AECOM

Sada Services Pty Ltd
16-May-2016

Glenlee Precinct Rezoning

RIPARIAN CORRIDOR STUDY

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Client: Sada Services Pty Ltd

ABN: 48 002 984 447

Prepared by

AECOM Australia Pty Ltd
Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8934 0000 F +61 2 8934 0001 www.aecom.com
ABN 20 093 846 925

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Quality Information

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Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
0	27 Nov 2013	Draft 1 for Client review	Mark Blanche Associate Director	
1	27-Feb-2014	Draft 2 for Council Review	Mark Blanche Associate Director	
3	13-Nov-2014	Final	Mark Blanche Associate Director	
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4	11-Apr-2016	Final 2.2	Mark Blanche Associate Director	
5	16-May-2016	Final 2.3	Mark Blanche Associate Director	

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Executive Summary

AECOM was commissioned on behalf of the Glenlee Consortium[1] to provide a number of sub-studies including a riparian corridor study associated with the Industrial rezoning of the Glenlee Precinct for employment and related purposes. Current site uses include the Sada Services landholding (truck maintenance and depot, coal washery and reject coal emplacement), Camden Soil Mix (truck maintenance and depot, green waste and recycling facility), and TRN (truck maintenance and depot).

AECOM has developed an outline riparian management strategy for the Glenlee Precinct that seeks to provide a framework for a balanced planning outcome. The project is seeking to optimise employment outcomes, foster ecological corridors and green links, accommodate an arterial road, rehabilitate riparian corridors and facilitate sustainable water management outcomes. All of the foregoing are proposed within a highly disturbed landscape.

Selected proponent studies were reviewed to inform the findings of this study as follows:

- Visual and Landscape Assessment – Musecape
- Ecological Assessment – Eco Logical
- Water Cycle Management Strategy – Aecom
- Bushfire Protection Assessment – Eco Logical
- Soil assessment – Sydney Environmental & Soil Laboratory for Aecom
- Geotechnical Assessment – Douglass Partners

Key findings were:

- The Precinct has a high level of visual exposure from the Australian Botanic Gardens, and a number of significant European heritage sites, including the 'Glenlee' Colonial homestead and curtilage, the 'Camden Park' estate and Elizabeth Macarthur Agricultural Institute. The report recommends the provision of substantial naturalistic screening to the proposed Precinct development, to address views from these sites.
- The ecological assessment identified three (3) potential biodiversity corridors within the site, comprising:
    - Vegetation adjacent to the Nepean River (the Nepean River Corridor)
    - An east-west terrestrial biodiversity link between the Nepean River and the Australian Botanic Gardens in the north-east of the site (the East-West Terrestrial Link), and
    - Along the modified drainage line known as Caleys Creek (the Caleys Creek Corridor), which comprises a toe-drain to the southern and western base of the emplacement batter.

  The East-West Terrestrial Link was found to be highly weed infested, with poor prospects for rehabilitation and only minor fauna habitat attributes.
- The water cycle management strategy proposed that all water quality management measures take place to the top of the coal chitter emplacement, upon which development is proposed.
- The bushfire protection assessment determined that all development within the site could be protected by means of an asset protection zone located around the rim of the emplacement, including any future proposed revegetation to both the emplacement batters, and to adjoining land to the east and south owned by Urban Growth.
- The soil assessment found that using readily achievable soil creation processes, the steep coal chitter emplacement batters would be able to support a substantial association of endemic plant species, broadly characteristic of locally occurring endangered ecological communities.

The key recommendation of this report is that the emplacement batters should be rehabilitated to a riparian / bushland corridor up to 80m in width, in conjunction with a chitter, fill soil and compost mix. The report demonstrates that these rehabilitated batters have the potential to take up a biodiversity role that was earlier envisaged for the East-West Terrestrial Link between the Nepean River and the Australian Botanic Gardens.

[1] Sada Services, Glenlee Properties Pty Ltd and J & W Tripodi Holdings Pty Ltd

1.0 Introduction

AECOM was commissioned on behalf of the Glenlee Consortium[2] to provide a number of sub-studies including riparian corridor study associated with the Industrial rezoning of the Glenlee Precinct for employment and related purposes.

1.1 Study Area

Glenlee is located near Narellan, approximately 50 km south-west of Sydney, within the Camden and Campbelltown Local Government Areas (LGAs). The regional context of the Study Area is shown in Figure 1 below.

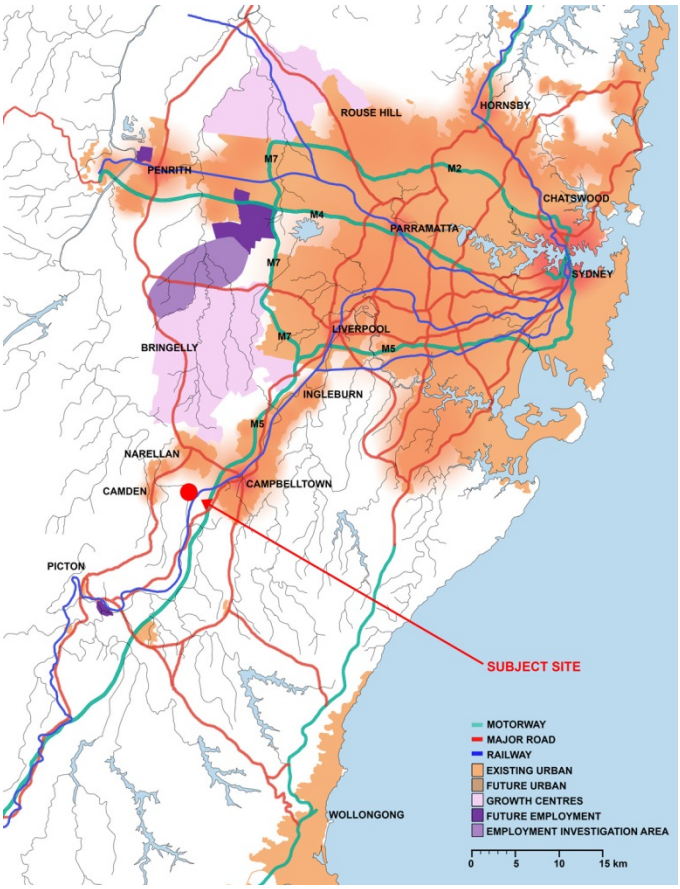


Figure 1 – Regional Context of Glenlee (Source: Sada Services Pty Ltd, 2008)

The location of Glenlee in relation to major local centres and features is as follows:

- 6 km west of Campbelltown;
- 3.5 km south of Narellan Town Centre;
- 5 km east of Camden Town Centre;
- Immediately west of the South Western Freeway and Main Southern Railway;
- South-west of Australian Botanic Gardens;
- Immediately south-east of the proposed Spring Farm Residential Release Area;
- South of Mount Annan residential area;

[2] Sada Services, Glenlee Properties Pty Ltd and J & W Tripodi Holdings Pty Ltd

- Adjacent to Macarthur Resource Recovery Park (formerly Jacks Gully Waste and Recycling Centre (WRC));
- North of Menangle Park Residential Release Area; and
- North and east of the Nepean River and its expansive flood plain.

The Precinct is situated to the west of the South Western Freeway and Main Southern Railway, southwest of Australian Botanic Gardens (ABG) and to the southeast of Spring Farm, with the SITA land essentially creating a buffer to lands to the north and northwest. Further, it is located south of the Mount Annan residential area and the Macarthur Resource Recovery Park (MRRP), northwest of the proposed Menangle Park Residential Release Area and north and east of the Nepean River and its expansive flood plain. The Precinct is shown Figure 2 below. The Local Government boundary between Camden Council and Campbelltown City Council traverses the Study, Area.

The Precinct comprises the following holdings and respective ownerships, as shown in Table 1 below:

Table 1: The Site – property descriptions

Owner	Property Description	Size
Sada Services	Lot 38 DP 1098588	71.04 Ha
	Lot 1 DP 250033	3,071 m^2
	Part Lot 1 DP 405624	2,800 m^2
J&W Tripodi Holdings Pty Ltd (Camden Soil Mix)	Lot 1102 DP 883495	27.16 Ha
Glenlee Properties Pty Ltd (TRN Group)	Lot 54 DP 864754	8.836 Ha

Source: Planning Proposal – Glenlee Precinct, October 2012

The Precinct to a greater extent has been used for industrial related purposes, notwithstanding the current rural zoning of the land for a number of years. These industrial uses include the Sada Services landholding (truck maintenance and depot, coal washery and reject coal emplacement), Camden Soil Mix (truck maintenance and depot, green waste and recycling facility), and TRN (truck maintenance and depot).

1.2 Study Brief and Gateway Determination

The study brief required the undertaking of the following:

- Background document review, including the amended planning proposal (2012), ecology, bushfire, water cycle, heritage and visual amenity
- Liaison with the NSW Department of Primary Industries (Office of Water) with regard to changes to the riparian corridor guidelines, and statement of relevance to updating of this report
- Updating of the original Riparian Corridor Management Strategy (2008) to address changes arising from the amended planning proposal, response to changes in government policy
- Coordination with Eco Logical Australia with regard to the ecological assessment and bushfire assessment to ensure the proposed riparian corridor measures are compatible with the findings of these reports

A further requirement from Camden Council was that:

- The report is to *'make reference to the re-assessment of the Cumberland Plain Woodland vegetation* (the east-west corridor) *and its relevance to riparian corridor management.*'

The Gateway Determination required additional information on a range of matters. There was no specific requirement for additional information with regard to riparian corridor restoration. However, this study is pertinent to the Gateway Determination requirement for additional information regarding:

- flora, fauna and habitat
- surface, groundwater and flooding
- bushfire hazard management
- scenic quality, visual.

Figure 2 – Location of Study Area – Aerial Photo (Source: Planning Proposal – Glenlee Precinct, October 2012)

1.3 Background

The continually evolving nature of activities in the study area and evolution and planning for the locality and service infrastructure provision occasioned a need to review the prevailing planning controls.

In December 2006, Camden Council and Campbelltown City Council resolved to prepare a Local Environmental Study (LES) and Draft Local Environmental Plan (DLEP) for the rezoning of the subject site. A draft LES was submitted to both Councils in February 2009, which included a number of technical support studies. These studies included:

- Land Capability – AECOM
- Ecology – Hayes Environmental Services
- Noise – AECOM
- Air Quality/Odour - AECOM
- Water Cycle Management – AECOM
- European and Aboriginal Heritage – Historyworks and Cultural Heritage Connections
- Transport/Traffic/Accessibility – AECOM
- Landscape and Visual – Musecape

- Bushfire – Eco Logical
- Civil Infrastructure/Servicing – AECOM
- Masterplanning/Urban Design – Geolyse
- Human Service – BBC Consulting

In addition to these studies, a draft Local Environmental Plan (LEP), draft Development Control Plan (DCP), was prepared for each Council area, including an Infrastructure Strategy/Section 94 Contributions Plan.

The LES, LEP and DCP was not placed on public exhibition due to a number of issues arising from the technical studies, which required additional information to be provided to Councils.

Since that time, the key issues pertaining to the development have been progressively resolved to the extent which would satisfy the requirements of the PP to gain a Gateway Determination.

On 28 February and 23 April 2013 Campbelltown City Council and Camden Council respectively resolved to provide 'in principle' support to the intentions of the PP.

The PP received a Gateway Determination on July 3rd, 2013 to proceed with the rezoning of the Glenlee area subject to various conditions including additional/updated information for a number of specialist technical studies.

A number of these specialist studies were prepared for the rezoning application lodged with the Local Environmental Study in 2008. However, legislation has changed in respect of a number of studies and therefore there is a need for these studies to be reviewed and revised, particularly as the SITA lands no longer form part of the PP.

In August 2013 a Preliminary Draft Project Plan was submitted to Council's including an outline of the various specialist technical study requirements. Camden responded with comments addressing these requirements, therefore forming the basis of the sub-consultant's brief for the various specialist technical studies. AECOM has since responded to confirm requirement expectation.

1.4 The Proposal

The zoning request is generally in accordance with the proposed zoning map shown in Figure 3, highlighting General Industrial, Infrastructure and Environmental Conservation zones. Measured zone areas are shown in Figure 4. The area zoned under General Industrial (IN1) has increased as a result of including the lead-in road infrastructure into this zoning rather than the E2 zone, however the increase in area of the IN1 zone does not generate additional land for development.

The proposed zones and stated objectives are as follows:

Zone IN1 General Industrial

Objectives of zone

- To provide a wide range of industrial and warehouse land uses.
- To encourage employment opportunities.
- To minimise any adverse effect of industry on other land uses.
- To support and protect industrial land for industrial uses.
- To enable other land uses that provides facilities or services to meet the day to day needs of workers in the area.
- To enable non-industrial land uses that are compatible with and do not detract from the surrounding industrial and warehouse land uses.

Zone SP2 Infrastructure

Objectives of zone

- To provide for infrastructure and related uses.
- To prevent development that is not compatible with or that may detract from the provision of infrastructure.

Zone E2 Environmental Conservation

Objectives of zone

- To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.
- To prevent development that could destroy, damage or otherwise have an adverse effect on those values.
- To provide for land uses compatible with the high ecological, scientific, cultural or aesthetic values of this zone.
- To foster the protection, enhancement and creation of natural systems corridors.

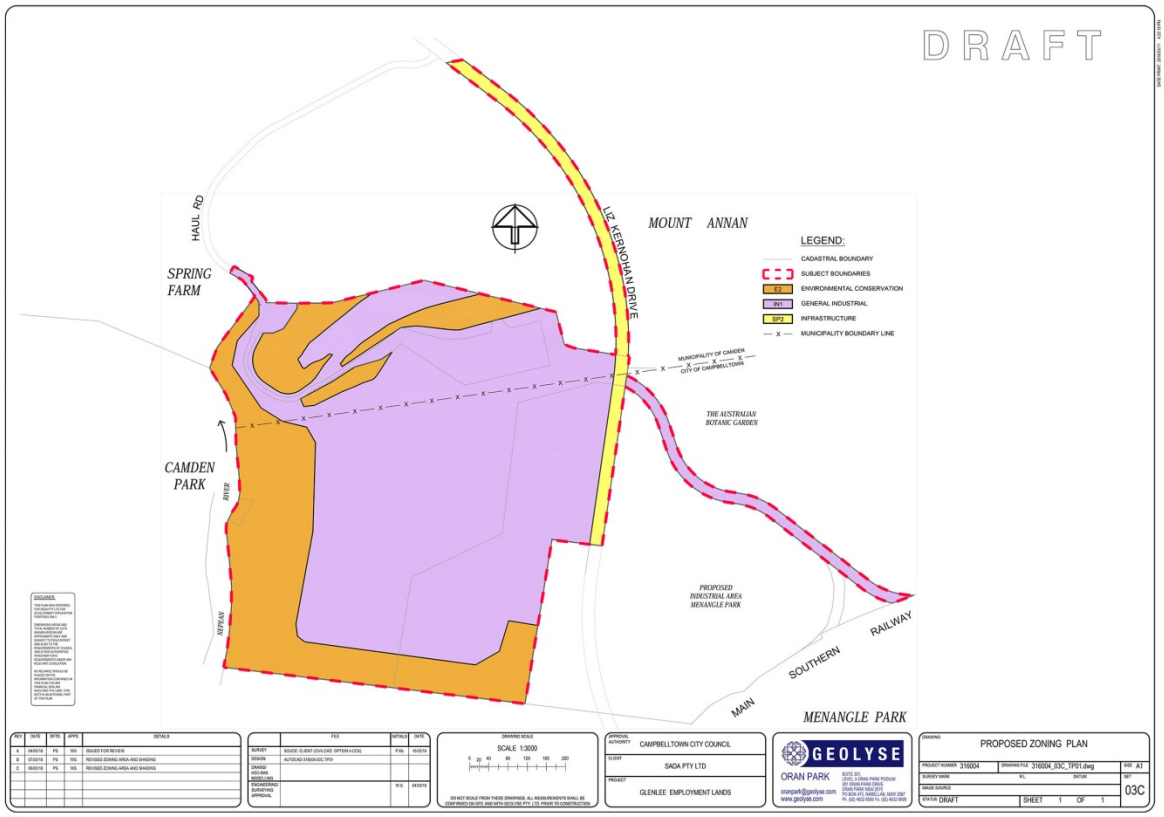


Figure 3 – Proposed

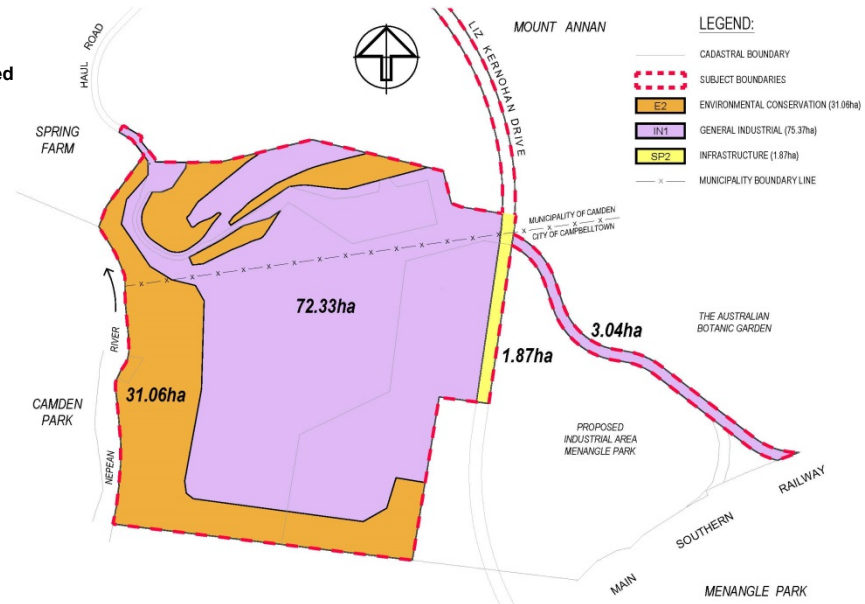


Figure 4 – Measured Zone Areas

An Indicative Layout Plan (ILP) has been prepared for the Precinct shown in Figure 5.

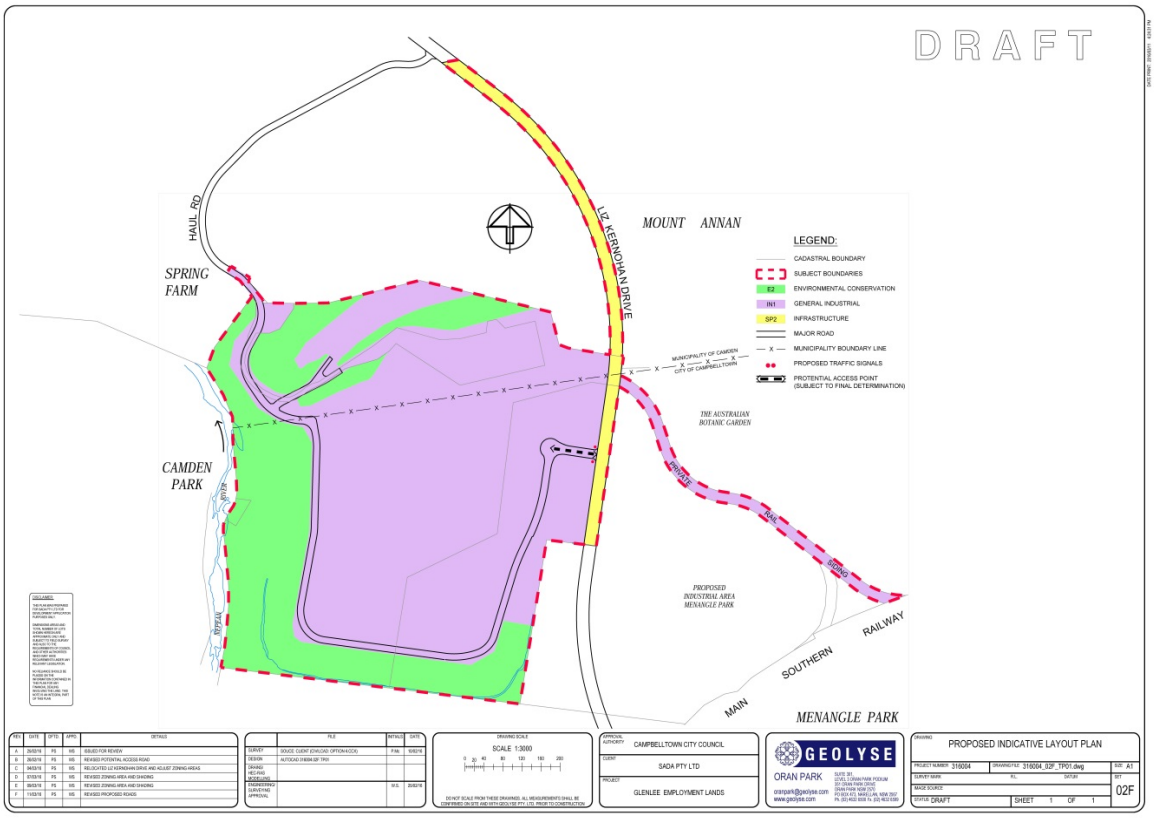


Figure 5 –Indicative Layout Plan

1.5 Referenced Reports / Relevant Standards

The following documents are considered of most relevance to this study.

Department of Primary Industries – Office of Water

- Guidelines for Riparian Corridors on Waterfront Land

Existing Proponent Studies

A number of technical studies were prepared in 2008 for the submission of the Local Environmental Study and comprised the following:

- Water Cycle Management – Aecom
- Landscape and Visual – Musecape
- Bushfire – Eco Logical
- Soil Assessment – Sydney Environmental & Soil Laboratory

Additional Study

- Ecology – Eco Logical (2013)

1.6 Objectives of this Study

Objectives

a. Obtain a thorough understanding of the factors relevant to design of the riparian corridor restoration strategy.

b. Understand plant media properties of the emplacement coal washery waste, and capacity for remediation suitable for substantial native planting outcomes to steep emplacement batters.

c. Determine watercourse classifications in accordance with NSW Office of Water Guidelines.

d. Determine the role of the riparian corridors within the context of all existing vegetation present within the Precinct.

e. Provide recommendations for remediation of riparian corridors and associated emplacement batters.

Tasks

a. Review a broad range of background documents to inform the riparian restoration strategy, including associated proponent studies.

b. Commission a soil assessment for the site, including detail analysis of coal washery waste material, and recommendations for remediation.

c. Determine watercourse classifications in consultation with NSW Office of Water.

d. Develop a riparian corridor restoration strategy drawing upon the above.

Deliverables

- Provide a restoration strategy with a sufficient level of detail to meet associated planning approval requirements.

1.7 Compliance with the Brief

The above measures address the requirements of the Study Brief as described below:

Requirements of Brief	Location Addressed
Background document review, including the amended planning proposal (2012), ecology, bushfire, water cycle, heritage and visual amenity	Objective (a) Task (a) s.2.1 of this report
Liaison with the NSW Department of Primary Industries (Office of Water) with regard to changes to the riparian corridor guidelines, and statement of relevance to updating of this report	Objective (c) Task (c) s.2.2 of this report
Updating of the original Riparian Corridor Management Strategy (2008) to address changes arising from the amended planning proposal, response to changes in government policy	Objective (e) Task (d) s.2.3 of this report
Coordination with Eco Logical Australia with regard to both the ecological assessment and bushfire assessment to ensure the proposed riparian corridor measures are compatible with the findings of these reports	Objectives (a), (d) and (e) Task (a) and (d) s.2.1.2.2 – 'East-West Terrestrial Link' s.2.1.4 – 'Bushfire Assessment'
The report is to *'make reference to the re-assessment of the Cumberland Plain Woodland vegetation* (the east-west corridor) *and its relevance to riparian corridor management.'*(Camden Council)	s.2.3 - 'Southern Boundary Precinct' s.3.0 of this report

1.8 Report Framework

The report has been structured in the following sections:

- **Section 1:** Introduction as above
- **Section 2**: Riparian Restoration Concept –commencing with a summary of relevant proponent studies that informed the restoration concept; followed by classification of watercourses in accordance with NSW Office of Water Guidelines, and then description of the restoration concept
- **Section 3:** Conclusion of the report.

1.9 Response to Council Consolidated Comments

Camden Council and Campbelltown City Council reviewed Revision 1 of this report and provided comments in a table form, identifying issues and recommended responses from AECOM (refer Appendix C – Columns 1 and 2.

AECOM met with representatives of both Councils on 9 October, 2014 to discuss each issue and determine an agreed response. These responses have been added to the table in Appendix C (column 3), and the locations within the report where each issue has been addressed identified (column 4).

2.0 Riparian Restoration Concept

AECOM has developed an outline riparian management strategy for the Precinct that seeks to provide a framework for a balanced planning outcome. The project is seeking to optimise employment outcomes, foster ecological corridors and green links, accommodate an arterial road, rehabilitate riparian corridors and facilitate sustainable water management outcomes. All of the foregoing are proposed within a highly disturbed landscape.

2.1 Relevant Studies

The following proponent studies have significantly informed the findings of this study:

- Visual and Landscape Assessment – Musecape
- Ecological Assessment – Eco Logical
- Water Cycle Management Strategy – Aecom
- Bushfire Protection Assessment – Eco Logical
- Soil assessment – Sydney Environmental & Soil Laboratory for Aecom
- Geotechnical Assessment: Summary Report – Douglas Partners

2.1.1 Landscape and Visual Assessment

Key findings of the Musecape landscape and visual assessment relevant to this study are provided below.

The Precinct has a high level of visual exposure from the Australian Botanic Gardens, and a number of significant European heritage sites, including:

- The ‘Glenlee’ Colonial homestead and curtilage, located within 0.5km south-east of the Precinct
- ‘Camden Park’ estate and Elizabeth Macarthur Agricultural Institute to the west / south-west of the Precinct (refer Appendix A - Figure 6).

The study makes strong representation that with regard to:

- Australian Botanic Gardens, ‘the buildings on the Sada and TRN sites are clearly visible and are in contrast to the rest of the view which comprises a grassed foreground, a middle distance of indigenous vegetation and invasive species and a background of wooded hills’, and ’new development in the Study Area has the potential to have an increased negative visual impact on the garden and on the quality of the visitor experience unless strict development guidelines are employed’.
- Key heritage items, ‘views and vistas of the major key heritage items are key elements in the landscape and should be protected from any unsympathetic development’.

The study provides a list of design guidelines that should be put in place to minimise adverse landscape and visual impacts from the Precinct, including:

- New buildings should not break the skyline, either by exceeding the visual height of the tree canopy, or the ridgeline in or behind the site
- Protection of significant views and vistas as above
- ‘The use of locally indigenous plant species, particularly canopy trees, should be encouraged to assist in the maintenance and recovery of the naturalness of the landscape’
- Regular patterns of trees should be avoided, such as the existing Radiata Pine plantations to the emplacement batters
- ‘Views out from the site may have to be foregone or restricted … in the wider community interest’.

The above findings demonstrate the desirability of providing more than just grass cover to the emplacement batters. A key finding of this report is that these batters should also support a range of endemic shrub and tree

species to facilitate the required substantial level of screening, in order to protect key heritage views and vistas, as well as views from the Australian Botanic Gardens.

2.1.2 Ecological Assessment

An ecological assessment of all vegetation within the Precinct was undertaken by Eco Logical with the following outcomes:

- Three (3) potential biodiversity corridors were identified within the site, comprising:
    - Vegetation adjacent to the Nepean River (hereafter the Nepean River Corridor)
    - An east-west terrestrial link between the Nepean River and the Australian Botanic Gardens in the north of the site (hereafter the East-West Terrestrial Link), and
    - Along the modified drainage line known as Caleys Creek (hereafter the Caleys Creek Corridor).

2.1.2.1 Nepean River Corridor

The vegetation along the Nepean River provides potential biodiversity connectivity in a north-south corridor. Elderslie Banksia Scrub Forest is located to the north-west of this site in the Spring Farm area, and the Menangle Park area to the south/ south-west. Cumberland Plain Woodland (CPW) which is a critically endangered community, occurs adjacent to the corridor in the north-west corner of the Precinct. The corridor comprises predominantly of River-flat Eucalypt Forest (RFEF) which is an endangered ecological community. The ecological value of this corridor is currently degraded by weed infestation, including substantial pockets of African Olive.

This corridor, the adjoining patch of CPW and some adjoining weed infested areas have been designated as Management Zone A. It is proposed that this area be subject to weed control and revegetation to improve the ecological value of the corridor (refer Appendix A - Figure 7).

2.1.2.2 East-West Terrestrial Link

The vegetation to the north of the Precinct has the potential to provide some connectivity between the Nepean River and the Australian Botanic Gardens, albeit discontinuous. This vegetation is dominated by African Olive, which predominantly occurs on very steep slopes that have been subject to substantial loss of the original soil profile. The ecological study (EcoLogical, 2013) finds that the African Olive is providing a significant slope stabilisation function, and that given the extent of the disturbed soil, the revegetation of this area to a native woodland is unlikely to be successful. The study also finds that notwithstanding the highly degraded nature of this vegetation, it may be utilised by some native species, and therefore offers some limited ecological connectivity between the Nepean River and the Australian Botanic Gardens.

This corridor has been designated as Management Zone B. Management of this corridor is limited to where possible, planting within the vicinity of the zone with flora species representative of CPW (refer Appendix A - Figure 7).

The findings of this report were developed in consultation with the author of the ecological assessment (EcoLogical Australia), to ensure a response that took account of the assessment findings that the East-West Terrestrial Link had limited potential for both restoration and ecological connectivity. Refer . s.2.3 – ‘Southern Boundary Precinct’.

2.1.2.3 Caleys Creek Corridor

The study notes that portions of Caleys Creek occur within the adjoining Urban Growth land to the west of the Precinct, and that the Creek has been re-directed as a drainage channel to the southern boundary of the Precinct. This area is highly modified, with little native vegetation. The corridor includes areas of exotic grassland that have been established to stabilise the emplacement batters. Given this situation, the study concludes that an ecological corridor connecting the Nepean River with the Australian Botanic Gardens would be dependent upon outcomes within the Urban Growth land. In this regard, the study notes that ‘the offset strategy for Menangle Park (the Urban Growth land) identifies that “precinct riparian corridors” are proposed in proximity to the eastern boundary of the Glenlee site, and adjacent to the southern boundary of the Glenlee lands as “potential offset lands”’.

This corridor has been designated as Management Zone C. Management of this corridor is proposed as revegetation with native grasses, and that revegetation with trees and shrubs may also be appropriate in some sections, mainly away from the embankments (refer Appendix A - Figure 7).

2.1.3 Water Cycle Management Assessment

The water cycle management assessment recommends that drainage from the site be conveyed via the existing and supplemented toe drain at the base of the emplacement batters, with pollutant polishing functions to occur at the top of emplacement. The existing 'water quality dam' (refer Figure 8) near the end of the toe drain will be retained, but any water quality benefits stemming from this facility will be in addition to meeting the required targets by the treatment measures at the top of the emplacement.

2.1.4 Bushfire Assessment

The bushfire protection assessment states that all buildings will need to have an APZ of either:

- 60m, which would prevent flame contact, and allow all construction materials providing they comply with the principles within AS 3959-1999 'Construction of Buildings in Bushfire Prone Areas', Level 3, or
- 41m, using the high standard of construction (with respect to bushfire protection) inherent within light industrial and commercial buildings, and fire rated glass.

The report notes that from a planning perspective, it may be simpler to require all buildings ta have an APZ of 41m assuming that the front façade facing the public perimeter roads and bushland will have glazing.

The APZ will comprise of large building setbacks, public perimeter roads and 'the managed landscaping of the steep embankments'.

With regard to the issue of managing steep embankments as APZ's, given the very steep nature of the emplacement batters, these may be difficult to manage for fuel load. Additionally, given what will in all likelihood be a relatively thin skin of topsoil to these areas, regular tracking on these batters may lead to exposure of the underlying coal chitter, and subsequent batter erosion points. Given these issues, the corridor restoration proposals for the emplacement batters in this study recommend that the APZ starts at the top of the embankment.

The report notes that the APZs for the western, southern and eastern boundaries of the Precinct may need to include an Outer Protection Area (OPA) of 30m. In this instance, any street tree avenue planting would fall within this area. The extent / spacing of these trees may therefore be limited to meet the requirement that mature canopy trees must be discontinuous and have an overall canopy cover of less than 30%. This requirement might therefore reduce the potential for the proposed perimeter street tree avenues to screen views to industrial buildings from outside the site, a key objective as described above. This potentially reinforces the need for a substantial planting of trees, shrubs and ground layer to the emplacement batters.

The findings of this report were developed in consultation with the author of the bushfire assessment (Eco Logical Australia) to ensure a coordinated response with regard to riparian corridor restoration.

2.1.5 Soil Assessment

Aecom commissioned Sydney Environmental & Soil Laboratory to undertake testing of coal chitter and site soil, and provide an initial guide to early stages of rehabilitation work (refer Appendix B). The study identified three (3) possible scenarios as follows:

2.1.5.1 Straight Chitter

Providing the chitter is not too coarse and open and contains some 'soily' fine material to provide water holding capacity, it should be possible to vegetate it by simply applying the missing nutritional elements.

This soil treatment would be adequate for rough grassing and for colonising leguminous species such as clovers, acacias and native legumes. Cumberland Plain flora would likely grow but would need follow-up fertiliser applications.

2.1.5.2 Chitter with Fill Soil

By applying 50-100mm of fill soil, and working this in to 200mm depth, a soil with better physical properties than straight chitter will result. This would be consistent with good growth of colonising species and of Cumberland Plain flora.

2.1.5.3 Chitter with Fill Soil and Compost

By applying 100mm of fill soil and 50mm of green waste derived compost and working this in to a depth of 200mm, a soil with even better physical properties will result. This would be consistent with good growth of Cumberland Plain flora and for use in amenity garden and landscaping areas.

2.1.5.4 Surface Mulching

The report noted that surface mulching of mass planted areas would bring the benefits of weed control, erosion reduction and moisture retention.

2.1.6 Geotechnical Assessment

A summary geotechnical report was prepared by Douglass Partners (2013) for the Precinct. The report noted with regard to batter height and slopes that … *'The maximum height of the embankment is around 18-23 m with average side slopes measures to be in the range of 4.5:1 (H:V) on the eastern side, 3.2 -3.7:1 (H:V) on the southern side, and 2.8:1 (H:V) on the western side.'*

2.2 Watercourse Classification

A stream classification has been prepared for the Glenlee site in accordance with the NSW Office of Water – Guidelines for Riparian Corridors on Waterfront Land, July 2012. This information was confirmed in correspondence with the NSW Office of Water, and has been transposed onto an aerial photograph of the site (refer Appendix A - Figure 8). As can be seen from the figure, the majority of the main watercourse falls outside the Precinct boundary, within the adjoining Australian Botanic Gardens and land owned by Urban Growth, with the exception of:

- a small part of a 1st order watercourse that cuts across the north-east corner of the Study Area
- a 3rd order watercourse (Caleys Creek) with a large on-line dam shown running through the Sada site (Note: This part of the watercourse no longer exists, it having being removed with the coal washery development over 50 years ago). The watercourse has been re-routed as an open drainage channel from the confluence of the 2nd and 3rd order watercourses at the south-east corner of the Precinct, to run along the toe of the southern coal washery batter and then north to a 'water quality dam' that discharges shortly thereafter to the Nepean River.

Additionally, a 3rd order watercourse runs immediately adjacent to the north-west Precinct boundary, emanating from the Macarthur Resource Recovery Park.

2.3 Restoration Concept

The principles of the riparian corridor response are illustrated in Appendix A - Figures 6 and 7, which illustrate site context and proposed site environmental restoration concepts within the Precinct, as follows:

- **Nepean River Corridor**: This corridor, the adjoining patch of CPW and some adjoining weed infested areas have been designated as Management Zone A. It is proposed that this area be subject to weed control and revegetation to improve the ecological value of the corridor (refer Appendix A - Figure 7).

  It is noted that some of the river bank areas within the Nepean River Corridor and contributing waterways to this system are currently incised and eroded. It is anticipated that without suitable measures the Precinct's post-development flow regime may result in more frequent occurrence of conditions where stream flow exceeds the channel forming flow for some of these receiving waterways.

  In NSW, the Department of Environment, Climate Change and Water (now Office of Environment and Heritage) set a Stream Erosion Index (SEI) objective of between 1 to 2 for waterway geomorphic protection, which has been adopted by the Growth Centre Commission for urban developments within designated 'growth centres' of greater Sydney. The SEI is the ratio of pre to post-development erosion potential. An SEI objective of 1 to 2 implies that post-development stormwater management must limit the increase in erosion potential of waterways to no more than twice pre-development erosion potential, and ideally should match the pre-development erosion potential. The purpose of this objective is to maintain waterway stability by reducing the impact of frequent events, thereby minimising bed and bank erosion.

  The flow management targets nominated for the Precinct include maintaining the 1.5 year ARI peak discharge to pre-development magnitude and providing treatment of frequent stormwater events (typically up to the 3-month ARI). This combination will limit the SEI to between 1 and 2.

  For further information refer to Section 2.3 of the Water Cycle Management Strategy Report.

- **North-South Integrated Boulevard "Green Link"**: The proposed Spring Farm Link Road is to be developed as a "Green Link" boulevard. It will be densely landscaped and promote diverse accessibility

options, including pedestrian/cycle movements to William Howe Reserve. This linking landscape treatment, although not providing major habitat opportunities, will provide a medium for the migration of some fauna species, and will comprise of locally occurring flora species.

- **East-West Terrestrial Link**: An east-west terrestrial vegetated link will be retained across the site between the Australian Botanic Gardens and the Nepean River. The link comprises predominantly of dense African Olive, which would be discontinuous, and is proposed to be retained as a limited form of wildlife corridor (Eco Logical, 2013). Restoration of these areas to a native plant association characteristic of Cumberland Plain Woodland would be a highly resource intensive activity that may not perform the role of slope stability as well as the existing situation (ibid.).

  Restoration for this area (Management Zone B) would take the form of a gradual process of partial landscape restoration, commencing with the gradual planting and establishment of endemic tree species within and adjoining the management zone, followed by a gradual process of African Olive removal and replacement with native shrub and ground layer species where practical. This work would be detailed within a Vegetation Management Plan.

  The proposed east-west link partially augments the function of the existing east-west environmental corridor that runs between the residential suburb of Spring Farm and the Macarthur Resource Recovery Park, linking William Howe Reserve with the Nepean River Corridor (refer Figure 6).

- **Southern Boundary Precinct:** The southern and eastern boundary of the Precinct abuts Urban Growth (UG) land, part of the Proposed Menangle Park Urban Release Area. Given that the Caleys Creek formed channel is located on or very close to the southern Precinct boundary, riparian / corridor restoration on this boundary would be put in place to the north of the channel, to an approximate width of 80 metres to the top of the emplacement batter, as shown in Appendix A - Figure 9. The extent of the planting response assumes the ‘chitter with fill soil and compost’ soil remediation approach as described in s.2.1.5.3 above (the most comprehensive soil creation process).

  The restoration will be fully structured to the toe of the emplacement batter (this area is on natural ground), and as practicable up the adjoining batter. Revegetation of the batter will be carefully considered. The approach will aim to create a ‘fully structured’ outcome (i.e. a full suite of ground layer, shrub and canopy species), but the final structural form may result in an emphasis on the ground layer, incorporating as much of a shrub and tree layer as the planting medium will allow. It may be possible to bench the batter in places to facilitate the placement of a deeper planting medium, potentially resulting in an increased plant material response over that achieved otherwise.

  The restoration would utilise a seeding approach, using a diverse suite of endemic native grasses to achieve a relatively quick, dense cover. The mix would include a light sterile cover crop sufficient to provide rapid soil-holding, while not of such a density that it would choke out the slower germinating natives. Depending upon the stability of the batters once the soil remediation work was in place, a preference would then be to overplant once the ground layer was established. This would allow for a careful cover of shrubs and trees, sufficient to provide habitat and visual screening, but not so dense as to shade out the grassy ground layer. The dense grass layer would remove the need for a mulch layer.

  If the batters were not sufficiently stable for this process, then a full suite of ground layer, shrub and canopy species would be seeded. In this case, the quantities of shrub and canopy species would be carefully calculated to ensure sufficient light for the important soil holding layer of grasses.

  Stability of trees on the chitter batters is considered likely to be satisfactory. This assumption is informed by observation on site over a period of years, of a substantial plantation of Radiata Pines (recently removed) to the south-east corner of the chitter batter. None of these trees were observed to have fallen over during the life of the plantation.

  Restoration planting adjacent to the watercourse will comprise of a plant association characteristic of the River-flat Eucalypt Forest community, with the batter slopes being planted to a modified, site specific community comprising of those locally endemic species best able to colonise the drought-prone, relatively free-draining conditions of the soil remediated slope, e.g. Cumberland Plain Woodland species, and / or potentially components of the local Elderslie Banksia Scrub Forest community which is adapted to highly free-draining conditions. All plant material used in the restoration process will be of local provenance. The design intent of this process is to provide a broad suite of species which have the greatest potential to successfully colonise / stabilise the batter, and create a self-regenerating, native ecological community.

A habitat creation measure for the batters could comprise pinning of tree trunks and large branches felled as part of the Precinct development process onto the batters, e.g. to increase upslope soil depth; surface roughness; water harvesting; fauna shelter and basking opportunities.

As discussed above and shown in Appendix A - Figure 9, the Asset Protection Zone is located off the top of the batter. This ensures practicality with regard to maintaining the area to the required fine fuel levels. Potentially, this work could be incorporated into a regime of enhanced landscape maintenance activities.

Importantly, the vegetating of the emplacement batters has the potential to be both bio-diverse and of a substantial width, and to link-up with still relatively intact part of Caleys Creek. In this way, the corridor would take up the role that was originally envisaged for the East-West Terrestrial Corridor, between the Nepean River and the Australian Botanic Gardens.

2.3.1 Vegetation Management Plan

A Vegetation Management Plan will be prepared for the rehabilitation works at DA stage in accordance with the guidelines provided by NSW Office of Water.

2.4 Management Responsibility

The following vegetated areas as shown on Figure 7 will be managed by means of Community Title:

- Management Zone A: Nepean River Corridor (s.2.1.2.1)
- Management Zone B: East-West Terrestrial Link (s.2.1.2.2)
- Management Zone C: Caleys Creek Corridor (s. 2.1.2.3)
- Any riparian vegetation associated with the watercourse that crosses through the north-east corner of the site
- The existing ‘water quality control dam’ (refer Figure 6), which will be managed for habitat and aesthetic values.

3.0 Conclusion

Caleys Creek has been reduced to a toe drain where it runs along the southern boundary of the Precinct and then north to the Nepean River via an existing on-line dam. The drain is located on or close to the southern boundary of the Precinct, precluding works to the south on the adjoining Urban Growth land. To the north of the toe drain, the batters of the coal washery waste emplacement comprise a harsh, drought-prone environment that is highly susceptible to erosion and difficult to revegetate in the current state.

The review of the visual and landscape assessment reporting demonstrates a strong imperative to provide substantial naturalistic screening to the proposed Precinct development, to address views and viewsheds from the State Heritage listed ‘Camden Park’ estate and ‘Glenlee’ Colonial homestead and curtilage, both located within 500m of the Precinct. Additionally, the study identified the importance of views from the Australian Botanic Gardens, across the Precinct towards the heavily wooded ‘Camden Park’ estate and the Blue Mountains beyond.

Importantly, the soil assessment of the coal washery waste emplacement demonstrates that the batters would be able to support a substantial association of endemic plant species, broadly characteristic of locally occurring endangered ecological communities, and with the potential to take up the biodiversity role that was originally envisaged for the East-West Terrestrial Link between the Nepean River and the Australian Botanic Gardens.

Appendix A

A3 Figures

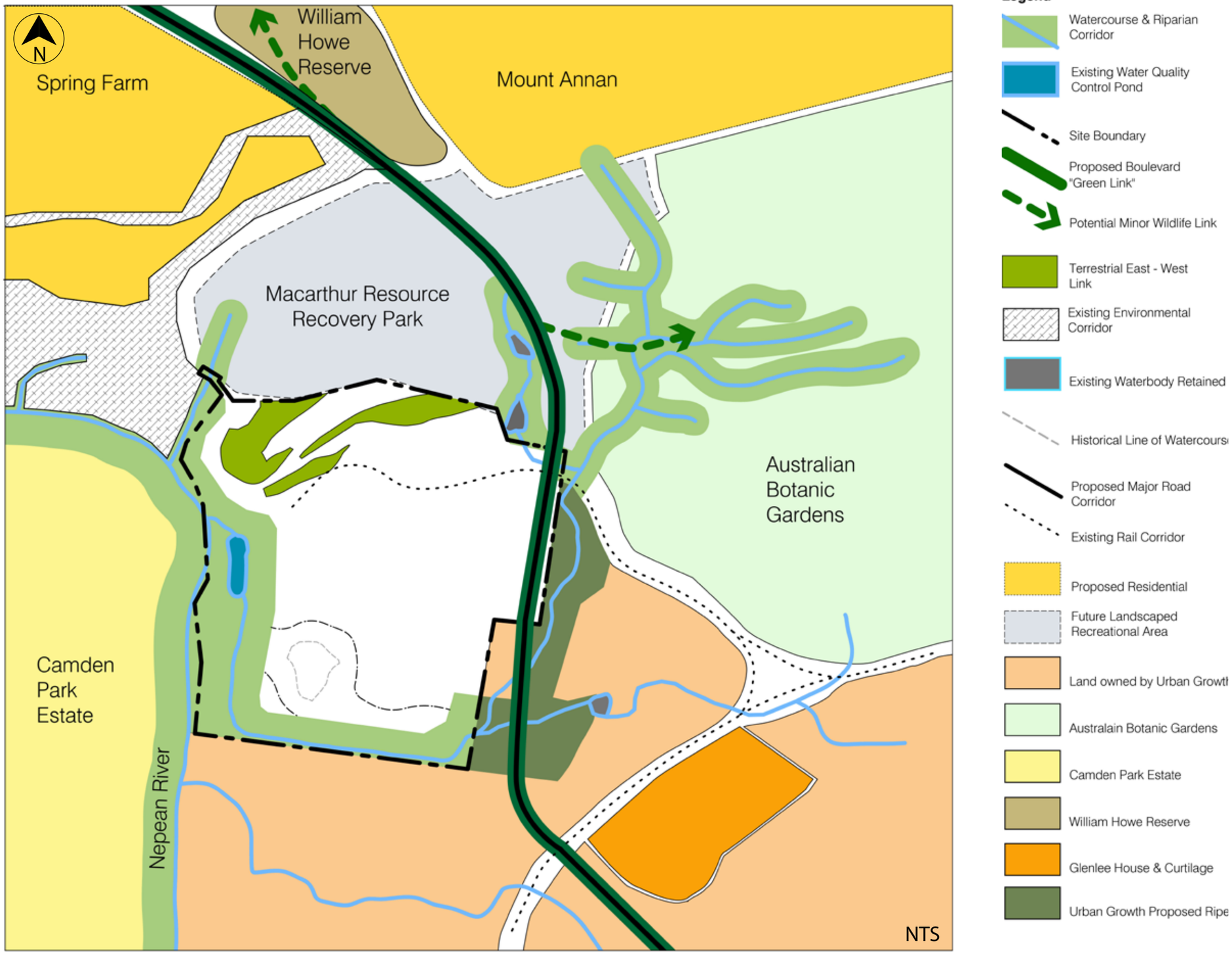
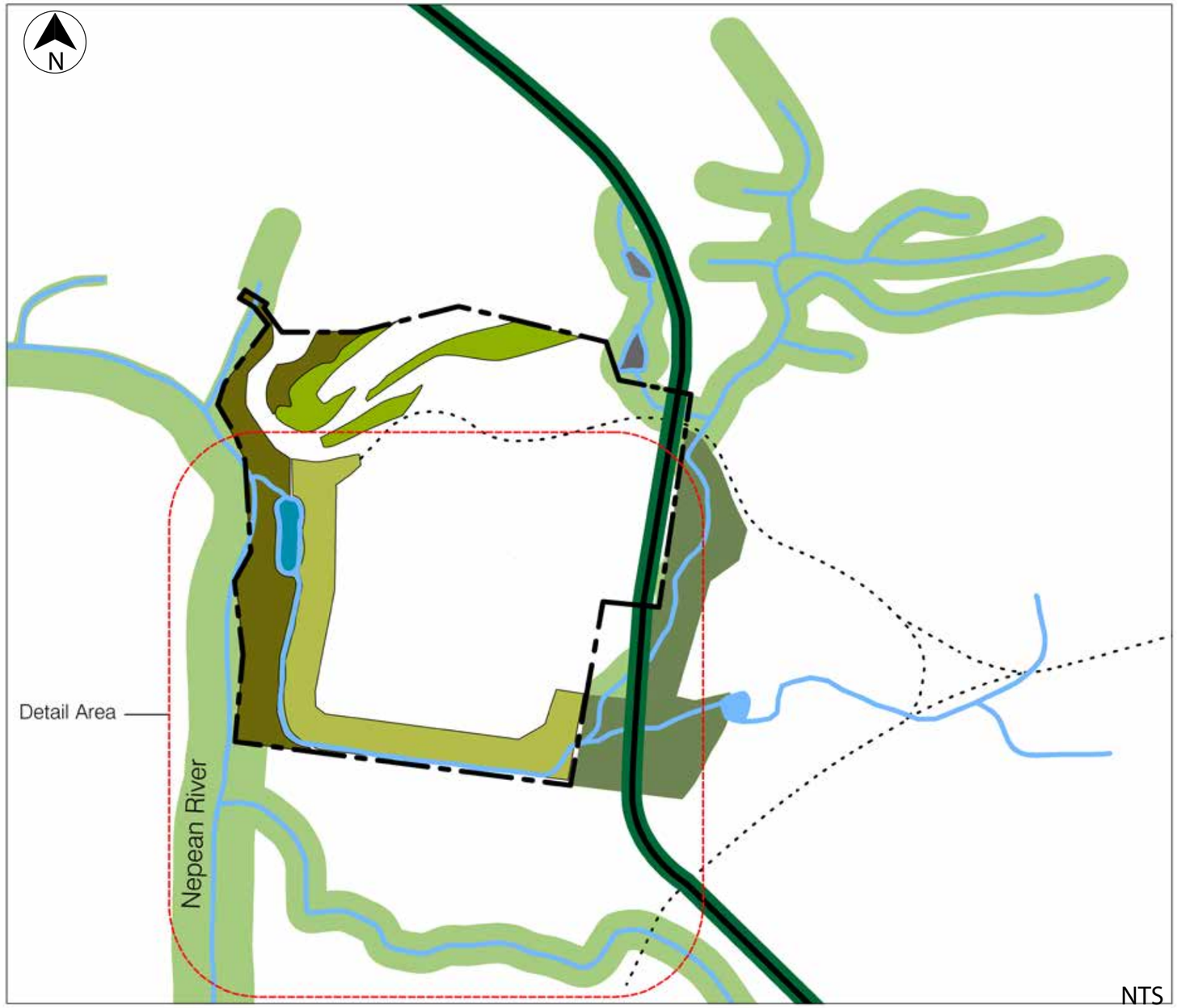


Figure 6. Site Context / Environmental Considerations

Glenlee Precinct - Proposed Rezoning



Legend

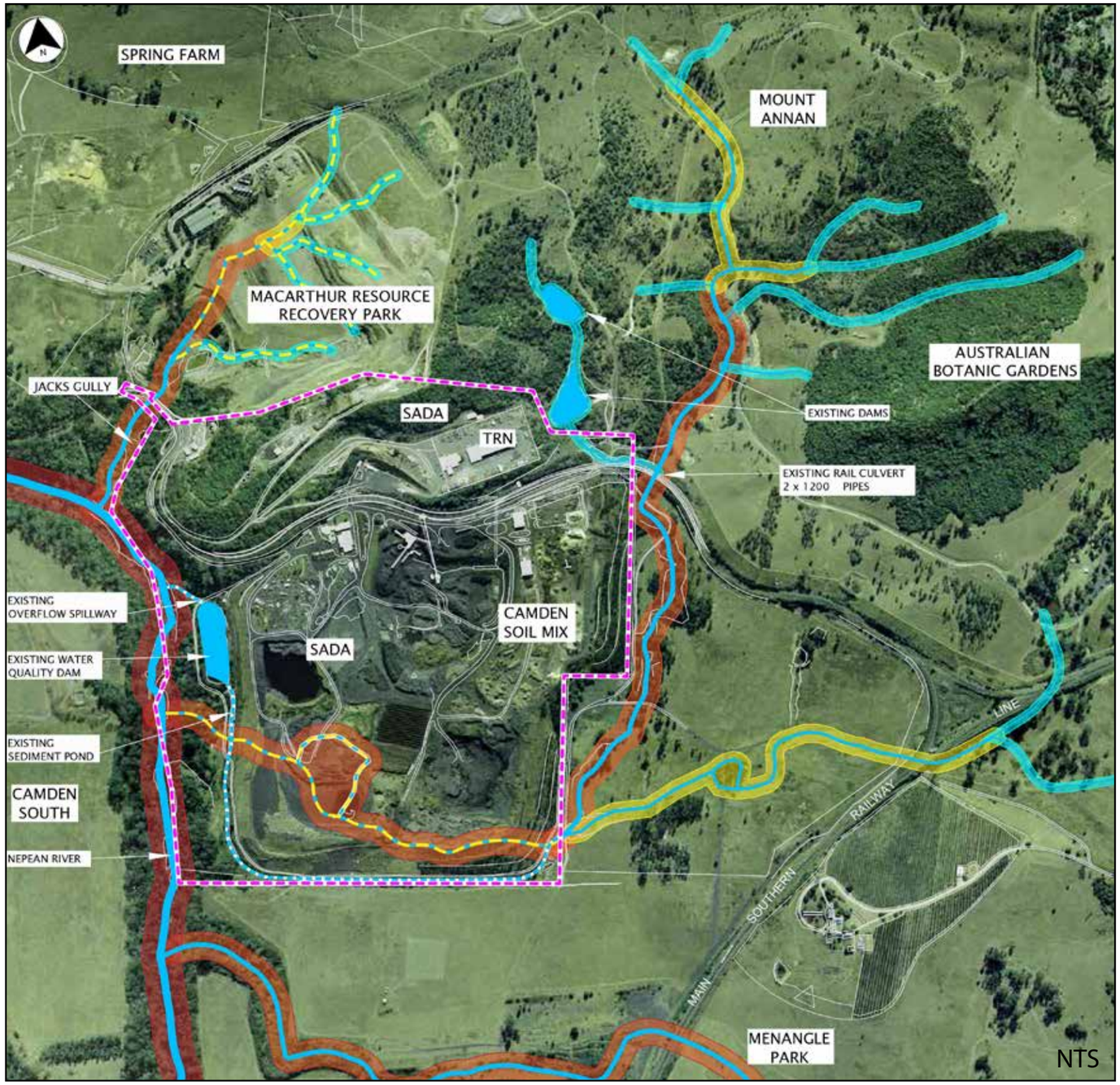
- Watercourse & Riparian Corridor
- Existing Water Quality Control Pond
- Site Boundary
- Proposed Boulevard "Green Link"
- Management Zone A* Retained Native Vegetation - Nepean River Environmental Corridor
- Management Zone B* Retained Exotic Vegetation - Environmental Corridor
- Management Zone C* Landscape Restoration Corridor
- Urban Growth Proposed Riperian Corridor
- Proposed Major Road Corridor
- Existing Rail Corridor

Management Zones A+B are as per Ecological Assessment (Eco Logical Australia, 2013)

Management Zone C is broadly in accordance with the Ecological Assessment

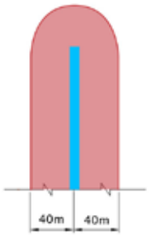
Figure 7. Environmental Planning Principles

Glenlee Precinct - Proposed Rezoning

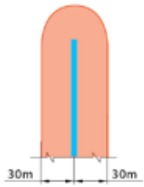


LEGEND

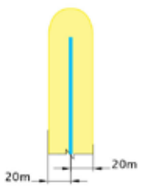
- PRECINCT BOUNDARY
- EXISTING WATERCOURSE
- OLD WATERCOURSE (FILLED)
- EXISTING SOUTHERN TOE DRAIN



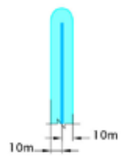
4th+ ORDER WATERCOURSE
40m Vegetated Riparian Zone (VRZ)
from top of bank each side



3rd ORDER WATERCOURSE
30m Vegetated Riparian Zone (VRZ)
from top of bank each side



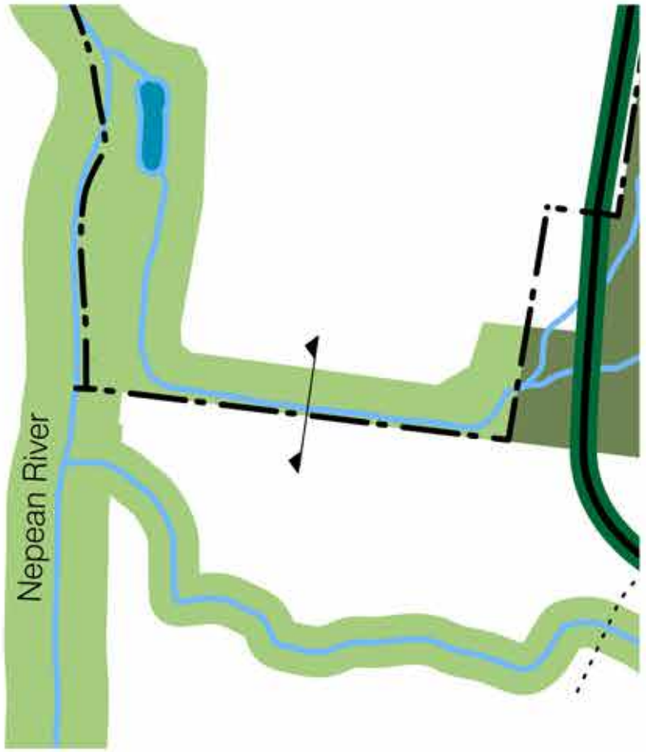
2nd ORDER WATERCOURSE
20m Vegetated Riparian Zone (VRZ)
from top of bank each side



1st ORDER WATERCOURSE
10m Vegetated Riparian Zone (VRZ)
from top of bank each side

Figure 8. Water Cycle Management - Watercourse Classification

Glenlee Precinct - Proposed Rezoning



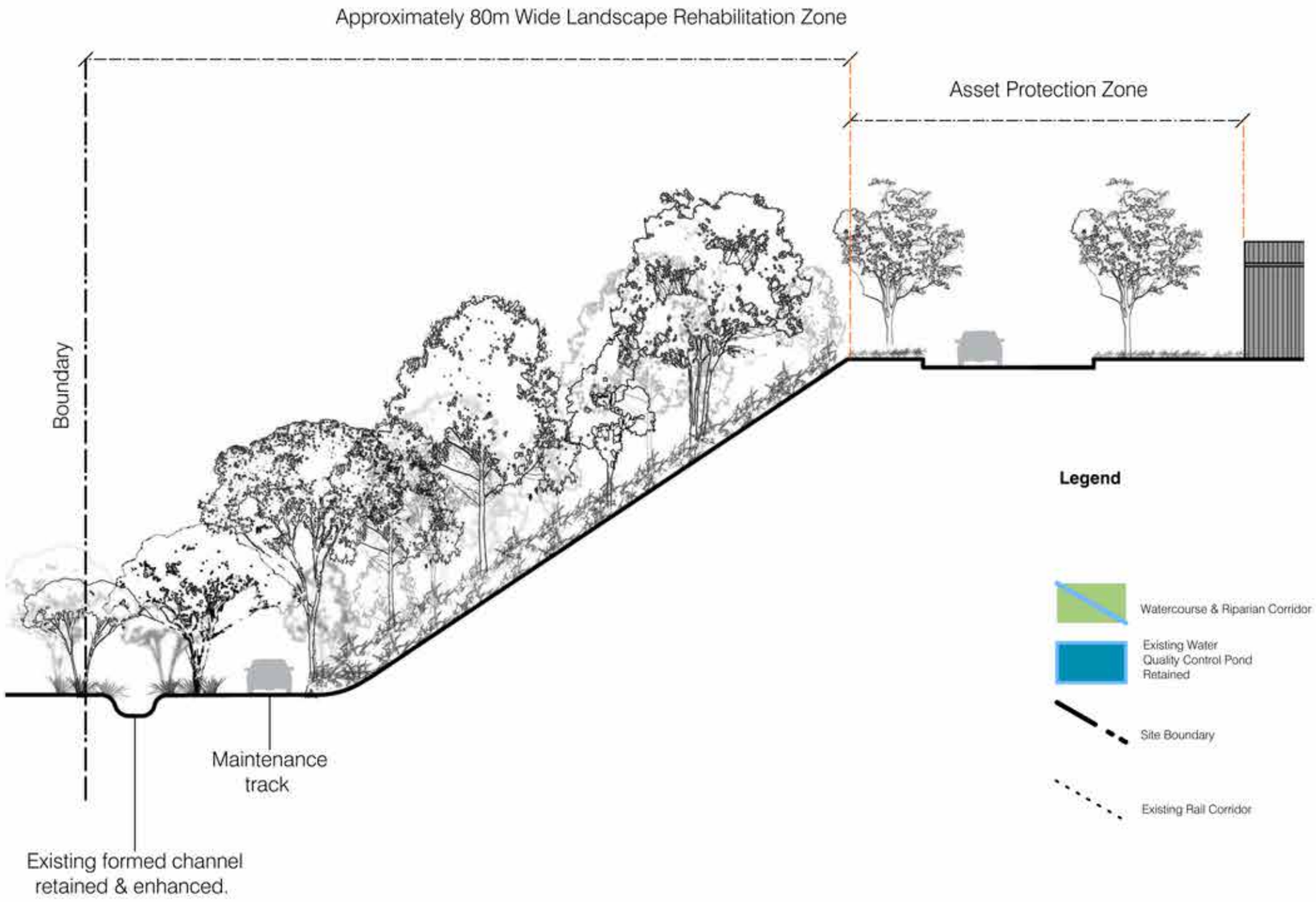


Figure 9. Detail - Southern Boundary Restoration

Appendix B

Precinct Preliminary Soil Investigations

Sydney Environmental and Soil Laboratory Pty Limited
ABN 70 106 810 708
PO Box 357
PENNANT HILLS NSW 1715
T: (02) 9980 6554
F: (02) 9484 2427
E: info@sesl.com.au
W: www.sesl.com.au

Specialists in Soil Chemistry, Agronomy and Contamination Assessments.

20 June 2008

Mark Blanche
EDAW
Level 1, 2-14 Mountain St
ULTIMO
NSW 2007

Dear Mark

Re: Jack's Gully, Preliminary Soil Investigations

A site inspection, planning workshop and soil sampling exercise was held on 5 June for the purpose of providing some initial scoping ideas to guide early stages of the rehabilitation work being planned for the Jack's Gully development project. It is understood that the work is limited at this stage to providing some level of confidence for planners that the site can be rehabilitated to form a viable and diverse vegetation community.

In our experience rehabilitation of such sites requires a careful site-specific analysis and response. Where this is performed, and appropriate responses made virtually any site, except perhaps the most saline of mine wastes, can be successfully vegetated. Mistakes are often made by assuming, for example, that all coal chitter material is the same and applying a "formula" approach from another region. Another major error is assuming that indigenous vegetation does not need fertiliser and hence expecting it to grow in grossly deficient or hostile material. They may not need fertiliser in natural soil but mine spoil and fill is not soil and can be so grossly deficient in simple nutrients like phosphorus that even native vegetation will not grow. By using appropriate amounts of the right fertiliser to shortcut hundreds of years of slow "bioaccumulation" of these limiting elements a vegetation community can be "kick started" into forming a rapid climax community on otherwise hostile material.

The purpose of this preliminary work is to identify the major nutrient limitations of the coal mining spoil and to present concepts that will ensure that any vegetation treatment planned will grow into a viable ecology supporting the biodiversity or landscape aesthetic aims required of it.

To this end a number of samples were collected in order to understand the full range of materials on site and available revegetation namely-

Sample 1. North Eastern Batter – An area of reasonable tree growth and good cover obtained by applying imported fill soils over chitter. The current soil is a mix of the two.

Sample 2. Southern Bank East Poor Pines. An area that was vegetated straight on to chitter. Pine trees and couch grass the main vegetation. Plants have established and grown but growth is obviously stunted with trees half the size of trees the same age in topsoiled areas.
Sample 3. Southern Bank East Next to Pines. An area of couch grass on straight chitter showing shortened internode length and purple foliage colours indicative of phosphorus deficiency.
Sample 4. Mixed Fill. From a stockpile of imported waste fill soils brought on to site from a wide range of local excavation and cut and fill works. Mixed origins but mainly local clayey subsoil.
Sample 5. East-West Corridor. An eroded batter of natural, in-situ subsoil that is very poorly colonised by plants. Indicative of one of the few remaining intact subsoils.

Individual test results are attached with comments on each result pointing out the major conclusions from the analysis. The overall conclusions can be summarised as follows.

1. This coal chitter, unlike most, is not acidic and not calcium deficient. In fact the Ca/Mg ratios are quite acceptable for plant growth except for mildly deficient potassium. It is not saline or sodic either.
2. The most obvious difference between the area of good native tree growth on the NE side and the very poor growth of pines on the Southern bank is phosphorus. A P level of around 7mg/kg on the NE side is about what we would find in the moderately fertile soils of the SW Cumberland plain. This element very deficient in the two chitter samples.
3. The alkaline pH of the chitter is quite acceptable for Cumberland Plain flora which is adapted to neutral and alkaline soils but the low iron level is an issue since in natural soil iron would be present despite alkaline pH.
4. Nitrogen and Sulphur are likely secondary deficiencies. Coal chitter, being high in carbon, is constantly "hungry" for nitrogen since the C/N ratio is so high. It is estimated at about 60:1 in the chitter soils despite an apparently high total N. This is overcome by applying N fertiliser and by using N fixing species such as plants from the leguminoseae and Mimosaceae families.
5. The imported fill is typically sodic and magnesic which is normal for soils in the area. Mixed with the chitter this will be corrected by the calcium content of the chitter and make an ideal physical and chemical medium. Simply placed on top it is likely to cause problems related to crusting and increased run off rather than infiltration of rainfall.

These results suggest some very simple approaches to constructing soils by using the available on-site resources and some imported materials. Three such methods are described as follows with suggestions as to what vegetation treatment would be appropriate for each approach.

1. Straight Chitter. Providing the chitter is not too coarse and open and contains some "soily" fine material to provide water holding capacity it should be possible to vegetate it by simply applying the missing nutritional elements. One approach to this would be to apply-
    - Monoammonium phosphate (MAP) 75g/sqm*
    - Sulphate of iron 50g/sqm
    - Muriate of potash 20g/sqm

* this amount has been carefully calculated to provide about 100mg of total P per kilogram of surface soil 150mm thick. This is consistent with a low fertility native soil. More may be needed at a future time as the vegetation takes this amount up into the standing canopy and fertility drops as a consequence.

This soil treatment would be adequate for rough grassing and for colonising leguminous species such as clovers, acacias and native legumes. Some degree of drought tolerance would be needed. Cumberland Plain flora would likely grow but would need follow-up fertiliser applications as it develops or it would likely stagnate. The soil would also be likely to support a more xeric vegetation type such as open woodland or banksia scrub. In such a vegetation type we may reduce the phosphorus input to 50g/sqm of MAP.

2. Chitter with Fill Soil

By applying 50-100mm of fill soil and working this in to 200mm depth a soil with better physical properties than straight chitter will result. This would be consistent with good growth of colonising species and of Cumberland Plain flora. Apply-

- Monoammonium phosphate (MAP) 75g/sqm*
- Sulphate of iron 50g/sqm
- Muriate of potash 20g/sqm

The same fertilisers apply because a higher level of both chemical and physical fertility is required to support the more high status Cumberland Plain woodland for which the soil type is designed.

3. Chitter with Fill Soil and Compost

By applying 100mm of fill soil and 50mm of green waste derived compost and working this in to 200mm depth a soil with even better physical properties will result. This would be consistent with good growth of Cumberland Plain flora and for use in amenity garden and landscaping areas. Apply-

- Monoammonium phosphate (MAP) 75g/sqm*
- Sulphate of iron 50g/sqm
- Muriate of potash 20g/sqm

The same fertilisers apply because an even higher level of both chemical and physical fertility is required to support the more high status Cumberland Plain woodland or amenity landscape components.

Surface mulching of mass planted areas always brings the benefits of weed control, erosion reduction and moisture retention and would ideally be applied to all areas except turf or grassing. A temporary cover crop is recommended for all areas especially sloping areas. A suitable winter cereal is oats and for summer Japanese millet. The use of leguminous components is strongly recommended in all areas.

As a result of this analysis and preliminary appraisal we can be fairy certain that large amounts of topsoil will not be needed to provide a successful rehabilitation and landscaping result for this project. The chitter on site is not hostile (eg not acidic or saline) but has some very obvious nutrient deficiencies and poor water holding that is holding back otherwise successful plantings. Results can be improved to support a range of vegetation types is the

nutrient deficiencies are targeted and corrected. Results may be further improved by incorporating some waste soils and compost to improve water holding sufficiently for the higher status vegetation types and landscaping aims.

We trust this outline report provides you with sufficient detail to provide the confidence at this stage that the soil issues on site can be overcome and managed to a successful end. We look forward to providing the detail of these specification in due course.

Yours

Simon Leake
Principal Soil Scientist.

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

Batch N°: 6773
Sample No: 1

Report Status: ○ Preliminary ◉ Final

AS/NZS ISO 9001: 2000 QEC 21650 — Quality Endorsed Company

Sydney Environmental and Soil Laboratory Pty Limited ABN 70 106 810 708 PO Box 357, Pennant Hills NSW 1715 Australia T: 02 9980 6554 F: 02 9484 2427 E: info@sesl.com.au W: www.sesl.com.au

CLIENT DETAILS:
EDAW Pty Limited

Level 8
17 York Street
SYDNEY NSW 2000

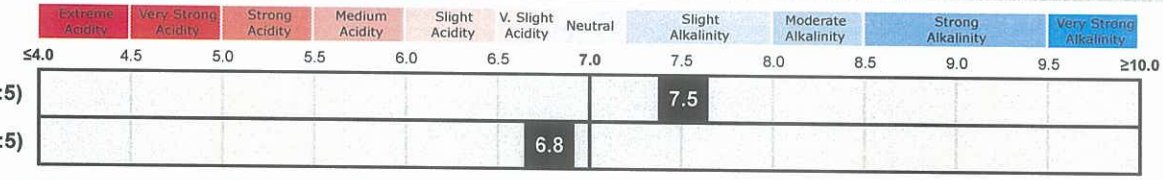
Attn: Mark Blanche

PROJECT DETAILS:
Project Name:
Jack's Gully
Location:
SESL Quote N°:
Client Job N°:
Client Order N°:
Date Received: 10/06/2008

SAMPLE DETAILS:
Sample Name:
North Eastern Batter
Sample N°: 1
Sample Description:
Soil,
Test Type: SS03-L (FS), TN

pH and ELECTRICAL CONDUCTIVITY

pH ANALYSIS



ELECTRICAL CONDUCTIVITY (dS/m)

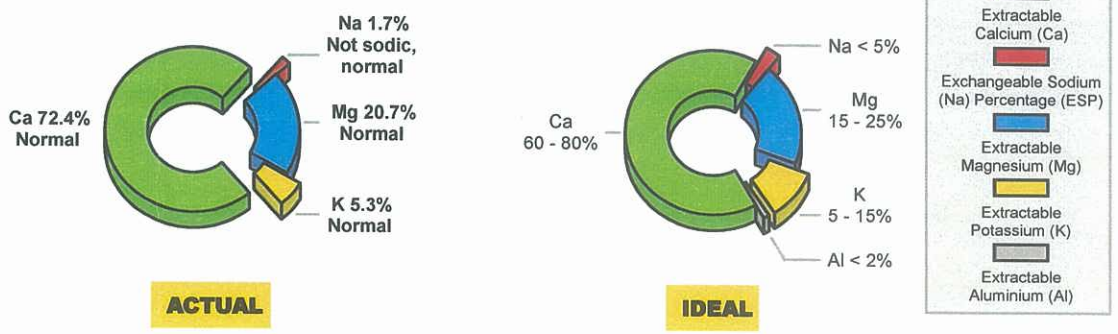
SOLUBLE CATIONS (meq%)

Na	K	Ca	Mg

CHLORIDE (mg/kg)
Not determined

CATION BALANCE

BASE SATURATION PERCENTAGE (BSP)



CATION RATIOS

		Exhangeable Sodium Percentage (ESP)	1.7% - Not sodic, normal		
Ca:Mg	3.5 Normal	K:Mg	0.3 Low	Sodium Absorption Ratio	ND

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC)

CALCULATED LIME REQUIREMENT (CLR)*

Surface application rate:
0 kg/ha (ie. 0 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 0 kg/m^3

CLR = Lime application required to reduce available Aluminium to 0. pH preference and cation ratios must also be considered when determining liming rate and product.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

CALCULATED GYPSUM REQUIREMENT (CGR)*

Surface application rate:
0 kg/ha (ie. 0 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 0 kg/m^3

CGR = Gypsum application required to achieve 70% exchangeable Calcium. The CGR is corrected for any Lime addition specified in CLR.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

* Calculation for kg/ha and g/m^2 is based on a Bulk Density of 1.3 and a soil depth of 150mm.

Date: 20/6/2008 Sample Name: North Eastern Batter Sample No.: 1 Batch No.: 6773

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

Batch N°: 6773
Sample No: 1

Report Status: ○ Preliminary ◉ Final

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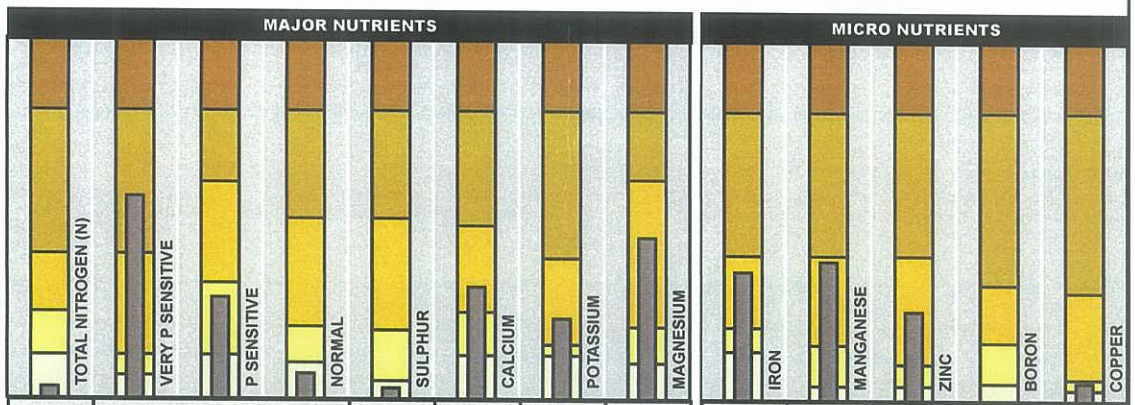
Sydney Environmental and Soil Laboratory Pty Limited ABN 70 106 810 708 PO Box 357, Pennant Hills NSW 1715 Australia T: 02 9980 6554 F: 02 9484 2427 E: info@sesl.com.au W: www.sesl.com.au

PLANT AVAILABLE NUTRIENT PROFILE



	NH_4+NO_3	Phosphorus as PO_4	Sulphur as SO_4	Ca	K	Mg	Fe	Mn	Zn	B	Cu
mg/kg	4	7	< 5	1553	223	269	133	48	12.3	ND	5
kg/ha*	8	14	6	3028	435	525	259	94	24	ND	9.8

Ammonium - N (NH_4): **2.7 mg/kg**

Nitrate - N (NO_3): **1.0 mg/kg**

Total Available Nitrogen: **4.0 mg/kg**

* Calculation for kg/ha is based on a Bulk Density of 1.3 and a soil depth of 150mm.

ND denotes Not Determined.

Category	Description	Probability of response to a nutrient addition
Excessive	Potential phytotoxic response. No nutrient addition required. Drawdown is recommended.	<2
High	Nutrient level is more than adequate and luxury consumption may be occurring.	5-30
Sufficient	The most desirable category. Nutrient additions are appropriate for most plants.	30-60
Low	Potential "hidden hunger", or subclinical deficiency.	60-90
Deficient	Growth is likely to be severely depressed and deficiency symptoms present.	>90

Method References:
pH, EC, Sol Cat, NO3, Al, Cl; Bradley et al (1983)
Exch Cat, ECEC; Method 15A1 Rayment and Higginson (1992)
PO4; Method 9E1 Rayment and Higginson (1992)
NH4, SO4, Fe, Cu, Mg, Zn; Method 83-1 to 83-5 Black (1983)

SUMMARY OF SOIL CHEMISTRY

pH	EC	Sodicity (ESP)	Ca:Mg	Ca % of eCEC
Slight alkalinity	Very low	Not sodic - normal	Normal	Normal

RECOMMENDATION

Total Nitrogen (LECO): 0.20 % w/w

This area showed reasonable growth of trees and grasses. Soil was used to cap the area and hence the chemistry is reasonably well balanced. Phosphorus levels are reasonable in marked contrast to the areas of straight chitter. N levels are low.

Consultant: Simon Leake

Authorised Signatory: Simon Leake

Report Date: 20 Jun 2008

Signature - required for Final Reports

Record ID: 1

Date: 20/6/2008 Sample Name: North Eastern Batter Sample No.: 1 Batch No.: 6773

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

Batch N°: 6773
Sample No: 2

Report Status: ○ Preliminary ◉ Final

Quality System — Quality Endorsed Company
AS/NZS ISO 9001: 2000
QEC 21650

Sydney Environmental and Soil Laboratory Pty Limited ABN 70 106 810 708 PO Box 357, Pennant Hills NSW 1715 Australia T: 02 9980 6554 F: 02 9484 2427 E: info@sesl.com.au W: www.sesl.com.au

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Location:
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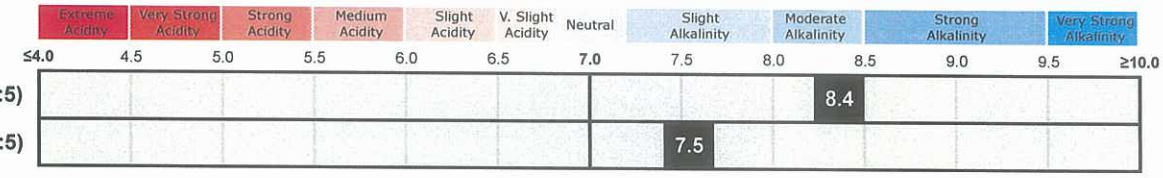
SAMPLE DETAILS:

Sample Name:
Southern Bank East Poor Pine
Sample N°: 2
Sample Description:
Soil,
Test Type: SS03-L (FS), TN

pH and ELECTRICAL CONDUCTIVITY

pH ANALYSIS



ELECTRICAL CONDUCTIVITY (dS/m)

SOLUBLE CATIONS (meq%)

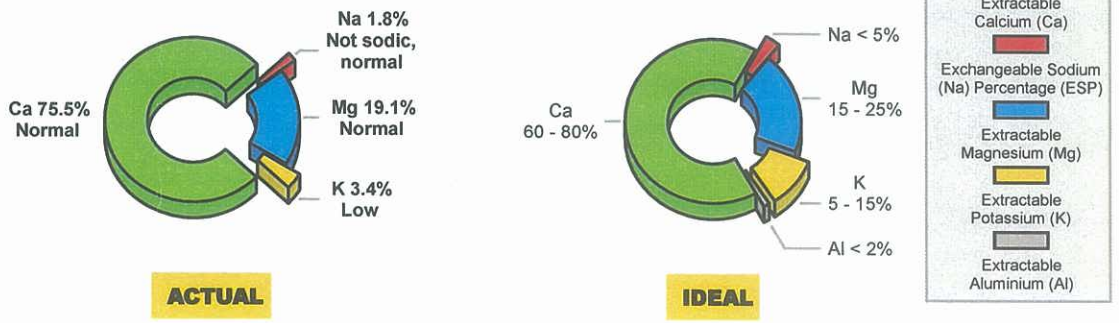
Na	K	Ca	Mg

CHLORIDE (mg/kg)

Not determined

CATION BALANCE

BASE SATURATION PERCENTAGE (BSP)



CATION RATIOS

Exhangeable Sodium Percentage (ESP)	1.8% - Not sodic, normal				
Ca:Mg	4 Normal	K:Mg	0.2 Low	Sodium Absorption Ratio	ND

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC)

CALCULATED LIME REQUIREMENT (CLR)*

Surface application rate:
0 kg/ha (ie. 0 g/m^2), based on treating a 150mm soil depth.

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SEE PAGE 2 FOR FINAL RECOMMENDATIONS

CALCULATED GYPSUM REQUIREMENT (CGR)*

Surface application rate:
0 kg/ha (ie. 0 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 0 kg/m^3

CGR = Gypsum application required to achieve 70% exchangeable Calcium. The CGR is corrected for any Lime addition specified in CLR.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

* Calculation for kg/ha and g/m^2 is based on a Bulk Density of 1.3 and a soil depth of 150mm.

Date: 20/6/2008 Sample Name: Southern Bank East Poor Pine Sample No.: 2 Batch No.: 6773

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

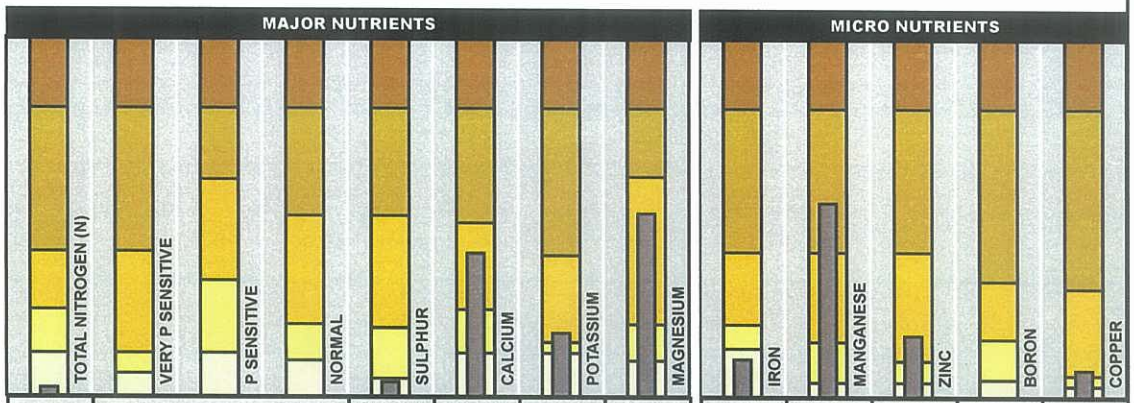
Batch N°: 6773
Sample No: 2

Report Status: ○ Preliminary ◉ Final

AS/NZS ISO 9001: 2000 QEC 21650 — Quality Endorsed Company

Sydney Environmental and Soil Laboratory Pty Limited ABN 70 106 810 708 PO Box 357, Pennant Hills NSW 1715 Australia T: 02 9980 6554 F: 02 9484 2427 E: info@sesl.com.au W: www.sesl.com.au

PLANT AVAILABLE NUTRIENT PROFILE



	NH_4+NO_3	Phosphorus as PO_4	Sulphur as SO_4	Ca	K	Mg	Fe	Mn	Zn	B	Cu
mg/kg	3	< 0.8	< 5	1982	176	304	39	67	8.5	ND	7.5
kg/ha*	6	0	8	3865	343	593	76	131	16.6	ND	14.6

Ammonium - N (NH_4): **2.5 mg/kg**

Nitrate - N (NO_3): **0.5 mg/kg**

Total Available Nitrogen: **3.0 mg/kg**

Category	Description	Probability of response to a nutrient addition
Excessive	Potential phytotoxic response. No nutrient addition required. Drawdown is recommended.	<2
High	Nutrient level is more than adequate and luxury consumption may be occurring.	5-30
Sufficient	The most desirable category. Nutrient additions are appropriate for most plants.	30-60
Low	Potential "hidden hunger", or subclinical deficiency.	60-90
Deficient	Growth is likely to be severely depressed and deficiency symptoms present.	>90

* Calculation for kg/ha is based on a Bulk Density of 1.3 and a soil depth of 150mm.

ND denotes Not Determined.

Method References:
pH, EC, Sol Cat, NO3, Al, Cl; Bradley et al (1983)
Exch Cat, ECEC; Method 15A1 Rayment and Higginson (1992)
PO4; Method 9E1 Rayment and Higginson (1992)
NH4, SO4, Fe, Cu, Mg, Zn; Method 83-1 to 83-5 Black (1983)

SUMMARY OF SOIL CHEMISTRY

pH	EC	Sodicity (ESP)	Ca:Mg	Ca % of eCEC
Moderate alkalinity	Very low	Not sodic - normal	Normal	Normal

RECOMMENDATION

Total Nitrogen (LECO): 0.48 % w/w

This was the area of poor growth of pines on straight chitter. The chitter is remarkable in that it is not calcium deficient as most chitter is but in fact slightly limy and alkaline. Cation exchange capacity is actually quite well balanced if low in potassium. Total N is high for a soil but we must recall that the carbon content is also very high so the actual C/N ratio is probably high meaing low available N. NH4 plus NO3 is consequently low. Probably the most important deficiencies are phosphorus, sulphur and, unexpectedly, iron.

Consultant: Simon Leake

Authorised Signatory: Simon Leake

Report Date: 20 Jun 2008

Signature - required for Final Reports

Record ID: 1

Date: 20/6/2008 Sample Name: Southern Bank East Poor Pine Sample No.: 2 Batch No.: 6773

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

Batch N°: 6773
Sample No: 2

Report Status: ○ Preliminary ◉ Final

AS/NZS ISO 9001: 2000 QEC 21650 — Quality Endorsed Company

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CLIENT DETAILS:
EDAW Pty Limited

Level 8
17 York Street
SYDNEY NSW 2000

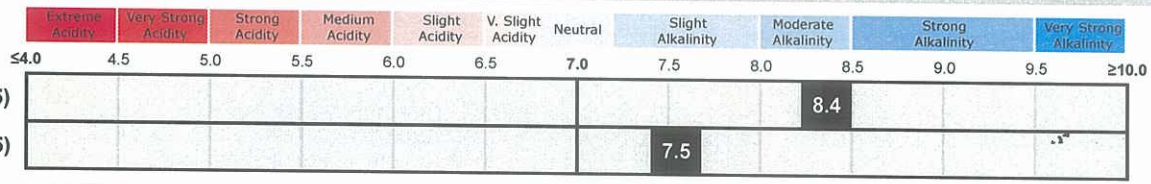
Attn: Mark Blanche

PROJECT DETAILS:
Project Name:
Jack's Gully
Location:
SESL Quote N°:
Client Job N°:
Client Order N°:
Date Received: 10/06/2008

SAMPLE DETAILS:
Sample Name:
Southern Bank East Poor Pine
Sample N°: 2
Sample Description:
Soil,
Test Type: SS03-L (FS), TN

pH and ELECTRICAL CONDUCTIVITY

pH ANALYSIS



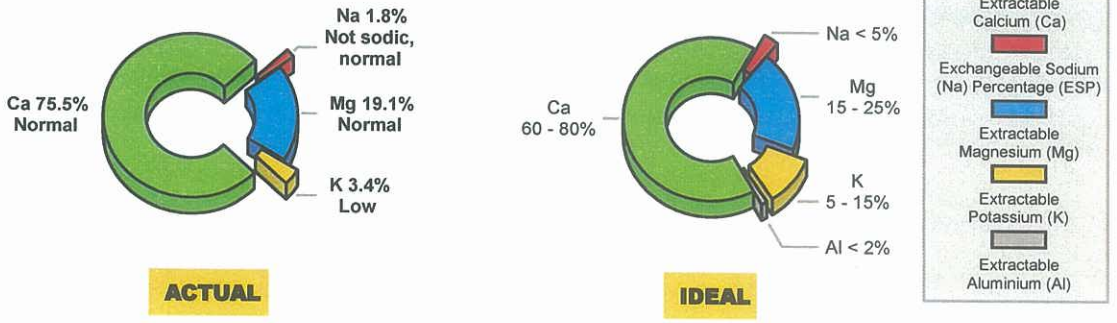
ELECTRICAL CONDUCTIVITY (dS/m)

SOLUBLE CATIONS (meq%)
Na K Ca Mg

CHLORIDE (mg/kg)
Not determined

CATION BALANCE

BASE SATURATION PERCENTAGE (BSP)



CATION RATIOS

Exhangeable Sodium Percentage (ESP)	1.8% - Not sodic, normal				
Ca:Mg	4 Normal	K:Mg	0.2 Low	Sodium Absorption Ratio	ND

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC)

CALCULATED LIME REQUIREMENT (CLR)*

Surface application rate:
0 kg/ha (ie. 0 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 0 kg/m^3

CLR = Lime application required to reduce available Aluminium to 0. pH preference and cation ratios must also be considered when determining liming rate and product.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

CALCULATED GYPSUM REQUIREMENT (CGR)*

Surface application rate:
0 kg/ha (ie. 0 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 0 kg/m^3

CGR = Gypsum application required to achieve 70% exchangeable Calcium. The CGR is corrected for any Lime addition specified in CLR.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

* Calculation for kg/ha and g/m^2 is based on a Bulk Density of 1.3 and a soil depth of 150mm.

Date: 20/6/2008 Sample Name: Southern Bank East Poor Pine Sample No.: 2 Batch No.: 6773

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

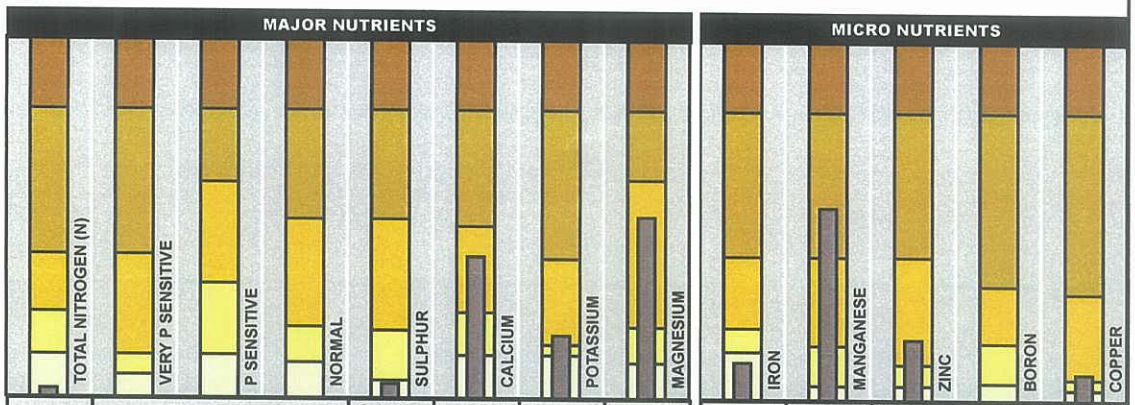
Batch N°: 6773
Sample No: 2

Report Status: ○ Preliminary ◉ Final

AS/NZS ISO 9001: 2000 QEC 21650
Quality Endorsed Company

Sydney Environmental and Soil Laboratory Pty Limited ABN 70 106 810 708 PO Box 357, Pennant Hills NSW 1715 Australia T: 02 9980 6554 F: 02 9484 2427 E: info@sesl.com.au W: www.sesl.com.au

PLANT AVAILABLE NUTRIENT PROFILE



	NH_4+NO_3	Phosphorus as PO_4	Sulphur as SO_4	Ca	K	Mg	Fe	Mn	Zn	B	Cu
mg/kg	3	< 0.8	< 5	1982	176	304	39	67	8.5	ND	7.5
kg/ha*	6	0	8	3865	343	593	76	131	16.6	ND	14.6

Ammonium - N (NH_4): **2.5 mg/kg**

Nitrate - N (NO_3): **0.5 mg/kg**

Total Available Nitrogen: **3.0 mg/kg**

* Calculation for kg/ha is based on a Bulk Density of 1.3 and a soil depth of 150mm.

ND denotes Not Determined.

Category	Description	Probability of response to a nutrient addition
Excessive	Potential phytotoxic response. No nutrient addition required. Drawdown is recommended.	<2
High	Nutrient level is more than adequate and luxury consumption may be occurring.	5-30
Sufficient	The most desirable category. Nutrient additions are appropriate for most plants.	30-60
Low	Potential "hidden hunger", or subclinical deficiency.	60-90
Deficient	Growth is likely to be severely depressed and deficiency symptoms present.	>90

Method References:
pH, EC, Sol Cat, NO3, Al, Cl; Bradley et al (1983)
Exch Cat, ECEC; Method 15A1 Rayment and Higginson (1992)
PO4; Method 9E1 Rayment and Higginson (1992)
NH4, SO4, Fe, Cu, Mg, Zn; Method 83-1 to 83-5 Black (1983)

SUMMARY OF SOIL CHEMISTRY

pH	EC	Sodicity (ESP)	Ca:Mg	Ca % of eCEC
Moderate alkalinity	Very low	Not sodic - normal	Normal	Normal

RECOMMENDATION

Total Nitrogen (LECO): 0.48 % w/w

This was the area of poor growth of pines on straight chitter. The chitter is remarkable in that it is not calcium deficient as most chitter is but in fact slightly limy and alkaline. Cation exchange capacity is actually quite well balanced if low in potassium. Total N is high for a soil but we must recall that the carbon content is also very high so the actual C/N ratio is probably high meaing low available N. NH4 plus NO3 is consequently low. Probably the most important deficiencies are phosphorus, sulphur and, unexpectedly, iron.

Consultant: Simon Leake

Authorised Signatory: Simon Leake

Report Date: 20 Jun 2008

Signature - required for Final Reports

Record ID: 1

Date: 20/6/2008 Sample Name: Southern Bank East Poor Pine Sample No.: 2 Batch No.: 6773

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

Batch N°: 6773
Sample No: 3

Report Status: ○ Preliminary ◉ Final

AS/NZS ISO 9001: 2000 QEC 21650

Quality Endorsed Company

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CLIENT DETAILS:
EDAW Pty Limited

Level 8
17 York Street
SYDNEY NSW 2000

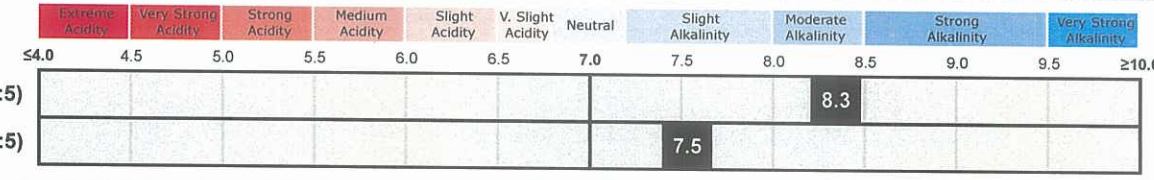
Attn: Mark Blanche

PROJECT DETAILS:
Project Name:
Jack's Gully
Location:
SESL Quote N°:
Client Job N°:
Client Order N°:
Date Received: 10/06/2008

SAMPLE DETAILS:
Sample Name:
Southern Bank East Next to Pine
Sample N°: 3
Sample Description:
Soil,
Test Type: SS03-L (FS), TN

pH and ELECTRICAL CONDUCTIVITY

pH ANALYSIS



ELECTRICAL CONDUCTIVITY (dS/m)

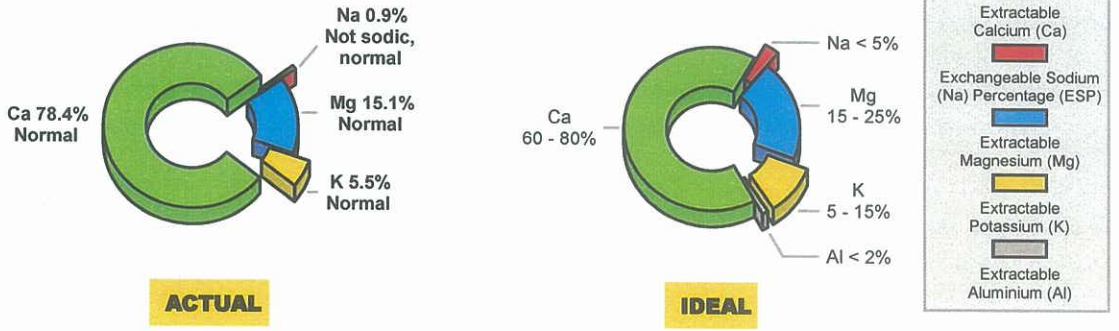
SOLUBLE CATIONS (meq%)

Na	K	Ca	Mg

CHLORIDE (mg/kg)
Not determined

CATION BALANCE

BASE SATURATION PERCENTAGE (BSP)



CATION RATIOS

		Exchangeable Sodium Percentage (ESP)	0.9% - Not sodic, normal		
Ca:Mg	5.2 Normal	K:Mg	0.4 Low	Sodium Absorption Ratio	ND

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC)

CALCULATED LIME REQUIREMENT (CLR)*

Surface application rate:
0 kg/ha (ie. 0 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 0 kg/m^3

CLR = Lime application required to reduce available Aluminium to 0. pH preference and cation ratios must also be considered when determining liming rate and product.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

CALCULATED GYPSUM REQUIREMENT (CGR)*

Surface application rate:
0 kg/ha (ie. 0 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 0 kg/m^3

CGR = Gypsum application required to achieve 70% exchangeable Calcium. The CGR is corrected for any Lime addition specified in CLR.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

* Calculation for kg/ha and g/m^2 is based on a Bulk Density of 1.3 and a soil depth of 150mm.

Date: 20/6/2008 Sample Name: Southern Bank East Next to Pine Sample No.: 3 Batch No.: 6773

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

Batch N°: 6773
Sample No: 3

Report Status: ○ Preliminary ◉ Final

AS/NZS ISO 9001: 2000 QEC 21650 — Quality Endorsed Company

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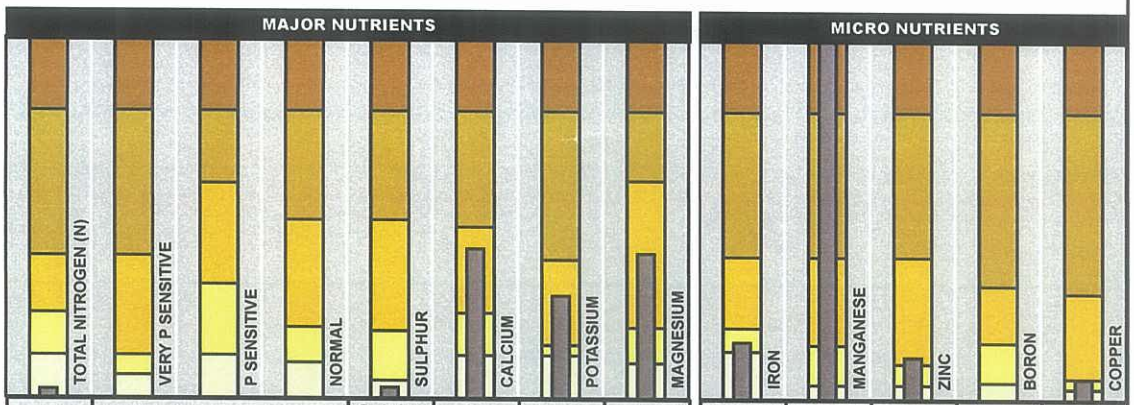
PLANT AVAILABLE NUTRIENT PROFILE



	NH_4+NO_3	Phosphorus as PO_4	Sulphur as SO_4	Ca	K	Mg	Fe	Mn	Zn	B	Cu
mg/kg	3	< 0.8	< 5	2104	289	245	60	156	5.9	ND	5.8
kg/ha*	6	0	6	4103	564	478	117	304	11.5	ND	11.3

Ammonium - N (NH_4): **2.9 mg/kg**

Nitrate - N (NO_3): **0.0 mg/kg**

Total Available Nitrogen: **3.0 mg/kg**

* Calculation for kg/ha is based on a Bulk Density of 1.3 and a soil depth of 150mm.

ND denotes Not Determined.

Category	Description	Probability of response to a nutrient addition
Excessive	Potential phytotoxic response. No nutrient addition required. Drawdown is recommended.	<2
High	Nutrient level is more than adequate and luxury consumption may be occurring.	5-30
Sufficient	The most desirable category. Nutrient additions are appropriate for most plants.	30-60
Low	Potential "hidden hunger", or subclinical deficiency.	60-90
Deficient	Growth is likely to be severely depressed and deficiency symptoms present.	>90

Method References:
pH, EC, Sol Cat, NO3, Al, Cl; Bradley et al (1983)
Exch Cat, ECEC; Method 15A1 Rayment and Higginson (1992)
PO4; Method 9E1 Rayment and Higginson (1992)
NH4, SO4, Fe, Cu, Mg, Zn; Method 83-1 to 83-5 Black (1983)

SUMMARY OF SOIL CHEMISTRY

pH	EC	Sodicity (ESP)	Ca:Mg	Ca % of eCEC
Moderate alkalinity	Low	Not sodic - normal	Normal	Normal

RECOMMENDATION

Total Nitrogen (LECO): 0.34 % w/w

Very similar to the "poor pines" next door, phosphorus, sulphur and iron are the main deficiencies but. N availability is low.

Consultant: Simon Leake

Authorised Signatory: Simon Leake

Report Date: 20 Jun 2008

Signature - required for Final Reports

Record ID: 1

Date: 20/6/2008 Sample Name: Southern Bank East Next to Pine Sample No.: 3 Batch No.: 677

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

Batch N°: 6773
Sample No: 4

Report Status: ○ Preliminary ◉ Final

AS/NZS ISO 9001: 2000 QEC 21650 — Quality Endorsed Company

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CLIENT DETAILS:
EDAW Pty Limited

Level 8
17 York Street
SYDNEY NSW 2000

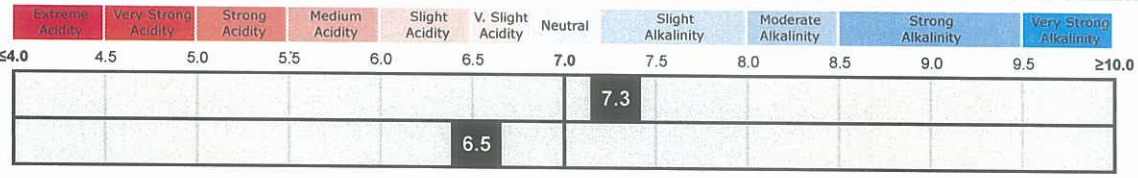
Attn: Mark Blanche

PROJECT DETAILS:
Project Name:
Jack's Gully
Location:
SESL Quote N°:
Client Job N°:
Client Order N°:
Date Received: 10/06/2008

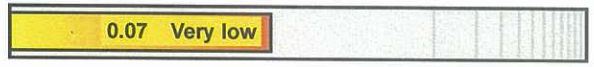
SAMPLE DETAILS:
Sample Name:
Mixed Fill
Sample N°: 4
Sample Description:
Soil,
Test Type: SS03-L (FS), TN

pH and ELECTRICAL CONDUCTIVITY

pH ANALYSIS



ELECTRICAL CONDUCTIVITY (dS/m)



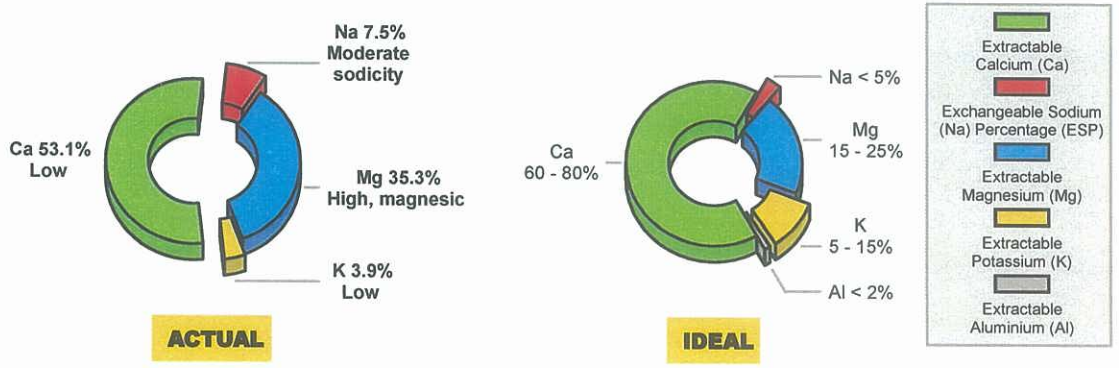
SOLUBLE CATIONS (meq%)

Na	K	Ca	Mg

CHLORIDE (mg/kg)
Not determined

CATION BALANCE

BASE SATURATION PERCENTAGE (BSP)



CATION RATIOS

Exhangeable Sodium Percentage (ESP)	7.5% - Moderate sodicity

Ca:Mg	1.5 Low - magnesic	K:Mg	0.1 Low	Sodium Absorption Ratio	ND

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC)

CALCULATED LIME REQUIREMENT (CLR)*

Surface application rate:
0 kg/ha (ie. 0 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 0 kg/m^3

CLR = Lime application required to reduce available Aluminium to 0. pH preference and cation ratios must also be considered when determining liming rate and product.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

CALCULATED GYPSUM REQUIREMENT (CGR)*

Surface application rate:
4360 kg/ha (ie. 436 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 2.9 kg/m^3

CGR = Gypsum application required to achieve 70% exchangeable Calcium. The CGR is corrected for any Lime addition specified in CLR.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

* Calculation for kg/ha and g/m^2 is based on a Bulk Density of 1.3 and a soil depth of 150mm.

Date: 20/6/2008 Sample Name: Mixed Fill Sample No.: 4 Batch No.: 6773

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

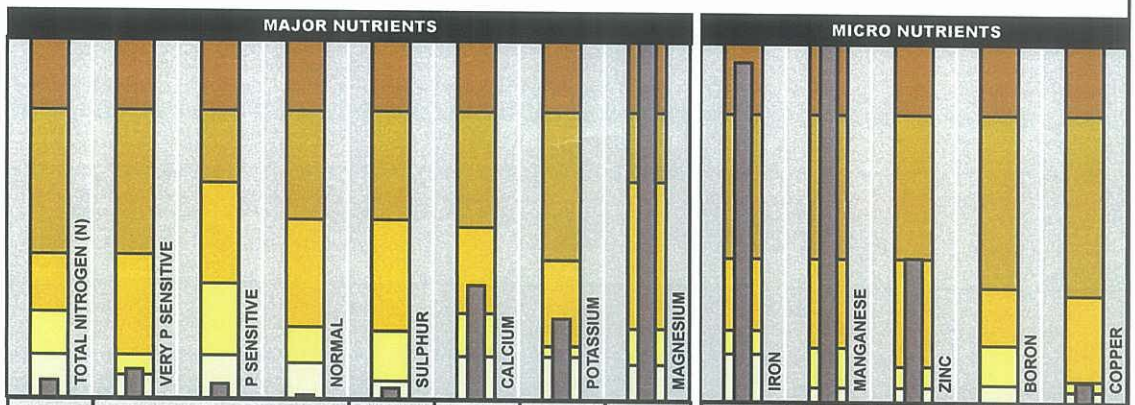
Batch N°: 6773
Sample No: 4

Report Status: ○ Preliminary ◉ Final

AS/NZS ISO 9001: 2000 QEC 21650 — Quality Endorsed Company

Sydney Environmental and Soil Laboratory Pty Limited ABN 70 106 810 708 PO Box 357, Pennant Hills NSW 1715 Australia T: 02 9980 6554 F: 02 9484 2427 E: info@sesl.com.au W: www.sesl.com.au

PLANT AVAILABLE NUTRIENT PROFILE



	NH_4+NO_3	Phosphorus as PO_4	Sulphur as SO_4	Ca	K	Mg	Fe	Mn	Zn	B	Cu
mg/kg	6	1	< 5	1595	227	644	354	443	20.1	ND	5.6
kg/ha*	12	2	6	3110	443	1256	690	864	39.2	ND	10.9

Ammonium - N (NH_4): **4.7 mg/kg**

Nitrate - N (NO_3): **1.5 mg/kg**

Total Available Nitrogen: **6.0 mg/kg**

Category	Description	Probability of response to a nutrient addition
Excessive	Potential phytotoxic response. No nutrient addition required. Drawdown is recommended.	<2
High	Nutrient level is more than adequate and luxury consumption may be occurring.	5-30
Sufficient	The most desirable category. Nutrient additions are appropriate for most plants.	30-60
Low	Potential "hidden hunger", or subclinical deficiency.	60-90
Deficient	Growth is likely to be severely depressed and deficiency symptoms present.	>90

* Calculation for kg/ha is based on a Bulk Density of 1.3 and a soil depth of 150mm.

ND denotes Not Determined.

Method References:
pH, EC, Sol Cat, NO3, Al, Cl; Bradley et al (1983)
Exch Cat, ECEC; Method 15A1 Rayment and Higginson (1992)
PO4; Method 9E1 Rayment and Higginson (1992)
NH4, SO4, Fe, Cu, Mg, Zn; Method 83-1 to 83-5 Black (1983)

SUMMARY OF SOIL CHEMISTRY

pH	EC	Sodicity (ESP)	Ca:Mg	Ca % of eCEC
Slight alkalinity	Very low	Moderate sodicity	Low - magnesic	Low

RECOMMENDATION

Total Nitrogen (LECO): 0.18 % w/w

The clayey fill soil is typically magnesic and slightly sodic. As it turns out this will not be a problem since the chitter material is calcic and will counteract this. A mix of this fill, about 25% and chitter 75% would in fact make an ideal medium physically. This would also result in a good cation exchange balance, would improve iron levels somewhat but would need fertiliser applications to correct low P, S, K, N and Fe in that order of priority.

Consultant: Simon Leake

Authorised Signatory: Simon Leake

Report Date: 20 Jun 2008

Signature required for Final Reports

Record ID: 1

Date: 20/6/2008 Sample Name: Mixed Fill Sample No.: 4 Batch No.: 677

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

Batch N°: 6773
Sample No: 5

Report Status: ○ Preliminary ◉ Final

Quality System
AS/NZS ISO 9001: 2000
QEC 21650
Quality Endorsed Company

Sydney Environmental and Soil Laboratory Pty Limited ABN 70 106 810 708 PO Box 357, Pennant Hills NSW 1715 Australia T: 02 9980 6554 F: 02 9484 2427 E: info@sesl.com.au W: www.sesl.com.au

CLIENT DETAILS:
EDAW Pty Limited

Level 8
17 York Street
SYDNEY NSW 2000

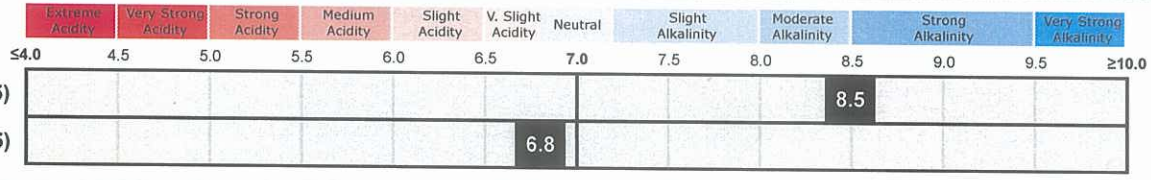
Attn: Mark Blanche

PROJECT DETAILS:
Project Name:
Jack's Gully
Location:
SESL Quote N°:
Client Job N°:
Client Order N°:
Date Received: 10/06/2008

SAMPLE DETAILS:
Sample Name:
East West Corridor
Sample N°: 5
Sample Description:
Soil,
Test Type: SS03-L (FS), TN

pH and ELECTRICAL CONDUCTIVITY

pH ANALYSIS



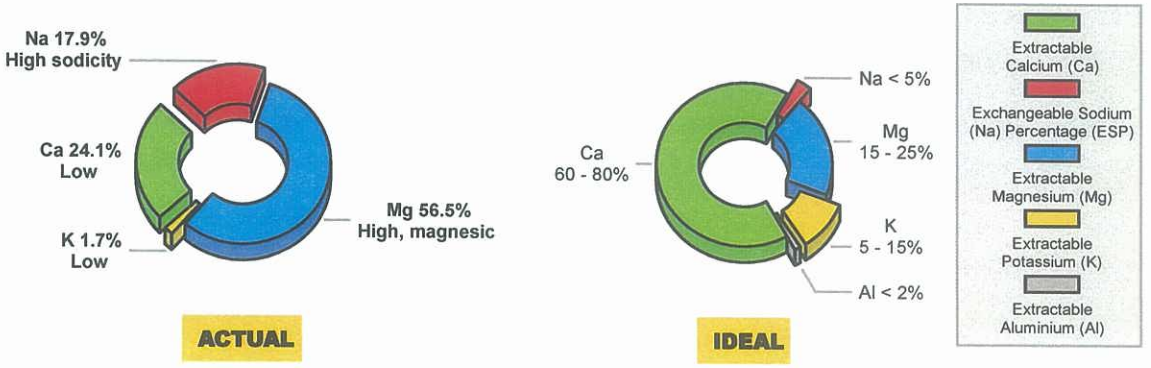
ELECTRICAL CONDUCTIVITY (dS/m)

SOLUBLE CATIONS (meq%)
Na K Ca Mg

CHLORIDE (mg/kg)
Not determined

CATION BALANCE

BASE SATURATION PERCENTAGE (BSP)



CATION RATIOS

		Exhangeable Sodium Percentage (ESP)	17.9% - High sodicity		
Ca:Mg	0.4 Low - magnesic	K:Mg	00 Low	Sodium Absorption Ratio	ND

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC)

CALCULATED LIME REQUIREMENT (CLR)*

Surface application rate:
0 kg/ha (ie. 0 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 0 kg/m^3

CLR = Lime application required to reduce available Aluminium to 0. pH preference and cation ratios must also be considered when determining liming rate and product.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

CALCULATED GYPSUM REQUIREMENT (CGR)*

Surface application rate:
17020 kg/ha (ie. 1702 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 11.3 kg/m^3

CGR = Gypsum application required to achieve 70% exchangeable Calcium. The CGR is corrected for any Lime addition specified in CLR.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

* Calculation for kg/ha and g/m^2 is based on a Bulk Density of 1.3 and a soil depth of 150mm.

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

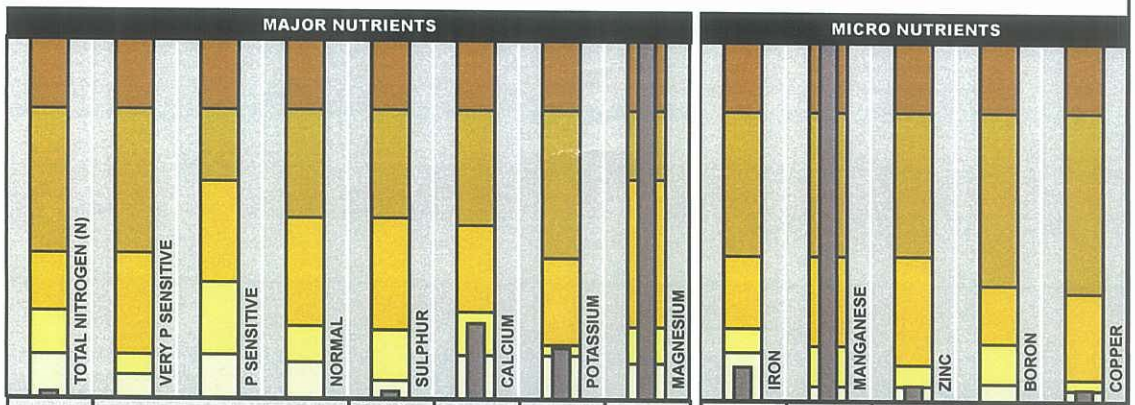
Batch N°: 6773
Sample No: 5

Report Status: ○ Preliminary ◉ Final

AS/NZS ISO 9001: 2000 QEC 21650 — Quality Endorsed Company

Sydney Environmental and Soil Laboratory Pty Limited ABN 70 106 810 708 PO Box 357, Pennant Hills NSW 1715 Australia T: 02 9980 6554 F: 02 9484 2427 E: info@sesl.com.au W: www.sesl.com.au

PLANT AVAILABLE NUTRIENT PROFILE



	NH_4+NO_3	Phosphorus as PO_4	Sulphur as SO_4	Ca	K	Mg	Fe	Mn	Zn	B	Cu
mg/kg	2	< 0.8	< 5	1044	141	1482	35	249	2.1	ND	3.2
kg/ha*	4	0	4	2036	275	2890	68	486	4.1	ND	6.2

Ammonium - N (NH_4): **1.9 mg/kg**

Nitrate - N (NO_3): **0.1 mg/kg**

Total Available Nitrogen: **2.0 mg/kg**

Category	Description	Probability of response to a nutrient addition
Excessive	Potential phytotoxic response. No nutrient addition required. Drawdown is recommended.	<2
High	Nutrient level is more than adequate and luxury consumption may be occurring.	5-30
Sufficient	The most desirable category. Nutrient additions are appropriate for most plants.	30-60
Low	Potential "hidden hunger", or subclinical deficiency.	60-90
Deficient	Growth is likely to be severely depressed and deficiency symptoms present.	>90

* Calculation for kg/ha is based on a Bulk Density of 1.3 and a soil depth of 150mm.

ND denotes Not Determined.

Method References:
pH, EC, Sol Cat, NO3, Al, Cl; Bradley et al (1983)
Exch Cat, ECEC; Method 15A1 Rayment and Higginson (1992)
PO4; Method 9E1 Rayment and Higginson (1992)
NH4, SO4, Fe, Cu, Mg, Zn; Method 83-1 to 83-5 Black (1983)

SUMMARY OF SOIL CHEMISTRY

pH	EC	Sodicity (ESP)	Ca:Mg	Ca % of eCEC
Moderate alkalinity	Very low	High sodicity	Low - magnesic	Low

RECOMMENDATION

Total Nitrogen (LECO): 0.12 % w/w

It is hardly surprising this batter shows little recolonmisation and significant erosion. The cation exchange result shows it to be severely sodic and magnesic, indeed it is alkaline sodic material. This would explain the erosion. Very significant N, P, Fe, Zn, and Cu deficiencies add to the limitation of poor soil physical properties and explain the poor plant growth.

Consultant: Simon Leake

Authorised Signatory: Simon Leake

Report Date: 20 Jun 2008

Signature - required for Final Reports

Record ID: 1

Date: 20/6/2008 Sample Name: East West Corridor Sample No.: 5 Batch No.: 6773

Appendix C

Response Table to Council Consolidated Comments

Council Reference: Riparian Corridor Study prepared by AECOM - 27 February 2014 (Rev 1)			
Council Issue	**Council Recommendation**	**Client Action**	**Where addressed in this report**
1. 2.1.2.1 Some of the river bank areas in the Nepean River Corridor are highly incised and eroded and may require stabilisation works. This has not been identified or addressed.	1. The study needs to be revised with specific reference to the Nepean River Corridor in order to identify the highly incised and eroded river bank areas and also address the stabilisation works, which are required to be applied to the river bank areas.	1. This issue has been addressed in the body of this report.	s.2.3 - Nepean River Corridor
2 2.1.2.2 It is noted that the vegetation in the proposed East-West terrestrial vegetation corridor has been put in the "too hard basket" with respect to rehabilitation. It is acknowledged that this area is located in the Camden LGA; however, if the African Olive is allowed to remain, it will make remediating any other areas particularly difficult (birds will transfer seeds). It is strongly recommended that the proposed approach to treatment of this corridor is revisited and a more sympathetic approach in support of native vegetation in the local area adopted.	2. The study needs to be revised with regard to the rehabilitation of the proposed East-West terrestrial vegetation corridor, i.e. address the proposed treatment of corridor to allow for a more sympathetic approach in support of native vegetation to this local area.	2. The east west link is an area of steep slopes which are subject to substantial loss of original soil profiles and dominated by African Olive. Whilst it is acknowledged that rehabilitation works need to be undertaken, slope stability also needs to be considered, with the woody weeds providing a significant slope stabilisation function (as reported by EcoLogical Australia, 2013). A gradual process of partial landscape restoration is proposed for the East-West Terrestrial Corridor, commencing with the gradual planting and establishment of endemic tree species within and adjoining the management zone, followed by a gradual process of African Olive removal and replacement with native shrub and ground layer species where practical. This work would be detailed within a Vegetation Management Plan. However, EcoLogical	s.2.3 – East-West Terrestrial Link

		Australia (ibid) note that 'the revegetation of this area to a native woodland is unlikely to be successful.' It is expected that this area would require an ongoing and perpetual commitment to weed control and vegetation maintenance.	
3. 2.1.2.3 and 2.1.4 The study does not identify which areas are proposed to be handed over to Council, however, the extensive rehabilitation and ongoing maintenance requirements of the Caley's Creek corridor could be a major cost to Council. From this report, the area will require fertilising of the vegetated corridor due to the highly infertile conditions of the coal chitter. Additionally, the report refers to the need to manage this corridor as an APZ. They also indicate that the batters are "very steep". This represents a WHS issue for Council and may have additional costs associated with this responsibility. Consideration should be given to not handing this corridor to Council, but leaving it in private ownership and management to minimise this impost on Council.	3. (i) The study to be revised in order to identify which areas are proposed to be handed over to Council and address their management should the areas remain under private ownership. (ii) Further identify the extent of rehabilitation and ongoing maintenance, which is required, particularly in Caley's Creek corridor for further consideration by Council.	3. (i) The following vegetated areas as shown on Figure 7 will be managed by means of Community Title: - Management Zone A: *Nepean River Corridor* (s.2.1.2.1) - Management Zone B: *East-West Terrestrial Link* (s.2.1.2.2) - Management Zone C: *Caleys Creek Corridor* (s. 2.1.2.3) - any riparian vegetation associated with the watercourse that crosses through the north-east corner of the site. (ii) A Vegetation Management Plan will be prepared for the rehabilitation works at DA stage in accordance with the guidelines provided by NSW Office of Water.	s.2.4 s.2.3.1
4. 2.1.3 The report indicates that water quality will be achieved with water quality control treatments located at the top of the coal emplacement. They indicate that the existing water quality dam will remain for polishing. This means that more water quality treatment is being provided than is strictly necessary. If these systems are to remain in private ownership and management, this will not be an issue, but if Council takes on responsibility, it may mean that this site requires a disproportionate amount of maintenance.	4. Further details to be provided on water quality control treatments/systems with regards to future ownership & their ongoing management.	4. The water quality control treatments / systems will be managed using Community Title. This includes the existing 'water quality control dam', which will be managed for habitat and aesthetic values.	s.2.4

5. 2.1.5 This section discusses the amelioration that the coal chitter will require to support plant growth. It has not addressed the issue of nutrients at depth. All the discussion is focussed on the top 200mm of the soil profile. We need to ensure that deep rooted trees can, and will, get their roots deeply into the chitter. If not, they will remain shallow rooted and potentially unstable. Additionally, shallow rooted trees will not assist with bank stability which will be required on the steep batters	5. The study is to address the issue of nutrients at depth and detail how deep rooted trees can, and will, get their roots deeply into the chitter and to assist bank stability which will be required on the steep batters.	5. As per s.2.1.5.3 of report, we had a highly experienced soil scientist / agronomist test the chitter and recommend a range of soil creation treatment types. We recommended adoption of the most comprehensive approach, about which the soil scientist stated that …*'this would be consistent with good growth of Cumberland Plain flora and for use in amenity garden and landscaping areas '* Further, our approach noted that the restoration approach will aim to create a 'fully structured' outcome (i.e. a full suite of ground layer, shrub and canopy species), but the final structural form may result in an emphasis on the ground layer, incorporating as much of a shrub and tree layer as the planting medium will allow. Further, In this regard we included for potential incorporation of species from the Elderslie Banksia Scrub Forest community which is adapted to highly free-draining conditions – the design intent being to ensure we provide a broad suite of species which have the greatest potential to successfully colonise / stabilise the batter, and create a self-regenerating, native ecological community using local provenance plant material. Further, with regard to stability of trees, we have not observed any of the Radiata Pines previously planted into the south-east chitter batter having fallen over due to poor anchorage – as confirmed	s.2.3 – Southern Boundary Precinct

		by the client.	
6. 2.1.5.4 Surface mulching is recommended. This will be difficult to keep in place on the steep batters. It may be necessary to consider benching and retaining structures to make this area safer for access and less prone to land slip issues. This is mentioned, but not detailed, in Section 2.3	6. Address with details on methodology of surface mulching, particularly on the steep batters and explore options for benching and retaining structures to make this area safer for access and less prone to land slip issues.	6. The reference to surface mulch in s.2.1.5.4 of the report is taken from the soil report, and is provided as a general observation by the soil scientist. Our proposed restoration method does not require the use mulch. Instead, it is based upon achieving a dense initial native grass cover to the batters after the implementation of a batter soil creation process. This removes the need for a mulch layer. Once established, the batters would be subject to over-planting with shrub and tree species. Refer s.2.3 – Southern Boundary Precinct, for the full description of the landscape restoration process.	s.2.3 – Southern Boundary Precinct
7. 2.3 It is proposed that all restoration will be undertaken with seeding. City Works considers that a mixture of seeding and planting should be utilised. The exact mix would be subject to negotiation, but should include a significant proportion of tube stock to ensure site establishment occurs within a reasonably short time frame. I very long include a significant proportion of tube stock to ensure site establishment occurs within a reasonably short time frame. Will also be required for this area (5 to 10 years).	7. Revise study with regards to the restoration, i.e. a mixture of seeding and planting to be utilised with inclusion for a significant proportion of tube stock to ensure site establishment occurs within a reasonably short time frame. Also address the requirements for maintenance.	7. Our restoration approach is based on seeding, using a diverse suite of endemic native grasses to achieve a relatively quick, dense cover, followed by overplanting with large cell planting (e.g. Hiko Cell 0.093L) trees and shrubs (Refer s.2.3 – Southern Boundary Precinct). We believe that planting out these batters as a first process will require too much walking over the batters and associated disturbance. As described above, re	s.2.3 – Southern Boundary Precinct

		maintenance requirements, a Vegetation Management Plan will be prepared for the rehabilitation works at DA stage in accordance with the guidelines provided by NSW Office of Water. Maintenance requirements will be in accordance with these guidelines.	
8. 2.3 The report notes that the Caley's Creek corridor will replace the East West Terrestrial Corridor between the Nepean River and the Australian Botanic Gardens. In so doing, it also shifts the responsibility for this corridor from the Camden LGA to the Campbelltown LGA. If the Caley's Creek corridor remains the responsibility of the development to manage in perpetuity this may not be an issue. If, however, long term management becomes the responsibility of Council, this could have significant cost and resource impacts. It is therefore again recommended that the Caley's Creek corridor remains the responsibility of the development.	8. Revise document with reference to the Caley's Creek corridor, i.e. it remains the responsibility of the development regarding to its future management.	8. The Caleys Creek Corridor will be managed under Community Title.	s.2.4
9. Figure 8, This figure shows the Stream Order. While the colours appear logical, the scale widths do not appear representative. This is particularly noticeable for the Nepean River. The Figure should represent these corridors at their scaled widths.	9. Revise Figure 8 to represent corridors at their scaled widths.	9. Given that this is a rezoning proposal, we consider that Figure 8, which is a conceptual representation of the requirements for watercourses, sufficiently conveys the required level of information.	n/a
10. Figure 9 shows the chitter batters. It does not indicate the existing and proposed batter grade. To provide informed comment, this information is necessary.	10. Further details to be provided with Figure 9 with regard to the chitter batters, i.e. indicate the existing and proposed batter grade to allow for further Council comment. .	10. The maximum height of the embankment is around 18-23 m with average side slopes measures to be in the range of 4.5:1 (H:V) on the eastern side, 3.2 -3.7:1 (H:V) on the southern side, and 2.8:1 (H:V) on the western side.	s.2.1.6