9.4 page 56).

Penrith has an annual average rainfall of 718.6mm:
http://www.bom.gov.au/climate/averages/tables/cw_067113.shtml

and is in the 600-700mm band of evapotranspiration so that may be an option:
http://www.bom.gov.au/jsp/ncc/climate_averages/evapotranspiration/index.jsp

Local native species are specified so the long-term expectation is that the landfill site will act as a de facto addition to Mulgoa Nature Reserve and thus, widen the north-south habitat corridor on the east side of the Mulgoa valley (Figure 12).

The E2 zone across Lot 17 and connection to the Sensitive Land to the west provides for a long-term habitat corridor (Figure 13).

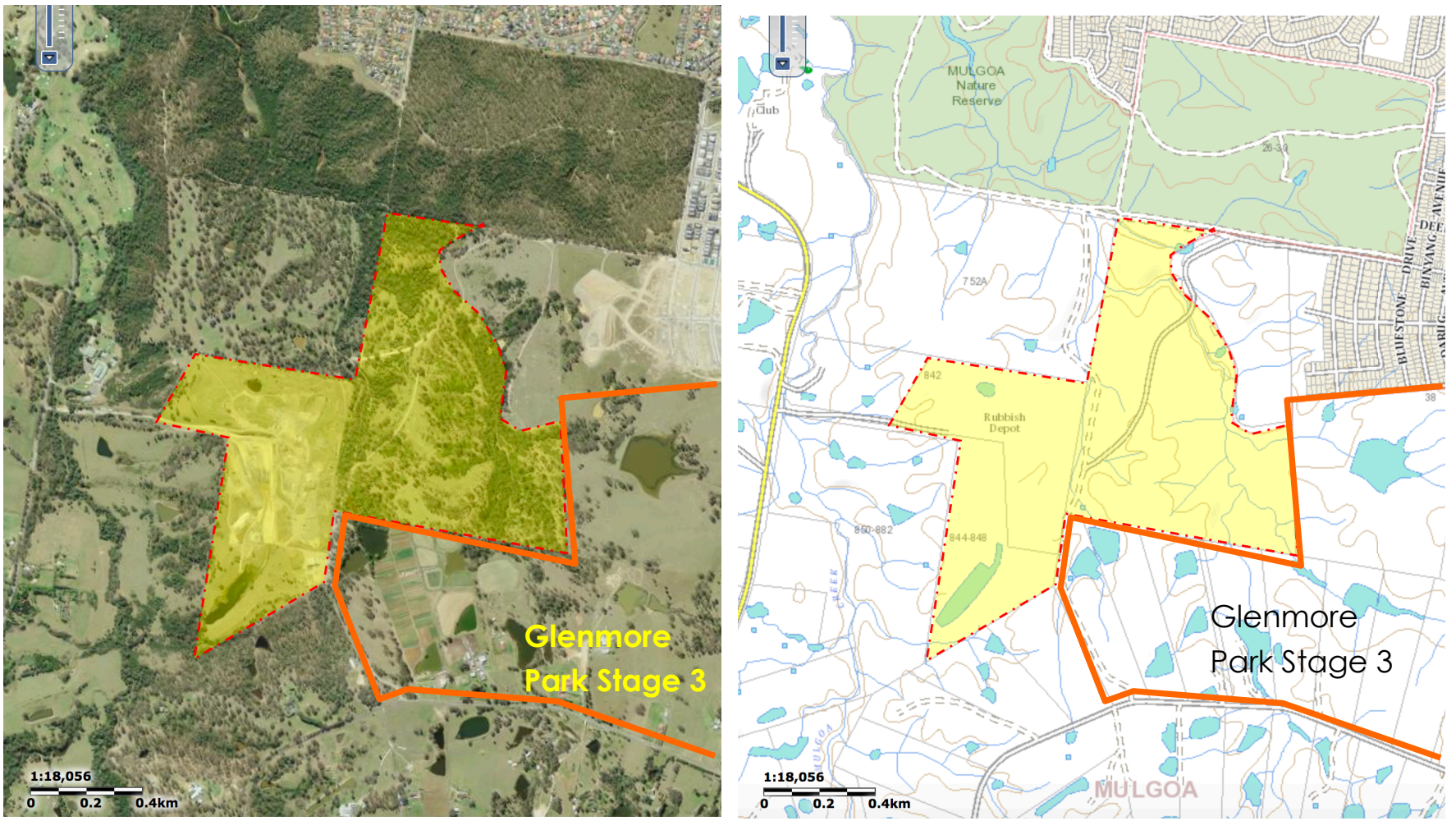


Figure 12: Mulgoa landfill and extension to Mulgoa NR west of Stage 3.

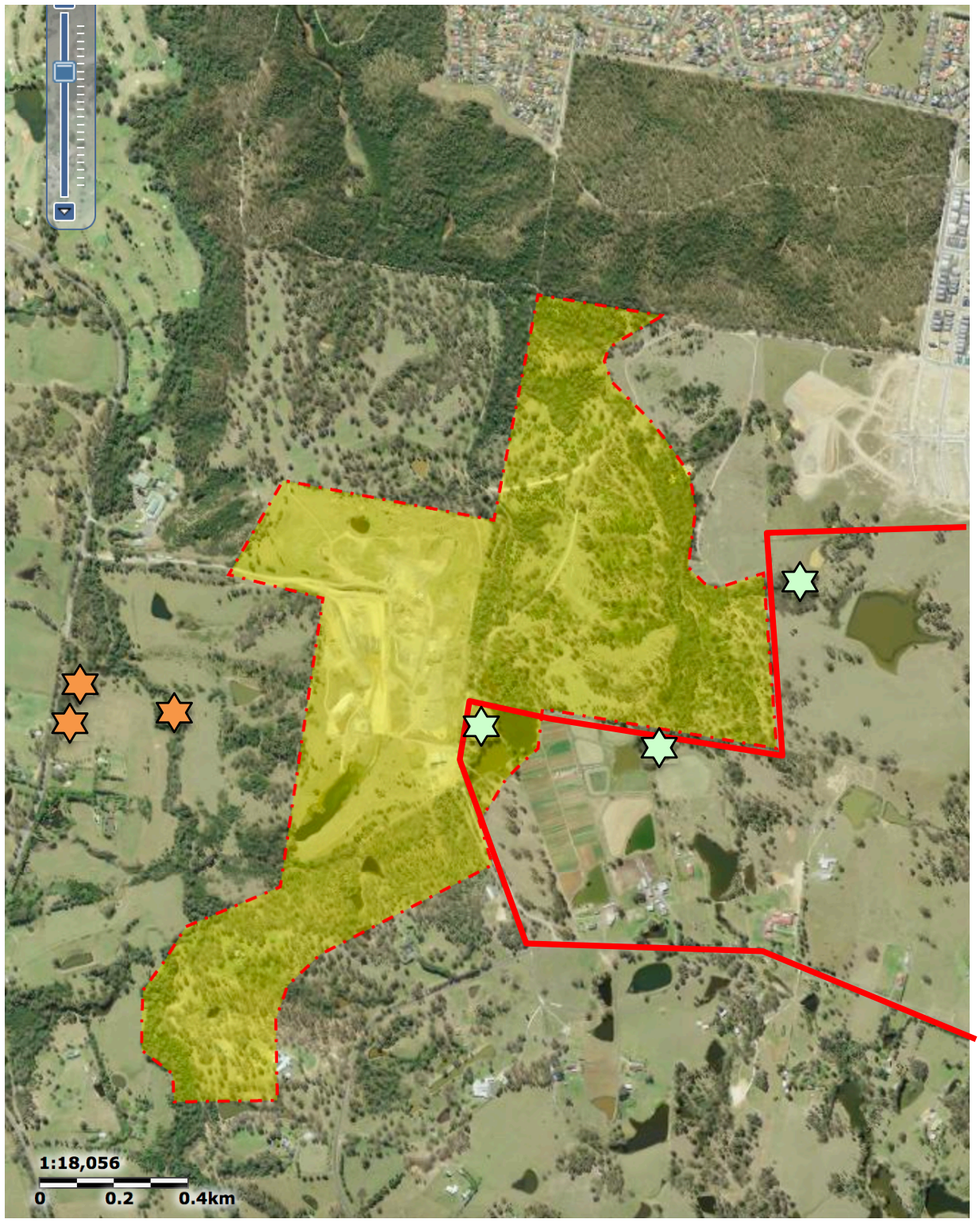


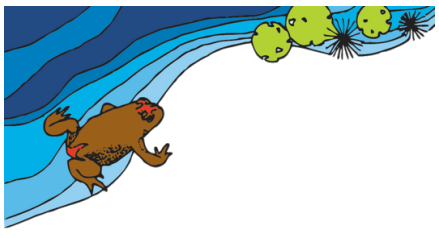
Figure 13: Potential long-term corridor connection with Mulgoa NR.

Key

Koala OEH records and local reports for 2018

Glenmore Park Stage 3

Cumberland Plain Land Snail found on site



7.4 Long term future potential of corridor connections

Given the history of clearing, grazing, agriculture and horticulture on the site, the site has little ecological integrity. Thus, most of the site is degraded with little prospect of regeneration. Trees are scattered with very little understorey of native herbs or shrubs or sapling canopy trees. Any reconstruction of vegetation along watercourses will provide an ecological corridor of some value for some groups of fauna, regardless of the width of the corridor. A corridor needs to be more than 100 metres wide and lead to a viable patch of vegetated habitat to be of any value as a pathway for most terrestrial fauna. Roads across a drainage line can be a death trap, so any crossing needs to be bridged in order to preclude a potential net negative value for a corridor for species such as turtles and water dragons.

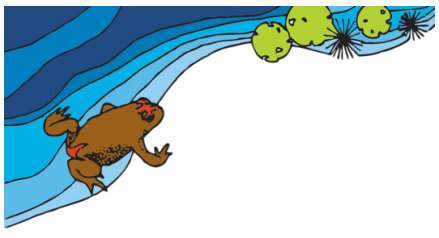
The value of corridor connections is demonstrated by arrival of Koalas near Glenmore Park (Figure 13). Koalas enjoy and depend on local species such as forest red gum *Eucalyptus tereticornis*, which is common in the area. In the long-term, Koalas can be expected along the creek line within Glenmore Park Stage 3 (GP3), so appropriate controls need to be specified in advance of development within a Koala Plan of Management (KPoM), either as a Glenmore Park Individual KPoM or for Penrith LGA.

Similarly, Cumberland Plain Land Snail *Meridolum corneovirens* was found at three locations on site in vegetation adjacent to the proposed addition to Mulgoa Nature Reserve. Within the CPW vegetation patch on reach D3 there is habitat suitable for the snail although none were found. Appropriate zoning as E2 for the occupied and suitable locations will ensure at least potential for persistence of the snail population. A robust Management Plan for E2 zones will assist that objective.

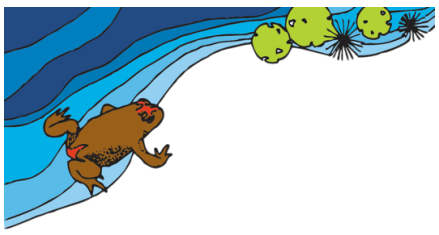
Within the site the main riparian corridor follows a watercourse east to west (reaches D1 to D15) thence into the proposed Mulgoa NR extension. A connection to Surveyors Creek on the northern boundary is feasible along reach B1.

Another internal riparian corridor may be considered as well, perhaps as a future consideration in urban subdivision design. The large north dam, Dam 1, has one steep gully running east (reach A9) that has potential as a vegetated riparian zone, to join up with a similar drainage line reach D10 that runs south to Dam 8 (Figure 6). The two reaches connect at the top of a ridge (Figure 5). Both reaches lack definitive features to be regarded as a 'river' but are significant drainage lines in topographic terms. Design for these reaches is perhaps best considered in the context of drainage design by a hydraulic engineer at a later stage of the development process.

The western boundaries of the site are both Mulgoa Nature Reserve extension and the Sensitive Lands area of Mulgoa Valley. At present the land use is cropping and grazing, so a range of threats as edge effects include weeds, wind and low humidity. Such edge effects are currently affecting the natural vegetation beyond the western boundary. A perimeter road as required by *Planning for Bushfire Protection 2018,* will act as an improved buffer to the natural areas. Edge effects may not be reduced but such a road may enable better access for management of the western boundary within the road reserves. Any bushfire asset protection zones will include the road formation and front setbacks within large Lots fronting that western perimeter road.



Edge effects along the western boundary with the proposed extension to Mulgoa Nature Reserve may be managed in a number of ways. A perimeter road immediately reduces the natural transfer of weeds from any residential area. A Plan of Management for the GP3 area may include a specific consideration of that western interface with the Nature Reserve. Control of dumping of garden waste and garbage is necessary to minimise weed invasion and pollution of the Nature Reserve. The effects of light, drying by low humidity and wind speed as edge effects act for up to 100 metres into natural bushland. A dense planted hedge along the western edge of the road reserve would reduce edge effects to some extent but not eliminate those effects. Such a planted hedge would have to be considered in the extent of a bushfire asset protection zone by shifting the building line for dwellings to the east. A Plan of Management with a particular provision for the GP3 area at the western interface would thus serve both ecological and bushfire protection purposes.



8. Conclusion and recommendations

Glenmore Park Stage 3 (GP3) is proposed on land that has a long history of clearing, grazing and cropping. The ecological values of the site are poor and vegetation is discontinuous.

This site offers opportunities for both sensitive urban development and significant ecological benefits. Connectivity is already proposed across the site by enhanced riparian corridors. The urban forest potential of riparian corridors is most beneficial where it enables both animal and human connectivity, as well as environmental values. Green loops of various lengths through the landscape offer variety of length and visual pathways for walking, jogging and strolling after dinner on a summer evening. Varsity Lakes on Queensland's Gold Coast is an example of the concept.

In this review, we have assessed the vegetation and watercourse and some fauna species sufficiently to make some informed assessments and recommendations.

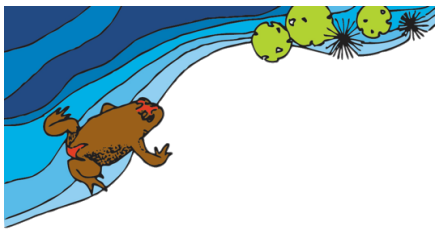
In general terms, I can support the proposed Master Plan as a concept and recommend some tweaks. For example, where potential residential areas are reduced by development of RE1/E2 corridors, compensating residential density and building heights can be increased in and around the B2 area with higher density residential zones (e.g. Area 1).

The areas identified in Figure 5 are conceptual and relate to the opportunities and constraints of the site in its present condition. The Objectives written for any zone applied to the riparian corridors will enable ecological management, conservation and recreational use.

Loss of any native vegetation will necessarily require an offset when site assessment is made under a Biodiversity Development Assessment Report using the Biodiversity Assessment Method (BAM). Firstly, the ecological value of various vegetation patches, scattered individual trees, habitat for threatened species such as koalas and structural habitat such as hollow-bearing trees will be quantified under the BAM. Secondly, those values will require offsetting either on site or off site by an appropriate method. Any BAM offset requires funding in perpetuity.

Site management such as weed control is likely to be very expensive and a long-term burden. Relocation of hollow trees to riparian corridors and installation of nest boxes is also expensive to provide as well as to maintain in the long term. Any planning proposal or development proposal must provide for such costs.

There are some structural habitat values on the site in the form of dams and drainage lines. Any retained dam on site is a 'lake' under the *Water Management Act 2000* so requires a defined buffer zone. No reach of watercourse on the site fully meets the definition of a 'river', so Vegetated Riparian Zone buffers do not apply. However, a dramatic increase in hard surfaces across the site by urban development poses a challenge to construct the project as Water Sensitive Urban Design under BASIX, so that pre-construction flow rates and volumes are maintained and water quality for discharges to Mulgoa Nature Reserve are acceptable under Council criteria.



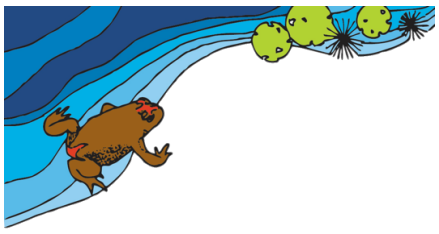
The indicative RE1/E2 zones across the site (Figure 5) do not indicate any specific clearance from a dam or line of a watercourse. The placement of zone boundaries can be the means by which Vegetated Riparian Zones (VRZs) can be specified. Any required vegetation management plan (VMP) for the site can include a range of performance specifications to establish and maintain riparian corridors. Specifications can include allowance for stormwater management structures, footpaths, vegetation composition, relocated or artificial nest hollows and structural habitat for Cumberland Plain Land Snails.

Can this site fulfil the Objectives or Intended Outcomes of the Planning Proposal?
" … there will be environmental benefits from supporting the change of use whereby water quality targets and preservation and regeneration of native vegetation can be better achieved."

My assessment is Yes, conditionally.

What does it take?

- Adequate site analysis;
- Realistic assessment of impacts, opportunities and constraints by the BAM process before rezoning;
- Appropriate zoning of the site;
- Functional and viable environmental design in the Development Application process.

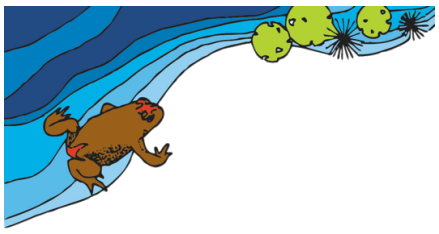


Appendix 1. Fauna List for "Wallaroo" property, Mulgoa

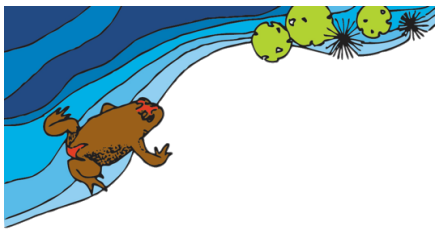
Species lists are reproduced as provided by Mulgoa Landcare Group.

Birds

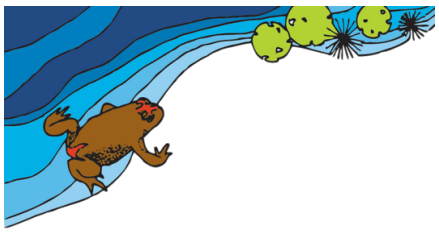
Common name	Scientific name
Brown Quail	Coturnix ypsilophora
Black Swan	Cygnus atratus
Australian Wood Duck	Chenonetta jubata
Pacific Black Duck (b)	Anas superciliosa
Grey Teal	Anas gracilis
Chestnut Teal	Anas castanea
Hardhead	Aythya australis
Australasian Grebe (b)	Tachybaptus novaehollandiae
Yellow-billed Spoonbill	Platalea flavipes
Straw-necked Ibis	Threskiornis spinicollis
Royal Spoonbill	Platalea regia
Yellow-billed Spoonbill	Platalea flavipes
Black Bittern	Dupetor flavicollis
Nankeen Night Heron	*Nycticorax caledonicus*
Great Egret	Ardea alba
Eastern Cattle Egret	Bubulcus coromandus
White-necked Heron	Ardea pacifica
White-faced Heron	Egretta novaehollandiae
Little Pied Cormorant	Microcarbo melanoleucos
Little Black Cormorant	Phalacrocorax sulcirostris
Great Cormorant	Phalacrocorax carbo
Australasian Darter	Anhinga novaehollandiae
Baillon's Crake	Porzana pusilla
Purple Swamphen (b)	Porphyrio porphyrio
Dusky Moorhen (b)	Gallinula tenebrosa
Eurasian Coot	Fulica atra
Black-fronted Dotterel	Elseyornis melanops
Masked Lapwing	Vanellus miles
Latham's Snipe	Gallinago hardwickii
Wedge-tailed Eagle	Aquila audax
White-bellied Sea-Eagle	Haliaeetus leucogaster
Swamp Harrier	Circus approximans
Black-shouldered Kite	Elanus axillaris
Whistling Kite	Haliastur sphenurus
Pacific Baza	Aviceda subcristata



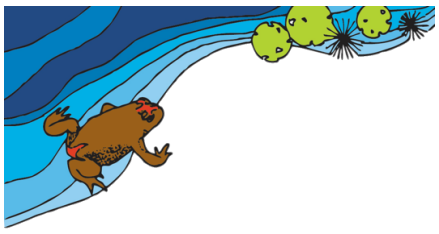
Common name	Scientific name
Grey Goshawk	Accipiter novaehollandiae
Brown Goshawk	Accipiter fasciatus
Collared Sparrowhawk	Accipiter cirrocephalus
Little Eagle	Hieraaetus morphnoides
Nankeen Kestrel	Falco cenchroides
Australian Hobby	Falco longipennis
Brown Falcon	Falco berigora
*Spotted Dove	Spilopelia chinensis
Common Bronzewing	Phaps chalcoptera
Crested Pigeon	Ocyphaps lophotes
Peaceful Dove	Geopelia placida
Bar-shouldered Dove	Geopelia humeralis
Brown Cuckoo-Dove	Macropygia amboinensis
Pacific Koel	Eudynamys orientalis
Horsfield's Bronze Cuckoo	Chalcites basalis
Shining Bronze Cuckoo	Chrysococcyx lucidus
Pallid Cuckoo	Cacomantis pallidus
Fan-tailed Cuckoo	Cacomantis flabelliformis
Brush Cuckoo	Cacomantis variolosus
Channel-billed Cuckoo	Scythrops novaehollandiae
Southern Boobook	Ninox boobook
Tawny Frogmouth	Podargus strigoides
White-throated Needletail	Hirundapus caudacutus
Pacific Swift	Apus pacificus
Dollarbird (b)	Eurystomus orientalis
Laughing Kookaburra (b)	Dacelo novaeguineae
Sacred Kingfisher (b)	Todiramphus sanctus
Azure Kingfisher	Ceyx azureus
Rainbow Bee-eater	Merops ornatus
Galah	Eolophus roseicapillus
Long-billed Corella	Cacatua tenuirostris
Little Corella (b)	Cacatua sanguinea
Sulphur-crested Cockatoo	Cacatua galerita
Glossy Black-Cockatoo	Calyptorhynchus lathami
Yellow-tailed Black-Cockatoo	Calyptorhynchus funereus
Rainbow Lorikeet (b)	Trichoglossus haematodus
Musk Lorikeet	Glossopsitta concinna
Little Lorikeet	Glossopsitta pusilla
Eastern Rosella	Platycercus eximius
Crimson Rosella	Platycercus elegans
Red-rumped Parrot	Psephotus haematonotus
Australian King-Parrot	Alisterus scapularis
Satin Bowerbird (b)	Ptilonorhynchus violaceus



Common name	Scientific name
White-throated Treecreeper	Cormobates leucophaea
Superb Fairy-wren (b)	Malurus cyaneus
Variegated Fairy-wren	Malurus lamberti
Eastern Spinebill	Acanthorhynchus tenuirostris
Scarlet Honeyeater	Myzomela sanguinolenta
Noisy Friarbird (b)	Philemon corniculatus
Little Wattlebird	Anthochaera chrysoptera
Red Wattlebird	Anthochaera carunculata
Lewin's Honeyeater	Meliphaga lewinii
Yellow-faced Honeyeater (b)	Caligavis chrysops
Bell Miner	Manorina melanophrys
Noisy Miner (b)	Manorina melanocephala
Brown-headed Honeyeater	Melithreptus brevirostris
White-eared Honeyeater	Lichenostomus leucotis
Fuscous Honeyeater	Lichenostomus fuscus
White-plumed Honeyeater	Lichenostomus penicillatus
Spotted Pardalote (b)	Pardalotus punctatus
Weebil	Smicrornis brevirostris
White-browed Scrubwren	Sericornis frontalis
White-throated Gerygone	Gerygone olivacea
Brown Gerygone	Gerygone mouki
Brown Thornbill	Acanthiza pusilla
Yellow-rumped Thornbill	Acanthiza chrysorrhoa
Yellow Thornbill	Acanthiza nana
Striated Thornbill	Acanthiza lineata
Eastern Whipbird	Psophodes olivaceus
Grey Butcherbird	Cracticus torquatus
Australian Magpie	Gymnorhina tibicen
Pied Currawong	Strepera graculina
Black-faced Cuckoo-shrike	Coracina novaehollandiae
White-bellied Cuckoo-shrike	Coracina papuensis
Varied Sittella (b)	Daphoenositta chrysoptera
Golden Whistler	Macropygia amboinensis
Rufous Whistler	Pachycephala rufiventris
Grey Shrike-thrush	Colluricincla harmonica
Australasian Figbird	Sphecotheres vieilloti
Olive-backed Oriole	Oriolus sagittatus
Dusky Woodswallow	Artamus cyanopterus
Willie Wagtail (b)	Rhipidura leucophrys
Grey Fantail	Rhipidura albiscapa
Rufous Fantail	Rhipidura rufifrons
Magpie-Lark	Grallina cyanoleuca
Leaden Flycatcher	Myiagra rubecula



Common name	Scientific name
Restless Flycatcher	Myiagra inquieta
Australian Raven	Corvus coronoides
White-winged Chough	Corcorax melanoramphos
Eastern Yellow Robin	Eopsaltria australis
Rose Robin	Petroica rosea
Jacky Winter	Microeca fascinans
*Red-whiskered Bulbul	Pycnonotus jocosus
Australian Reed Warbler	Acrocephalus australis
Rufous Songlark	Megalurus mathewsi
Welcome Swallow	Hirundo neoxena
Fairy Martin	Petrochelidon ariel
Tree Martin	Petrochelidon nigricans
Golden-headed Cisticola (b)	Cisticola exilis
Silvereye	Zosterops lateralis
*Common Myna	Acridotheres tristis
*Common Starling	Sturnus vulgaris
*Common Blackbird	Turdus merula
Mistletoebird	Dicaeum hirundinaceum
Double-barred Finch	Taeniopygia bichenovii
Red-browed Finch (b)	Neochmia temporalis
Chestnut-breasted Mannikin	Lonchura castaneothorax
Australasian Pipit	Anthus australis
*European Goldfinch	Carduelis carduelis

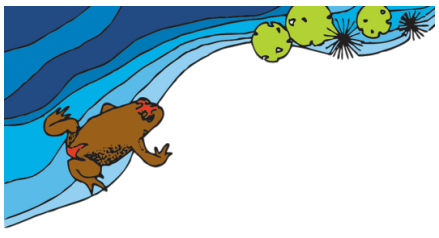


Mammals

Common name	Scientific name
Koala	Phascolarctos cinereus
Common Ringtail Possum	Pseudocheirus peregrinus
Common Brushtail Possum	Trichosurus vulpecula
Sugar Glider	Petaurus breviceps
Common Wombat	Vombatus ursinus
Eastern Grey Kangaroo	Macropus giganteus
Common Wallaroo	Macropus robustus
Swamp Wallaby	Wallabia bicolor
Large-eared Pied Bat	Chalinolobus dwyeri
Gould's Wattled Bat	Chalinolobus gouldii
Chocolate Wattled Bat	Chalinolobus morio
Little Bent-winged Bat	Miniopterus australis
Eastern Bent-winged Bat	Miniopterus schreibersii
Eastern coastal Free-tailed Bat	Mormopterus norfolkensis
Large-footed Myotis	Myotis macropus
Long-eared Bat	Nyctophilus spp.
Eastern Horseshoe Bat	Rhinolophus megaphyllus
Coastal Sheath-tailed Bat	Tadarida australis
*European Hare	Lepus europaeus
*European Rabbit	Oryctolagus cuniculus
*European Red Fox	Vulpes vulpes
*Fallow Deer	Dama dama
*Black Rat	Rattus rattus
*House Mouse	Mus musculus

Reptiles

Common name	Scientific name
Lace Monitor	Varanus varius
Eastern Water Dragon	Physignathus lesuerii
Jacky Lizard	Amphibolurus muricatus
Eastern Water Skink	Eulamprus quoyii
Garden Skink	Lampropholis delicata
Weasel Skink	Saproscincus mustelinus
Eastern Snake-necked Turtle	Chelodina longicollis
Red-bellied Black-snake	Pseudechis porphyriacus
Eastern Brown Snake	Pseudonaja textilis
Yellow-faced Whip Snake	Demansia psammophis



Amphibians

Common name	Scientific name
Dwarf Green Tree Frog	Litoria fallax
Broad-palmed Frog	Litoria latopalmata
Peron's Tree Frog	Litoria peronii
Whistling Tree Frog	Litoria verreauxii
Bleating Tree Frog	Litoria dentata
Striped Marsh Frog	Limnodynastes peronii
Common Eastern Froglet	Crinia signifera
Smooth Toadlet	Uperoleia laevigata

Fish

Common name	Scientific name
*European Carp	Cyprinus carpio
*Mosquito Fish	Gambusia affinis
Short-finned Eel	Anguilla australis
Long-finned Eel	Anguilla reinhardtii
Freshwater Mullet	Trachystoina petardi
Australian Bass	Percalates colonorum
Firetail Gudgeon	Hypseleotris galii

Appendix 2. Company Profile

Abel Ecology has been in the biodiversity consulting business since 1991, starting in the Sydney Region, and progressively more state wide in New South Wales since 1998, and now also in Victoria. During this time extensive expertise has been gained with regard to Master Planning, Environmental Impact assessments including flora and fauna, bushfire reports, Vegetation Management Plans, Management of threatened species, Review of Environmental Factors, Species Impact Statements, Biodiversity Development Assessment Reports and as Expert Witness in the Land and Environment Court. We have done consultancy work for industrial and commercial developments, golf courses, civil engineering projects, tourist developments as well as residential and rural projects. This process has also generated many connections with relevant government departments and city councils in NSW. Our team consists of four scientists and two administrative staff, plus casual assistants as required.

Licences

NPWS s132C Scientific licence number is SL100780 expires 30 April 2019
NPWS GIS data licence number is CON95034
DG NSW Dept of Primary Industries Animal Care and Ethics Committee Approval expires 8 December 2021
DG NSW Dept of Primary Industries Animal Research Authority expires 8 November 2019

The Consultancy Team

Dr Danny Wotherspoon
Grad Dip Bushfire Protection (University of Western Sydney 2012)
PhD (researching Cumberland Plain vegetation and fauna habitat, at Centre for Integrated Catchment Management, University of Western Sydney, 2008)
Planning for Bushfire Protection Certificate course (University of Technology, 2006)
Consulting Planners Bushfire Training Course (Planning Institute of Australia, 2003)
MA (Macquarie University, 1991)
Wildlife Photography Certificate (Sydney Technical College, 1987)
Herpetological Techniques Certificate (Sydney Technical College, 1986)
Applied Herpetology Certificate (Sydney Technical College, 1980)
Dip Ed (University of New England, 1978)
BSc (Zoology, Ecology) University of New England 1974)

Dr Daniel McDonald
B. Ag Sc; M. Agr; PhD (The University of Sydney)
Cert IV – GIS (Riverina TAFE)
Daniel is an accredited Biobanking Assessor (0075) and an accredited BAM assessor (BAAS17056)
Quantified Tree Risk Assessment (QTRA) and Visual Tree Assessment (VTA), White Card

Daniel is an experienced ecologist with expertise in fauna, plant species identification, vegetation assessment, agriculture, arboriculture, conservation genetics and seed collection and preservation. He is accredited both for BAM assessments, BioBanking assessments and Biodiversity Certification. His present research interest is in Eastern Suburbs Banksia Scrub and fragmented endangered ecological communities.

Mark Mackinnon
Qualifications: B Env. Sci. (Hons),
MEIANZ, White Card
Graduate Diploma of Bushfire Protection (enrolled)
Mark is a passionate and enthusiastic scientist who thrives in the field of natural resource management. In the last 6 years, Mark has worked for a number of inter-state government agencies and environmental consultancies. He has experience in threatened species, fire ecology, bushfire management, pest plant and animals, and landscape restoration. In particular he specialises in ornithology and bushfire management. Mark has a number of specialized field-based skills including: simple and complex tree climbing, working at heights, general firefighter departmental fire accreditation, venomous snake and reptile handling, immunization to handle bat species, and an A - class bird banding licence with mistnet endorsement. Mark is also skilled in ArcGIS mapping, first-aid, four -wheel-driving.

Dr Stephanie A Clark
BAppSc (Biochemistry), MSc, PhD
Member of the IUCN SSC Mollusc Specialist Group. Research Associate at both the Field Museum of Natural History, Chicago, IL, USA and The Australian Museum, Sydney, NSW.

Stephanie has been interested in the taxonomy, systematics and conservation of invertebrates particularly molluscs since the late 1970's when she first started volunteering at the Australian Museum.

She has been an ecological consultant specialising in invertebrates since 1997. She has worked for private developers, mining companies, local community groups and local, state and federal government agencies in three countries (Australia, USA and Canada) and has been an expert witness for the NSW Land and Environment Court.

Stephanie's PhD researched the taxonomy, systematics and conservation of the NSW listed snail Meridolum corneovirens (Cumberland Plain Land Snail). She has given presentations to local, national and international conferences in Australia, Germany and USA. She has field experience in 16 countries, all states of Australia and 40 US states. Stephanie's has published more than 30 scientific papers in national and international journals and described more than 155 species.