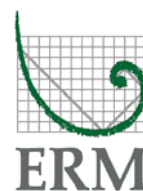


Riverside at Tea Gardens
*Construction Environmental Management
Plan*

Crighton Property Pty Ltd
December 2011
0043707CEMP Final
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Delivering sustainable solutions in a more competitive world



Prepared by:	<i>Jacinta Coulin</i>
Project Manager:	<i>Senior Planner</i>
Signed:	
Date:	<i>6 December, 2011</i>
Approved by:	<i>Steve O'Connor</i>
Position:	<i>Partner</i>
Signed:	
Date:	<i>6 December, 2011</i>

Environmental Resources Management Australia Pty Ltd Quality System

Riverside at Tea Gardens

Construction Environmental Management Plan

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Crighton Property Pty Ltd

Riverside at Tea Gardens
*Construction Environmental
Management Plan*

December 2011

**Environmental Resources Management
Australia**

53 Bonville Avenue,
Thornton, NSW 2322
Telephone +61 2 49642150
Facsimile +61 2 49642152
www.erm.com

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1 INTRODUCTION

1.1 BACKGROUND

Crighton Properties Pty Ltd (Crighton) is seeking concept approval for a residential and tourist development at the Riverside site in Tea Gardens under Part 3A of the *Environmental Planning and Assessment Act, 1979* (EP&A Act).

This Construction Environmental Management Plan (CEMP) has been prepared by Environmental Resources Management (Australia) Pty Ltd (ERM) for the initial stages of the residential and tourist development and details the proposed environmental management procedures that will be implemented during construction.

1.2 SITE DESCRIPTION

The Riverside at Tea Gardens site ('the site') comprises Lot 10 DP 270100, Lot 40 DP 270100, and Part Lot 1 DP 270100 and is approximately 222.5 hectares in area. The site is bounded by Myall River to the east and Myall Street to the west. The Shearwater Residential Estate lies to the north of the site and residential development of Tea Gardens is to the south. The site has approximately a one kilometre frontage to Myall Street and two kilometre frontage to the Myall River. State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14) applies to wetlands within a portion of the eastern boundary of the site adjacent to the Myall River. These wetlands were clearly identified along with a buffer to the wetlands and zoned for environment protection when the site was rezoned in 2000.

The site is flat with generally sandy soils. The majority of the site was previously used for a pine plantation and has been substantially cleared of native vegetation. Some scattered isolated occurrences of both pines and natives currently exist on the site. A locality plan is provided in *Figure 1.1*.

Legend

Riverside at Tea Gardens
Site Boundary

Source:

1:25,000 Topo Series Port Stephens Sheet

Suffix	Revisions	Date	Init
R0	Preliminary Issue	06-12-11	JD

Figure 1.1

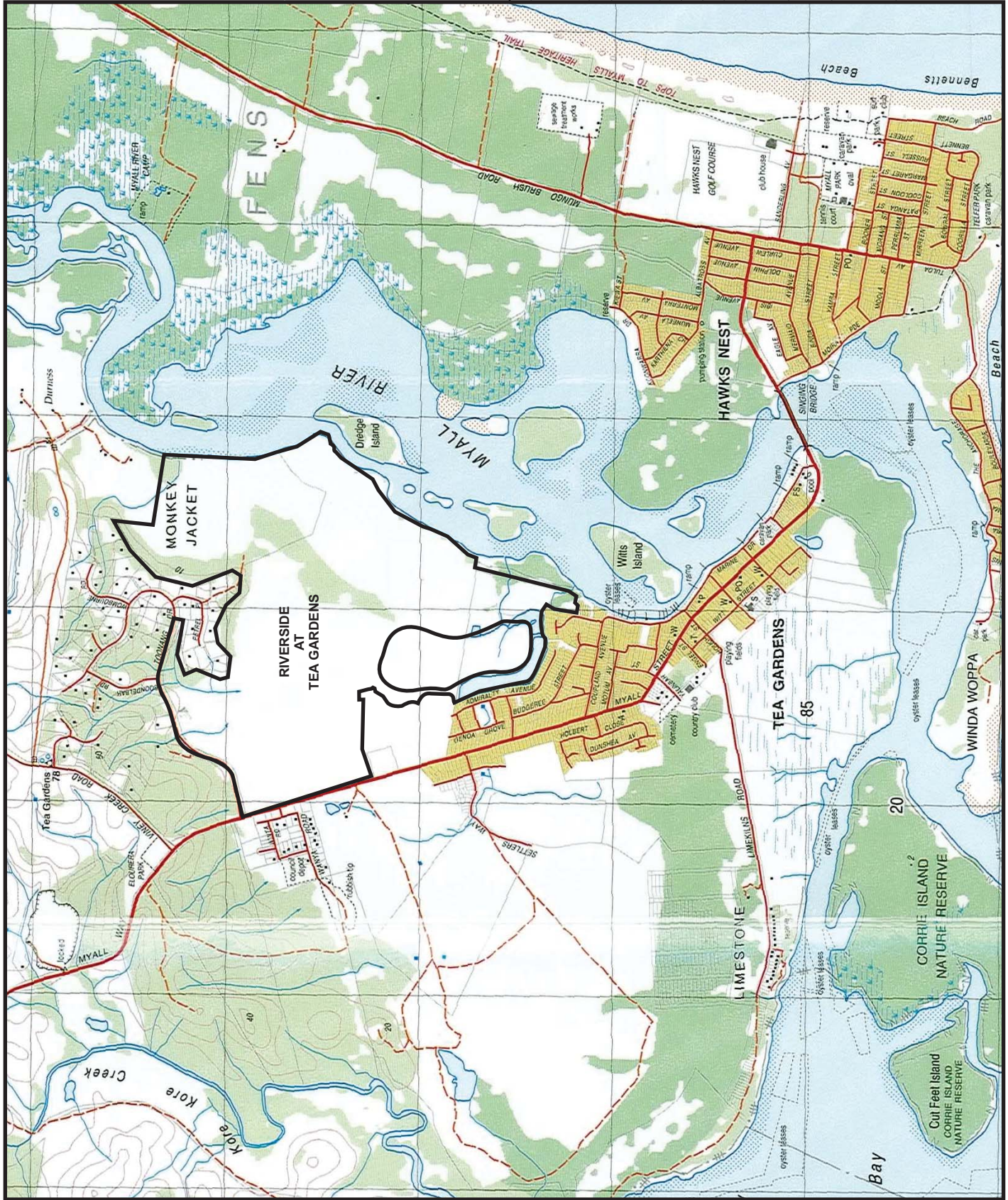
Locality Plan

Client:	Crighton Properties Pty Ltd
Project:	Concept Plan 2011 Environmental Assessment Riverside at Tea Gardens
Drawing No:	0043707h_CP_EA_11_CEMP_C001_R0.cdr
Date:	06/12/2011
Drawn by:	JD
Scale:	Refer to Scale Bar



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Telephone +61 2 4964 2150



Riverside at Tea Gardens will include a residential development over the majority of the site and a tourist and residential component located within the north eastern portion of the site. The key elements of the overall concept plan include:

- residential development of the site which will include the potential to create approximately 920 dwellings, comprised as follows:

Development	Number of Dwellings
Residential (variety of lots)	855
Tourist Precinct - lodges	50
Tourist Precinct - houses	15
Total	920

- water sensitive urban design (WSUD) measures including the retention of the existing saltwater basin and single drain outlet to the Myall River, the creation of new freshwater detention ponds as well as new dry water management devices;
- a residentially zoned open space network comprising 82.8 hectares in total which provides for public recreation, stormwater management, a wildlife corridor, and clubhouses and community facilities;
- an 8.1 hectare tourist/recreational precinct (including a conference centre and accommodation) in the north east portion of the site and a foreshore park of 5.6 hectares (included as part of the open space network);
- substantial areas (approximately 59.7 hectares) of the Residential 2(f) zoned land are proposed to be protected and enhanced as open space / wildlife movement corridors, over and above those already protected within the Environmental Protection 7(a) and 7(b) zones (which comprise 28.6 and 21 hectares respectively);
- approximately 23.1 hectares of drainage reserves and large parks also proposed;
- upgrading of intersections and associated road works and other construction works (such as cycleways) external to the site;
- access from Toonang Drive and Myall Street;
- an internal road network; and
- associated landscaping and infrastructure works.

Substantial areas of the Residential 2(f) zoned land are proposed to be protected and enhanced as open space / wildlife movement corridors, over and above those already protected within the Environmental Protection 7(a) and 7(b) zones.

The Concept Plan for Riverside at Tea Gardens is provided in *Figure 1.2*.

The area proposed to be developed has been defined by a detailed analysis of the constraints and opportunities of the site to determine the most appropriate development footprint.

The subdivision will be created under Community Title, as part of the existing approved Community Title residential development.

Whilst Concept Approval only is sought at this stage, this Construction Environmental Management Plan (CEMP) has been prepared to identify key environmental management measures that will be implemented during the construction of the subdivision following approval of a future development application. The plan will be updated as required prior to the commencement of construction. The CEMP relates to the construction of the subdivision and associated infrastructure only and does not address construction of dwellings once the construction of the subdivision is complete.

1.4 CONSTRUCTION ACTIVITIES

Activities associated with the construction of the subdivision, and which are covered by this plan include:

- clearing of vegetation in accordance with the project approval;
- stripping and stockpiling of topsoil;
- construction of road pavements, kerb and guttering, and associated piped stormwater drainage and water quality controls;
- construction of telecommunications, electricity, and reticulated water and sewer services and infrastructure;
- earthworks; and
- revegetation of exposed soils following completion.

1.5 OPERATING HOURS

Proposed operating hours are within the following:

- Monday to Friday, 7:00 am to 6:00 pm;
- Saturday, 8:00 am to 4:00 pm if inaudible at residential premises, alternatively hours will be 8:00 to 1:00pm; and
- no construction on Sundays or public holidays.

Legend

- Riverside at Tea Gardens Site Boundary

Source:

Crighton Properties - Concept Plan R.C.-03/ November 2011 Revision N

Suffix	Revisions	Date	Init
R0	Preliminary Issue	06-12-11	JD

Figure 1.2
Concept Plan for Riverside at Tea Gardens

Client:	Crighton Properties Pty Ltd
Project:	Concept Plan 2011 Environmental Assessment Riverside at Tea Gardens
Drawing No:	0043707h_CP_EA_11_CEMP_C003_R0.cdr
Date:	06/12/2011 Drawing size: A4
Drawn by:	JD Reviewed by: SOC
Scale:	Refer to Scale Bar



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Item	Description
1	Extent of concept plan area 'Riverside' at Tea Gardens.
2	Existing 7(a) wetland zone.
3	Existing 7(b) buffer zone.
4	Wildlife movement corridor.
5	Water management & open space corridors.
6	Community parks incorporating walking/cycle ways, BBQs, children's play area equipment.
7	Community pocket parks.
8	Not Applicable
9	Not Applicable
10	Existing detention and water quality lake.
11	New fresh water, water quality management & detention ponds.
12	Existing residential development.
13	Foreshore setback line.
14	Future precinct community facilities.
15	Site area currently owned by Great Lakes Council.
16	Separate medium density/commercial precinct (not part of this application-current waver issued by DCP).
17	Tourist lodgings precinct.
18	Additional land proposed for conservation
19	Proposed residential lot development to be developed under community title.
20	Future development site.
21	Existing house.
22	DCP buffer.
23	Location of known midden & buffer.
24	Existing drain outlet to Myall River.
25	Existing drainage swale
26	Existing shopping centre/medium density approvals
27	Future connecting road

Land Use Legend		
Total Site	Ha	%
Open Space		
- Wetlands (zoned 7a)	28.6	12.9
- Buffer Zones (zoned 7b)	21.0	9.4
- Additional Conservation Buffer	17.8	8.0
- Wildlife Corridors	41.9	18.8
- Drainage Corridors, Ponds & Large Parks	23.1	10.4
- Pocket Parks	2.6	1.2
- Existing detention & water quality lake	6.7	3.0
Total	141.7 Ha	63.7%
Built Upon Area		
- Residential (including roads & community facilities)	67.1	30.2
- Tourist/Residential (Lodgings)	8.1	3.6
Total	75.2 Ha	33.8%
Future Development Site		
Total	5.6 Ha	2.5%
Total	222.5 Ha	100%



2 CONSTRUCTION MANAGEMENT

2.1 OBJECTIVES OF THE CEMP

The objectives of the CEMP are to:

- ensure that the construction activities comply with current environmental legislation and best practice environmental management;
- comply with the relevant project approval for the site; and
- minimise the risk to public safety, and to protect the amenity of adjoining residents and the public generally.

2.2 ENVIRONMENTAL MANAGEMENT STRUCTURE AND RESPONSIBILITIES

This plan is to be updated prior to the commencement of construction with appropriate roles and responsibilities relating to environmental management. Tasks and responsibilities are summarised in *Annex A* of this CEMP.

2.3 APPROVAL AND LICENSING REQUIREMENTS

The proposal requires Concept Plan approval from the NSW Minister for Planning under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Construction and subdivision certificates will be required to be obtained once development applications are approved for the various stages of the proposed development under Part 4 of the EP&A Act.

2.4 TRAINING AND SITE INDUCTION

All employees and subcontractors will undergo environmental awareness training as part of the site induction to ensure they understand their obligations and responsibilities under this CEMP. The site induction will include:

- familiarisation with the requirements of the CEMP and other relevant management plans (ie erosion and sediment control plan);
- environmental emergency response procedures; and
- familiarisation with site environmental controls.

Records of all site inductions will be kept and maintained by the site supervisor.

2.5

EMERGENCY CONTACT AND RESPONSE

In the event of an environmental emergency, the following person can be contacted 24 hours per day, seven days per week:

Name:	Peter Childs
Position/Responsibility:	Crighton Project Manager
Contact Number:	02 4352 4352
Alternative Contact Number:	0419 971 666

Emergency services contact details are as follows:

Emergency Hotline:	000
Ambulance:	000
NSW Fire Service:	000
(Tea Gardens) Police Station:	(02) 4997 0244
SES:	13 2500
WIRES (injured wildlife):	0500 559 559

All on-site information relating to hazardous materials, including Material Safety Data Sheets and spill containment materials will be kept at the Site Office.

3 *SITE CONTROLS*

3.1 *PUBLIC SAFETY, AMENITY, AND SITE SECURITY*

Procedures for the management of public safety, amenity and site security include:

- all vehicular access/egress associated with the construction works will be via the main site entrance (refer to Sheet 11, *Volume 2* of the Environmental Assessment Report);
- main entrance and site office will be appropriately signposted;
- signage will be placed at site boundary to provide appropriate safety warnings, and include contact details of construction company and/or site supervisor;
- no materials will be stored within the road reserve or placed where it will hinder public access across adjoining public land;
- exposed areas will be kept to a minimum to minimise visual impact as well as reduce air and water pollution; and
- safety fencing will be erected and maintained around specific areas of the work site as appropriate (to be identified in an occupational health and safety plan).

3.2 *FLORA AND FAUNA*

The following measures are intended to minimise the impact of construction activities on flora and fauna in accordance with the requirements of the Ecological Site Management Strategy for Riverside at Tea Gardens (Conacher Environmental Group, 2011) (refer to *Annex B*):

- clearing activities will be restricted to only those areas nominated on construction plans for each stage;
- cleared vegetation is to be chipped / mulched on site for reuse in landscaping;
- vehicle movements within uncleared areas will be restricted;
- weed control will be undertaken during construction as required to ensure there is no spread of weeds on or off site;

- prior to construction commencing, areas that are to be retained as corridors and reserves and their adjacent APZ's are to be delineated on site plans and survey marked in the field. This will minimise the risk of damage to vegetation contained within retained areas and APZ's during construction;
- where trees are identified for retention and are in areas adjacent to construction areas, tree protection fencing will be erected to eliminate risk of damage during construction. Fencing will be erected to adequately protect the critical root zone of trees from excavation or compaction damage;
- where corridor or reserve areas are adjacent to construction areas temporary fencing will be erected to indicate these as no go areas. This will be supported by site contractor inductions notifying personnel of protection areas and restricted access to these;
- to minimise the impact on hollow dependant fauna during tree felling operations the following measures will be used were considered appropriate;
 - identification and marking of hollow bearing trees required to be cleared;
 - inspection of tree hollows prior to clearing to determine if hollows are being utilised by tree dwelling fauna, including threatened species. Fauna occupying hollows will be carefully removed by an experienced and licensed fauna expert and relocated to another tree away from the area of clearing;
 - implementation of a trapping program prior to tree clearing to trap any mammal fauna within areas proposed for staged clearing. Any trapped animals will be released into appropriate areas on dusk;
 - restriction of clearing hollow bearing trees during the breeding season for microchiropteran bats and the Squirrel Glider (September-March);
 - implementation of hollow log salvage and re-erection program in order to retain roosting and nesting opportunities for hollow dependent fauna, including Owls, Squirrel Gliders and threatened bat species; and
- two options are available for removing tree hollows or felling hollow bearing trees. These are:
 - hollow bearing trees containing fauna are to be sectionally dismantled. This will be carried out in accordance with Council's established procedure and involve a representative from WIRES and/ or the Project Ecologist;

- where machinery is required to fell hollow trees, the blade or bucket of the machinery will be tapped against the base of the tree to disturb any fauna present. The tree will then be felled as gently as possible. All hollow limbs will be inspected after felling for occupation by fauna. Any fauna will be removed and relocated to adjoining bushland;
- any felling of hollow bearing trees will be supervised by a qualified fauna ecologist with experience in the handling of fauna;
- all hollow limbs will be removed from those trees felled by a licensed contractor. These hollow limbs will be returned to the fauna ecologist for re-use at a later date within the corridor areas of the site; and
- any injured wildlife will be reported to WIRES or similar organisation immediately for rescue.

3.3

NOISE AND VIBRATION CONTROLS

Noise emissions associated with bulk earth works, particularly in relation to the construction of the stormwater quality management and detention ponds at the proposed Riverside Estate, Tea Gardens have the potential to impact on the acoustic amenity of several adjacent residential receptors. The EPA criteria for noise from construction sites are assessed at residential properties and the following are applicable during construction of the subdivision:

- for a cumulative period of exposure to noise from construction activity of between 4 weeks and 26 weeks duration, the LA10 (15minute) noise level emitted by the works, when measured at a residential receiver, should not exceed the LA90 (15minute) RBL more than 10 dBA; and
- for a cumulative period of exposure to noise from construction activity in excess of 26 weeks duration, the LA10 (15minute) noise level emitted by the works, when measured at a residential receiver, should not exceed the LA90 (15minute) RBL by more than 5 dBA.

The Construction Noise Assessment for Riverside at Tea Gardens undertaken by ERM (2010) (refer to *Annex C*) recommends the implementation of the following mitigation and management procedures during construction activities:

- where practical, pushing topsoil or fill to form earth mounds between the construction site and residences during initial stripping. Barrier calculations identify that noise levels may be reduced by up to 15 dBA if a 3.5 metre earth mound is established between the sources and residences;
- where possible barriers should be placed nearest to plant and equipment to maximise barrier attenuation;

- maximise the offset distance between noisy plant items and nearby noise sensitive receivers;
- avoiding any coincidence of noisy plant working together in close proximity simultaneously near to sensitive receivers;
- minimising the occurrence of consecutive days works in the same locality;
- orienting noisy plant or equipment away from sensitive areas;
- carrying out loading and unloading away from noise sensitive areas, if loading near sensitive receivers acoustic enclosures or barriers of a suitable height should be constructed to minimise the noise impacts;
- where noise complaints arise, monitor construction noise levels to quantify potential impact at most sensitive residences; and
- the contractor must take reasonable steps to manage and control noise from all plant and equipment. Examples of appropriate noise management and control may include installation of acoustic silencers, low noise mufflers and alternatives to reversing alarms.

No construction activities are to be undertaken outside the operating hours nominated in this plan to minimise the impact of noise on nearby residences.

All combustion engine plants, such as generators, compressors and welders, will be maintained and kept in good working order to ensure they produce minimal noise. Where practical, machines will be operated at low speed or power and switched off when not being used rather than be left idling for prolonged periods.

Machines found to produce excessive noise compared to industry best practice will be removed from the site or stood down until repairs or modifications can be made.

Once noisy construction activity commences close to any residence, it is to be completed with the minimum of undue delay. In any case, all reasonable attempts will be made to complete significant noisy activities within a short period.

While the above measures will not necessarily result in meeting the construction noise criteria, they will serve to reduce impacts to levels most residents will find acceptable considering the relatively short-term nature of construction work.

3.4 *AIR AND DUST MANAGEMENT*

Management of air quality and dust impacts on the site during construction will include:

- exposed soil areas will be regularly watered down during hot and windy days, or as needed;
- vehicle movements will be restricted to sealed or dedicated areas;
- truck and vehicle speeds will be below 20km/hr on unsealed roads;
- all vehicles containing loads that may generate dust travelling to or from the site will be covered to prevent dust emissions; and
- all site vehicles and machinery will be kept in good working order to minimise exhaust emissions.

3.5 *SOIL AND WATER MANAGEMENT*

All soil, water and sediment control and management will be undertaken generally in accordance with the requirements of the *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004) (Blue Book). Erosion and sediment control measures will be in place as required until exposed areas are appropriately stabilized following construction.

General requirements for stormwater and sediment control during construction activities include:

- the estate should be developed in stages to minimise the potential for soil erosion and water pollution and enable progressive rehabilitation as the development proceeds;
- sediment control measures are to be installed and maintained throughout all construction areas prior to and during construction activities in accordance with the erosion and sediment control plan;
- all erosion and pollution control devices will be inspected at least weekly and following every rainfall event greater than 5mm, with appropriate maintenance or additional measures initiated as required;
- erosion and sediment control measures must be maintained until landscaping has been completed and becomes established;
- temporary rehabilitation is to be undertaken on disturbed areas where works have stopped and soils are expected to remain exposed for two months;

- as soon as practicable after the completion of earthworks for each stage, lots will be re-seeded to establish a fast growing cover crop which will minimise erosion and movement of sediment across and off site;
- wherever possible, the site will remain grassed and otherwise undisturbed until construction commences;
- topsoil and excess soil will be stockpiled separately in designated areas and protected from surface run off by diversion drains or similar and surrounded on downstream sides by silt fencing. Stockpiles will be suitably compacted to inhibit erosion. Where the stockpiling period exceeds four weeks, the stockpile shall be seeded to encourage vegetative regrowth; and
- entry into the site during construction will be restricted to designated ingress and egress areas.

All rubbish and waste materials will be stored appropriately to ensure they do not enter nearby drains and waterways. Chemicals, oils, and fuels will not be stored on site, or alternatively, will be stored in suitable containers, in a secure storage area.

3.6 *ACID SULFATE SOILS*

All measures detailed within the Acid Sulfate Soils Management Plan (Coffey, 2011) provided within *Annex D* are to be implemented, including:

- management of exposed acid sulphate soils through neutralisation methods (the application of lime for example);
- management of dewatering processes to minimise the impact of acidic groundwater;
- monitoring pH levels of soils;
- monitoring pH levels of groundwater removed during dewatering operations; and
- contingencies for use of additional neutralising agents as required.

3.7 *WASTE AND MATERIALS RE-USE*

The objectives of waste management during construction activities will be to:

- ensure that the construction activities comply with current environmental legislation and best practice environmental management;
- comply with all relevant approvals for the site; and

- minimise the risk to public safety, and protect the amenity of adjoining residents and the public generally.

The consideration of waste minimisation during the design and planning phases of a project is more likely to maximise reuse opportunities and minimise the waste generated.

There are a number of practical techniques outlined in the 'WasteWise Construction Program - Handbook Techniques for reducing construction waste' (Department of the Environment and Heritage, 2005) that assist with construction managers with site waste management. Various procedures will be implemented by the successful contractor including the nomination of an appropriate person to be responsible for waste management.

It is estimated that approximately 241,400m³ of soil will be generated through site cutting during the construction of the subdivision. All of this will be reused on site for the following purposes:

- filling and shaping in areas of the site where fill material is required, including roads, east / west drainage basin, commercial site regrading, allotments, level spreader and diversion bank construction;
- the creation of earth mounds proposed to be constructed between the Riverside at Tea Gardens construction site and existing residences within the adjacent Myall Quays residential area. The earth mounds will be created at the commencement of construction of the water detention lake as a noise mitigation measure and following construction the mounds will be reshaped to remove the mound and provide a shaped, landscaped area adjacent to the water storage lake; and
- shaping of landscaped and open space areas throughout the Riverside at Tea Gardens site.

The Bulk Earthworks Plan for the development detailing quantities and location of cut and fill works is provided in *Annex E*.

The bulk of topsoil stripped will be reused on the Riverside at Tea Gardens site during rehabilitation and landscaping works. All green waste generated through clearing will be chipped / mulched on site and used in landscaping throughout the site.

To achieve adequate reuse and recycling of materials, appropriate areas for the separation and storage of waste will be provided.

Appropriate training and supervision of staff will be conducted to ensure that the objectives of the waste management plan are implemented and that contamination of the recyclable waste streams is avoided.

The successful construction contractor will ensure any subcontractor's waste streams are also included in the planning process and comply with the CEMP.

Waste segregation is the practice of classifying waste and placing it into the appropriate waste container immediately after the waste is generated. In order to achieve effective recycling and reuse, appropriate waste segregation will be carried out on site.

3.7.1 *Avoidance*

Purchasing policies will ensure that excessive waste is avoided through simple product substitutions for those with less packaging (or packaging that can be recycled), and avoiding over-ordering of items with expiry periods.

3.7.2 *Reduction*

Products will be assessed prior to purchase in terms of potential to generate excess waste. Products that include minimal packaging would be favoured, without compromising product performance. Pre-fabricated products that avoid the production off-cuts will be preferred.

3.7.3 *Re-Use*

Whenever possible, practical and cost effective to do so, re-usable waste from the construction of the first stage of the subdivision will be utilised later in the development. Items that will be considered for reuse include:

- green waste will be mulched, stockpiled, and used in landscaping;
- topsoil will be stripped, stockpiled and reused to revegetate exposed areas following construction and in landscaping;
- excess fill will be used onsite for filling purposes, with remaining soil to be transported to the proposed sporting complex site on the western side of Myall Street and reused in the filling and improvement works required at that site; and
- waste timber, and other suitable items will be reused as formwork.

3.7.4 *Recycling*

Plastic, paper, cardboard and other recyclable products will be disposed of in dedicated receptacles, and, stored for recycling collection. Pallets, if used, will be stored and returned to the supplier, or recycled.

3.7.5

Waste Management Plan

A preliminary waste management plan has been prepared as shown in *Table 3.1*. It outlines the waste streams expected to be generated during the construction of the subdivision, and outlines the proposed reuse/recycling/ or disposal methods for those waste streams.

Specific areas on site will be dedicated to the storage and segregation of waste. This will include skip bins dedicated to particular recyclable materials (ie scrap metal) with a separate receptacle for mixed waste.

Prior to the construction phase commencing, this plan will be finalised in more detail – including nomination of contractors and specific destinations.

Table 3.1 Preliminary Construction Waste Management Plan

Materials Generated On-Site	Reuse and Recycling		Destination	
	On-Site (proposed reuse/recycling method)	Off-Site (contractor/recycling outlet)	On-Site (contractor/recycling outlet)	Disposal Contractor / disposal site
Green waste (from clearing)	Green waste will be chipped / mulched and stockpiled for later use in site landscaping.			
Excavated material	Engineering design will aim to minimised excess fill by balancing cut and fill. Approximately 15,070m ³ of excavated soil will be reused on site.	There will be no excess fill and therefore no requirement for offsite reuse.		
Topsoil	Stockpiled on site for reuse in site rehabilitation and landscaping			
Weathered rock	Stockpiled on site for reuse in site landscaping.			
Concrete	Any excess used for footpaths/minor works.	Place in dedicated skip bin - excess will be taken to nearest recycling contractor.		
Timber pallets		To be collected by supplier.		
Timber - other	Ordered to suit - offcuts reused on site ie formwork	Suitable pieces will be taken to nearest recycling contractor.		Only pieces not suitable for recycling will be sent to landfill.
Steel reo	Ordered to suit - offcuts reused.	Place in dedicated skip bin - remove to a metal recycling facility.		
Scrap metal		Place in dedicated skip bin - remove to a metal recycling facility.		
Other - mixed waste				Skip bins will be placed on site, taken to landfill as required.

Pedestrian and cycle access is available along Myall Street adjacent to the site. Construction works will impact vehicular traffic and pedestrian flows as the site access way enters Myall Street. The accessway will be signposted with warning signage to alert pedestrians, cyclists and drivers.

The following measures will be taken to minimise any disruption to local traffic during the demolition works:

- all vehicular access/egress associated with the construction works will be via the Myall Street entrance (to be noted to personnel during site inductions);
- staggering the arrival of vehicles where possible;
- heavy vehicle movements to/from the site shall be restricted to the operating hours noted in *Section 1.5*
- oversize vehicle movements will obtain appropriate permits from the Roads & Traffic Authority and comply with any conditions contained therein;
- all vehicles will be accommodated within on-site parking areas;
- all loading and unloading will be carried out within the boundaries of the site;
- use of advisory signage to warn pedestrians and cyclists of heavy vehicle movements; and
- where traffic movements associated with the construction works will cause delays in traffic flows on the surrounding road network, appropriate traffic control plans will be developed and implemented.

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Annex A

Construction Environmental Management Plan Checklist

Table A.1 Construction Environmental Management Plan Checklist

Environmental Management Control	Person Responsible	Timing/Frequency	Completed (Initials/date)	Reference/Notes
General Site Issues				
Conduct site induction training for all personnel to alert them to sensitive work areas, explain the requirements of this CEMP, outline each individual's responsibilities, outline emergency response procedures. Documented evidence to be kept and maintained of site inductions.	Environmental Manager	Before commencing work and ongoing during operations		
Public Safety, Amenity and Site Security				
Ensure all vehicles access site via Myall Street entrance only.	Site Supervisor	Ongoing during operations		CEMP Section 3.1, CEMP Section 3.5
Ensure site compound and Myall Street entrance are clearly signposted.	Site Supervisor	Before commencing work		CEMP Section 3.1
Safety signage erected around site compound and at site entrance.	Safety Manager	Before commencing work		CEMP Section 3.1
No materials are to be stored/placed within public road reserve.	Site Supervisor	Ongoing during operations		CEMP Section 3.1
Areas of work to be kept to minimum required to minimise visual impact (as well as dust emissions and sediment generation).	Site Supervisor	Ongoing during operations		CEMP Section 3.1
Safety fencing erected around work areas in accordance with the site safety plan.	Safety Manager	Before commencing work and ongoing during operations		CEMP Section 3.1
Flora and Fauna				
Clearing activities restricted to only those areas nominated on construction plans for each stage	Site Supervisor	Ongoing during operations		CEMP Section 3.2
Cleared vegetation chipped / mulched on site and reused in landscaping	Environmental Manager	Ongoing during operations		CEMP Section 3.2
Vehicle movements in uncleared areas restricted	Site Supervisor	Before commencing work and ongoing during operations		CEMP Section 3.2

Environmental Management Control	Person Responsible	Timing/Frequency	Completed (Initials/date)	Reference/Notes
Weed control undertaken as required to control spread of weeds on or off site	Environmental Manager	Before commencing work and ongoing during operations		CEMP Section 3.2
Delineation of retained areas (corridors, reserves, APZ's) on site plans and field survey	Environmental Manager	Before commencing work and ongoing during operations		CEMP Section 3.2
Ensure conservation areas are protected with polyweb fencing or similar before commencing vegetation clearing. Maintain fencing during works to keep vehicles out of designated areas.	Environmental Manager	Before commencing work and ongoing during operations		CEMP Section 3.2
Tree protection fencing installed around trees to be retained, including protection of tree root zone	Environmental Manager	Before commencing work and ongoing during operations		CEMP Section 3.2
Temporary fencing installed where construction is adjacent to corridors or reserve areas to delineate area as no go areas	Environmental Manager	Before commencing work and ongoing during operations		CEMP Section 3.2
Hollow bearing trees identified and marked in field prior to clearing	Environmental Manager	Before commencing work and ongoing during operations		CEMP Section 3.2
Inspection of tree hollows prior to clearing to determine use by fauna	Environmental Manager	Before commencing work and ongoing during operations		CEMP Section 3.2
Removal and release (nearby) of fauna from hollows by experienced and licensed fauna expert	Environmental Manager	Ongoing during operations		CEMP Section 3.2
Trapping program undertaken prior to tree clearing to trap any mammal fauna within areas proposed for staged clearing. Fauna to be released in appropriate areas on dusk.	Environmental Manager	Before commencing work and ongoing during operations		CEMP Section 3.2
No clearing of hollow bearing trees during the breeding season for microchiropteran bats and the Squirrel Glider (Sept – Mar)	Environmental Manager	Before commencing work and ongoing during operations		CEMP Section 3.2
Hollow logs cleared are salvaged and re-erected to create roosting / nesting opportunities	Environmental Manager	Ongoing during operations		CEMP Section 3.2
Clearing of hollow bearing trees via sectional dismantling including inspection of each section by a fauna ecologist and removal, released of fauna by qualified expert.	Environmental Manager	Ongoing during operations		CEMP Section 3.2

Environmental Management Control	Person Responsible	Timing/Frequency	Completed (Initials/date)	Reference/Notes
Clearing of hollow bearing trees via felling to include tapping of base of tree to disturb any fauna present prior to felling. All limbs to be inspected following felling and fauna removed and released in appropriate areas.	Environmental Manager	Ongoing during operations		CEMP Section 3.2
All felling of hollow bearing trees to be supervised by qualified fauna ecologist	Environmental Manager	Ongoing during operations		CEMP Section 3.2
Any injured wildlife is to be reported to a fauna rescue organisation for rescue and care.	Environmental Manager	Before commencing work and ongoing during operations		CEMP Section 3.2
Noise and Vibration				
Plant and equipment maintained and kept in good working order to reduce potential noise impacts	Site Supervisor	Before commencing work and ongoing during operations		CEMP Section 3.3
Where practical, machines operated at low speed or power and switched off when not being used and not left idling for prolonged periods	Site Supervisor	Ongoing during operations		CEMP Section 3.3
Machines producing excessive noise (in comparison to industry standards) removed from the site or stood down until repairs / modifications made	Site Supervisor	Ongoing during operations		CEMP Section 3.3
Barriers placed nearest to plant and equipment to maximise barrier attenuation where possible in areas in close proximity to residences	Site Supervisor	Before commencing work and ongoing during operations		CEMP Section 3.3
Avoiding any coincidence of noisy plant working together in close proximity simultaneously near to sensitive receivers	Site Supervisor	Ongoing during operations		CEMP Section 3.3
Minimising the occurrence of consecutive days work in the same locality	Site Supervisor	Ongoing during operations		CEMP Section 3.3
Maximise the offset distance between noisy plant items and nearby noise sensitive receivers, orienting noisy plant or equipment away from sensitive areas	Site Supervisor	Ongoing during operations		CEMP Section 3.3

Environmental Management Control	Person Responsible	Timing/Frequency	Completed (Initials/date)	Reference/Notes
Carrying out loading and unloading away from noise sensitive areas. If loading near sensitive receivers, acoustic enclosures or barriers of a suitable height constructed to minimise the noise impacts;	Site Supervisor	Ongoing during operations		CEMP Section 3.3
Where noise complaints arise, monitor construction noise levels to quantify potential impact at most sensitive residences	Environmental Manager	Ongoing during operations as required		CEMP Section 3.3
Check that all work is being conducted within prescribed operation hours.	Site Supervisor	Daily		CEMP Section 1.5
Air Quality				
Check vehicles are keeping to sealed and/or designated areas.	Site Supervisor	Ongoing during operations		CEMP Section 3.4
Check machines are complying with emission standards (i.e. emissions not visible for more than 10 seconds).	Site Supervisor	Ongoing during operations		CEMP Section 3.4
Enforce 20km/h speed limit on unsealed tracks/roads.	Site Supervisor	Ongoing during operations		CEMP Section 3.4
Ensure a mobile water tanker equipped with a pump and sprays is used to suppress dust from unsealed roads when in use and other areas as required.	Site Supervisor	Ongoing during operations		CEMP Section 3.4
All vehicles leaving and entering a site with loads that may generate dust will be covered at all times except during loading/unloading.	Site Supervisor	Ongoing during operations		CEMP Section 3.4
Stormwater and Sediment Control				
Construction works undertaken in stages to minimise potential soil erosion and water pollution and enable progressive rehabilitation	Site Supervisor	Ongoing during operations		CEMP Section 3.5
Sediment control measures installed and maintained throughout all construction areas in accordance with Erosion and Sediment Control Plan and maintained until landscaping is established	Site Supervisor	Prior to commencement of work and inspected weekly thereafter and following every rainfall event greater than 5mm		

Environmental Management Control	Person Responsible	Timing/Frequency	Completed (Initials/date)	Reference/Notes
Temporary rehabilitation undertaken on disturbed areas where works are stopped and soils are expected to remain exposed for two months	Site Supervisor	Ongoing during operations		
Lots re-seeded with a fast growing cover crop immediately following completion of earthworks	Site Supervisor	Ongoing during operations		
Site remained grassed and undisturbed until construction commences, wherever possible	Site Supervisor	Prior to commencement of work		
Topsoil / excess soil stockpiles separated in designated area and sediment control devices installed (eg diversion drains, silt fencing). Stockpiles compacted to reduce erosion and where stockpiling exceeds four months, stockpile is seeded to encourage vegetative growth	Site Supervisor	Ongoing during operations		
Ensure all hazardous materials are appropriately stored.	Site Supervisor	Prior to commencement of work		CEMP Section 3.5
Acid Sulphate Soils				
All measures detailed within the Acid Sulphate Soils Management Plan (Coffey, 2007) are implemented.	Environmental Manager	Before commencing work and ongoing during operations		CEMP Section 3.6
Waste Management				
During clearing, vegetation will be stockpiled for mulching and use in landscaping on-site.	Environmental Manager	During clearing operations		CEMP Section 1.5, CEMP Section 3.7
Topsoil and excess fill will be reused on site wherever possible.	Site Supervisor	Prior to commencement of work		CEMP Section 3.7
Waste materials will be reused on site wherever possible prior to recycling or disposal.	Site Supervisor	Prior to commencement of work		CEMP Section 3.7
Provide an area for the segregation, storage and recycling of waste.	Site Supervisor	Prior to commencement of work		CEMP Section 3.7

Environmental Management Control	Person Responsible	Timing/Frequency	Completed (Initials/date)	Reference/Notes
Traffic Management				
Heavy vehicle movements to/from the site shall be restricted to the operating hours.	Site Supervisor	Ongoing during operations		CEMP Section 3.8
Oversize vehicle movements will obtain appropriate permits from the Roads & Traffic Authority and comply with any conditions contained therein.	Site Supervisor	Ongoing during operations		CEMP Section 3.8
Ensure the main access is not used for parking, loading, marshalling or standing of any semi-trailer, heavy plant floats or wide loads.	Site Supervisor	Ongoing during operations		CEMP Section 3.8
Ensure all vehicles can be accommodated within on-site parking areas.	Site Supervisor	Prior to commencement		CEMP Section 3.8
All loading and unloading will be carried out within the boundaries of the site.	Site Supervisor	Ongoing during operations		CEMP Section 3.8
Erect advisory signage to warn pedestrians and cyclists of heavy vehicle movements.	Site Supervisor	Prior to commencement		CEMP Section 3.8
Where traffic movements associated with the construction works will cause delays in traffic flows on the surrounding road network, appropriate traffic control plans will be developed and implemented.	Site Supervisor	Ongoing during operations		CEMP Section 3.8

Annex B

Ecological Site Management Strategy



DRAFT
ECOLOGICAL SITE MANAGEMENT STRATEGY

RIVERSIDE
TEA GARDENS

NOVEMBER 2011
(REF: 11118)

Suite E, 78 York Street, East Gosford NSW 2250
PO Box 4300, East Gosford NSW 2250

• Ph (02) 4324 7888 • Fax (02) 4324 7899

• Email cegconsult@bigpond.com

www.cegconsult.com

ABN 62 274 841 042

**DRAFT
ECOLOGICAL SITE MANAGEMENT STRATEGY**

**RIVERSIDE
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NOVEMBER 2011

Conacher Environmental Group

Environmental and Land Management Consultants

Suite E, 78 York St East Gosford NSW 2250
PO Box 4300, East Gosford NSW 2250
Phone: 02 4324 7888 Fax: 02 43247899

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Conacher Environmental Group ABN 62 274 841 042

PREFACE

This Ecological Site Management Strategy (ESMS) has been prepared in draft form to provide a range of ecological management strategies in protecting the long term environmental and ecological values of lands within the proposed development for Riverside at Tea Gardens.

This report has been prepared to accompany an Environmental Assessment to be submitted as part of a development application for the "Riverside" lands known as Lots 10 and 34 DP 270100 Myall Road Tea Gardens. The Environmental Assessment has been prepared in accordance with the Director General's Environmental Assessment Requirements (DGEAR's). These DGEARs have been provided in accordance with Part 3A Major Infrastructure and Other Projects of the *Environmental Planning and Assessment Act* (1979).

The ESMS has been prepared to specifically address the following:

- Vegetation and Bushland Management;
- Bushfire Management;
- Fauna and Habitat Management;
- Provision and Establishment of Environmental Corridors;
- Provision of Environmental Buffers;
- Erosion and Sediment Control;
- Stormwater Quality and Management;
- Cultural Values and Management;
- Community Education, Vigilance and Reporting;
- Access, Signage and Fencing;
- Prohibited Use Identification and Management;
- Feral Pest Species;
- Monitoring and Reporting Regime.

This ESMS uses the site and local area information collected across a large number of studies in recommending suitable environmental management objectives and actions in the long term protection of the environmental values of the area proposed to be developed.

It should be noted that this is a "Draft" report which is required to be reconsidered during the preparation of a more detailed "offsetting package" which is to be considered and prepared following concept plan approval.

Report compiled by:

PHILLIP ANTHONY CONACHER B.Sc.(Hons), Dip.Urb Reg Planning, M.Nat.Res.
NPWS Scientific Licence Number: SL100361
Director
Conacher Environmental Group

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SECTION 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This Draft Ecological Site Management Strategy (ESMS) has been completed to provide a range of environmental management strategies for protecting the long term environmental and ecological values of lands within the proposed development area and associated retained natural areas and biodiversity/vegetation off-set areas associated with the Riverside proposed development.

This report has been prepared to accompany an Environmental Assessment to be submitted as part of a development application for the Riverside site. The Environmental Assessment has been prepared in accordance with the Director Generals Environmental Assessment Requirements (DGEAR's). These DGEARs have been provided in accordance with Part 3A Major Infrastructure and Other Projects of the *Environmental Planning and Assessment Act* (1979).

Conacher Environmental Group have been engaged by *Crighton Properties* as proponents of the application for the development of Riverside to prepare this ESMS.

The land subject to the provisions of this ESMS consists of those areas bound by Lots 10 and 34, DP 270100 Myall Road, Tea Gardens and herein known as the Riverside site.

This Draft Ecological Site Management Strategy has been produced to a Draft standard on the basis that the final details on the location and extent of development has not been fully determined and therefore the full extent of the requirements of the ecological site management measures have not been finalised.

1.2 BACKGROUND

The Riverside development area is bound by Toonang Drive in the north, the Myall River in the east, Shearwater Estate in the south and Myall Road to the west. The Riverside site area is approximately 230 hectares in size.

The proposed development is for a mixed use commercial, industrial and residential development. According to the Concept Masterplan the proposal will include the following:

- Residential lot development as Community Title;
- Conference and Clubhouse facilities and low rise Townhouse accommodation;
- Low density "Lodge Houses" associated with Conference facilities;
- Wildlife movement corridors;
- Water management corridors;
- Open space corridors;
- Sporting ovals and tennis courts;
- Lake areas for water quality management;
- Public Reserve areas incorporating sporting ovals and tennis courts;
- Community parks incorporating walking trails, gazebo and other facilities.

The Masterplan design includes the retention of large areas of the site for the purposes of environmental protection. These areas include:

- SEPP 14 Wetlands;
- Conservation zoned lands;
- Asset Protection Zones and environmental buffers;
- Wildlife Corridors;
- Drainage Corridors;
- Open Space areas;
- Vegetation and biodiversity off-set areas.

The possible future ownership of these areas and the responsibility of management of these areas is outlined in Section C of this Strategy.

1.3 PROCEDURES FOR THE PREPARATION OF THE MANAGEMENT STRATEGY

This ESMS has been prepared using information obtained from a range of sources including the following:

- Ecological Assessment Report for Riverside at Tea Gardens (Cumberland Ecology 2011);
- Local Environmental Study – Myall Quays (and related Supplementary Reports) (Gardner Browne Planning Consultants, Resource Planning, Patterson Britton and Partners 1991, 1992);
- Flora and Fauna Assessment Report – Myall Quays Estate (*Conacher Travers* 2002);
- Local Environmental Study – Myall River Downs (PPK Environment and Infrastructure 2000);
- Local Environmental Study – North Hawkes Nest (ERM Mitchell McCotter 1997);
- Species Impact Statement – Myall River Downs (*Conacher Travers* 2007);
- Recovery Plan – Hawkes Nest Tea Gardens Endangered Koala Population (Department of Environment and Conservation 2003);
- Ecological Studies of the Squirrel Glider Myall River Downs (D. Sharpe and R. Goldingay 2006);
- Draft Environmental Site Management Plan Rural Residential Subdivision Myall River Downs (*Conacher Travers* 2007).

This Ecological Site Management Strategy details the strategies and measures to be implemented in protecting the natural values of the post development landscape at Riverside at

Tea Gardens. In particular the Ecological Site Management Strategy provides information on the following:

- Vegetation and Bushland Management;
- Bushfire Management;
- Provision and Establishment of Environmental Corridors;
- Provision of biodiversity off-set areas;
- Provision of Environmental Buffers;
- Erosion and Sediment Control;
- Cultural Values and Management;
- Community Education, Vigilance and Reporting;
- Access, Signage and Fencing;
- Prohibited Use Identification and Management;
- Fauna and Fauna Habitat Management;
- Feral Pest Species;
- Monitoring and Reporting Regime.

Each of the above issues is addressed separately in Part B through the process outlined below:

- i) Identification of objectives to be achieved for each issue;
- ii) A statement of the proposed actions to be implemented to address each issue and the objectives provided;
- iii) More detailed information on methods, procedures or quantifying information supporting proposed actions is to be provided as operational or works plans prepared to meet the objectives and requirements identified in the strategy.

1.4 AREA TO WHICH THIS MANAGEMENT STRATEGY APPLIES

The area to which this Management Strategy applies is the area bound by the Concept Masterplan for the proposed development and known as Riverside at Tea Gardens. The area bound by the Masterplan is detailed in the Masterplan by ERM and is shown as Figure 1 of this Report.

1.5 LIFESPAN AND REVIEW OF THE MANAGEMENT STRATEGY

The ESMS will be implemented for ten years following the date of sign-off of the project by the Department of Planning. The plan will be reviewed at Year one, Year two and Year five to assess the adequacy of implementation of the management actions.

Those areas within the Riverside Masterplan area that are proposed to be managed under Community Title will have the management actions provided in this ESMS to be included in the Community Management Statement for the Community Title areas. However this will require a full review and amendment of the ESMS at the ten year period. This process may require individual management plans to be prepared to accompany individual Development Applications as part of the development staging process.

1.6 FORMAT OF THE MANAGEMENT STRATEGY

The overall Management Strategy is provided as a single document separated into several sections as outlined below.

SECTION 1 Introduction and Background

Outlines the purpose/ objectives and procedures for preparing this Management Strategy.

SECTION 2 Management Objectives and Proposed Actions

This part identifies the various management objectives and Management Actions to achieve the objectives of the Management Strategy.

SECTION 3 Implementation of Management Actions

This part details how the Management Strategy will be implemented, who is responsible for implementing various actions and provides details on the monitoring and reporting for the life of this management strategy.

1.7 ENVIRONMENTAL MANAGEMENT OBJECTIVES

The environmental management objectives for the areas covered within this Management Strategy are:

- i) Protection of the environmental and ecological values of the retained and conserved areas of the site.
- ii) Minimisation of the impacts of development within adjacent land upon the retained vegetation and habitat areas during construction and occupation phases of adjoining residential areas.
- iii) Maintenance of biodiversity and protection of native flora and fauna species and their habitats (including threatened species) within the conservation and off-set areas.
- iv) Increased awareness and promotion of a culture of protection of the environmental values of the retained and conserved areas of the site by the community.
- v) Long term monitoring of the area to determine changes (if any) to flora and fauna, particularly threatened species, and vegetation communities and recommend corrective actions if required.

1.8 SITE DESCRIPTION

RIVERSIDE SITE

Landform Features

Topography and slopes

The topography of the site consists predominantly of flat land of negligible slope and less than 5 metres AHD. In the north of the site a small ridge with a southerly aspect rises to approximately twenty metres.

Drainage

Drainage from the site is via overland flow and through small drainage channels into the Myall River. Areas of the site drain into SEPP 14 Wetland No. 746 on the shores Myall River in the east of the site.

Soils

Three soil landscapes occur within the subject site. These are the Bobs Farm, Tea Gardens and Pindimar Road Soil Landscapes (Murphy 2002).

The majority of the site consists of soils of the Tea Gardens soil landscape. These soils are found in local relief usually less than 1 metre and elevation 5-8 metres. Soils consist of deep (<300 cm) imperfectly drained Humus Podzols on ridges with poorly drained Peaty Humus Podzols in swales. The soils are prone to seasonal and permanent waterlogging, ground water pollution hazards and are of very low fertility.

The soils associated with the upslope and ridge areas in the north of the site are within the Pindimar Road soil landscape. These soils are found locally on undulating to rolling hills to local relief 30-60m. Soils consist of Brown and Yellow Podzolic soils and Soloths in poorly drained areas. These soils are of low fertility and exhibit high erosion, strong acidity and seasonal waterlogging.

The north-western area of the site contains poorly drained clays and loam soils of the Bobs Farm soil landscape unit. A detailed Soils Assessment Report for the site (Whitehead and Associates 2011) has determined that the soil types present are not alluvial floodplain soils but are dominated by aeolian sand podzol soils.

Vegetation

The subject site is bounded to the west by the Myall Road, disturbed grasslands with scattered trees, industrial and residential development; to the south, by predominately existing residential and commercial development; to the east, by the Myall River; and to the north, by a mixture of open forest vegetation communities, areas of rural residential development and agricultural lands.

The majority of the vegetation of the site forms a mosaic of highly disturbed vegetation with scattered trees and woodland/open forest communities. However, the eastern portion of the Riverside site is dominated by a remnant of naturally vegetated Swamp Forests, Heathlands and Estuarine vegetation communities associated with the low lying areas adjoining the Myall River. This remnant is largely isolated from adjoining vegetation to the south by existing residential development and to the north by an area of cleared agricultural land.

The northern boundary of the subject site is largely dominated by a mixture of open forest vegetation communities and areas of rural residential development. Connectivity exists between the sites eastern remnant vegetation and the areas of remnant open forest to the north, via a mosaic of disturbed woodland and open forest vegetation communities occupying the north eastern areas of the site. These vegetation communities have been impacted by a history of agricultural land use and grazing, resulting in a sparse understorey layer. Continued habitat fragmentation has also resulted from the development of the rural residential areas of Shearwater Estate to the north of the site.

Fauna

Surveys within the subject site and the local area have recorded a range of fauna species. These fauna observations consisted of bird species, mammal species, frog species and reptile species.

During the fauna surveys of the subject site the following threatened fauna species were observed. These species are:

- Osprey (*Pandion haliaetus*);
- Barking Owl (*Ninox connivens*);
- Wallum Froglet (*Crinia tinnula*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*).
- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*);
- Large-footed Myotis (*Myotis adversus*);

A number of other threatened fauna species have been observed within the Tea Gardens area as the result of past local area surveys. These are:

- Black-necked Stork (*Ephippiorhynchus asiaticus*);
- Powerful Owl (*Ninox strenua*);
- Masked Owl (*Tyto novaehollandiae*);
- Koala (*Phascolarctos cinereus*);
- Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*);
- Eastern Pygmy-possum (*Cercatetus nanus*);
- Eastern Blossom-bat (*Synconycterus australis*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*).

Habitats

A range of fauna habitats are present within the subject site reflecting the diversity in the vegetation communities present. The majority of the site is of decreased habitat quality due to the large amount of disturbance through removal and modification of the groundcover and shrublayer through grazing, slashing and previous clearing for pine plantations.

The following fauna habitats are present on the site and on land adjacent to the site:

- Flower, nectar, fruit and seed producing tree and shrub species;
- Hollow-bearing trees;
- Cleared pasture;
- Aquatic areas associated with permanent farm dams and water courses;
- Semi-aquatic habitats associated with low lying areas;
- Dense understorey areas;
- Leaf litter;
- Drainage depressions;
- Aquatic areas associated with the Myall River foreshore and wetland areas.

The flower, nectar, seed and fruit producing tree and shrub species within the site provide a seasonal foraging resource for a range of fauna species, particularly bird and arboreal mammal species. The site contains a relatively low number of hollow-bearing trees with mostly small hollows. These hollows contain potential den, roost and breeding hollows for bird, arboreal mammal, microchiropteran bat and reptile species.

The site consists predominantly of disturbed vegetation types with no shrublayer and a groundcover dominated by pasture grasses. As such the habitat values are decreased for small terrestrial mammal, bird and reptile species. The lack of cover however does increase foraging opportunities for raptorial and other bird species. The open grassed areas contain suitable habitat for macropod species, particularly the Eastern Grey Kangaroo and Red-necked Wallaby.

Areas of the subject site are prone to ponding after rain providing suitable habitat for a range of amphibian species. The drainage depressions associated with tracks and tree removal holes contain suitable foraging and breeding habitat for these locally occurring amphibian species.

The denser, less disturbed vegetation types associated with the Myall River foreshore provide higher quality habitat due to the increased density and diversity of the various structural layers. These less disturbed habitats provide increased foraging, refuge and breeding opportunities for mammal, bird, reptile and amphibian species. This is reflected in the species richness of these vegetation types in comparison to the majority of the site containing the disturbed vegetation communities. These higher quality vegetation and habitat types will be retained as part of the proposed development.

The fauna habitats within the site are typical of those associated with low lying areas of the lower reaches and estuarine areas of the Myall River. The habitats are isolated to the south by Myall Quays estate and the Tea Gardens township and to the east by the Myall River. The highest degree of connectivity extends to the north of the subject site. The area to the north of the site consists of bushland of higher habitat quality due to decreased levels of disturbance. The site also shows some connectivity to similar, larger areas of vegetation and habitat to the west, including lands within Myall River Downs. This area shows connectivity via the slope and low ridgeland areas in the north of the site to large areas of vegetation to the north-west of the subject site.

SECTION 2

MANAGEMENT OBJECTIVES AND ACTIONS

The following section provides details on the objectives and actions of each broad management category. The responsibility and timing for each of the management actions is provided within Table 1 of Section C with each management action sub-heading corresponding with a similar action category within Table 1.

2.1 VEGETATION RETENTION AND BUSHLAND MANAGEMENT

Objectives

- **Identify and protect vegetation to be retained within bushland and reserve areas including biodiversity off-set areas**
- **Implement measures to reduce the extent of weed species within retained areas and biodiversity off-set site**
- **Improve the current bushland and biodiversity values of retained areas and biodiversity off-set site**
- **Implement measures to control the risk of weeds spreading from residential development**
- **Promote community involvement in the bushland management and improvement of bushland values**

Actions

i) Preparation of Vegetation Management Works Plan

Reserve and corridor areas within the site are to be targeted for weed removal and rehabilitation with native, provenance specific species. The rehabilitation of these areas will ultimately improve and restore the vegetation and habitat values of those reserve and corridor areas. A specific Vegetation Management Works Plan will be produced for those reserve and corridor areas to direct the specific management actions in relation to vegetation management. These Vegetation Management Plans will include information on:

- the use of provenance specific species in revegetation works
- lists of provenance specific species to be used for revegetation
- identification of key priority areas for works
- detailed weed removal and vegetation management/protection strategies
- inter-relationship of fuel and vegetation management
- timetable for works and details of implementation, responsibility, timing and funding of specific vegetation management works.

ii) Implementation of weed removal programs

All weed control and vegetation management works will be co-ordinated by the developer of the land or the Community Association who will engage the relevant bush regeneration contractors to complete works as per the Vegetation Management Works Plan for the site.

The majority of weeds occur outside and at the edges of the bushland areas and proposed reserves. However there are also disturbed areas within the site that contain high numbers of weeds.

Species targeted for control include:

- *Lantana camara* (Lantana);
- *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush);
- *Cinnamomum camphora* (Camphor Laurel);
- *Erythrina x sykesii* (Coral Tree);
- *Ligustrum lucidum* (Broad-leaved Privet);
- *Ligustrum sinense* (Small-leaved Privet);
- Exotic Pine species;
- *Rubus fruticosus* (Blackberry).

Where weeds are identified as occurring appropriate weed control will be undertaken. Weed control can be carried out either through the careful and localised use of chemicals or through physical control methods as outlined below:

- *Physical control methods* involve using physical means such as hand removal and the use of hand tools to remove either specific or broad ranges of weeds. A common physical method for weed removal and subsequent natural revegetation is the Bradley Method. This method involves hand removal and is best for small areas. The use of machinery such as Bobcats, Backhoes, Slashers, etc should not be used for weed removal due to the potential for large scale disturbance to result.
- *Chemical control methods* involve the use herbicides. These herbicides can be specific to a particular plant or more broad ranging types of chemicals. Problems with the use of herbicides include chemical residues affecting soils, herbicide runoff into waterbodies and the health and safety of the operator involved in the application of the herbicide. Advantages of herbicide use include the low time taken to spray weeds as opposed to physically removing them, especially for large infestations of weeds. Broad area spray application is considered inappropriate for this program. Herbicides will be applied by cut and paint or hand held application methods only. Suitable physical control methods are to be the preferred option.

Weed control in the reserve and corridor areas is to be carried out by professional bush regeneration contractors having TAFE qualifications in bushland regeneration (minimum Certificate 2) and under the supervision of a professional bush regenerator who is a member or is eligible for membership of the Australian Association of Bush Regenerators (AABR). Any individuals or groups undertaking weed removal or bush regeneration activities must currently possess or obtain a licence from the NSW Department of Environment and Climate Change.

Within the biodiversity off-set area (Myall River Conservation Area) the targeted removal of the invasive exotic pines is proposed as the principal action for weed control. Exotic pines have been identified as a significant plant pest species in the adjoining Myall Lake National Park (NPWS 2002) therefore a targeted pine removal program is considered to be an appropriate management action for this area.

iii) Rehabilitation of disturbed areas

In conjunction with weed removal programs, and as part of the Vegetation Management Works Plan, those disturbed areas identified within the site will be targeted for rehabilitation. The Vegetation Management Works Plan will detail strategies for those areas to be rehabilitated including the use of provenance specific species, long term protection of rehabilitation areas and monitoring and maintenance of rehabilitation areas.

iv) Erection of signage delineating protection areas

Signs will be erected throughout Riverside delineating corridor and reserve areas and identifying vegetation protection areas and strategies. This will include information discouraging residents from dumping lawn and garden waste that will have future impacts upon natural areas in terms of potential for weed infestation.

Signs, in conjunction with fencing, can also aid in restricting access to sensitive areas.

Further details on signage management actions are contained in Section B11.

v) Erection of fencing delineating protection areas

Fencing can be used to delineate vegetation and bushland protection areas, particularly those areas undergoing vegetation rehabilitation. Sensitive areas such as the SEPP 14 wetland area can also be fenced to restrict pedestrian and vehicular access.

Further details on fencing management actions are contained in Section B11.

vi) Monitoring of vegetation management areas

Full details of monitoring are included in Section B12.

vii) Encouragement of community initiatives

The encouragement and establishment of local community groups (such as Landcare) will aid in the organisation and carrying out of weed removal and vegetation rehabilitation programs will encourage partial ownership of the bushland values of Riverside by the community.

The establishment of site specific community groups should be developed as an initiative between the developers of the land and the Community Association.

2.2 BUSHFIRE MANAGEMENT

Objectives

- **Ensure all bushfire protection measures occur outside of bushland areas retained for conservation or off-set purposes**
- **Maximise tree and habitat protection**
- **Ensure that bushfire protection measures are implemented to reduce the risk of bushfire from retained bushland areas upon adjacent property**

Actions

i) Incorporate the findings of the Bushfire Protection Assessment which identified the requirements for bushfire protection measures for asset protection zones

A Bushfire Protection Assessment (Conacher Environmental Group 2011a) has been prepared for the site. This Bushfire Protection Assessment identifies the bushfire protection strategies required to protect developed areas within Riverside. These strategies need to be incorporated into the vegetation management of the site.

ii) Identification of retained areas and Asset Protection Zone (APZ) boundaries prior to construction

Prior to construction commencing those areas to be retained as corridor and reserve and their adjacent APZ's are to be delineated on site plans and survey marked in the field. This will minimise the risk of damage to vegetation contained within retained areas and APZ's during construction.

iii) Maximise tree protection in APZ's

A discontinuous tree canopy is required as establishment of the Inner Protection Area of APZ's. It is considered that due to the relatively open nature of the vegetation communities present within that site that tree clearing required as part of the establishment of APZ's will be minimal.

iv) Monitor bushfire risk within retained bushland areas

While all hazard reduction is to occur outside of reserve, corridor areas and off-set areas the vegetation and accumulation of fuel and consequent bushfire risk over time within the reserve and corridor areas is to be monitored as a long term strategy. Full details of monitoring will be included within the Vegetation and Bushfire Management Plan.

iv) Implementation fire hazard reduction and fuel management where considered necessary in accordance with vegetation management principles

This may require future ecological burn strategies to be implemented using a sector/mosaic burn plan based physical/mechanical actions to reduce inground fuel levels or on best knowledge of appropriate regimes for the various vegetation communities present within the site. The results of monitoring will be used to plan for any subsequent fuel reduction operations

carried out in conjunction with the RFS and other relevant statutory authorities such as the NSW Department of Environment and Climate Change.

2.3 PROVISION AND ESTABLISHMENT OF ENVIRONMENTAL CORRIDORS

Objectives

- **Protect the sites ecological value as a movement area for local fauna**
- **Minimise the impacts of development upon local fauna**
- **Provide green space for residents to maximise the sites aesthetic values and recreational opportunity**
- **Maximise environmental values of drainage and water management areas**

Actions

i) Establish Wildlife Corridors as key component of the concept design

The Wildlife Corridors areas have been provided within the proposal to retain connectivity within the post development landscape and provision for fauna movement through the area. These consist of a north-west running corridor in the east of the site and an east-west running corridor at the northern boundary of the site. These areas will allow movement through the site to greater areas of habitat to the north, particularly for arboreal and terrestrial fauna species. These areas will also provide a lesser open space/recreational role.

These Wildlife Corridors will provide continuity of habitat and movement areas for local fauna within the development and between habitat areas within the local landscape. This includes movement areas and habitats for threatened species including the Squirrel Glider, Koala and threatened microchiropteran bat species.

Vegetation and habitats within these areas will be managed under specific vegetation and habitat management planning proposed for the site.

ii Establish Drainage Corridors as key component of the concept design

Drainage corridors have been proposed as part of the development concept layout for water/drainage management. These areas will serve a function in providing landscape linkage and providing habitat for semi-aquatic species within the site, particularly amphibian species, including the Wallum Froglet. These areas will also provide a lesser open space/recreational role.

2.4 PROVISION OF ENVIRONMENTAL BUFFERS

Objectives

- **Protect the values of retained vegetation and habitats within the site**
- **Reduce occurrence and severity of edge effects on retained vegetation**

- **Maximise use of Asset Protection Zones in acting as environmental buffers**
- **Maximise the opportunity for vegetation management within environmental buffers**
- **Protect sensitive environments including riparian, estuarine and wetland areas**

i) Establish buffer areas between development areas and environments associated with the Myall River

The less disturbed vegetation communities within the site associated with the Myall River will be retained as part of the concept development proposal. This includes the retention of Swamp Forest, Closed Heathland, Closed Rushland and Mangrove complex vegetation communities. The retention of these communities will provide an approximately 150m to 500m buffer between the development edge and the banks of the Myall River. The establishment retention of these areas as buffers will provide for the protection of the Myall River from potential offsite and downstream impacts of adjacent development. This also includes the protection of areas of the endangered ecological community Coastal Saltmarsh. These buffers were identified and included in environmental protection zones as part of the outcomes of the rezoning process.

ii) Implement vegetation management strategies within buffer areas

The outer 20 metres of the buffer areas will be targeted for vegetation management. The implementation of vegetation management actions within buffer areas will increase these areas ability to protect vegetation and habitats from the impacts of development. These actions will include:

- weed removal
- replanting
- erosion and sediment control
- fencing
- monitoring
- ongoing maintenance

iii) Restrict vehicle access to buffer areas

Access to buffer areas by vehicles will be restricted and prohibited, other than for vegetation management purposes.

2.5 EROSION AND SEDIMENT CONTROL

Objectives

- **Protect the soil properties of the area during the construction and occupation phases of the development**
- **Minimise risk of sedimentation of downstream aquatic areas**
- **Maximise use for in-situ replacement and use of displaced topsoil**

Actions

i) Prepare an Erosion and Sediment Control Plan for the site

Development within the site is adjacent to sensitive areas including the Myall River and associated SEPP 14 wetlands. To minimise the impacts of downstream sedimentation to aquatic environments an Erosion and Sediment Control Plan will be prepared for the site.

The Erosion and Sediment Control Plan will detail the strategies required for the minimisation of erosion within the site and the control of potential sedimentation impacts likely as a result of any erosion. The Erosion and Sediment Control Plan will detail the strategies required for the construction and occupation phases of the development.

This plan is to be prepared by a qualified Engineer and in accordance with best practice industry standards and Great Lakes Councils Erosion and Sediment Control Policy. The plan will also consider Council's Port Stephens/Myall Lakes Estuary Management Plan.

ii) Provide erosion and sediment control devices in accordance with best practice industry standards

The Erosion and Sediment Control Plan will detail measures for the installation, ongoing use monitoring and maintenance of erosion and sediment control devices during all construction and occupation phases of development.

iii) Implement suitable protection measures for storing of topsoil and on-site re-use

All topsoil stripped from the site will be stored and re-used on site. Topsoil and spoil shall be stockpiled in non-hazard areas and protected from surface run-off by diversion drains or similar. Stockpiles are to be surrounded on down-stream sides by silt fencing and stockpiles shall be suitably compacted to inhibit erosion. Where the stockpiling period exceeds four (4) weeks, the stockpile shall be seeded to encourage vegetation growth and reduce further loss due to water/wind erosion.

iv) Restrict access to disturbed areas during construction

Access to disturbed areas during construction will be restricted, particularly following rainfall.

v) Rehabilitate disturbed areas immediately upon the cessation of construction activities

All disturbed areas will be rehabilitated according to actions detailed within the Erosion and Sediment Control Plan and Vegetation Management Plan immediately following the completion of site construction activities.

vi) Monitor erosion and sediment control devices and downstream and aquatic areas for evidence of soil loss and sedimentation

2.6 STORMWATER QUALITY AND MANAGEMENT

Objectives

- Provide suitable stormwater control devices that maximise habitat opportunities for flora and fauna
- Provide suitable stormwater control devices that maximise passive recreational opportunities
- Locate and design stormwater structures within the development in accordance with the conservation and protection principles of this Management Strategy to minimise environmental impacts

Actions

- i) *Integrate landscape design initiatives into stormwater control structures that maximise benefits to local aquatic and semi-aquatic flora and fauna species*

Measures are to include promotion of growth of native fringing vegetation, monitoring of water quality, weed removal and monitoring for presence of predatory *Gambusia holbrooki*. Design of detention and sedimentation structures will incorporate features to facilitate *Gambusia* eradication. These measures may be addressed within individual habitat management plans for each proposed basin.

2.7 CULTURAL HERITAGE VALUES AND MANAGEMENT

Objectives

- Protect the cultural heritage values of the local area
- Provide information to the community on the cultural heritage values of the Riverside area

Actions

Consider the implementation of the recommendations of the Cultural Heritage Report by ERM Australia.

2.8 COMMUNITY EDUCATION, VIGILANCE AND REPORTING

Objectives

- Promote ownership and appropriate use of the natural areas within Riverside by the community
- Promote community vigilance in reporting prohibited use
- Promote community involvement in wildlife observation and protection
- Encourage local involvement in bushland rehabilitation schemes

- **Provide information to the community on the environmental, cultural and recreational values of the area**

Actions

i) Provide informative pamphlet to residents at point of sale and update/supply regularly

A pamphlet will be supplied to residents at the point of sale to supply information in regards to the sites natural area values. The pamphlet will include information on:

- The area covered by the Riverside development and the reserve and corridors within;
- History of the area;
- Access points and any walking trails;
- Prohibited uses and reasons for restricted use;
- Location of any facilities or important ecological/cultural features;
- Accepted passive recreational uses of the area;
- Significant flora and fauna (particularly threatened species) and habitats;
- Practices to reduce the impacts of adjacent use upon the corridor (eg. Use of locally occurring garden species, limited use of fertilisers, controlling pets, weed management, fauna monitoring, habitat creation);
- Contact details with regard to reporting prohibited use, fauna injuries;
- Landcare/Bush regeneration details;
- Sources of further information (e.g. Great Lakes Council, DECC websites);

ii) Provide interpretive signing around extent of retained reserve and corridor areas to inform community of values and appropriate use

Signage will include information on:

- Ownership and management of the land;
- Bushland values;
- Prohibited activities (eg: rubbish dumping, vehicular access, entry of cats, off lead dogs);
- Permitted activities;
- Contact/Reporting details;
- Penalties for misuse;
- Indicative map of natural areas within riverside.

iii) Encourage community and resident ownership and involvement through use of Community Title initiatives

Residential areas of the site are to be administered under the provisions of Community Title. This approach allows for ongoing regulation of activities, including maintenance within the entire development area, within individual allotments, within bushfire protection areas, vegetation retention areas and within common community association areas. This approach also provides substantial benefits in terms of regulating the impact of the development upon the natural environment into the future.

The Community Management Statement embodies the Legal Framework under which the Community Association operates defining its purpose, responsibilities, procedures and by-laws

which regulate the association and its members. The Community Management Statement, by definition, places the burden of ongoing environmental management works upon the landholders thus ensuring the implementation of these works in perpetuity.

2.9 PROHIBITED USE IDENTIFICATION AND MANAGEMENT

Objectives

- **Identify likely uses of the natural areas within the Riverside development that may have impacts upon ecological and environmental values**
- **Encourage appropriate uses of the natural areas within Riverside by the community**
- **Promote community awareness and vigilance of reporting of prohibited uses**
- **Implement mechanisms for penalties for mis-use of natural areas**

Actions

i) Erect prohibited use signage

Potential uses of the natural areas of Riverside to be identified as prohibited uses are:

- Rubbish dumping;
- Vehicular (4WD and trail bike) access;
- Off-leash dogs;
- Flora/fauna harm or removal;
- Horse riding;
- Dead wood removal.

ii) Implement community education programs to encourage the appropriate low impact, passive use of reserve and corridor areas

Community education material (pamphlets/signage) will include information on appropriate use of the natural areas within the site. Passive use of the site will be encouraged with activities such as walking, fauna observation to have facilities provided for (eg. walking trails, boardwalks, viewing platforms). Those recreational activities likely to cause harm will be discouraged (walking off set trails, trailbiking, horse riding, unleashed dog walking, camping).

iii) Restrict access to reserve and corridor areas, particularly to vehicles, trail bikes and horses

The recreational opportunities and use of the site will be controlled by the provision of services and access to those services. Access to reserve areas and the facilities within those areas will be restricted to service vehicles and pedestrian traffic only.

Access to walking/service trails will be restricted by locked gates or bollards. Unauthorised vehicular access will not be permitted and identified as a prohibited use.

2.10 NATIVE FAUNA, HABITAT AND FERAL PEST SPECIES MANAGEMENT

Objectives

- Provide suitable strategies for the protection of native fauna species within the post development landscape
- Provide adequate protection and habitats for threatened species known from the area
- Provide compensatory (off-set) habitat for native fauna and flora
- Minimise human related impacts upon local native fauna
- Protect key den, nest, roost and foraging resources by establishing adequate bushland reserves
- Control and/or remove pest fauna species and invasive flora species from the conservation areas of the site
- Reduce the risk of damage to native flora and fauna resulting from the occurrence of pest species related to human occupation

Actions

i) *Provide compensatory habitat within retained areas, particularly nest and roost boxes*

a. Nest Boxes

Relative low densities of hollow-bearing trees have been recorded within the subject site. These hollows ranged in size from small to medium (<5cm to 30cm) suitable for a number of hollow dependent fauna species observed during surveys. These include:

- | | |
|--------------------------------|--------------------------|
| * Green Tree Snake | * Rainbow Lorikeet |
| * Galah | * Musk Lorikeet |
| * Scaly-breasted Lorikeet | * Squirrel Glider |
| * Eastern Rosella | * Feather-tail Glider |
| * Common Brushtail Possum | * Common Ringtail Possum |
| * Microchiropteran bat species | |

As part of the Master planning process it is proposed to retain all hollow-bearing trees within the undeveloped areas of the site. However, in the interests of providing net gains in habitat nest and roost boxes are proposed to be erected within trees in those reserve and corridor areas to be retained by the development.

It is considered that 2-3 nest boxes per hectare of current suitable habitat to be cleared will be erected as compensatory habitat within the retained and protected reserve and corridor areas. This equates to between 200-300 replacement nest boxes. This will consist of a mix of Squirrel Glider, possum, micro chiropteran bat, small and large parrot boxes.

The following specific management strategies are to be carried out in relation to nest boxes:

- All replacement nest boxes are to be secured to trees at a minimum height of four metres above ground level facing the east to north east direction. An experienced arborist is required to install the nest boxes. Nest boxes and re-erected limbs are not to be placed near locations where public access is planned along entrance points or tracks. All nest boxes and re-erected limbs will be inspected annually and any damaged, or in danger of falling, are to be repaired or replaced. The locations of each of the erected nest boxes or re-erected hollows will be mapped for later reference.
- A fauna ecologist (Project Ecologist) is to co-ordinate the construction and erection of nest boxes and locate appropriate trees and locations for installing the nest boxes. The locations of all nest boxes and re-erected hollows are to be included on plans provided with annual progress reports. Each box is to be identified with a readable, weather resistant number (75mm) in size for identification and recording purposes.
- All nest boxes will be inspected regularly for the life of this plan. Any damaged or dangerous boxes will be replaced. Any boxes seen to contain exotic fauna (Indian Myna, European Bees) will have fauna removed or the nest box replaced.
- The locations of all nest boxes will be fixed by GPS as part of ongoing monitoring strategies.
- All nest boxes will be constructed of a durable marine ply material and fixed to trees by qualified climbers using stainless steel bolts. Boxes will be hinged for ease of future monitoring.

The habitats within the reserve and corridor areas will be enhanced by the implementation of vegetation management strategies. The removal of weeds and rehabilitation of disturbed areas and community involvement has been discussed within Section B1.

ii) Supervise clearing works during construction

The removal of hollow bearing trees will occur as part of this development. To minimise the impact on hollow dependant fauna during tree felling operations the following measures will be used were considered appropriate:

- Identification and marking of hollow bearing trees required to be cleared;
- Inspection of tree hollows by spotlight survey and appropriate bat detection methods immediately prior to clearing to determine if hollows are being utilised by tree dwelling fauna, including threatened species;
- Implementation of a trapping program prior to tree clearing to trap any mammal fauna within areas proposed for staged clearing. Any trapped animals will be released into appropriate areas on dusk;
- Inspection of hollow bearing trees marked for clearing. Trees will be felled in sections of approximately one-metre lengths. Inspections of hollow sections prior to felling will be undertaken to determine if fauna is present within hollows. Fauna occupying hollows will

be carefully removed by an experienced and licensed fauna expert and relocated to another tree away from the area of clearing;

- Restriction of clearing hollow bearing trees during the breeding season for microchiropteran bats and Squirrel Glider (September-March);
- Implementation of hollow log salvage and re-erection program in order to retain roosting and nesting opportunities for hollow dependent fauna, including Owls, Squirrel Gliders and threatened bat species;

Two options are available for removing tree hollows or felling hollow bearing trees. These are:

- i) Hollow bearing trees containing fauna are to be sectionally dismantled. This will involve an arborist / tree climber to hand removal hollow limbs into one metre lengths. Each hollow length will be inspected for fauna occupation. Once all hollow limbs are dismantled the tree can be felled by machine. Fauna occupying hollows will be carefully removed by the Project Ecologist and relocated to adjoining corridor or reserve areas.
- ii) Where machinery is required to fell hollow trees, the blade or bucket of the machinery will be tapped against the base of the tree to disturb any fauna present. The tree will then be felled as gently as possible. All hollow limbs will be inspected after felling for occupation by fauna. Any fauna will be removed and relocated to adjoining bushland.

Any felling of hollow bearing trees will be supervised by a qualified fauna ecologist (Project Ecologist).

All hollow limbs will be removed from those trees felled by a licensed contractor. These hollow limbs will be returned to the Project Ecologist for re-use at a later date.

- iii) *Provide information within community education material encouraging the provision of habitat for native fauna species within residential allotments*

Information will be included within interpretive material on the importance of providing suitable landscape initiatives within residential areas for the provision of habitat for native species within urban areas.

- iv) *Implement suitable initiatives to control impacts of domestic pets upon local fauna*

The following will form part of strategies in minimising the risks posed to native wildlife of domestic animals:

- All domestic pets kept within fenced yards
- Covenants restricting cat ownership
- Curfews on cats
- All dogs to be kept on leash when out of yards and in open space areas
- Penalties for unrestrained animals

- v) *Implement feral pest control programs, particularly for rabbits, foxes, Mosquitofish and Noisy Miner*

Suitable management strategies will be implemented for the control of feral animals, particularly the fox, rabbits, Mosquito fish and Noisy Miner. This will include engaging a licensed pest controller to carry out regular programs, when required, within the site, particularly those corridor and reserve areas.

vi) Monitor distribution and abundance within the site of threatened species, native fauna and pest species

Regular monitoring will be implemented to gather information on the occurrence of native fauna, particularly threatened species, and pest species within the site. Full details are provided within Section B12.

2.11 ACCESS, SIGNAGE AND FENCING

Objectives

- **Protect the environmental values of natural areas throughout the Riverside development through appropriate signage and fencing**
- **Protect environmentally sensitive areas through restriction of access**
- **Increase community awareness of environmental values of natural areas through appropriate signage**

Actions

i) Erect interpretive signing around corridor and reserve areas providing community and residents with information on access restriction, appropriate use, prohibited use and environmental values

Interpretive signing will be erected around the boundaries and within reserve and corridor areas. This will include information on:

- Location of reserve and corridor areas (site plan);
- Prohibited uses;
- Natural features of the site (flora/fauna/habitats/wetlands etc);
- Recreational opportunities;
- Contact details;
- “No go” areas;
- Penalties for misuse.

ii) Erect fencing during construction to protect individual trees

Where trees are identified for retention and are in areas adjacent to construction areas tree protection fencing will be erected to eliminate risk of damage during construction. Fencing will be erected to adequately protect the root zone of trees from excavation or compaction damage.

iii) Erect fencing during construction to protect reserve and corridor areas

Where corridor or reserve areas are adjacent to construction areas temporary fencing will be erected to indicate these no go areas. This will be supported by site contractor inductions notifying personnel of protection areas and restricted access to these.

iv) Erect bollards or fencing to restrict access to environmentally sensitive areas

Bollards or fencing will be erected to control access to environmentally sensitive areas within the site such as SEPP 14 Wetland areas and conservation zones. Temporary fencing will also be erected to protect areas that are undergoing vegetation management to protect juvenile plants.

v) Monitor signage and fencing and repair/replace when necessary

The management program will include monitoring of condition of signs, fencing and bollards to allow for damaged structures to be replaced or repaired. Full details of monitoring are included within Section 2.12.

2.12 MONITORING AND REPORTING REGIME

Objectives

- **Collect long term information on the environmental and ecological quality of natural areas and impacts of development within the Riverside development**
- **Collect long term information on impacts of the development upon reserve and corridor areas and make contingency for the implementation of appropriate rehabilitative and compensatory measures**
- **Collect long term information on the success of ameliorative measures introduced as part of this management strategy**
- **Collect information on the occurrence of threatened species, native fauna and condition of vegetation within reserve and corridor areas**
- **Provide regular meaningful reports to statutory authorities on the results of monitoring and other ongoing issues and make these available to the Community Association and other local interest groups**

Actions

The monitoring program will be designed to collect information over the long term on key environmental and ecological parameters to provide information on the long term environmental health of the reserve and corridor areas. These consist of the following:

- **Threatened species:**
 - Wallum Froglet;
 - Osprey;
 - Barking Owl;
 - Squirrel Glider;
 - Koala;

- Grey-headed Flying-fox;
- Greater Broad-nosed Bat;
- Eastern Bentwing-bat
- Little Bentwing-bat;
- Large-footed Myotis.
- Native fauna
- Native vegetation and bushland
- Weeds
- Rubbish
- Nest boxes
- Pest species

i) Monitor occurrence and persistence of threatened species

Wallum Froglet

The Wallum Froglet has been recorded within a number of locations within the site. The monitoring program is to be designed so as to detect the continued presence of this species within those suitable habitat areas retained within the site. Surveys are to be completed bi-annually and annually and consist of call detection and call playback, particularly during times of peak detection (i.e. after rain April-Nov).

Osprey

The Osprey was been recorded within the subject site during surveys conducted in February 2008. This species was observed roosting in trees on the shoreline of the Myall River. Monitoring programs are to be designed so as to detect the continued presence of this species within the area. Bi-annual surveys are to be carried out to detect the continued presence of this species within the subject site and to record any nesting activity that may occur. Surveys are to consist of diurnal observation surveys.

Barking Owl

The Barking Owl was been recorded calling in areas to the north of the subject site during nocturnal owl call playback surveys conducted in February 2008. Monitoring programs are to be designed so as to detect the continued presence of this species within the area. Bi-annual surveys are to be carried out to detect the continued presence of this species within the subject site and to record any nesting activity that may occur. Surveys are to consist of nocturnal call playback and spotlighting surveys.

Squirrel Glider

The Squirrel Glider has been recorded within vegetation near the northern boundary of the site. Monitoring programs are to be designed so as to detect the continued presence of this species within the area. Bi-annual surveys are to be carried out to detect the continued presence of this species within reserve and corridor areas. Surveys are to consist of arboreal Elliott trapping, spotlighting and nest box inspection.

Koala

There are no recent local records for the Koala within the subject site; however it is known to occur within the local area. The site contains suitable foraging and refuge habitat for this species. Monitoring is to be carried out bi-annually for this species to detect any future use of the site. Monitoring is to consist of Spot Assessment Techniques, spotlighting and call playback. Full details of the monitoring program are included within the Koala Management Strategy prepared for the site.

Grey-headed Flying-fox

The Grey-headed Flying-fox was been recorded within the subject site during nocturnal surveys conducted in February 2008. This species was observed foraging in flowering eucalypt trees within the subject site. Monitoring programs are to be designed so as to detect the continued presence of this species within the area. Bi-annual surveys are to be carried out to detect the continued presence of this species within the subject site and to record any roosting camp activity that may occur. Surveys are to consist of nocturnal spotlighting surveys.

Microchiropteran Bat Species (Greater Broad-nosed Bat, Little Bentwing-bat, Eastern Bentwing-bat, Large-footed Myotis)

Four threatened microchiropteran bat species have been recorded within the site during previous surveys. The area contains foraging, roosting and breeding habitat for these species. Monitoring programs are to be designed so as to detect the continued presence of this species within the area. Surveys for these species are to be carried out biannually and consist of Anabat echolocation recording.

ii) Monitor abundance and diversity of native fauna species

The monitoring program is to include collection of information on the diversity of fauna species within the site. Standard fauna survey methods targeting vertebrate groups (mammals, birds, reptiles, amphibians) is to be completed seasonally and bi-annually to gather information on the diversity of fauna species within the site for year to year comparison and also comparison against baseline data.

iii) Monitor condition of native vegetation and bushland including rehabilitation areas

The monitoring program will include monitoring the condition of vegetation within those areas undergoing vegetation management works within the site, particularly those rehabilitation areas. Monitoring is to be carried out annually to assess the condition of rehabilitation areas and make contingency for additional rehabilitation and protection works if the results of monitoring indicate the need.

iv) Monitor occurrence and extent of weeds and rubbish

The extent of weeds within the retained bushland and off-set areas are to be monitored annually. Where weeds are observed to be increasing removal programs will be carried out. This could be implemented as part of community initiatives as discussed in Section B8.

Monitoring for incidences of rubbish dumping will be carried out regularly. Where build up of rubbish is observed removal programs are to be carried out. This could also be implemented as part of community initiatives as discussed in Section B8.

vi) Monitor occurrence of pest fauna species

Monitoring will include gathering information on the presence of the following pest species:

- Foxes;
- Rabbits;
- Gambusia;
- Common Myna;
- Cats;
- Dogs.

The collection will allow for the occurrence of pest species to be recorded and provision made for their removal from those retained areas.

Any signs of predation by foxes, dogs or cats will also be monitored and reported on.

vii) Produce regular meaningful reports on results of surveys and provide analysis against baseline information

Reports will be supplied regularly to the Community Association and relevant statutory authorities in conjunction with the end of each monitoring period.

At the completion of each monitoring period an assessment report will be completed detailing all methodologies used and results gained during surveys for that monitoring period. The report is included as a minimum:

- details on survey methods;
- results of surveys;
- comparison between monitoring/reporting periods;
- management issues;
- any suggested amendments to management plan.

viii) Make contingency for review of management actions where monitoring identifies significant impacts

Management actions will be reviewed regularly as part of the monitoring and reporting process. Where impacts are identified that indicate the failure of management actions or the requirement for new management actions contingency will be made for these to be addressed within the ongoing environmental management framework.

SECTION 3

IMPLEMENTATION OF MANAGEMENT ACTIONS

3.1 IMPLEMENTATION OF MANAGEMENT ACTIONS

It is envisaged that the management strategies included within this plan will be enforced as conditions of consent for various stages of approval for the development application. Following review of the application by the various authorities it is considered that further refinement of the management actions and implementation will be required for the various stages of the approved development. This may be achieved by the preparation of individual Management Plans for the various development stages with this Ecological Site Management Strategy to form the basis of the objectives, actions and implementation strategies of those plans.

The actions detailed within this Management Strategy will be implemented over a minimum ten year period following signoff of the plan by the Department of Planning and Infrastructure. The long term timing, implementation and responsibility of those actions will ultimately depend upon the development of the various stages of the development and the title on the land. The location of the various management areas is shown in Figure 1.

Table 1 provides details on the implementation of management actions contained within Section B. Each of the actions relates to a Management Area within the Riverside area. These areas have been identified to ensure that only those actions relevant to certain areas are applied to the relevant area. These Management Areas have been separated as per the following:

- Management Area A – SEPP 14 Wetlands;
- Management Area B – Conservation Zoned Lands;
- Management Area C – Asset Protection Zones and Environmental Buffers;
- Management Area D – Wildlife Corridors;
- Management Area E – Drainage Corridors;
- Management Area F – Developable Area.

Management Area A – SEPP 14 Wetlands

The area within Management Area A is that low-lying land associated with the Myall River and bound by State Environmental Protection Policy No. 14 Coastal Wetlands known as wetland number 746. This area corresponds with an area mapped as 7(a) Wetlands and Littoral Rainforest Zone within the Great Lakes LEP. This area will be wholly retained as part of the proposed development. The SEPP 14 Wetland will also be buffered by the retention of vegetation communities between the wetland boundary and the development edge. Management within this area will primarily consist of weed management via regular inspections, and low impact weed control works where and when necessary. Bushfire hazard reduction activities will not be undertaken in this management area.

Management Area B – Conservation Zoned Land

This area consists of land zoned 7(b) Conservation Zone and contains land of conservation and environmental significance. This area is adjacent to the land within SEPP 14 wetlands and serves a buffer function in protecting the wetland area from adjacent use. The vegetation within this land zoned for conservation consists of relatively high quality Closed Heathland and Swamp Forest vegetation. Management within this area will primarily consist of weed management via

regular inspections, and low impact weed control works where and when necessary. Bushfire hazard reduction activities will not be undertaken in this management area.

Management Area C – Asset Protection Zones and Environmental Buffers

These areas consist of those areas adjacent to development that are retained as buffer areas to adjacent reserved lands or are retained and modified as part of Asset Protection Zones (APZs). These areas serve as the interface between developed lands and those areas of native vegetation retained due to high conservation value, environmental significance or habitat and landscape function. These areas will contain a reduced amount of vegetation within semi-natural areas. Areas designated as bushfire APZs will be managed in accordance with the requirements for APZs in Planning for Bushfire Protection (RFS 2006). It is likely that some of these areas will incorporate grassy swale / nutrient sinks, some stormwater management areas, ephemeral drainage lines and parklands.

Asset Protection Zones and Environmental Buffers are located within or adjacent to a large number of habitat types across the site. Replanting zones labelled A to G having different treatment requirements have been created to better define the species to be used and the densities required to be planted (See Figures A4.1 and A4.2 and Table 2). This is to ensure that future revegetated areas are consistent with the habitat and existing vegetation types within or adjacent to the replanting zones. Where revegetation is required within these areas species to be planted and the densities of plantings required are shown in Table 2. The location of zones (labelled with a prefix of A to G) that may require replanting is shown in Figure A4.2 - Re-vegetation Zones.

Management Area D – Wildlife Corridors

These Wildlife Corridor areas have been provided to retain connectivity within the post development landscape and provision of fauna movement through the area. These consist of a north-west running corridor in the east of the site and an east-west running corridor at the northern boundary of the site. Management within these areas will primarily consist of weed management via regular inspections, and low impact weed control works where and when necessary.

These areas will allow movement through the site to greater areas of habitat to the north, particularly for arboreal and terrestrial fauna species. Those other areas retained in Management Areas A and B will also function in a landscape connectivity capacity.

The Wildlife Corridors will be consolidated / augmented by replanting within existing disturbed areas. Areas of replanting works are shown in Figure A4.2 – Re-vegetation Zones which designates zones with a prefix between A and G. The species and the densities to be replanted within the specific zones are shown in Table 2.

Management Area E – Drainage Corridors and Open Space Areas

The lands contained within Management Area E consist of areas set aside for water/drainage management. These areas will also serve a function in providing landscape linkage and providing habitat for semi-aquatic species within the site, particularly amphibian species. These areas will also provide a lesser open space/recreational role.

The drainage corridors will contain a number of habitat types such as Parkland, Freshwater Edges, Fresh Waterbodies and Saline Shores. Areas of replanting works are shown in Figure A4.2 – Re-vegetation Zones which designates zones with a prefix of G for the Drainage Corridor areas. The species and the densities to be replanted within the G zones are shown in Table 2.

Management Area F – Developable Area

This area consists of the land to be developed for residential and commercial purposes. The management actions to be implemented within Management Areas A to E are ultimately as a result of the activities that are to be carried out within Management Area F.

APPLICATION OF MANAGEMENT STRATEGY ACTIONS TO VARIOUS MANAGEMENT AREAS WITHIN RIVERSIDE										
SITE ISSUE	ACTION	APPLICABILITY OF MANAGEMENT ACTION FOR MANAGEMENT AREA								TIMING
		A	B	C	D	E	F	RESPONSIBILITIES		
B1. Vegetation and Bushland Management	i) Prepare Vegetation Management Plan	√	√	√	√	√			Applicant	Pre-construction
	ii) Weed removal programs	√	√	√	√	√			As part of Development Consent Contractor	Pre-construction, construction and ongoing through occupation
	iii) Rehabilitate / replant disturbed areas	√	√	√	√	√			As part of Development Consent Contractor	Pre-construction, construction and ongoing through occupation
	iv) Erect signage	√	√	√	√	√	√		Contractor	Pre-construction
	v) Erect protective fencing		√	√	√	√	√		Contractor	Pre-construction
	vi) Monitor vegetation management areas	√	√	√	√	√			Project Ecologist	Construction and ongoing through occupation
	vii) Encourage Landcare initiatives	√	√	√	√	√	√		Project Ecologist	Occupation
B2. Bushfire Management	i) Prepare Bushfire Protection Assessment			√	√	√			Applicant	
	ii) Identify APZ's prior to construction			√	√	√	√		Project Ecologist	
	iii) Maximise tree protection in APZ's			√	√	√	√		Contractor	
	iv) Monitor bushfire risk	√	√						Project Ecologist	
	v) Fire hazard reduction			√	√	√			Contractor	

APPLICATION OF MANAGEMENT STRATEGY ACTIONS TO VARIOUS MANAGEMENT AREAS WITHIN RIVERSIDE										
SITE ISSUE	ACTION	APPLICABILITY OF MANAGEMENT ACTION FOR MANAGEMENT AREA						RESPONSIBILITIES	TIMING	
		A	B	C	D	E	F			
B3. Provision & Establishment of Environmental Corridors	i) Establish Wildlife Corridors				√			Applicant Consent Conditions	Pre-construction and ongoing through occupation	
	ii) Establish Drainage Corridors					√		Applicant Consent Conditions	Pre-construction and ongoing through occupation	
B4. Provision of Environmental Buffers	i) Establish buffer areas between development and Myall River	√	√	√				Applicant Consent Conditions	Pre-construction and ongoing through occupation	
	ii) Implement vegetation management strategies	√	√	√				Applicant Consent Conditions	Pre-construction and ongoing through occupation	
	iii) Restrict vehicle access	√	√	√				Applicant Consent Conditions	Pre-construction and ongoing through occupation	
B5. Erosion and Sediment Control	i) Prepare Erosion and Sediment Control Plan						√	Contractor	Pre-construction and ongoing through occupation	
	ii) Provide erosion and sediment control devices				√		√	Contractor	Pre-construction, operational through construction	
	iii) Implement topsoil storage and re-use methods						√	Contractor	Construction	
	iv) Restrict access to disturbed areas						√	Contractor	Construction	
	v) Rehabilitate disturbed areas						√	Contractor	Construction	
	vi) Monitor erosion and sediment control devices/effectiveness						√	Project Ecologist	Construction	

**TABLE 1 (Cont.)
APPLICATION OF MANAGEMENT STRATEGY ACTIONS TO VARIOUS MANAGEMENT AREAS WITHIN RIVERSIDE**

SITE ISSUE	ACTION	APPLICABILITY OF MANAGEMENT ACTION FOR MANAGEMENT AREA							RESPONSIBILITIES	TIMING
		A	B	C	D	E	F			
B6. Stormwater Quality Management	i) Landscape/habitat design initiatives in structures				√			√	Applicant	Pre-construction
	ii) Advice from qualified ecologists				√			√	Applicant/Consultant	Pre-construction
	iii) Landscape and habitat design plans				√			√	Applicant/Consultant	Pre-construction
	iv) Locate structures in appropriate areas				√			√	Consent Conditions	Pre-construction
B7. Cultural Heritage Values and Management	i) Identification and protection of sites	√	√	√	√	√		√	Consent Conditions	Pre-construction
	ii) Provision of information to community	√	√	√	√	√		√	Applicant	Occupation
B8. Community Education, Vigilance and Reporting	i) Informative pamphlet to residents							√	Applicant	Occupation
	ii) Interpretive signage	√	√	√	√	√		√	Applicant/Consultant	Construction
	iii) Encourage community and resident ownership	√	√	√	√	√		√	Applicant	Occupation
B9. Prohibited Use Identification and Management	i) Erect prohibited use signage	√	√	√	√	√		√	Contractor	Construction
	ii) Promote low impact/passive use	√	√	√	√	√		√	Applicant	Occupation
	iii) Restrict access to reserve areas	√	√	√	√	√		√	Consent Conditions	Construction

APPLICATION OF MANAGEMENT STRATEGY ACTIONS TO VARIOUS MANAGEMENT AREAS WITHIN RIVERSIDE											
SITE ISSUE	ACTION	APPLICABILITY OF MANAGEMENT ACTION FOR MANAGEMENT AREA								TIMING	
		A	B	C	D	E	F	RESPONSIBILITIES			
B10. Native Fauna, Habitat and Feral Pest Species Management	i) Provide compensatory habitat (nest boxes)		√		√		√			Applicant/Consent Conditions	Pre-construction
	ii) Supervise clearing works							√		Project Ecologist	Construction
	iii) Protection of threatened species	√	√	√	√	√	√	√		Contractor	Construction
	iv) Community education material	√	√	√	√	√	√	√		Applicant Conditions of Consent	Occupation
	v) Domestic pet control								√	Community Title Plan	Occupation
	vi) Feral pest control	√	√	√	√	√	√	√	√	Community Title Plan	Pre-construction to ongoing works during occupation
	vii) Monitor fauna distribution and abundance	√	√	√	√	√	√	√	√	Project Ecologist	Pre-construction to ongoing works during occupation
B11. Access, Signage and Fencing	i) Erect interpretive signing	√	√	√	√	√	√	√	√	Contractor	Construction
	ii) Erect tree protection fencing								√	Contractor	Pre-construction
	iii) Erect fencing corridor/reserve protective fencing		√	√	√	√	√	√		Contractor	Pre-construction
	iv) Erect fencing/bollards for environmentally sensitive areas	√	√	√	√	√	√	√		Contractor	Pre-construction
	v) Monitor signage and fencing	√	√	√	√	√	√	√	√	Project Ecologist	Construction to ongoing works during occupation

APPLICATION OF MANAGEMENT STRATEGY ACTIONS TO VARIOUS MANAGEMENT AREAS WITHIN RIVERSIDE									
SITE ISSUE	ACTION	APPLICABILITY OF MANAGEMENT ACTION FOR MANAGEMENT AREA						RESPONSIBILITIES	TIMING
		A	B	C	D	E	F		
B12. Monitoring and Reporting Regime	i) Monitor threatened species	√	√	√	√	√	√	Project Ecologist	Pre-construction to ongoing works during occupation
	ii) Monitor native fauna	√	√	√	√	√	√	Project Ecologist	Pre-construction to ongoing works during occupation
	iii) Monitor native vegetation condition	√	√	√	√	√	√	Project Ecologist	Pre-construction to ongoing works during occupation
	iv) Monitor weeds and rubbish	√	√	√	√	√	√	Project Ecologist	Pre-construction to ongoing works during occupation
	v) Monitor pest species	√	√	√	√	√	√	Project Ecologist	Pre-construction to ongoing works during occupation
	vi) Produce regular meaningful reports	√	√	√	√	√	√	Project Ecologist	Pre-construction to ongoing works during occupation
	vii) Review management actions	√	√	√	√	√	√	Project Ecologist Community Title Council	Pre-construction to ongoing works during occupation
	Management Area A – SEPP 14 Wetland Management Area B – Conservation zoned lands Management Area C – Asset Protection Zones/Buffers Management Area D – Wildlife Corridors Management Area E – Drainage Corridors Management Area F – Development Area								

TABLE 2		
SPECIES TO BE USED IN REVEGETATION WORKS		
REVEGETATION AREAS "A-PREFIX"		
Open Forest (<i>Angophora costata</i>, <i>Corymbia gummifera</i>)		
Species		Total Number of Plants*
Trees	Plantings per 100m² = 5	
<i>Angophora costata</i> (Smooth-barked Apple)	1.6	
<i>Corymbia gummifera</i> (Red Bloodwood)	1.6	
<i>Eucalyptus microcorys</i> (Tallowwood)	1.6	
Shrubs	Plantings per 100m² = 10	
<i>Melaleuca nodosa</i> (Ball Honey Myrtle)	3.3	
<i>Leptospermum polygalifolium</i> (Yellow Tea Tree)	3.3	
<i>Leucopogon lanceolatus</i>	3.3	
Groundcovers	Plantings per 100m² = 15	
<i>Lomandra longifolia</i> (Spiky-headed Mat Rush)	3.75	
<i>Themeda australis</i> (kangaroo Grass)	3.75	
<i>Microlaena stipoides</i> (Weeping Rice Grass)	3.75	
<i>Entolasia stricta</i> (Wiry Panic)	3.75	
REVEGETATION AREAS "B-PREFIX"		
Open Forest (<i>Eucalyptus microcorys</i>)		
Species		Total Number of Plants*
Trees	Plantings per 100m² = 5	
<i>Eucalyptus microcorys</i> (Tallowwood)	1.6	
<i>Angophora costata</i> (Smooth-barked Apple)	1.6	
<i>Eucalyptus resinifera</i> (Red Mahogany)	1.6	
Shrubs	Plantings per 100m² = 10	
<i>Leptospermum polygalifolium</i> (Yellow Tea Tree)	2.5	
<i>Acacia longifolia</i> var. <i>longifolia</i> (Sydney Golden Wattle)	2.5	
<i>Breynia oblongifolia</i> (Coffee Bush)	2.5	
<i>Callistemon salignus</i> (Willow Bottlebrush)	2.5	

TABLE 2 (Cont.) SPECIES TO BE USED IN REVEGETATION WORKS		
REVEGETATION AREAS "B-PREFIX" (Cont.) Open Forest (<i>Eucalyptus microcorys</i>)		
Species		Total Number of Plants*
Groundcovers	Plantings per 100m² = 15	
<i>Entolasia stricta</i> (Wiry Panic)	3.75	
<i>Lomandra longifolia</i> (Spiky-headed Mat Rush)	3.75	
<i>Imperata cylindrica</i> var. <i>major</i> (Blady Grass)	3.75	
<i>Entolasia stricta</i> (Wiry Panic)	3.75	
REVEGETATION AREAS "C-PREFIX" Open Forest (<i>Eucalyptus pilularis</i>)		
Species		Total Number of Plants*
Trees	Plantings per 100m² = 5	
<i>Eucalyptus pilularis</i> (Blackbutt)	1	
<i>Angophora costata</i> (Smooth-barked Apple)	1	
<i>Banksia serrata</i> (Old-man Banksia)	1	
<i>Corymbia gummifera</i> (Red Bloodwood)	1	
<i>Eucalyptus robusta</i> (Swamp Mahogany)	1	
Shrubs	Plantings per 100m² = 10	
<i>Monotoca elliptica</i> (Tree Broom-heath)	3.33	
<i>Pultenaea villosa</i>	3.33	
<i>Notolaea longifolia</i> (Large Mock Olive)	3.33	
Groundcovers	Plantings per 100m² = 15	
<i>Imperata cylindrica</i> var. <i>major</i> (Blady Grass)	5	
<i>Lomandra longifolia</i> (Spiky-headed Mat Rush)	5	
<i>Baloskion tetraphyllum</i> subsp. <i>meiostachyum</i>	5	

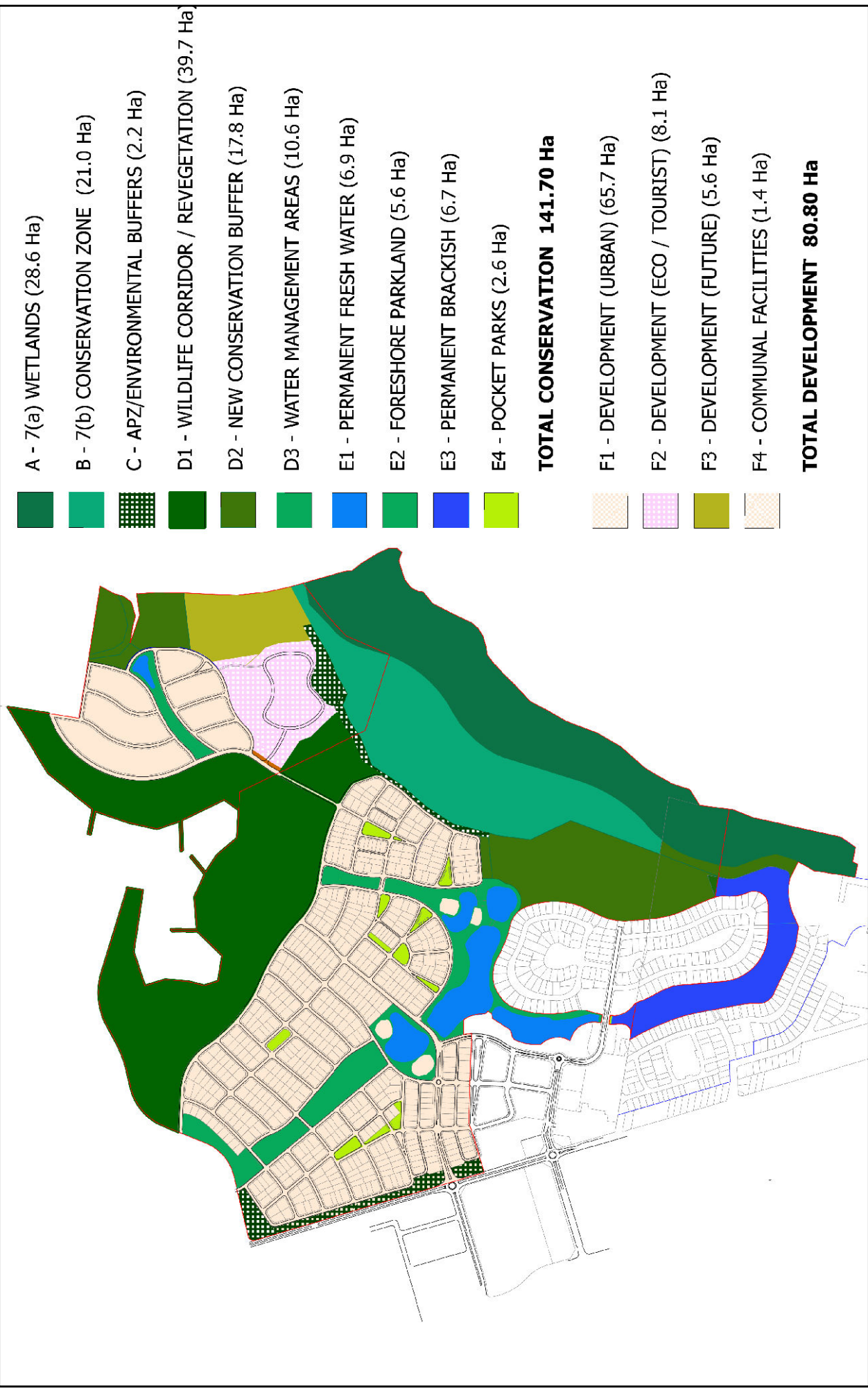
TABLE 2 (Cont.) SPECIES TO BE USED IN REVEGETATION WORKS		
REVEGETATION AREAS "D-PREFIX" Woodland (<i>Eucalyptus resinifera</i>)		
Species		Total Number of Plants*
Trees	Plantings per 100m² = 5	
<i>Eucalyptus resinifera</i> (Red Mahogany)	1.25	
<i>Eucalyptus robusta</i> (Swamp Mahogany)	1.25	
<i>Angophora costata</i> (Smooth-barked Apple)	1.25	
<i>Eucalyptus signata</i> (Scribbly Gum)	1.25	
Shrubs	Plantings per 100m² = 10	
<i>Melaleuca sieberi</i>	2	
<i>Leptospermum polygalifolium</i> (Yellow Tea Tree)	2	
<i>Melaleuca thymifolia</i>	2	
<i>Leptospermum liversidgei</i>	2	
<i>Callistemon pachyphyllus</i> (Wallum Bottlebrush)	2	
Groundcovers	Plantings per 100m² = 15	
<i>Entolasia stricta</i> (Wiry Panic)	3	
<i>Hemarthria uncinata</i> (Matgrass)	3	
<i>Lepyrodia scariosa</i> (Scale Rush)	3	
<i>Xanthorrhoea latifolia</i> subsp. <i>latifolia</i>	3	
<i>Aristida benthamii</i>	3	
REVEGETATION AREAS "E-PREFIX" Woodland / Open Forest (<i>Eucalyptus robusta</i>)		
Species		Total Number of Plants*
Trees	Plantings per 100m² = 5	
<i>Eucalyptus robusta</i> (Swamp Mahogany)	2.5	
<i>Melaleuca linifolia</i> (Snow in Summer)	2.5	
Shrubs	Plantings per 100m² = 10	
<i>Melaleuca nodosa</i> (Ball Honey Myrtle)	3.33	
<i>Pultenaea villosa</i>	3.33	
<i>Epacris pulchella</i> (NSW Coral Heath)	3.33	

TABLE 2 (Cont.) SPECIES TO BE USED IN REVEGETATION WORKS		
REVEGETATION AREAS "E-PREFIX" (Cont.) Woodland / Open Forest (<i>Eucalyptus robusta</i>)		
Groundcovers	Plantings per 100m ² = 15	
<i>Entolasia stricta</i> (Wiry Panic)	3	
<i>Imperata cylindrica</i> var. <i>major</i> (Blady Grass)	3	
<i>Lomandra longifolia</i> (Spiky-headed Mat Rush)	3	
<i>Dianella caerulea</i> var. <i>producta</i> (Blue Flax Lily)	3	
<i>Baloskion tetraphyllum</i> subsp. <i>meiostachyum</i>	3	
REVEGETATION AREAS "F-PREFIX" Woodland / Open Forest (<i>Eucalyptus umbra</i>)		
Species		Total Number of Plants*
Trees	Plantings per 100m ² = 5	
<i>Eucalyptus umbra</i> (Broad-leaved White Mahogany)	1	
<i>Eucalyptus globoidea</i> (White Stringybark)	1	
<i>Angophora costata</i> (Smooth-barked Apple)	1	
<i>Corymbia gummifera</i> (Red Bloodwood)	1	
<i>Eucalyptus microcorys</i> (Tallowwood)	1	
Shrubs	Plantings per 100m ² = 10	
<i>Callistemon salignus</i> (Willow Bottlebrush)	2.5	
<i>Leptospermum polygalifolium</i> (Yellow Tea Tree)	2.5	
<i>Persoonia linearis</i> (Narrow-leaved Geebung)	2.5	
<i>Lomatia silaifolia</i> (Crinkle Bush)	2.5	
Groundcovers	Plantings per 100m ² = 15	
<i>Entolasia stricta</i> (Wiry Panic)	3	
<i>Imperata cylindrica</i> var. <i>major</i> (Blady Grass)	3	
<i>Lomandra longifolia</i> (Spiky-headed Mat Rush)	3	
<i>Microlaena stipoides</i> (Weeping Rice Grass)	3	
<i>Themeda australis</i> (Kangaroo Grass)	3	

TABLE 2 (Cont.) SPECIES TO BE USED IN REVEGETATION WORKS REVEGETATION AREAS "G-PREFIX" Aquatic Corridor / Parkland		
PARKLAND		
Species		Total Number of Plants
Trees	Plantings per 100m² = 1	
<i>Eucalyptus resinifera</i> (Red Mahogany)	0.5	
<i>Eucalyptus robusta</i> (Swamp Mahogany)	0.5	
Shrubs	Plantings per 100m² = 2	
<i>Melaleuca sieberi</i>	0.5	
<i>Leptospermum polygalifolium</i> (Yellow Tea Tree)	0.5	
<i>Melaleuca thymifolia</i>	0.5	
<i>Leptospermum liversidgei</i>	0.5	
Groundcovers	Plantings per 100m² = 150	
<i>Entolasia marginata</i> (Bordered Panic)	50	
<i>Themeda australis</i> (Kangaroo Grass)	50	
<i>Panicum simile</i> (Two-coloured Panic)	50	
FRESHWATER EDGE		
Species		Total Number of Plants
Trees	Plantings per 100m² = 1	
<i>Eucalyptus resinifera</i> (Red Mahogany)	0.5	
<i>Eucalyptus robusta</i> (Swamp Mahogany)	0.5	
Shrubs	Plantings per 100m² = 15	
<i>Leptospermum polygalifolium</i> (Yellow Tea Tree)	5	
<i>Melaleuca thymifolia</i>	5	
<i>Leptospermum liversidgei</i>	5	
Groundcovers	Plantings per 100m² = 150	
<i>Paspalum distichum</i> (Native Water Couch)	50	
<i>Themeda australis</i> (Kangaroo Grass)	20	
<i>Lomandra longifolia</i> (Spiky-headed Mat-rush)	20	
<i>Dianella caerulea</i> (Blue Flax Lily)	20	
<i>Juncus usitatus</i> (Common Rush)	40	

TABLE 2 (Cont.) SPECIES TO BE USED IN REVEGETATION WORKS REVEGETATION AREAS "G-PREFIX" (Cont.) Aquatic Corridor / Parkland		
FRESHWATER BODY		
Species		Total Number of Plants
Waterplants	Plantings per 100m² = 100	
<i>Eleocharis sphacelata</i> (Tall Spike Rush)	20	
<i>Potamogeton crispus</i> (Curly Pondweed)	20	
<i>Triglochin microtuberosum</i> (Water Ribbons)	20	
<i>Ottelia ovalifolia</i> (Swamp Lily)	20	
<i>Vallisneria gigantea</i> (Ribbon Weed)	20	
SALINE SHORE		
Species		Total Number of Plants
Halophiles	Plantings per 100m² = 60	
<i>Juncus kraussii</i> (Sea Rush)	20	
<i>Sarcocornia quinqueflora</i> (Glasswort)	20	
<i>Spinifex sericeus</i>	20	

* Numbers may change subject to the existing on-ground presence of native trees, shrubs or groundcovers.




Plan for indicative purposes only not for detailed measurement. Subject site boundary subject to final survey.



conacher
environmental group

ABN: 62 274 841 042
PO Box 4300
78 York Street
East Gosford NSW 2250
Ph: (02) 4324 7888
Fax: (02) 4324 7899
cegconsult@bigpond.com

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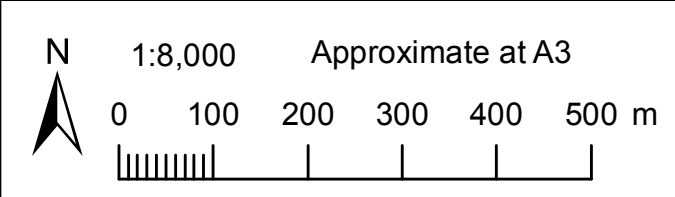
0 100 200 300 400 500 m

Approximate at A4

Original plan produced in A4 colour

Drawing No.	11118	Date	
Drawn By	DC	Date	01/12/11
Amendment		Date	
	A		
	B		
	C		

Figure 1.1
Site Management Zones
Riverside, Tea Gardens
Source: Cighton Properties 2011



Flora survey locations are approximate and have not been fixed by land survey. *Subject Site boundary subject to final survey.
Plan for indicative purposes only. Not for detailed measurement. Original plan produced in A3 colour

Future Revegetated Types

Subject Site Boundary	RA/A Aquatic / Dam Areas	RA/D Pasture with Scattered Trees	RA/G Woodland / Open Forest (E. umbra)
	RA/B Open Forest (E. microcorys)	RA/E Woodland (E. resinifera)	
	RA/C Open Forest (E. pilularis)	RA/F Woodland / Open Forest (E. robusta)	



ABN: 62 274 841 042
PO Box 4300
78 York Street
East Gosford NSW 2250
Ph: (02) 4324 7888
Fax: (02) 4324 7899
cegconsult@bigpond.com

By DC
16/12/10
Ref. No. 10122

Figure 2
Re-vegetation Areas
Riverside, Teagardens

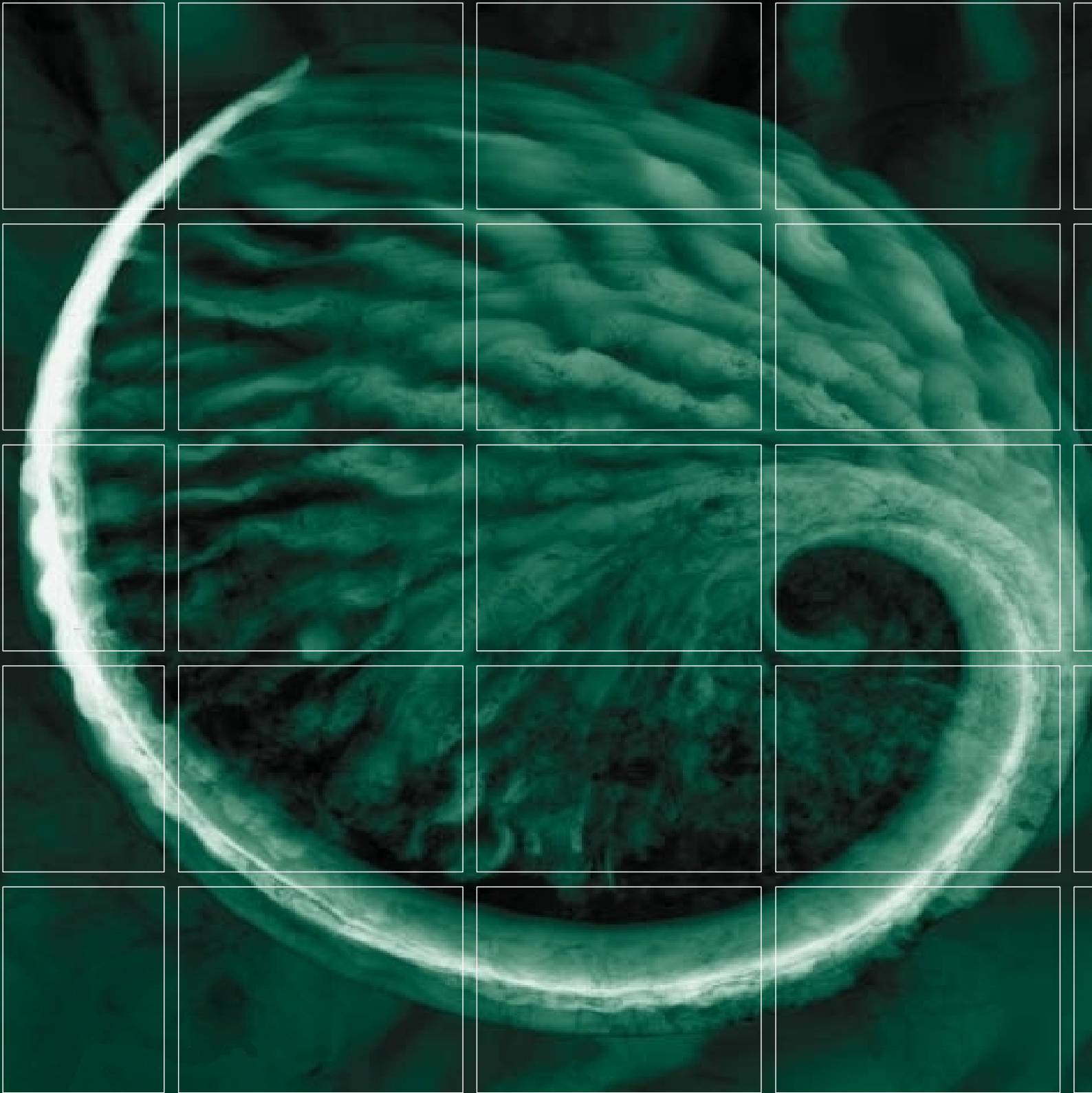
Source: Aerial © Department of Lands (2007)

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Annex C

Construction Noise Assessment



Riverside at Tea Gardens

Construction Noise Assessment

For Crighton Properties Pty Ltd


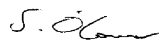
July 2008

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Prepared by:	<u>Oliver Muller</u>
Position:	<u>Senior Scientist - Acoustics</u>
Signed:	
Date:	<u>2 July 2008</u>
Approved by:	<u>Steve O'Connor</u>
Position:	<u>Project Director</u>
Signed:	
Date:	<u>2 July, 2008</u>

Environmental Resources Management Australia Pty Ltd Quality System

Riverside at Tea Gardens

Construction Noise Assessment

For Crighton Properties Pty Ltd

July 2008

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This report has been prepared in accordance with the scope of services described in the contract or agreement between Environmental Resources Management Australia Pty Ltd ABN 12 002 773 248 (ERM) and the Client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client and ERM accepts no responsibility for its use by other parties.

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1 CONSTRUCTION NOISE ASSESSMENT





1.1 INTRODUCTION

Noise emissions associated with bulk earth works, particularly in relation to the construction of the fresh stormwater quality management and detention ponds at the proposed Riverside Estate, Tea Gardens have the potential to impact on the acoustic amenity of several adjacent residential receptors.

ERM have completed an acoustical assessment to determine the extent of noise impacts associated with these construction activities. *Figure 1.1* presents a locality plan identifying the proposed stormwater quality management ponds. This assessment focuses on existing residences in the northern section of Leeward Circuit, Tea Gardens, as identified on *Figure 1.1*.

This assessment has been prepared with reference to the Department of Environment and Climate Change (DECC) NSW Industrial Noise Policy (INP, 2000) and the Environmental Noise Control Manual (ENCM).

Legend

-  Riverside at Tea Gardens Site Boundary
-  Proposed Stormwater Ponds
-  Attended Measurement Location (residence)
-  Assessed Distances of Construction Works

Source:

Crighton Properties - Concept Plan R.C.-03 October 2010

Suffix	Revisions	Date	Init
R0	Preliminary Issue	15-11-10	JD

Figure 1.1

Locality Plan

Client:	Crighton Properties Pty Ltd
Project:	Concept Plan 2010 Environmental Assessment Riverside at Tea Gardens - Noise Assessment
Drawing No:	0043707h_CP_EA_N_C001_R0.cdr
Date:	15/11/2010
Drawn by:	JD
Reviewed by:	OM
Scale:	Refer to Scale Bar



Maps and figures contained within this document may be based on third party data, may not be to scale and is intended for use as a guide only. ERM does not warrant the accuracy of any such maps or figures.

Environmental Resources Management Australia Pty Ltd
53 Bonville Avenue, Thornorton, NSW 2322
Telephone +61 2 4964 2150



A number of technical terms used in this report describe various noise levels. These terms are explained in *Table 2.1*.

Table 2.1 *Glossary of Terms*

Term	Description
ABL	Assessment Background Level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L_{90} statistical noise levels.
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(LinPeak)	The peak sound pressure level (not RMS) expressed as decibels with no frequency weighting.
L1	The noise level exceeded for 1 % of a measurement period.
L10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
L90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
Leq	<i>The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.</i>
Lmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment.
Temperature inversion	A positive temperature gradient. A meteorological condition where atmospheric temperature increases with altitude to some height.

The DECC's current guidelines for construction are described below and apply to residential receivers only:

3.1.1 Working Hours

The primary objective of the DECC is to limiting audible construction working hours to:

- Monday to Friday - 0700 hours to 1800 hours
- Saturday - 0800 hours to 1300 hours
- No work on Sundays or Public Holidays
- Noise Levels

To determine the likelihood of impact, the provide noise level based criteria. DECC guidelines set out methods for determining construction criteria associated with proposed developments. *Table 3.1* summarises the construction noise criteria with respect to the rating background noise level (RBL) based on duration that applies to nearest sensitive receivers.

Table 3.1 Construction Noise Goals

Construction Period	Acceptable LA10 Noise Level ¹
4 weeks and under	Background LA90 plus 20 dBA
4 weeks to 26 weeks	Background LA90 plus 10 dBA
Greater than 26 weeks	Background LA90 plus 5 dBA

For a cumulative period of exposure to noise from construction activity of up to four (4) weeks in duration, the LA10 (15minute) noise level emitted by the works, when measured at a residential receiver, should not exceed the LA90 (15minute) RBL by more than 20 dBA.

For a cumulative period of exposure to noise from construction activity of between 4 weeks and 26 weeks duration, the LA10 (15minute) noise level emitted by the works, when measured at a residential receiver, should not exceed the LA90 (15minute) RBL more than 10 dBA.

For a cumulative period of exposure to noise from construction activity in excess of 26 weeks duration, the LA10 (15minute) noise level emitted by the works, when measured at a residential receiver, should not exceed the LA90 (15minute) RBL by more than 5 dBA.

4.1 ATTENDED NOISE MONITORING RESULTS

To gain an understanding of the existing noise environment ERM conducted attended noise monitoring during calm clear weather conditions to ascertain dominate ambient noise sources and to quantify existing noise contributions. Fifteen minute noise measurements were undertaken using a Brüel and Kjær Type 2250 one-third octave integrating sound level meter (see results in *Table 4.1*). Calibration of the instrument was undertaken using a Brüel and Kjær type 4231 calibrator.

Table 4.1 *Attended Noise Survey Results - 4 April 2008*

Monitoring Location Time	Primary Noise Descriptor (dBA ref 20µPa)					Observations, Description of Noise Emissions (dBA)
	LAm _{ax}	LA ₁	LA ₁₀	LA _{eq}	LA ₉₀	
Opposite 52 Leeward Circuit, Tea Gardens 10:38 am	66	51	44	43	38	Distant Road Traffic (Myall Street) 30 to 40 Birds 36 to 48 Wind 37 to 40
1. Meteorological conditions at the time of the survey were calm and clear. (Temp 20°C, Wind Speed 2m/s NW)						

4.2 CONSTRUCTION NOISE CRITERIA

The construction phase of this project is expected to occur for a period of between 4 weeks and 26 weeks duration.

Therefore in accordance with the DECC guidelines, the construction noise goals are set to background plus 10 dBA (LA₉₀ + 10dBA). Therefore, the following noise criteria shown in *Table 4.2* for construction apply. It should be noted that the DECC rarely set noise limit based restrictions for construction sites. Therefore, the construction limits should be seen as an indicative goal for the development.

Table 4.2 **Construction Noise Goals (between 4 weeks to 26 weeks construction period)**

Location	Project Specific Noise Criteria L10(15minute)
All Receivers	48 dBA
1. Construction may only occur between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. For all other times construction noise must be inaudible at the receiver.	

5.1 PROPOSED CONSTRUCTION OPERATIONS

Several items of mobile construction plant and equipment are proposed to be used during construction of the stormwater management and detention ponds associated with the Riverside Estate.

The noise assessment calculated the received L10 noise levels at nearby sensitive receptors. It should be noted that this assessment has assumed that all plant and equipment operate simultaneously. In practice, such an operating scenario would be unlikely to occur and the results should therefore be considered conservatively high. Where relevant, modifying factors in accordance with Section 4 of the INP have been applied to calculations.

Table 5.1 presents the items of plant along with the overall sound power level (SWL) adopted in this assessment.

Table 5.1 Sound Power Levels (SWL) of Construction Plant

Proposed Mobile Items	Sound Power Level (dB(A))
CAT D9N Dozer	113
CAT 825 Compactor	110
Volvo A30 Haul Truck	105
Volvo A40 Haul Truck	105
CAT 631 Scraper	111
Komatsu PC300 Excavator	103
Komatsu PC450 Excavator	105

Note : Sound power levels were obtained from the ERM database of noise sources.

5.2 RESULTS

Construction noise impacts were assessed from two distances representing the near and far distances of construction positions of the stormwater quality/detention ponds from residences within Leeward Circuit, Tea Gardens. Results for both distances are represented as highest (at 40 metres) and lowest (at 280 metres), additionally, plant was assessed at the existing ground surface at the same level as nearby residences and when at lower levels when in the base of the proposed ponds (up to 3.5 m below current ground surface levels). The results of the assessment for both scenarios are presented in Table 5.2.

Table 5.2 *Calculated Construction Noise Emissions*

Receptor	Highest L10 Noise Impact dB(A)	Lowest L10 Noise Impact dB(A)	Construction Noise Criteria L10 dB(A)
Leeward Circuit, Tea Gardens.	76	45	48

Calculations of noise emissions associated with the construction of the Riverside stormwater quality/detention ponds identify that the construction noise criteria would be exceeded when plant items are stripping the surface soils, although would reduce significantly when are at lower depths within the lower areas of the proposed ponds. To minimise the potential acoustic impacts of construction activities on nearby residences, it is recommended that the management and mitigation activities (described in *Chapter 6*) be implemented as part of the construction process.

To minimise the impacts of construction noise emissions on nearby residences in Leeward Circuit, Tea Gardens during construction of the Riverside stormwater quality/detention ponds, it is recommended the following mitigation and management procedures be implemented:

- where practical, pushing topsoil or fill to form earth mounds between the construction site and residences during initial stripping. Barrier calculations identify that noise levels may be reduced by up to 15 dBA if a 3.5 metre earth mound is established between the sources and residences;
- where agreement can be reached negotiated agreements between developers and residents in close proximity to the proposed works should be established;
- where possible barriers should be placed nearest to plant and equipment to maximise barrier attenuation;
- maximise the offset distance between noisy plant items and nearby noise sensitive receivers;
- avoiding any coincidence of noisy plant working together in close proximity simultaneously near to sensitive receivers;
- minimising the occurrence of consecutive days works in the same locality;
- orienting noisy plant or equipment away from sensitive areas;
- carrying out loading and unloading away from noise sensitive areas, if loading near sensitive receivers acoustic enclosures or barriers of a suitable height should be constructed to minimise the noise impacts;
- where noise complaints arise, monitor construction noise levels to quantify potential impact at most sensitive residences; and
- the contractor must take reasonable steps to manage and control noise from all plant and equipment. Examples of appropriate noise management and control may include installation of acoustic silencers, low noise mufflers and alternatives to reversing alarms.

CONCLUSION

ERM has completed a noise impact assessment for the proposed construction activities associated with of proposed stormwater quality management ponds adjacent to residence situated in Leeward Circuit, Tea Gardens, NSW.

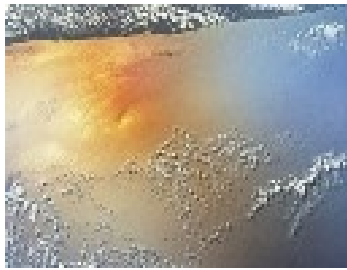
Noise levels associated with construction are likely to be above the relevant construction noise criteria during initial stages, although when operations are at lower levels within the proposed ponds noise levels would reduce significantly. To minimise impacts on residences during construction, management and mitigation strategies provided in this assessment would significantly reduce impacts on nearby residences.

REFERENCES

Environment Protection Authority of NSW (1994), Environmental Noise Control Manual (ENCM).

Environment Protection Authority of NSW (January 2000), Industrial Noise Policy.

ERM consulting services worldwide www.erm.com



Environmental Resources Management Australia

53 Bonville Ave

Thornton NSW 2322

Telephone (02) 4964 2150

Facsimile (02) 4964 2152

Annex D

Acid Sulphate Soil Management Plan

**PROPOSED SUBDIVISION -
RIVERSIDE ESTATE PROJECT
APPLICATION AND CONCEPT PLAN
AREA, TEA GARDENS
ACID SULFATE SOIL MANAGEMENT
PLAN**

Tattersall Lander Pty Ltd

GEOTWARA21006AB-Appendix C
4 April 2011

4 April 2011

Tattersall Lander Pty Ltd
PO Box 54
RAYMOND TERRACE NSW 2324

Attention: Bob Lander

Dear Bob

**RE: PROPOSED SUBDIVISION
RIVERSIDE ESTATE PROJECT APPLICATION AND CONCEPT PLAN AREA
TEA GARDENS
ACID SULFATE SOIL MANAGEMENT PLAN**

Please find enclosed an acid sulfate soils management plan for the above project.

If you have any questions regarding this matter please contact the undersigned.

For and on behalf of Coffey Geotechnics Pty Ltd.



Arthur Love

Principal Geotechnical Engineer

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Important Information About Your Coffey Report

Figures

Figure 1: Test Pit / Borehole Location Plan

1 INTRODUCTION

As requested Coffey Geotechnics Pty Ltd (Coffey) has prepared an Acid Sulfate Soil (ASS) Management Plan for earthworks associated with the proposed Riverside Estate Project Application and Concept Plan area development, Tea Gardens.

The ASS Management Plan has been prepared using field and laboratory test results reported in Coffey Report No. GEOTWARA21006AB-AA, dated 4 April 2009.

2 SITE CONDITIONS

The site is located at Tea Gardens, on the New South Wales mid north coast, within the Great Lakes Council local government area. The site is bounded by Toonang Drive and an existing residential subdivision to the north, undeveloped low lying land adjoining the Myall River to the east, the recently constructed Myall Quays Estate to the south and Myall Way to the west.

The total site area is 222.5 ha and comprises the proposed development over approximately half of this area within a concept plan application.

Topographically the site is located on a low sand plain. The site is flat to slightly sloping and is subject to prolonged water logging during periods of wet weather. Surface elevations across the site range from about RL0.75m AHD in the south eastern corner of the site to about RL5m near the northern site boundary.

The majority of the site has been cleared, with vegetation comprising an established cover of medium to tall grasses and scattered medium sized eucalypts.

Geologically, the site is located within a region of windblown sand deposits probably of Pleistocene age (i.e. greater than 20,000 years old). The subsurface profile encountered in Coffey's report referenced above revealed four material types:

- TOPSOIL – Silty Clayey SAND, Silty SAND and Silty CLAY / Silty Sandy CLAY, root affected;
- CLAY – A discontinuous layer of Sandy CLAY, CLAY and Clayey SAND, typically encountered to a maximum depth of <2.0m;
- SAND – fine to medium grained, pale grey to white, pale grey brown, grey brown and dark brown;
- INDURATED SAND – Clayey SAND and Silty SAND, fine to medium grained, dark brown, pale brown and orange brown.

Groundwater or groundwater inflows were encountered at depths of between 0.3m to 2.3m.

Test pit and borehole locations are shown on Figure 1.

3 PROPOSED DEVELOPMENT

The proposed Riverside Estate Project Application is understood to involve the subdivision of the site into a total of 390 dwellings, including dual occupancy dwellings and small lot / medium density development and construction of associated subdivision roads.

The proposed Riverside Estate Concept Plan area is located to the north and north east of the Riverside Estate Project Application and is understood to involve the subdivision of the site. Development of residential lots will involve filling to raise surface levels above a minimum requirement of RL 2.1m AHD. Excavations proposed as part of the development are associated with the creation of numerous drainage basins and will be to a minimum level of RL-2.7m AHD, involving excavation up to a maximum depth of about 5m.

Plans showing the extent, depth and volume of proposed excavations are attached to Coffey's report referenced above.

4 PRESENCE OF ACID SULFATE SOILS

Acid sulfate soils (ASS) are soils which contain significant concentrations of pyrite which, in the presence of sufficient moisture, oxidises when exposed to oxygen, resulting in the generation of sulfuric acid. For the purposes of assessment, potential ASS are indicated by $pH < 3$ upon oxidation in hydrogen peroxide or laboratory test results which exceed a range of Action Criteria presented in the ASS Assessment Guidelines.

Engineering logs of test pits and boreholes are presented in Appendix A of Coffey's report referenced above. The results of screening tests and laboratory SPOCAS / SCR technique analysis are presented in Appendix B of the same report.

Laboratory test results for samples sent for SPOCAS / SCR technique analysis are summarised in Table 1. These results indicate that some samples tested from both the clay layer and sands show low ASS potential and that their occurrence across the site is sporadic.

TABLE 1 – SUMMARY OF ASS TEST RESULTS

TEST LOCATION	SAMPLE DEPTH (m)	GEOTECH. UNIT	SCREENING TEST RESULT		S _{POS} / S _{CR} (%)	TPA / NET ACIDITY (mol H ⁺ / tonne)
			pH _F	pH _{FOX}		
TP6	2.0 – 2.1	UNIT 3	4.94	4.06	0.02	16
TP14	0.6 – 0.7	UNIT 2	5.20	3.26	0.14	84
TP19	0.5 – 0.6	UNIT 2	4.96	3.70	0.08	49
TP25	1.9 – 2.0	UNIT 4	4.36	3.26	0.12	76
TP26	1.5 – 1.6	UNIT 3	4.71	2.60	<0.02	<10
TP27	1.1 – 1.2	UNIT 3	4.47	3.35	0.03	21
TP28	0.6 – 0.7	UNIT 4	4.95	3.55	0.08	53

PROPOSED SUBDIVISION - RIVERSIDE ESTATE PROJECT APPLICATION AND CONCEPT PLAN AREA, TEA GARDENS
ACID SULFATE SOIL MANAGEMENT PLAN

TEST LOCATION	SAMPLE DEPTH (m)	GEOTECH. UNIT	SCREENING TEST RESULT		S _{POS} / S _{CR} (%)	TPA / NET ACIDITY (mol H ⁺ / tonne)
			pH _F	pH _{FOX}		
TP30	1.5 – 1.6	UNIT 3	5.25	2.81	0.09	58
TP32	1.6 – 1.7	UNIT 2	6.40	1.43	0.13	84
TP33	1.1 – 1.2	UNIT 2	6.34	1.45	0.12	77
TP34	1.0 – 1.1	UNIT 2	6.35	1.36	0.19	117
BH36	0.5 – 1.0	UNIT 3	5.03	4.24	0.04	26
BH36	3.5 – 4.0	UNIT 3	5.75	3.26	<0.02	11
BH37	0.5 – 1.0	UNIT 3	5.85	4.67	0.02	14
BH37	2.0 – 2.5	UNIT 3	5.55	3.92	0.07	44
BH37	5.0 – 5.5	UNIT 4	5.83	3.27	0.15	93
BH37	6.5 – 7.0	UNIT 4	5.73	3.07	0.17	104
BH38	0.5 – 1.0	UNIT 2	5.19	4.20	0.24	147
BH38	6.5 – 7.0	UNIT 3	5.63	4.26	<0.02	11
TP39	1.0 – 1.1	UNIT 2	6.75	3.86	0.006	56
TP40	1.5 – 1.6	UNIT 3	5.90	4.73	<0.005	9
TP41	0.5 – 0.6	UNIT 2	5.20	3.86	<0.005	39
TP42	1.0 – 1.1	UNIT 2	5.25	4.19	0.007	37
TP43	1.7 – 1.8	UNIT 3	5.83	5.18	<0.005	7
BH45	5.5 – 5.9	UNIT 3	6.17	4.80	0.011	22
BH46	1.0 – 1.1	UNIT 3	6.57	2.28	0.028	20
BH46	2.5 – 3.0	UNIT 3	6.70	4.38	0.016	18

TEST LOCATION	SAMPLE DEPTH (m)	GEOTECH. UNIT	SCREENING TEST RESULT		S _{POS} / S _{CR} (%)	TPA / NET ACIDITY (mol H ⁺ / tonne)
			pH _F	pH _{FOX}		
BH46	5.5 – 6.0	UNIT 3	7.68	5.33	0.013	10
ASSMAC Action Criteria	-	-	-	-	0.1* 0.03**	62* 18**
Levels of Concern for Screening Test	-	-	4	3	-	-

NOTE:

* Action criteria shown are those for fine textured soils (ie clays) and management of excavations involving disturbance of less than 1000 tonnes of soil;

** Action criteria shown are those for coarse textured soils (ie sands) and management of excavations involving disturbance of more than 1000 tonnes of soil;

S_{POS} – Percentage of oxidisable Sulfur;

S_{CR} – Percentage of chromium reducible Sulfur;

TPA – Total Potential Acidity.

Based on the results shown in Table 1, expected acid generation rates for oxidation of sand and clay are summarised in Table 2, together with ratios of lime which would be required to neutralise the effects of acid production.

TABLE 2 – SUMMARY OF POTENTIAL ACID GENERATION RATES

MATERIAL	SAND	CLAY
ACID GENERATION (kgH ₂ SO ₄ /tonne)		
Maximum	5.2	7.4
Minimum	1.0	1.8
Mean*	2.5	3.8

MATERIAL	SAND	CLAY
LIME RATIOS** (kg/tonne)		
Maximum	7.8	11.1
Minimum	1.5	2.7
Mean*	3.8	5.7

NOTES:

* - Arithmetic mean value, not weighted to take into account expected volume or mass;

** - Based on a factor of safety of 1.5.

Assuming a bulk density of 1.8 tonne/m³ in the sands and 1.6 tonne/m³ in the clays, the neutralisation treatment of the sand and clay would require an average of 7kg lime/m³ and 9kg lime/m³.

5 PROPOSED CONSTRUCTION METHOD

In summary the proposed development involves filling of residential lots and associated roads and excavating numerous drainage basins. It is understood that excavations are proposed to be carried out in the dry. Dry excavation is preferred over dredging for the following reasons:

- A cutter suction dredge would have difficulty achieving the required batters;
- Local contractors are more experienced in dry excavation;
- Previous excavations on the adjoining Myall Quays Estate were constructed in the dry;
- The costs of excavation in the dry are much lower than dredging;
- The dry excavation could be carried out more quickly and efficiently;
- Dry excavation allows visible recognition of clay during excavation, promoting easier separation and treatment.

A shallow excavation of about 0.9m maximum depth and 60m³ volume associated with a proposed extension of an existing outlet drain is also proposed immediately to the south of the site. This excavation is located adjacent to an existing saline lake that was previously excavated as part of the adjoining Myall Quays Estate development.

Construction works will be staged and will comprise the creation of drainage basins and branches initially as indicated on the Tattersall Lander's Construction Activity Staging Plan attached to Coffey's report referenced above. The duration of the works is not known, however based on previous experience construction of each of the larger drainage basins is expected to take less than about two months.

6 BASIS OF MANAGEMENT PLAN

6.1 Acid Sulfate Soils (ASS) Issues

The proposed method of construction raises the following ASS related issues that need to be addressed:

- The oxidation of potential ASS exposed in the excavation spoil;
- The oxidation of potential ASS exposed on the walls of the excavation;
- Possible oxidation of potential ASS within the dewatering zone;
- Migration of ASS impacted groundwater from the dewatering zone to off site receptors;
- Disposal of possibly ASS affected leachate and excavation water.

6.2 ASS Management Rationale

The majority of excavated spoil is expected to comprise sands, however clays will also be excavated in some areas. Sands are more readily workable from an engineering perspective and are more easily treated by the addition of lime from an ASS neutralisation perspective than clays. For this reason, it is understood that sands are proposed to be reused as fill and clays are proposed to be disposed of on site below the water table, hence preventing exposure and oxidation. This was also the rationale used during construction of the adjoining Myall Quays Estate.

It is therefore proposed to excavate sands from a suitably located on site borrow and disposal area to sufficient depth to provide adequate storage volume below the water table for disposal of clays encountered. The sand excavated from the proposed disposal area could then be treated with lime and reused as fill material.

Short term oxidation of ASS exposed at the face of the excavation is generally confined to that soil located within a few millimetres of the excavation face. The thickness of the oxidation zone varies, being generally thinner in clays than sands. The oxidation and acidification process is not completely understood but it is known that the process does not occur instantaneously in natural conditions, instead requiring some time. Therefore, significant acid production from the potential ASS at the face of excavations is not likely to occur during the expected construction timeframe. It is considered that the small amount of acid generation which would be expected to occur could be managed by pH monitoring at the face of the excavation with a standby supply of lime provided to allow implementation of contingency measures should unacceptable monitoring results occur.

Other potential ASS within the dewatering zones would be overlain by at least 0.5m of soil cover and are considered unlikely to oxidise to a degree that would produce acid sulfate conditions within the proposed construction timeframe. This risk can be managed by monitoring of groundwater and surface water pH during construction.

The dewatering process will lower the water table in the excavation areas and this will have the effect of drawing surrounding groundwater towards the excavation during construction. Off site migration of groundwater during construction is therefore not expected during the works.

7 ACID SULFATE SOIL MANAGEMENT PLAN

7.1 Preventing Oxidation of ASS

This method of management will apply to clays excavated from proposed detention basins and involves disposal of the material back into an anaerobic environment (below RL 0m AHD) within proposed drainage reserve areas. The spoil will be carted directly from excavation to disposal. The clay will probably excavate as large blocks, which retain the shape of the excavator bucket on disposal. Attempts will be made to achieve some degree of light compaction such as pressing the material down with an excavator bucket to reduce the occurrence of large voids, thereby reducing potential for oxidation during the construction process and also avoiding excessive bulking and subsequent settlements. It is anticipated that bulking of the order of 20% would occur due to the loose dumping of the material into the excavation and a bulking factor of at least 20% to 30% will be allowed for in estimating the volume required for clay ASS disposal.

7.2 Neutralisation by Lime

This method will apply to sands excavated from below the water table. Sands should be taken directly from the excavation to the placement site and spread in layers not more than 300mm thick. Lime should be spread over each layer immediately after placement and be thoroughly mixed through the sand using a rotary hoe or similar. The liming should be confined to areas of a manageable size (maximum 1 ha). Fill placement and liming areas should be bunded to allow collection of all leachate and stormwater runoff until test results indicate acceptable levels of neutralisation have been achieved. The collected water should be pumped to a treatment pond as discussed in Section 7.4 of this plan.

Good quality fine agricultural lime should be used. Based on the results of SPOCAS / SCR technique analysis it is recommended that sands be treated with lime at a rate of between 1.5kg/tonne to 8kg/tonne. This quantity of lime includes a factor of safety of 1.5 to take into account the rate of lime reactivity and the possibility of inhomogeneous mixing. Liming ratios should be confirmed by testing and monitoring at the time of construction. The limed sand may impact on future plant growth and it is recommended that a capping of topsoil be placed over this sand for landscaping purposes.

7.3 Management of Stockpiles

The proposed work program should avoid the necessity to stockpile potential ASS. If circumstances are such that stockpiling becomes necessary, temporary stockpiles should be located in specific approved areas and fully bunded to allow collection and control of leachate. Leachate collected in the bund should be monitored for pH levels and should be pumped to a treatment pond to be neutralised prior to release. Stockpiles should be shaped to minimise the exposed surface area and promote runoff rather than infiltration of rainwater. Bunds are to be constructed from non-ASS material.

7.4 Neutralisation of Leachate and Excavation Water

All leachate from bunded areas, water collected from inflows into excavations and stormwater collected from the excavation and stormwater collected from excavation areas is to be collected and pumped to treatment ponds. Once acceptable water quality is achieved, the treated water will be released. It is anticipated that the short time frame of the works and the construction management practices discussed in this document should result in low concentrations of acid leachate requiring treatment.

The method of neutralisation is either to add lime as a slurry to the water within the treatment pond (depending on the salinity of the water to be treated) or to use a mechanical lime spreader to spread lime over a 25m semi circle close to the inlet point of the treatment pond.

The preferred method of neutralisation should be confirmed once salinity of the water can be assessed from background data collected. The addition of lime should be carried out in conjunction with monitoring to avoid achieving excessively high pH levels. The quality of the water to be finally discharged must meet appropriate guidelines for release to the wetland. These guidelines should be based on statistical evaluation of background water quality data. The size of treatment ponds should be designed to accommodate expected flows from dewatering, excavation inflow and stormwater runoff likely to occur over the period of excavation.

7.5 Monitoring Program

Monitoring will be required in the following areas:

- In each layer of neutralised fill;
- In excavations;
- In treatment ponds.

7.5.1 Fill Monitoring

Field monitoring of the pH of each layer of completed fill will be required and is to be initially supplemented with a minimum of one standard ASS laboratory test per 1000m³ of fill placed, with the rate of testing reduced once greater confidence in correlations between field and laboratory test results is achieved. Testing will be required to produce Total Potential Acidity (TPA) results of zero, or indicating a small amount of excess lime. Laboratory results indicating soil layers containing up to 0.5kg H₂SO₄/tonne would be acceptable provided the subsequent layer produces an excess lime result to avoid a cumulative TPA build up.

No layer of fill is to be covered by a subsequent layer until field screen tests indicate that the minimum soil acidity level has been achieved.

As a guide during construction, field screening tests should be carried out on the fill placed on the site to check for ASS conditions in accordance with methods 21Af and 21Bf of Reference 2.

7.5.2 Excavation Monitoring

The soils exposed in the walls and floor of the excavation should be checked daily for the generation of acid conditions, using an approved field pH screening test. Lime should be added to the exposed surface of the excavation if values of less than pH 4 occur. Water collected in the excavation should also be checked for indications of acid production occurring within the dewatering zone. Contingency measures should be put in place in accordance with Section 7.6 of this plan if water pH values of less than pH 4 occur.

7.5.3 Water Quality Monitoring

Recording of water entering and leaving the proposed treatment pond must be implemented. The following information should be recorded:

- Flow and pH measurements of water pumped into the treatment pond;
- Flow and pH measurements of water discharged from the site as well as general water quality parameters including turbidity, TDS, salinity, chloride / sulfate ratio, aluminium, iron.

Water pumped into the pond will include dewatering pump water, stormwater collected over the construction area, seepages collected in the excavation and leachate collected from the unfinished areas of fill. The pH of the discharged water should be within the range of pH 6 to pH 9 or otherwise within two pH points of the background pH of the receiving water body.

Prior to discharge, laboratory testing should be carried out on water samples, with the testing suite based on the water quality monitoring program carried out in surrounding water bodies. The results should be statistically evaluated against background water quality. Background water quality parameters therefore need to be established prior to the work, as direct comparison against environmental guidelines might be misleading if existing water quality does not compare favourably with such guidelines. The water quality in surrounding water bodies should also be monitored during construction, with the results statistically evaluated against background levels to assess the need for further action.

7.5.4 Contingency Measures

Soil acidity in the completed fill layers will be monitored. Should the field pH tests and the laboratory tests (initially one lab test per 1000m³) show that the soil acidity has not achieved the minimum required standard, then that layer must be reworked and additional lime treatment carried out until it is verified that the layer comes up to the required standard. No layer of fill is to be covered by a subsequent layer until the field screening tests indicate that the minimum soil acidity level has been achieved.

If monitoring of the water in the ponds at the point of discharge indicates the pH is below acceptable discharge limits then discharge from the ponds must immediately cease and further treatment be carried out. Monitoring of leachate entering the ponds is to be carried out to detect discharges of acid leachate to the ponds, in which event the lime neutralisation of the leachate should occur in isolation tanks or small ponds before discharge back into the main pond.

In the event that pH measurements of exposed soils in the excavation does not meet required levels, lime shall be spread over the affected area and the pH levels monitored.

Sufficient lime is to be stored in a dry location on site to permit the immediate implementation of the above contingency measures. Lime should be stored adjacent to the treatment ponds, excavations and fill areas.

It is recommended that the works be carried out in the presence of a suitably qualified environmental consultant who can document the procedures carried out and assist with the monitoring and implementation of contingency measures during the works.

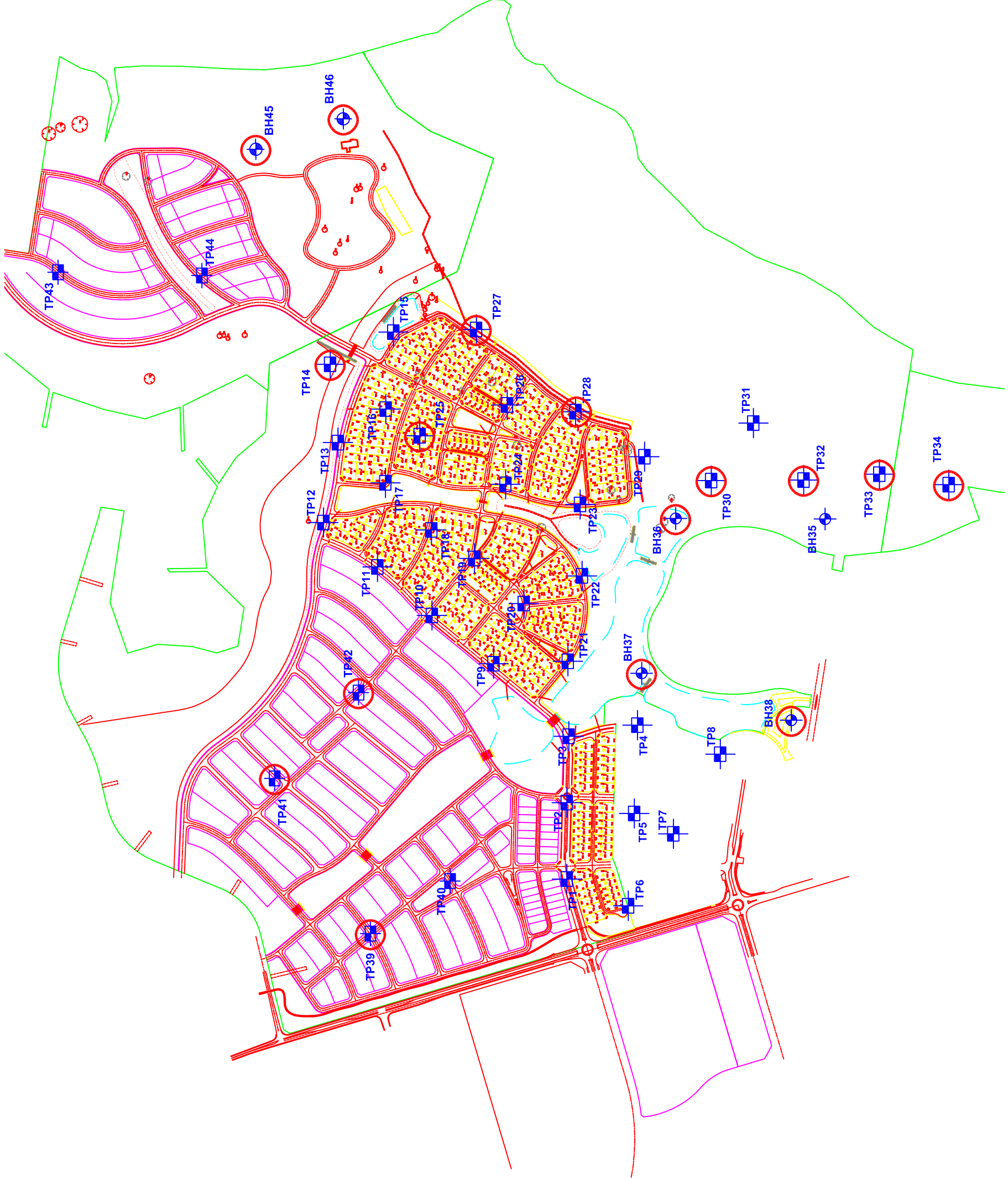
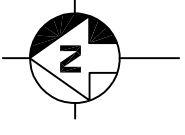
For and on behalf of Coffey Geotechnics Pty Ltd



Arthur Love

Principal Geotechnical Engineer

Figures



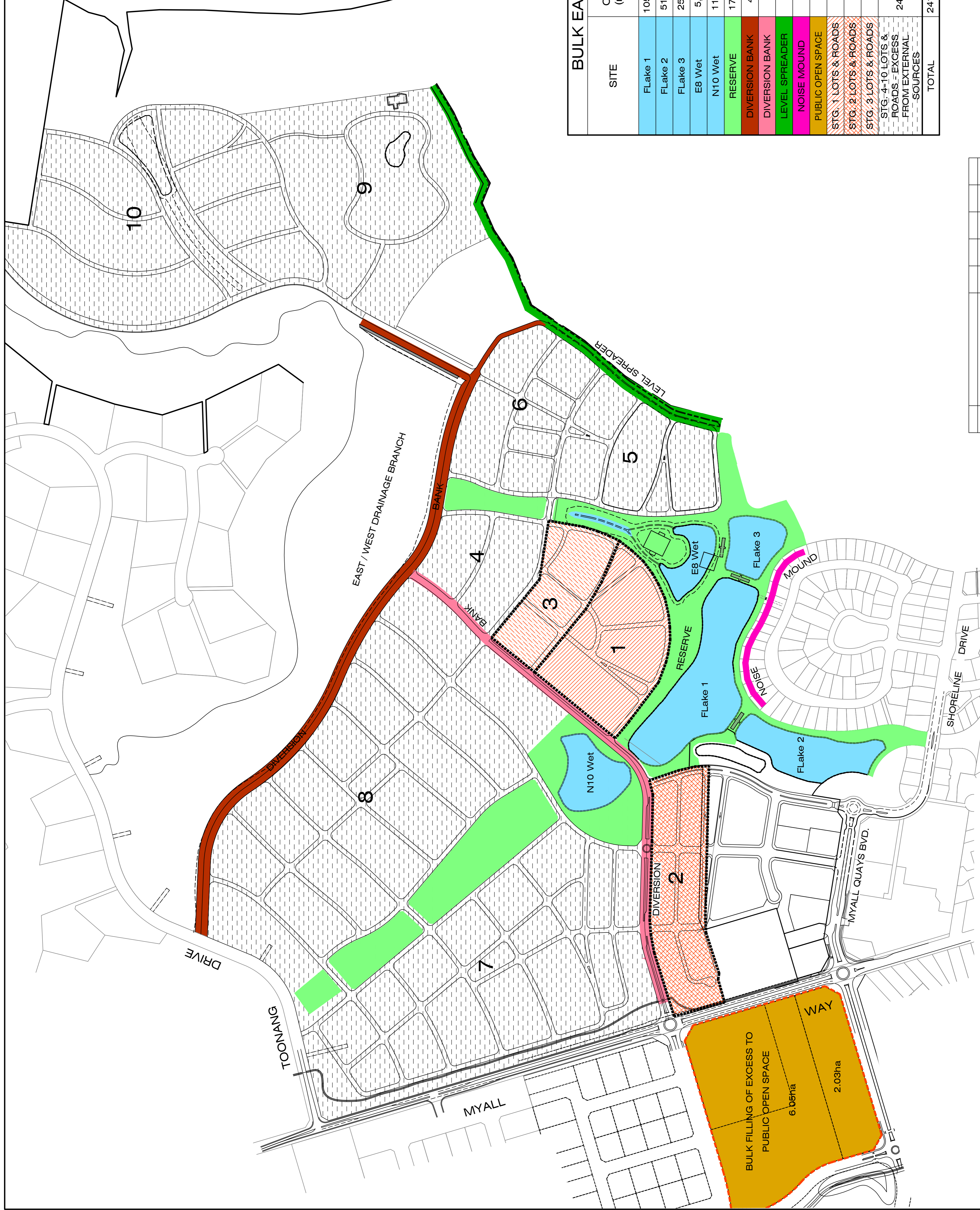
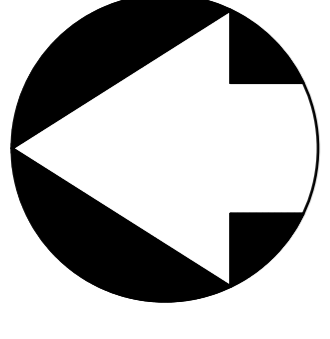
LEGEND

- APPROXIMATE TEST PIT LOCATION
- APPROXIMATE BOREHOLE LOCATION
- POTENTIAL ASS ENCOUNTERED

revision									 Scale (metres)	approved date scale original size	NLS <i>ABL</i> 05-04-11 1:8000 A3	 SPECIALISTS MANAGING THE EARTH	client:	TATTERSALL SURVEYORS PTY LTD
							project:	PROPOSED SUBDIVISION RIVERSIDE ESTATE PROJECT APPLICATION AND CONCEPT PLAN AREA, TEA GARDENS						
							title:	TESTPIT/BOREHOLE LOCATION PLAN						
							project no:	GEOTWARA21006AB figure no: 1						

Annex E

Bulk Earthworks Plan



SITE	CUT (m³)	FILL (m³)	NETT EARTHWORKS (m³)
Flake 1	105,750	0	105,750
Flake 2	51,170	0	51,170
Flake 3	25,750	0	25,750
E8 Wet	5,100	0	5,100
N10 Wet	11,650	0	11,650
RESERVE	17,180	14,250	2,930
DIVERSION BANK	450	28,300	-27,850
DIVERSION BANK	0	17,680	-17,680
LEVEL SPREADER	0	12,200	-12,200
NOISE MOUND	0	9,000	-9,000
PUBLIC OPEN SPACE		38,000	-38,000
STG. 1 LOTS & ROADS	0	30,500	-30,500
STG. 2 LOTS & ROADS	0	27,900	-27,900
STG. 3 LOTS & ROADS	0	34,200	-34,200
STG. 4-10 LOTS & ROADS - EXCESS FROM EXTERNAL SOURCES	24,350	390,370	-366,020
TOTAL	241,400	602,400	-361,000

REV	DESCRIPTION	DATE	BY	CHECKED	DATE		
B	Revised Development Footprint	2/12/11	BL*				
A	Original Issue	24/11/11	AV	AV			
REV	DETAILS OF AMENDMENT		DISIGNED	DRAWN	CHECKED	APPROVED	DATE

BULK EARTHWORKS PLAN

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Environmental Resources Management

PO Box 71
Thornton NSW 2322
53 Bonville Avenue
Thornton NSW 2322

T: +61 2 4964 2150
F: +61 2 4964 2152
www.erm.com

