

Elaine Engelbrecht

From: Howard Aaron <ahoward@penrithcity.nsw.gov.au>
Sent: Tuesday, 18 November 2014 10:24 AM
To: Elaine Engelbrecht
Subject: RE: 9892 Jordan Springs Village 13
Attachments: 18112014092553.pdf

Hi Elaine,

Please find attached the DA fee quote for 1 into 51 lot subdivision of **Lot 21** DP 1194338.

In addition to the attached fee quote, 2x separate \$320 cheques are required (1x addressed to the NSW Rural Fire Service and 1x to the NSW Office of Water).

You will also notice the attached fee quote includes 'subdivision without new road' – this is not an error. Road/Civil works have been considered in the total cost of works.

Can you please bring in the attached quote when lodging the application to ensure an efficient lodgement process.

Regards,

Aaron Howard
Environmental Planner

E ahoward@penrithcity.nsw.gov.au
T (02) 4732 7774 | F (02) 4732 7958 |
PO Box 60, PENRITH NSW 2751
www.penrithishere.com.au
www.penrithcity.nsw.gov.au

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From: Elaine Engelbrecht [<mailto:EEengelbrecht@jwprince.com.au>]
Sent: Friday, 14 November 2014 9:37 AM
To: Howard Aaron
Cc: Andrew Taylor
Subject: 9892 Jordan Springs Village 13

Aaron,

Please find attached the summary of housing and civil work costs for the proposed 1 into 51 lot subdivision of Lot 22 DP 1194338.

Also attached is a copy of the proposed subdivision plan.

Would you kindly advise Penrith City Council's DA fee for this application?

Housing Cost (ex gst):	\$9,474,245.36
Civil Works (ex gst, includes BEW, roads & drainage):	\$713,933.00
Total Cost:	<u>\$10,188,178.36</u>

If you require any further information to calculate this fee, please do not hesitate to contact us at your convenience.

Elaine Engelbrecht – Project Management Administrator

J. WYNDHAM PRINCE

CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS

P 02 4720 3303 **F** 02 4721 7638 **W** www.jwprince.com.au
580 High Street, Penrith NSW
PO Box 4366 PENRITH WESTFIELD 2750

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Elaine Engelbrecht

From: Howard Aaron <ahoward@penrithcity.nsw.gov.au>
Sent: Tuesday, 25 November 2014 1:05 PM
To: Elaine Engelbrecht
Subject: RE: 9892 Jordan Springs Village 13

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Elaine,

If you wish to forward this on:

- 4 hard copies of all plans and documentation (1x file, 1x stamping, 2x exhibition)
- 4 digital copies of all plans (1x records, 1x NSW RFS, 1x NSW Office of Water, 1x RMS)

Tried to minimise down as much as possible and that's the best we can do. Again just bring this email in when
going in case I am not on counter duty.

Regards,

Aaron Howard
Environmental Planner

E ahoward@penrithcity.nsw.gov.au
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From: Elaine Engelbrecht [<mailto:EEngelbrecht@jwprince.com.au>]
Sent: Tuesday, 25 November 2014 12:04 PM
To: maroun@planmaster.com.au
Cc: Andrew Taylor; Howard Aaron
Subject: 9892 Jordan Springs Village 13

Maroun,

I have spoken with Aaron Howard of Penrith City Council querying the number of copies of plans that we will need to supply them with when we submit the Development Application.

At this stage, I am awaiting a response and will contact you as soon as I have an answer.

Regards

Elaine Engelbrecht – Project Management Administrator

J. WYNDHAM PRINCE

CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS

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21th November 2014

Attention: Maroun Hachem
Planmaster Design Consultants
For Ancon Homes
Unit 2 , 5 McCormack St
ARNDELL PARK, NSW 2148

Dear Maroun,

The design plans for your new homes in Village Centre Subdivision are now stamped and ready for submission to Penrith City Council or your Certifier on the following conditions:

- Lot 13 – Bed 2 western wall requires a highlight window 2.5 – 3m in length to address secondary frontage. Master bedroom requires a window to western wall to address secondary frontage.
- Lot 15 – Private open space does not comply for this design. Re-design of home to provide entry off Greenwood Parkway and private open space at the rear to comply is required. Re-design of plan is to be submitted to Lend Lease for review prior to submission of plans to Council or Certifier. No private open space fencing to Greenwood Parkway.
- Lot 18 - Glazing is required to the ground floor of this home on the front façade. Stairs must be arranged in a way that will allow for vertical window to be provided from first floor to halfway down ground floor. No private open space fencing to Greenwood Parkway.
- Lot 19 - Private open space does not comply for this design. Re-design of home to provide entry off Greenwood Parkway and private open space at the rear to comply is required. Re-design of plan is to be submitted to Lend Lease for review prior to submission of plans to Council or Certifier.
- Lot 33 - Private open space does not comply for this design. Use redesign of same house on Lot 15 * Lot 19 for this lot and ensure private open space complies. *Remove 'Greenwood Parkway' from site plan.*
- Lot 41 – Stairwell window to the western elevation is to be extended to include an additional panel. A vertical window to the western façade of the Bed 4 as shown on marked up plans.

LANDSCAPE PLAN AMENDMENTS:

- Front fencing to Lakeside Pde to be 1.2m high masonry pier and base fencing with horizontal aluminium slat infill to match existing on Lakeside Pde. Masonry pier and base to be 360mm. Amend plan and detail accordingly.
- Secondary fencing to Lot 1 is to finish just after laundry door and is to be shown and noted as secondary frontage fencing with a detail of the masonry pier and base fencing with horizontal slat infill shown on landscape plan. Amend plan accordingly.
- All rear Lysaght fencing on dual frontage lots is to be set in 1m from the rear boundary and is not be level with garage.
- Secondary fencing on Lot 13 & Lot 16 is to be amended in length to reflect marked up plan and must be clearly noted as secondary fencing with standard secondary fencing detail provided.
- Lot 15 landscaping and fencing is to be amended to suit new home design on this lot. No private open space fencing is permitted to Greenwood Parkway on this lot.
- Lot 19 landscaping and fencing is to be amended to suit new home design on this lot. No private open space fencing is permitted to Greenwood Parkway on this lot.
- Lot 33 landscaping and fencing is to be amended to suit new home design on this lot.

- All internal Lysaght fencing on lots including those fronting Greenwood Parkway are to be set back to a minimum of 7.5m from the front boundary or 2m behind the adjacent façade. Amend plans accordingly.
- A planting strip is required to be provided for the full length of the front boundary on Lots 21, 22 & 51.
- Show secondary fencing on Lot 25 and provide detail.
- Secondary frontage fencing to northern boundary of Lot 26 is to be removed. Side gate only to be provided 7.5m from northern boundary.
- Secondary fencing on lot 34 is to shown as secondary fencing symbol not Lysaght symbol and detail provided.

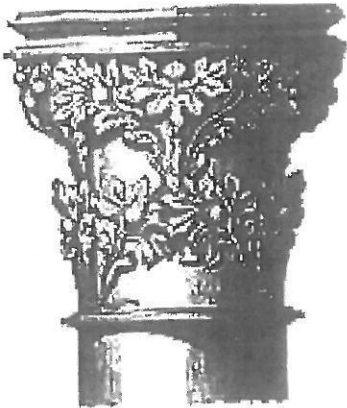
We thank you for your efforts to date in working with the team at Jordan Springs to deliver a scheme that responds positively to the design guidelines for Jordan Springs and look forward to seeing the subdivision completed.

If I can be of any further assistance throughout the approval process please feel free to contact me at any time.

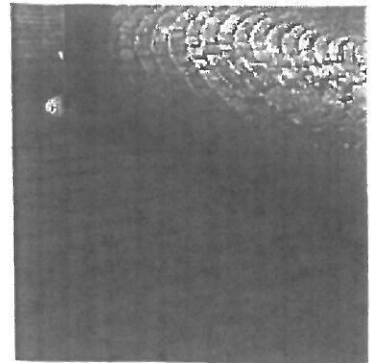
Yours sincerely,



Rebecca Minney
Design Coordinator, Jordan Springs



General Housing Specifications



ADDRESS OF PROPERTY:

Lakeside Parade Jordan Springs
Village 13

GENERAL HOUSING SPECIFICATIONS BETWEEN:

OWNER:

Ancon Development Group P/L

AND

CONTRACTOR:

Ancon Development Group P/L

CONTRACTOR LICENCE NO:

140 758C

Initials _____ / _____

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GENERAL HOUSING SPECIFICATION
(NSW version revised October 2010)

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1.0 INTRODUCTION

1.1 General

This Specification forms part of the Contract documents referred to in the building Contract and details the works to be executed and the materials to be used in carrying out those works at the site.

This Specification shall be read as a general specification only. The extent of the works shall be governed by the approved plans and other requirements under the contract.

Any works not fully detailed shall, where appropriate, be sufficiently performed if carried out in accordance with the Building Code of Australia (BCA, the relevant manufacturer's recommendations or Engineer's Recommendations.

1.2 Preliminary Use

This Specification forms part of the contract and should be read in conjunction with the other contract documents.

1.3 Prevailing Documents

Where there is a difference between the plans and this specification, this specification will take precedence. The Builder must at all times maintain a legible copy of the plans and this Specification bearing the approval of the relevant Local Authority.

1.4 Size and Dimensions

All sizes and dimensions given in this Specification are in millimetres unless otherwise stated and are nominal only.

1.5 Prime Cost and Provisional Sum Items

Prime cost items and provisional sum items are listed in the Schedule of Works.

1.6 Definitions

In this Specification:

"BCA" refers to the publication entitled Building Code of Australia Class 1 and class 10 Buildings, Housing Provisions, Volume 2 published by the Australian Building Codes Board.

"Engineer's Recommendations" includes any soil classification report, preliminary footing report, construction footing report and any other report, recommendation, site or other instruction, calculations or plans prepared by an engineer in respect of the works.

Where the words "Local Authority" are mentioned they shall mean the local council, or other governing authority or private certifier with statutory responsibility for the compliance of the work performed.

Where referred to in this Specification, "Regulations" shall mean the building Regulations and codes (including the BCA, as amended) statutory enforceable at the time application is made for a construction certificate or other permits, consents or approvals relating to the Contract.

2.0 STATUTORY REQUIREMENTS

2.1 The Building Works

The building works shall be constructed in accordance with:

- a. the regulations and in particular the Performance Requirements referred to in the BCA, Housing Provisions, Volume 2;
- b. any conditions imposed by the relevant development consent or complying development certificate; and
- c. commitments outlined in the relevant BASIX Certificate,

in so far as the Builder is required in accordance with the Schedule of Works addended to this Specification.

2.2 Compliance with Requirements of Authorities

The Builder is to comply with the requirements of all legally constituted authorities having jurisdiction over the building works and the provisions of the Home Building Act 1989.

2.3 Electricity

Where there is no existing building, the Builder is to make arrangements for any electrical power to be used in the construction of the building works and is to pay fees and costs incurred therein. The cost of providing and installing any additional poles, wiring, service risers or underground wiring etc., as may be required by the electricity supply authority, shall be borne by the Owner.

2.4 Sanitary Accommodation

Prior to the commencement of the building works, unless toilet facilities exist on the site, the Builder shall provide temporary toilet accommodation for the use of subcontractors. Where the Local Authority requires the temporary toilet to be connected to sewer mains, the additional cost of this work shall be borne by the Owner. On completion the Builder shall remove the convenience.

3.0 OWNER'S OBLIGATIONS

3.1 Engineer's Recommendations

If the contract so indicates, the Owner shall, at the Owner's expense, provide the Builder with the reports and recommendations (including soil classification) as to the foundations or footings requirements for the building works prepared by an engineer.

In these circumstances, if the Builder instructs any party to provide such recommendations, the Builder does so only as agent for the Owner.

3.2 Trades Persons Engaged by Owner

The Owner shall not engage or employ any tradesperson, trade-contractor or any other person to work on the site without the consent of the Builder whose consent may be subject to such terms and conditions as the Builder may stipulate.

3.3 Items Supplied by Owner

For all items referred to in this Specification to be supplied by the Owner, it is the responsibility of the Owner to arrange payment for delivery of and protection against damage and theft of all these items.

Initials _____ / _____

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3.4 Water Supply

Where there is no existing building on the site, the Owner shall, at the Owner's expense, supply adequate water to the site for construction purposes. Unless otherwise specified, the Builder shall pay the standard water meter connection fee to the water supply authority provided this service is prelaidd to the site ready for use. The owner shall be responsible for any fee to be paid in excess of the standard water meter connection fee.

3.5 Sanitation

Unless otherwise specified:

- (a) the Owner shall, at the Owner's expense, supply sewerage connection riser or common effluent drainage connection riser to the site;
- (b) the Builder shall pay the standard sewer connection fee to the sewerage supply authority provided this service is prelaidd to the site and ready for use; and
- (c) the Owner shall be responsible for any fee to be paid in excess of the standard sewer connection fee.

4.0 PLANS, PERMITS AND APPLICATION FEES

4.1 Permits and Fees

Subject to a contrary requirement under the contract, the Builder shall lodge all necessary application notices, plans and details with the Local Authority for the approval prior to commencement of construction.

4.2 Mines Subsidence

In areas affected by mines subsidence the appropriate authority is to be consulted and any work carried out in accordance with the authority's requirements.

4.3 Setting Out

The Builder shall accurately set out the building works in accordance with the site plan and within the boundaries of the site.

5.0 EXCAVATIONS

5.1 Excavations

The part of the site to be covered by the proposed building or buildings and an area at least 1000mm wide around that part of the site or to the boundaries of the site, whichever is the lesser, shall be cleared or graded as indicated on the site works plan.

Top soil shall be cut to a depth sufficient to remove all vegetation.

Excavations for all footings shall be in accordance with the Engineer's Recommendations and BCA R

6.0 FOUNDATIONS AND FOOTINGS

6.1 Underfloor Fill

Underfloor fill shall be in accordance with BCA.

6.2 Termite Risk Management

Termite treatment shall be carried out in accordance with BCA.

6.3 Vapour Barrier

The vapour barrier installed under slab-on-ground construction shall be 0.2mm nominal thickness, high impact resistance polyethylene film installed in accordance with the BCA.

6.4 Reinforcement

Reinforcement shall conform and be placed in accordance with the Engineer's Recommendations and the BCA.

Support to all reinforcement shall be used to correctly position and avoid any undue displacement of reinforcement during the concrete pour.

6.5 Concrete

Structural concrete shall not be less than Grade N20 except where otherwise approved by the engineer and in accordance with BCA.

Pre-mixed concrete shall be manufactured in accordance with AS 1379 with delivery dockets kept on site and available for inspection by the engineer.

Concrete shall be placed and compacted in accordance with good building practice and referenced standards in the BCA.

6.6 Curing

All concrete slabs shall be cured in accordance with AS 3600.

6.7 Footings and Slabs on Ground

Concrete slabs and footings shall not be poured until approval to pour concrete is given by the engineer or the Local Authority.

NOTE: Bench levels and floor levels on the site works plan shall be regarded as nominal, unless specified otherwise.

6.8 Suspended Slabs

All concrete slabs, other than those supported on solid ground or properly compacted filling, shall be constructed as suspended slabs. These slabs shall be constructed in accordance with the Engineer's Recommendations.

6.9 Foundation Walls

On footings as previously specified, brick walls are to be built to the thickness shown on plan to level underside of floor bearers or plates.

6.10 Sub-Floor Ventilation

Where required, adequate cross ventilation will be provided to the space under suspended ground. Construction is to meet the requirements of the BCA. No section of the under floor area wall to be constructed in such a manner that will hold pockets of still air.

6.11 Sub-Floor Access

If required, access will be provided under suspended floors in position where indicated on plan.

7.0 RETAINING WALLS

7.1 Retaining Walls

Where the Builder is required by the Schedule of Works annexed to this Specification, the Builder shall construct retaining walls as shown on the approved plans. Where a retaining wall is not included in the Schedule of Works, the construction of the retaining wall shall be the responsibility of the Owner.

8.0 EFFLUENT DISPOSAL/DRAINAGE

8.1 Effluent Disposal/Drainage

In both sewered and unsewered areas:

(a) Bath, wash basin, kitchen, wash tubs, pedestal pan and floor grate shall be fitted to shower recess in positions shown on plan (refer to Schedule of Works); and

(b) Waste pipes with traps shall be provided to the above fittings and connected to the drainage system.

The whole of the work is to be performed in accordance with the rules and requirements of the sewerage authority concerned.

8.2 Septic System

The builder will provide and install a septic system where applicable to the requirements of the Local Authority and in accordance with the manufacturer's recommendations.

8.3 Storm Water Drainage

Stormwater drainage shall be carried out in accordance with BCA.

The Builder will allow for the supplying and laying of stormwater drains where shown on the site plan.

9.0 TIMBER FRAMING

9.1 Generally

All timber framework sizes, spans, spacing, notching, checking and fixing to all floor, wall and roof structures shall comply with BCA or AS 1684. Alternative structural framing shall be to structural engineer's details and certification.

The work shall be carried out in a proper and tradesperson like manner and shall be in accordance with recognised and accepted building practices.

9.2 Floor Framing

All floors not specified to be concrete are to be framed at the level shown. Span and spacing of bearers is to conform to the requirements of the span tables for the appropriate member size. Deep joists to upper floors, where shown, are to be fitted with solid blocking or herringbone strutting as required. All sizes and stress grades of timber members and tie down methods are to be in accordance with AS 1684.

Initials _____ / _____

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9.3 Wall Framing

Plates may be trenched to provide uniform thickness where studs occur. Where plates are machine gauged to a uniform thickness, trenching may be omitted. Wall framing is to be erected plumb and straight and securely fastened to floor framing. The width of the wall cavity shall comply with the BCA. The Builder will provide a clear space of 40mm between outer face of wall frame and inner face of brick veneer walls. The Builder will tie brickwork to studs with approved veneer ties. Ties are to slope downwards towards the veneer wall.

Studs in each panel of walling shall be stiffened by means of solid noggings or bridging pieces at not more than 1350mm centres over the height of the wall. Bottom plates shall be fixed to the floor structure in accordance with AS 1684.

9.4 Heads Over Opening (Lintels)

All sizes, stress grade and bearing areas shall conform to AS 1684. Heads exceeding 175mm in depth shall be seasoned or a low shrinkage timber species will be used. Plywood web lintels conforming to the requirements of the Plywood Association of Australia may be used. Glue laminated beams conforming to AS 1328 or laminated veneer lumber beams to manufacturer's specification and data sheets may be used.

9.5 Roof Trussed

Where roof truss construction is used, trusses shall be designed in accordance with AS 1720 and fabricated in a properly equipped factory and erected, fixed and braced in accordance with the fabricator's written instructions.

9.6 Bracing

Bracing units shall be determined and installed in accordance with AS 1684 as appropriate for the design wind velocity for the site. Bracing shall be evenly distributed throughout the building.

9.7 Flooring

Floor joist will be covered with strip or sheet flooring as shown on plan with particular regard to ground clearance and installation in wet areas as required by the BCA. Thickness of flooring is to be appropriate for the floor joist spacing.

Strip and sheet flooring shall be installed in accordance with AS 1684.

When listed in Schedule of Works, floors shall be sanded to provide an even surface and shall be left clean throughout.

9.8 Roof Framing

Roofs are to be pitched to the slope on plan. The Builder will provide tie-down as required for the appropriate design, wind speed and roof covering. The Builder will provide all rafters, ridges, hips, valleys, purlins, struts, collar ties and wind bracing as appropriate with all sizes and stress grades in accordance with AS 1684.

Metal fascias shall be installed in accordance with the manufacturer's recommendations and shall meet the requirements of AS 1684.

9.9 Timber Posts

Posts supporting carports, verandahs and porches shall be timber suitable for external use, or as otherwise specified, supported on galvanised or treated metal post shoes, unless otherwise specified. Post shall be bolted to all adjoining beams as required by AS 1684 for the wind speed classification assessed for the site.

9.10 Corrosion Protection

All metal brackets, facing plates and other associated fixings used in structural timber joints and bracing must have appropriate corrosion protection.

9.11 Hot Water Storage Tank Platforms

Where a hot water storage tank is to be installed in the roof space, the tank platform shall be supported directly off the wall plates and must not be supported on ceiling joists. Where installed in the roof space the storage tank shall be fitted with an appropriate spill tray and overflow drain pipe.

Where a hot water storage tank is supported by the roof structure shall be specifically designed to support all imposed loads.

10.0 STEEL FRAMING

10.1 Generally

Steel floor, wall or roof framing shall be installed in accordance with the manufacturer's recommendations and BCA.

11.0 ROOFING

All roof cladding to comply with the relevant structural performance and weathering requirements of the BCA and be installed as per the manufacturer's recommendations.

11.1 Tiled Roofing

The Builder will cover the roof of the dwelling with approved tiles as selected. The tiles are to be fixed (as required for the appropriate design wind speed) to battens of sizes appropriate to the spacing of rafters/trusses in accordance with manufacturer's recommendations. The Builder will cover hips and ridges with capping and all necessary accessories including starters and apex caps. Capping and verge tiles are to be well bedded and neatly pointed. Roofing adjacent to valleys should be fixed so as to minimise water penetration as far as practicable. As roof tiles are made of natural products slight variation in colour is acceptable.

11.2 Metal Roofing

The Builder will provide and install a metal roof together with accessories all in accordance with the manufacturer's recommendations.

Except where design prohibits, sheet shall be in single lengths from fascia to ridge. Fixings of sheets shall be strictly in accordance with the manufacturer's recommendations as required for the appropriate design wind speed. Incompatible materials shall not be used for flashings, fasteners or downpipes.

11.3 Gutters and Downpipes

Gutters and downpipes shall be manufactured and installed in accordance with BCA. Gutters and downpipes are to be compatible with other materials used.

Initials _____ / _____

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11.4 Sarking

Sarking under roof coverings must comply and be fixed in accordance with AS/NZS 4200.1 for materials and AS/NZS4200.2 for installation.

11.5 Sealants

Appropriate sealants shall be used where necessary and in accordance with manufacturer's recommendations.

11.6 Flashing

Flashings shall comply with, and be installed in accordance with BCA.

12.0 MASONRY

12.1 Bricks

All clay bricks and brickwork shall comply with AS 3700 and BCA. Clay bricks are a natural fired product and as such their individual size may vary.

Tolerances shall only be applied to the total measurements over 20 units, not to the individuals units.

12.2 Concrete Blocks

Concrete blocks are to be machine pressed, of even shape, well cured and shall comply with AS 3700. Concrete blockwork shall be constructed in accordance with BCA.

Autoclaved aerated concrete blocks shall be in accordance with the manufacturer's product specification at the time the work is being carried out.

12.3 Damp Proof Courses

All damp proof courses shall comply with BCA and Clause 1.0.10. The damp proof membrane shall be visible in the external face of the masonry member in which it is placed and shall not be bridged by any applied coatings, render or the like.

12.4 Cavity Ventilation (Weep Holes)

Open perpendicular joints (weepholes) must be created in the course immediately above any DPC or flashing at centres not exceeding 1.2m and be in accordance with BCA.

12.5 Mortar and Joining

Mortar shall comply with BCA. Joint tolerances shall be in accordance with AS 3700.

12.6 Masonry Accessories

Masonry accessories shall comply with BCA and accepted building practices. Wall ties are to meet corrosion resistant rating appropriate for the exposure conditions of the site. The Builder will provide appropriate ties to articulated joints in masonry.

12.7 Lintels

Lintels used to support brickwork opening in walls must be suitable for the purpose as required by BCA. The Builder will provide one lintel to each wall leaf. The Builder will provide corrosion protection in accordance with BCA Part 3.4.4 as appropriate for the site environment and location of the lintels in the structure.

12.8 Cleaning

The Builder will clean all exposed brickwork with an approved cleaning system. Care should be taken not to damage brickwork or joints and other fittings.

13.0 CLADDING AND LININGS

13.1 External Claddings

Sheet materials or other external cladding shall be fixed in accordance with the manufacturer's recommendations and any applicable special details.

Where required in open verandas, porches and eaves soffits, material indicated on the plans shall be installed.

13.2 Internal Wall and Ceilings Linings

The Builder will provide gypsum plasterboards or other selected materials to walls and ceilings. Plasterboard sheets to have recessed edges and be a minimum of 10mm thick. Internal angles in walls from floor to ceiling to be set. Suitable cornice moulds shall be fixed at the junction of all walls and ceilings or the joint set as required. The lining of wet area walls shall be constructed in accordance with BCA. Wet area lining is to be fixed in accordance with the manufacturer's recommendations.

The ceiling access hole shall be of similar material to the adjacent ceiling.

13.3 Waterproofing

All internal wet areas and balconies over internal habitable rooms are to be waterproofed in accordance with BCA.

14.0 JOINERY

14.1 General

All joinery work (metal and timber) shall be manufactured and installed according to accepted building practices.

14.2 Door Frames

External door frames shall be a minimum of 32mm thick solid rebated 12mm deep to receive doors. Internal jamb linings shall be a minimum of 18mm thick fit with 12mm thick door stops. Metal door frames shall be installed where indicated on drawings in accordance with the manufacturer's recommendations.

14.3 Door and Doorsets

All internal and external timber door and door sets shall be installed in accordance with accepted building practices. Unless listed otherwise in the Schedule of Works door and door sets shall be manufactured in accordance with AS 2688 and AS 2689.

14.4 Window and Sliding Doors

Sliding and other timber windows and doors shall be manufactured and installed in accordance with AS2047.

Sliding and other aluminium windows and doors shall be installed in accordance with manufacturer's recommendations and AS 2047.

All glazing shall comply with BCA and any commitments outlined in the relevant BASIX Certificate.

14.5 Architraves and Skirting

The Builder will provide architraves and skirting as nominated on the plans or listed in the Schedule of Works.

14.6 Cupboards/Kitchens/Bathroom

Units shall be installed to manufacturer's recommendations. Bench tops shall be of a water resistant material.

14.7 Stairs, Balustrades and other Barriers

The Builder will provide stairs or ramps to any change in levels, and balustrades or barriers to at least one side of ramps, landings and balconies as per BCA.

15.0 SERVICES

15.1 Plumbing

All plumbing shall comply with the requirements of the relevant supply authority and AS 3500. The work is to be carried out by a licensed plumber. Fittings, as listed in the Schedule of Works shall be supplied and installed to manufacturer's recommendations. Fittings, hot water systems and any rainwater harvesting facilities shall be appropriate to satisfy any commitment outlined in the relevant BASIX Certificate.

15.2 Electrical

The Builder will provide all labour and materials necessary for the proper installation of electricity service by a licensed electrician in accordance with AS/NZS 3000 and the requirements of the relevant supply authority. Unless otherwise specified, the electrical service shall be 240 volt, single phase supply.

15.3 Gas

All installation (including LPG) shall be carried out in accordance with the rules and requirements of the relevant supply authority.

15.4 Smoke Detectors

The Builder will provide and install smoke alarms manufactured in accordance with AS 3786 as specified or as indicated on the plans and in accordance with BCA.

15.5 Thermal Insulation

Where thermal insulation is used in the building fabric or services, such as air conditioning ducting or hot water systems, it shall be installed in accordance with manufacturer's recommendations to achieve the R-Values required by BCA or as outlined in the relevant BASIX Certificate.

16.0 TILING

16.1 Materials

Cement mortar and other adhesives shall comply with AS 3958.1 or tile manufacturer's recommendations.

16.2 Installation

Installation of tiles shall be in accordance with AS 3958.1, manufacturer's recommendations or accepted building practices.

Where practicable, spacing between tiles should be even and regular. The Builder will provide expansion joints where necessary. All vertical and horizontal joints between walls and fixtures e.g bench top, bath, etc. and wall/floor junctions to be filled with flexible mould resistant sealant. All joints in the body of tiled surfaces shall be neatly filled with appropriate grout material as specified by the tile manufacturer or accepted building practice. As tiles are made of natural products a slight variation in colour is acceptable.

16.3 Walls

The Builder will cover wall surfaces where indicated on the drawings with selected tiles. Tiles are to be fixed to the wall substrate with adhesives compatible with the substrate material. The Builder will provide all required strips, vent tiles and recess fittings.

16.4 Floors

The Builder will lay selected floor tiles in sand and cement mortar, or adhesive compatible with the substrate material, to areas indicated on the drawings. Where required, the Builder will fit approved edge strips or metal angle to exposed edges in doorways or hobless showers in wet areas in accordance with BCA. The Builder will provide adequate and even fall to wastes where required.

17.0 PAINTING

17.1 General

All paint used shall be of a quality suitable for the purpose intended and the application shall be as per the manufacturer's recommendations. The colours used shall be as listed in the Schedule of Works or other relevant contract document. All surfaces to be painted shall be properly prepared to manufacturer's recommendations.

18.0 WORKMANSHIP STANDARDS AND TOLERANCES

18.1 General

These general specifications incorporate the HIA Guide. By agreeing to these specifications, the Owner agrees that he/she has been provided a copy and has had the opportunity to read this guide.

This guide is to be used by the Builder and Owner as a point of reference for information on workmanship standards and tolerances, and amongst things, in deciding whether an alleged defect exists and/or whether the materials used and/or workmanship are in accordance with the plans and specifications.

The parties agree to use these specifications in precedence over any other non legislated guide to standards and tolerances.

19.0 SIGNITURES

This is the Specification referred to in the contract

No..... Date.....

Signed by the said
Owner in the
Presence of

.....
Witness

.....
Owner's Signature

..... / /
Date

.....
Witness

.....
Owner's Signature

..... / /
Date

Signed by the said
Builder in the
Presence of

Nick Bilbija
.....
Witness


.....
Builder's Signature

27 / 11 / 14
..... / /
Date



Bushfire Protection Assessment

Proposed Subdivision: Village Centre 13 and Education Site

Prepared for
Lend Lease

29 October 2013



DOCUMENT TRACKING

ITEM	DETAIL
Project Name	Bushfire Protection Assessment, Proposed Subdivision, Jordan Springs Village Centre 13 and Education Site
Project Number	09SUTBUS-0001
Prepared by	David Peterson
Status	FINAL
Version Number	2
Last saved on	29 October 2013

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd.

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and Maryland Development Company. The scope of services was defined in consultation with Maryland Development Company, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information.

Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

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1 Property and proposal

Name:	Maryland Development Company		
Street or property Name:	Jordan Springs, Village Centre 13 and Education Site		
Suburb, town or locality:	Jordan Springs	Postcode:	2747
Lot/DP no:	Lot 8 DP 1176874		
Local Government Area:	Penrith City Council		
Type of development:	Subdivision for future development (medium density residential and school)		

1.1 INTRODUCTION

Maryland Development Company commissioned Eco Logical Australia Pty Ltd (ELA) to prepare a bushfire protection assessment (BPA) for a proposed subdivision at Jordan Springs to create four super lots for future development.

This assessment has been prepared by the ELA Principal Bushfire Consultant David Peterson (FPAA BPAD-A Certified Practitioner No. BPD-PA-18882). David is recognised by the NSW Rural Fire Service as a qualified bushfire consultant in bushfire risk assessment.

1.2 LOCATION AND DESCRIPTION OF SUBJECT LAND

The subject land is located within the central portion of the Jordan Springs residential community as shown in **Figure 1**. The site is bounded by Greenwood Parkway to the north, Alinta Promenade to the east, Cullen Avenue to the south and Lakeside Parade to the west. Beyond these streets are newly subdivided residential lots and the lake precinct.

1.3 DESCRIPTION OF PROPOSAL

The proposal consists of a subdivision to create four lots as shown in **Figure 2**. The future use of each lot is described below:

- Proposed Lot 21 – future medium density housing
- Proposed Lot 22 – future school
- Proposed Lot 23 – riparian corridor (channel earthworks and revegetation approved)
- Proposed Lot 24 – future open space including oval.

This assessment addresses the proposed subdivision based on the known intended use of the four lots when created. The bushfire protection measures required for the above future uses in each respective lot are detailed in the following sections. There is no construction proposed as part of the subdivision proposal.



Figure 1: Location of Village Centre 13 and Education Site



Figure 2: Proposed subdivision layout plan

2 Bushfire threat assessment

2.1 ASSESSMENT REQUIREMENTS

The subject land is identified as containing Bush Fire Prone Land by Penrith City Council. The following assessment is therefore prepared in accordance with Section 100B of the *Rural Fires Act 1997*, Clause 44 of the *Rural Fires Regulation 2008*, and 'Planning for Bush Fire Protection 2006' (RFS 2006) herein referred to as PBP.

The assessment also adopts the recommendations approved within the Precinct Plan relating to bushfire protection described within the report '*Bushfire Protection Assessment – St Marys Western and Central Precincts*' prepared by BES (2009). This assessment follows and builds upon the findings of the initial bushfire report.

2.2 VEGETATION TYPES AND SLOPES

The vegetation and slope have been assessed outwards from the boundaries of the proposed subdivision stages in the direction of any bushfire hazards found. In accordance with PBP the predominant vegetation class has been calculated for a distance of at least 140 metres out from the boundary of the subject land and the slope class most significantly affecting fire behaviour was determined for a distance of at least 100 metres. The predominant vegetation and effective slope assessments are shown in **Figure 3** and summarised in **Table 1** within the following Section 3 – Asset Protection Zones.

Only one area of bushfire hazard will be located within 140 metres of the subdivision perimeter. The hazard will consist of the proposed riparian corridor that will exist within proposed Lot 23. The corridor will have Lots 21 and 22 intended for future development on its western side and Lot 24 that will form open space to the east.

The riparian corridor works and revegetation has been approved in a previous DA and is proposed to create a vegetated corridor the full width of the lot ranging from approximately 60 to 80 metres. The climax vegetation community is to represent the surrounding Cumberland Plain Woodland and is therefore categorised as 'woodland' in accordance with PBP (Refer to **Figure 3**) and the BES (2009) assessment.

The corridor will drain from north to south on a very gentle gradient therefore the vegetation will be on a slope within the PBP slope class of 'downslope >0-5 degrees'.

3 Asset Protection Zones (APZ)

The subdivision proposal involves the creation of super lots for future development applications and does not include construction or the creation of residential lots. Therefore specific APZs are not required for the proposal. The assessment below demonstrates that the proposed lots are able to accommodate future development with the required APZ wholly within the lot boundary.

Table 1 below shows the APZ calculation based on intended future use. The location of future APZs are shown in **Figure 3**. All proposed APZs comply with the PBP Acceptable Solutions as listed below:

- Lot 21 - residential subdivision
- Lot 22 – Special Fire Protection Purpose development (school)

Future development applications will be required to demonstrate the provision of a compliant APZ (see **Table 1**) between the proposed development and the riparian corridor.

Table 1: Asset Protection Zone assessment

Location (Refer to Figure 3)	Slope	Vegetation	PBP APZ	Comment
Lot 21	Downslope >0-5°	Woodland	15 m	Future subdivision or housing within proposed Lot 21 will require a minimum APZ of 15 m. Lot 21 will be able to accommodate an APZ of this size.
Lot 22	Downslope >0-5°	Woodland	50 m	A future school within proposed Lot 22 will require a minimum APZ of 50 m. Lot 22 will be able to accommodate an APZ of this size.
Lot 24	Downslope >0-5°	Woodland	PBP does not require and APZ for the intended future use of proposed Lot 24 (open space and oval).	

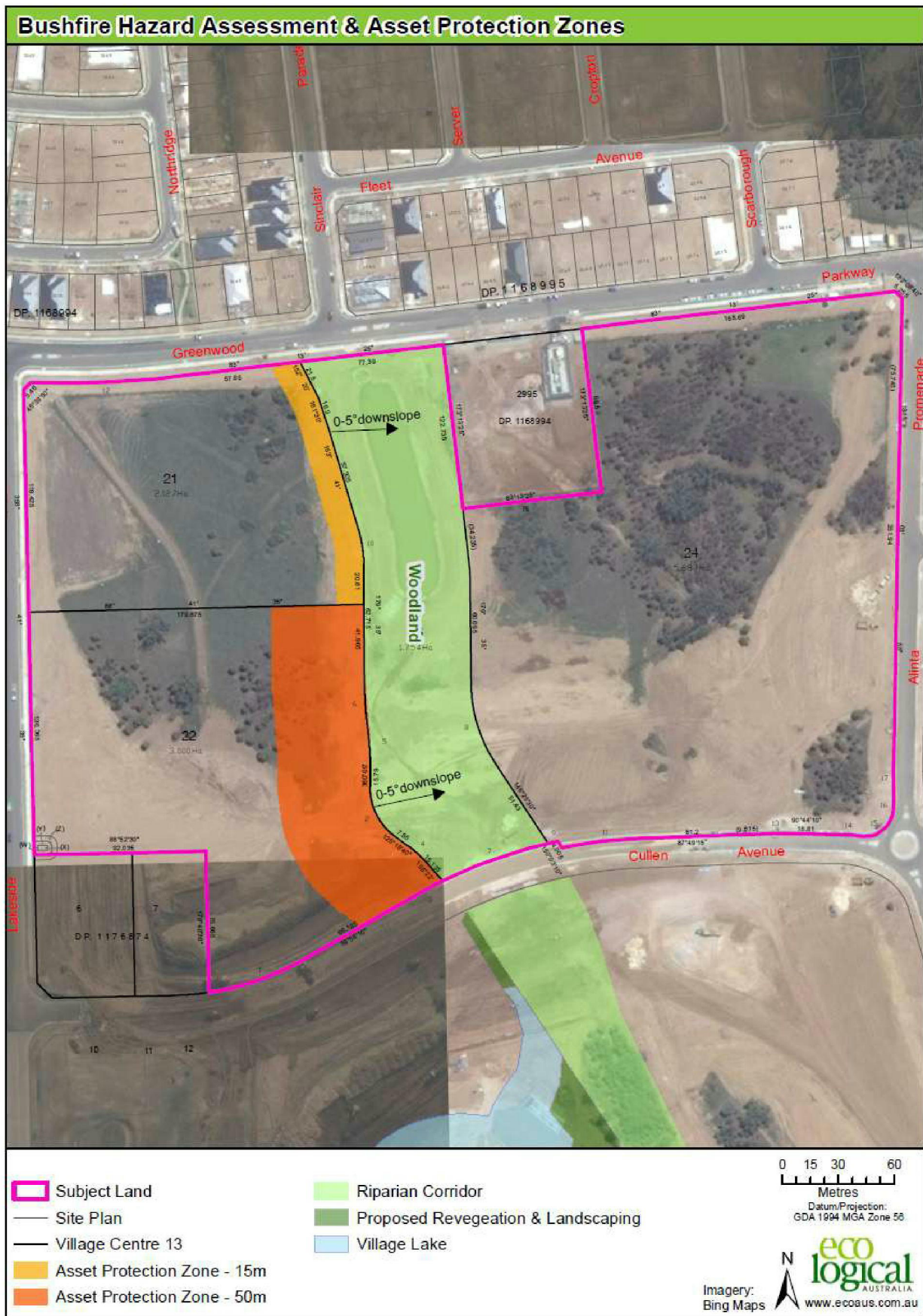


Figure 3: Bushfire hazard analysis and future Asset Protection Zones

4 Bushfire Attack Levels

A Bushfire Attack Level (BAL) map has been prepared for proposed Lots 21 and 22 (see **Figure 4**). The map was prepared in accordance with the PBP Acceptable Solution (deemed-to-satisfy) method, which is to apply BALs based on the vegetation and slope assessment methodology within PBP and Table 2.4.2 (Method 1) of *AS 3959-2009 Construction of buildings in bushfire-prone areas* (Standards Australia 2009).

The BAL map indicates the areas potentially affected by the various AS 3959 BALs. Construction in these areas will need to comply with the respective construction requirements. The BALs have been mapped based on an understanding of the future revegetation within the riparian corridor.

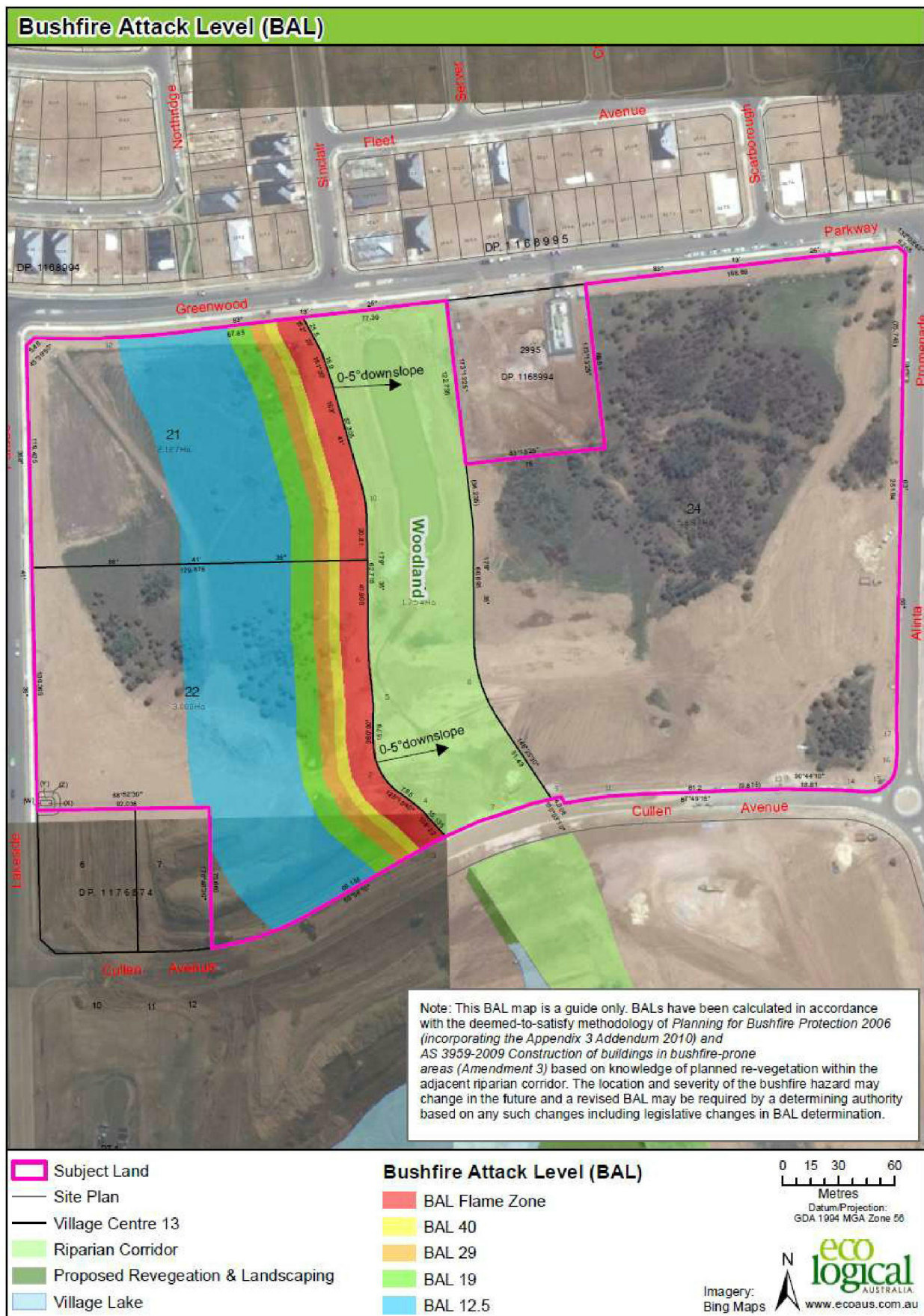


Figure 4: Bushfire Attack Levels (BALs)

5 Access and egress

Both proposed Lots 21 and 22 will front two public roads (see **Figure 2**) with linkages throughout the remainder of the Jordan Springs community. The surrounding public road layout complies with PBP.

The subdivision proposal does not involve the creation of roads. Any future internal road layout should comply with the acceptable solutions of PBP for the design and construction of public roads as listed in **Table 2**. PBP also requires access to the bushfire hazard interface (perimeter of the riparian corridor). Although PBP prefers a public perimeter road at the bushland interface, it is acceptable in some cases not to have a continuous public road. The acceptability of which is determined on a case-by-case basis and reasoning to support this approach is usually based on a combination of risk factors developed within an alternate solution.

Table 2: Performance criteria for proposed public roads

Performance Criteria	Acceptable Solutions
The intent may be achieved where:	
<ul style="list-style-type: none"> firefighters are provided with safe all weather access to structures (thus allowing more efficient use of firefighting resources) 	<ul style="list-style-type: none"> public roads are two-wheel drive, all weather roads
<ul style="list-style-type: none"> public road widths and design that allows safe access for firefighters while residents are evacuating an area 	<ul style="list-style-type: none"> urban perimeter roads are two-way, that is, at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb), allowing traffic to pass in opposite directions. Non perimeter roads comply with Table 4.1 – Road widths for Category 1 Tanker (Medium Rigid Vehicle) the perimeter road is linked to the internal road system at an interval of no greater than 500 metres in urban areas traffic management devices are constructed to facilitate access by emergency services vehicles public roads have a cross fall not exceeding 3 degrees public roads are through roads. Dead end roads are not recommended, but if unavoidable, dead ends are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end and direct traffic away from the hazard curves of roads (other than perimeter roads) are a minimum inner radius of six metres and minimal in number to allow for rapid access and egress the minimum distance between inner and outer curves is six metres maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient there is a minimum vertical clearance to a height of four metres above the road at all times
<ul style="list-style-type: none"> the capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles 	<ul style="list-style-type: none"> the capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles (approximately 15 tonnes for areas with reticulated water, 28 tonnes or 9 tonnes per axle for all other areas). Bridges clearly indicated load rating
<ul style="list-style-type: none"> roads that are clearly sign posted (with easy distinguishable names) and buildings / properties that are clearly numbered 	<ul style="list-style-type: none"> public roads greater than 6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water for fire suppression public roads between 6.5 metres and 8 metres wide are No Parking on one side with the services (hydrants) located on this side to ensure accessibility to reticulated water for fire suppression
<ul style="list-style-type: none"> there is clear access to reticulated water supply 	<ul style="list-style-type: none"> public roads up to 6.5 metres wide provide parking within parking bays and located services outside of the parking bays to ensure accessibility to reticulated water for fire suppression one way only public access roads are no less than 3.5 metres wide and provide parking within parking bays and located services outside of the parking bays to ensure accessibility to reticulated water for fire suppression
<ul style="list-style-type: none"> parking does not obstruct the minimum paved width 	<ul style="list-style-type: none"> parking bays are a minimum of 2.6 metres wide from kerb to kerb edge to road pavement. No services or hydrants are located within the parking bays public roads directly interfacing the bush fire hazard vegetation provide roll top kerbing to the hazard side of the road

6 Utilities

The subdivision proposal does not involve construction or the installation of utilities. These will be subject to future development applications.

6.1 WATER SUPPLY

A future development application will need to demonstrate the proposal to install a reticulated water supply compliant with Section 4.1.3 of PBP. The provisions include:

- Reticulated water supply to urban subdivisions uses a ring main system for areas with perimeter roads;
- Fire hydrant spacing, sizing and pressures comply with *AS 2419.1 – 2005 Fire hydrant installations - System design, installation and commissioning*. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles;
- Hydrants are not located within any road carriageway;
- All above ground water and gas service pipes external to the building are metal, including and up to any taps; and
- The [PBP] provisions of parking on public roads are met.

6.2 GAS AND ELECTRICAL SUPPLIES

A future development application will need to demonstrate the adequate installation of gas and electricity compliant with Section 4.1.3 of PBP. The provisions include:

- Electricity should be underground wherever practicable, otherwise no part of a tree should be closer to a powerline than the distance specified in "Vegetation Safety Clearances" issued by Ausgrid (NS179, December 2010); and
- Any gas services are to be installed and maintained in accordance with *AS/NZS 1596:2008 The storage and handling of LP Gas* (Standards Australia 2008).

7 Statement of compliance

This assessment demonstrates that the proposal to subdivide Lot 8 DP 1176874 into four super lots complies with the PBP Acceptable Solutions for the subdivision of bushfire prone land, and hence satisfies the aim and objectives of PBP. The proposal does not involve construction or the creation of residential lots therefore there are no specific requirements or recommendations for the issue of a Bush Fire Safety Authority (BFSA).

The intended future use of the super lots consists of medium density housing, a school, riparian zone and open space. Development applications for these future lots and uses will need to address the relevant specifications and requirements of PBP for each use. This assessment provides a guide on the likely requirements for each intended use. These are as follows:

- Asset Protection Zones : Section 3 – **Table 1** and **Figure 3**
- Construction standards(BALs): Section 4 – **Figure 4**
- Access: Section 5 – **Table 2**
- Utilities: Section 6



David Peterson
Principal Bushfire Consultant
Eco Logical Australia Pty Ltd
FPAA BPAD Certified Practitioner No. BPD-PD-23276



References

Ausgrid. 2010. *Network Standard NS 179 Vegetation Safety Clearances* (updated from Energy Australia. 2002. *Network Standard NS 179 (Vegetation Safety Clearances)*, Sydney.)

NSW Rural Fire Service (RFS). 2006. *Planning for Bush Fire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners*. Australian Government Publishing Service, Canberra.

Standards Australia. 2005. *Fire hydrant installations - System design, installation and commissioning*, AS2419.1, Fourth edition 2005, Standards Australia International Ltd, Sydney.

Standards Australia. 2008. *The storage and handling of LP Gas*, AS/NZS 1596:2008, Fourth edition 2005, Standards Australia International Ltd, Sydney

Standards Australia. 2009. *Construction of buildings in bushfire-prone areas*, AS 3959-2009, Standards Australia International Ltd, Sydney

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Job No: 7508/23
Our Ref: 7508/23-AA Final Revised
8 March 2010

Delfin Lend Lease Pty Ltd
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ST MARYS NSW 1790

Attention: Mr A Ali

Dear Sir

re: **Western Precinct - Jordan Springs
The Northern Road, Cranebrook
Salinity Review**

Further to your request, and in accordance with Geotech Testing Pty Ltd quote Q717AH dated 23 February 2010, we have reviewed salinity reports prepared by others for the Western Precinct to satisfy salinity requirements and for inclusion in the tender documents.

Documents Received

We are in receipt of the following salinity reports:

- SKM Report on water, soil and infrastructure for the St Marys Project, Western Precinct Plan dated May 2009, which included the following reports by EIS (a division of Jeffery & Katauskas Pty Ltd):
 - Report E13431F Volume 1 dated 31 May 2000.
 - Report E13431FRPT Volume 2 dated 31 May 2000.
 - Report E13431FRPT Volume 3 dated 31 May 2000.
- EIS Report E13431FRPT-ASI dated 7 March 2001 (Additional investigation in Western Precinct).

Scope of Work

In preparation for this report, the following work was completed:

- Review of all documents received.
- Review of other information provided for development and building in a saline environment.
- Research and contemplate experiences gained from previous projects with similar ground conditions.

Soil Investigation

The soil investigations for the preparation of the foregoing reports were carried out over a period between 1999 and 2001 and generally included electromagnetic survey, excavation of test pits, installation of groundwater monitoring wells, recovery of soil and groundwater samples, laboratory testing and submission of detailed engineering reports. These investigations were carried out by EIS, and the results were used by SKM in preparation of their report on water, soil and infrastructure in 2009.

The following sections summarise the results of the investigation that is relevant to the scope of works.

Electromagnetic Induction (EMI) Survey

An EMI was carried out across the entire development site in December 1999 (Refer EIS report, Volume 2) and generally indicated a low saline profile in the Western Precinct with the exception of a highly saline anomaly, which, after further investigation and laboratory testing, indicated a moderate rather than a high saline profile.

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Soil Salinity

Based on the available soil maps, the soils at the site are likely to belong to the Luddenham Group, which is characterised by undulating to rolling low hills on Bringelly Shale of the Wianamatta Group of Shales, and comprise narrow ridges, hillcrests and valleys. Soils in this group are likely to be up to 1.5m deep, highly plastic, moderately reactive, locally impermeable and susceptible to high erosion hazards. The salinity publication indicates that the soils on the site are potentially moderately saline.

Electrical Conductivity (EC) testing was carried out to assess soil salinity. The determined EC is multiplied by a factor (varying from 6 to 17) based on the texture of the soil sample, to obtain the Corrected Electrical Conductivity designated as EC_e , as outlined in the Department of Infrastructure, Planning and Natural Resources (DIPNR) publication "Dryland Salinity – Introductory Extension Notes - 1991". The DIPNR publication defines various classes of saline soils, as follows:

TABLE 1

Classification	EC_e (dS/m)
Non-saline	<2
Slightly saline	2 – 4
Moderately saline	4 – 8
Very saline	8 – 16
Highly saline	>16

The results carried out on recovered soil samples indicated:

- About 52% of the results were less than 4dS/m or non-saline to slightly saline
- About 50% of the results were in the range of 4 – 8 dS/m or moderately saline
- One result indicated very saline soil ($EC_e = 9.90\text{dS/m}$)

In addition, the test results indicated that the topsoil was generally non-saline and increasing in salinity with depth. Based on the test results, it is assessed that the soils on site are generally slightly saline to moderately saline (Refer Figures 5.5, 5.6 & 5.7, which are extracts from the SKM report). It should be noted that the laboratory test results are based on a very limited number of recovered soil samples.

Soil pH

Soil pH or acidity is an important soil fertility parameter. Soils with strong acidity are aggressive to both concrete and steel structures buried within the soil. The original EIS report indicated possible strongly acidic soil. It should be noted that the majority of the soils are residual in nature and are not expected to be acidic. Acidic soils may be encountered at low-lying grounds that are subject to frequent flooding, such as those close to waterways and creeks. The acid sulphate soil mapping indicates 'no known occurrence' of acid sulphate soils west of Parramatta River and Prospect. Based on our experience in the area, it is our opinion that soil acidity would not affect site works or the development of the site.

Dispersive Soil

Dispersive soil is commonly associated with erosion, sediment loss to waterways, susceptibility to tunnelling or piping through earth dams and soil softening when saturated. Based on the soil mapping and previous investigations, the surface soils on site are likely to be slightly to moderately dispersive, while the deeper soils are likely to be highly dispersive. This will affect site works during construction.

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Regional Hydrogeology & Groundwater Salinity

There are two groundwater bearing systems (aquifers) within the Western Precinct. The shallow aquifer is generally fresh, with low salinity and typically unconfined. The materials making up the shallow aquifer are predominately impervious clay, with a low to medium rate of permeability. This aquifer is affected by surface run-off and rainwater. The deep aquifer is generally saline, high salinity approaching seawater levels and confined within the underlying Bringelly Shale. This aquifer is less permeable and is less affected by surface run-off and rain.

The results of the investigation generally indicate that the groundwater on site is moderately saline (Refer Figures 5.9 & 5.10, which are extracts from the SKM report).

Conclusions

Based on the investigation, it is concluded that the moderately saline conditions encountered on site are typical of the area in general. Implementation of a Soil and Water Management Plan is essential to maintain current conditions of the site.

The report prepared by SKM included a salinity, erosion and sediment management strategy overview (Table 5.5, attached), which should be implemented for quality control during construction.

In addition to these measures, there are some additional measures that Geotech Testing Pty Ltd might recommend or disagree with, as shown below:

1.0 Treatment of the majority of the site with lime and gypsum (EIS Report Volume 1)

There is no need for such treatment, as the implementation of a soil erosion control plan would suffice. However, it might be required to stabilise local area(s) that would encounter very highly dispersive (erodible) soils.

In addition to the soil erosion control plan, it is recommended that all exposed embankments are battered to about 1V:2.5H in natural clays (1V:3H in compacted fill) and seeded to produce a vegetation cover that will minimise the effect of surface run-off on the embankment. Dish drains may be used on top of selected embankments to divert surface run-off, if affected by dispersive soils.

2.0 Use of Groundwater for irrigation purposes (Table 5.5 in SKM Report)

Groundwater extracted from the underlying deep aquifer is likely to be saline and thus should not be introduced to the surface or allowed to mix with surface waters, which are likely to feed the shallower fresh aquifer.

3.0 Excavation exposing moderately saline soils

It is likely that excavation to depths of about 2m, (as part of the proposed site works or for installation of utilities) would expose soils that could be assessed as moderately saline. It is recommended that exposed moderately saline soils are covered with about 500mm of non-saline material, which may include topsoil.

To confirm the presence of moderately saline soils, additional salinity testing at bulk excavation level (at the rate of two tests for a typical residential lot) may be carried out.

Excavated materials may be re-used on site provided they are replaced in the same order they are removed from the ground. Recommendations in Section 4.4 of the SKM report (attached) should be implemented.

The Building Code of Australia (BCA) has provisions in the 2008 edition, including "high impact resistant" membrane of 0.2mm nominal thickness to be used below all ground supported house slabs. This membrane is now used for construction of all residential slabs, with the main purpose being to stop rising vapour or dampness to the underside of the slab, thus eliminating the effect of any salinity on the slab.

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In addition, the DIPNR prepared a bulletin in 2003, titled "Building in Saline Environment", which commented on the different standards commonly used in the building industry in terms of salinity issues. These are:

- AS3600: Concrete Structures
- AS3700: Masonry Structures
- AS2870: Residential slabs and footings
- AS4419: Soils for Landscaping and Garden Use

The bulletin also included specifications for concrete strength depending on the aggressivity of the environment. These are reproduced below in Table 2.

TABLE 2

	Non Aggressive Environment	B2 (Moderately Aggressive Environment)	C (Aggressive Environment)
Concrete strength	20 MPa	40 MPa	50 MPa
Curing time	3 days	7 days	7 days
Cover to reinforcement	40mm	45mm	50mm

Adaptation of the recommendations by BCA and DIPNR (or DNR as it is now known) would reduce the effect of any potential moderately saline soils within the ground that might come into contact with the foundations of future residences.

4.0 Importation of fill during site works

It is also understood that additional fill might be imported during site works. All imported fill should be tested by a qualified Geotechnical Engineer for salinity prior to importation, along with submission of a quality process system addressing the following:

- Segregation of material at excavation
- Monitoring process
- Transportation routes

The imported fill should be non-saline to slightly saline for use on all fill layers, so as not to adversely affect existing salinity conditions on site.

In general imported fill (VENM or ENM) should be:

- Low to medium plasticity clays such as sandy, silty and gravelly clays
- Non-saline to slightly saline soils
- Non-dispersive to slightly dispersive
- Non-aggressive to slightly aggressive to concrete and concrete
- Free of acid sulphate soils

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The salinity report accompanied by a validation certificate shall be submitted to the certifying authority for approval prior to commencement of fill importation (Refer DA Consent of Conditions set by Penrith City Council).

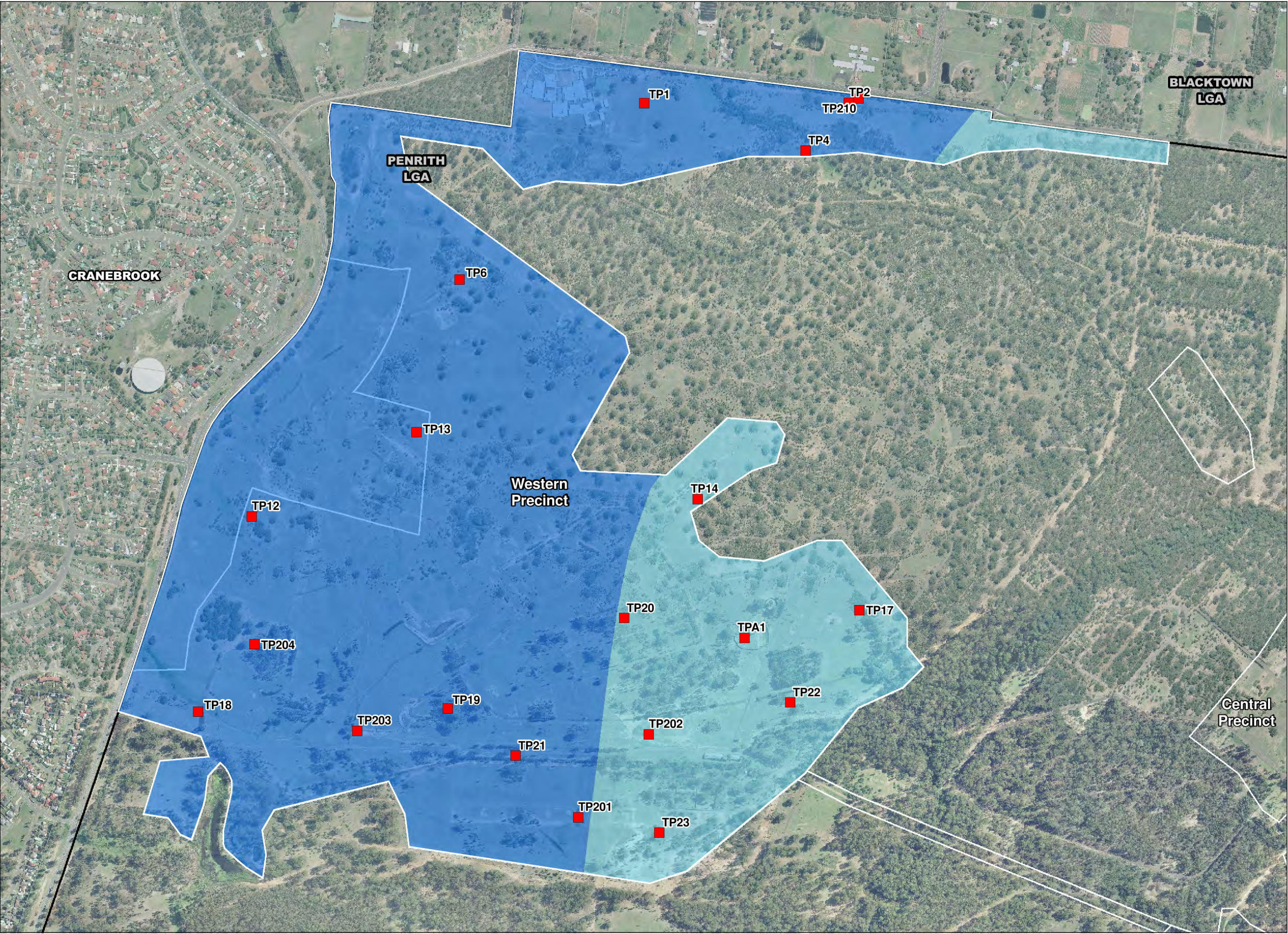
If you have any questions, please do not hesitate to contact the undersigned.

Yours faithfully
GEOTECH TESTING PTY LTD



EMGED RIZKALLA
Director

Attachments Extracts from SKM report
-Fig 5.5: Soil Salinity at a Depth of 0.3m (A-Horizon)
-Fig 5.6: Soil Salinity at a Depth of 0.75m (B-Horizon)
-Fig 5.7: Soil Salinity at a Depth of 2m (Lower B-Horizon in Weathered Shale)
-Fig 5.9: Groundwater Salinity (J & K Nov 1999)
-Fig 5.10: Groundwater Salinity (J & K Jan 2000)
Table 5.5: Salinity, Erosion and Sediment Management Strategy Systems
Section 4.4: Soil and Water Management Strategy



Legend

SREP 30 boundaries

Site boundary

(Sydney Regional Environmental Plan No 30 – St Marys Structure Plan Amendment No 1. Environmental Planning and Assessment Act, 1979. 11/04/2006. NSW Department of Planning.)

Property boundaries (LPI 2007)

LGA boundaries (LPI 2007)

Soil Bore Locations

Soil Salinity

Class	EC _e (dS/m)
Non-Saline	<2
Slightly Saline	2-4
Moderately Saline	4-8
Very Saline	8-16
Highly Saline	>16

2007 Aerial Photography by AUSIMAGE

0 250
Metres



Fig 5.5 : Soil Salinity at a Depth of 0.3m (A-Horizon)

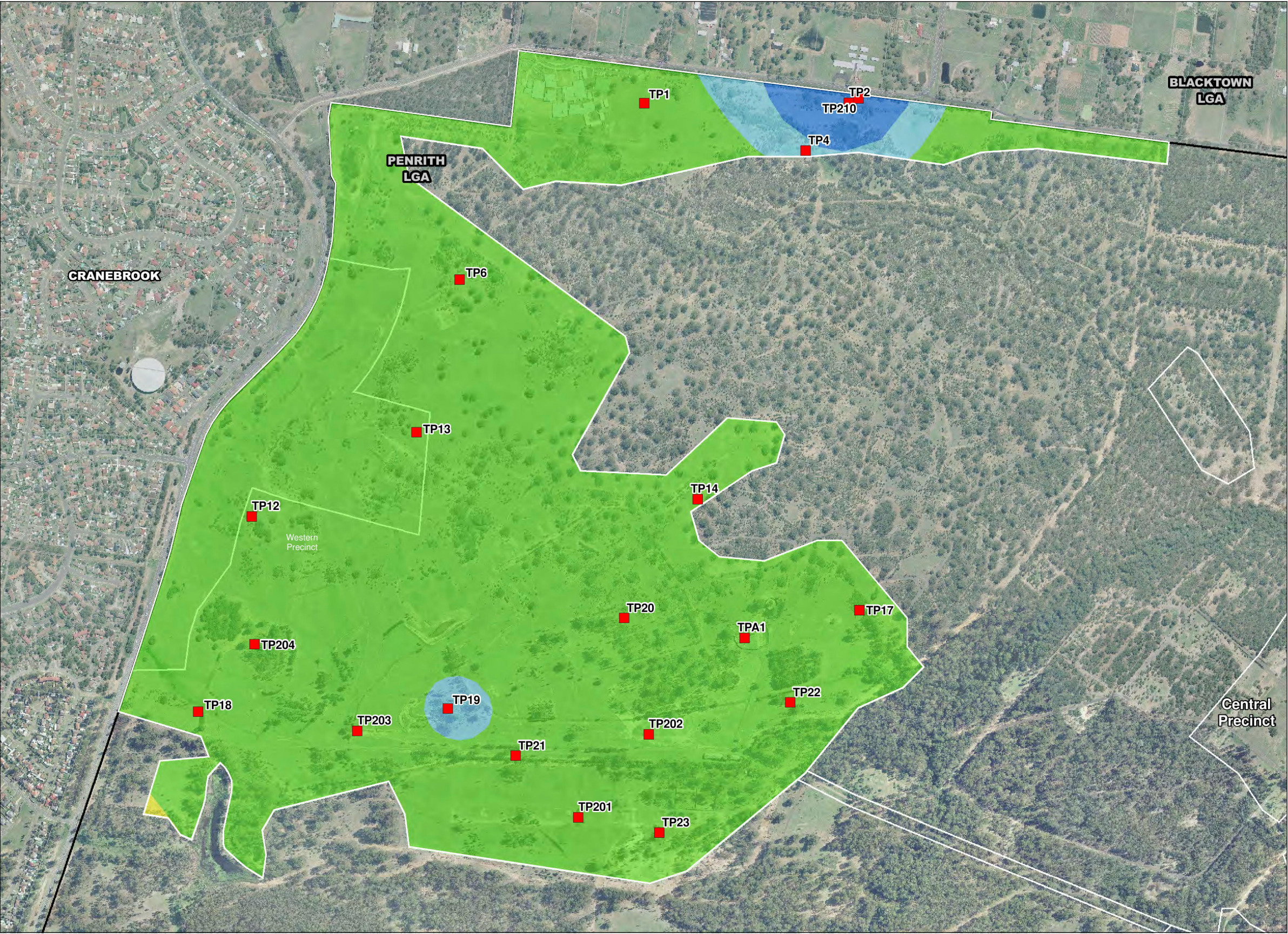
St Marys Development Project - Western Precinct

GDA 94 MGA Zone 56

June 26, 2008

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Legend

SREP 30 boundaries

Site boundary

(Sydney Regional Environmental Plan No 30 – St Marys Structure Plan Amendment No 1. Environmental Planning and Assessment Act, 1979. 11/04/2006. NSW Department of Planning.)

Property boundaries (LPI 2007)

LGA boundaries (LPI 2007)

Soil Bore Locations

Soil Salinity

Class	EC _e (dS/m)
Non-Saline	<2
Slightly Saline	2-4
Moderately Saline	4-8
Very Saline	8-16
Highly Saline	>16

2007 Aerial Photography by AUSIMAGE

0 250
Metres



Fig 5.6 : Soil Salinity at a Depth of 0.75m (B-Horizon)

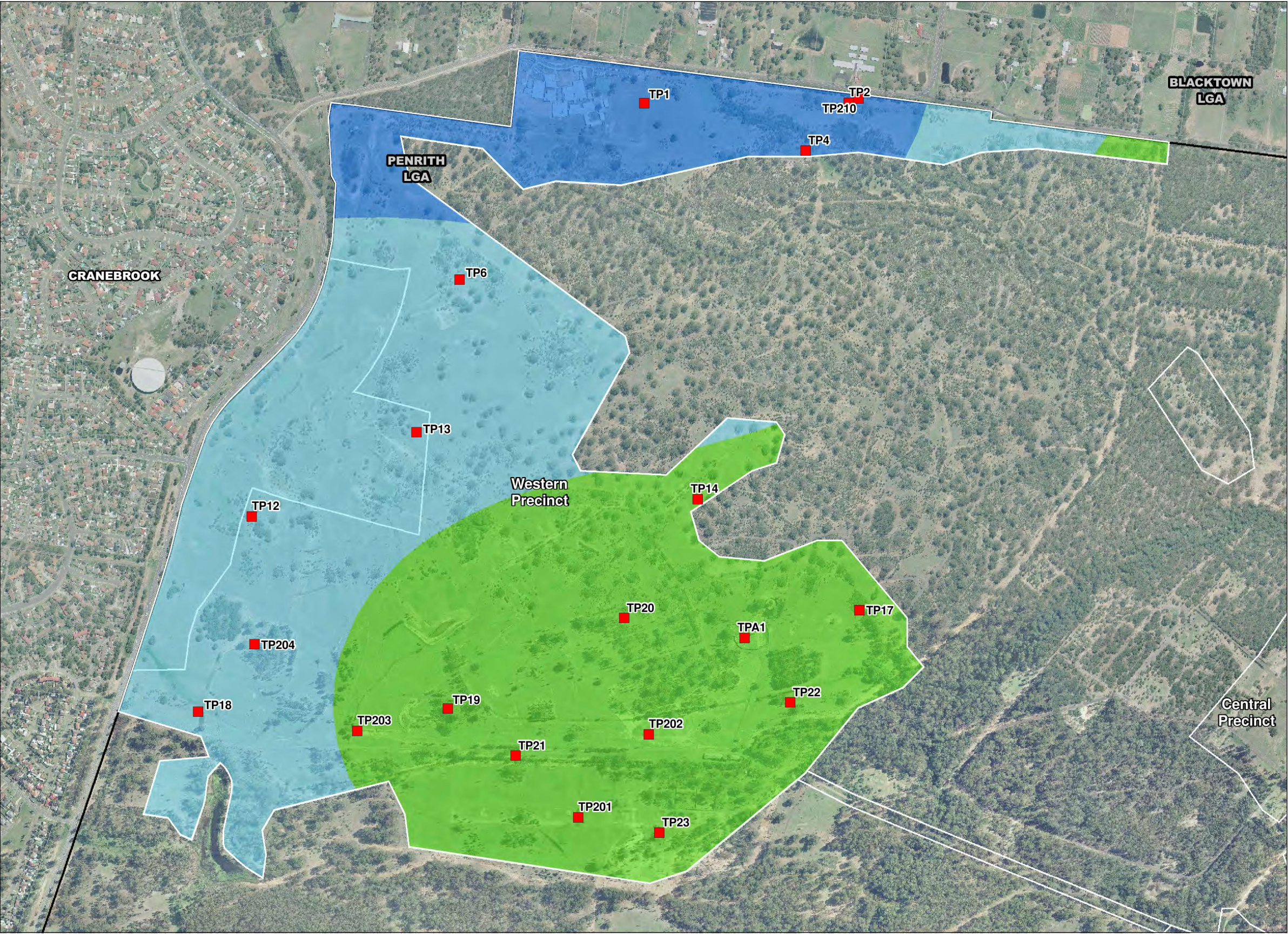
St Marys Development Project - Western Precinct

GDA 94 MGA Zone 56

June 26, 2008

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Legend

SREP 30 boundaries

Site boundary

(Sydney Regional Environmental Plan No 30 – St Marys Structure Plan Amendment No 1. Environmental Planning and Assessment Act, 1979. 11/04/2006. NSW Department of Planning.)

Property boundaries (LPI 2007)

LGA boundaries (LPI 2007)

Soil Bore Locations

Soil Salinity

Class	EC _e (dS/m)
Non-Saline	<2
Slightly Saline	2-4
Moderately Saline	4-8
Very Saline	8-16
Highly Saline	>16

2007 Aerial Photography by AUSIMAGE

0 250
Metres



Fig 5.7 : Soil Salinity at a Depth of 2m (Lower B-Horizon in Weathered Shale)

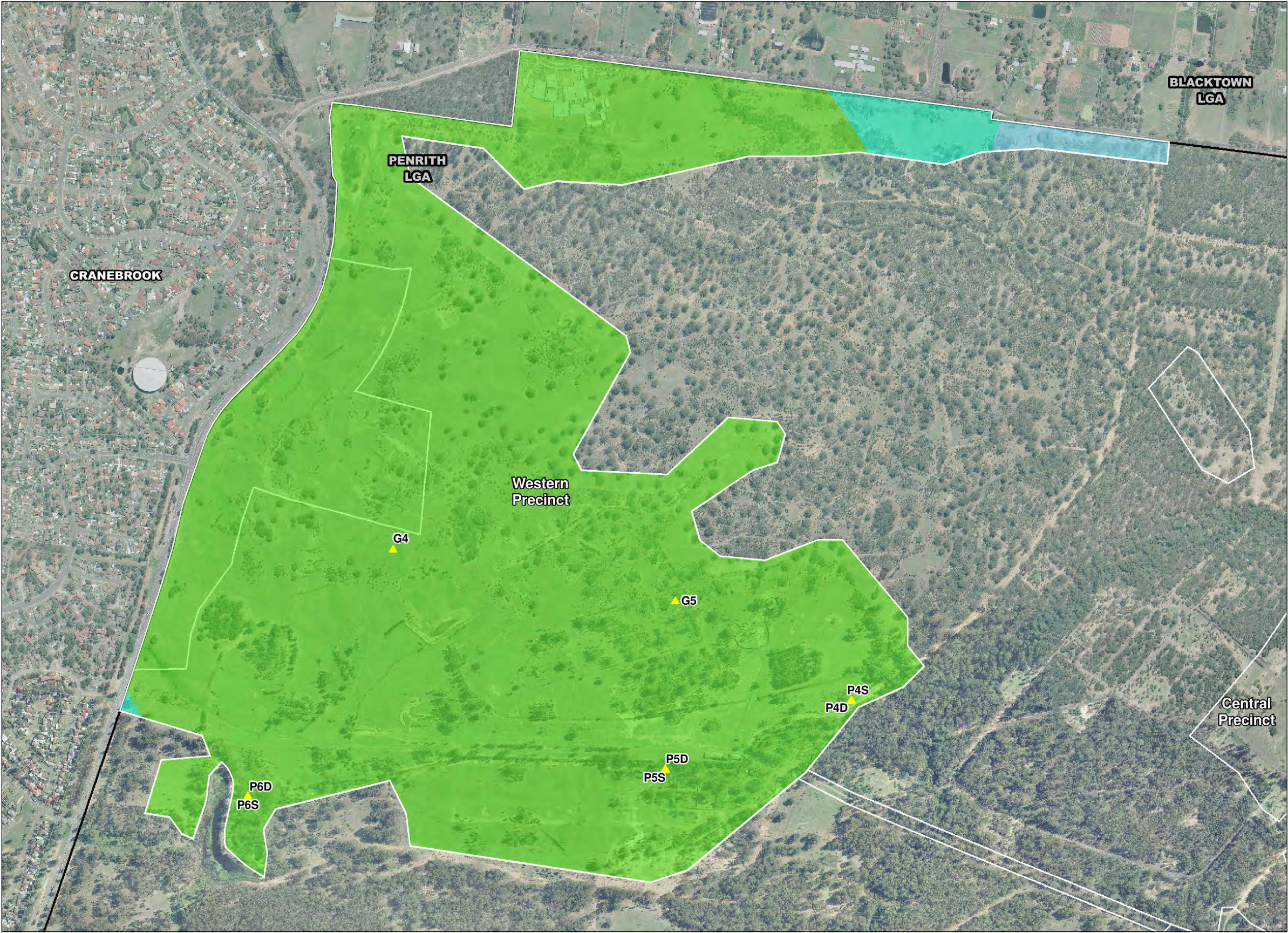
St Marys Development Project - Western Precinct

GDA 94 MGA Zone 56

June 26, 2008

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Legend

SREP 30 boundaries

Site boundary

(Sydney Regional Environmental Plan No 30 – St Marys Structure Plan Amendment No 1. Environmental Planning and Assessment Act, 1979. 11/04/2006. NSW Department of Planning.)

Property boundaries (LPI 2007)

LGA boundaries (LPI 2007)

Piezometers (J & K, Nov 1999)

Groundwater Salinity

Groundwater Salinity ($\mu\text{S}/\text{cm}$)

0 - 2,000
2,000 - 10,000
10,000 - 20,000
20,000 - 40,000
40,000 - 60,000
60,000 - 70,000
>70,000

2007 Aerial Photography by AUSIMAGE

0 250
Metres



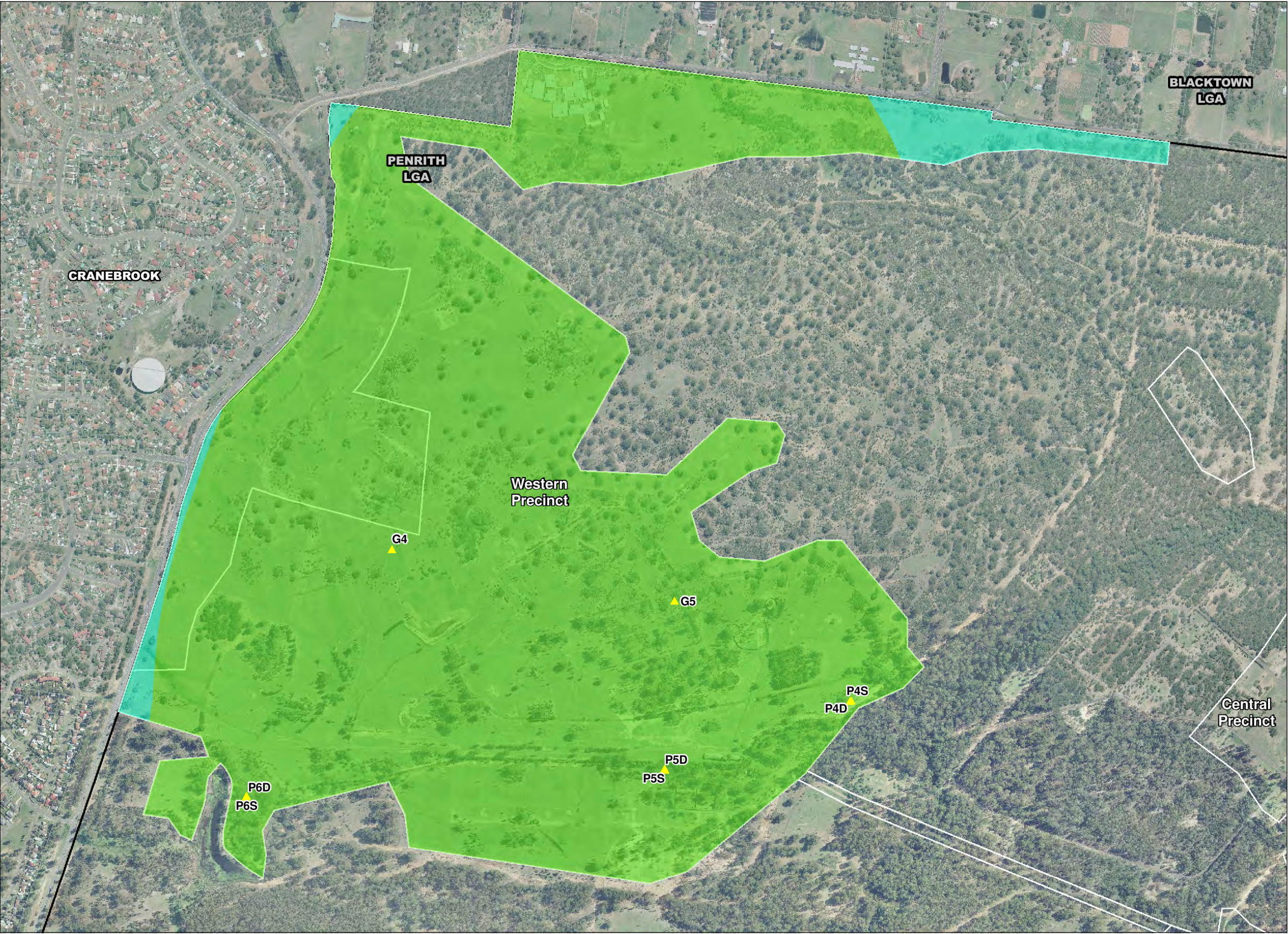
Fig 5.9: Groundwater Salinity (J & K Nov 1999)

St Marys Development Project - Western Precinct

GDA 94 MGA Zone 56

June 27, 2008
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Legend

SREP 30 boundaries

Site boundary

(Sydney Regional Environmental Plan No 30 – St Marys Structure Plan Amendment No 1. Environmental Planning and Assessment Act, 1979. 11/04/2006. NSW Department of Planning.)

Property boundaries (LPI 2007)

LGA boundaries (LPI 2007)

Piezometers (J & K, Jan 2000)

Groundwater Salinity

Groundwater Salinity ($\mu\text{S}/\text{cm}$)

0 - 2,000
2,000 - 10,000
10,000 - 20,000
20,000 - 40,000
40,000 - 60,000
60,000 - 70,000
>70,000

2007 Aerial Photography by AUSIMAGE

0 250
Metres



Fig 5.10: Groundwater Salinity (J & K Jan 2000)

St Marys Development Project - Western Precinct

GDA 94 MGA Zone 56

June 27, 2008
I:\INFR\Projects\IN90398\Technical\GIS\Template\IN90398_018_Groundwater_Salinity_002.mxd





■ **Table 5-5 Salinity, Erosion and Sediment Management Strategy Overview**

OBJECTIVE	BENEFIT	CONTROL	DETAILS	MONITORING METHOD	MANAGEMENT METHOD
SALINITY CONTROL MINIMISE GROUNDWATER RECHARGE	PREVENT RISING GROUNDWATER TABLE LEVEL AND DEVELOPMENT OF SALINE SOIL PROBLEMS	MINIMISE IMPORTATION AND USE OF POTABLE WATER ONTO THE SITE	<ul style="list-style-type: none"> • REUSE STORMWATER FOR IRRIGATION OF OPEN AREAS • MINIMISE POTABLE WATER DEMAND 	INSTALL MONITORING BORE NETWORK	<ul style="list-style-type: none"> • MONITOR GROUNDWATER TABLE LEVELS • PERFORM REGULAR, RANDOM INSPECTIONS OF HOUSE SITES, AND VEGETATION AND GENERAL INFRASTRUCTURE AREAS
		REDUCE IRRIGATION REQUIREMENTS	<ul style="list-style-type: none"> • ADOPT SMALL GARDEN/LAWN AREAS • ESTABLISH LOW WATER REQUIREMENT PLANTS • USE MULCH COVER • USE LOW FLOW WATERING FACILITIES 		
		AVOID USE OF INFILTRATION PITS TO DISPERSE SURFACE WATER	<ul style="list-style-type: none"> • DESIGN STORMWATER SYSTEM TO NEGATE NEED FOR HOME SITE STORMWATER STORAGE DISPOSAL • CONNECT ALL DOWNPIPES DIRECTLY TO STORMWATER 		
		PREVENT LEAKAGE FROM WETLAND AND DRAINAGE FACILITIES	<ul style="list-style-type: none"> • LINE ALL PERMANENT STORMWATER RETENTION STRUCTURES AND WETLANDS 		
SALINITY CONTROL ENCOURAGE USE OF GROUNDWATER AS A RESOURCE	MAINTAIN OR LOWER GROUNDWATER TABLE LEVEL	ENCOURAGE TREE PLANTING AND RETENTION, ESPECIALLY IN AREAS OF HIGHER RECHARGE	<ul style="list-style-type: none"> • USE/RETAIN NATIVE, DEEP-ROOTED, LARGE GROWING SPECIES 		
EROSION CONTROL	PREVENTS SILTATION PROBLEMS IN DRAINAGE FACILITIES AND DAMAGE THAT COULD RESULT FROM EROSION	DESIGN ALL WORKS TO LIMIT GENERATION OF POTENTIAL EROSION SURFACES AND STABILISE DISTURBED AREAS AS SOON AS POSSIBLE	<ul style="list-style-type: none"> • STABILISE DISTURBED SURFACES • CONSERVE TOPSOIL BY STOCKPILING FOR LATER REUSE • USE FAST GROWING GRASS SPECIES • USE TEMPORARY GROUND COVER OR MULCH FOR AREAS TO BE REDISTURBED • MINIMISE AREA OF DISTURBANCE • COVER STOCKPILES WITHIN 10 DAYS • USE LIME STABILISATION DURING EARTHWORKS TO IMPROVE SUBGRADE AND REDUCE DISPERSIBILITY 	<ul style="list-style-type: none"> • UNDERTAKE REGULAR INSPECTIONS OF ALL CONSTRUCTION ACTIVITIES • PERFORM REGULAR INSPECTION OF VEGETATION CONDITION IN DEVELOPMENT AREA 	REGULAR INSPECTION REPORTS TO BE SUBMITTED TO CONTROLLING AUTHORITY
SEDIMENT CONTROL	CONTROL SEDIMENT GENERATED BY CONSTRUCTION AND OTHER ACTIVITIES	INCLUDE SEDIMENT CONTROL CONSIDERATIONS IN ALL DESIGNS	<ul style="list-style-type: none"> • PROTECT STOCKPILES FROM EROSION • USE TEMPORARY SEDIMENT BASINS • USE SPECIFIC SOIL STABILISATION MEASURES IN AREAS OF HIGH POTENTIAL SOIL EROSION 		



4.4 Soil and Water Management Strategy

This section describes the Soil and Water Management Strategy (SWMS) for the construction phase of the project and with respect to groundwater and salinity management measures should be read in conjunction with section 5.9 and Appendix C.

Overall Approach

A soil and water management plan would need to be prepared as part of the development application. Its purpose is to safeguard the environment during the construction stages of the development.

The objectives of the SWMS are to:

- Provide an overall erosion and sediment control concept for the proposed development;
- Control the erosion of soil from disturbed areas on the site;
- Limit the area of disturbance that is necessary;
- Protect downstream water quality; and
- Prevent any sediment-laden water from entering South Creek.

In addition to the controls that have been identified in the SWMS, Erosion and Sediment Controls Plans (ESCP) for the site would need to be prepared at the development application stage in accordance with the requirements of : *Penrith City Council, Erosion and Sediment Control DCP, December 2006- section 2.4*, and the Landcom “*Soils and Construction “ Manual, 2004*, known as the “Blue Book”. The ESCP would describe the requirements for erosion and sediment controls, such as handling of excavation and filling, sediment fences, diversion drains, top soil stockpiles and reuse of soils, barrier fences, energy dissipaters, check dams, temporary culvert crossings and sedimentation basins.

Management Measures

The following soil and water management measures would be used during the construction phase of the development.

Land Disturbance Protection

Land disturbance during construction will be minimised to reduce the soil erosion hazard on site and may include the following;

- Clearly visible barrier fencing will be installed at the discretion of the site superintendent to minimise unnecessary site disturbance and to ensure construction traffic is controlled. Vehicular access to the site will be limited to only those essential for construction work and they will enter and exit the site only through the stabilised access points;



- Soil materials should be replaced in the same order that they are removed from the ground. It is particularly important that all subsoils are buried and topsoils are replaced on the surface at the completion of the works;
- The duration of all works, and thus the potential for soil erosion and pollution, should be minimised;
- Where practical, foot and vehicular traffic will be kept away from all recently stabilised areas; and
- Stockpiles should be seeded.

Erosion and Sediment Control Measures

The relevant measures listed below to address erosion and sedimentation should be used on site:

- Stabilised entry/exit point;
- Sediment filter fences;
- Weed-free straw bales;
- Barrier fences;
- Diversion drain banks/channels;
- Check dams;
- Temporary sedimentation basins; and
- Top soil stockpiles.

These control structures are described in the following sections.

Stabilised Entry/Exit Point

A stabilised entry/exit structure should be installed at the access point to the site to reduce the likelihood of vehicles tracking soil materials onto public roads. A shaker ramp (cattle grid) will also be used in addition to the stabilised gravel access.

Sediment Filter Fences

Sediment filter fences should be installed where needed to confine the coarser sediment fraction (including aggregated fines) as near to their source as possible.

Barrier Fences

Barrier mesh fences should be installed to define those areas on site that should not be entered to avoid unnecessary soil/land disturbance.

Diversion Drain Banks/Channels

Diversion banks intended to remain effective for more than 2 weeks will be rehabilitated when possible. Hessian cloth can be used if tacked with an anionic bitumen emulsion (0.5L/m²). Foot

SINCLAIR KNIGHT MERZ



and vehicular traffic will be kept away from these areas. Pipe culvert crossings that can withstand the maximum expected trucks loads will be installed where required. Concrete encasement for the pipe may be used if needed.

Check Dams

Check dams should be installed on diversion drains that are laid on longitudinal slopes greater than 2.5% to reduce runoff velocities. Check dams are to be located at intervals of approximately 100m.

Temporary Sedimentation Basins

Sediment basins will need to be constructed. These basins would be located at the furthest downstream point in their sub-catchment to maximise the capture and treatment of surface runoff during the construction phase. The sedimentation basins will need to be designed to suit type D (Dispersible) soils. Stored contents of the basins should be treated with gypsum or other approved flocculating agents where they contain more than 50mg/L of suspended solids. An energy dissipater rip rap may be installed at the weir outlet located at the downstream end of each sediment basin outlet to reduce runoff velocities where required.

Top Soil Stockpiles

Stockpiles will be constructed away from hazardous areas, particularly areas that are likely to have concentrated water flows. Stockpiles may be seeded.

Main Principles of Erosion and Sediment Control during Construction

The main principles for erosion and sediment control are summarised below:

- Stockpile and reuse all topsoil;
- Divert clean runoff water from the upstream drainage system around the disturbed open trench area;
- Restrict vehicular access to stabilised entry and exit points with controls to reduce soil export attached to excavators and truck tyres exiting the site;
- Restrict access to areas that do not require land disturbance;
- Provide adequately designed sediment fences, barrier fences, catch drains, check dams, sediment fences and other required structures;
- Ensure that the temporary top soil stockpiles are protected from erosion when works are unlikely to continue for long periods. Ensure that stockpiles are not placed in the flow path of upslope runoff;
- Make provisions for emergency quick clean-up and removal of any accidental spills of soil on to public property and provide tanker with pump to cope with accidental runoff;



- Provide wire mesh and gravel inlet filters at stormwater kerbs (if any) located downstream of the entrance to the site to trap any accidental spill of soil material;
- Monitor and maintain all sediment and erosion control measures;
- Minimise additional solid disturbance activities during wet weather;
- Undertake water quality monitoring at the outlet of the sediment basins to ensure compliance with the DECC (formerly EPA) guidelines;
- Stabilise rehabilitated surfaces as soon as possible; and
- Obtain additional information needed from the “*Soils and Construction*”, *Landcom 2004* manual.

4.5 Flooding

The Western Precinct lies to the west of South Creek and the site is not at risk of flooding from South Creek in the 1 in 100 year ARI event.

4.6 Flood Evacuation Strategy

The Probable Maximum Flood (PMF), the regional flooding in the Hawkesbury-Nepean River system, does not impact on the Western Precinct which is demonstrated on the SREP30 Structure Plans.

4.7 Conclusion

The MUSIC model results, as provided indicate that the proposed stormwater management wetlands would meet the SREP30 water quality objectives of ensuring that there is no net increase in the annual pollutant load in the developed case compared to the existing case.

This assessment identifies fewer stormwater management ponds across the St Marys Project site compared with the 1998 Study. This result is an expected one, as the proposed area to be developed by MDC has been reduced since the 1998 SKM report was produced. In summary, the modelling results indicate that the proposed stormwater management wetlands would meet the water quality and quantity objectives.

4.8 References

- 1) ANZECC Guidelines for Fresh and Marine Water Quality, 2000.
- 2) Environmental Investigation Services, *Soil and Groundwater Investigation*, December 2006
- 3) eWater, *MUSIC User Guide*, Version 3.1
- 4) Healthy Rivers Commission of New South Wales, *Independent Inquiry into the Hawkesbury Nepean River System, Final Report*, August 1998.
- 5) Landcom, *Soils and Construction*, 2004



NSW Environment Protection Authority
SITE AUDIT STATEMENT (SAS)

Site Audit Statement No.: CHK001/1

Site Auditor (accredited under NSW Contaminated Land Management Act 1997):

Name: Christopher H Kidd Company: HLA-Envirosciences Pty Limited
Address: 55-65 Grandview Street, Pymble, NSW Postcode: 2076
Phone: (02) 9988 4422 Fax: (02) 9988 4441

Site Details

ADI St. Marys Property – excluding Eastern Sector, QEL, Site 6 and Site 23, buildings and concrete stockpile.

Address: Forrester Road, St. Marys Postcode: 2760
Lot and DP Number: Lot 2 in DP803832
 Lot 2 and 3 in DP223888 (part of)
 Lot 3 in DP789196
 Lot 3 in DP598653
 (see attached map for excluded areas)
Local Government Area: Penrith and Blacktown

Site Audit requested by:

Name: Mr P Newton Company: Department of Urban Affairs and Planning
Address: Sydney Region West
 Level 8, Signature Tower
 2-10 Wentworth Street
 Parramatta NSW 2150
 Phone: (02) 9895 7142 - Fax: (02) 9895 6270

Name of contact person (if different from above):

Consultancy(ies) who conducted the site investigation(s) and/or remediation:

- ADI Limited Chemical and Explosives Ordnance Investigations, Remediation and Validation 1990 - 1999
- Mackie Martin & Associates Groundwater Investigations, 1991

Title(s) of Report(s) reviewed:

1. Historical Report – St Marys Property, ADI Limited, 1996;
2. Validation Report for the Western Sector, ADI St Marys Facility, ADI Limited November 1994;
3. Validation Report for the North Western Sector of the ADI St Marys Facility, Report No. 498800, ADI Limited 1995;
4. Validation Report for the Southern Sector West of the ADI St Marys Property, Report No. 498810, ADI Limited 1996;



5. Validation Report for the Southern Sector East of the St Marys Property, Report No. 498810, ADI Limited 1996;
6. Validation Report for the Northern Sector of the ADI St Marys Property, Report No. 498820, ADI Limited 1996;
7. Validation Report for the Cental Sector East of the ADI St Marys Property, Report No. 498840, ADI Limited 1997;
8. Validation Report for the Central Sector West of the ADI St Marys Property, Report No. 498840, ADI Limited 1996;
9. Validation Report for the North Eastern Sector of the ADI St Marys Property, Report No. 498850, ADI Limited 1996;
10. QA/Verification Survey Results, ADI St Marys Property, Report No. PG980323da ADI Limited, 1999.

Other Information reviewed:

1. Site Investigation Report of St Marys Facility Ammunition and Missiles Division, Volume 4 – Discussions and Conclusions, ADI, June 1991.
2. Remediation Action Plan for the Northern Sector, ADI St Marys Facility, Report No. 498820, ADI Limited 1996;
3. Remediation Action Plan for Central Eastern Sector, ADI St Marys Facility, Report No. 498840, ADI Limited 1996;
4. Remediation Action Plan for the Eastern Sector of the ADI St Marys Property, Report No. 498830, ADI Limited 1996;
5. Stage I Decontamination Audit, ADI St Marys CMPS&F, 1997.

Summary Site Audit Report Title:

Stage 2 Decontamination Audit Report for ADI Site, St Marys.

I have completed a site audit (as defined in the Contaminated Land Management Act 1997) and reviewed the reports and information referred to above with due regard to relevant laws and guidelines. I certify that the site (tick **all** appropriate boxes)

(a) is suitable for the following use(s):

- ☒ residential, including substantial vegetable garden and poultry;
- ☒ residential, including substantial vegetable garden, excluding poultry; *use*
- ☒ residential with accessible soil, including garden (minimal home grown produce contributing less than 10% fruit and vegetable intake), excluding poultry; *use*
- ☒ residential with minimal opportunity for soil access including units;
- ☒ daycare centre, preschool, primary school;
- ☒ secondary school;
- ☒ park, recreational open space, playing field;
- ☒ commercial/industrial use;
- ☒ Other *use*



subject to

✓ Conditions

1. Excludes Eastern Sector, QEL, Site 6 and Site 23 which are covered by separate site audit statements, namely CHK001/2, CHK001/3, CHK001/4 and CHK001/5.
2. Excludes areas not yet investigated including the footprint of original buildings, car parks and roads, mainly around former Administration Centre Buildings CHK001/6) and the concrete stockpile in Central Sector West. (Stockpile CHK001/7)
3. An appropriate management plan, including procedures for the safe handling and disposal of any items of ordnance that may be found during earthworks, should be lodged prior to the commencement of development earthworks. This plan should be similar to the "Remnant Contamination Management Plan" submitted by ADI (see Appendix E of the Site Audit Report).

~~(b) is not suitable for any beneficial use due to risk of harm from contamination~~ *Mike*

☐ (comments): *John*

I am accredited by the NSW Environment Protection Authority under the Contaminated Land Management Act, 1997 as a site auditor (Accreditation No. 9813).

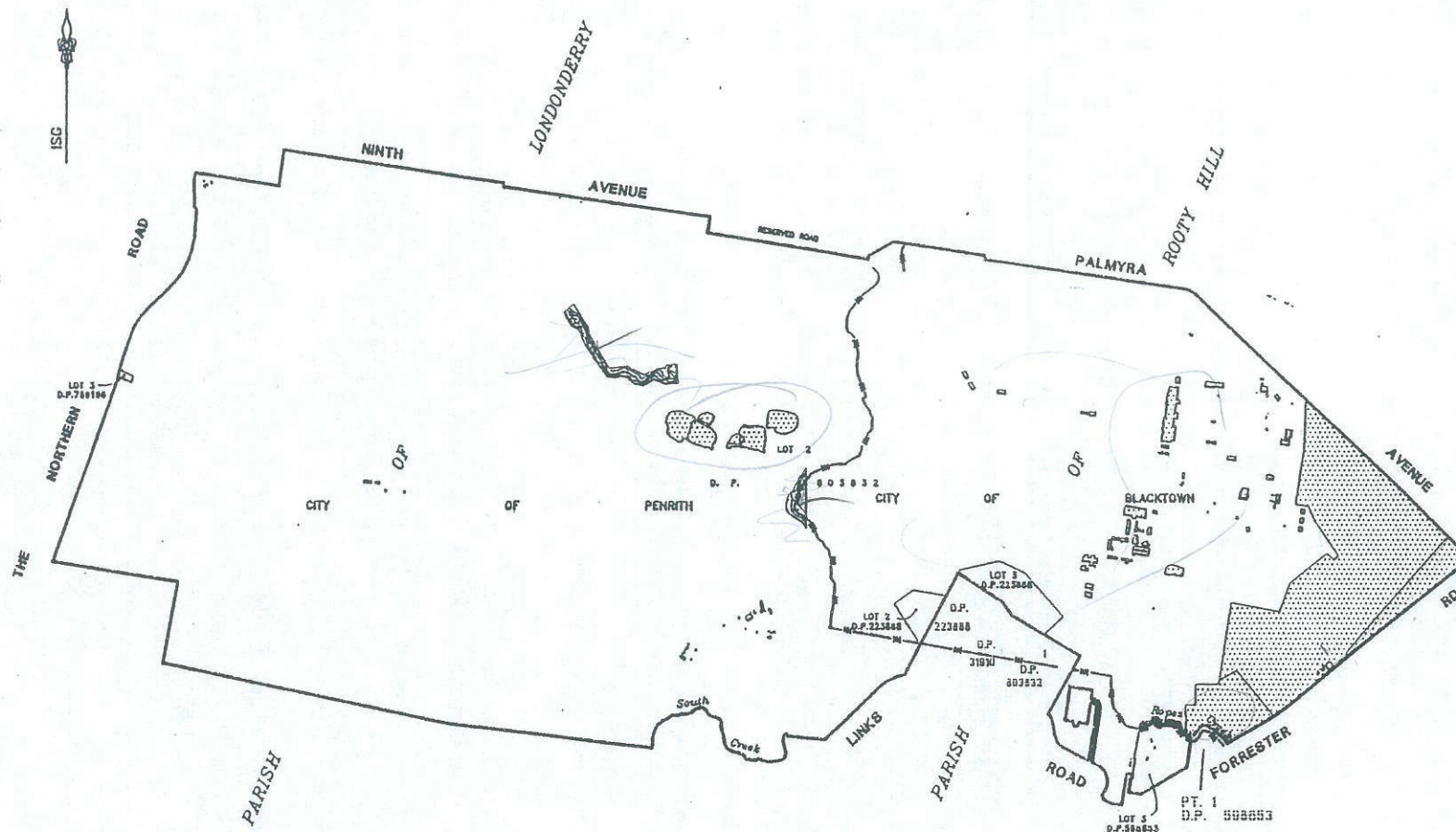
I Certify that:

- (a) I have personally examined and am familiar with the information contained in this statement, including the reports and information referred to in this statement, and
- (b) this statement is to the best of my knowledge, true, accurate and complete, and
- (c) on the basis of my inquiries made to those individuals immediately responsible for making the reports, and obtaining the information, referred to in this statement, those reports and that information are, to the best of my knowledge, true, accurate and complete.

I am aware that there are penalties for wilfully submitting false, inaccurate or incomplete information.

Signed: *Lawson*

Date: *7/6/99*



NOTE :

GEOMETRY SHOWN AS SUPPLIED BY ADI LIMITED TO OUR OFFICE 10.5.1999
FOR SITE DETAILS ON EXCLUDED AREAS PLEASE REFER TO DRAWINGS :

- 5467-123
- 5467-125
- 5467-126
- 5467-127
- 5467-128
- 5467-129
- 5467-130
- 5467-131
- 5467-132
- 5467-133
- 5467-134
- 5467-135

SHADED AREAS ARE EXCLUDED FROM
AUDIT STATEMENT CHK001/1

NOTES:

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PREPARED BY:

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Planners
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12 Victoria Road, Parramatta.
NSW 2150
Telephone 02) 9630 4199
Facsimile 02) 9630 4599

PREPARED FOR:

ADI Property

**ADI ST MARYS PROPERTY
PLAN TO ACCOMPANY SITE
AUDIT STATEMENT CHK001/1**

ORIGINAL SIZE:		A3
SCALE	HOR: 1 : 25,000	VERT: -
CO-ORDS:	ISG	DATUM: -
DATE OF SURVEY	DATE OF PLAN: 11 May 1999	
SURVEY	-	DRAWN Acad/MTB
CHECKED:	MTB	DATE 24.5.1999
APPROVED:	PW	DATE 24.5.1999
JOB REF:	8662	
CAD REF:	5467-122.DWG	SHEET 1 OF 13 SHEETS

Contamination Management Plan Western Precinct Development Phase

Prepared for

Maryland Development Company

Private Road
Off Forrester Road
St Marys 2760

JULY 2008

URS

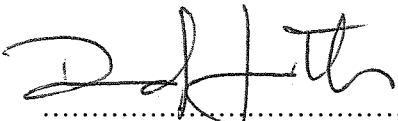
Project Director:


.....

Seth Molinari
Senior Principal

URS Australia Pty Ltd
Level 3, 116 Miller Street
North Sydney, NSW 2060 Australia
Tel: 61 2 8925 5500
Fax: 61 2 8925 5555

Author:


.....

David Smith
Principal

Date: 7th July 2008
Reference: 4321 7287
Status: Final

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APPENDICES

Appendix A Site Audit Statements

Glossary of Abbreviations and Terms

Abbreviation	Term	Definition
Ammunition	Ammunition	A device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in connection with defence or offence including demolitions. Certain ammunition can be used for training, ceremonial or other non-operational purposes.
Category A	Category A ordnance items	An item clearly of a military nature and which might readily be recognised by a member of the public as such (e.g. in effect complete in appearance as a projectile of 20 mm calibre or greater, hand grenade, mortar, bomb, etc) and <u>containing explosive filling</u> , but excluding small arms ammunition.
Category B	Category B ordnance items -	An item clearly of a military nature and which might readily be recognised by a member of the public as such (e.g. in effect complete in appearance as a projectile of 20 mm calibre or greater, hand grenade, mortar, bomb, etc) and <u>not containing explosive filling</u> , but excluding small arms ammunition.
CMP (2003)	Contamination Management Plan for the Eastern Precinct	The Contamination Management Plan prepared in 2003 and submitted to Blacktown City Council and other authorities as required by the Site Audit Statements issued in the Stage 2 Decontamination Audit of ADI St Marys Munitions Factory, dated 7 th June 1999.
CMP	Contamination Management Plan	The Contamination Management Plan issued to support Precinct Plan(s).
DPP	Dunheved Precinct Plan	The Dunheved Precinct Plans set out the future pattern of development for the Dunheved Precinct. The Plan was adopted by Penrith City Council on 11 December 2006 and by Blacktown City Council on 12 January 2007.
DUXOP	Defence Unexploded Ordnance Panel	The panel of contractors and consultants from whom the Department of Defence selects members for UXO related tasks.

Contents

Abbreviation	Term	Definition
EPP	Eastern Precinct Plan	The Eastern Precinct Plan sets out the future pattern of development for the Eastern Precinct. The Plan was adopted by Blacktown City Council on 4 February 2004.
Induction	Site Specific Induction	<p>Section 8(2) of the OHS Act requires employers to ensure that persons other than their workers are not exposed to risks while in the employer's workplace. These persons include contractors, customers and visitors.</p> <p>If there are significant risks in the workplace, there may be a need for site induction training and procedures for managing people while on the premises.¹</p>
Property	Property	The whole of the landholding by St Marys Land Limited and which is sometimes called the St Marys Property for the purposes of its rezoning and redevelopment.
Site	Site	The subject area, where potential contamination has been found.
UXO	Unexploded Ordnance	Explosive ordnance that has been primed, fused, armed or otherwise prepared for action and which has been fired, dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installations, personnel or material but remains unexploded either by malfunction or design or for any cause. UXO includes items of military ammunition or explosives removed from their original resting-place for any reason, including souveniring.

¹ "<http://www.workcover.nsw.gov.au/Employers/LegalResponsibility/default.htm>" WorkCover's webpage on 18th September 2006.

1.1 General Introduction

The former Australian Defence Industries (ADI) Property (the Property) at St Marys was endorsed by the NSW Government for inclusion on the Urban Development Program in 1993. The Property was seen to present an opportunity to provide housing for Sydney's growing population within an environmentally sustainable framework.

The Property is located approximately 45km west of the Sydney CBD, 5km north-east of the Penrith City Centre and 12km west of the Blacktown City Centre. The main western railway is located approximately 2.5km south of the Property. The Great Western Highway is located another 1 km south and the M4 Motorway a further 1.5km south.

The Property has an area of 1,545ha, and stretches roughly 7 kilometres from east to west and nearly 3 kilometres from north to south, from Forrester Road, St Marys in the east to The Northern Road, Cranebrook in the west, and is bounded by Llandilo and Willmot in the north and Cambridge Gardens / Werrington County and the Dunheved Industrial Area in the south. Figure 1, following, illustrates the location of the Property.

Figure 1 Aerial photograph of the St Marys Property



Given that the Property straddles the boundary between two local government areas (Blacktown and Penrith), the NSW Government decided that a regional environmental plan should be prepared covering development of the Property. Technical investigations into the environmental values and development capability of the land were commenced in 1994, and the Regional Environmental Plan for St Marys (Sydney Regional Environmental Plan No. 30 (SREP 30)) was gazetted in January, 2001. SREP 30 zoned the land for a combination of “urban”, “employment”, “regional open space”, and “regional park” uses.

A package of documents was prepared to guide and control development comprising SREP 30 (maps and a written instrument) and an Environmental Planning Strategy (EPS) which sets out performance objectives and strategies to address key constraints associated with the Property, including: conservation, cultural heritage, water and soils, transport, urban form, energy and waste, human services, employment and land contamination.

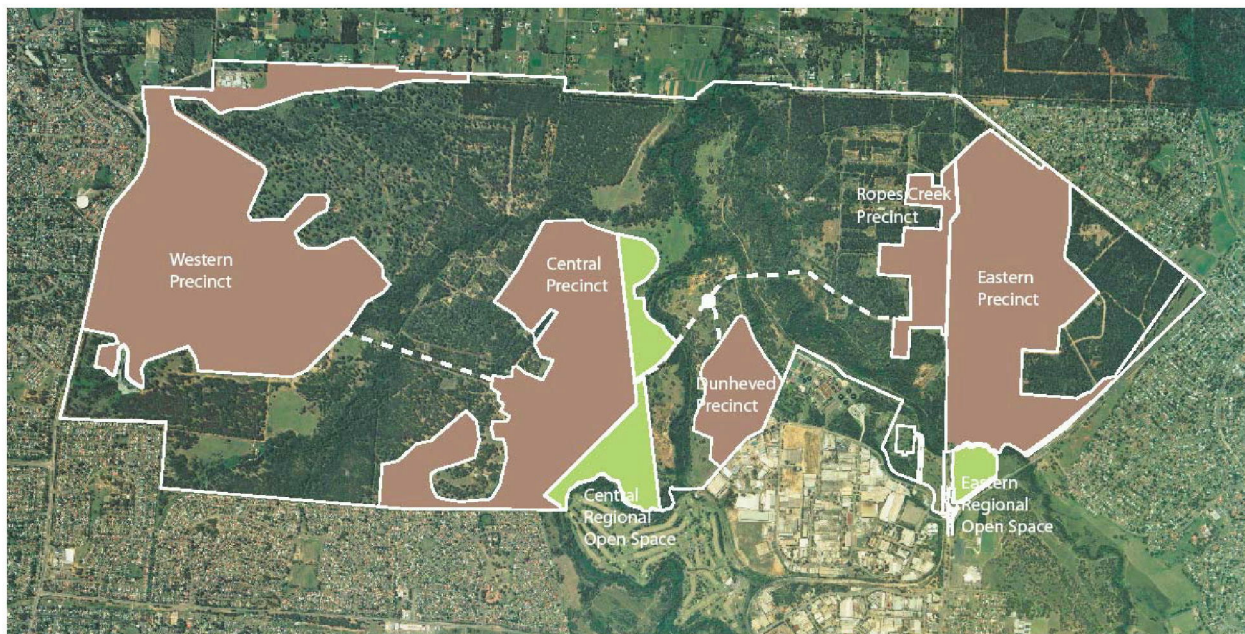
In December 2002, a Deed of Agreement was entered into between the landowner and developers of the land (a Joint Venture comprising ComLand and Lend Lease Development) and the NSW Government setting out the developer’s and State Government’s responsibilities in providing services and infrastructure.

SREP 30 identified six development “precincts” (known as the Western Precinct, Central Precinct, North and South Dunheved Precincts, Ropes Creek Precinct and Eastern Precinct) within the Property.

SREP 30 requires that a Precinct Plan, addressing the issues in SREP 30 and the EPS (including preparation of management plans for a range of key issues), be adopted by Council prior to any development taking place.

In March 2002, the Commonwealth Government advised that those areas of the Property listed on the Register of the National Estate should be excluded from urban development. This had the effect of changing the boundaries of the areas to be set aside for conservation. SREP 30 was subsequently amended in April 2006 to reflect these boundary changes. The precincts available for development are shown in Figure 2 below.

Figure 2 Western Precinct (with other developable areas)



On 29 September 2006, the Minister for Planning declared the Western Precinct a Release Area, paving the way for the preparation of a Precinct Plan for this area. The Western Precinct, the subject of this CMP, occupies an area of approximately 229 hectares. Although currently zoned under SREP 30 for both Urban and Employment uses, there is a draft amendment to SREP 30 currently being prepared under which the entire Western Precinct is zoned Urban.

A Precinct Plan for the Eastern Precinct (EPP) was adopted by Blacktown City Council (BCC) on 4 February 2004. The EPP incorporated a Contamination Management Plan (CMP) prepared by URS in 2003, and other management plans, and an accompanying Development Control Strategy (DCS). The Dunheved Precinct Plans have since been adopted by Penrith City Council and Blacktown City Council.

Since completion of the CMP (2003), development of the Eastern Precinct Release Area has progressed and additional site investigations have been completed as required by Site Audit Statements.

In addition, the Department of Environment and Conservation (DEC) (incorporating the NSW Environment Protection Authority and now known as the NSW Department of Environment and Climate Change (DECC)) has provided advice to Site Auditors that “*auditors should be able to rely on expert opinion [Department of Defence Unexploded Ordnance panel (DUXOP) consultants] to form a view about site suitability*” when assessing a site for munitions contamination. Further deliberations by the DEC and Site Auditors have determined that the presence of munitions items on a site is not likely to be within the ambit purview of a Site Auditor accredited under the Contaminated Land Management Act (1997) – but rather a suitably qualified expert in procedures for the location, handling and disposal of munitions items. Such experts can be found in, but are not limited to, the DUXOP.

Notwithstanding this change in process, the 1999 Site Audit Statements for the St Marys property have addressed the issue of potential UXO contamination.

Bulk earthworks commenced in the Eastern Precinct on 8 December 2004. Development applications for the construction of the Ropes Creek Bridge and the Southern Entry Road into the site have been submitted to BCC and Penrith City Council.

Subsequently, CMPs have been prepared by URS for the North and South Dunheved Precincts (2004), Ropes Creek and Eastern Precincts (2006) and the Eastern Regional Park (2006).

This CMP (Western Precinct Contamination Management Plan) has been prepared to support the lodgement of the Western Precinct Plan and takes into account current site knowledge including and DECC guidance relating to the reliance on specialist consultants for use in the development phase prior to sub-division.

1.2 Introduction to the Contamination Management Plan

The Western Precinct was the subject of extensive investigation during the 1990s. The investigation work was undertaken with the full involvement of the EPA and subsequently an independent NSW EPA accredited Site Auditor who produced and issued Site Audit Statements for the whole of the St Marys Property (*Stage 2 Decontamination Audit of ADI St Marys Munitions Factory*, dated 7 June 1999).

The investigation and remediation programme for the Property commenced in 1990, with the objective of assessing the nature, degree of chemical contamination and remediating to a level suitable for redevelopment for a variety of land uses including residential. For the purposes of the remediation and validation, the Property was divided into nine sectors. The Western Precinct covers part of the following sectors as follows:

- Part Western Sector Covered by SAS CHK001/1.
- Part Southern West Sector Covered by SASs CHK001/1, CHK001/6 and CHK001/7.

The information presented in the remediation and validation reports for these sectors has been considered, along with other relevant information for the Property, to develop this CMP (Western Precinct).

The majority of the Western Precinct was assessed by the Site Auditor to pose a negligible risk to the public or the environment with regard to chemical contamination and/or explosive ordnance (See SASs as listed above in Appendix A). Conditions on the SASs required investigation and assessment of areas underlying roadways which had not been investigated at the date of the SASs.

1.3 Contamination Management Plan Objectives

The objective of this CMP is to provide a framework for identifying and addressing any discovery of chemical contamination or potentially explosive ordnance so as to ensure a safe working environment for workers during development and to avoid unacceptable impact on the natural environment.

Unexpected finds may occur in areas which, although searched extensively, contain remnant materials which were obscured by the local topography, the type of surface cover (e.g. building) or at a depth preventing detection. The Site Auditor considered that, while explosive ordnance may be uncovered during earthworks, it is unlikely that these will present an unacceptable risk provided appropriate procedures for the safe handling and disposal of such material are adopted.

The successful implementation of the CMP requires the appropriate briefing and Site Specific OHS Induction of Site Operatives who may uncover potential chemical contamination (including potential asbestos containing materials) and/or explosive ordnance. It is proposed this briefing will include the review of this CMP and the associated flow chart (Figure 3 on p2-4).

This CMP describes reporting procedures and lines of responsibility (See Section 3). These experts should include those with detailed knowledge of the remediation which has been undertaken at the Property and details on the location of, and access to, the supporting documents related to the assessment and remediation of the Western Precinct.

The Property has been remediated, audited and declared suitable for its intended land uses, and remnant contamination, if present, is most likely to be discovered during the development earthworks which will occur prior to subdivision.

The approaches included in this CMP are intended for use only during the site preparation phase of development, during which structures may be demolished and disposed of, land levels may be altered and redundant infrastructure is removed and new infrastructure is installed.

Subsequent plans, if required, will be administered through the relevant local government authority.

The operation of the CMP is described in the attached flow-chart (Figure 3).

The objective of the CMP is to provide clear guidance on the safe and appropriate actions in the event of encountering potential chemical or explosive ordnance contamination during site development works. Where such material is uncovered the CMP prescribes the quarantining of the relevant area of concern, allowing other site works to proceed unhindered, while the area of concern is assessed and, if necessary, remediated and validated.

Where required, reference should be made to the extensive library of documents containing information on the historic assessment and remediation of the site. This library provides a valuable source of information which can be drawn on to provide support for development of remedial and/or assessment approaches.

Two classes of potential contamination are discussed separately below: chemical (including potential asbestos containing materials) and ordnance.

2.1 Potential Chemical Contamination

Potential chemical contamination may be indicated in the field by:

- Discoloured soils;
- Odorous soils;
- Potentially asbestos containing sheeting, fragments or insulation materials; or
- The presence of other foreign materials, such as drums, waste dumps or building rubble which could be a source of contamination.

If the Site Manager considers material to be potential chemical contamination the area will be quarantined and a suitably qualified Environmental Consultant will be contacted. The Environmental Consultant will be responsible for assessing the findings, taking samples to characterise and delineate the extent of the potential contamination and defining appropriate remedial actions, if required.

Suspected asbestos containing materials should be managed in accordance with relevant WorkCover requirements and a site specific Asbestos Management Plan.

If deemed necessary by the Environmental Consultant, the contamination will be removed for disposal at a suitably licensed facility in accordance with *Waste Classification Guidelines* (NSW DECC, April 2008). The resultant excavation will be validated by the Environmental Consultant and a report on the remediation and subsequent validation will be completed and, if appropriate, be reviewed and approved by an independent NSW EPA accredited Site Auditor. The quarantine barriers can be removed and the earthworks continued upon receipt of advice from the Environmental Consultant, issue of an SAS, or preliminary advice from the Site Auditor.

If the area is determined by the Environmental Consultant to not be contaminated or the analyses meet the relevant site validation criteria, the Environmental Consultant should notify the Site Manager that the quarantine restrictions on the area can be lifted and the works in that area may resume. The Environmental Consultant will prepare a report on the investigation and the conclusions drawn.

Extensive Contamination

In the event that assessment by the Environmental Consultant identifies that the contamination is extensive² in its lateral and/or vertical extent, then the Environmental Consultant will prepare a sampling and analysis plan to delineate the contamination and assess the extent of any remediation required. The sampling and analysis plan must be reviewed by the independent Site Auditor, who would be engaged to review the works and issue a new SAS, on successful completion of the works.

2.2 Potential Explosive Ordnance Materials

Potential explosive ordnance material may be indicated in the field by:

- Munitions shells;
- Flares;
- Ammunition packaging;
- Grenade components; or
- Metal debris not identifiable as non-munitions or of uncertain origin.

Should potential ordnance material be uncovered, the earthworks will cease immediately and the Site Manager informed. The area should be quarantined, by means of some appropriate barrier to prevent access to the area to protect the workforce from potential injury.

The Site Manager will make a preliminary assessment of the find and determine whether it is some miscellaneous debris, a fragment of ordnance or a potentially explosive device.

Where the Site Manager can identify the item as non-ordnance debris or a minor harmless fragment of ordnance debris, the material should be removed from the excavation and disposed of appropriately.

Where it is considered to be a potentially explosive device, the Site Manager shall contact an appropriately qualified Ordnance Contractor, to assess the item and the area.

Should the Ordnance Contractor consider the object(s) to be non-ordnance or harmless fragments of ordnance, the object(s) can be removed and disposed of appropriately. The quarantine restrictions can be lifted and the earthworks continued.

² When the area is sufficiently large to warrant audit of the remediation and issue of a replacement Site Audit Statement, the Environmental Consultant will advise when to engage an Auditor reflecting contemporary industry practise. Less than 1000 m² would not immediately qualify.

If the Ordnance Contractor identifies the object(s) as potential explosive ordnance, the Ordnance Contractor shall inform the Site Manager, and arrange disposal.

Based on the nature of find, it may be recommended that a geophysical survey of the area be undertaken to establish whether the item was an individual piece, one of a number of pieces or a disposal pit. The survey would be undertaken by the Ordnance Contractor using appropriate equipment. Further surveys are mandatory if the explosive ordnance is considered a Category A item or more than three readily identifiable Category B items are found at one location.

- **Category A** - An item clearly of a military nature and which might readily be recognized by a member of the public as such (e.g. in effect complete in appearance as a projectile of 20 mm calibre or greater, hand grenade, mortar, bomb, etc) and containing explosive filling, but excluding small arms ammunition.
- **Category B** - An item clearly of a military nature and which might readily be recognized by a member of the public as such (e.g. in effect complete in appearance as a projectile of 20 mm calibre or greater, hand grenade, mortar, bomb, etc) and not containing explosive filling, but excluding small arms ammunition.

This is in accordance with the validation procedures for the earlier site assessments, remediation and audit, and maintains the same level of confidence for the whole Property.

The Ordnance Contractor will prepare a report on the investigations undertaken, remediation works undertaken and validation surveys completed. Subject to review of the Ordnance Contractor's report by a suitably qualified consultant, the quarantine restrictions on the area can be removed and the earthworks resumed. The Site Auditor will be provided with a copy of the Clearance Report for the area issued by the Ordnance Consultant.

Further Explosive Ordnance Surveys

Any additional ordnance surveys should be designed to characterise the extent and character of the ordnance contamination and then (or concurrently) to remove the contaminant so that the area is safe for the development activities to resume. These surveys should be undertaken by an Ordnance Contractor, with the objective of characterising and delineating the extent of the explosive ordnance contamination. Such surveys may, as appropriate, utilise magnetic, electromagnetic or other diagnostic techniques.

In the event that further explosive ordnance is discovered the search area may need to be extended to ensure a suitable buffer zone is searched. A remediation and sampling strategy for the area is to be developed in consultation with the Ordnance Consultant.

All additional finds should be logged and disposed of appropriately. Once the investigation is complete a report on the scope of the investigation, remedial work and results should be produced by the Ordnance Contractor, approved by the Ordnance Consultant and provided to the independent Site Auditor. The quarantine restrictions on the area can be removed and the earthworks resumed.

2.3 Temporary Stockpiling of Materials

Earthworks in the development phase are likely to, temporarily, generate excess material which may be stockpiled for re-use. Unless some event or observation indicates that the material excavated and placed into the stockpile is potentially contaminated, no particular treatment is required other than normal dust suppression, and erosion controls in accordance with relevant Council requirements.

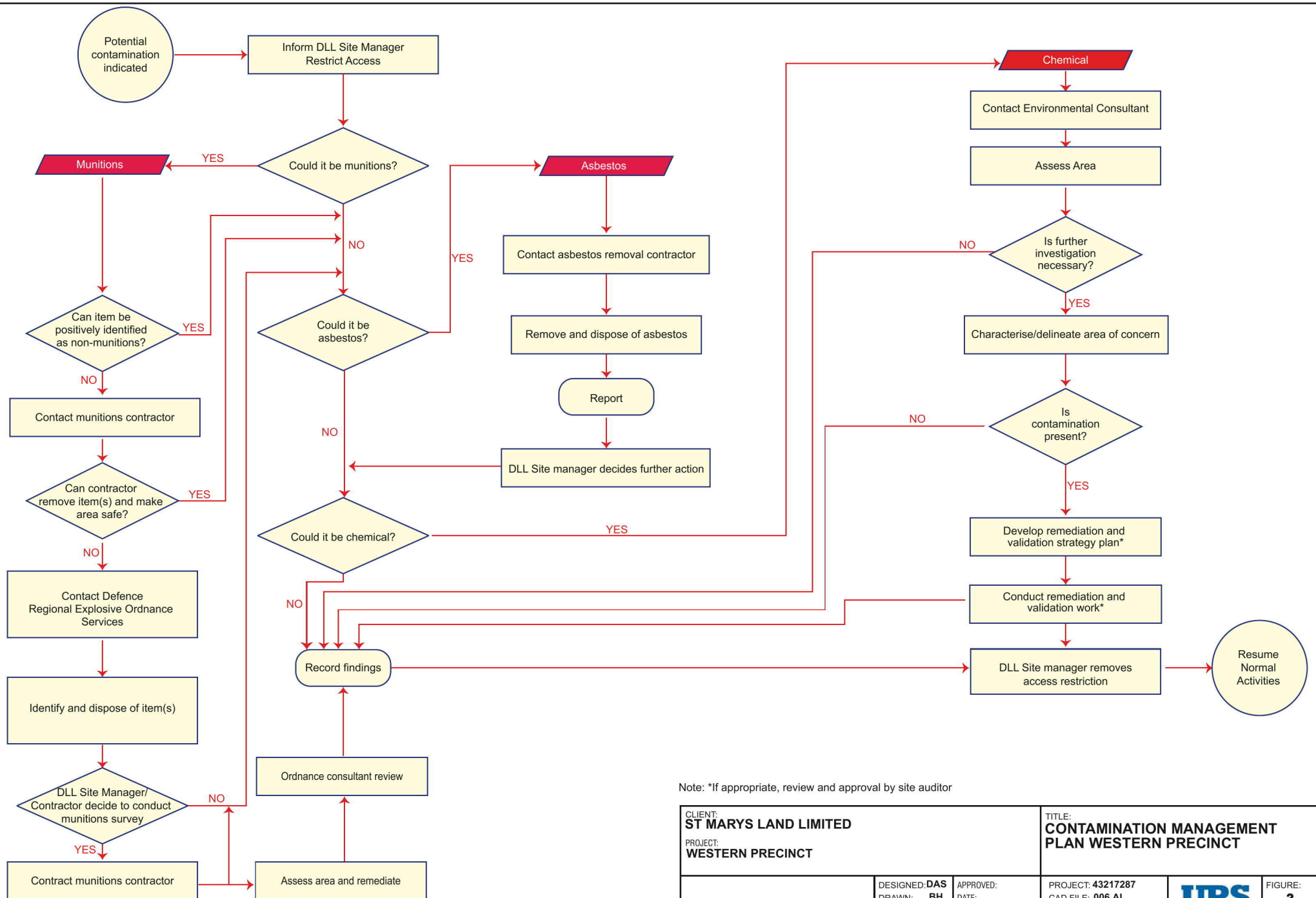
If assessment by the Environmental Consultant or the Ordnance Contractor identifies contamination that is extensive in its lateral and/or vertical extent, or a stockpile is observed to be contaminated, then the Environmental Consultant will prepare a sampling and analysis or survey plan to delineate the contamination and assess the extent of remediation required. The sampling and analysis plan or survey plan should, as appropriate, be reviewed by the Site Auditor or the Ordnance Consultant.

Subject to the agreement of the relevant Consultant, it may be possible to move and stockpile the affected material. Where temporary stockpiling is permitted such stockpiles shall be installed and maintained to eliminate risk to workers and other people due to exposure to contaminants in dust or vapours and risk to the environment as a result of silt or contamination of stormwater.


Validation sampling or surveying of the contaminated area or stockpile would be required before earthworks continue in that area.

2.4 Contaminated Management Plan Flowchart

Figure 3, following, describes the decision processes in the implementation of this CMP.



Note: *If appropriate, review and approval by site auditor

CLIENT: ST MARYS LAND LIMITED			TITLE: CONTAMINATION MANAGEMENT PLAN WESTERN PRECINCT		
PROJECT: WESTERN PRECINCT					
DESIGNED: DAS DRAWN: BH DATE: 17/08/06		APPROVED: DATE: STATUS:	PROJECT: 43217287 CAD FILE: 006.A1 REVISION: A		FIGURE: 3

The key roles³ and responsibilities with respect to this CMP are as follows:

Title	Role
Asbestos Consultant	Responsible for reviewing the assessment of areas contaminated by potential asbestos containing materials. The Asbestos Consultant will provide a brief report which certifies the subject area is free of asbestos and suitable for residential development.
Asbestos or Environmental Contractor	Responsible for removal or treatment of contaminated material in accordance with this procedure and direction by the Environmental Consultant and the Site Manager.
Environmental Consultant	Once called to the site, the Environmental Consultant will be responsible for assessing the potential chemical contamination find, undertaking any necessary sampling and delineation, if required, developing a remedial scope and validating remediation to render the site suitable for residential development. The Environmental Consultant may, as appropriate, have expertise in environmental assessment and/or asbestos assessment. All findings and conclusions will be reported, as appropriate, to the satisfaction of the Site Manager and/or the Site Auditor or asbestos consultant if a Site Audit is not required.
Site Manager:	Responsible for the preliminary assessment of potential contamination and/or ordnance materials discovered and assessing whether further action is required. The Site Manager is responsible for ensuring the induction of Site Operatives, assessing the adequacy of quarantine measures and contacting the relevant Consultant and/or Ordnance Contractors and Site Auditor where appropriate. Once an area is declared free of the contamination, the Site Manager's role will be to remove the quarantine and allow site works to proceed.
Ordnance Consultant	Responsible for reviewing the survey and assessment of areas contaminated by suspected ordnance which is undertaken either as a consequence of discovery of suspect materials or as a requirement of the Site Audit Statements. The Ordnance Consultant, who will be independent of the Ordnance Contractor and be a member of DUXOP, will, when satisfied with information provided by the Ordnance Contractor, provide a letter which confirms the site is suitable for recommencement of development activities.

³ Contact details are updated as required and can be seen in Appendix A.

Title	Role
Ordnance Contractor	<p>Once called to the site, the Ordnance Contractor will be responsible for assessing the ordnance find, undertaking any surveying sampling and delineation, developing any necessary remedial scope and validating any remediation necessary to render the site suitable for residential development. The Ordnance Contractor shall complete a clearance report on each area investigated and/or remediated and provide a copy for review by the Ordnance Consultant.</p> <p>As necessary, the Ordnance Contractor will conduct surveys of the site and complete reports to validate the remediation of areas where ordnance is discovered for review by the Ordnance Consultant.</p>
Site Auditor	<p>Responsible for reviewing the remediation and assessment of areas contaminated by chemicals which is undertaken either as a consequence of discovery of suspect materials or as a requirement of the Site Audit Statements. The Site Auditor, who will be independent of the Environmental Consultant and accredited by the NSW EPA, will then, when satisfied by the information provided and relying on clearance reports provided by the Ordnance Consultant, issue further Site Audit Statements which certify the site is suitable for residential development.</p>
Site Operatives:	<p>During the works, the Site Operative will be vigilant for potential contamination and/or ordnance. Where potential contamination and/or ordnance is identified, Site Operatives will quarantine the area and inform the Site Manager</p>

URS Australia Pty Ltd (URS) has prepared this report for the use of Maryland Development Company in accordance with the usual care and thoroughness of the consulting profession. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 12 July 2007.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared in the period up to 7th 2008 and is based on the information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Appendix A

SITE AUDIT STATEMENTS



NSW Environment Protection Authority SITE AUDIT STATEMENT (SAS)

Site Audit Statement No.: CHK001/1

Site Auditor (accredited under NSW Contaminated Land Management Act 1997):

Name: Christopher H Kidd Company: HLA-Envirosciences Pty Limited
Address: 55-65 Grandview Street, Pymble, NSW Postcode: 2076
Phone: (02) 9988 4422 Fax: (02) 9988 4441

Site Details

ADI St. Marys Property – excluding Eastern Sector, QEL, Site 6 and Site 23, buildings and concrete stockpile.

Address: Forrester Road, St. Marys Postcode: 2760
Lot and DP Number: Lot 2 in DP803832
 Lot 2 and 3 in DP223888 (part of)
 Lot 3 in DP789196
 Lot 3 in DP598653
 (see attached map for excluded areas)

Local Government Area: Penrith and Blacktown

Site Audit requested by:

Name: Mr P Newton Company: Department of Urban Affairs and
 Planning
Address: Sydney Region West
 Level 8, Signature Tower
 2-10 Wentworth Street
 Parramatta NSW 2150
 Phone: (02) 9895 7142 - Fax: (02) 9895 6270

Name of contact person (if different from above):

Consultancy(ies) who conducted the site investigation(s) and/or remediation:

- ADI Limited Chemical and Explosives Ordnance
 Investigations, Remediation and Validation 1990 -
 1999
- Mackie Martin & Associates Groundwater Investigations, 1991

Title(s) of Report(s) reviewed:

1. Historical Report – St Marys Property, ADI Limited, 1996;
2. Validation Report for the Western Sector, ADI St Marys Facility, ADI Limited
November 1994;
3. Validation Report for the North Western Sector of the ADI St Marys Facility, Report No.
498800, ADI Limited 1995;
4. Validation Report for the Southern Sector West of the ADI St Marys Property, Report
No. 498810, ADI Limited 1996;



5. Validation Report for the Southern Sector East of the St Marys Property, Report No. 498810, ADI Limited 1996;
6. Validation Report for the Northern Sector of the ADI St Marys Property, Report No. 498820, ADI Limited 1996;
7. Validation Report for the Central Sector East of the ADI St Marys Property, Report No. 498840, ADI Limited 1997;
8. Validation Report for the Central Sector West of the ADI St Marys Property, Report No. 498840, ADI Limited 1996;
9. Validation Report for the North Eastern Sector of the ADI St Marys Property, Report No. 498850, ADI Limited 1996;
10. QA/Verification Survey Results, ADI St Marys Property, Report No. PG980323da ADI Limited, 1999.

Other Information reviewed:

1. Site Investigation Report of St Marys Facility Ammunition and Missiles Division, Volume 4 – Discussions and Conclusions, ADI, June 1991.
2. Remediation Action Plan for the Northern Sector, ADI St Marys Facility, Report No. 498820, ADI Limited 1996;
3. Remediation Action Plan for Central Eastern Sector, ADI St Marys Facility, Report No. 498840, ADI Limited 1996;
4. Remediation Action Plan for the Eastern Sector of the ADI St Marys Property, Report No. 498830, ADI Limited 1996;
5. Stage I Decontamination Audit, ADI St Marys CMPS&F, 1997.

Summary Site Audit Report Title:

Stage 2 Decontamination Audit Report for ADI Site, St Marys.

I have completed a site audit (as defined in the Contaminated Land Management Act 1997) and reviewed the reports and information referred to above with due regard to relevant laws and guidelines. I certify that the site (tick all appropriate boxes)

(a) is suitable for the following use(s):

- ✓ residential, including substantial vegetable garden and poultry;
- ☒ ~~residential, including substantial vegetable garden, excluding poultry;~~ *use*
- ☒ ~~residential with accessible soil, including garden (minimal home grown produce contributing less than 10% fruit and vegetable intake), excluding poultry;~~ *use*
- ✓ residential with minimal opportunity for soil access including units;
- ✓ daycare centre, preschool, primary school;
- ✓ secondary school;
- ✓ park, recreational open space, playing field;
- ✓ commercial/industrial use;
- ☒ ~~Other~~ *use*



subject to

✓ Conditions

1. Excludes Eastern Sector, QEL, Site 6 and Site 23 which are covered by separate site audit statements, namely CHK001/2, CHK001/3, CHK001/4 and CHK001/5.
2. Excludes areas not yet investigated including the footprint of original buildings, car parks and roads, mainly around former Administration Centre Buildings CHK001/6) and the concrete stockpile in Central Sector West. (Stockpile CHK001/7)
3. An appropriate management plan, including procedures for the safe handling and disposal of any items of ordnance that may be found during earthworks, should be lodged prior to the commencement of development earthworks. This plan should be similar to the "Remnant Contamination Management Plan" submitted by ADI (see Appendix E of the Site Audit Report).

~~(b) is not suitable for any beneficial use due to risk of harm from contamination~~ *[Signature]*

☐ (comments): *[Signature]*

I am accredited by the NSW Environment Protection Authority under the Contaminated Land Management Act, 1997 as a site auditor (Accreditation No. 9813).

I Certify that:

- (a) I have personally examined and am familiar with the information contained in this statement, including the reports and information referred to in this statement, and
- (b) this statement is to the best of my knowledge, true, accurate and complete, and
- (c) on the basis of my inquiries made to those individuals immediately responsible for making the reports, and obtaining the information, referred to in this statement, those reports and that information are, to the best of my knowledge, true, accurate and complete.

I am aware that there are penalties for wilfully submitting false, inaccurate or incomplete information.

Signed: *[Signature]*

Date: *7/6/99*

NOTES:

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PREPARED BY:

Whelans	
Surveyors	
Planners	
Costs in N.£	
Not in a hurry	

Wholans Australia Pty Ltd

Head Office:

Whelons Australia Pty Ltd

Level 5, 141 Elizabeth Street

Sydney, New South Wales.

2000 Australia

Telephone 021 5285 2400

Parramatta Office:

Level 1, Suite 2

12 Victoria Road, Parramatta

NSW 2150

Telephone 02) 9530 4198

PREPARED FOR:

ADI Property

ADI ST MARYS PROPERTY
PLAN TO ACCOMPANY SITE
AUDIT STATEMENT CHK001/1

ORIGINAL SIZE
A3

ORIGINAL SIZE: A3

SCALE	HORI	1 : 25,000	VERT:

CO-ORDS:	ISG	DATUM:	--
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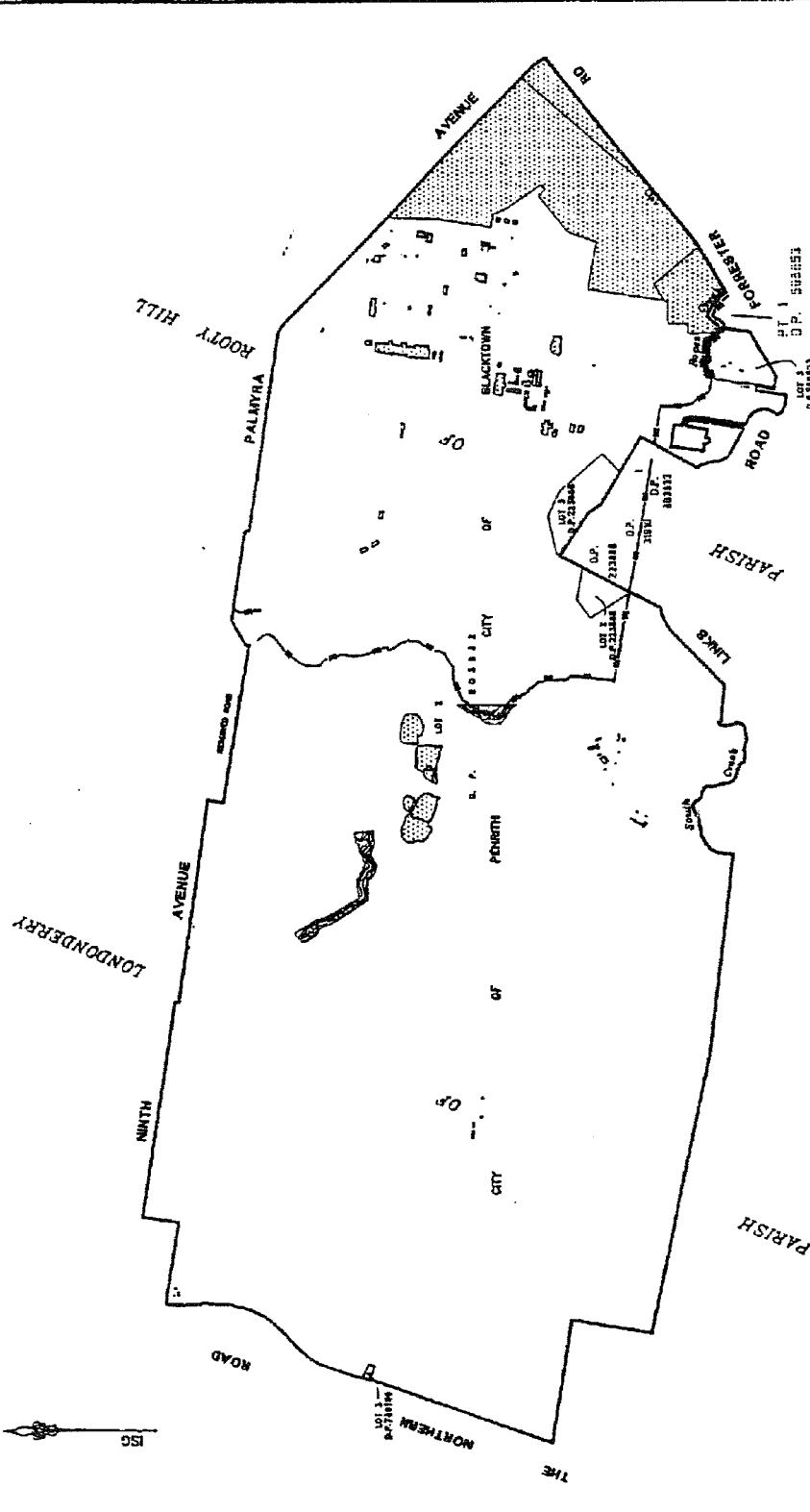
DATE OF SURVEY	DATE OF PLANT: 11 MAY 1958
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SURVEY	-	DRAWN	Actual/MTB

CHECKED:	MTB
DATE	24.5.1998

APPROVED: PW	DATE 24.5.1999
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NON REF:	8662
NO REF:	3467-122.DWG
	SHEET 1 OF 15 SHEETS



NOTE :

GEOMETRY SHOWN AS SUPPLIED BY AND LIMITED TO OUR
OFFICE 10.5.1989

FOR SITE DETAILS ON EXCLUDED AREAS PLEASE REFER TO DRAWINGS:

5467-123
5467-125
5467-126
5467-127
5467-128
5467-129
5467-130
5467-131
5467-132
5467-133
5467-134
5467-135

SHADED AREAS ARE EXCLUDED FROM
AUDIT STATEMENT CHK001/1

100



NSW Environment Protection Authority
SITE AUDIT STATEMENT (SAS)

Site Audit Statement No.: CHK001/6

Site Auditor (accredited under NSW Contaminated Land Management Act 1997):

Name: Christopher H Kidd Company: HLA-Envirosciences Pty Limited
Address: 55-65 Grandview Street, Pymble, NSW Postcode: 2076
Phone: (02) 9988 4422 Fax: (02) 9988 4441

Site Details

ADI St. Marys Property – existing buildings and paved areas scattered about the site.

Address: Forrester Road, St. Marys Postcode: 2760
Lot and DP Number: Lot 2 in DP803832
 Lot 2 and 3 in DP223888 (part of)
 Lot 3 in DP789196
 Lot 3 in DP598653
 (see attached 7 maps)
Local Government Area: Penrith and Blacktown

Site Audit requested by:

Name: Mr P Newton Company: Department of Urban Affairs and
 Planning
Address: Sydney Region West
 Level 8, Signature Tower
 2-10 Wentworth Street
 Parramatta NSW 2150
 Phone: (02) 9895 7142 - Fax: (02) 9895 6270

Name of contact person (if different from above):

Consultancy(ies) who conducted the site investigation(s) and/or remediation:

- ADI Limited Chemical and Explosives Ordnance
 Investigations, Remediation and Validation 1990 -
 1999
- Mackie Martin & Associates Groundwater Investigations, 1991

Title(s) of Report(s) reviewed:

11. Historical Report – St Marys Property, ADI Limited, 1996;
12. Validation Report for the Western Sector, ADI St Marys Facility, ADI Limited
November 1994;
13. Validation Report for the North Western Sector of the ADI St Marys Facility, Report No.
498800, ADI Limited 1995;
14. Validation Report for the Southern Sector West of the ADI St Marys Property, Report
No. 498810, ADI Limited 1996;



15. Validation Report for the Southern Sector East of the St Marys Property, Report No. 498810, ADI Limited 1996;
16. Validation Report for the Northern Sector of the ADI St Marys Property, Report No. 498820, ADI Limited 1996;
17. Validation Report for the Central Sector East of the ADI St Marys Property, Report No. 498840, ADI Limited 1997;
18. Validation Report for the Central Sector West of the ADI St Marys Property, Report No. 498840, ADI Limited 1996;
19. Validation Report for the North Eastern Sector of the ADI St Marys Property, Report No. 498850, ADI Limited 1996;
20. QA/Verification Survey Results, ADI St Marys Property, Report No. PG980323da ADI Limited, 1999.

Other Information reviewed:

6. Site Investigation Report of St Marys Facility Ammunition and Missiles Division, Volume 4 – Discussions and Conclusions, ADI, June 1991.
7. Remediation Action Plan for the Northern Sector, ADI St Marys Facility, Report No. 498820, ADI Limited 1996;
8. Remediation Action Plan for Central Eastern Sector, ADI St Marys Facility, Report No. 498840, ADI Limited 1996;
9. Remediation Action Plan for the Eastern Sector of the ADI St Marys Property, Report No. 498830, ADI Limited 1996;
10. Stage I Decontamination Audit, ADI St Marys CMPS&F, 1997.

Summary Site Audit Report Title:

Stage 2 Decontamination Audit Report for ADI Site, St Marys.

I have completed a site audit (as defined in the Contaminated Land Management Act 1997) and reviewed the reports and information referred to above with due regard to relevant laws and guidelines. I certify that the site (tick all appropriate boxes)

(a) is suitable for the following use(s):

- ☒ residential, including substantial vegetable garden and poultry; *mark*
- ☒ residential, including substantial vegetable garden, excluding poultry; *mark*
- ☒ residential with accessible soil, including garden (minimal home grown produce contributing less than 10% fruit and vegetable intake), excluding poultry; *mark*
- ☒ residential with minimal opportunity for soil access including units; *mark*
- ☒ day care centre, preschool, primary school; *mark*
- ☒ secondary school; *mark*
- ☒ park, recreational open space, playing field; *mark*
- ☒ commercial/industrial use;
- ☒ Other – May continue to be used for existing commercial use and carparks, but underlying soils need to be tested for chemical and ordnance contamination after demolition.

subject to

✓ Conditions

1. Soils under existing buildings, car parks, roads and the concrete stockpile shall be tested for ordnance and/or chemical contamination when these facilities are removed; site audits statements for these areas will also be required.
2. An appropriate management plan, including procedures for the safe handling and disposal of any items of ordnance that may be found during earthworks, should be lodged prior to the commencement of development earthworks. This plan should be similar to the "Remnant Contamination Management Plan" submitted by ADI (see Appendix E of the Site Audit Report).

~~(b) is not suitable for any beneficial use due to risk of harm from contamination~~

☐ (comments) *per*

I am accredited by the NSW Environment Protection Authority under the Contaminated Land Management Act, 1997 as a Site Auditor (Accreditation No. 9813).

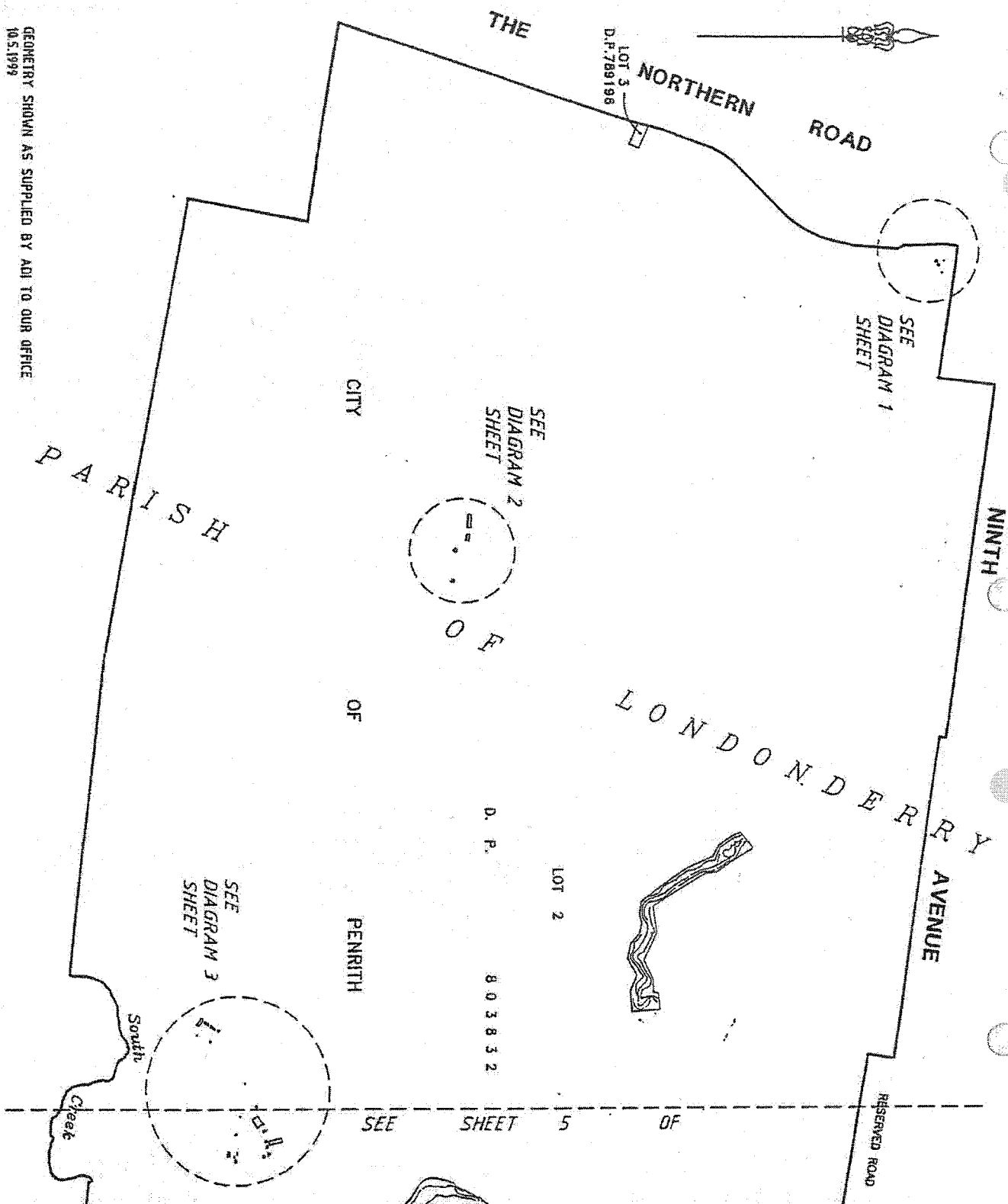
I Certify that:

- (a) I have personally examined and am familiar with the information contained in this statement, including the reports and information referred to in this statement, and
- (b) this statement is to the best of my knowledge, true, accurate and complete, and
- (c) on the basis of my inquiries made to those individuals immediately responsible for making the reports, and obtaining the information, referred to in this statement, those reports and that information are, to the best of my knowledge, true, accurate and complete.

I am aware that there are penalties for wilfully submitting false, inaccurate or incomplete information.

Signed: *Lawson*

Date: 7/6/99



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PREPARED FOR:

ADI PROPERTY

ADI ST MARYS PROPERTY
RETAINED BUILDINGS/PAVED AREA
PLAN TO ACCOMPANY SITE AUDIT
STATEMENT CHK001/6

ORIGINAL SIZE

AC

SCALE: HQR:

VERTI

DATE OF SUBM

DATE OF PLAN: 19

1

SURVEY

DRAWN FOR

CHECKED: ☐

DATE 24.5.1988

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED

1. *What is the main purpose of the study?*

CAD REF: 5

SHEET 7 OF 13 SH

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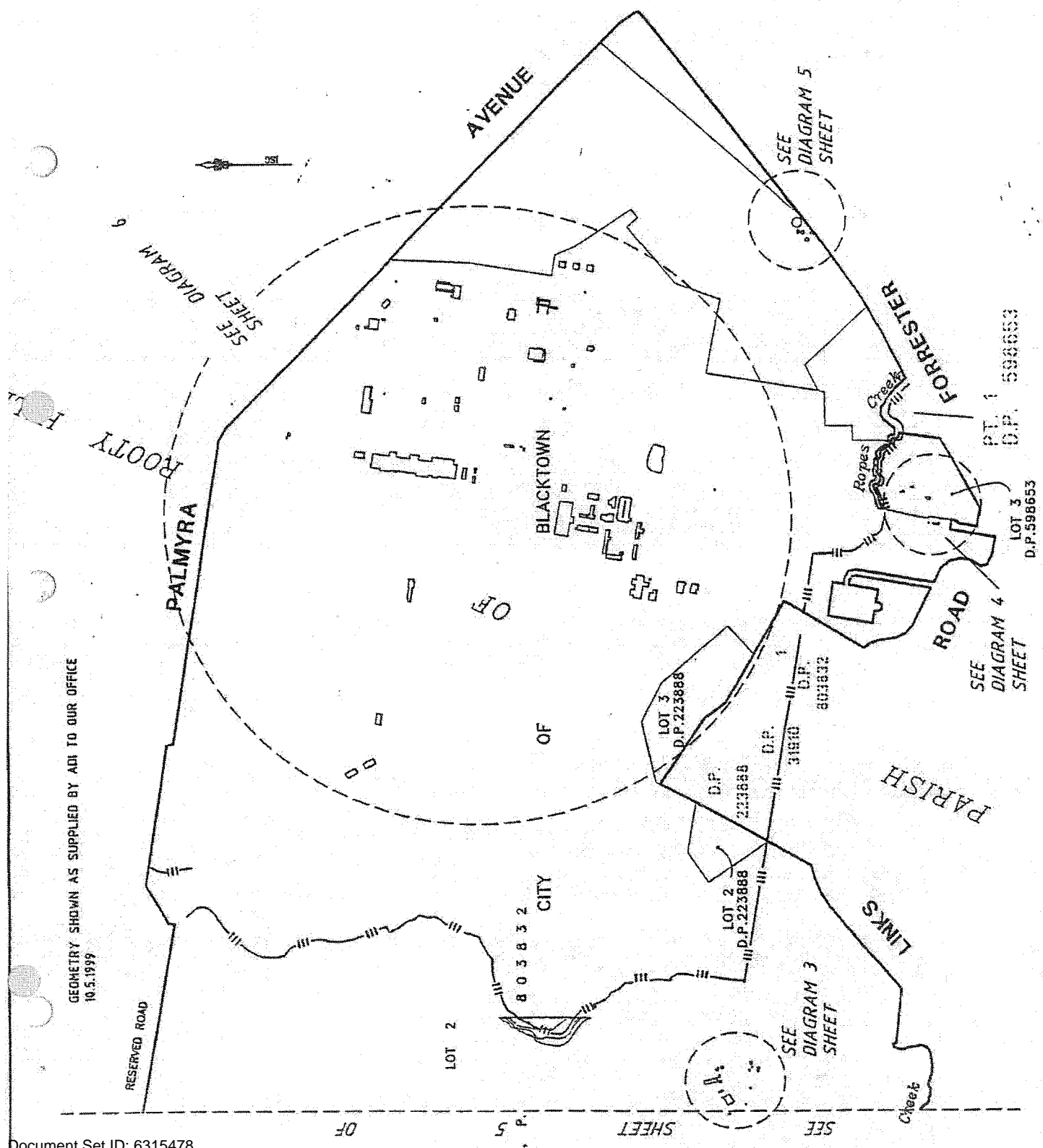
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ADI PROPERTY

**ADI ST MARYS PROPERTY
RETAINED BUILDINGS/PAVED AREA
PLAN TO ACCOMPANY SITE AUDIT
STATEMENT CHK001/6**

A3

ORIGINAL SIZE:	SCALE:	HOR:	VERT:
	1:2500		
DATE OF SURVEY	DATE OF PLAN	DATE OF PLAN	DATE OF PLAN
	10 MAY 1999	10 MAY 1999	10 MAY 1999
SURVEY	CHECKED:	DATE	DATE
	DDW	24.5.1999	24.5.1999
APPROVED:	JOB REF:		
PW	8662		
CAD REF:			
5467-125			
SHEET 6 OF 13 SHEETS			



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**ADI ST MARYS PROPERTY
RETAINED BUILDINGS/PAVED AREA
PLAN TO ACCOMPANY SITE AUDIT
STATEMENT CHK001/6**

ORIGINAL SIZE:

A3

SCALE: HOR: 2000 VERT:

CO-ORDS: DATUM:

DATE OF SURVEY: DATE OF PLAN: MAY 1999

SURVEY: DRAWN: DOW

CHECKED: DOW DATE: 21.5.1999

APPROVED: PW DATE: 21.5.1999

JOB REF: 8862

CAD REF: 5467-127 SHEET 9 OF 13 SHEETS

CONCRETE BUILDING	274588 1267987 274590 1267987 274590 1267985 274588 1267985
SUBSTATION	274625 1267979 274626 1267983 274631 1267982 274630 1267978
WATERTANK	274606 1267968 274603 1267964 274598 1267968 274602 1267972
WATERTANK	274589 1267965 274586 1267960 274591 1267957 274594 1267960
K6	275465 1266407 275425 1266410 275426 1266422 275466 1266419
K2	275507 1266403 275487 1266407 275488 1266416 275508 1266413
CARETAKERS SHED	275532 1266368 275537 1266377 275546 1266373 275541 1266364
K4	275642 1266357 275635 1266360 275637 1266367 275645 1266364

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GEOMETRY SHOWN AS SUPPLIED BY ADI TO OUR OFFICE
10.5.1999

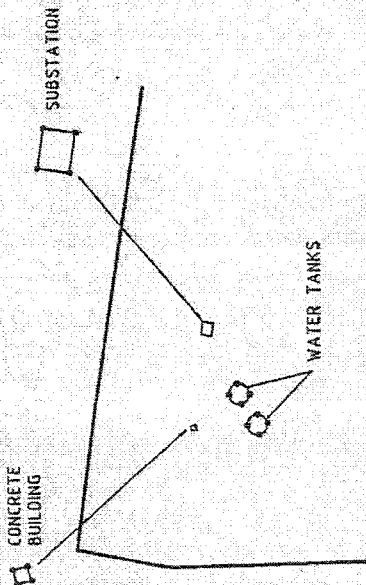


DIAGRAM 1

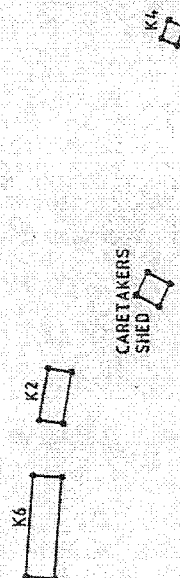


DIAGRAM 2

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PREPARED FOR:

ADI PROPERTY

**ADI ST MARYS PROPERTY
RETAINED BUILDINGS & PAVED AREA
PLAN TO ACCOMPANY SITE
AUDIT STATEMENT CHK001/6**

A3

ORIGINAL SIZE:

SCALE: HOR: 2000

VERT:

CO-ORDS: DATE:

DATE OF SURVEY: DATE OF PLAN: MAY 1998

SURVEY: DRAWN: DOW

CHECKED: DOW

DATE: 21.5.1998

APPROVED: PW

DATE: 21.5.1998

JOB REF: 8002

CAD REF: 5467-128

SHEET 10 OF 13 SHEETS

BDG No	EASTING	NORTHING
W09	277529	1265648
	277530	1265651
	277524	1265652
	277524	1265650
W07	277513	1265658
	277513	1265661
	277520	1265662
	277520	1265659
W02	277453	1265658
	277511	1265634
	277527	1265632
	277526	1265626
W05	277536	1265658
	277536	1265652
	277546	1265653
	277546	1265659

BDG No	EASTING	NORTHING
TOILET	277519	1265773
	277521	1265766
	277516	1265765
	277514	1265772
POWER	277283	1265688
	277285	1265686
	277287	1265689
	277286	1265691
W11	277477	1265767
	277468	1265809
	277480	1265811
	277489	1265770
SHED	277439	1265759
	277437	1265763
	277439	1265764
	277441	1265761
CONTROL TOWER	277453	1265658
	277511	1265634
	277527	1265632
	277526	1265626

BDG No	EASTING	NORTHING
W01	277452	1265655
	277456	1265654
	277457	1265658
	277453	1265658
W04	277475	1265762
	277481	1265760
	277479	1265755
	277474	1265756
W05	277493	1265765
	277500	1265764
	277499	1265759
	277492	1265760
W06	277433	1265729
	277407	1265712
	277395	1265731
	277418	1265746
W07	277444	1265749
	277440	1265755
	277444	1265758
	277448	1265751
W08	277399	1265671
	277397	1265674
	277395	1265672
	277396	1265670
W09	277360	1265728
	277365	1265731
	277368	1265726
	277363	1265723

BDG No	EASTING	NORTHING
X4	277113	1265596
	277111	1265594
	277105	1265598
	277107	1265601
X3	277106	1265581
	277101	1265585
	277091	1265570
	277096	1265566
X2	277076	1265549
	277082	1265545
	277091	1265539
	277086	1265563
X1	277067	1265535
	277072	1265542
	277094	1265527
	277089	1265520
X5	277127	1265521
	277125	1265518
	277122	1265520
	277124	1265523
X6	277142	1265565
	277145	1265563
	277150	1265568
	277145	1265571

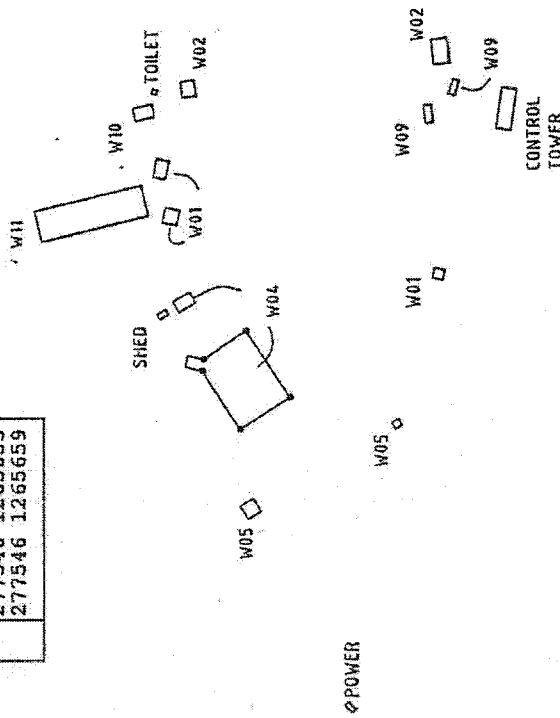


DIAGRAM 3



NOTES:

BUG No	EASTING	NORTHING
WATER TANK BUILDING	280345	1265484
	280349	1265492
	280351	1265494
	280354	1265491
	280359	1265495
	280389	1265510
	280403	1265494
	280305	1265477
WATER TANKS	280371	1265496
	280357	1265477
	280358	1265474
	280350	1265468
	280347	1265475
	280326	1265452
	280372	1265458
	280334	1265459
GATE HOUSE	280330	1265464
	280354	1265445
	280356	1265441
	280347	1265444
GUARD HOUSE	280349	1265436
	279372	1265033
	279375	1265032
	279372	1265030
	279374	1265030
	279369	1265017
	279374	1265016
	279372	1264995
ABATTOR BUILDINGS	279364	1264997
	279366	1265001
	279459	1265041
	279453	1265040
	279450	1265027
	279454	1265026
	279457	1265027
	279491	1265094
	279495	1265093
	279489	1265083
	279496	1265084
	279473	1265130
	279476	1265131
	279478	1265125
	279475	1265124
	279475	1265117
	279480	1265121
	279482	1265118
	279478	1265114

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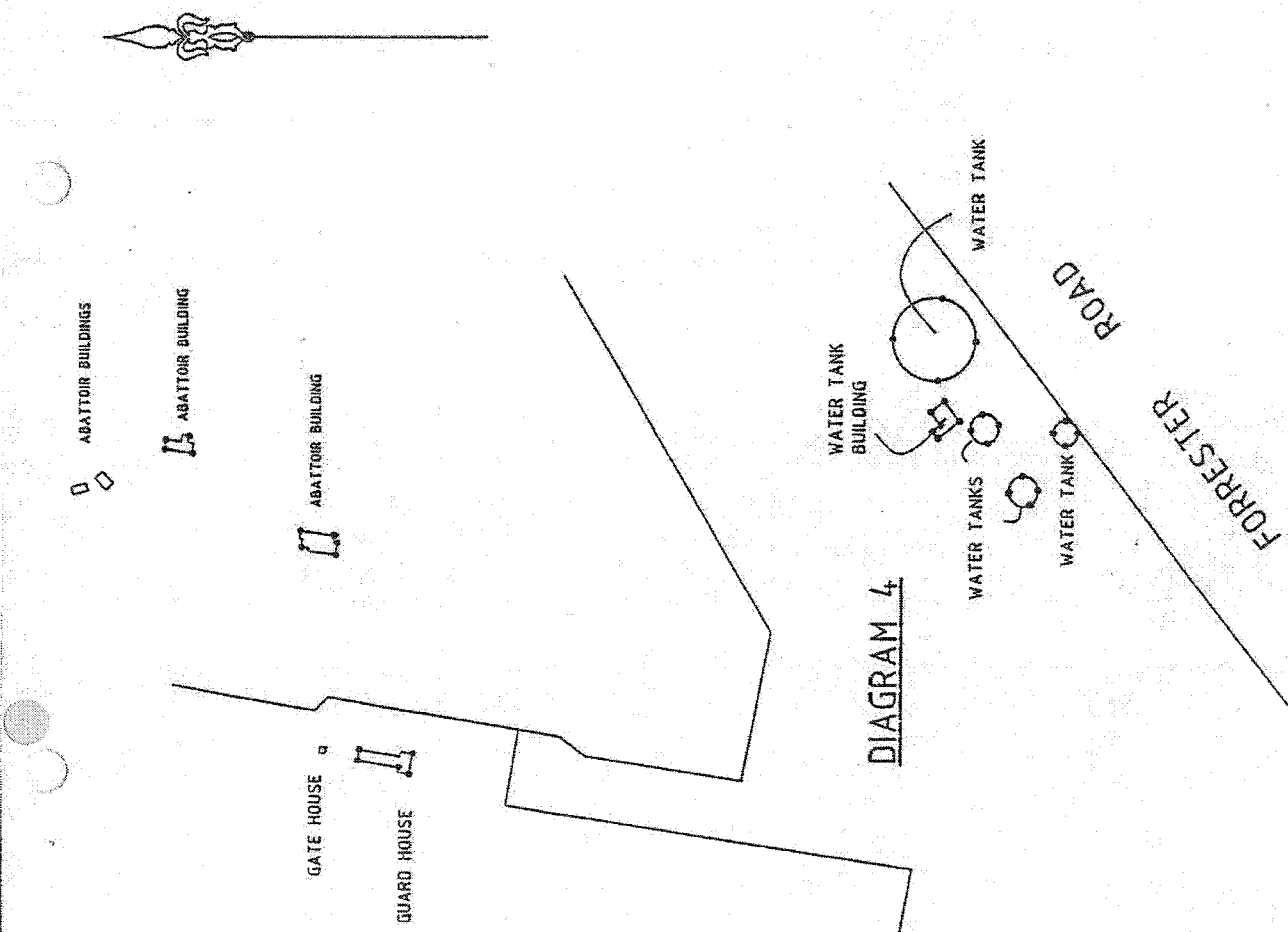
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ADI ST MARYS PROPERTY
RETAINED BUILDINGS/PAVED AREA
PLAN TO ACCOMPANY SITE AUDIT
STATEMENT CHK001/6

ORIGINAL SIZE: A3

SCALE	HORI	VERT
DATE OF SURVEY	DATE OF PLAN: MAY 1999	
SURVEY		
CHECKED: DOW	DRAWN: ACAD/DOW	
APPROVED: PM	DATE: 21.5.1999	
JOB REF: 9882	SHEET 11 OF 13 SHEETS	
CAD REF: 5467-129		




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10.5.1999

DIAGRAM 5

STATION

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	Planners	
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RETAINED BUILDINGS/PAYED AREA
PLAN TO ACCOMPANY SITE AUDIT
STATEMENT CHK001/6

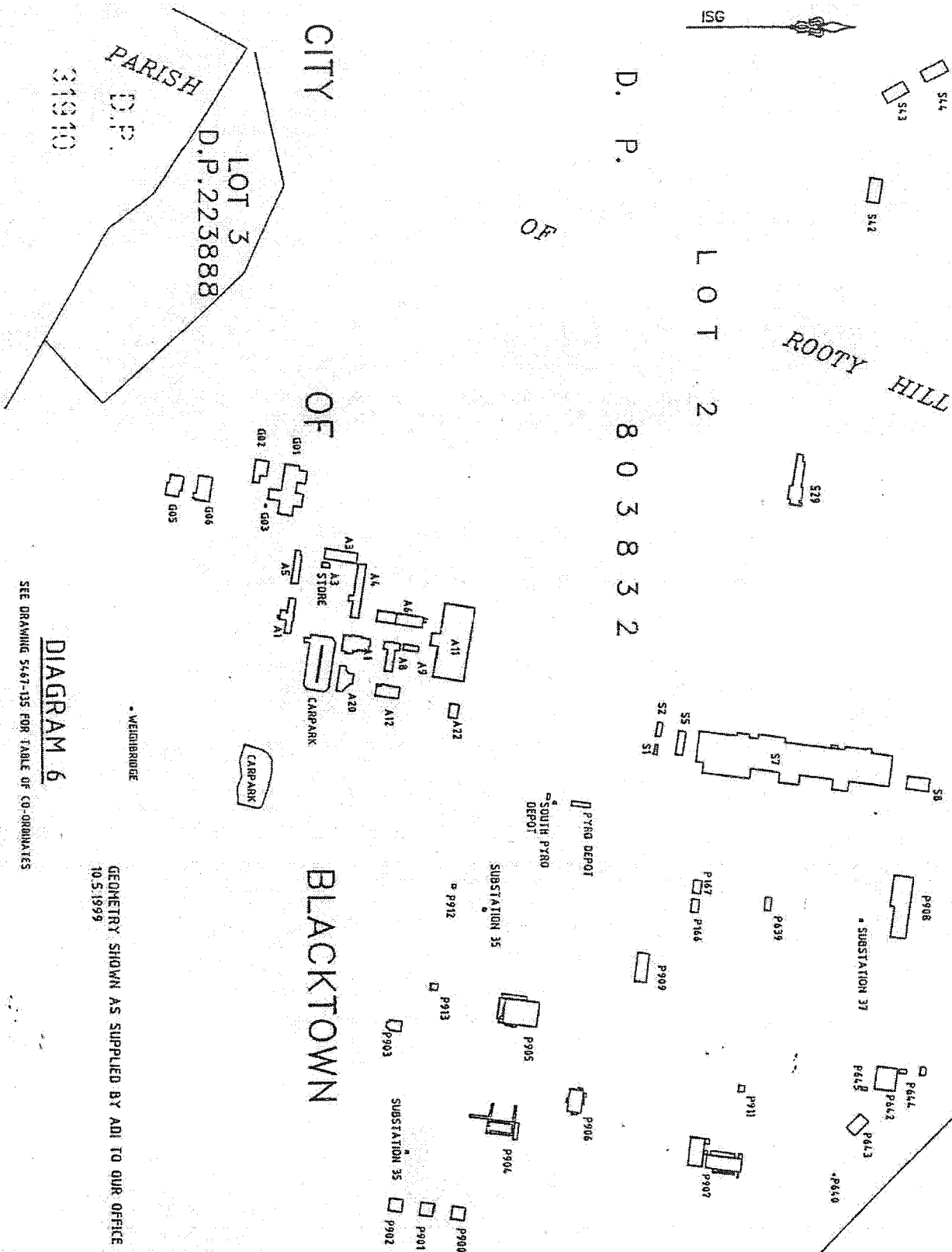
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• WEIGHBRIDGE

GEOMETRY SHOWN AS SUPPLIED BY ADI TO OUR OFFICE
10.5.1999

DIAGRAM 6

SEE DRAWING 5467-135 FOR TABLE OF CO-ORDINATES



55-10410-100

LOT 3
D.P. 223888

CITY

OL

BLACKTOWN

D.
P.

803832

LOT 2

ROOTY HILL

15G

BOG NO	EASTING	NORTHING
A11	279334	1266254
	279340	1266297
	279449	1266279
	279442	1266237
A12	279484	1266274
	279504	1266270
	279503	1266258
	279482	1266261
A9	279398	1266217
	279344	1266215
	279403	1266194
	279394	1266195
A8	279394	1266191
	279435	1266178
	279402	1266172
	279390	1266168
A6	279344	1266158
	279385	1266155
	279370	1266222
	279354	1266224
A4	279276	1266141
	279274	1266129
	279353	1266117
	279355	1266128
A3	279280	1266128
	279274	1266126
	279266	1266077
	279252	1266079
A3 STORE	279273	1266086
	279271	1266074
	279281	1266085
	279279	1266073
A5	279302	1266026
	279304	1266037
	279262	1266043
	279254	1266033
A1	279324	1266033
	279326	1266033
	279377	1266025
	279357	1266017
	279342	1266010
A7	279380	1266107
	279404	1266108
	279405	1266143
	279387	1266146
A12	279454	1266162
	279455	1266155
	279470	1266153
	279475	1266187
A12	279425	1266100
	279462	1266094
	279453	1266113
	279437	1266113

BOG NO	EASTING	NORTHING
A11	279567	1265996
	279556	1265990
	279542	1265953
	279567	1265945
	279606	1265940
	279631	1265942
	279504	1265975
	279609	1265990
A12	279591	1266093
	279384	1266088
	279344	1266056
	279383	1266046
	279453	1266044
	279464	1266076
A9	279203	1266029
	279200	1266006
	279178	1265991
	279136	1266018
	279138	1266052
A8	279144	1265979
	279145	1265989
	279122	1265993
	279119	1265972
	279153	1265966
A6	279142	1265881
	279146	1265903
	279182	1265897
	279177	1265871
A4	279174	1265850
	279171	1265829
	279141	1265838
	279144	1265854
A3	278521	1267007
	278511	1266998
	278529	1266966
	278545	1266974
A5	278578	1266916
	278560	1266949
	278544	1266937
	278562	1266907
A1	278729	1266884
	278732	1266903
	278696	1266909
	278693	1266890
A7	279324	1266023
	279326	1266033
	279377	1266025
	279376	1266015
A12	279618	1266073
	279614	1266041
	279595	1266044
	279600	1266076
A22	279564	1266023
	279611	1266016
	279524	1266031
	279588	1266035
A12	279425	1266186
	280242	1266167
	280323	1266170
	280226	1266189
A22	279973	1266187
	279959	1266189
	279971	1266170
	279957	1266172

BOG NO	EASTING	NORTHING
S5	279525	1266609
	279523	1266598
	279560	1266592
	279561	1266604
S2	279533	1266570
	279511	1266575
	279531	1266565
	279531	1266562
S1	279192	1266708
	279189	1266769
	279114	1266781
	279115	1266791
RAILWAY	279599	1266665
	279580	1266665
	279575	1266685
	279605	1266652
P908	279750	1266952
	279746	1266923
	279837	1266917
	279840	1266939
SUB/ ST 37	279810	1266872
	279814	1266872
	279814	1266876
P639	279593	1266784
	279608	1266782
	279604	1266781
	279589	1266753
P167	279772	1266631
	279770	1266618
	279752	1266621
	279753	1266634
P166	279799	1266627
	279798	1266615
	279779	1266617
	279781	1266630
P909	279860	1266552
	279856	1266533
	279900	1266528
	279902	1266546
P900	280258	1266278
	280239	1266278
	280236	1266259
	280235	1266257
P901	280251	1266231
	280252	1266234
	279377	1266215
	280248	1266212
P902	280245	1266186
	280242	1266167
	280323	1266170
	280226	1266189
P903	279973	1266187
	279959	1266189
	279971	1266170
	279957	1266172

BOG NO	EASTING	NORTHING
P645	280151	1266194
	280155	1266193
	280156	1266197
	280152	1266198
P643	279792	1266307
	279792	1266311
	279796	1266310
	279796	1266306
P913	279910	1266231
	279902	1266231
	279903	1266241
	279913	1266240
P912	279763	1266268
	279763	1266262
	279758	1266268
P904	280136	1266332
	280111	1266335
	280105	1266311
	280125	1266309
P905	279931	1266395
	279967	1266380
	279924	1266349
	279960	1266337
P906	280063	1266482
	280096	1266448
	280093	1266447
	280060	1266431
P907	280186	1266650
	280135	1266636
	280178	1266637
	280178	1266637
	280135	1266636
	280177	1266631
	280174	1266639
	280165	1266681
P911	280056	1266698
	280066	1266697
	280065	1266687
	280055	1266689
P640	280192	1266831
	280190	1266832
	280189	1266831
	280190	1266829
P642	280063	1266923
	280032	1266927
	280028	1266896
	280058	1266892
P643	280111	1266883
	280133	1266862
	280120	1266850
	280099	1266870
P644	280039	1266920
	280032	1266930
	280034	1266940
	280040	1266939
	280041	1266958
	280030	1266960
	280039	1266966
	280031	1266966

NO	EASTING	NORTHING
P645	280059	1266871
	280060	1266881
	280065	1266880
	279799	1266827
P643	279634	1266465
	279630	1266436
	279637	1266435
	279641	1266464
P645	279634	1266408
	279631	1266408
	279631	1266413
	279635	1266412
P645	279619	1266599
	279628	1266598
	279629	1266402
	279619	1266404
WEIGH/ BRIDGE	279487	1265773
	279484	1265777
	279485	1265777
	279488	1265776

NOTES:

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PREPARED FOR: **ADI PROPERTY**
ADI ST MARYS PROPERTY
RETAINED BUILDINGS/PAVED AREA
PLAN TO ACCOMPANY SITE AUDIT
STATEMENT CHK001/6

ORIGINAL SIZE: **A3**

SCALE: **HON**

CO-ORDS: **HON**

DATE OF SURVEY: **DATE OF PLAN: MAY 1999**

SURVEY: **DRAWN: ACO/DOH**

CHECKED: **DOV** **DATE: 24.5.1999**

APPROVED: **FW** **DATE: 24.5.1999**

JOB REF: **0062**

CAD REF: **5467-115** **SHEET 13 OF 13 SHEETS**



Other Information reviewed:

- 3 Site Investigation Report of St Marys Facility Ammunition and Missiles Division, Volume 4 – Discussions and Conclusions, ADI, June 1991.
- 4 Stage I Decontamination Audit, ADI St Marys CMPS&F, 1997.

Summary Site Audit Report Title:

Stage 2 Decontamination Audit Report for ADI Site, St Marys.

I have completed a site audit (as defined in the Contaminated Land Management Act 1997) and reviewed the reports and information referred to above with due regard to relevant laws and guidelines. I certify that the site (tick all appropriate boxes)

(a) is suitable for the following use(s):

- ☐ residential, including substantial vegetable garden and poultry;
- ☐ residential, including substantial vegetable garden, excluding poultry;
- ☐ residential with accessible soil, including garden (minimal home grown produce contributing less than 10% fruit and vegetable intake), excluding poultry;
- ☐ residential with minimal opportunity for soil access including units;
- ☐ daycare centre, preschool, primary school;
- ☐ secondary school;
- ☐ park, recreational open space, playing field;
- ☐ commercial/industrial use;
- ☒ Other – May continue to be used as stockpile for crushed concrete, but underlying soils need to be tested for chemical and ordnance contamination after stockpile removed.

subject to

- ☒ Conditions

1. On removal of all or part of the stockpile the underlying ground should be tested for both chemical and ordnance contamination. The testing should follow similar methods and levels of quality assurance as other parts of the ADI St Marys site. Appropriate remediation and validation should be performed (if necessary) the work reviewed by a site auditor.
3. Appropriate management plan including procedures for the safe handling and disposal of any items of explosive ordnance, shall be in place before development earthworks commences and shall remain in place to cover any excavation on the site during its ongoing use. This plan should be similar to the "Remnant Contamination Management Plan" submitted by ADI (see Appendix E of the Site Audit Report).
4. The final surface of any earthworks in areas which are to be used for active recreational land uses, e.g. sports grounds, school grounds and picnic areas, or low density residential use, should, on completion of the earthworks, be surveyed with a metal detector by appropriately qualified and experienced personnel and the work reviewed by an independent site auditor.

~~(c) is not suitable for any beneficial use due to risk of harm from contamination~~

~~☐ (comments):~~



I am accredited by the NSW Environment Protection Authority under the Contaminated Land Management Act, 1997 as a Site Auditor (Accreditation No. 9813).

I Certify that:

- (g) I have personally examined and am familiar with the information contained in this statement, including the reports and information referred to in this statement, and
- (h) this statement is to the best of my knowledge, true, accurate and complete, and
- (i) on the basis of my inquiries made to those individuals immediately responsible for making the reports, and obtaining the information, referred to in this statement, those reports and that information are, to the best of my knowledge, true, accurate and complete.

I am aware that there are penalties for wilfully submitting false, inaccurate or incomplete information.

Signed: _____

Date: _____

7/6/99

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STANBURY
ASSOCIATES**

ABN: 79 943 737 368

**TRAFFIC & TRANSPORT ASSESSMENT
PROPOSED INTEGRATED HOUSING
DEVELOPMENT
GREENWOOD PARKWAY
JORDAN SPRINGS**

Ref: 14-082

OCTOBER 2014

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1. INTRODUCTION

The Practice of Thompson Stanbury Associates has been engaged by J Wyndham Prince Pty Limited, on behalf of Ancon Development Group, to prepare a Traffic Impact Assessment accompanying a development application ('DA' or 'application') with Penrith City Council. The subject application proposes an integrated housing development comprising 52 dwellings on land referred to as Village 13 within the Jordan Springs master planned residential community. Village 13 is situated on the south eastern corner of the intersection of Greenwood Parkway and Lakeside Parade.

The general purpose of this report is to undertake an assessment of the potential traffic related implications resulting from the proposed development from a traffic safety and efficiency perspective. To this end, this report:

- 1) Assesses the suitability of the proposed subdivision/road layout with respect to the design requirements of Penrith City Council and the surrounding traffic conditions;
- 2) Assesses the proposed access arrangements from the future public roads to the residential lots/dwellings;
- 3) Reviews the overall transport/traffic assessments prepared for the Jordan Springs residential release area;
- 4) Examines the existing traffic conditions in the immediate vicinity of the site; and
- 2) Undertakes an assessment of the potential traffic generation from the proposed development and determines the ability of the surrounding traffic infrastructure to accommodate this additional traffic;

Throughout this report, reference is made to the following documents:

- St Marys Western Precinct Plan, May 2009;
- *St Marys Development Revised Transport Management Plan Traffic Study* (Sims Varley, 2004);
- *St Marys Development Transport Management Strategy Study* (SKM, 2007);
- *St Mary's Western Precinct Plan Traffic and Transport Report* (SKM, 2008);
- The Roads & Maritime Services' *Guide to Traffic Generating Developments*; and
- Australian Standard for *Parking Facilities Part 1: Off-Street Car Parking* (AS2890.1-2004).

A DA subdivision plan has been prepared by J Wyndham Prince Pty Ltd and a building envelope plan has been prepared by Plan Master Design Consultants, both of which are attached as **Appendix 1**.

2. PRE-LODGMET MEETINGS

A pre-lodgement meeting was held with Penrith City Council on 24 April 2014 and again on 30 June, 2014. The specific traffic related comments that were raised at those meetings are detailed below.

24 April, 2014

- The road network is required to comply with the design requirements within the DCS (where dedicated as public road) being a minimum road reserve of 15.6m;
- A Traffic and Parking Assessment report will be required to be submitted addressing road design, traffic volumes and cumulative impacts within the precinct; and
- The location of Road 1 as proposed is not supportable. The access road is to be relocated in place of Lots 6/7 and 14/15 or adjacent to the riparian corridor (noting intersectional design concerns to the north).

30 June, 2014

- The resulting single access driveway onto Lakeside Parade has been further considered and is not believed to be an appropriate outcome being contrary to the broader strategic intent to prevent/limit access straight onto Lakeside Parade;
- Access (driveway) constraints for Lots 1-5 + 16 and Lots 10-12 + 42;
- Constraints on waste collection/storage within the road reserve;
- The width of Road No. 3 is not supported. All road widths including pavement width and verge widths are to comply with the Western Precinct Plan – local roads (15.6m road reserve comprising of 2 x 3.8m verges and 8m pavement);
- Special consideration shall be given to access driveways that serve multiple residential lots and turn paths shall be provided;
- The shared access driveway for Lots 11 and 12 shall be shown as a minimum 6m wide pavement;
- Consideration shall be given to relocating the garage for Lot 42 to the eastern side to reduce access constraints at the road frontage;
- The shared access driveways are required to be in private ownership and shall be detailed as reciprocal rights of carriageway;
- The application will need to consider if pedestrian through-fare is required from Greenwood Parkway for the shared access driveways;
- The application shall be supported by a traffic report prepared by a suitably qualified person;
- The application must demonstrate that access, car parking and manoeuvring details comply with AS2890 Parts 1, 2 and 6 and Council's Development Control Plan; and
- The proposed development shall be designed to be serviced by a Heavy Rigid Vehicle.

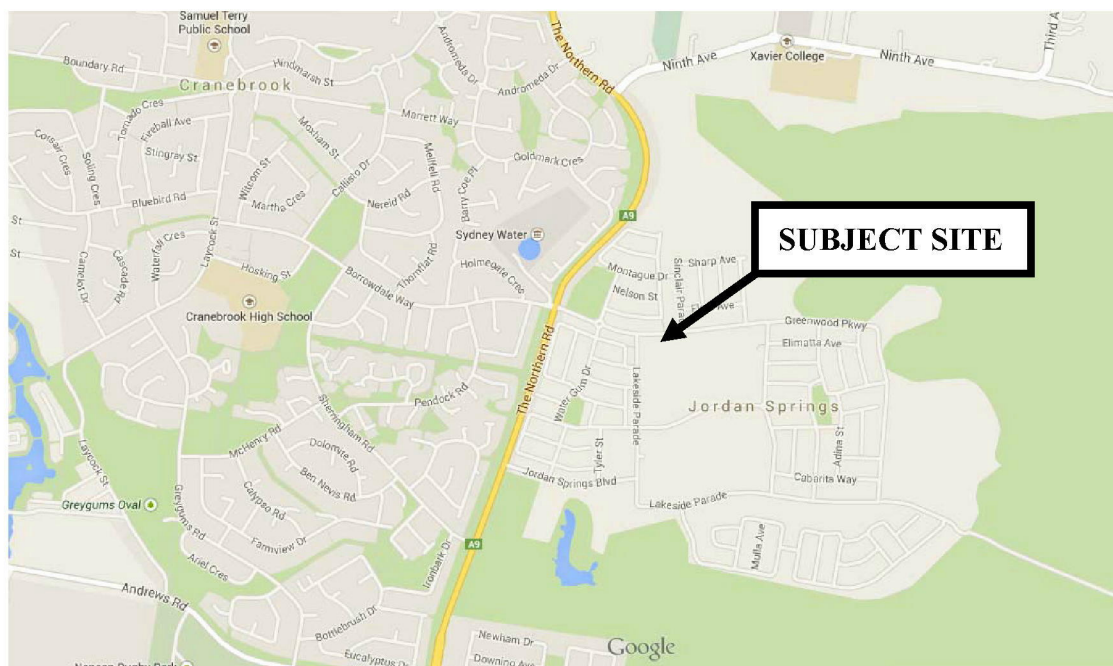
Comment will be provided throughout this report on those matters that were not the subject of design amendments between the pre-lodgement meeting and the submitted DA plans.

3. SITE DETAILS

3.1 Site Location

The subject site is referred to as Village 13 within the Jordan Springs master planned residential community. It is situated on the south eastern corner of the intersection of Greenwood Parkway and Lakeside Parade, Jordan Springs. This location is represented in **Figure 1** below.

FIGURE 1 – SITE LOCATION



3.2 Site Description

The subject land is described as Lot 22, DP1194338. It has a frontage to Greenwood Parkway of approximately 150m and to Lakeside Parade of approximately 121m. Total site area is approximately 21,000 m².

3.3 Existing Uses

The land is currently vacant.

3.4 Surrounding Uses

The subject site forms part of the Jordan Springs master planned residential community, which, at full development, will accommodate approximately 2450 residential dwellings and a town centre. In the immediate vicinity of the subject site, existing residential development is situated to the north (across Greenwood Parkway) and to the west (across Lakeside Parade). Land to the south is currently vacant, although earmarked for an educational precinct. Future public open space in the form of a riparian corridor is intended to the immediate east of the subject site.

4. STRATEGIC CONTEXT

4.1 St Marys Western Precinct

The site the subject of the current DA forms part of the St Mary's Western Precinct under Sydney Regional Environmental Plan No. 30 – St Mary's (SREP 30). The Western Precinct, representing one of the precincts within the overall St Marys Precinct, was declared a release area by the Minister for Planning on 29 September, 2006, with the *St Marys Western Precinct Plan* (the "Precinct Plan") adopted by Penrith City Council on 23 March, 2009. The Western Precinct is predominantly being developed by Lend Lease as a master planned residential community known as Jordan Springs.

The Precinct Plan identifies the following proposed development for the Western Precinct:

- *A Village Centre Character Area, comprising a mix of retail, commercial, community, open space and residential uses in the southern part of the precinct;*
- *Predominantly residential development in the remainder of the precinct;*
- *Construction of roads, including external connections to The Northern Road and Ninth Avenue and east to the Central Precinct; and*
- *Provision of local open space, riparian corridors and stormwater basins.*

The Western Precinct is anticipated to accommodate approximately 2450 dwellings with an overall resident population of 6400 people.

4.2 Western Precinct Concept Plan

As part of the precinct planning process, a general concept plan was prepared for the Western Precinct fundamentally identifying an indicative road layout, urban design structure, and land use designation. A copy of this concept plan is included as **Attachment 2**.

The concept plan earmarks the land bound by Greenwood Parkway, Lakeside Parade, Cullen Avenue and the future riparian corridor for an educational precinct. This includes the subject site. Since the preparation of the concept plan, it has been identified that the overall area allocated for educational purposes under the concept plan is greater than the actual land required. Accordingly, alternative uses are proposed for the northern portion of the precinct that forms the subject site.

4.3 Previous Transport Studies

As part of the strategic planning process for the Western Precinct (and other precincts under SREP 30), a number of traffic and transport studies have previously been undertaken. We understand these to include:

- *St Marys Development Revised Transport Management Plan Traffic Study* (Sims Varley, 2004);

- *St Marys Development Transport Management Strategy Study* (SKM, 2007); and
- *St Mary's Western Precinct Plan Traffic and Transport Report* (SKM, 2008).

4.3.1 St Marys Development Revised Transport Management Plan Traffic Study (2004)

We understand that the *St Marys Development Revised Transport Management Plan Traffic Study* was conducted by Sims Varley on behalf of the (then) Department of Infrastructure, Planning and Natural Resources (DIPNR).

The primary purpose of this technical study was to assess the traffic and transport requirements to support the future development of the entire St Marys Precinct as well as to establish a structure for the apportionment of costs between relevant parties.

The land use assumptions adopted in the 2004 study for the St Mary's Precinct are presented in Table 1.

TABLE 1					
2004 LAND USE ASSUMPTIONS					
	Western	Central	Eastern	Dunheved	Total
Residential (dwellings)	1561	1351	2000	-	4912
Commercial (Ha)	23.8	2.89	5.87	-	35.56
Retail (Ha)	3.4	0.85	1.7	-	5.95
Industrial (Ha)	-	-	-	25.76	25.76
Education (Ha)	7.65	2.55	7.65	-	17.85

Source: *St Mary's Western Precinct Plan Traffic and Transport Report* (SKM 2008)

We understand that one of the paramount objectives in the planning process for the St Marys Precinct, including the Western Precinct, was to reduce travel by private vehicle by adopting urban design principles and performance objectives. These included:

- An urban form that maximised use of public transport;
- Locating high trip generating uses adjacent to major public transport routes and nodes;
- Public transport infrastructure and services to achieve higher public transport use than other similar established areas in the region;
- Providing a range of uses that will reduce demand for travel outside the area; and
- The provision of pedestrian and cycle routes to encourage travel by these modes.

Based on these principles, a modal shift away from the private vehicle was adopted for the traffic and transport planning for the Western and other precincts. The study recognised that traditional residential development in Western Sydney had the following attributes:

- A journey to work mode split of around 80% by private car; and
- 0.85 vehicle trips per dwelling per peak hour generated.

For the Western Precinct, a 10% shift away from the private car was adopted having regard to the underlying transport measures, which would see:

- a journey to work modal split by private vehicle of 70%; and
- 0.75 vehicle trips per dwelling in peak hour periods.

Based on the land use assumptions identified in Table 1 and the trip generation rates adopted above, total trip generation from the St Mary's precinct was assessed at approximately 5026 trips. The Western Precinct (being part of the St Marys Precinct) was assessed to generate 1725 trips.

The *St Marys Development Revised Transport Management Plan Traffic Study* developed a suite of transport and infrastructure requirements and a road transport network strategy to cater for the planned development of the entire St Marys Precinct (including the Western Precinct).

4.3.2 St Marys Development Transport Management Strategy Study (2007)

The *St Marys Development Transport Management Strategy Study* was prepared by SKM in 2007 in accordance with the planning framework under SREP 30. SREP 30 identified a number of transport related performance objectives to be achieved with the delivery of the St Marys Precinct and this 2007 study articulated a number of regional and local initiatives to achieve the prescribed objectives.

4.3.3 St Marys Western Precinct Plan Traffic and Transport Report (2008)

The *St Marys Western Precinct Plan Traffic and Transport Report* is the most recent of the traffic and transport studies undertaken and was prepared as part of the precinct planning process for the Western Precinct.

Revised development assumptions between the various precincts were assessed as part of this study, being a decrease of employment in the Western Precinct and an increase of employment in the Central Precinct. Similarly, there was an increase in residential development for the Western Precinct and a reduction in residential development in the Central Precinct. The land use assumptions adopted under this study are shown in **Table 2**.

TABLE 2					
2008 LAND USE ASSUMPTIONS					
	Western	Central	Eastern	Dunheved	Total
Residential (dwellings)	2446	967	2000	-	5413
Commercial (Ha)	-	-	-	-	34.8
Retail (Ha)	3.4	0.85	1.7	-	5.95
Industrial (Ha)	-	34.8	-	25.76	30.3
Education (Ha)	4.9	2.55	7.65	-	15.1

Source: *St Mary's Western Precinct Plan Traffic and Transport Report (SKM 2008)*

The total trip generation from the entire St Marys Precinct reduced slightly as a result of the revised 2008 development assumptions to 5004 peak hour vehicle trips. The Western Precinct in particular increased from 1725 peak hour vehicle trips to 1887 peak hour vehicle trips.

5. PROPOSED DEVELOPMENT

5.1 Subdivision Layout

The subject DA proposes an integrated housing development comprising 52 residential dwellings on land referred to as Village 13 within the Jordan Springs master planned residential community.

Single lot sizes range in size from 192m² to 943m² with a combination of front and rear loaded dwellings proposed.

Vehicular access to the proposed development involves the construction of a new road (Road 1) that forms a T intersection with Greenwood Parkway approximately 95m west of its intersection with Lakeside Parade. Road 1 is proposed with an overall reservation width of 15.6m, comprising a carriageway width of 8m and 2 x 3.8m wide verges. Both verges within Road 1 are proposed to accommodate a pedestrian footpath of 1.5m wide. The dedication of Road 1 to Council as public road is proposed as part of the registration of the plan of subdivision.

Proposed Road 1 forms a T intersection with proposed Road 2 at its southern extremity. Road 2 forms a circuitous route and, except for an eastern section, comprises a road cross section identical to that of proposed Road 1, that being a carriageway of 8m and 2 x 3.8m wide verges, within an overall reservation of 15.6m. The eastern section of Road 2 (between chainage 67 and 135) is proposed with a reservation width of 13.8m, the difference being a narrowing of the eastern verge to 2.0m adjacent to the future public open space where service corridors and pedestrian pathways are not required. Road 2 is also proposed to be dedicated to Council as public road.

A shared accessway forming a total width of 9.5m is proposed in the north western corner of the site serving proposed lots 1 to 5. This comprises a pavement width of 6.0m with a 2.5m wide verge on the western side and a 1m wide verge on the eastern side. This access driveway will be retained in private ownership with the benefit of reciprocal rights of carriageway to provide the legal right for shared use.

Proposed lots 11 and 12 in the south western corner of the site are serviced by a 6m wide rear accessway, incorporated into the area of lots 11 and 12. Reciprocal rights of carriageway will be established to allow both lots 11 and 12 the legal right to utilise the accessway.

5.2 Dwelling Access

A building envelope plan (BEP) has been prepared to ensure due consideration is given to the plethora of design elements relevant for smaller lot housing (**Attachment 1**). The building envelope plan establishes the required garage locations for each dwelling and, by default, the proposed vehicular access arrangements.

Proposed lots 1-12 are situated on the western side of the site and are of a narrower frontage, in the order of 10m wide. To provide these dwellings with the provision of dual car parking, yet achieve an attractive streetscape to Lakeside Parade, these

dwellings are of a rear loaded nature, that is, the garages are accessed from the road network proposed under the subject DA, rather than Lakeside Parade where the built form otherwise addresses. Proposed lots 6-10 will access the rear garages directly from Road 2, while lots 1-5 and 11-12 will access the rear garages from the north western and south western accessways previously described.

Proposed lots 13-51 predominantly comprise front loaded garages mostly accessed from the road network proposed under the subject DA, with some garages on corner lots fronting the secondary street. There are 4 lots (lots 13, 14, 20 and 21) where access to the front loaded garage is proposed directly from Greenwood Parkway, a road that has been constructed and dedicated.

Section 7 of this report undertakes an assessment of the traffic attributes of the subdivision layout and the proposed vehicular access arrangements.

6. EXISTING TRAFFIC CONDITIONS

6.1 Surrounding Road Network

The subject site, as previously noted, is bound by Greenwood Parkway to the north and Lakeside Parade to the west. Greenwood Parkway performs a collector function within the local road hierarchy. In this regard, it intersects with The Northern Road at its western extremity under traffic signal control, with upgrades at this intersection and The Northern Road generally currently underway. From The Northern Road, Greenwood Parkway continues in an easterly direction for approximately 1.2km and then continues in a southerly direction forming a T intersection with Lakeside Parade. Adjacent to the subject site, Greenwood Parkway forms a carriageway width of approximately 12m within an overall road reservation of approximately 20m (excluding the landscaping strip on the northern side). A speed limit of 50km/h applies to Greenwood Parkway consistent with State Government policy on local residential roads.

Lakeside Parade forms the western boundary of the subject site and has also been established to perform a collector road function as part of the network planning for the Western Precinct. It forms a T intersection with Greenwood Parade at its northern extremity and continues in a southerly direction for approximately 650m, before continuing in an easterly direction to the eastern boundary of the Western Precinct. Adjacent to the subject site, Lakeside Parade forms a carriageway width of 12m within an overall road reservation of approximately 20m. A speed limit of 50km/h applies.

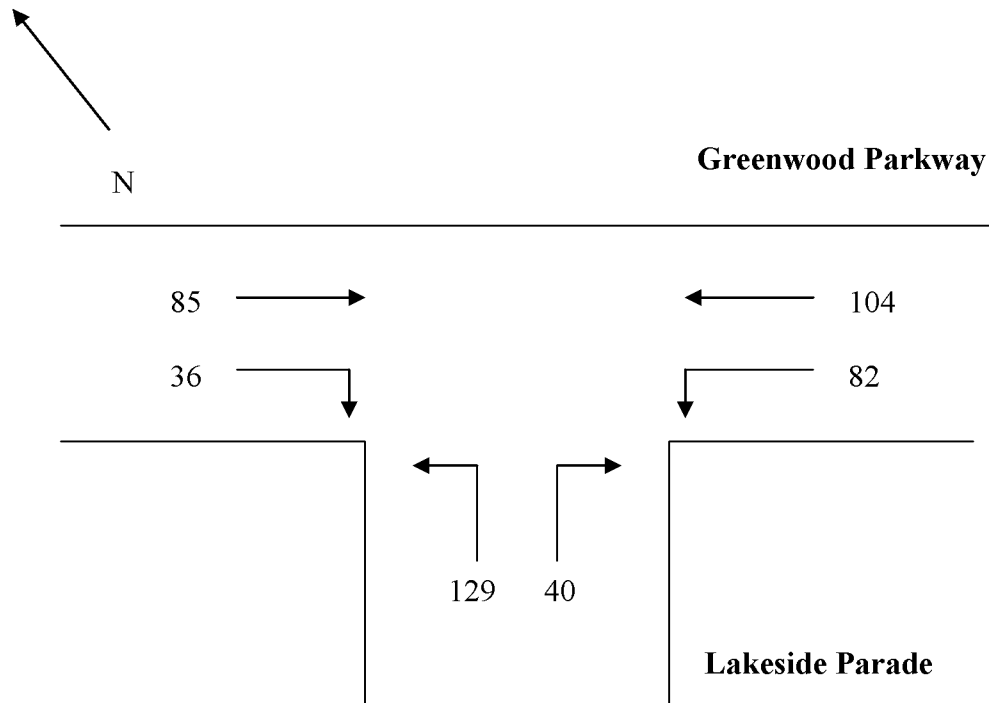
Our observations of Greenwood Parkway and Lakeside Parade indicate that traffic is free flowing with gap conditions predominating. In this regard, traffic movements at the intersection of Greenwood Parkway and Greenwood Parade have been observed to occur efficiently, with minimal delay experienced for motorists.

6.2 Traffic Volumes

The St Marys Western Precinct Plan Traffic and Transport Report established both Greenwood Parkway and Lakeside Parade to operate as collector roads within the Western Precinct road network strategy. The report predicted that Greenwood Parkway would carry in the order of 490 AM peak hour vehicles and that Lakeside Parade would carry in the order of 290 AM peak hour vehicles.

This practice has recently undertaken spot traffic surveys at the intersection of Greenwood Parkway and Lakeside Parade on Friday the 10th of October between 5.00pm and 6.00pm. The outcomes of this spot survey are represented in **Figure 2** overleaf.

FIGURE 2
EXISTING EVENING PEAK HOUR TRAFFIC VOLUMES
INTERSECTION OF GREENWOOD PARKWAY AND LAKESIDE PARADE



The above figures suggest that PM traffic volumes on Lakeside Parade are in the order of 180 peak hour vehicles northbound and 132 vehicles southbound. Total two-way volumes are therefore in the order of 312 vehicles.

Traffic volumes on Greenwood Parkway adjacent to the subject site (i.e. east of Lakeside Parade) are currently in the order of 190 vehicles west bound and 135 vehicles eastbound. Two way volumes are in the order of 325 vehicles in the evening peak hour period, which is currently below the volumes forecast at ultimate development of the Western Precinct.

7. **PROJECTED TRAFFIC CONDITIONS**

7.1 **Traffic Generation**

Section 4.3.1 of this report noted that the traffic generation rate adopted for residential development for the Western Precinct in the *St Marys Development Revised Transport Management Plan Traffic Study* was 0.75 peak hour vehicle trips per dwelling. This represented a reduction from 0.85 peak hour vehicle trips per dwelling typically experienced in traditional residential development throughout the Sydney metropolitan area on the basis of the integrated land use and transport planning principles implemented during the planning phase. These principles and actions were expected to invoke a shift away from private vehicle transport towards public transport initiatives.

In addition to the above, the *St Marys Development Revised Transport Management Plan Traffic Study* assumed 85% of trips in the morning peak were outbound with the remaining 15% comprising inbound. In the evening peak, inbound trips were assumed to comprise 75% of all trips, with 25% outbound.

Having regard to the above, peak hour traffic generation from the proposed 52 dwellings is presented in **Table 3**.

TABLE 3 PEAK HOUR VEHICLE TRIPS			
Peak Hour Period	Total Trips	Outbound Trips	Inbound Trips
AM Peak	39	33	6
PM Peak	39	10	29

It is also a common traffic engineering ‘rule of thumb’ that peak hour vehicle trips represent 10% of daily vehicle trips. Daily vehicle trips from the proposed development are there expected to be in the order of 390 vehicles.

7.2 **Trip Distribution**

It is expected that the vast majority of traffic, if not all, associated with the development on the subject site will utilise the signalised intersection of The Northern Road and Greenwood Parkway, given the site’s proximity thereto (approximately 350m).

In the event of the eastern end of Lakeside Parade continuing further to the east to connect with precincts further afield, it could be expected that a smaller proportion of trips will be destined to The Northern Road, representing those trips generally destined eastbound and who would use a more direct route.

7.3 **External Transport Considerations**

7.3.1 **Traffic Network**

A number of traffic and transport reports have been undertaken during the planning phases for the development of the Western Precinct, which have assessed the package

of upgrades and initiatives required to the regional infrastructure to suitably accommodate the additional transport demand. These studies would have assessed, in one form or another, the future development of the subject site. In this regard, the regional transport implications resulting from the development of the subject site has largely been assessed under these previous studies.

To the extent that the current development intentions for the subject site (i.e. residential) are different to those adopted during the previous studies (i.e. school), these are not expected to have any material affect on the conclusions drawn from previous assessments.

The subject development proposes the construction of Road 1, which forms a 'T' intersection with Greenwood Parkway approximately 95m west of Lakeside Parade and approximately 80m east of Sinclair Parade. Traffic movements are unrestricted at this proposed intersection. We note that having regard to the constructed horizontal and vertical alignment of Greenwood Parkway, sight distance to the east and west meets acceptable criteria to allow vehicles to safely observe other road users at this proposed new intersection.

The forecast traffic volumes for Greenwood Parkway of 490 AM peak hour vehicles (see Section 6.2) is expected to result in frequent gaps of adequate length to allow vehicles accessing Greenwood Parkway from Road 1 (and vice versa) to undertake this movement without any unacceptable delay. Furthermore, the location of this new T intersection is sufficiently separated from the nearby intersections of Greenwood Parkway/Lakeside Parade and Greenwood Parkway/Sinclair Parade to avoid any undesirable intersection conflicts.

7.3.2 Public Transport

The *St Marys Development Revised Transport Management Plan Traffic Study* suggested that bus services would be the most effective form of public transport for the Western Precinct. In addition, bus priority routes from the Western Precinct to both Penrith and St Marys train stations were prominent in the early planning work, as part of a suite of measures to achieve a shift in travel mode to public transport.

Figure 17 of the Precinct Plan identifies the indicative bus route through the Western Precinct as well as the preferred location of bus stops. On this basis, it is noted that the subject site will be well serviced by bus services, with a route ear marked along Greenwood Parkway and Lakeside Parade immediately adjacent to the site. Furthermore, a potential bus stop was identified on Greenwood Parkway at its intersection with Lakeside Parade adjoining the site.

7.3.3 Pedestrian and Cycle Paths

Figure 16 of the Precinct Plan establishes the indicative pedestrian and cycle network throughout the Western Precinct, as part of the suite of measures to reduce reliance on private transport. A number of north/south and east/west links are identified to provide efficient movement between key nodes and along open space links to contribute to the well being of residents.

In the immediately vicinity of the site, the Precinct Plan identifies the provision of a 2.5m wide shared path along both Greenwood Parkway and Lakeside Parade. It is noted that the shared paths on both roads have been constructed, being on the southern side of Greenwood Parkway and the eastern side of Lakeside Parade. Significantly, these shared paths link the subject site in a westerly direction to The Northern Road and a southerly direction to the Jordan Springs Village Centre. The subject development site is considered to be well serviced by pedestrian and cycle paths.

7.4 Internal Considerations

7.4.1 Road Layout and Accessibility

The proposed subdivision layout, as presented in Section 5.1, proposes the construction of two public roads, Road 1 and Road 2.

Road 1 forms a north/south link between Greenwood Parkway and proposed Road 2. It forms an overall road reservation of 15.6m comprising an 8m wide carriageway and 2 x 3.8m wide verges that accommodate a 1.5m wide footpath.

Road 2 forms a circuitous route, generally forming a road reservation of 15.6m with the same cross section as above. Between chainage 67.321 and 135.661, the road reservation is 13.8m, reflective of a 2.0m wide verge adjacent to the future public open space. The carriageway and western verge is otherwise the same as that for the 15.6m cross section.

Table 2 of Section 5.2 of the Precinct Plan establishes the required road configuration for various street types. L1, being a 'minor street with parking both sides' is required to comprise a carriageway width of 8m with 2 x 3.8m wide verges accommodating a 1.5m footpath. Proposed Road 1 and Road 2 therefore meet the requirements of the Precinct Plan.

The majority of the 51 proposed dwellings (all except lots 1-5 and 11-12) will access the associated garages directly from an existing public road (Greenwood Parkway) or the roads proposed under the subject development application. Four dwellings (lots 13, 14, 20 & 21) are proposed to be accessed directly from Greenwood Parkway. As previously discussed, Greenwood Parkway will provide frequent gaps of adequate length to allow residents to safely transition from their private driveway to the public road and vice versa. All other lots that are directly accessed from proposed Road 1 or Road 2 are provided with acceptable conditions to facilitate convenient access to residential garages.

A number of shared accessways are proposed to facilitate vehicular access to rear loaded dwellings fronting Lakeside Parade. This includes a shared accessway in the north western corner of the site serving the garages associated with dwellings 1-5 and a shared accessway in the south western corner serving lots 11 and 12.

The north western accessway forms a pavement width of 6m with a 2.5m wide verge on the western side and a 1m verge on the eastern side. While this road has been designed in accordance with the specifications of the A2 ('accessway parking on one

side') road type as defined in Table 2 of the Precinct Plan, it is not intended to be dedicated to Council as public road. Rather, the entire 9.5m will be incorporated into the area of lots 1-5, with reciprocal rights of carriageway established to facilitate the shared use between various owners. A total of 8.5m in width will be available to facilitate vehicular accessibility between the garages of lots 1-5 and the shared accessway. This will be sufficient to allow vehicles to access the garages in a forward direction, reverse from the garages on exit before moving in a forward direction to a public road in the form of Road 2.

The south western accessway serving proposed lots 11 and 12 is proposed with a pavement width of 6m. It is intended that this accessway will be retained in private ownership with rights of way established under the plan of subdivision to provide the legal right for both lot 11 and 12 to use the physical accessway. The proposed 6m wide pavement will facilitate efficient accessibility to the rear load garages on these lots, allowing vehicles to enter the garages in a forward direction. Exit movements from the garages will involve vehicles reversing from the garages onto the accessway, accessing Road 2 in a forward direction.

7.4.2 Car Parking

Building envelope plans submitted with the subject DA illustrate the provision of a double garage to each dwelling proposed. Table 4 within Section 5B of the Precinct Plan stipulates between 1 and 2 spaces for each dwelling. The proposed development therefore satisfies this requirement.

7.4.3 Servicing/Garbage Collection

Roads 1 and 2 under the subject DA, as mentioned above, form a proposed carriageway width of 8m. This width is generally sufficient to facilitate the movement of a garbage truck throughout the proposed development. It is noted that the pavement in the vicinity of Lot 51 has been increased to facilitate the turning circle of such a vehicle and to provide parking bay for vehicles in maintaining a stormwater gross pollutant trap adjacent to the kerb

The vast majority of dwellings have direct access to a public verge on Greenwood Parkway, Road 1 or Road 2 to allow the convenient movement of garbage bins for collection. We note that garbage truck access to the shared accessways serving lots 1-5 and 11-12 will not be practical. This will require residents of these dwellings to transport garbage bins either to the verge on Greenwood Parkway or the verge forming part of Road 3. In practice, it is expected that residents in lots 1 and 2 will use Greenwood Parkway while lots 3-5 and 11 & 12 will use Road 2. This arrangement is not considered unacceptable.

8. SUMMARY & CONCLUSION

This Practice has undertaken an assessment of the traffic and transport matters associated with a proposed integrated housing development comprising 52 dwellings on land situated on the south eastern corner of Greenwood Parkway and Lakeside Parade, Jordan Springs. Following this assessment, the following conclusions are now made:

- A number of traffic and transport studies have been undertaken as part of the precinct planning process for the Western Precinct. The site forms part of the 'education precinct' under the Jordan Springs concept plan, nevertheless, any potential difference in traffic generation between the two uses is not expected to be material in the overall context of the Western Precinct. The external traffic impact from development of the site, and the measures to address such an impact, are considered to have been addressed as part of previous precinct wide studies;
- The development has been assessed to generate approximately 39 peak hour vehicle trips. Even in the event of these trips being over and above the traffic generation from the previous education assumption for the site, this traffic is not expected to have any noticeable impact on the traffic conditions or intersections in the immediate vicinity of the site;
- The proposed subdivision layout involves the construction of a public road forming a T intersection with Greenwood Parkway. This intersection is expected to operate efficiently and safely having regard to the existing and likely future conditions of Greenwood Parkway, the available sight distance and the relatively low number of trips generated from the subject development;
- The proposed public roads under the subject DA satisfy the cross section specifications as outlined in the Precinct Plan;
- Two shared accessways are proposed in the north western and south western corner of the subject site. Both accessways are proposed to be retained in private ownership and will be subject to reciprocal rights of carriageway to facilitate shared use. In both instances, a pavement width of 6m is proposed, with the north western accessway serving lots 1-5 benefiting from pseudo verges to further assist vehicle accessibility to the garages of these lots. In any event, the 6m wide pavement will facilitate efficient accessibility to the garages of the relevant lots, with minimal manoeuvring required.
- Each dwelling is provided with a double garage. This satisfies the parking requirements stipulated in the Precinct Plan; and
- Servicing and garbage collection is considered acceptable.

Based on the contents of this report and the recommendations and conclusions reached herein, we do not consider that there are any traffic related issues that should prevent approval of the subject DA.

Jordans Springs Village Centre
Bulk Earthworks DA

[illegible]

Aboriginal Heritage Impact Permit

National Parks and Wildlife Act 1974 (NPW Act)

Department of Environment & Climate Change NSW



Your reference:

Our reference: AHIMS No. 3057 FIL07/10749

Document number: 1097716

Contact: Fran Scully (02) 9995 6830

LEND LEASE DEVELOPMENT,
Trading as LEND LEASE DEVELOPMENT,
ABN 33 000 311 277,
LEVEL 1, 19 HARRIS STREET,
PYRMONT NSW 2009
STANDARD POST

ABORIGINAL HERITAGE IMPACT PERMIT

AHIP No: 10996059

Dear Mr Ilias

RE: s90 consent, Western Precinct, St Marys site, ADI

I refer to your application for an Aboriginal Heritage Impact Permit under section 90 of the *National Parks and Wildlife Act 1974* (NPW Act), and accompanying information provided for the archaeological test and salvage excavation programme received by the Department of Environment and Climate Change (NSW) (DECC) on 11 December 2008.

DECC has considered the application and supporting information provided and has decided to issue an AHIP subject to conditions. The AHIP is attached.

You should read the AHIP carefully and ensure you comply with its conditions. In particular please note the following conditions:

- Test and salvage excavations must be carried out in accordance with the excavation methodology as outlined in the research design accompanying the consent application.

You should note that it is an offence under the NPW Act to knowingly destroy, deface or damage, or knowingly cause or permit the destruction or defacement of (or damage to) an Aboriginal object or Aboriginal place without consent. The maximum penalty that a court may impose on a corporation for failing to comply with this AHIP is \$22,000.

You may appeal to the Minister if dissatisfied with any condition of this AHIP. The appeal must be in writing and set out the basis for the appeal. The deadline for lodging the appeal is 28 days after the date this AHIP was issued.

Department of Environment and Climate Change NSW

Printed: 10:13 13-Feb-2009

Aboriginal Heritage Impact Permit

National Parks and Wildlife Act 1974 (NPW Act)

Department of Environment & Climate Change NSW



If you have any questions, or wish to discuss this matter further please contact Fran Scully on (02) 9995 6830.

K.L. Brown

Mr Karl Brown

Acting Manager Planning & Aboriginal Heritage Section

Metropolitan

(by Delegation)

Date: 13/2/09

Consent to destroy, deface or damage Aboriginal

Aboriginal Heritage Impact Permit

Section 90 of the National Parks and Wildlife Act 1974

Department of Environment & Climate Change NSW



AHIP number: 1096059

AHIMS number: 3057

AHIP Issued To:

LEND LEASE DEVELOPMENT,
Trading as LEND LEASE DEVELOPMENT,
ABN 33 000 311 277,
LEVEL 1, 19 HARRIS STREET,
PYRMONT NSW 2009
STANDARD POST

DECC Office issuing this AHIP

Department of Environment and Climate Change (NSW)
Metropolitan Branch EPRG
PO Box 668
Parramatta NSW 2150
02 9995 6830
02 9995 6900

Short description of activity and/or location

Mix of residential and commercial development at the Western Precinct,
St Marys site, ADI.

Note: A Dictionary at the end of the AHIP defines terms used in this document. Further information about this AHIP is also set out after the Dictionary.

Consent to destroy, deface or damage Aboriginal

Aboriginal Heritage Impact Permit

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Department of Environment & Climate Change NSW



CONSENT TO DESTROY, DEFACE AND DAMAGE ABORIGINAL OBJECTS

Background

On 11-Dec-2008 an application was made to the Director-General of the Department of Environment and Climate Change for a consent pursuant to s.90 of the National Parks and Wildlife Act 1974.

Consent given subject to conditions

A consent is given to destroy, deface and damage Aboriginal objects identified in Schedule C, in accordance with the conditions of this AHIP.

This consent is given pursuant to section 90 of the National Parks and Wildlife Act 1974.

K. L. Brown

Mr Karl Brown

Acting Manager Planning & Aboriginal Heritage Section

Metropolitan

(by Delegation)

DATED: 13/2/09

Consent to destroy, deface or damage Aboriginal

Aboriginal Heritage Impact Permit

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Department of Environment & Climate Change NSW



CONDITIONS OF AHIP

Schedule A: Land to which this AHIP applies

The land to which this AHIP applies is all land within the Western Precinct, St Marys site, ADI.
See Attachment 1

Schedule B: Protected Aboriginal objects which must not be disturbed or moved

1. **Burials** All human remains in, on under the land.

Schedule C: Aboriginal objects to be destroyed, damaged or defaced

Aboriginal objects on the land which are identified on the map (figure 2 of the application) other than the protected Aboriginal objects described in Schedule B.

AHIMS SITE ID	SITE NAME	SITE FEATURE	EASTINGS	NORTHINGS	DATUM — AGD or GDA
45-5-3587	ADI-FF11	PAD	290527	6266893	AGD
45-5-1035	ADI-34	PAD	289539	6266322	AGD
45-5-1033	ADI-32	PAD	289077	6266354	AGD
45-5-1057	ADI-56	PAD	289077	6266354	AGD
45-5-1042	ADI-41	PAD	288835	6265442	AGD
45-5-3331	ADI-FF30	PAD	289330	6265200	AGD
45-5-1023	ADI-22	PAD	289330	6265200	AGD
45-5-1029	ADI-28	PAD	289330	6265200	AGD
45-5-1055	ADI-54	PAD	290637	6265743	AGD
45-5-3328	ADI-FF3	PAD	290637	6265743	AGD
45-5-3588	ADI-FF20	PAD	290749	6265178	AGD
45-5-3586	ADI-FF21	PAD	290749	6265178	AGD
45-5-3586	SA-4	PAD	290749	6265178	AGD

Schedule D: Proposed works

A combination of residential and commercial development.

Consent to destroy, deface or damage Aboriginal

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COMMENCEMENT AND OVERSIGHT OF ACTIVITIES RELATING TO THIS AHIP

Commencement of AHIP

1. This AHIP commences on the date it is signed unless otherwise provided by this AHIP.
2. The AHIP holder must not, in a salvage area described in an AHIP that remains in force, commence activities that would damage, destroy or deface any Aboriginal object or Aboriginal Place, unless the following have taken place:
 - (a) the salvage works described in that AHIP have been completed; and
 - (b) the AHIP holder responsible for the salvage works has notified the DECC in writing that those works have been completed.

Duration of AHIP

3. Unless otherwise revoked in writing, this AHIP remains in force for:
 - (a) 10 years from the date of commencement; or
 - (b) the date on which the s90 report is submitted,whichever is the sooner.

Responsibility for compliance with conditions of AHIP

4. The AHIP holder must ensure that all of its employees, contractors, sub-contractors, agents and invitees are made aware of and comply with the conditions of this AHIP.

Project manager to oversee the activities relating to this AHIP

5. The AHIP holder must appoint a suitably qualified and experienced individual who is responsible for overseeing, for and on behalf of the AHIP holder, the activities relating to this AHIP.
6. The individual appointed must be the individual nominated in the application form.
7. If an alternative individual is appointed whilst this AHIP remains in force, the AHIP holder must advise the DECC office in writing within 14 days of the new appointment.

Notification of commencement of work

8. Prior to the proposed commencement of activities authorised by this AHIP, the AHIP holder must give the DECC office written notice of the proposed commencement date of those activities.

Consent to destroy, deface or damage Aboriginal

Aboriginal Heritage Impact Permit

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Department of Environment & Climate Change NSW



GENERAL OPERATIONAL CONDITIONS

Activities must not damage Aboriginal objects

9. The AHIP holder must not damage Aboriginal objects other than those Aboriginal objects specified in Schedule C.

Activities must be in accordance with methodology

10. Activities must be carried out in accordance with the methodology specified in the application to which this AHIP applies, except as otherwise expressly provided by a condition of this AHIP.

PROTECTION OF ABORIGINAL OBJECTS

Protection of Aboriginal objects

11. The AHIP holder must ensure that Aboriginal objects specified in Schedule B are not damaged.
12. To the fullest extent possible, each protected Aboriginal object must be clearly marked so as to provide a clear visual marker to persons on foot or in vehicles in the vicinity of that Aboriginal object.
13. The AHIP holder must ensure that persons entering the land such as employees, contractors, sub-contractors, agents and invitees have a copy of any Map referred to in Schedule B.
14. Appropriate sediment control measures must be installed, operated and maintained so as to prevent any disturbance of a protected Aboriginal object.
15. Vehicles must not be driven on or in the immediate vicinity of a protected Aboriginal object.

NOTIFICATION AND REPORTING CONDITIONS

Human remains

16. If any human remains are disturbed in, on or under the land, the AHIP holder must:
 - (a) not further disturb or move these remains;
 - (b) immediately cease all work at the particular location;
 - (c) notify DECC's Environment Line on 131 555 and the local police as soon as practicable and provide any available details of the remains and their location; and
 - (d) not recommence any work at the particular location unless authorised in writing by the DECC.

Consent to destroy, deface or damage Aboriginal

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Incidents which may breach the Act or AHIP

17. The AHIP holder must notify the DECC office in writing as soon as practicable after becoming aware of:
- (a) any contravention of s.90 or s86 of the Act not authorised by an AHIP;
 - (b) any contravention of the conditions of this AHIP.

Reports about incidents which may breach the Act or AHIP

18. Where an authorised officer reasonably suspects that an incident which may have breached the Act or AHIP has occurred, the officer may request in writing that the AHIP holder prepare a written report about that incident. The report must detail:
- (a) the nature of the incident;
 - (b) the nature and location of relevant Aboriginal objects or Aboriginal places, referring to and providing maps and photos where appropriate;
 - (c) the impact of the incident on Aboriginal objects or Aboriginal places;
 - (d) any conditions of an AHIP which may have been breached; and
 - (e) the measures which have been taken or will be taken to prevent a recurrence of the incident.
19. The report must be provided to the DECC office by the due date specified by the authorised officer.

Report about damage to Aboriginal objects under s.90

20. The AHIP holder must prepare a report about the activities relating to the damage of Aboriginal objects as consented to by this AHIP, as soon as practicable after completing the activities. The report must:
- (a) include a short summary of the report;
 - (b) provide details of the objects which were fully or partially damaged in the course of undertaking the activities;
 - (c) describe any ongoing consultation with or involvement of representatives of local Aboriginal groups in relation to this AHIP;
 - (d) describe how any protected Aboriginal objects were managed during the period covered by the AHIP;
 - (e) comment on the effectiveness of monitoring activities and mitigation measures that were implemented; and
 - (f) comment on the effectiveness of any management plan which was in place.
21. The report must be provided to the DECC office within 21 days of completion of the activities.

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Provision of copies of reports to local Aboriginal groups

22. The AHIP holder must provide a copy of each report provided to the DECC under this AHIP to each local Aboriginal group, within 14 days after each report is provided to the DECC.

Copy of this AHIP to be provided to local Aboriginal groups

23. The AHIP holder must provide a copy of this AHIP to each local Aboriginal group, within 14 days of receipt of the AHIP from DECC.

OTHER GENERAL CONDITIONS

Indemnity

24. The AHIP holder agrees to indemnify and keep indemnified, the Crown in right of NSW, the Minister administering the Act, the Director-General of DECC, and their employees, agents and contractors, in the absence of any willful misconduct or negligence on their part, from and against all actions, demands, claims, proceedings, losses, damages, costs (including legal costs), charges or expenses suffered or incurred by them resulting from
- (a) any damage or destruction to any real or personal property; and
 - (b) injury suffered or sustained (including death) by any persons arising out of or in connection with any activities undertaken pursuant to this AHIP.

Release

25. The AHIP holder agrees to release to the full extent permitted by law, the Crown in right of NSW, the Minister administering the Act, the Director-General of DECC, and their employees, agents and contractors, in the absence of any willful misconduct or negligence on their part, from all suits, actions, demands and claims of every kind resulting from
- (a) any damage or destruction to any real or personal property; and
 - (b) injury suffered or sustained (including death) by any persons arising out of or in connection with any activities undertaken pursuant to this AHIP.

Ongoing obligation to comply with due dates

26. Where a condition of this AHIP specifies a date by which something must be done or ceased to be done, the AHIP holder has a continuing obligation to comply with that condition after that date (subject to any written revocation or variation of the AHIP by DECC).

Written notice

27. Any requirement to provide written notice to the DECC office in this AHIP may be complied with by faxing the notice to the DECC office's fax number or by sending by registered post

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to the DECC office's address. The DECC office's contact details are specified at the front of this AHIP.

DICTIONARY

In this AHIP, unless the contrary is indicated the terms below have the following meanings:

Aboriginal object(s)	has the same meaning as in the Act
Aboriginal place	has the same meaning as in the Act
Act	means the National Parks and Wildlife Act 1974
AHIMS	means the Aboriginal Heritage Information Management System maintained by DECC
AHIP holder	means the person listed on the cover page under the heading "AHIP issued to"
Application	means the completed application form and all other documents in written or electronic form which accompanied the application when it was lodged or which were subsequently submitted in support of the application.
Authorised officer	means an employee of the DECC who is appointed as authorised officer under s.156B of the Act
Community collection	means the recovery of Aboriginal objects by representative(s) of the Aboriginal community
Damage	in relation to an Aboriginal object or Aboriginal place, unless otherwise specified in this AHIP, includes destruction and defacement
DECC	Department of Environment and Climate Change (NSW)
DECC office	means the office listed on the cover page of this AHIP
Director-General	means the Director-General of DECC
Invasive analysis	Any analysis of an Aboriginal object that damage the Aboriginal object
Land	means the land described at Schedule A
Local Aboriginal groups	means the following the following groups: <i>Deerubbin Local Aboriginal Land Council</i> PO Box 314, Mt Druitt NSW 2770

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Department of Environment & Climate Change NSW



Kevin Kavanagh and Steve Randall

Darug Tribal Aboriginal Corporation

PO Box 441 Blacktown NSW 2148

Sandra Lee

Darug Custodians Aboriginal Corporation

PO Box 81 Windsor NSW 2756

Leanne Watson

Darug Aboriginal Cultural Heritage Assessments

90 Hermitage Rd Kurrajong Hills NSW 2758

Gordon Morton

Darug Land Observations

PO Box 571 Plumpton NSW 2761

Gordon Workman

Non-invasive analysis	Any analysis of an Aboriginal object that does not damage the Aboriginal object
Protected Aboriginal objects	means those Aboriginal objects which are described in Schedule B
Salvage	the recovery of Aboriginal objects in accordance with the archaeological research methodology accompanying the application, as modified by the conditions of this AHIP
Standards and Guidelines Kit	means the Aboriginal Cultural Heritage Standards and Guidelines Kit (NSW National Parks and Wildlife Service 1997) as amended or replaced from time to time

INFORMATION ABOUT THIS AHIP

Responsibilities of AHIP holder

The AHIP holder is responsible for ensuring the AHIP holder's employees, contractors, sub-contractors agents, invitees are made aware of and comply with the conditions of this AHIP.

Penalties for breach of the Act

Significant penalties can be imposed by a court for failure to obtain or breach of an AHIP. The DECC can also issue penalty notices.

Responsibility for obtaining all approvals and compliance with applicable laws

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The AHIP holder is responsible for obtaining and complying with all approvals necessary to lawfully carry out the work referred to in this AHIP, including but not limited to development consents.

Other relevant provisions of the National Parks and Wildlife Act

Newly identified Aboriginal objects need to be notified to the Director-General under s.91 of the Act using the form available on www.environment.nsw.gov.au

Stop work orders and interim protection orders may be issued in certain circumstances to protect Aboriginal objects or places.

Obligation to report Aboriginal remains under Commonwealth laws

The AHIP holder may have additional obligations to report any discovery of Aboriginal remains under the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Commonwealth).

Exercise of investigation and compliance powers

Officers appointed or authorised under the Act may exercise certain powers and functions, including the power to enter land.

Duration of AHIP

This AHIP remains in force for the period specified in the AHIP.

Variation of AHIP

The AHIP holder may apply to the DECC office in writing for a variation of any conditions of an AHIP. Requests for variations may need to be accompanied by evidence of further consultation with interested parties including Aboriginal stakeholders and in some cases may include payment of fees. The conditions of an AHIP may be varied at any time at the discretion of the Director-General. The AHIP holder may appeal a decision of the Director General to vary the conditions of the AHIP.

Transfer of AHIP

An AHIP is not transferable. The surrender or revocation of an existing AHIP could occur at the same time an AHIP is issued to a new AHIP holder.

Revocation of AHIP

An AHIP may be revoked at any time at the discretion of the Director General. Prior to revoking the AHIP, the AHIP holder will be given notice and an opportunity to make submissions. The AHIP holder will be notified in writing of the final decision. The AHIP holder may appeal a decision to revoke the AHIP.

Entry to land

AHIP number: 1096059

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An AHIP does not automatically entitle its holder to enter land for the purpose of conducting work related to the AHIP. The AHIP holder is responsible for obtaining permission to enter land from the owner and/or occupier of the land.

Disclosure of information pursuant to lawful requirement

This AHIP does not prevent the disclosure of any information or document in DECC's possession in accordance with any lawful requirement.

Making copies of reports

By providing a report, the AHIP holder acknowledges that DECC can use the information in that report to inform its regulatory functions, note details of that report in AHIMS and include a copy of the report in its library which may be available to members of the public.

DECC is able to make copies of any reports provided to DECC under this AHIP.

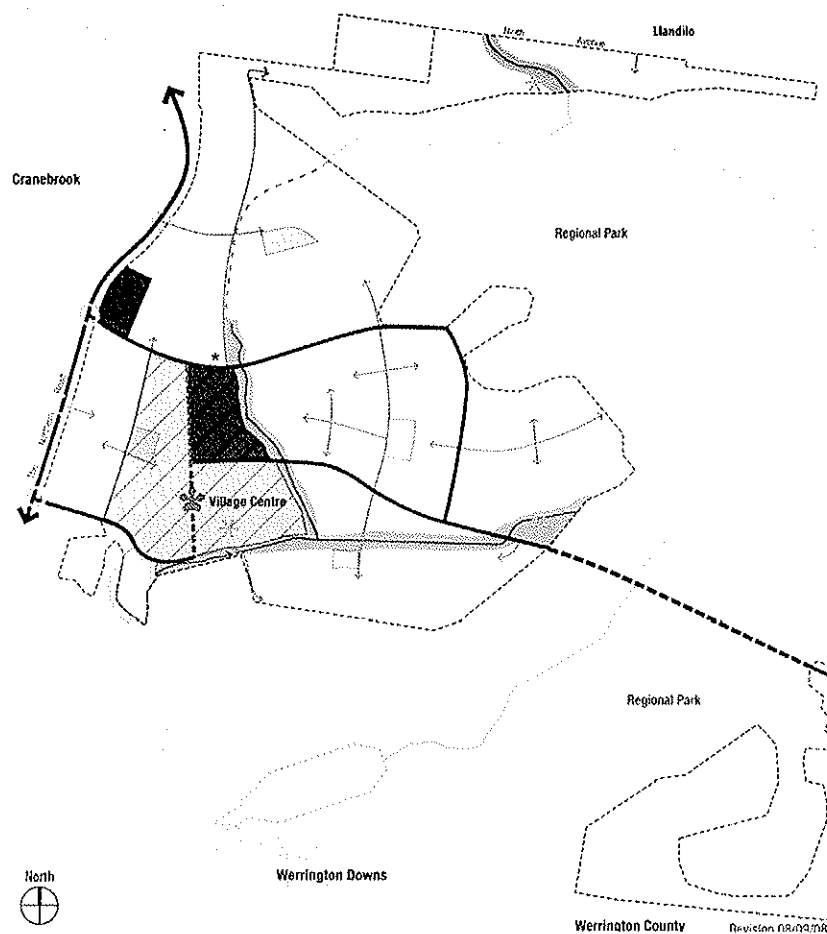
St Marys Site Western Precinct - Archaeological excavation programme Research Design accompanying s90 Consent application

Introduction

The St Marys Project is located on the northern Cumberland Plain to the east of The Northern Road. The St Marys Site comprised c.15 square kilometres straddling South Creek, at its confluence with Ropes Creek.

The Western Precinct is located at the western end of the St Marys Site. It covers an area of c.229ha. It is bounded by The Northern Road to the west and the Regional Park lies to its north, south and east. The Framework Plan for the Western Precinct, as included in the draft Western Precinct Plan lodged with Penrith City Council on 25 July 2008, is shown (Figure 1).

Figure 1: St Marys Western Precinct showing the land included in this s90 application.



Impact of the proposed development

The proposed development of the Precinct, as outlined in the draft Precinct Plan,

involves mostly residential development. A combination of housing, roads, retail/commercial, open space, and related infrastructure impacts will destroy any Indigenous cultural heritage remaining here. The location of this Precinct has been defined by SREP30 and it is assumed that the entire Precinct is developable. There is a major conservation outcome achieved by the broader management strategy in place for the St Marys Site: 98% of the lands west of the South Creek tributary identified as having conservation potential are to be included in the Regional Park.

It can be assumed that all and artefact-bearing topsoil across this developable area will be impacted by a range of development impacts. Any archaeological sites/Aboriginal objects located here would be destroyed. This research design reflects the need to salvage information from this western end of the Site, to ensure appropriate mitigation prior to development and to provide interpretation of Indigenous heritage resources within the Regional Park.

Management Background

The St Marys Site at St Marys includes approximately 1,545ha of land which have been the subject of studies since the early eighties. In 1994 a Regional Environmental Study was undertaken (Kinhill 1994) as were more intensive studies for the section 22 committee process (McDonald and Mitchell 1994). These studies resulted in more than 45% (670ha) of the Site being identified as having high conservation value – for both Indigenous heritage and biodiversity. This land with high conservation value and an additional 273ha (with mixed archaeological sensitivity) have now been designated as a conservation outcome, and falls within the Wianamatta Regional Park - which comprise approximately 900ha.

The early planning work was targeted at providing this conservation outcome for Indigenous cultural heritage generally across the St Marys Site, and at facilitating the systematic management of Indigenous cultural heritage in the resultant development Precincts. A strategic management model (SMM) was devised, the overriding aim of which was the preservation of a representative sample of intact landscapes across the St Marys Project (McDonald & Mitchell 1994, Jo McDonald CHM 1997a, 2003, 2005, 2006, 2008). The SMM was seen as a meaningful management outcome which could be refined throughout the life of the Project.

The SMM presumes that once the conservation zone had been designated and the Regional Park finalised that the remaining lands (the Precincts) would be developable and that the archaeology here would be affected by a range of development impacts. It was also envisaged that landscapes with sensitivity in the Precincts would provide the archaeological evidence (through salvage) documenting both the areas to be impacted by the Precinct and likely to be conserved within the adjacent Regional Park.

The Western Precinct is the developable land of interest to the current planning activity. Around 40% of the Western Precinct is Zone 4, with minimal or no archaeological potential. There is a very small area of Zone 1 but quite large areas of Zones 2 and 3.

Survey Results

As a result of the previous survey and assessment (JMcD CHM 1997a, 2006d, Kinhill 1994) a total of 39 surface sites have been identified within the Western Precinct (JMcD

CHM 2008: Table 8). All previously recorded sites in the Western Precinct are shown (Figure 2). These have been located on surface exposures across the subject land, in a variety of landscape settings and management zones.

As a result of detailed analysis of representative landscapes and management zones (JMcD CHM 2008) a set of target landscapes have been identified for salvage in the Western Precinct as part of the Strategic Management Plan for the (former ADI Site) – now the St Marys Project (Table 1, Figure 3).

Salvage Research Design

This research design develops the overarching archaeological research aims of the St Marys Site, and specifically defines the works programme for the Western Precinct (and adjacent fauna fence) at the seven identified salvage locations.

A total of 39 surface archaeological sites with almost 250 artefacts have been recorded within the Western Precinct. Previous sub-surface investigations in the western end of the St Marys Site (at SA4, SA5 and ADI-47+48) have produced over 7,000 stone artefacts. Over 131 hectares of land with Potential Archaeological Deposit (Zones 1-3) have been identified here.

Figure 2: The locations of all identified surface features, showing background of sensitive topography (Zones 1, 2 and 3).

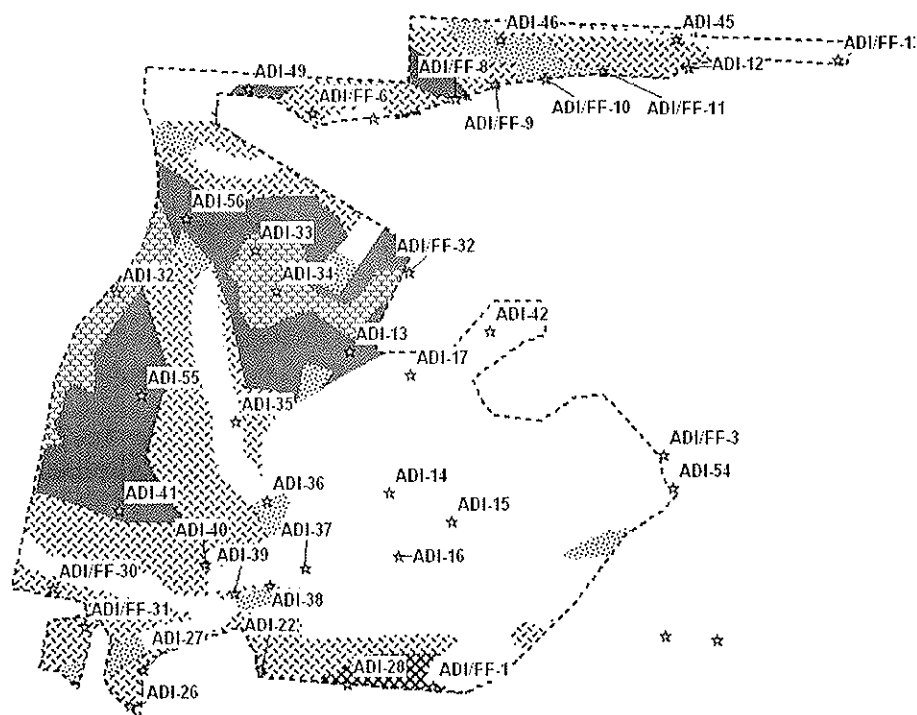
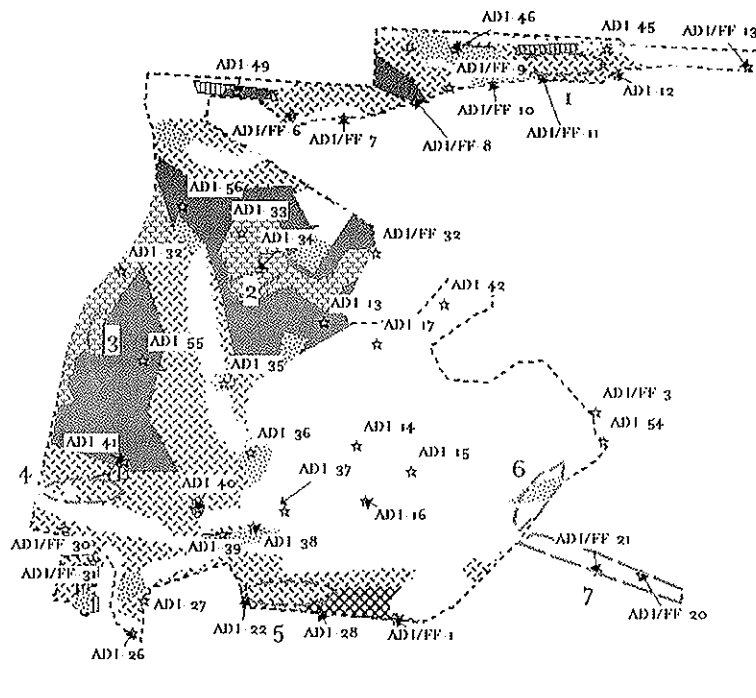


Table 1: Salvage locations in the Western Precinct and adjoining Fauna Fence.

Target	Near	Catchment	Landscape	Topo	SMM Zone
1	ADI-FF11	1	Shale	UHS	3
2	ADI-34	1_2	Shale	RT	3
3	ADI-32, ADI-55	2	Shale	RT/LRT	3
4	ADI-41, ADI/FF-30	2	Shale	LHS, CB1	2
5	ADI-22, ADI-28	2	Shale	LHS	2
6	ADI-54, ADI-FF3	2	Qal	FP/CB2	1
7	ADI/FF20, 21; SA-4	3	Qal	LHS/CB2	1

Note that these target locations will be excavated sequentially, with locations 3 and 4 being the first areas excavated (as these fall within the proposed Stage 1 development area).

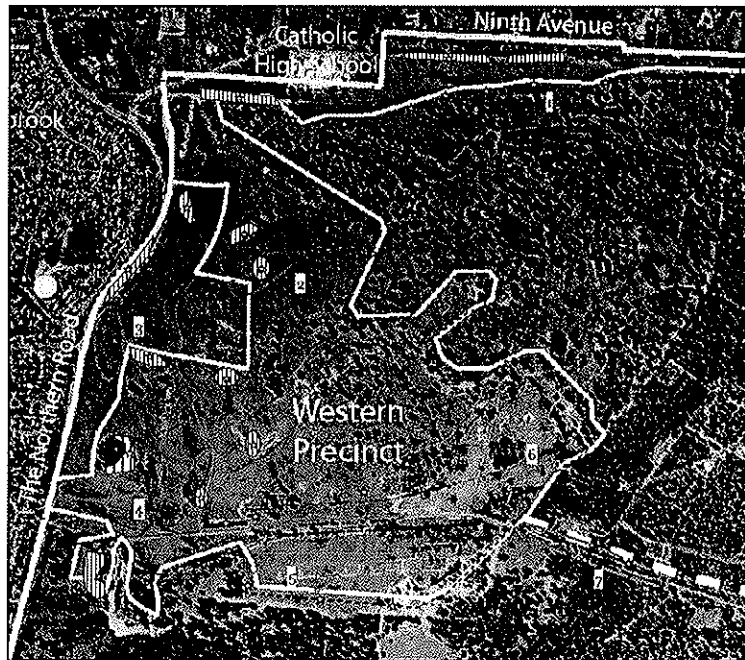
Figure 3: Surface sites, sensitive topographic zones and suggested salvage locations.

Aims

Given the extremely poor surface visibility across the Site generally (Jo McDonald CHM Pty Ltd 1997, 1996, 2001a, 2006d) and the fact that surface evidence is not a good indicator for the nature of the archaeological resource, salvage in each area will commence with a programme of random intensive sub-surface testing. Testing will locate suitable assemblage(s) for salvage – in a manner which is comparable with other

recent excavations on the Cumberland Plain (particularly the RHIP Stage 2 and 3 works, Xavier College, the St Marys Eastern Precinct, Greystanes Estate and Plumpton Ridge).

Figure 4: Aerial photo of Western Precinct and Access road showing locations of suggested salvage locations (numbered as per Table 1).



The over-riding research aim of this salvage project is to investigate the archaeology in relation to landscape. Subsidiary aims include:

- ☉ Characterising the locations investigated via artefact distribution and assemblage characteristics.

How do the assemblages at the various sites compare given the differences in stream order and other landscape characteristics?

The retrieval of assemblages from specific activities (including knapping floors) will investigate how technology was organised.

The identification of assemblage 'signatures' - tentatively identified during the earlier work and further explored in a range of subsequent investigations (e.g. across the St Marys Development Site, at Regentville, at Richmond and in the RHDA - will be part of these analyses.

- ☉ The retrieval of statistically viable samples of artefacts will allow comparison with other similar salvage excavation.
- ☉ The comparison of the results of the present investigations with results from other projects elsewhere on the Cumberland Plain, to identify intra- and inter-regional variation and to establish significance values.

Research framework

The project seeks to investigate Aboriginal use of this part of the Cumberland Plain.

Management investigations across the Cumberland Plain over the last 10 years have focussed on archaeological landscapes. This contrasts with the arguably ineffective and inappropriate site-based approach to heritage management. Archaeological landscapes are based on a combination of geomorphological and topographic criteria.

Technological organisation involves studying artefacts to explore how people used landscapes in the past. It is concerned with the production, use, transport and discard of tools and the materials needed for their manufacture and maintenance (e.g. Nelson 1991). Many factors influenced the particular strategies that were adopted by people – including the raw materials that were available (their physical properties) the particular kinds of jobs that tools were needed for (e.g. heavy duty chopping, wood shaving, fine cutting), whether tools could be made and used in the same place or whether they had to be carried over long distances. Sometimes tools also had to code social information. More commonly understood strategies included curation, expediency, specialisation, and stone rationing (e.g. in response to great distance from stone sources).

Technological organisation and particular technological strategies are manifest in the archaeological record through people's stone discard actions. Previous analysis on the Cumberland Plain has already identified a variety of activities, including the procurement of raw materials, initial testing and reduction of stone, transport, heat treatment, systematic core reduction and production of formal tools (including backed artefacts), expedient reduction to produce unshaped tools, hafting, tool use, tool maintenance, storage and recycling or reuse.

Field methods

The salvage of the seven identified landscapes in the Western Precinct will target areas with no (or minimal) surface archaeological manifestation. The approach being advocated is a combination of systematic testing and salvage excavation: the methodology includes both the discovery of buried features across a landscape and then the salvage of features encountered. It is important that this is done in a way which is comparable to other salvage excavations done in a range of landscapes across the Cumberland Plain.

- ⊗ Open-plan excavation: Salvage will target features/locations that intercept a number of activities. If the archaeological evidence is found to be dispersed and localised (i.e. activities were spatially discrete), more than one open plan excavation area may be needed. It is proposed that open plan excavation would proceed either until a statistically viable sample has been obtained – or until the edge/boundaries of the feature(s) are reached (whichever is smaller). The outer limits of a knapping feature are defined as either sterile deposit and/or a sufficiently low artefact density to signify the absence of interpretable artefactual material e.g. <10 small artefacts not including tools and/or retouched items.
- ⊗ Statistically viable sample: >2,000 artefacts/assemblage but preferably more, if possible. Sufficient artefacts need to be recovered so that assemblages can be described in terms of raw materials types, artefact types, artefact size, and so on. Some artefact types such as cores, backed artefacts and retouched and/or used tools may each make up <1-2% of the assemblage. In an assemblage of 2,000 artefacts there might therefore be only 10-80 artefacts of these types: the

minimum number, statistically speaking, required to analyse these types further. To calculate a statistically significant result (e.g. for a chi-square test) it must be possible to calculate an expected value of at least five artefacts in each cell of a data table (Clegg 1990:176). If one wanted to compare the size of artefacts of silicified tuff and silcrete, and silicified tuff made up only 20% of an assemblage of 2,000 artefacts, then there would be only 400 artefacts of this raw material. If only 1% of those artefacts were >4cm in size then there might be only 4 silicified tuff artefacts >4cm in size.

- ⊗ Moderate and high density locations: Moderate and high artefact density locations are needed to achieve statistically viable samples economically. If artefact density is only 20/m² then 100 square metres would need to be excavated to recover 2,000 artefacts. If densities were c. 50/m² then 40m square metres would need to be excavated to recover 2,000 artefacts. As artefact density may vary in relation to the kind of activity (systematic core reduction and backed artefact production may result in high artefact densities while casual reduction to produce unshaped tools may result in moderate or low densities) excavation areas ought not be restricted only to high density locations, unless a range of activities are indicated. Entire features should be retrieved where possible to ensure that the assemblage can be properly characterised.
- ⊗ Range of activities: Different activities indicated by different artefact types, including backed artefacts, partly made backed artefacts and backing debitage, tool retouching debitage, debitage with dorsal grinding, and retouched and/or used tools. Different activities are also indicated by different and/or distinctive raw materials.

The proposed methodology is as follows:

Sub-surface testing will be conducted across seven defined PAD locations.

Dispersed test pits measuring 1m x 1m will be excavated at 10m – 20m intervals across a grid centred over the proposed target PAD. The testing will aim to locate high and/or moderate density pits and/or interesting assemblages. Approximately 40-45 test pits will be excavated per target area.

Testing along the fauna fence line in Zone 1 near ADI/FF:21 will be bounded by the centreline of the proposed fence line. Features here will only be excavated on the road side of the fence (i.e. not into the Regional Park). The aim of this testing is to identify a suitable salvage location. Some variation to the spacing may be necessitated by the presence of large trees, areas of localised disturbance, etc.

General

It is intended open area excavation will be undertaken where features are encountered. A 'feature' would include a high density of artefacts in a square metre or a pit which contains unusual/diagnostic artefact types. Open area excavation aims to salvage an entire assemblage – or where this appears to be extensive and/or continuous a large enough sample of artefacts to be statistically viable (see above). The aim would be to retrieve a statistically viable sample from this site/landscape to facilitate valid comparison with other sites/landscapes.

The size of the area to be open area excavated will depend on the retrieved artefact

densities. A target of 100m² is generally required to yield the necessary artefact assemblage. An excavation area of this dimension will ensure comparability with other salvage projects currently being undertaken on the Cumberland Plain.

Test pits will be excavated in bulk, down to the base of the A₂ deposit. All the deposit will be wet sieved on site using a water truck and nested 8mm and 3.5mm sieves. The sieving location will be positioned in an area where there will ultimately be site disturbance (i.e. in developable land). Appropriate sediment controls will be used.

The site will be mapped to scale and the location of the excavated test pits clearly identified and logged using handheld (differential) GPS. Stratigraphic sections detailing the stratigraphy and features within the excavated deposit will be drawn and the excavation area (including any features encountered) will be photographed.

Artefacts will be analysed on a comparable level with previous analyses of excavated assemblages on the Cumberland Plain (e.g. Jo McDonald CHM Pty Ltd 1997b, 1997c, 1999b, 2001, 2004, 2005, 2006; McDonald and Rich 1993). This will ensure comparison of these sites with other open sites in (former) ADI Site and on the Cumberland Plain generally. The assessment of the sites' significance can thus be made.

The analysis will provide information on the kinds of activities carried out, what stone materials were used and in what quantities, how stone tools were made, used and maintained, and how they and the materials from which they were made were transported around the landscape. By comparing different investigation areas it will be possible to determine whether there were differences in the kinds of activities carried out and the way that stone technologies were organised across the landscape. Such differences could be expected if different aspects of settlement organisation varied in relation to the landscape units as defined.

- ☉ Raw material type will be recorded to document what stone materials were used.
- ☉ Flaking quality and whether stone was heat treated or not will be recorded to provide additional information on stone selection.
- ☉ Artefact size and weight will be recorded.
- ☉ To document information on tool production, use and maintenance an artefact type list will be developed, including formal tools such as backed artefacts, other artefacts used as tools, tools which were maintained (had retouched working edges), and artefacts struck from the working edges of tools (tool retouching debitage).
- ☉ To document how stone was reduced and tools were made, flaking pattern will be recorded for cores and conjoin sets.
- ☉ Where features of previously reported generalised reduction sequences or strategies are observed, these will be noted as relevant.
- ☉ To document the form of transported items the types of artefacts reconstructed through conjoining will be recorded, and from the nature of activities it may be possible to determine what other artefacts were brought to each area.
- ☉ Various types of evidence will be used to determine the kinds of activities that were carried out.

A full description of the recording methods will be included in the archaeological report. The lithic assemblage will be analysed by lithics specialist, Ms E. White. Limited conjoining to assist in discerning prehistoric 'events' will be attempted, depending on the nature and size of the assemblage retrieved.

Aboriginal Consultation

Consultation with the Deerubbin Local Aboriginal Land Council (DLALC) and the Darug Aboriginal community groups - The Darug Tribal Aboriginal Corporation, Darug Custodian Aboriginal Corporation, Darug Aboriginal Cultural Heritage Assessments and Darug Land Observations will continue. Aboriginal representatives/fieldworkers will be part of the field team. Representatives are to be involved in discussions subsequent to the sub-surface testing and prior to management recommendations being made. In accordance with DECC Community Consultation Guidelines, and advertisement has been lodged in the local print media at the time of lodgement of the s87/s90 application to ensure that no additional stakeholders have been omitted from this consultation process.

Personnel

The project will be undertaken by Jo McDonald CHM Pty Ltd. The Project Archaeologist directing the fieldwork will be Sandra Wallace who will supervise a field team of four fully qualified archaeologists and four Aboriginal representatives/fieldworkers.

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Archaeological assessment of
Indigenous Heritage values in the
Western Precinct of the St Marys Site, St Marys

April 2009



Report to Maryland Development Company

Executive Summary

A total of 39 surface archaeological sites with almost 250 artefacts have been recorded within the Western Precinct at the St Marys Development Site. Previous sub-surface investigations in the western end of the Site have produced over 7,000 stone artefacts. The following findings are central to the devising the appropriate management outcome for the Precinct:

- ☞ Surface archaeological evidence has been found across the Precinct wherever conditions have been appropriate to allow its discovery;
- ☞ 130 hectares of land has been identified as having archaeological sensitivity (Zones 1, 2 and 3) within this Precinct (Table 4);
- ☞ A range of landscape and topographic characteristics are found across this Precinct;
- ☞ Ridge tops, low ridge tops, headwater and 1st order creek lines and upper hillslopes are shale hillslope landscapes particular to this end of the St Marys Site: these are landscapes will be significantly impacted by development here;
- ☞ The Regional Park will retain a representative proportion of all of these except ridge tops and headwater tributaries (Table 4).

Seven target areas within the developable lands of the Western Precinct have been identified as requiring archaeological salvage prior to development taking place (refer Figure 19).

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I. INTRODUCTION AND BACKGROUND

I.1 Background

The former Australian Defence Industries (ADI) site at St Marys, now known as the St Marys Development site, was endorsed by the NSW Government for inclusion on the Urban Development Program (UDP) in 1993. The site was seen to present an opportunity to provide housing for Sydney's growing population within an environmentally sustainable framework.

The St Marys site is located approximately 45km west of the Sydney CBD, 5km north-east of the Penrith City Centre and 12km west of the Blacktown City Centre. The main western railway is located approximately 2.5km south of the site. The Great Western Highway is located another 1 km south and the M4 Motorway a further 1.5km south.

The overall Site had an area of 1,545ha. It stretches approximately 7 kilometres from east to west and 2 kilometres from north to south, from Forrester Road, St Marys in the east to The Northern Road, Cranebrook in the west. It is bounded by Llandilo and Wilmott in the north and Cambridge Gardens/ Werrington County and the Dunheved Industrial Area in the south (see Figure 1).

Given that the site straddles the boundary between two local government areas (Blacktown and Penrith); the Government decided that a regional environmental plan should be prepared for the site. Technical investigations into the environmental values and development capability of the land were commenced in 1994, and the Regional Environmental Plan for St Marys [Sydney Regional Environmental Plan No. 30 (SREP 30)] was gazetted in January, 2001. It zoned the land for a combination of 'urban', 'employment', 'regional open space'; 'regional park', 'road and road widening' and 'drainage' uses (Figure 2).

In view of the original scale of the residential and employment uses, a package of documents was prepared to guide and control development. It comprised the REP (maps and written instrument), and an Environmental Planning Strategy (EPS) which sets out performance objectives and strategies to address key aspects associated with the site, including: conservation, cultural heritage, water and soils, transport, urban form, energy and waste, human services, employment, and land contamination.

A Deed of Agreement was entered into in December 2002, between the landowner and developers of the land (a Joint Venture comprising ComLand and Lend Lease Development) and the NSW Government. This sets out the developer's and State Government's responsibilities in providing services and infrastructure.

SREP 30 identified 6 development "precincts", known as the Western Precinct, Central Precinct, North and South Dunheved Precincts, Ropes Creek Precinct and Eastern Precinct (Figure 3).

SREP30 requires that a Precinct Plan be adopted by Council prior to any development taking place.

Planning for any precinct is to address all of the issues in SREP30 and the EPS, including preparation of management plans for a range of key issues.

Figure 1: Aerial photograph of the St Marys site.



In March 2002 the Australian Heritage Commission (AHC) declared that additional areas of the site should be included on the Register of the National Estate (RNE) and be set aside for Regional Park, on the grounds of their environmental value. This had the effect of changing the boundaries of the areas to be set aside for conservation, and areas available for residential and employment development. In April 2006, the precinct boundaries in SREP 30 were amended to reflect the RNE boundaries.

Initial planning for the St Marys site suggested that development would commence with the Western Precinct adjacent to The Northern Road, progressing eastwards through the site. However, the listing of additional lands on the Register of the National Estate changed this. The Joint Venture decided that the focus of initial development should commence with the Eastern Precinct, while boundary adjustments were resolved. Since then the Ropes Creek Precinct and Dunheved Precincts have similarly progressed through the Precinct Planning stages.

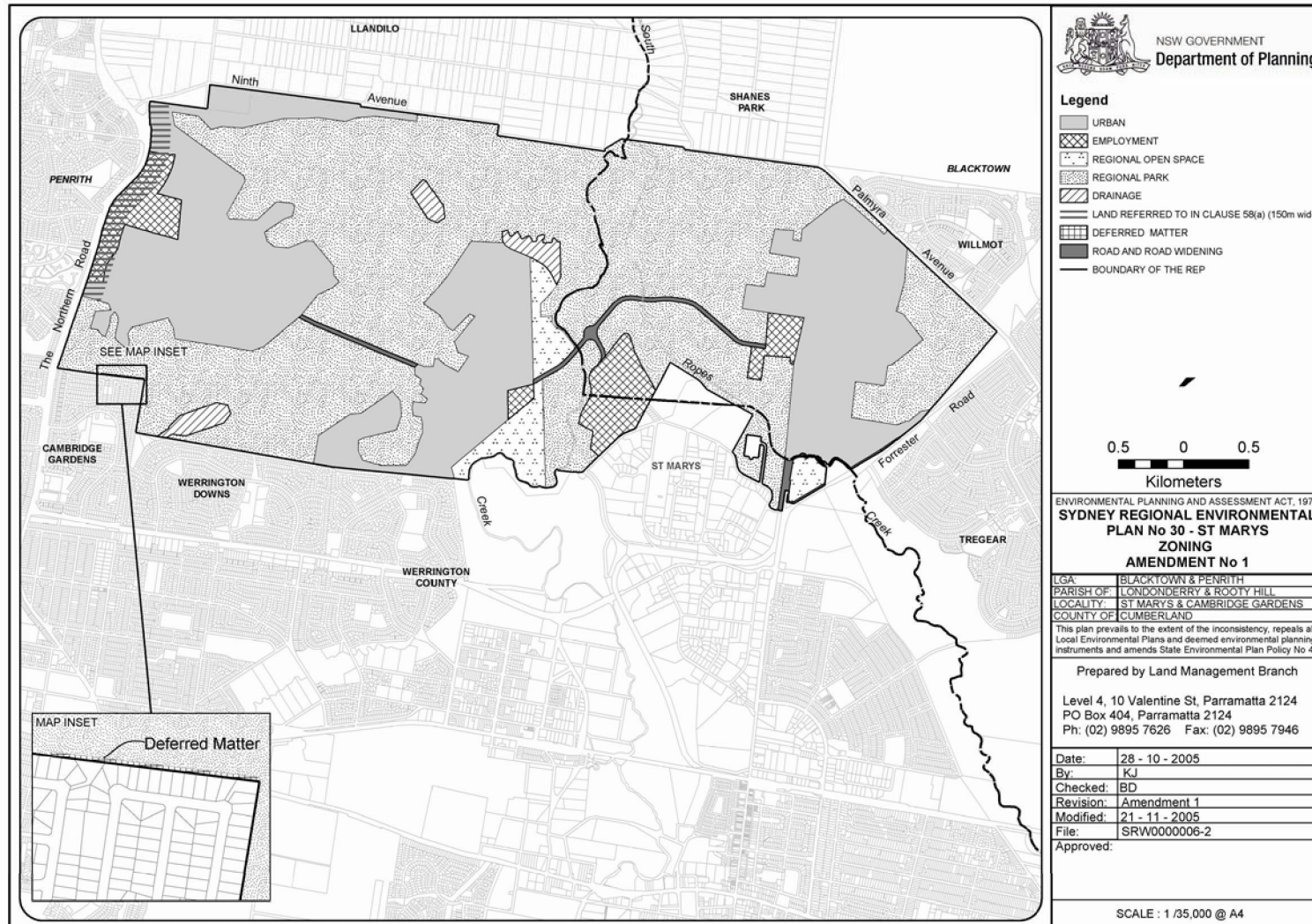
In September 2006 the Minister for Planning declared the Western Precinct a Release Area, paving the way for the preparation of a Precinct Plan for this area. In December 2006, the Minister for Planning directed the preparation of a draft amendment to consolidate and rationalise the employment lands on the St Marys development site. This is proposed to entail a relocation of the Employment zone from the Western Precinct to the Central Precinct.

The Western Precinct is proposed to be developed for mostly residential uses, as well as related uses including retail and commercial, community uses, open space, drainage infrastructure and roads.

This report has been prepared in accordance with the requirements of SREP 30 and the St Marys EPS, and addresses all relevant legislation. It is also written in accordance with the Principles defined in the Penrith City Council's *Sustainability Blueprint for Urban Release Areas* (PCC 2005) – specifically Principles 1 and 2.

It supports the draft Precinct Plan for the Western Precinct. While the focus of the report is on the Western Precinct specifically, the investigations carried out have taken into account the implications of planning for the nearby Central Precinct, the installation of a fauna fence around the Regional Park and in particular the conservation outcome achieved at this western end of the St Marys Site.

Figure 2: The St Marys Precinct boundaries as defined in current SREP 30 (subject to amendments under a current draft SREP 30 amendment). The Western Precinct is adjacent to the Northern Road.



1.2 Summary of Indigenous cultural heritage management issues

The Sydney Regional Environmental Plan No. 30 – St Marys (SREP) and the St Marys Environmental Planning Strategy (EPS) were gazetted in January 2001. These documents outline the processes, guidelines and objectives to be adopted for Precinct Planning following the declaration by the Minister for Urban Affairs and Planning of a Release Area on the site.

This report relates to the Western Precinct (Figure 4). This Indigenous archaeological assessment forms part of a suite of investigations being undertaken as part of the Precinct planning process.

The Interim Heritage Management Report, ADI Site, St Marys classified the site into four management zones based on archaeological sensitivity (Figure 5). Management strategies were recommended for each of these (JMcD CHM 1997a). The Section 22 Committee concluded (Draft Report of the Section 22 Advisory Committee for the ADI Site St Marys July 1997) that:

- ☉ The Committee supports ... and accepts that the Core Conservation Zone (i.e. the Regional Park) which has been proposed forms a suitable basis for the conservation of Aboriginal Heritage on the site;
- ☉ there is a suitable information base to make decisions about planning of the site; and,
- ☉ the outline of an appropriate set of strategies and protocols for controlling future development has been identified.

Previous work (JMcD CHM 1997a) and the EPS defines a conservation outcome for the majority of lands with Indigenous cultural heritage values in the Western Precinct. Following on from the logic and methodology of the previous work (and see JMcD CHM 2003, 2004, 2006) and the planning outcome, the Western Precinct in its entirety is assumed to be developable land. The conservation of additional archaeological sites/Indigenous cultural heritage features within this area is not envisaged and it is assumed that the management of any identified features which are assessed as having potential and/or significance within this area would be managed by

way of mitigation (i.e. salvage excavation). Given these assumptions, the methodology for undertaking the archaeological component of this work has been as follows:

- ☞ Identify what lands within the Western Precinct fall within Archaeological Zones 1, 2 and 3 (i.e. those which may require further archaeological investigation);
- ☞ Overlay the ground-truthed land-use mapping with topography and landscapes to identify the representative range of landscapes and proportions of these in the four archaeological zones (i.e. identify management options for potentially intact Aboriginal heritage landscapes);
- ☞ Consult with the Deerubbin Local Aboriginal Land Council and other Indigenous stakeholder groups, i.e. Darug Custodians Aboriginal Corporation Darug Tribal Aboriginal Corporation, Darug Aboriginal Cultural Heritage Assessments and Darug Land Observation's (sic);
- ☞ Confirm by field inspection locations with limited previous land-use disturbance (from Zones 1, 2 and 3) within the Western Precinct. This would include site inspection and ground-truthing of existing/current levels of disturbance, and the selection of likely locations for future site investigations;
- ☞ Document the results of field survey and other available information, making appropriate management recommendations in relation to this Precinct; and,
- ☞ Write a report detailing the results of these investigations, identifying any development constraints and opportunities. An appraisal of the strategic management model's utility, in terms of dealing with Indigenous archaeological landscapes across the Western Precinct, will be made.

Figure 3: The St Marys Development Site showing development precincts. The Western Precinct is at the western end of the Site.



1.3 Summary of current assessment and recommendations

The Western Precinct will impact on c.131 ha of land with defined archaeological sensitivity. A total of 39 surface archaeological sites with almost 250 artefacts have been recorded within the Western Precinct. Previous sub-surface investigations in the western end of the St Marys Site (at SA4, SA5 and ADI-47+48) have produced over 7,000 stone artefacts. The following findings are central to the devising the appropriate management outcome for the Precinct:

- ☉ Surface archaeological evidence has been found across the Precinct wherever conditions have been appropriate to allow its discovery;
- ☉ 130 hectares of land has been identified as having archaeological sensitivity (Zones 1, 2 and 3) within this Precinct (Table 4);
- ☉ A range of landscape and topographic characteristics are found across this Precinct;
- ☉ Ridge tops, low ridge tops, headwater and 1st order creek lines and upper hillslopes are shale hillslope landscapes particular to this end of the St Marys Site: these are landscapes will be significantly impacted by development here;
- ☉ The Regional Park will retain a representative proportion of all of these except ridge tops and headwater tributaries (Table 4).

There are two major landscape bases and a total of 12 topographic landscape elements across this Precinct (see Figure 17). Seven target areas within the developable lands of the Western Precinct have been identified as requiring archaeological salvage prior to development taking place (refer Figure 19).

It is recommended that:

1. There is a significant conservation outcome in this western part of the St Marys Site, with more than 60% of the total land area and more than 98% of the land with high archaeological sensitivity being excluded from the developable lands.
2. The basic precepts of the strategic management model are achieved by the planning process with this Precinct;

3. Six areas within the Western Precinct and the fauna fenceline along the road between the West and Central Precincts are identified as requiring archaeological salvage prior to development taking place (Table 9):
4. Depending on the timing of the proposed works programme, the Proponent should apply to the DECC NSW for either a s87 Permit or a s87/s90 Consent with Salvage to undertake these works.

2. ABORIGINAL CONSULTATION

The St Marys Development falls within the boundaries of the Deerubbin Local Aboriginal Land Council (DLALC). The study area also falls within the area of interest to the Darug Tribal Aboriginal Corporation (DTAC) the Darug Custodial Aboriginal Corporation (DCAC) and Darug Aboriginal Cultural Heritage Assessments (DACHA).

Fieldwork was first undertaken across the Western Precinct in mid-February 1996 (JMcD CHM 1997a). At that time, both the Deerubbin (then Daruk) Local Aboriginal Land Council and the (then) Daruk Link were consulted with. This was done on the advice from the (then) NPWS Sydney Zone, with an evolving NPWS NSW Consultation Policy whereby archaeologists in NSW were for the first time asked to consult with additional Aboriginal interest groups, particularly Native Title claimants.

Fieldwork in relation to the Xavier High School Site in the north west of the Precinct (JMcD CHM 2001, 2002) was done in consultation with the DLALC and the Darug Tribal Aboriginal Corporation (DTAC) and the Darug Custodial Aboriginal Corporation (DCAC).

The next fieldwork done within the Western Precinct was in 2004, with the survey of the initial fauna fence line proposal. This was undertaken between Monday 7th June and Friday 11th June, and the archaeologist (Mark Rawson) was accompanied by Steve Randall (Deerubbin LALC) on the 7th and 10th June, Jamie Eastwood (DCAC) on the 8th June, Justine Copeland (DCAC) on the 10th June, Celestine Everingham (DTAC) on the afternoon of 8th June, and Leanne Wright (DCAC) on the 11th June 2004.

Survey of the proposed realignment to the fauna fence route was undertaken on Thursday 8th December and Friday 9th December 2005. This time, the archaeologists (Amy Stevens and Andrea Ward) were accompanied by Phil Khan (Deerubbin LALC) on the 8th December and by Justine Copeland (DCAC) and Gordon Morton (DTAC)

on 9th December. Sometime after this survey the DTAC group split and formed two groups, with the second being called the Darug Aboriginal Cultural Heritage Assessments (DACHA).

In 2007 the consultative process has involved the Deerubbin LALC and three groups that have also been consulted with in the Eastern, Ropes Creek and Dunheved Precincts (DTAC, DCAC, DACHA). Representatives of all four groups were briefed at the commencement of the Precinct Planning phase by the consultant. All four groups have been invited to participate in the field inspection of the Western Precinct and to discuss the salvage options. Since this draft report was written, the DTAC group has also had a split and there is now an additional group known as Darug Land Observation (DLO).

A further field inspection is planned now that this report has been circulated and in response to the completion of the Precinct Plan when all impacts are known. The draft of this report was circulated to all groups for further discussion of the salvage options on the 23rd May 2008. All groups have indicated that they will produce reports on the cultural values of the Western Precinct lands (Appendix 1 includes those reports which had been received at the time of this report's production).

3. ADI SITE: STRATEGIC MANAGEMENT MODEL

3.1 Strategies for managing Indigenous Archaeological Sites

Background

The St Marys Site at St Marys included approximately 1,500ha of land which have been the subject of studies since the early eighties (Koettig 1980, Smith 1989). In 1994 a Regional Environmental Study was undertaken (Kinhill 1994) as were more intensive studies for the section 22 committee process (McDonald and Mitchell 1994). These studies resulted in more than 45% (670ha) of the Site being identified as having high conservation value – for both Indigenous heritage and biodiversity. This land with high conservation value was recommended to be included in a Regional Park. A subsequent Australian Heritage Commission listing added 273ha (with mixed archaeological

sensitivity) to the conservation outcome, and the Regional Park will now comprise approximately 900ha.

The early planning work was targeted at providing a conservation outcome for Indigenous cultural heritage generally across the St Marys Site, and at facilitating the systematic management of Indigenous cultural heritage in the resultant development Precincts. A strategic management model (SMM) was devised, the overriding aim of which was the preservation of a representative sample of intact landscapes across the St Marys Project (McDonald & Mitchell 1994, Jo McDonald CHM 1997a, 2003, 2005, 2006). Previous land use disturbance and a predictive model were used to identify areas with high conservation potential (i.e. the least disturbance), and representative landscapes where a variety of different types of archaeological sites are predicted to occur. The SMM was seen as a meaningful management outcome which could be refined throughout the life of the Project.

The SMM for the St Marys Project is predicated on a landscape-based philosophy. Rather than targeting only sites of known surface extent or known significance (e.g. through sub-surface investigation) landscape parameters are defined. The management of these landscapes is based on their conservation potential.

Most archaeological sites in western Sydney are open stone artefact scatters. Different site types (base camps, quarries, etc.) provide information on the different ways that the Plain landscapes were used by Aboriginal people. It is the variety of site types which have the potential, through their content and distribution across the region, to enhance our general model of prehistoric human occupation on the Cumberland Plain. Various types of evidence are likely to be present across the St Mary Project because of the range of landscapes present. Conservation potential here was high because a large proportion of this land has remained relatively undisturbed.

The SMM principles are summarised as follows:

- ④ The primary selection criterion for the conservation strategy was the selection of landforms which have been minimally disturbed by land-use practises over the last 200+ years;

- ☞ A similarly important criterion for the selection of conservation areas was that these must provide, and be representative of, the range of landscapes present across the St Marys Project;
- ☞ Regionally threatened landscapes, sites of recognised regional significance (i.e. rarity) and areas of significance to the Aboriginal community should also be included in the conservation area, as long as these are in good condition;
- ☞ A predictive model of Aboriginal site occupation on the Cumberland Plain has been devised, since some landscapes contain archaeological sites of higher significance than others;
- ☞ Landscapes which have been comprehensively disturbed by soil removal and/or rearrangement are of limited potential for archaeological sites. These require no further archaeological investigation and pose no constraint for development.

Four zones were devised with different designated management outcomes (Figure 5).

- | | |
|---|---|
| <ul style="list-style-type: none"> ☞ Zone 1 – Very high potential for intact archaeological evidence; ☞ Zone 2 – High potential for intact archaeological evidence; ☞ Zone 3 – Moderate potential for intact archaeological evidence; ☞ Zone 4 – Low-no potential for intact archaeological evidence. | <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; width: fit-content;">potential conservation zone</div> <div style="border: 1px solid black; padding: 5px; width: fit-content;">no further work required</div> |
|---|---|

Zone 1 was identified initially as the potential conservation zone. From this, based on a number of criteria, the Core Conservation Zone was selected (JMcD CHM 1997a: Figure 7). The CCZ falls within the defined Regional Park. The Regional Park includes areas identified with varying archaeological values – both high conservation potential (i.e. the CCZ) along with other areas which have lesser potential for intact archaeological sites but which have other conservation values (e.g. flora and fauna biodiversity). It was envisaged that no development would take place within the CCZ and that this would be managed into the future on the basis of its Aboriginal heritage values. It was also proposed that no archaeological investigations – these being inherently destructive – would take place within the CCZ.

Protocols and strategies are being developed by DECC (formerly NPWS NSW) for the Aboriginal (archaeological) Conservation Areas within the Regional Park (Katie

Littlejohn DECC, pers. comm., 2007). The nature and range of impacts which are likely to be acceptable within the archaeological CCZ will be limited.

The Western Precinct is the developable land of interest to the current planning activity. There is no constraint to development in this Zone. Around 40% of the Western Precinct is Zone 4 (see below), with minimal or no archaeological potential. There is a very small area of Zone 1 but quite large areas of Zones 2 and 3.

The SMM presumes that once the conservation zone had been designated and the Regional Park finalised that the remaining lands (the Precincts) would be developable and that the archaeology here would be affected by a range of development impacts. It was also envisaged that landscapes with sensitivity in the Precincts would provide the archaeological evidence (through salvage) documenting both the areas to be impacted by the Precinct and likely to be conserved within the adjacent Regional Park.

3.2 SMM Protocols

Strategies and protocols have been developed to guide ongoing Aboriginal heritage work in the development precincts. These have needed to be flexible and to develop robust compliance/validation procedures. The aim of the SMM was to streamline the development process and minimise undue procedural delay. It was also desirable to increase the usefulness of archaeological investigations undertaken.

These protocols have already been applied in the Eastern, Ropes Creek and Dunheved Precincts. Continuing consultation with the DECC and the Aboriginal community has been undertaken in all of these Precinct Planning works and regulatory changes have meant that some aspects of the SMM have now been refined. The current approach has been endorsed in the previous Precincts (see Figure 6):

1. All archaeological works are undertaken according to a research design that encompasses the entire St Marys Project and targets specific landscapes within the development Precincts for further investigation. This work is completed prior to development commencing and entire development precincts are investigated at one time. The research design, while broadly inclusive for the St Marys Project recognises development phasing and prioritises impact investigations.
2. Zones 1, 2 and 3 in the developable lands have high, good and moderate archaeological potential. A range of representative landscapes from these zones

should be targeted for investigation as per the overarching research design. All investigations include a testing phase and an open area excavation phase (of features/sites within landscapes to ensure statistically viable assemblage samples).

3. Zone 4 lands have had such high levels of previous land-use disturbance that they have no archaeological potential. No further archaeological work is required in Zone 4.

The targeting phase in each precinct will identify which lands from each of the zones will require further investigations and which will require no further archaeological work.

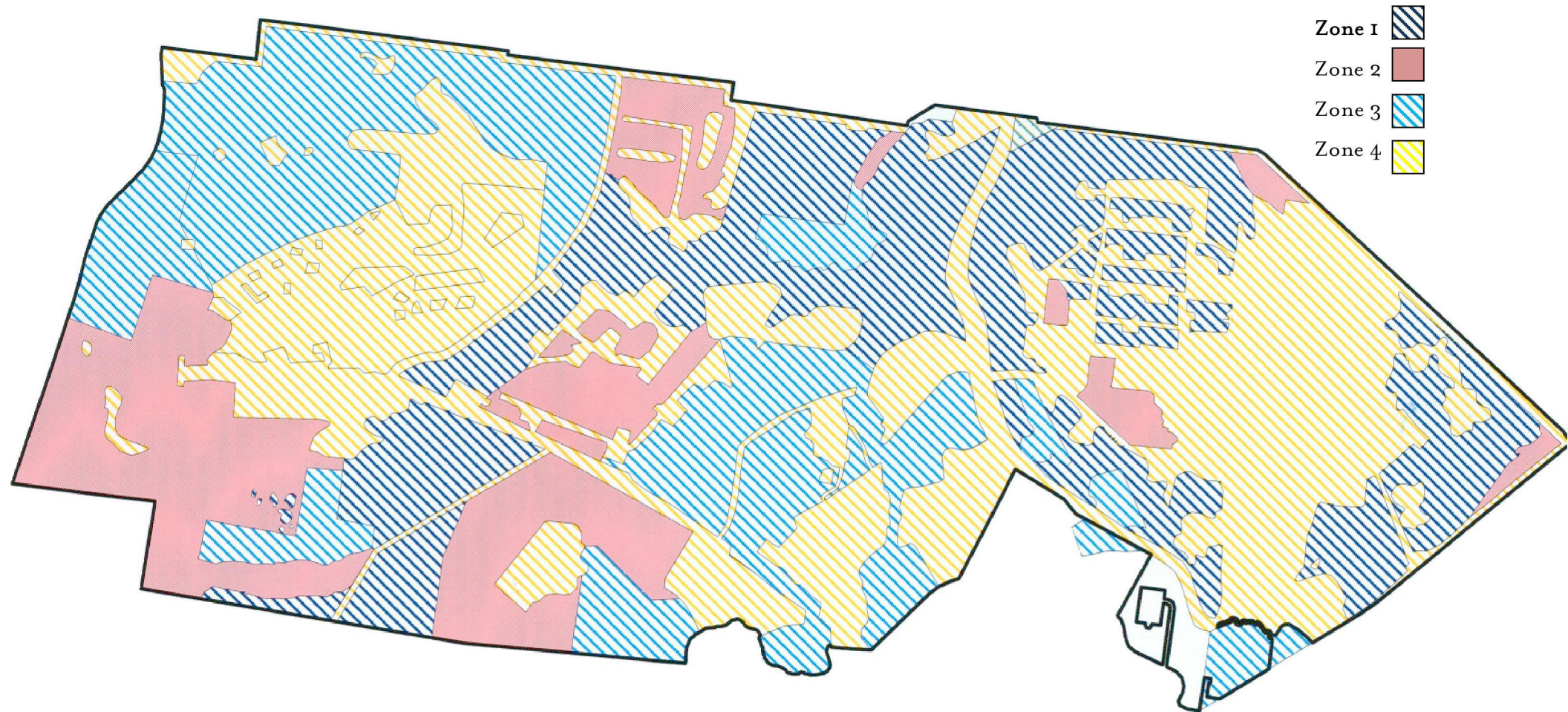
4. The selection procedure and consultation process forms part of the regulatory process. Once selection of target areas is complete, the proponent applies to DECC NSW for a whole of Precinct s.90 consent. This is granted on the condition that salvage excavation is completed in the designated target areas. Development is allowed to proceed in those parts of the developable land not affected by further archaeological investigation.
5. Upon completion of fieldwork in each target area, a clearance report is submitted to DECC, allowing the proponent to activate the s90 consent in that target area to allow construction to proceed. Full reporting on the excavation and analyses phases will be completed in due course and will be subject to review by DECC. The Aboriginal community may wish to monitor construction activity – but at this stage the archaeological requirements of the regulatory authority would be deemed complete.

There is a normal time limit of two years on s90 Consents. It has been general practise with the preceding Precincts to apply for a longer (generally 5 year) time period to ensure that all works associated with the Precinct development are covered by this s90.

The Strategic Management Model has the following advantages:

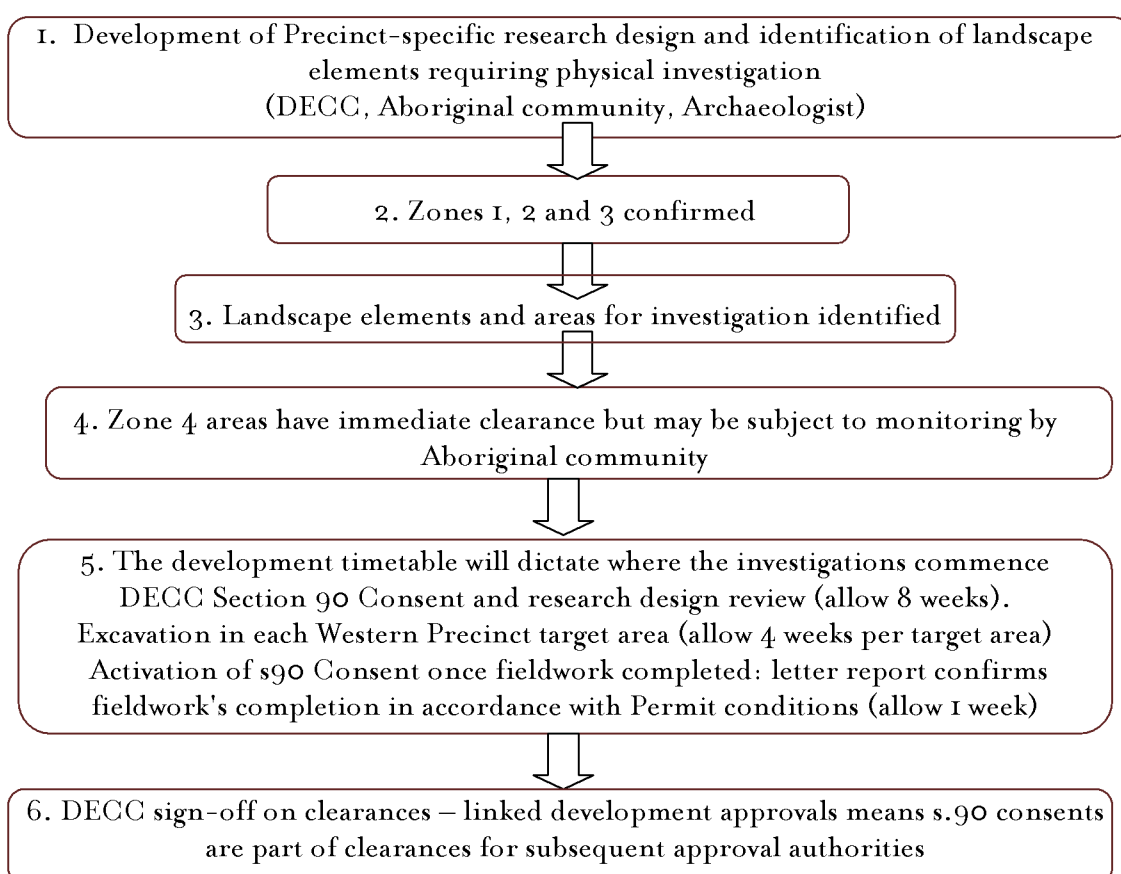
- ✎ The cultural heritage process is predicated on a conservation outcome which has been endorsed by the s.22 Committee. The conservation outcome is in lands now designated Regional Park. and,

Figure 4: The four management zones identified across the St Marys Site.



- ✎ The SMM enables planning and development of the St Marys Project to proceed with certainty and clarity. The Precincts are designated developable lands but with varying levels of archaeological sensitivity. Salvage from these Zones provides the archaeological evidence upon which management of the Conservation Area will be based, and by which an understanding of the cultural heritage resource can continue to be developed. It also provides for the mitigation of impacts on archaeologically sensitive landscapes.

Figure 5: Western Precinct – Protocols and strategies flow chart.



4. THE STUDY AREA - THE WESTERN PRECINCT

The Western Precinct is located at the western end of the St Marys Site (Figure 4). It covers an area of c.229ha. It is bounded by the Northern Road to the west and the Regional Park lies to its north, south and east, and the boundaries with the Park are irregularly shaped. The preliminary concept plan for the Western Precinct is shown (Figure 7).

For the purposes of discussing the conservation outcome in the Western Precinct, all land at the western end of the St Marys Site is considered. This covers approximately 574ha, and includes all land between the Northern Road and the main south tributary creek line which runs from Llandilo and joins with South Creek near its exit from the overall Site.

4.1 Geology

The three main landscapes identified within the St Marys Site are shale hillslopes (42%), Tertiary Terrace (28.5%) and Quaternary floodplain (30%: Table 1). Their proportions and levels of disturbance were mapped and calculated during the 1997 investigations (JMcD CHM 1997b: see Table 15). The Shale hill slope dominates this Precinct, covering 91% of the area. Quaternary alluvium is the only other landscape in this Precinct (9%: Table 2).

Table 1: Proportions of landscape types within the St Marys Site.

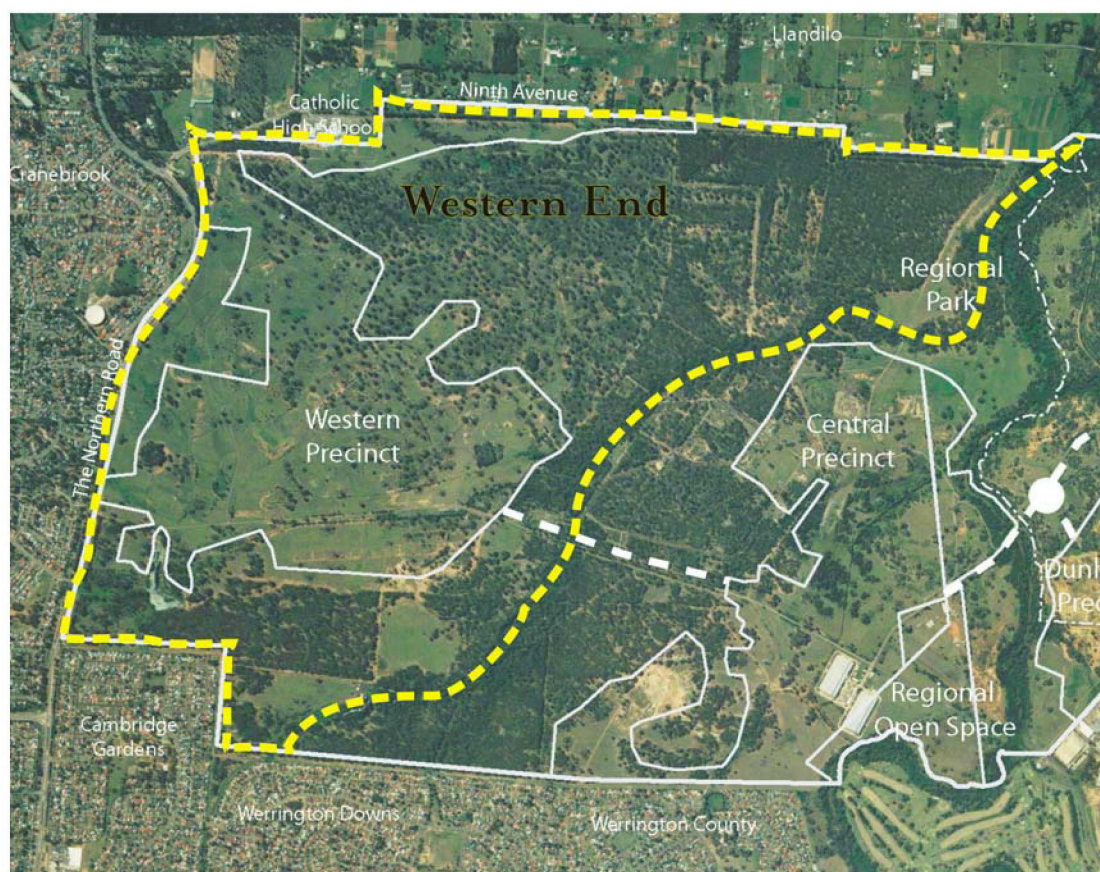
Landscape	Hectares	%f
Shale uplands	624	41.6
Tertiary terraces	427	28.5
Quaternary alluvium (including channels)	448	29.9
	1,499	100

Table 2: Proportions of landscape types in the Western Precinct.

Landscape	Hectares	%f
Tertiary terrace	0	0
Shale uplands	203.2	90.7
Quaternary alluvium	20.9	9.3
	224.1	100.0

Of particular interest to the current analysis is both the proportion of these landscapes within the Regional Park (RP) and those within the Western Precinct (WP: Table 3, Figure 8). The proportions of the representative landscapes in good condition – both in the RP and the WP – also require discussion in terms of identifying the conservation outcome at this end of the St Marys Project.

Figure 6: Air photo showing the Western Precinct and the land considered as the western end of the St Marys Site (outlined in yellow).

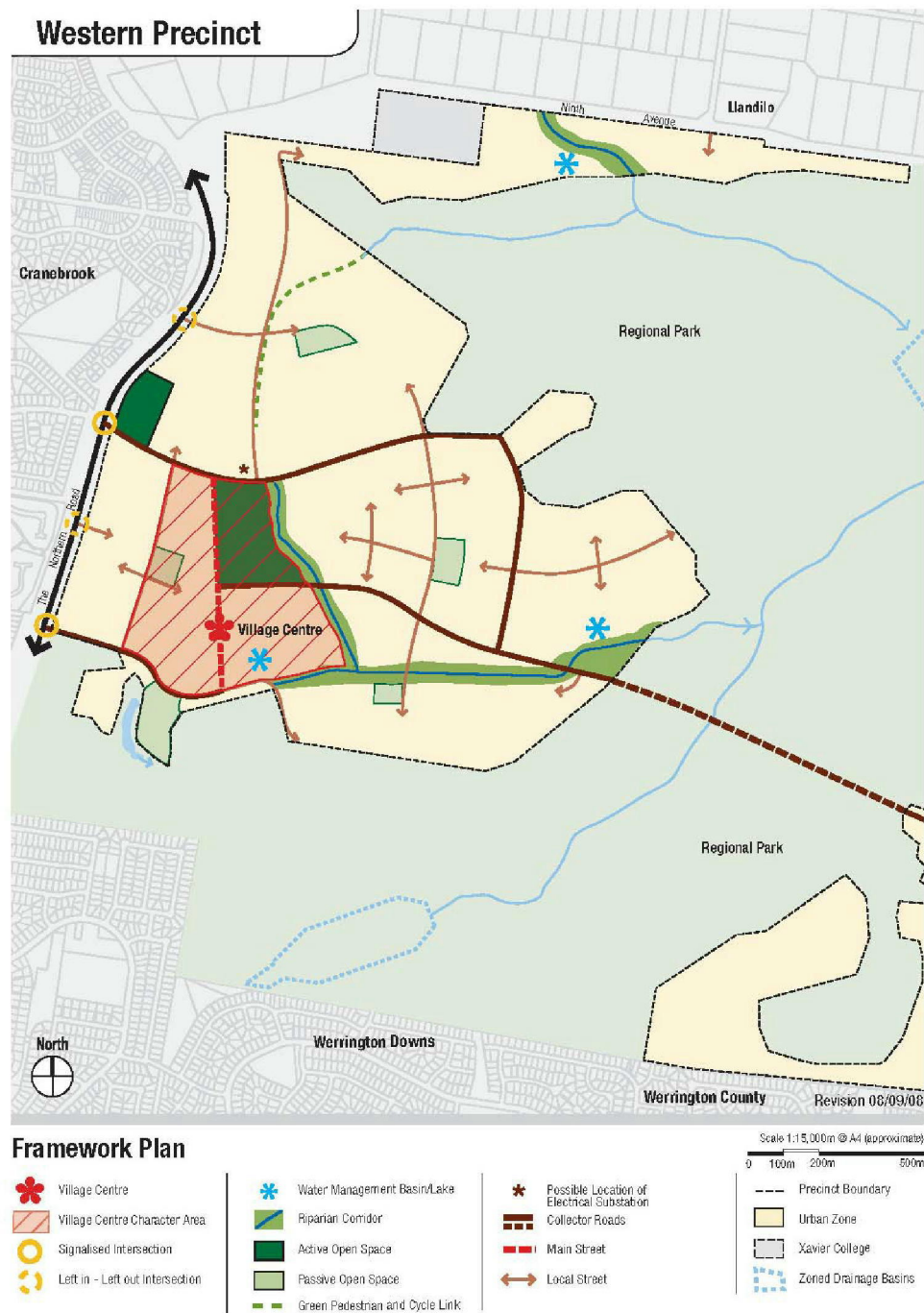


The conservation outcome at this western end of the St Marys Site is significant. As the Western Precinct is 229 hectares, the conservation outcome at this end of the Site represents more than 61% of the overall land.

The conservation outcome for the different landscapes in this western end of the Regional Park is also good. More than half (55%) of the shale hillslope landscapes falls within the Regional Park, while even larger percentage of the Quaternary alluvium (61%) is in the Park. The entire Tertiary terrace at the western end of the St Marys Site is within Regional Park (Table 3).

This is a substantial conservation outcome – which is even more significant when the proportions of archaeologically sensitive lands within the Regional Park are considered. In terms of the representativeness of landscapes being conserved within the Regional Park (see Table 4) all landscape types are conserved – and more than half of the predominant landscape (Shale Hillslopes) will be protected.

Figure 7: The Western Precinct framework plan.



4.2 Topography

There is a range in elevation between c.60m (AHD) at McGarritys Hill in the north west of the Western Precinct to c.30m AHD where the creek lines exit the Precinct. South Creek flows out of the St Marys Site at c.10m AHD. The Western Precinct is characterised by hilly terrain – generally sloping down from west to east.

Figure 8: The different landscapes in the Western Precinct.

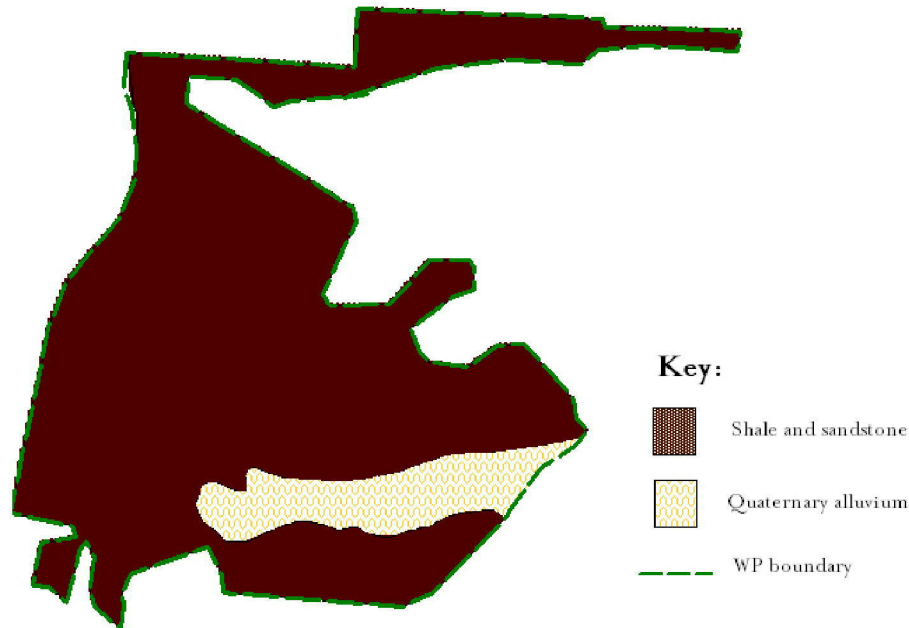


Table 3: Proportions of landscape types in the Regional Park – west of tributary 1.

	Western Precinct (ha)	Western end (ha)	Regional Park (ha)	% Landscape in Regional Park
Tertiary terrace		67.5	67.5	100
Shale	203.2	449	245.8	54.7
Qal	22.4	57.8	35.4	61.2
	225.6	574.3	348.7	60.7

4.3 Landscape elements

Landscape parameters were applied to the St Marys Site when regional comparisons were made and the SMM devised (JMcD CHM 1997b). This approach has since been used extensively in the Rouse Hill Development Area in the ongoing assessment of

Aboriginal sites during Stages 2 and 3 of the Rouse Hill Infrastructure Project (JMcD CHM 1999, 2002a, 2005d). A similar approach has been applied here.

The following topographic categories (as definitions) have been used in these analyses. These categories within both the Western Precinct and at the western end of the St Marys Site have been analysed. The codes used on Table 4 are shown in brackets.

- ☞ Creek bank (CB#) <50m to stream channel - number indicates stream order i.e. CB1 is a first order creek bank.
- ☞ Flood Plain (FP) >50m to water, flat land to slightly sloping
- ☞ Lower Hill Slope (LS) <200m to water
- ☞ Tributary headwaters (TH) sloping land <50m to water course
- ☞ Upper Hill Slope (US) >200m to water
- ☞ Flat plain (PL) >500m to water (many are alluvial terraces)
- ☞ Low Ridge (LR) <200m to water, <10m elevation above creek
- ☞ Low Ridge Top (LRT) >200m from water, <10m elevation above ck
- ☞ Ridge Top (RT) >200m to water, >10m elevation above creek

Table 4: Landscape elements at the western end of the St Marys Site, indicating those which occur within the Western Precinct.

Topographic elements	Geology	Western End (ha)	%f	Geology	Western Precinct (ha)	%f	%f in Regional Park
RT	Shale/s'stone	17.9	3.1	Shale/s'stone	15.6	6.9	13.2
LRT	78.2%	79.9	13.9	90.4%	39.4	17.5	50.7
US		48.3	8.4		15.6	6.9	67.8
LS	T. terrace	178.9	31.1	T. terrace	88.9	39.4	50.3
PL	11.8%	72.6	12.6	o	2.4	1.1	96.7
FP		74.1	12.9		16.8	7.5	77.3
TH		5.2	0.9		4.3	1.9	17.6
CB1	Qu'al	30.1	5.2	Qu'al	16.9	7.5	43.5
CB2	10.1%	38.7	6.7	9.6%	25.5	11.3	34.1
CB3		15.75	2.7		o	0.0	100.0
CB4		10.34	1.8		o	0.0	100.0
CB6		2.49	0.4		o	0.0	100.0
		574.35	100.0		225.6	100.0	60.7

The range of landscape elements within the Western Precinct is smaller than found at the western end of the St Marys Site, largely because of the inclusion of the major tributary creek line and particularly the lower reaches of this within the Regional Park. The large area of plain (on Tertiary Terrace) at the western end is also almost entirely within the Regional Park (Table 4).

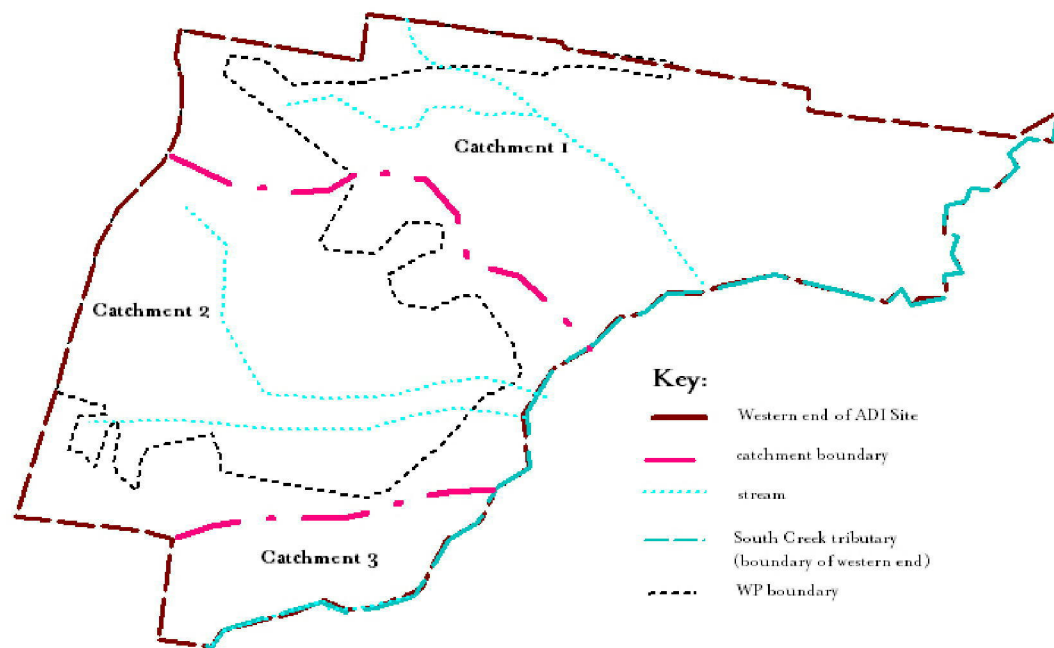
Good proportions of all landscapes will be conserved within the Regional Park, with the exception of ridge tops and headwater tributaries (RT and TH: Table 4). Less than 20% of these are to be conserved within the Regional Park. These landscape need to be emphasized in the selection of areas for targeted salvage.

Stream Order

The St Marys Site contains three major stream conjunctions on South Creek with a representative set of nodes from first to fourth order streams on the western side of South Creek. These are all found in the western end of the St Marys Site. A number of smaller streams through the shale hillslopes all flow eventually into a single left bank tributary of South Creek – the eastern boundary for 'the western end'. Three sub-catchments were originally defined (JMcD CHM 1997) as catchments 1, 2 and 3 (Figure 10). Ephemeral creek lines rise within the study area, and feed into these three main sub-catchments: some creeklines have their headwaters outside the St Marys Project.

The Western Precinct contains most of catchment 2. Almost all of catchments 1 and 3 are in the Regional Park. The main tributary stream (the boundary of the western end) is entirely within the Regional Park. Most of the streams within the Western Precinct are headwater, 1st and second order tributaries (Table 4). While all stream orders found within the Western Precinct are conserved within the Regional Park, proportionally more of the smaller order creeks will be impacted by development within this Precinct. These too should be considered in choosing target locations for salvage excavation.

Figure 9: Stream catchments at the Western End of the St Marys Site.



4.4 Stone Raw Material Sources

Silcrete was the raw material used extensively by Aboriginal people over the last 5,000 years. This material is found within the St Marys Formation, first identified in the railway cutting near St Marys railway station (Byrnes 1980, McDonald & Mitchell 1994, Corkill 1999). In 1997, targeted archaeological survey across the Tertiary Terraces of the St Marys Site determined a number of naturally outcropping silcrete locations and/or silcrete extraction sites (i.e. quarries). This targeted survey determined that the Tertiary terrace at the eastern end of the St Marys Site had several silcrete outcrops along Ropes Creek and a major cobble and boulder outcrop at a break-of-slope on the Tertiary Terrace. A major silcrete outcrop (ADI-57) in the Regional Park has extensive evidence for on-site testing and flaking. Salvage work in the Eastern Precinct (at ADI-EPI) demonstrated that quarrying extended beyond the obvious surface manifestations (JMcD CHM 2006b). More recent salvage along the fauna fence separating the Eastern Precinct from the Regional Park has similarly documented extensive quarrying activity closer to Ropes Creek (JMcD CHM 2008).

The Tertiary Terrace found in the western end of the St Marys Site does not have surface outcrops of silcrete present (JMcD CHM 1997b: Map 7).

4.5 Vegetation

The vegetation across the study area is dependent on the soil associations – which are related to the underlying geology. The variability in the soils here would have provided a resource rich interface (i.e. an ecotone). Seven different vegetation communities have been encountered during previous surveys of the western end of the St Marys Site. These are:

Cleared open woodland – trees 10-30m height; 10% canopy cover; *Eucalyptus moluccana* (Grey Box), *Eucalyptus tereticornis* (Forest Red Gum), and grasses maintained by grazing and mowing;

Woodland (some areas significantly disturbed) – trees 10-30m height; 10-30% canopy cover; *Eucalyptus moluccana* (Grey Box), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus amplifolia* (Cabbage Gum), *Bursaria spinosa* (Blackthorn), *Acacia implexa* (Hickory), *Themeda australis* (Kangaroo Grass);

Cleared grassland – flood prone land, some areas of marshes; drainage significantly altered by channelization; *Eucalyptus moluccana* (Grey Box), *Casuarina glauca* (Swamp Oak) are dominant, grazed grassland understorey;

Creeks and watercourses – *Casuarina glauca* (Swamp Oak) dominant species; weed impacted e.g. Privet (*Ligustrum lucidum*). South Creek has been severely impacted from upstream development. Large introduced trees include willows (*Salix babylonica*);

Closed Forest – trees 10-30m height; 70-100% canopy cover; *Casuarina glauca* (Swamp Oak) along original creek lines;

Cleared Open Woodland – trees 10-30m height; 10% canopy cover, *Eucalyptus fibrosa* (Broad-leaved Ironbark), *Eucalyptus sclerophylla* (Scribbly gum), *Eucalyptus moluccana* (Grey Box), *Eucalyptus crebra* (Narrow-leaved Ironbark) and grasses;

Open Forest – (some areas significantly disturbed) – trees 10-30m height; 30-70% canopy cover; *Eucalyptus fibrosa* (Broad-Leaved Ironbark), *Eucalyptus moluccana* (Grey Box), *Eucalyptus crebra* (Narrow-leaved Ironbark), thick understorey.

4.6 Existing disturbance

The current study area has suffered a variety of previous land use disturbance impacts. These have affected the ground surface and sub-soil, and would have resulted in varying degrees of damage and/or destruction of potential Aboriginal sites. The entire ADI Site was utilised for grazing and farming for approximately 150 years before the construction of the early factory and munitions storage complexes in the mid 1940s. This type of activity has had minimal impact on the soils and hence the archaeological deposit. In the Western Precinct, most serious impacts and damage were created in the 1950s by the construction of the storage bunkers, channels, road access and bridges in this part of the St Marys Site. These types of impact were relatively localised however and because of the need to have bunkers separated by some distance (to avoid the risk of fire, explosions and etc.) there are areas of low impact between the higher impact areas. There are thus localised areas of good potential between higher impact areas.

To quantify the previous land use impacts across the study area, aerial photo interpretation was undertaken (McDonald & Mitchell 1994, JMcD CHM 1997b). This mapping was ground-truthed during the previous survey of the western end of the Site (JMcD CHM 1997a). The land use mapping and analysis undertaken in 1994 and 1997 involved several stages. Data sources for this assessment task included the following:

- ✱ Stereo pairs of air photographs taken in December 1946 by Adastra and labelled 'Landsphoto';
- ✱ Oblique low altitude photographs of parts of the site taken in August 1955 and October 1956 by RAAF 22 Squadron;
- ✱ Stereo pairs of air photographs taken in August 1965 by the Department of Lands;
- ✱ Enlarged colour air photo taken early in 1994;
- ✱ Orthophotomaps at 1:4,000 scale produced by the Central Mapping Authority of New South Wales;
 - St Marys U7360-1, U7360-2 and U7360-3; with 2m contour intervals based on air photographs taken in May 1982;
 - Llandilo U7367-7 and U7367-8; with 1m contour intervals based on air photographs taken in October 1980.

This mapping process initially identified five zones [subsequently amalgamated into four management zones (see Table 5)] which form the basis for the strategic management model.

The disturbance mapping for the western end of the St Marys Site is shown (Figure 11). Calculations of land-use disturbance proportions across this, the Western Precinct and this part of the Regional Park have been made (Table 6). There is a significant conservation outcome at this western end of the St Marys Site. Not only is more than 61% of the total area to be conserved within the Regional Park, but this includes a significant proportion of the land with conservation value in this area. Of the 76 hectares of Zone 1 land identified, 75 hectares (97%) falls within the Regional Park. Similarly, most (67%) of the Zone 2 lands falls within the Regional Park and will therefore be unaffected by development within the Western Precinct.

Table 5: Correlation of archaeological sensitivity zones with degrees of land use impact.

Archaeological Sensitivity/ Management Zone	1994/1997 impact code	Land use impact
4	E	Extremely disturbed – land which has been subject to total vegetation clearance and soil disturbance by bulldozing; shallow soil removal for construction of earthen blast walls; tips and rubbish dumps; quarrying; and the construction of drains, roads, railway lines and buildings, creek channelisation and severe soil erosion. There is virtually no chance of any Aboriginal sites remaining intact in these areas.
4	H	Highly disturbed – land which has been almost totally cleared and has scattered buildings with blast walls, multiple tracks, roads tramlines, and extensive soil conservation earthworks.
3	M	Moderately disturbed – land which has been cleared and grazed, and on which there is evidence of at least one phase of ploughing. Aboriginal sites may be found in these areas but they will have been disturbed to a depth of about 20 to 30 cm.
2	L	Lightly disturbed – land which has been cleared and grazed but probably never ploughed. These areas often carry regrowth forest or woodland.
1	U	Relatively undisturbed – forest and woodland areas which have remained intact since 1946 and which were probably never cleared. Vegetation cover in these areas varies with the composition of the woodland/forest.

Table 6: West end and Western Precinct: Proportions of management zones (in ha).

Landscape	Zone 1	Zone 2	Zone 3	Zone 4	Total Area
West end St Marys Site	76.7	126.8	186.9	183.9	574.3
Western Precinct	1.6	42.2	87.4	94.4	225.6
Regional Park	75.0	84.6	99.5	89.5	348.7
<i>% in Regional Park</i>	<i>97.8</i>	<i>66.7</i>	<i>53.2</i>	<i>48.7</i>	<i>60.7</i>

Table 7: Western Precinct: Proportions of land use impact zones.

Landscape	Zone 1	Zone 2	Zone 3	Zone 4	Total Area
Shale	0.4	40.5	87.4	74.9	203.1
Quaternary alluvium	1.2	1.7		19.5	22.4
Total	1.6	42.2	87.4	94.4	225.6

4.7 Effective survey coverage (JMcD CHM 1997a, 2006d)

Previous survey of the subject land has indicated that visibility across the study area depends mostly upon the amount of vegetation present and on existing degrees of sub-surface disturbance (JMcD CHM 1997a, 2006c). Almost without exception, effective survey coverage was extremely low. This is due mainly to very low surface visibility except where there has been some form of previous land use disturbance.

The aim of the 1996 fieldwork was to provide quantitative data on surface evidence across the study area - to progress the management model. The types of exposures present (i.e. grading, clearing, erosion and so on) and the limitations that disturbance has had on artefact exposure, survival and recovery were assessed. The comparability of the surface recording results was also considered.

The 1996 survey recorded the following information:

- ☞ landscape parameters (soils, topography, distance to water, stream order);
- ☞ area of exposure (length x width);
- ☞ visibility on exposure (as a %);
- ☞ the type of exposure (natural/'artificial', i.e. graded, bulldozed, vehicle track, cattle track, etc.);
- ☞ the degree of disturbance in the area/on the exposure;
- ☞ the degree of soil intactness, i.e. is the presence of intact Unit A likely to impede artefact discovery;

- ☉ artefacts present (including totals, raw material, size, general technological information);
- ☉ maximum and averaged artefact density; and,
- ☉ possible associations of Potential Archaeological Deposit (PAD).

The 1996 survey targeted exposures, and these were recorded regardless of whether artefacts were present on the surface or not. The aim was to recover a representative and comparable sample from across this area, upon which further predictions could be made about archaeological potential. The only exposures which were not recorded (after day 1) were those which were so severely disturbed that only shale/clay soil material was present (e.g. deconstructed dam walls).

The 74 exposures were recorded on specially designed forms (JMcD CHM 1997a: Appendix 1), plotted on 1:4,000 orthophoto maps and on a 1:10,000 aerial photo.

Exposures were recorded in all landscape units present across that study area, with 8.4ha being systematically recorded. This represented a 1.5% sample of that 550ha study area. Overall, however (i.e. areas with very low surface visibility were surveyed on foot or by vehicle); survey coverage was in the order of 80% (c. 440ha). Further, the areas recorded were a comprehensive sample (c. 80%) of areas with good ground visibility. In other words, the survey effectively targeted exposures and the majority of these were recorded during the 1996 fieldwork.

The macro fauna management strategy involves the construction of a fauna-proof fence around the Regional Park (JMcD CHM 2006d). The fauna fence fenceline survey (in 2004 and then 2005) recorded a total of 43 exposures with varying degrees of surface visibility were recorded using the same procedures as the 1996 survey (JMcD CHM 2006d: Appendix 3). These exposures covered an area totalling of 35,365 m². This equates to 17.9% sample of that survey corridor (i.e. 196,980m² = 19,698 km long x 10m wide). Archaeological evidence was recorded on 23 of these exposures. Visibility along the proposed route was mostly low (zero–20%), limited by grass cover and leaf litter. On vehicle tracks and sheet erosion features, visibility was up to 50–80%, limited by grass, leaf litter and ironstone gravels.

Figure 10: West end of the St Marys Development Site, showing Management Zones, and the location of the Western Precinct.

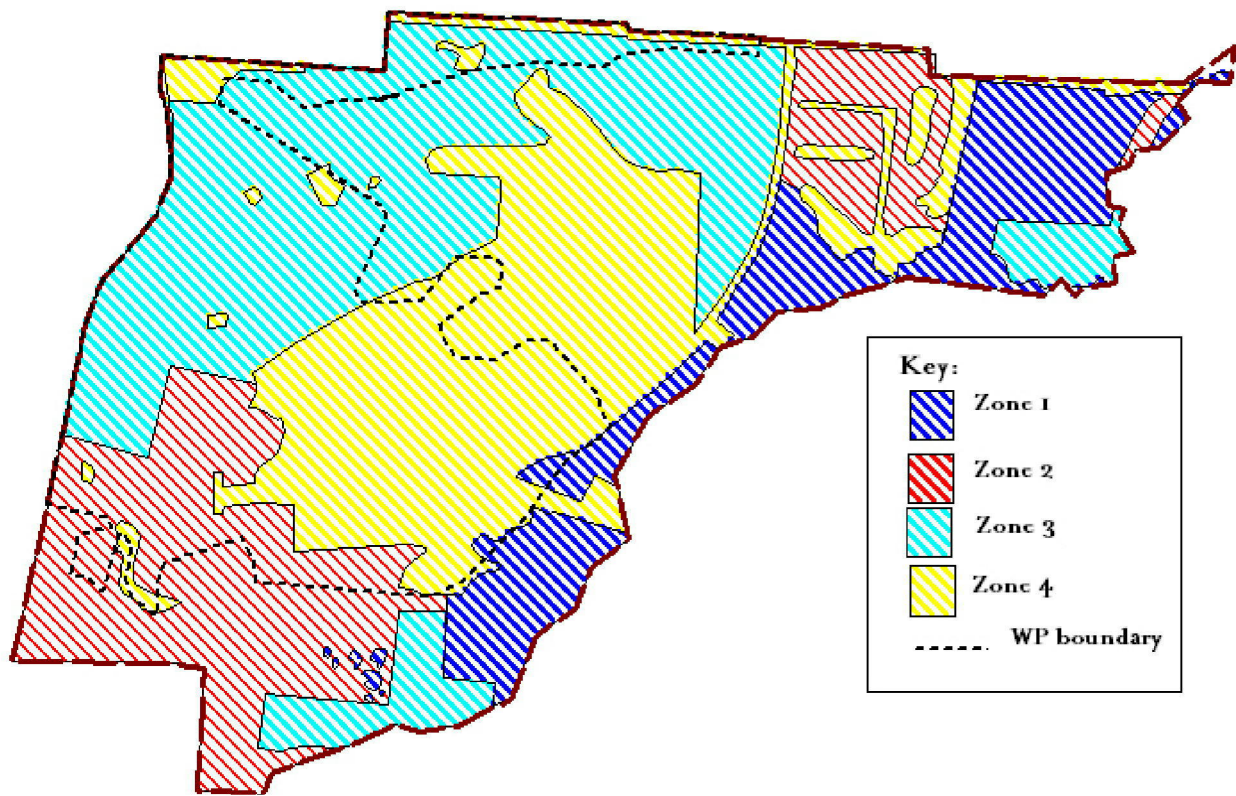


Figure 11: The West end of the ADI Site showing the Western Precinct and archaeological management zones, overlain on aerial photo.

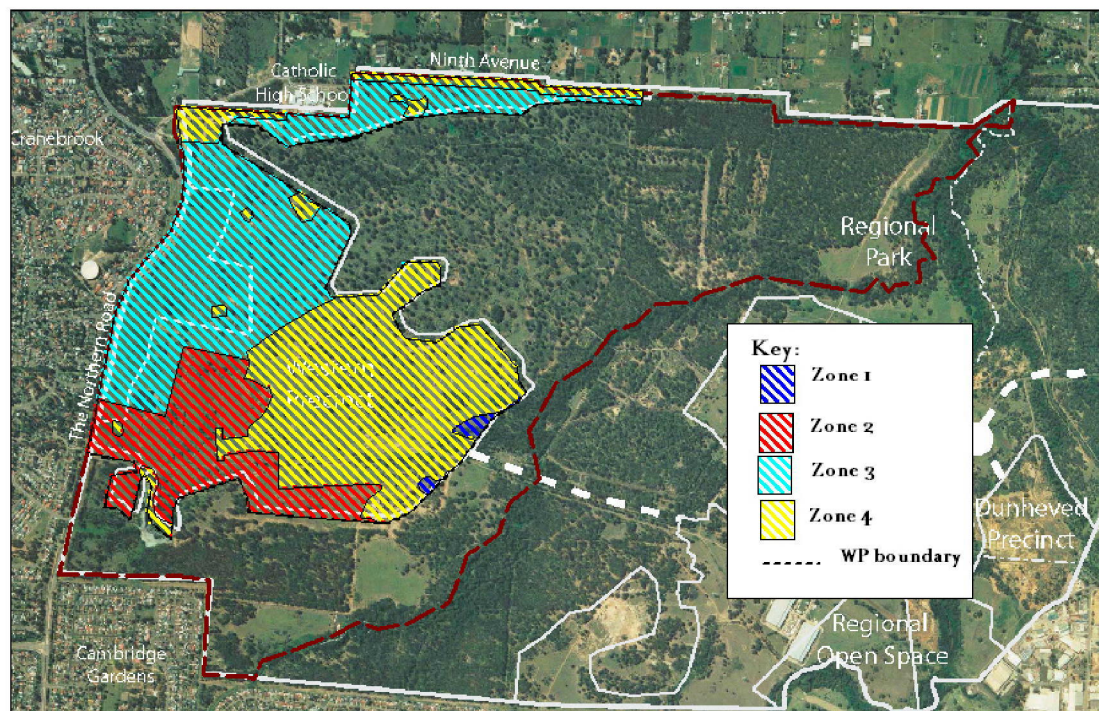
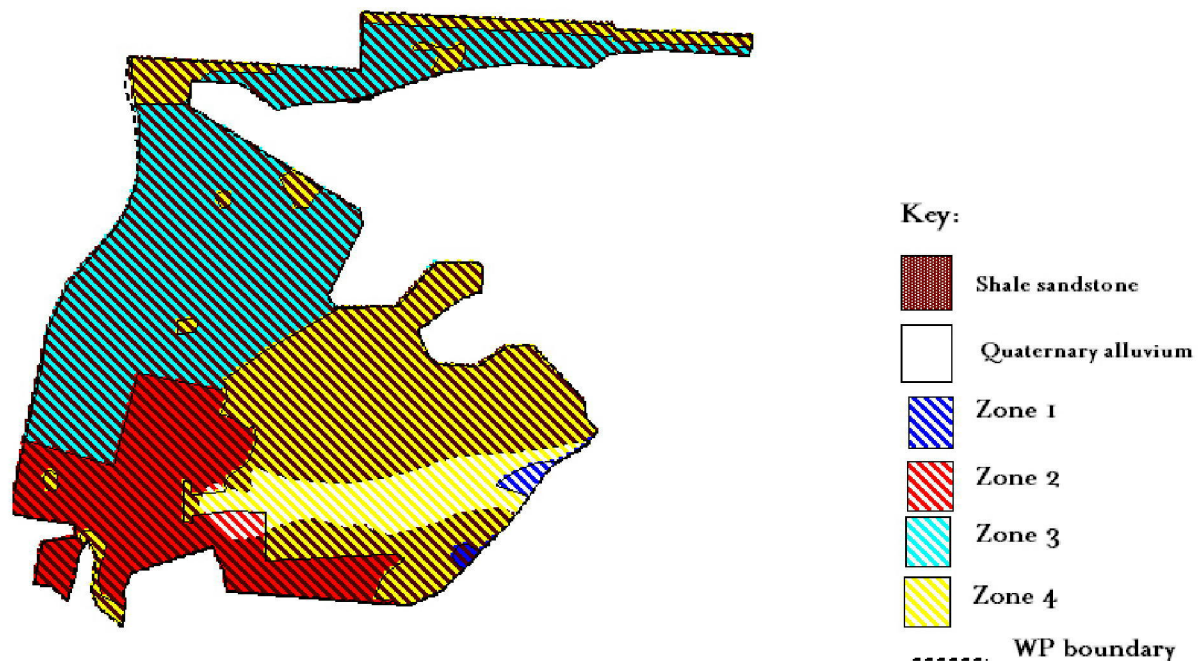


Figure 12: Western Precinct: Shale and alluvium landscapes showing management zoning.



5. PREVIOUS FIELDWORK

Fieldwork was first undertaken across the Western Precinct in early 1996 (JMcD CHM 1997a). This survey was undertaken over four days (26th and 27th February and 21st and 22nd March 1996) by Jo McDonald assisted by Huw Barton. A total of 10 person days were spent on this recording exercise. The area originally surveyed was 550ha – twice the size of the current Precinct. On Day 1 of the survey, the archaeologists were assisted by Mr Luke Hickey (DLALC). On Day 2 of the survey, Mr Colin Gale (then Daruk Link) took part in the survey. The last two days of the survey were done by the archaeologists alone.

In 1997, a series of test excavations were done across the St Marys Site to groundtruth the SMM (JMcD CHM 1997b). This was done in support of the S22 Committee report – which ultimately defined the SREP and EPS for the St Marys Project. Five test excavations across various landscapes were excavated, with two of these (SA4 and SA5) at the west end of the St Marys Site. Sample Area 4 (near WD-63: AHIMS # 45-5-702) was in the south of the western area and traversed the main tributary creekline. Sample Area 5 (near ADI-43: AHIMS # 45-5-1044) was towards the northern fenceline and crossed a minor tributary creek. Both excavated sample areas produced significant and

intact assemblages. These excavations were done with the involvement of the Deerubbin LALC: Daruk Link members inspected the excavations on several occasions. Both of these excavated areas are within the Regional Park.

In 2003, salvage investigations were carried out on a ridgeline in the north-west corner of the St Marys Site, prior to construction of the Xavier College High School (JMcD CHM 2003a). Two surface open campsites, ADI-47 (AHIMS#45-5-1048) and ADI-48 (AHIMS# 45-5-1049) had been recorded here (JMcD CHM 1997a). This salvage targeted Area 16, identified as a suitable location for testing the archaeological predictive model (JMcD CHM 1997a: Figure 9). The salvage programme included surface collections, 42 dispersed test pits and two large open area excavations. Almost 5,000 stone artefacts were recovered from within the 6ha development area. The excavated archaeological material here revealed at least four foci of prehistoric activity. This area is now described as the 'ADI 47+48 archaeological landscape'. The assemblage evidence revealed that this landscape was occupied repeatedly as a limited use and/or 'dinner-time' camp.

The macro fauna fence survey covered a 12.7km survey route (in 2004), and the realignments covered 8.9km (JMcD CHM 2006d: Figure 5). This development proposal had a narrow linear impact, and inspection focused on the centreline, with a 5m corridor on either side. All areas of surface exposure along the 10m wide corridor were closely inspected for artefacts and old growth and dead trees were inspected for scars of possible Aboriginal origin. For these surveys in 2004 and 2005, Deerubbin LALC and three Darug groups were involved and many of the 1996 sites were revisited at this time.

5.1 Previous results

Prior to our 1996 survey, nine sites (ADI-7, 12, 13, 14, 15, 16, 17, 18, 19) had been recorded at the western end of the St Marys Site (Kinhill 1994).

During the 1996 survey, 60 of the 74 recorded surface exposures were found to be artefact locations (JMcD CHM 1997a: Figure 6; Appendix 2). A total of 471 artefacts were recorded on these (JMcD CHM 1997a: Appendix 3). Most of these represented relatively sparse surface finds: only 13 artefact locations (22%) had more than 10 artefacts; 18 (30%) had single isolated finds and 13 (22%) had 2-3 artefacts (Figure 14).

Artefact numbers varied across the study area according to catchment and topography. Most artefacts (44%) were found in catchment 1, followed by catchment 2 (35%). Lots of artefacts (21%) were also recorded on the knoll/watershed between these two catchments. With the exception of the knoll/spurs in catchment 1, artefacts were recorded in all topographic locations.

During the initial (2004) fauna fence survey, open artefact scatters and isolated finds were found on 21 of the 41 exposures recorded along the proposed fenceline route. Thirteen sites previously recorded were relocated and 131 lithic artefacts were recorded at the new site locations (JMcD CHM 2006d: Table 5, Figures 7, 8). All recorded features are open campsites or isolated finds. The subsequent (2005) survey of fence realignments identified a further four open artefact scatters and two isolated finds. These realignments, however, avoid seven previously identified sites (ADI-12, ADI-23, ADI:FF-4, ADI:FF-5, ADI:FF-14, ADI:FF-15, ADI:FF-16 and ADI:FF-17). All sites were described and recorded fully in the earlier reports.

6. RESULTS

As a result of the previous survey and assessment (JMcD CHM 1997a, 2006d, Kinhill 1994) a total of 39 surface sites have been identified within the Western Precinct (Table 8). All previously recorded sites in the Western Precinct are shown (Figures 14, 15 and 16). These have been located on surface exposures across the subject land, in a variety of landscape settings and management zones. The descriptions of these sites are not repeated here (see JMcD CHM 1997a: Appendix 3; 2006d: 26-47 and Appendices).

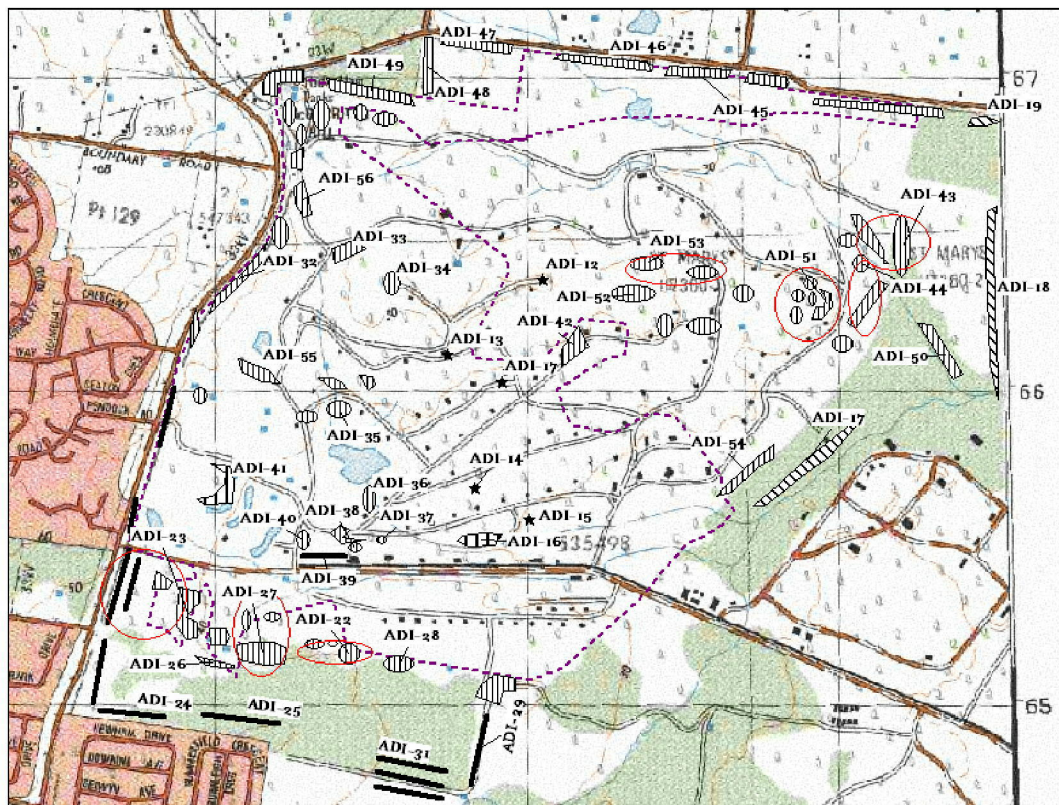
6.1 Previous recommendations

The earlier recommendations for the Western Precinct were directed at refining the SMM during the development of a conservation outcome (JMcD CHM 1997a:32-34). They pre-dated the test excavation report written in support of the s22 committee report (JMcD CHM 1997b) and also pre-dated the designation of the SREP 30 and EPS guidelines. They still have relevance because they identify the need for representative testing across the Precinct to document the range of occupation behaviours preserved there. Since that time, there have now been numerous widespread excavations across the Cumberland Plain which have developed aspects of the predictive

model and confirmed the extensive (buried) nature of the archaeological resource in this part of Sydney. The relevant recommendations are reiterated here:

1. Subsurface investigation is required ... so that the management model can be better assessed. This sub-surface testing should be directed at 'ground-truthing' the proposed strategic management model by documenting both the degrees of disturbance ... and the range of archaeological evidence present;

Figure I3: Surface exposures (and combined sites) after the 1996 survey (background Springwood 1:25k map). Western Precinct shown in dashed purple line.



2. Sub-surface testing should aim at sampling each of the four proposed management zones (and) should be directed at the range of landscape units present within this area. A number of testing locations fulfilling these criteria were identified (Figure I6) covering a range of archaeological potential;
3. An area representing 10% of the shale hillslope within the ADI Site (c. 50ha) needs to be identified as core conservation area. This should include ridgetop, hillslope and valley floors, to ensure that the range of landscapes is preserved.

While the selection of the conservation area requires more detailed fieldwork, subsurface testing should be restricted within Zone I to areas where there are likely to be development impacts.

Figure 14: Results of the Fauna Fence Survey (JMcD CHM 2006d).

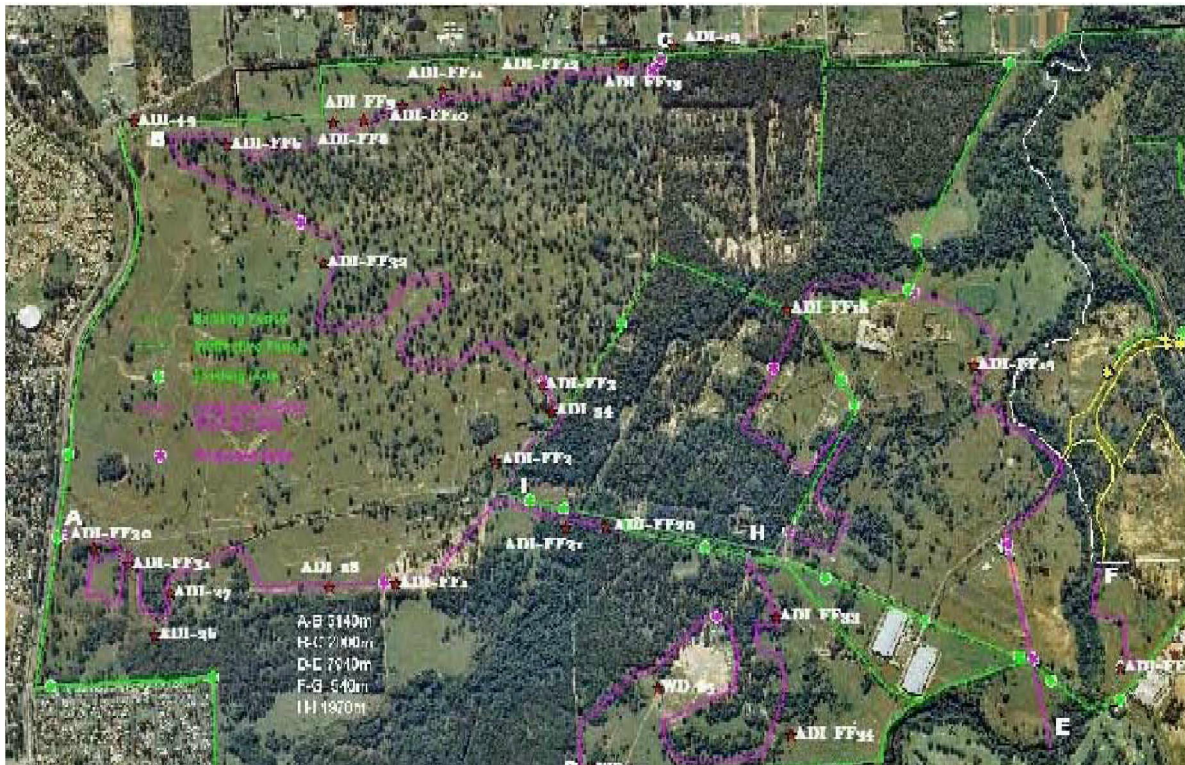


Table 8: Recorded surface features in the Western Precinct (including sites located long the proposed Fauna Fence).

Site Name	Exposure	Easting	Northing	Artefacts	Landscape	Topo	Zone
ADI-12		290778	6266882	2	Shale	UHS	Zone 3
ADI-13		289742	6266123	5	Shale	LRT	Zone 3
ADI-14		289829	6265696	5	Shale	LHS	Zone 4
ADI-15		290004	6265595	5	Shale	CB2	Zone 4
ADI-16		289845	6265507	5	Qal	FP CB2	Zone 4
ADI-17		289916	6266036	5	Shale	UHS	Zone 4
ADI-22		289330	6265200	18	Shale	LHS	Zone 2
ADI-26		288986	6265084	5	Shale	LHS	Zone 4
ADI-27		289080	6265230	11	Shale	LHS	Zone 2
ADI-28		289670	6265140	1	Shale	UHS	Zone 2
ADI-32	Exp-25, 26	289077	6266354	10	Shale	RT	Zone 3

Site Name	Exposure	Easting	Northing	Artefacts	Landscape	Topo	Zone
ADI-33	Exp-27	289488	6266448	3	Shale	RT	Zone 3
ADI-34	Exp-28	289539	6266322	3	Shale	RT	Zone 3
ADI-35	Exp-31, 33	289395	6265945	9	Shale	CB1	Zone 3
ADI-36	Exp-33	289471	6265703	1	Shale	CB2	Zone 2
ADI-37	Exp-34	289570	6265494	1	Qal	FP CB2	Zone 4
ADI-38	Exp-35,36	289463	6265450	3	Qal	FP CB2	Zone 4
ADI-39	Exp-37	289360	6265434	3	Qal	FP CB2	Zone 4
ADI-40	Exp-38	289281	6265528	10	Shale	LHS	Zone 2
ADI-41	Exp-39	289042	6265708	6	Shale	LRT	Zone 3
ADI-42	Exp-40	290153	6266148	2	Shale	UHS	Zone 4
ADI-45	Exp-53	290749	6266971	7	Shale	UHS	Zone 3
ADI-46	Exp-52	290239	6267012	20	Shale	CB2	Zone 3
ADI-49	Exp-46	289500	6266930	7	Shale	LRT	Zone 3
ADI-54		290650	6265640	21	Shale	FP CB3	Zone 4
ADI/FF-1		289922	6265112	1	Shale	UHS	Zone 2
ADI/FF-3		290637	6265743	5	Shale	FP CB3	Zone 4
ADI/FF-6		289681	6266839	27	Shale	UHS	Zone 3
ADI/FF-7		289857	6266809	1	Shale	CB2	Zone 3
ADI/FF-8		290096	6266847	1	Shale	LRT	Zone 3
ADI/FF-9		290210	6266840	1	Shale	CB2	Zone 3
ADI/FF-10		290368	6266865	5	Shale	CB2	Zone 3
ADI/FF-11		290527	6266893	24	Shale	UHS	Zone 3
ADI/FF-13		291218	6266870	1	Shale	PL	Zone 3
ADI/FF-20		290749	6265178	1	Qal	FP CB2	Zone 1
ADI/FF-21		290600	6265203	7	Qal	FP CB2	Zone 1
ADI/FF-30		288835	6265442	1	Shale	UHS	Zone 2
ADI/FF-31		288950	6265366	9	Shale	UHS	Zone 2
ADI/FF-32		289935	6266340	1	Shale	RT	Zone 3

3. The proponent should apply to the Director-General, DECC (NSW) for a section 90 Consent to Destroy (with Salvage) for the full extent of the proposed impacts for the fenceline development to cover all surface sites that have been identified as being impacted by the proposed development;
4. Fenceline routes (surrounding the Western Precinct) were identified as requiring further archaeological investigation. A number of locations were chosen to sample the range of landform units present (see section 8.5). It was envisaged that this work should be done under a section 90 (with Salvage) Impact Permit;
5. Some rare artefacts types i.e. ground edge hatchet heads, were identified as of scientific significance. These were found at the following sites:

- ☉ Section A-B: site ADI/FF- 3I
- ☉ Section B-C: site ADI/FF- 1I
- ☉ Section K-L: site ADI/FF-2I

These should be collected under the Section 90 (with salvage) Permit.

It was envisaged that salvage along these sensitive sections would take the form of spaced pits along the centreline, with impacts being confined to the developable lands. The following areas were identified as having particular sensitivity and as forming the focus for subsurface sampling:

- ☉ In the vicinity of sites ADI-22 and ADI-28. Lower hillslopes. Zone 2 (1,233m);
- ☉ In the vicinity of site ADI/FF-2I. Lower hillslope/valley flats/creek bank (2+ order). Zone 1 (406m);
- ☉ Between sites ADI/FF-1I and ADI/FF-13, on spur slopes off ridge in vicinity of shale /Tertiary terrace junction. Zone 3 (616m).

The recommendations of these previous reports (particularly those advocating areas of particular sensitivity or representativeness) are considered in this analysis of the various landscapes within the Western Precinct and management requirements of the SMM.

6.2 Landscape elements and areas for investigation

The previous recommendations are considered here in light of the current analyses of the Western Precinct. The following findings are central to the target area selection process:

- ☞ Surface archaeological evidence has been found across the Precinct wherever conditions have been appropriate to allow its discovery;
- ☞ 130 hectares of land has been identified as having archaeological sensitivity (Zones 1, 2 and 3) within this Precinct (Table 4);
- ☞ A range of landscape and topographic characteristics are found across this Precinct;
- ☞ Ridge tops, low ridge tops, headwater and 1st order creek lines and upper hillslopes are shale hillslope landscapes particular to this end of the St Marys Site: these are landscapes will be significantly impacted by development here;
- ☞ The Regional Park will retain a representative proportion of all of these except ridge tops and headwater tributaries (Table 4).

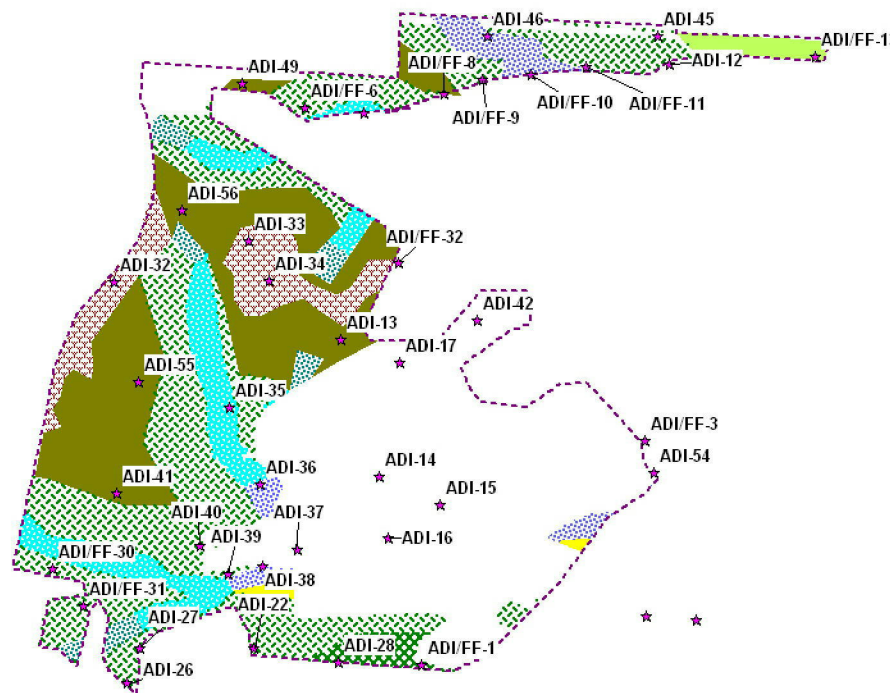
There are two major landscape bases and a total of 12 topographic landscape elements across this Precinct (see Figure 17).

When the three relevant sensitivity zones are combined with the amalgamated landscape parameters there are c. 40 combinations of potential targets for salvage. Based on representativeness criteria and the fact that there is such a substantial conservation outcome at this western end of the St Marys Site, it is considered that 40 salvage excavations would represent an excessive sampling target, particularly given the excellent conservation outcome afforded by the western end of the Regional Park. Instead, it is proposed that open area salvage excavation be undertaken in six target areas (Table 9).

These target areas cover the representative range of landscape elements. The average size of each target (or sample) area would be around 2ha, from which a goal of around 150 square metres of excavated deposit would be retrieved. The excavated sample would

represent c.0.75% sample of each Sample Area; the six Sample Areas will represent a 1.5% sample of the developable lands within Zones 1-3 of the Western Precinct.

Figure 16: The locations of all identified surface features, showing background of sensitive topography (Zones 1, 2 and 3).



The seven identified locations fulfil the necessary criteria of the SMM, both by testing a range of Management zones (1-3) and the range of representative landscape characteristics of the Western Precinct (Table 9, Figure 17, 18).

Table 9: Suggested salvage locations in the Western Precinct and adjoining Fauna Fence.

No.	Near	Catchment	Landscape	Topo	SMM Zone
1	ADI-FF11	1	Shale	UHS	3
2	ADI-34	1_2	Shale	RT	3
3	ADI-32, ADI-56	2	Shale	RT/LRT	3
4	ADI-41, ADI/FF-30	2	Shale	LHS, CB1	2
5	ADI-22, ADI-28	2	Shale	LHS	2
6	ADI-54, ADI-FF3	2	Qal	FP/CB2	1
7	ADI/FF20, 21; SA-4	3	Qal	LHS/CB2	1

Figure 17: Surface sites, sensitive topographic zones and suggested salvage locations.

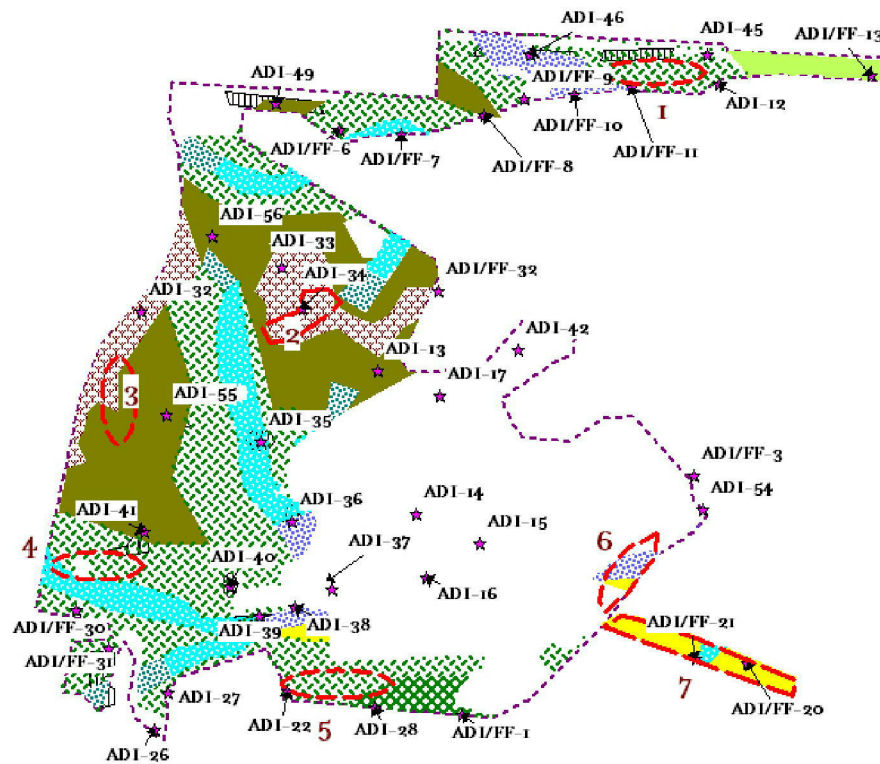
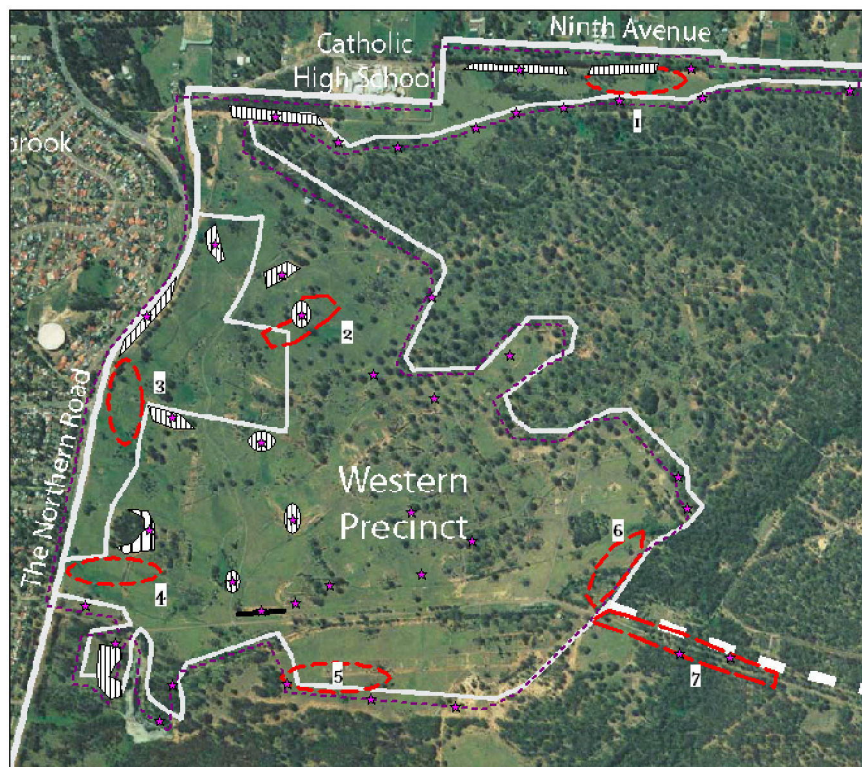


Figure 18: Aerial photo of Western Precinct and Access road showing locations of suggested salvage locations (numbered as per Table 9).



7. DISCUSSION

7.1 The Western Precinct

The current investigation of the Western Precinct considered 225ha of developable land in the St Marys Site. There is a significant conservation outcome with respect to Indigenous archaeological cultural heritage at the western end of the St Marys Site. More than 60% of the land here falls within the Regional Park, and of this land almost 22% has high conservation value (i.e. is zone 1) and another 53% has archaeological sensitivity (zones 2 and 3). Of the Zone 1 land to the west of the South Creek tributary, 98% falls within the Regional Park.

A substantial proportion (42%) of lands within the Western Precinct has already been highly disturbed (i.e. is Zone 4). The Western Precinct will impact on only 1.6ha of land which has conservation potential (i.e. Zone 1), although it does impact on c.130 hectares of land with varying archaeological sensitivity (Zones 2 and 3). The fauna management fenceline to be constructed along the margins of the access road between the Western and Central Precincts will also impact on Zone 1 landscapes.

In keeping with the precepts of the SMM, the investigation of a representative set of landscapes (in good condition) from the Western Precinct is required to assist in the interpretation and management of the archaeological resources in the Western Precinct and more broadly the Regional Park.

Six salvage locations within Western Precinct and another along the macro-fauna fence on the road linking the Western and Central Precincts have been identified as locations which fulfil the representativeness criteria of the SMM. The fauna fence salvage area crosses a landscape (floodplain and lower hillslope on Qal) which is not present in the Western Precinct in good conditions - but which is common in the Regional Park at this western end of the St Marys Site. Salvage of these six landscapes will add fundamentally to our understanding of Aboriginal occupation of this area throughout its human occupation. A research design, adapted from the overall Project Research aims has been developed to guide the investigation of these six locations (section 7.3). These proposed outcomes now require final discussion with the Aboriginal community and DECC Archaeologists.

7.2 Management Processes: applying the protocols

The management protocols (section 3.2; Figure 6) devised in 1997 have directed the works undertaken here, and those completed in the previous development Precincts. In terms of the protocols and strategies flow chart, the planning process for the Western Precinct is well underway.

An Indigenous heritage conservation outcome was determined by the REP, and the current work has completed stages 1-3 of the protocols (Figure 6). The Zone 4 areas within the developable lands can now be considered as 'cleared for development'. Once this approach has been validated by DECC and the procedures agreed, early development/construction works within the Zone 4 lands could proceed.

Once the Precinct Plan has been lodged with Council, the proponent should lodge with DECC NSW a section 87 + 90 application for Consent with salvage. That application should be accompanied by this report.

The current DECC NSW guarantee of service for processing a Consent application is eight weeks. Given their familiarity with the Project and the processes involved, DECC may not require this length of time. It should, however, be factored into the schedule.

Once the Consent is granted, the fieldwork would commence. A four week excavation period at each of the seven locations is envisaged.

Once the salvage excavation is completed, a preliminary report documenting the methods used and preliminary results of the excavation can be lodged with NPWS – and the proponent can then seek to activate the Consent for the (then) cleared salvage locations within the Western Precinct.

Once the analysis and reporting of the excavation is completed, sign off from DECC NSW will provide clearance for all subsequent works within the Western Precinct.

7.3 Salvage Research Design

This research design develops the overarching archaeological research aims of the St Marys Site, and specifically defines the works programme for the Western Precinct (and adjacent fauna fence) at the seven identified salvage locations.

A total of 39 surface archaeological sites with almost 250 artefacts have been recorded within the Western Precinct. Previous sub-surface investigations in the western end of the St Marys Site (at SA4, SA5 and ADI-47+48) have produced over 7,000 stone artefacts. Over 131 hectares of land with Potential Archaeological Deposit (Zones 1-3) have been identified here.

Study Area

The St Marys Project is located on the northern Cumberland Plain to the east of Northern Road. The St Marys Site comprised c.15 square kilometres straddling South Creek, at its confluence with Ropes Creek.

Impact of the proposed development

The proposed development Precinct involves mostly residential development (see Figure 5). A combination of housing, roads, retail/commercial, open space, and related infrastructure impacts will destroy any Indigenous cultural heritage remaining here. The location of this Precinct has been defined by SREP30 and it is assumed that the entire Precinct is developable. There is a major conservation outcome achieved by the broader management strategy in place for the St Marys Site: 98% of the lands west of the South Creek tributary identified as having conservation potential are to be included in the Regional Park.

It can be assumed that all and artefact-bearing topsoil across this developable area will be impacted by as range of development impacts. Any archaeological sites/Aboriginal objects located here would be destroyed. This research design reflects the need to salvage information from this western end of the Site, to ensure appropriate mitigation prior to development and to provide interpretation of Indigenous heritage resources within the Regional Park.

Aims

Given the extremely poor surface visibility across the Site generally (Jo McDonald CHM Pty Ltd 1997, 1996, 2001a, 2006d) and the fact that surface evidence is not a good indicator for the nature of the archaeological resource, salvage in each area will commence with a programme of random intensive sub-surface testing. Testing will

locate suitable assemblage(s) for salvage – in a manner which comparable with other recent excavations on the Cumberland Plain (particularly the RHIP Stage 2 and 3 works, Xavier College, the St Marys Eastern Precinct, Greystanes Estate and Plumpton Ridge).

The over-riding research aim of this salvage project is to investigate the archaeology in relation to landscape. Subsidiary aims include:

- ✎ Characterising the locations investigated via artefact distribution and assemblage characteristics.

How do the assemblages at the various sites compare given the differences in stream order and other landscape characteristics?

The retrieval of assemblages from specific activities (including knapping floors) will investigate how technology was organised.

The identification of assemblage 'signatures' – tentatively identified during the earlier work and further explored in a range of subsequent investigations (e.g. across the St Marys Development Site, at Regentville, at Richmond and in the RHDA – will be part of these analyses.

- ✎ The retrieval of statistically viable samples of artefacts will allow comparison with other similar salvage excavation.
- ✎ The comparison of the results of the present investigations with results from other projects elsewhere on the Cumberland Plain, to identify intra- and inter-regional variation and to establish significance values.

Research framework

The project seeks to investigate Aboriginal use of this part of the Cumberland Plain.

Management investigations across the Cumberland Plain over the last 10 years have focussed on archaeological landscapes. This contrasts with the arguably ineffective and inappropriate site-based approach to heritage management. Archaeological landscapes are based on a combination of geomorphological and topographic criteria.

Technological organisation involves studying artefacts to explore how people used landscapes in the past. It is concerned with the production, use, transport and discard of tools and the materials needed for their manufacture and maintenance (e.g. Nelson 1991). Many factors influenced the particular strategies that were adopted by people – including the raw materials that were available (their physical properties) the particular kinds of jobs that tools were needed for (e.g. heavy duty chopping, wood shaving, fine cutting), whether tools could be made and used in the same place or whether they had to

be carried over long distances. Sometimes tools also had to code social information. More commonly understood strategies included curation, expediency, specialisation, and stone rationing (e.g. in response to great distance from stone sources).

Technological organisation and particular technological strategies are manifest in the archaeological record through people's stone discard actions. Previous analysis on the Cumberland Plain has already identified a variety of activities, including the procurement of raw materials, initial testing and reduction of stone, transport, heat treatment, systematic core reduction and production of formal tools (including backed artefacts), expedient reduction to produce unshaped tools, hafting, tool use, tool maintenance, storage and recycling or reuse.

Field methods

The salvage of the six identified landscapes in the Western Precinct will target areas with no (or minimal) surface archaeological manifestation. The approach being advocated is a combination of systematic testing and salvage excavation: the methodology includes both the discovery of buried features across a landscape and then the salvage of features encountered. It is important that this is done in a way which is comparable to other salvage excavations done in a range of landscapes across the Cumberland Plain.

- ④ Open-plan excavation: Salvage will target features/locations that intercept a number of activities. If the archaeological evidence is found to be dispersed and localised (i.e. activities were spatially discrete), more than one open plan excavation area may be needed. It is proposed that open plan excavation would proceed either until a statistically viable sample has been obtained – or until the edge/boundaries of the feature(s) are reached (whichever is smaller). The outer limits of a knapping feature are defined as either sterile deposit and/or a sufficiently low artefact density to signify the absence of interpretable artefactual material e.g. <10 small artefacts not including tools and/or retouched items.
- ④ Statistically viable sample: >2,000 artefacts/assemblage but preferably more, if possible. Sufficient artefacts need to be recovered so that assemblages can be described in terms of raw materials types, artefact types, artefact size, and so on. Some artefact types such as cores, backed artefacts and retouched and/or used tools may each make up <1-2% of the assemblage. In an assemblage of 2,000 artefacts there might therefore be only 10-80 artefacts of these types: the minimum number, statistically speaking, required to analyse these types further. To calculate a statistically significant result (e.g. for a chi-square test) it must be possible to calculate an expected value of at least five artefacts in each cell of a data table (Clegg 1990:176). If one wanted to compare the size of artefacts of silicified tuff and silcrete, and silicified tuff made up only 20% of an assemblage of 2,000 artefacts, then there would be only 400 artefacts of this raw material.

If only 1% of those artefacts were >4cm in size then there might be only 4 silicified tuff artefacts >4cm in size.

- ✎ Moderate and high density locations: Moderate and high artefact density locations are needed to achieve statistically viable samples economically. If artefact density is only 20/m² then 100 square metres would need to be excavated to recover 2,000 artefacts. If densities were c. 50/m² then 40m square metres would need to be excavated to recover 2,000 artefacts. As artefact density may vary in relation to the kind of activity (systematic core reduction and backed artefact production may result in high artefact densities while casual reduction to produce unshaped tools may result in moderate or low densities) excavation areas ought not be restricted only to high density locations, unless a range of activities are indicated. Entire features should be retrieved where possible to ensure that the assemblage can be properly characterised.
- ✎ Range of activities: Different activities indicated by different artefact types, including backed artefacts, partly made backed artefacts and backing debitage, tool retouching debitage, debitage with dorsal grinding, and retouched and/or used tools. Different activities are also indicated by different and/or distinctive raw materials.

The proposed methodology is as follows:

Sub-surface testing will be conducted across seven defined PAD locations.

Dispersed test pits measuring 1m x 1m will be excavated at 10m – 20m intervals across a grid centred over the proposed target PAD. The testing will aim to locate high and/or moderate density pits and/or interesting assemblages. Approximately 40-45 test pits will be excavated per target area.

Testing along the fauna fence line in Zone I near ADI/FF:22 will be located along the centreline of the proposed fence line. Features here will only be excavated on the road side of the fence (i.e. not into the Regional Park). The aim of this testing is to identify a suitable salvage location. Some variation to the spacing may be necessitated by the presence of large trees, areas of localised disturbance, etc.

General

It is intended open area excavation will be undertaken where features are encountered. A 'feature' would include a high density of artefacts in a square metre or a pit which contains unusual/diagnostic artefact types. Open area excavation aims to salvage an entire assemblage – or where this appears to be extensive and/or continuous a large enough sample of artefacts to be statistically viable (see above). The aim would be to

retrieve a statistically viable sample from this site/landscape to facilitate valid comparison with other sites/landscapes.

The size of the area to be open area excavated will depend on the retrieved artefact densities. A target of 100m² is generally required to yield the necessary artefact assemblage. An excavation area of this dimension will ensure comparability with other salvage projects currently being undertaken on the Cumberland Plain.

Test pits will be excavated in bulk, down to the base of the A₂ deposit. All the deposit will be wet sieved on site using a water truck and nested 8mm and 3.5mm sieves. The sieving location will be positioned in an area where there will ultimately be site disturbance (i.e. in developable land). Appropriate sediment controls will be used.

The site will be mapped to scale and the location of the excavated test pits clearly identified and logged using handheld (differential) GPS. Stratigraphic sections detailing the stratigraphy and features within the excavated deposit will be drawn and the excavation area (including any features encountered) will be photographed.

Artefacts will be analysed on a comparable level with previous analyses of excavated assemblages on the Cumberland Plain (e.g. Jo McDonald CHM Pty Ltd 1997b, 1997c, 1999b, 2001, 2004, 2005, 2006; McDonald and Rich 1993). This will ensure comparison of these sites with other open sites in (former) ADI Site and on the Cumberland Plain generally. The assessment of the sites' significance can thus be made.

The analysis will provide information on the kinds of activities carried out, what stone materials were used and in what quantities, how stone tools were made, used and maintained, and how they and the materials from which they were made were transported around the landscape. By comparing different investigation areas it will be possible to determine whether there were differences in the kinds of activities carried out and the way that stone technologies were organised across the landscape. Such differences could be expected if different aspects of settlement organisation varied in relation to the landscape units as defined.

- ☉ Raw material type will be recorded to document what stone materials were used.
- ☉ Flaking quality and whether stone was heat treated or not will be recorded to provide additional information on stone selection.

- ☞ Artefact size and weight will be recorded.
- ☞ To document information on tool production, use and maintenance an artefact type list will be developed, including formal tools such as backed artefacts, other artefacts used as tools, tools which were maintained (had retouched working edges), and artefacts struck from the working edges of tools (tool retouching debitage).
- ☞ To document how stone was reduced and tools were made, flaking pattern will be recorded for cores and conjoin sets.
- ☞ Where features of previously reported generalised reduction sequences or strategies are observed, these will be noted as relevant.
- ☞ To document the form of transported items the types of artefacts reconstructed through conjoining will be recorded, and from the nature of activities it may be possible to determine what other artefacts were brought to each area.
- ☞ Various types of evidence will be used to determine the kinds of activities that were carried out.

A full description of the recording methods will be included in the archaeological report. The lithic assemblage will be analysed by lithics specialist, Ms E. White. Limited conjoining to assist in discerning prehistoric 'events' will be attempted, depending on the nature and size of the assemblage retrieved.

Aboriginal Consultation

Consultation with the Deerubbin Local Aboriginal Land Council (DLALC) and the Darug Aboriginal community groups - The Darug Tribal Aboriginal Corporation, Darug Custodian Aboriginal Corporation, Darug Aboriginal Cultural Heritage Assessments and Darug Land Observations will continue. Aboriginal representatives/fieldworkers will be part of the field team. Representatives are to be involved in discussions subsequent to the sub-surface testing and prior to management recommendations being made. In accordance with DECC Community Consultation Guidelines, and advertisement will be lodged in the local print media at the time of lodgement of the s87/s90 application to ensure that no additional stakeholders have been omitted from this consultation process.

Personnel

The project will be undertaken by Jo McDonald CHM Pty Ltd. The Project Archaeologist directing the fieldwork will be identified at the time as will the field team of four fully qualified archaeologists and four Aboriginal representatives/fieldworkers.

7.4 Impact from the proposed development

Within the Western Precinct it can be assumed that development impact will be total, and that any remaining archaeological sites/features/objects (previously "relics") or landscapes will be totally destroyed. The appropriate management of the defined areas with archaeological potential to be affected by this development proposal is dealt with by this investigation.

The aim of the strategic management model (JMcD CHM 1997b) was to establish a significant conservation outcome for the St Marys Site. This has arguably been achieved. Around 900ha of land is to be included in the Regional Park. The majority of the lands identified as having high archaeological significance and/or potential (Zone 1) fall within the Regional Park, and the appropriate management of these will be provided for by a Plan of Management being devised by the DECC NSW.

7.5 Conclusions

For this Precinct planning process the strategic management model has directed the further investigation of Indigenous heritage values. The outcomes achieved are in line with the principles defined in the EPS. There a significant conservation outcome achieved by the Regional Park at this western end of the St Marys Project. Sub-surface investigation of archaeological evidence at six target locations in the developable land will achieve the other designated goal of the EPS, i.e. further investigation and interpretation of Indigenous archaeological values from the St Marys Site.

8. RECOMMENDATIONS

The following recommendations are made on the basis of:

- ☉ legal requirements of the National Parks and Wildlife Act NSW 1974 (as amended) whereby it is illegal to damage, deface or destroy an Aboriginal object without the prior written consent of the Director, DECC NSW;
- ☉ the interests of the Deerubbin Local Aboriginal Land Council, the Darug Tribal Aboriginal Corporation, Darug Custodian Aboriginal Corporation, Darug Aboriginal Cultural Heritage Assessments and Darug Land Observations;
- ☉ the Strategic Management Model devised in 1997 and the processes as defined in the EPS;
- ☉ the findings of the previous field surveys done within the current study area, confirmed by current site inspections with the Aboriginal communities;
- ☉ the assessed potential of the landscapes and archaeological features identified within the study area; and,
- ☉ the Precinct Planning stage of the development process.

It is recommended that:

1. There is a significant conservation outcome in this western part of the St Marys Site, with more than 60% of the total land area and more than 98% of the land with high archaeological sensitivity being excluded from the developable lands.
2. The basic precepts of the strategic management model are achieved by the planning process with this Precinct.
3. Seven areas within the Western Precinct and the fauna fenceline along the road between the West and Central Precincts are identified as requiring archaeological salvage prior to development taking place (Table 9).
4. Depending on the timing of the proposed works programme, the Proponent should apply to the DECC NSW for a s87 / s90 Consent with Salvage for the entire Precinct to undertake these works.

5. One copy of this final report (each) should be sent to:

Mr. Frank Vincent
Chairperson
Deerubbin LALC
PO BOX VI84
MT DRUITT VILLAGE NSW 2770.

Ms. Sandra Lee
Darug Tribal Aboriginal Corporation
PO Box 441
BLACKTOWN NSW 2148

Mrs. Leanne Watson
Darug Custodian Aboriginal Corporation
PO Box 36
KELLYVILLE NSW 2155

Mr Gordon Morton
Darug Cultural Heritage Assessments
28 Calala St
MT DRUITT NSW 2770

Mr Gordon Workman
Darug Land Observations
PO Box 571
PLUMPTON NSW 2761

6. Three copies of this report should be sent to:

Ms Lou Ewins
Manager Cultural Heritage Division
Sydney Zone DECC
PO Box 668
PARRAMATTA NSW 2124

9. REFERENCES

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Appendix 1

Reports from DLALC, DTAC, DCAC, DACHA and DLO

(those received by 18th July 2008)



Darug Tribal Aboriginal Corporation

PO Box 441 Blacktown NSW 2148

PH: (02) 9622 4081

Mobile 0431 343 021

Fax: (02) 9622 4081

Email: darug_tribal@live.com.au

ABN: 77 184 151 969

Thursday, July 17, 2008

Dear Sandra

Re: Western Precinct St Marys Draft-Aboriginal Archaeological & Cultural Test Excavation

After reading the draft and doing the survey we at DTAC who are representing the local Darug community and are the Traditional Custodians believe the site reviewed has a very high heritage, cultural and spiritual significance to the Darug people: e.g. Hunting grounds and meeting places. The site is of importance to us to teach our young people how important their spiritual ties are to this land. The artifacts found are remembrance of important social and spiritual roles of our ancestors.

The scientific value of this is of importance resource because a lot of these areas were tool making areas and the site gives knowledge of our history for future generations.

The Aesthetic value of the site is on a ground where Elders could watch the younger ones, hold meetings and our community like to have a representative for the Darug community involved in all aspects of this project.

We are also pleased with the preparation draft report in all aspects and support the applications for s87 permit and s90 consents.

Hugs & Smiles
Sandra Lee
Secretary DTAC

Darugs
The Traditional & Spiritual Custodians of Darug land



Darug Aboriginal Cultural Heritage Assessments

ABN 51734106483

Gordon Morton & Associates
28 Calala St., Mt. Derritt, 2770
Ph. 9625 0005
Mob: 0422 865 831
Fax: 45 677 421

Celestine Everingham
90 Hermitage Rd., Kurrajong Hills, 2758
Ph/Fax: 45677 421
Mob: 0432 528 896

2.7.08

Attention

to Mr Donald

re Central and Western Precincts of the
St Mary's Development Site - Darrug land.

As within the Western Precinct the development
impact will totally destroy any Darrug sites
DHCHA support extensive sub surface investigations.
We wish to be involved in all discussions held
before any sub-surface testing and prior to
management recommendations being made.
When earthworks start at a later date we also
wish to monitor so as to salvage Darrug artefacts
before they are destroyed. This area is well
known to the Darrug people and my own family
has had a long association over time. I am
a Native Title Claimant and this region has
been recognised as part of our base claim.

Yours Sincerely,
Gordon Morton

Cultural Heritage - Building respect for the past and Conservation for the future

**DARUG CUSTODIAN ABORIGINAL
CORPORATION**

PO BOX 81 WINDSOR 2756
PH: 45775181 FAX: 45775098 MOB: 0415770163
ABN: 81935722930
mulgokiwiz@aol.com

30th June 2008.

Attention: Sandra Wallace.

SUBJECT: Archaeological Assessment of Indigenous Heritage values in the Western precinct of St Marys Development site.

Dear Sandra,

The Darug Custodian Aboriginal Corporation have received and read the draft report for the Western precinct in the St Marys Development site. We support the Archaeological recommendations, our group has not yet surveyed all of the Western precinct and cannot comment on the s90 permit until we have. We are pleased with the conservation outcomes within the St Marys Development site although we are concerned with the long term conservation within the regional park and would like further consultation on the management plan for this area, as playing fields and places of this nature destroy Aboriginal sites. We would also recommend signage on Darug history of this area be displayed within the regional park.

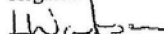
Our group would like to recommend that materials from the excavation works be dated in an appropriate area that would give us the most accurate dates. We also recommend that when the comparable study is carried out a plain English report appropriate for local schools and libraries be written about the Darug history and the Archaeological findings in conjunction with the central precinct with input from the traditional owners.

All assessment for Cultural Heritage should have a traditional owner present to identify sites, trees and all other Darug areas. Our group would like to participate in all works carried out in regards to Cultural Heritage as these are Darug sites and it is culturally appropriate for experienced Darug people to carry out these works.

We recommend that the earthworks in the areas that are zone 1, 2 and 3 be monitored and the correct permits are requested for collection of Aboriginal cultural Heritage materials to be relocated on site after works in a conservation area or in an area as a display for educational purposes.

We look forward to working with you on this project.

Regards


Leanne Watson

DARUG LAND OBSERVATIONS

ABN 87239202455

E-MAIL: gordow51@bigpond.net.au

PO BOX: 571 Plumpton: NSW 2761

PHONE 029831 8868 OR 0415 663 763

16th July 2008

Ms. Sandra Wallace

Project Archaeologist


Re: Central & Western precinct in the ADI site.

As in your report about theses recommendations for both Central
& Western areas we are in agreement.

But we all know the whole of ADI is one great big heritage pad.

With Thanks

Gordon Workman



D.L.O

Site's Officer

0415 663 763

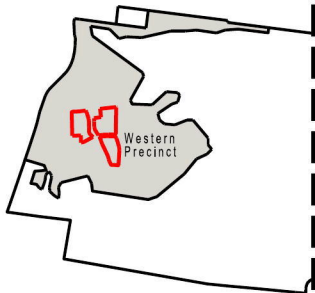


-
- Tree to be Retained

All Trees to be Removed unless otherwise shown

- Tree Significance
-
- AA - high ecological/high landscape

KEY PLAN



NOTES

Issue	Amendment	Date
A	Council Lodgement Issue	20.06.13

LEGEND

-
- DA Boundary

Developer

Lend Lease

Ropes Crossing Boulevard,
Ropes Crossing NSW 2760
p.02 9673 8800 f.02 9673 8888
ABN 88 000 966 085 ©

Project

JORDANSPRINGS

Drawing Title

Village Centre
Bulk Earthworks DA

Tree Plan

Scale AT A3

1:2500

Drawn by

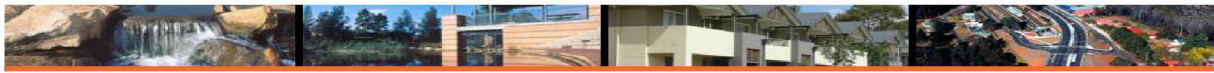
RAS

Drawing Number

WP VCBE TP



Issue A



Our Ref: 109892-02_SWMS_Rpt1A.docx

DG:dg

24 October 2014

Ancon Development Group
Unit 2, 5 McCormack Street
ARNDELL PARK NSW 2148

Attn: Jason Commisso

Subject: Jordan Springs Village 13
Stormwater Management Strategy

Dear Jason,

J. Wyndham Prince have been engaged by Ancon Development Group to prepare a Stormwater Management Strategy to support a Development Application for Village 13 at Jordan Springs.

The Village 13 site forms part of the Jordan Springs development and is bordered by Greenwood Parkway to the north, Lakeside Parade to the west, vacant land for future development to the south and a riparian corridor to the east. The Village 13 site is approximately 2.1 hectares in area and generally grades from west to east with overland flows discharging to the adjacent riparian corridor. The site is shown below on Plate 1 and in more detail on Figure 1.

Plate 1 – Existing Village 13 Site



The proposed Village 13 development involves the creation of approximately 51 residential lots and associated infrastructure, such as roads and stormwater drainage. Stormwater from the development will discharge at a single location in the south-east corner of the site to the adjacent riparian corridor, which then flows to the existing Jordan Springs Lake. The proposed Village 13 development layout is shown on the attached Figure 1. The engineering DA design is shown on the plans prepared by J. Wyndham Prince (Ref: 9892DA01-07).

The overall Jordan Springs Stormwater Management Strategy has been developed by SKM and is documented in various reports. In 2010, SKM prepared the Stormwater Management Report¹ for Jordan Springs Lake, which provides both water quality and stormwater detention for the catchments that drain to it. As noted above, the Village 13 development drains to Jordan Springs Lake. The report demonstrates that the Jordan Springs Lake has been designed to cater for the full development of the upstream catchment and states:

- *The size of the detention basin and its outlet has been designed to provide sufficient peak flow mitigation such that the peak flows from the fully developed catchment do not exceed current peak flow rates (Section 1.3).*
- *A water quality assessment was undertaken using the MUSIC model to estimate the reduction in water pollution by the proposed Lake. The main purpose of the modelling was to demonstrate that the proposed water quality management controls (Jordan Springs Lake/water quality pond) would meet the water quality objectives of reducing the annual pollutant loads generated from the future urbanised catchment. The results of the modelling indicate that the proposed size of the Lake would meet and exceed these objectives (Section 1.4).*

In summary, the existing Jordan Springs Lake has been designed to cater for a fully developed upstream catchment, for both water quantity (detention) and water quality control. Therefore, no additional stormwater management controls are required or proposed for the Village 13 development, which drains to the Jordan Springs Lake.

Should you have any queries regarding this matter please do not hesitate to contact me.

Yours faithfully

J. WYNDHAM PRINCE



DANIEL GARDINER

Senior Water Resources Engineer

¹ SKM (2010) – Jordan Springs Lake – Stormwater Management



LEGEND

Village 13 Site Boundary

➔ Flow Direction



Scale 1: 2,500 @ A3



Figure 1

Jordan Springs Village 13

Stormwater Management Strategy Plan

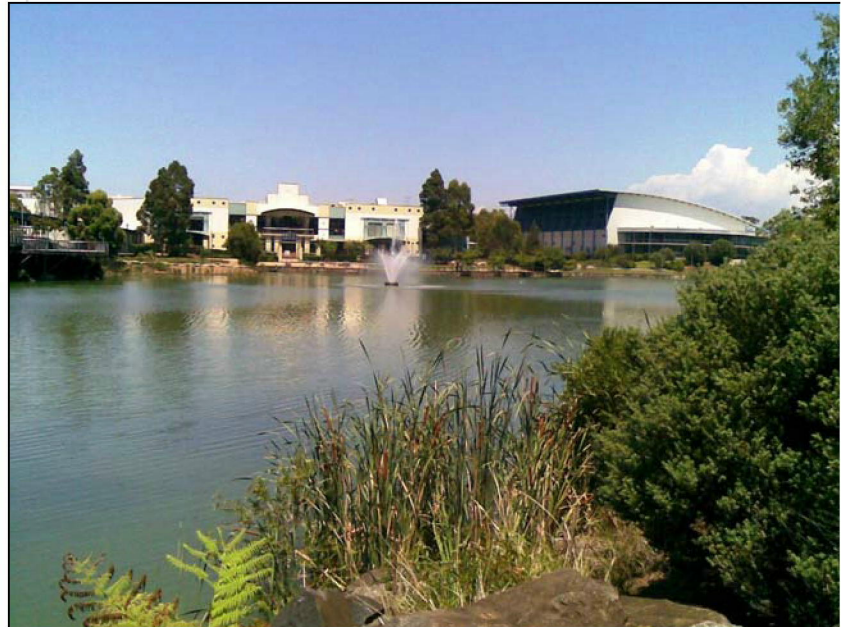
File Name: 109892-02_Fig01

Date : 24/10/14

Issue : A



Jordan Springs Lake



STORMWATER MANAGEMENT

Proposed Lake Development Application



Jordan Springs Lake

STORMWATER MANAGEMENT

Proposed Lake Development Application

Sinclair Knight Merz
ABN 37 001 024 095
100 Christie Street
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Executive Summary

This report has been prepared to support the Development Application (DA) of the Jordan Springs Lake at the western Precinct of the Delfin Lend Lease site at St Marys.

The assessment focuses on the stormwater management component of the Lake, however it also includes an assessment of bulk earthworks, noise and air issues associated with the construction of the Lake.

The stormwater management component includes an assessment of the required detention volume in the lake to provide peak flow mitigation, and an assessment of water quality.

A maintenance manual has also been prepared to outline the appropriate wetland management strategies for the Lake.

This report is to be read in conjunction with the following stormwater management DA drawings:

DRAWING No	DRAWING TITLE
EN02754-C-001	COVER SHEET
EN02754-C-002	INDEX SHEET AND NOTES
EN02754-C-003	BASIN LAYOUT PLAN
EN02754-C-004	TYPICAL SECTIONS
EN02754-C-005	DETAIL PLANS AND SECTIONS
EN02754-C-006	DETAIL SPILLWAY PLAN
EN02754-C-007	DETAIL SPILLWAY SECTIONS
EN02754-C-008	EROSION AND SEDIMENT CONTROL PLAN (ESCP)
EN02754-C-009	EROSION AND SEDIMENT CONTROL DETAILS
EN02754-C-010	BULK EARTHWORKS PLAN



1. Introduction

1.1. Purpose

The purpose of this report is to support the Jordan Springs Lake DA drawings on Stormwater Management. The main purpose of the Lake is to provide detention, water quality treatment and improve the aesthetic qualities of the area.

The emphasis in this report and associated drawings will be on the Lake area inside the water edge line but will include details on the proposed spillway at the outlet of the Lake. For all areas above the permanent water line, reference is to be made to the Landscaping Plans prepared by Environmental Partnership consultants.

1.2. Site Description of the proposed Lake

The proposed Lake will be located in a future residential area. When built, the wetland will occupy an area of approximately 3.25ha and contain a permanent water body of approximately 55ML. Stormwater collected in the drainage system of the future upstream residential areas will enter the wetland via three inlets shown on the DA drawings.

The wetland will comprise of a deep water zone and a perimeter safety bench macrophyte zone which will consist of reed beds around the perimeter of the wetland. The lake will provide detention, facilitate nutrient suspended solids removal and provide a habitat for wildlife.

The Landscape drawings of the Lake prepared by Environmental Partnership provide the outline of the Lake, the proposed landscaping around the Lake, trees, footpaths and building structures. There are some small differences between the layout of the Lake used in the DA drawings that accompany this report and the Landscape drawings. These differences have been reviewed and they do not have any significant impact on the results presented in this report.

1.3. Stormwater Detention in the Lake

A hydrological assessment has been undertaken to determine peak flow rates for existing conditions at the location of the proposed Lake at its downstream end. This was followed by an assessment of peak flow rates for a fully developed catchment which generated an increase in peak flows. The size of the detention basin and its outlet has been designed to provide sufficient peak flow mitigation such that the peak flows from the fully developed catchment do not exceed current peak flow rates. The detention volume is situated above the permanent water level in the Lake. **Appendix A – Hydrological and Detention Basin Assessment** provides a more detailed description of the methodology, parameters used and results of the hydrological and detention basin modelling.



1.4. Water Quality Assessment

The water quality objectives for the Jordan Springs Lake are to achieve the target reductions of pollutant loads generated from a fully developed catchment upstream of the Lake. The design criteria and target reductions for new urban areas were obtained from the Penrith City Council *Draft Policy on Stormwater Quality Control* and from the *'South Creek Stormwater Management Plans'* document.

A water quality assessment was undertaken using the MUSIC model to estimate the reduction in water pollution by the proposed Lake. The main purpose of the modelling was to demonstrate that the proposed water quality management controls (Jordan Springs Lake/water quality pond) would meet the water quality objectives of reducing the annual pollutant loads generated from the future urbanised catchment. **Appendix B – Water Quality Assessment** provides a more detailed description of the methodology, parameters used and results of the water quality modelling.

The results of the modelling indicate that the proposed size of the Lake would meet and exceed these objectives.

1.5. Maintenance of the Lake

The proposed Lake will comprise of a deep water zone and a perimeter macrophyte zone which will consist of reed beds around the perimeter of the wetland and open water areas. It will facilitate nutrient and suspended solids removal and provide a habitat for wildlife. Water Quality ponds and wetlands provide a very effective means of treating stormwater in urban areas. However, ongoing maintenance is essential in maintaining the water quality performance of the Lake.

A maintenance manual has been prepared to outline the maintenance and operational requirements associated with the Jordan Springs Lake.

Appendix C – Maintenance Manual for the Jordan Springs Lake provides a more detailed description of the required maintenance regime, noxious weeds management and routine inspections of the Lake.

1.6. Water Level in Lake

A water balance assessment has been undertaken to investigate the water levels in the proposed Lake and to estimate the draw down changes to these water levels that will occur for the following two scenarios:

- a) Stage1, which is the partial development of the catchment upstream of the Lake; and
- b) Stage 2, which is the ultimate development of the catchment upstream of the Lake.



Fifty (50) years of rainfall data from nine (9) nearby weather gauges has been collated, along with long-term evaporation data from the nearest three weather stations in the area. This data has been used in a water balance model to estimate the daily inflows and evaporation losses to which the lake is subjected over this 50 year period of time. The model assesses the resulting effect on water level.

The water balance model results indicate that the drop in water levels would rarely be more than 200mm for Stage 1, and 150mm for the ultimate Stage 2 of the development; however, during a severe drought, the water level could drop down by approximately 300mm to 400mm for Stage 1 and approximately 200mm for Stage 2.

A sensitivity assessment was undertaken to determine any potential significant impacts from climate change. This assessment indicated that the effect of climate change on any additional drops in the lake water levels is not significant. **Appendix D – Estimation of Water Levels in Jordan Springs Lake** provides a more detailed description of the methodology, parameters used and results of the water balance assessment.

1.7. Construction phase considerations

There are three considerations that have been addressed for the construction phase of the Lake:

- i. Erosion and sediment controls
- ii. Bulk Earthworks, and
- iii. Noise and air quality assessment

1.7.1. Erosion and Sediment Control for the Lake Area

The erosion of sediment control plan for the construction phase of the Lake has been described on drawing number: EN02754-C-008. The plan indicates that external runoff around the construction footprint of the Lake needs to be diverted around and not be allowed to enter the excavated area. Therefore the only runoff entering the construction site will be from direct rainfall, which will be absorbed into the soil; however if significant rainfall fell on the Lake, some dewatering by pumping may be required to the nearby existing sediment basin within two days after any such high rainfall event. Sediment fences will be used at the toe of any fill embankments to avoid sediment export outside the footprint of the Lake's construction area.

1.7.2. Bulk Earthworks for the Lake Area

The bulk earthwork cut and fill volumes have been assessed in a three dimensional model (12D) to estimate the volumes of excavation and amount of fill required. The depth of cut or fill from



existing ground levels has been described on drawing number: EN02754-C-010. The volumes of cut and fill have been estimated to be 46700 m³ and 87,000 m³ respectively.

1.7.3. Noise and Air Quality Assessment for the Lake Area

A noise and air quality assessment has been undertaken for the construction phase of the Lake area. This assessment is described in **Appendix E – Noise and Air Assessment**. It provides relevant information on the existing noise environment and air quality, the potential impacts from the construction phase of the Lake, and recommends mitigation measures for any impacts.



Appendix A Hydrological and Detention Basin Assessment



Detention Basin Requirements for Jordan Springs Lake, St Marys

1.1. Purpose

The purpose of this assessment is to provide the methodology and design criteria which have been adopted to calculate stormwater detention requirements in the proposed Jordan Springs Basin/Lake.

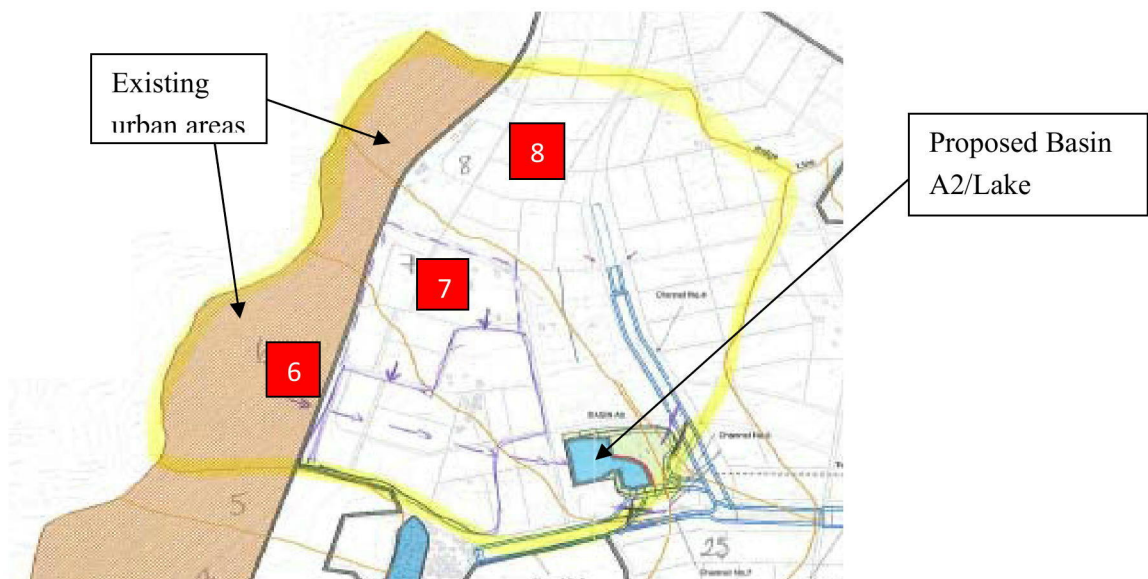
1.2. Introduction

This section summarises work undertaken to assess detention requirements for the development of a catchment upstream of a proposed basin in the Western Precinct, St Marys. It provides details of the hydrological modelling work undertaken to assess the “existing” and ‘developed’ case.

1.3. Study Area

The study area includes a total catchment area of 109 hectares draining to the proposed detention basin, A2 (catchment shown in yellow) to the south-east corner of the developed area. The existing catchment areas are predominantly rural, with some urban development on the western fringes of the catchment. The developed case has a fully urban catchment. The study area, showing the catchment boundary used in this assessment is shown in **Figure 1.1**

■ Figure 1.1 Study Area showing catchment boundary in yellow





1.4. Objective

The objective of the assessment is to mitigate the ‘with development’ peak flows such that the following requirement is met: the mitigated peak flow must be less than the existing peak flow for a range of design storms from 2-100 year average recurrence interval (ARI). In doing this exercise, details will be provided on the required detention volume and outlet configuration.

1.5. Design Criteria (hydrology and detention) and Model Set Up

1.5.1. Catchment Areas

The study area has been divided into three sub-catchments which are labelled catchment 6, 7 and 8 (Figure 1.1)¹. Delineation of the catchments was undertaken as part of the *St Marys Western Precinct Plan – Water, Soils and Infrastructure Report* (May, 2009). Some minor adjustments were made to catchments 6 and 8 for the current assessment. Total catchment areas and rural/urban areas in each sub catchment are shown in **Table 1.1**.

■ **Table 1.1 Sub catchment details**

Sub catchment	Total (ha)	Existing		Developed		slope
		Urban(ha)	Rural (ha)	Urban(ha)	Rural (ha)	
6	32.0	15.4	16.7	32.0	0.0	2.11%
7	28.7	3.8	24.9	28.7	0.0	2.22%
8	48.0	2.6	45.4	48.0	0.0	1.41%

The percentage impervious adopted in the model are as follows;

■ Existing Case

Urban Area outside the site – 50% impervious

Rural (within the site) – 5% impervious

■ Developed Case

Urban (within the site) – 70% impervious

Rural – 5% impervious (unchanged from existing case)

These values are based on the following assumptions:

- No development will occur in the regional park therefore % impervious does not change;

¹ Sub catchment labelling remains consistent with previous St Mary’s studies to avoid confusion.



- Areas allocated for urban development will have varying impervious percentages between 50-70%. For the purpose of the assessment the more conservative, 70% has been adopted for all areas; and
- Existing urban areas external to the site will be unchanged from existing, i.e. 50% impervious.

1.5.2. Rainfall Intensities and Loss Parameters

Penrith City Council IFD data was used in the RAFTS model. A suite of storm durations were input for each ARI rainfall event. IFD data is shown in **Table** below.

■ **Table 1.2 Penrith City Council IFD Rainfall Data**

Duration (min)	2yr ARI	5yr ARI	10yr ARI	20yr ARI	50yr ARI	100yr ARI
20	52.82	69.66	79.08	91.89	108.85	121.9
30	42.83	56.47	64.09	74.46	88.19	98.75
60	29.05	38.28	43.43	50.44	59.72	66.86
90	23.04	30.31	34.36	39.89	47.19	52.81
120	19.48	25.6	29	33.65	39.79	44.51
180	15.33	20.12	22.78	26.41	31.21	34.89
360	10.16	13.3	15.04	17.42	20.56	22.97
720	6.75	8.81	9.95	11.51	13.57	15.15

Loss parameters used in the model are as follows:

Impervious Losses; Initial 1.0mm Continuing 0.5mm
Pervious Losses; Initial 10.0mm Continuing 2.5mm
Bx factor 1.0

The loss parameters are consistent with previous work undertaken by SKM for St Marys, and are consistent with those adopted by JWP in the *Interim Stormwater Management Report* (August 2009).

1.5.3. Roughness Coefficients

Mannings 'n' values adopted in the model for different land uses are provided in **Table 1.3** for the existing and developed case. These values are consistent with previous assessments undertaken.



■ **Table 1.3 Roughness values**

Land use	Mannings 'n' value
Existing (pervious)	0.07
Existing (impervious)	0.025
Developed (pervious)	0.015
Developed (impervious)	0.025

1.5.4. Catchment lag times

Catchment lag times have been calculated using the flow path length for the subcatchment and assumed average velocities of the stormwater. The velocities of 2m/s for existing and 1.5m/s for developed have been adopted in the model.

1.6. Model Results

The XP-Rafts model was run for a range of durations from 15minutes – 6 hours to assess and compare the existing case and 'developed with detention' peak flows at the catchment outlet. A comparison of peak flows for the 2 year and 100 year events is shown in **Table 1.4**.

■ **Table 1.4 Peak Flow**

Design Storm (ARI)	Peak flow Existing (m ³ /s)	Peak flow Developed (m ³ /s) no detention	Peak flow Developed (m ³ /s) with detention
2 year	4.9	24.5	4.3
100 year	13.9	55.7	13.3

The results in Table 1.4 indicate that the developed peak flow (with detention) is less than the existing peak flow for the 2 year and 100 year events. The reduction in peak flows are 12% and 4% respectively. There is also a significant reduction in developed peak flows with the detention basin when compared to the unmitigated peak flows.

Results indicate that Basin A2 provides adequate detention for the Stage 1 development. Details of the detention basin are provided below.

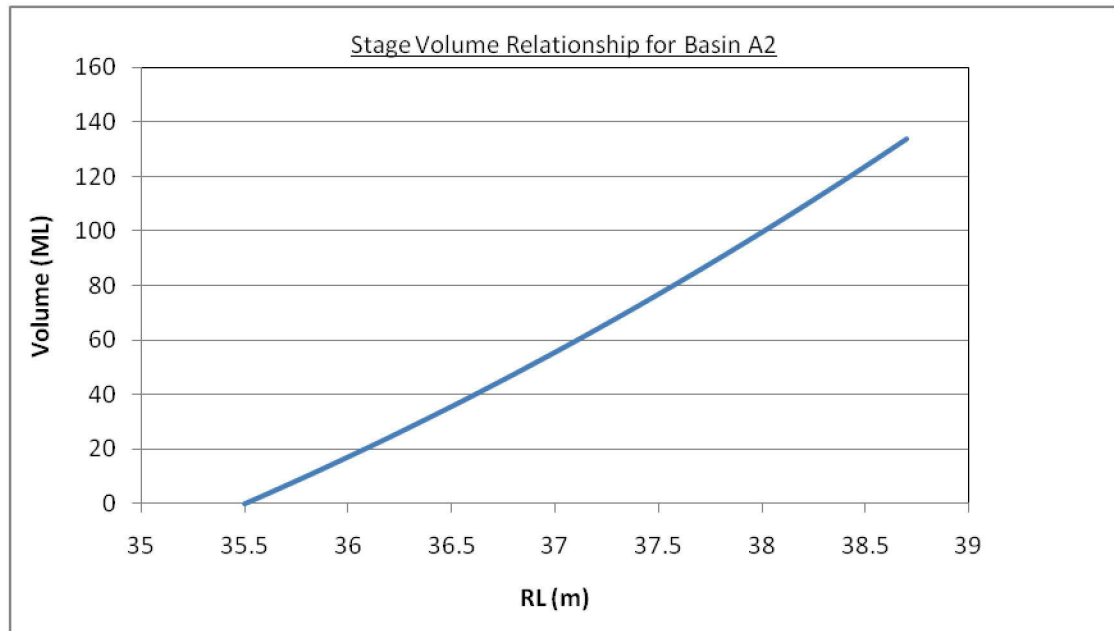
1.7. Detention Basin details

1.7.1. Basin geometry

A stage-volume relationship has been determined using 3D contour information and inputted into the model to represent the basin geometry. The relationship is shown in **Figure 1.2**.



■ **Figure 1.2 Stage-Volume relationship for A2**

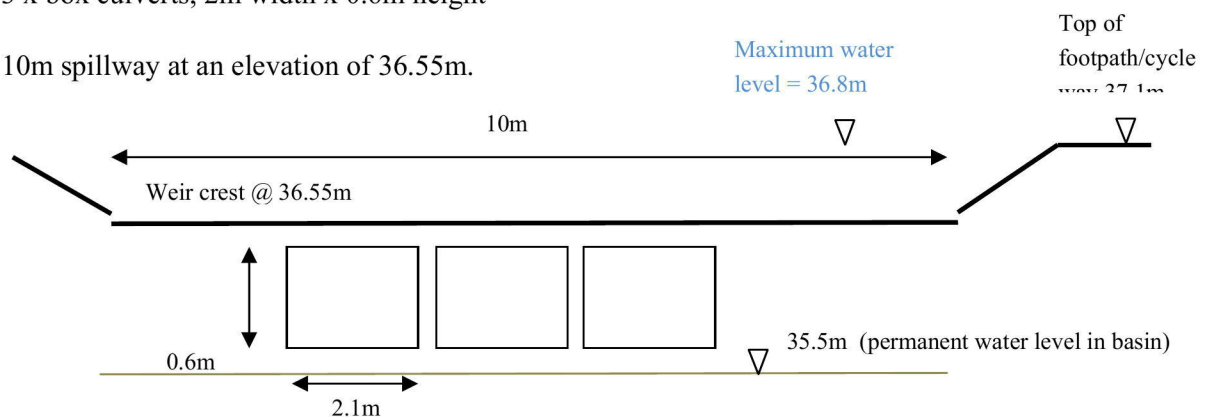


1.7.2. Outlet Configuration

Preliminary model runs have been undertaken assuming the following outlet configuration:

3 x box culverts, 2m width x 0.6m height

10m spillway at an elevation of 36.55m.



Preliminary results for the 2 year and 100 year design events are summarised in **Table 1.5**.



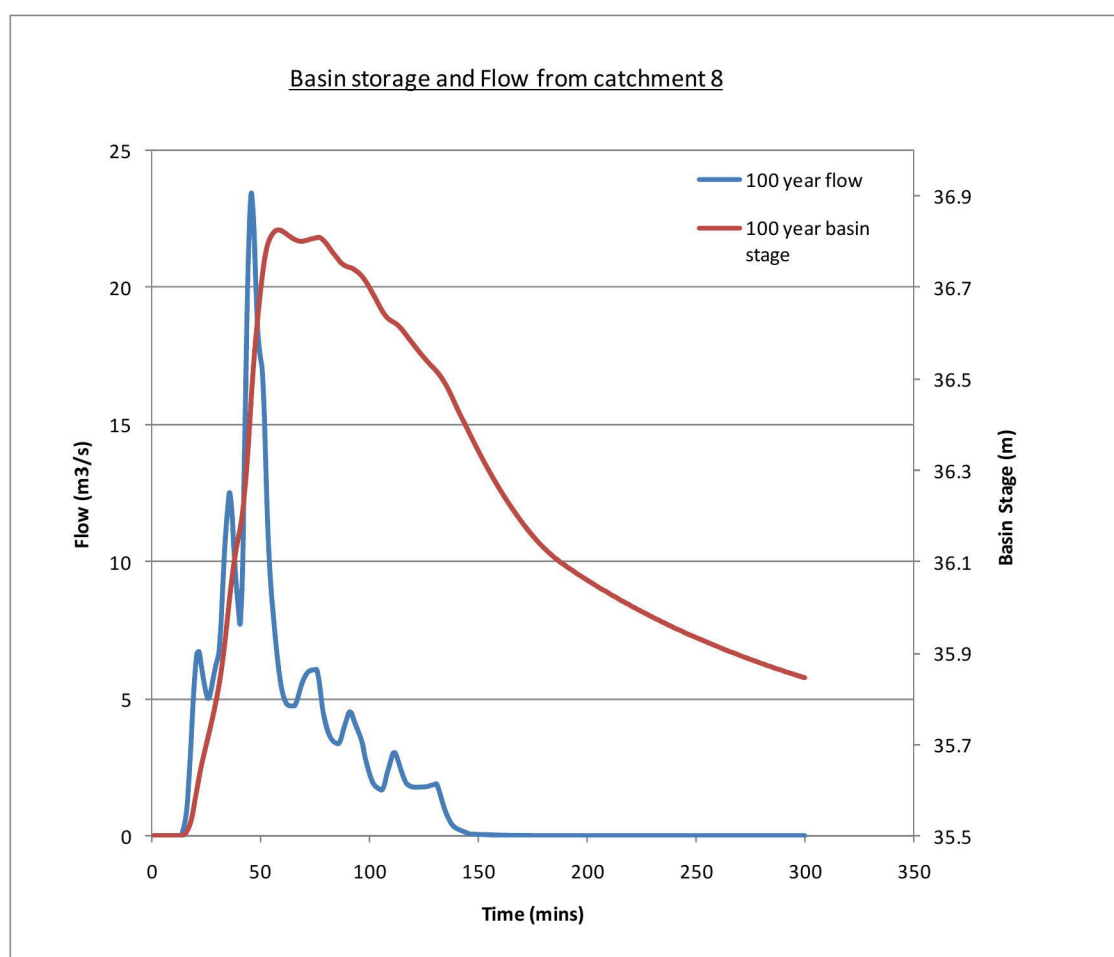
■ **Table 1.5 Detention Details**

Design Storm (ARI)	Detention Volume Required (ML)	Maximum Stage (m)	Maximum Depth over weir (mm)
2 year	25	36.2	0
100 year	48	36.8	300

1.7.3. Future inlet into the basin

Preliminary modelling work has been undertaken to assess the potential backwater impacts on the future northern inlet channel carrying flows from Catchment 8 (see **Figure 1.1**). A plot of flows from Catchment 8 and the water level in the basin are provided in Figure 1.3 for the 100 year event.

■ **Figure 1.3 Basin storage and flow from Catchment 8**



The peak flow and peak basin stage are not coincident, the basin stage peaks as the flow is receding in the channel, approximately 10 minutes after the peak flow. Preliminary results indicate that the



backwater impact on the channel would be minimal; however, an overflow side flow mechanism will be incorporated into the design of the future open channel through a single spillway of approximately 6m at an RL that is lower than the basin weir RL to ensure that the capacity of the future open channel is maintained and to limit any backwater impact.



Appendix B Water Quality Assessment

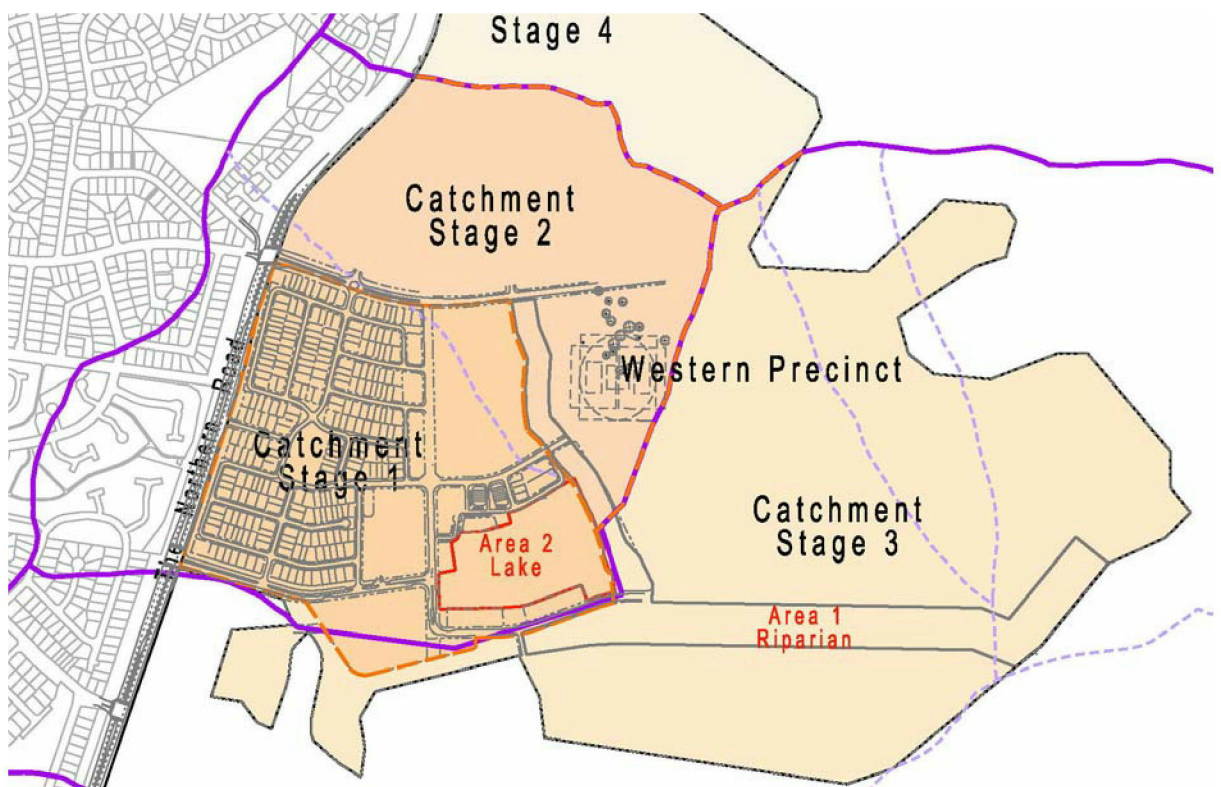


Stormwater Quality Management in Jordan Springs Lake, St Marys

1.1. Purpose

The purpose of this report is to provide a water quality assessment of the proposed Jordan Springs Lake (Area 2 Lake on **Figure 1**). The layout of the proposed development for Stages 1 and 2 of the Western Precinct at St Marys is also shown on **Figure 1**. The runoff generated from the proposed development area of Stages 1 and 2 will receive water quality treatment within the lake prior to discharge into the Riparian corridor (Area 1 in **Figure 1**). This assessment demonstrates that the proposed size of the lake will provide sufficient water quality treatment to meet and exceed the required water quality objectives.

■ Figure 1 – Location of the proposed Lake (Area 2) and layout of Stages 1 and 2 catchments



1.2. Stormwater Quality Management Objectives

The stormwater quality management objectives for the proposed development are to provide sufficient water quality treatment to reduce the pollutant loads from the proposed development catchments. The objectives that have been used were obtained from the 'South Creek Stormwater



Management Plans’ document and the *‘Draft Policy of PCC on Stormwater Quality Control’*. These criteria and water quality objectives for new urban areas are described on **Table 1**.

■ **Table 1 - Stormwater Treatment Objectives for New Urban Areas**

	Retention Criteria (Ref PCC)	ESD treatment Objectives (Ref South Creek SMP)
Suspended Solids	80% retention of the load for particles < 0.5mm dia	80% retention of the average annual load
Total Phosphorus	45% retention of the load	45% retention of the average annual load
Total Nitrogen	45% retention of the load	45% retention of the average annual load

Reference: *South Creek Stormwater Management Plan, Stormwater Trust, 2000- Pg60*
Penrith City Council, Draft Stormwater Quality Control Policy, 2005- pg8

1.3. Water Quality MUSIC modelling

A stormwater quality assessment was undertaken using the MUSIC model (Version 4.0) to estimate the reduction in water pollution by the proposed Lake. The main purpose of the modelling was to demonstrate that the proposed water quality management controls (Jordan Springs Lake/water quality pond) would meet the water quality objectives of reducing the annual pollutant loads generated from the future urbanised catchment.

The following data was used in the water quality MUSIC model:

- Pluviograph data for use in the model was obtained from the Bureau of Meteorology for station AWS 67113 at Penrith Lakes for the period December 1998 to November 2002. One year of rainfall data was used with 2001 chosen as the average rainfall year and the model was run at six minute time steps.
- Data from *‘Stormwater Flow and Quality and the Effectiveness of Non-Proprietary Stormwater Treatment Measures (Monash University and CRC for Catchment Hydrology, 2004)’* and the *‘Clean Waterways Program, Stormwater Monitoring Program, Sydney Water 1995’*, was used in the water quality model to represent urbanised conditions. The recommended typical values for suspended solids, total phosphorus and total nitrogen were adopted as the Event Mean Concentrations (EMC) in the model from **Table 2**.
- The proposed surface area of the Lake used in the model is 3.27 ha with a volume of 55.5ML.
- The total catchment area of Stage 1 and 2 is approximately 87 ha.



■ **Table 2 - EMC Values adopted for the future Urbanised catchment**

	Base EMC	Storm EMC
TSS mg/L	16	141
TP mg/L	0.14	0.25
TN mg/L	1.0	2.5

1.4. Results

The results for the MUSIC modelling are given in **Table 3**, which provides the annual pollutant loads for Total Phosphorus, Total Nitrogen and Total Suspended Solids at two locations, immediately upstream and downstream of the proposed Lake. The percentage reduction in annual pollutant loads is given on Table 3 and compared to the water quality criteria. The results indicate that the proposed Lake will provide sufficient water quality treatment for the runoff generated from the upstream area to be developed as part of Stages 1 and 2.

■ **Table 3 - Pollutant loads from Stages 1 and 2, and reductions achieved by the Lake**

Average Annual Pollutant Loads			Percent reduction	Water Quality Reduction Criteria
Total Phosphorus (kg/yr)	Upstream of water quality pond	93		
	Downstream of water quality pond	42	54%	45%
Total Nitrogen (kg/yr)	Upstream of water quality pond	851		
	Downstream of water quality pond	446	47%	45%
Suspended Solids (kg/yr)	Upstream of water quality pond	55 x10 ³		
	Downstream of water quality pond	8.3 x10 ³	85%	80%

A comparison check of the Lake's surface area to the catchment area for Stages 1 and 2 can be used as an approximate method to determine whether this ratio lies within a reasonable range. The commonly accepted range is between 2% and 4%. This ratio for the Jordan Springs Lake and the catchment area of stages 1 and 2 is 3.7%, which is in the higher end of this range. This is considered to be a conservative result.

Maintenance is an essential part of a healthy lake system that continues to provide an aesthetic environment as water quality treatment. A maintenance manual for the Lake has been prepared to provide all essential tasks needed to undertake a good maintenance regime. Refer to **Appendix C**.



1.5. Conclusion

The size of the proposed Jordan Springs Lake provides adequate water quality treatment to the future urbanised area of Stages 1 and 2. The Lake will require adequate maintenance to ensure optimum water quality treatment.



Appendix C - Maintenance Manual for the Jordan Springs Lake



1. Introduction

1.1. Purpose

Wetlands provide a very effective means of treating stormwater in urban areas. However, wetlands constructed in urban environments are subject to external factors and hence, will not behave like natural systems without regular maintenance. Therefore, this Maintenance Manual has been prepared to outline the maintenance and operational requirements associated with the proposed stormwater wetland at Jordan Springs Lake. The main purpose of the wetland is to facilitate water quality treatment and to improve the aesthetic qualities of the area.

1.2. Site Description

The proposed wetland will be located in a future residential area. When built, the wetland will occupy an area of approximately 3.25ha and contain a volume of approximately 55ML. Stormwater collected in the drainage system of the future residential area will enter the wetland via three inlets.

The wetland will comprise of a deep water zone and a perimeter macrophyte zone which will consist of reed beds around the perimeter of the wetland and open water areas. It will facilitate nutrient removal and provide a habitat for wildlife. The open water zone is the deeper part of the wetland without any emergent type macrophytes.



2. Wetland Management

2.1. Wetland Function

Constructed wetland ecosystems are vitally important and regarded as valuable environmental management tools with key qualities being that wetlands:

- Decrease storm-water pollution
- Provide habitat for native flora and fauna
- Act as a buffer for the protection of natural aquatic ecosystems

Wetlands function through a variety of biological, chemical and physical processes which interact to increase nutrient removal and uptake by wetland flora, the breakdown of harmful chemicals in storm water and the action of wetland physical processes which slow down the velocity of running storm water. Wetlands are vitally important and when successfully implemented provide attractive public amenity.

2.2. The Role of Vegetation

Vegetation plays an important role in the effective functioning of a wetland. The reed beds and littoral areas in the macrophyte zone enhance the stormwater treatment process by filtering the sediment from the water, facilitating nutrient removal and providing a habitat for wildlife. The reed beds also provide a substrate for microbial biofilms and enhance the transfer of oxygen to the substrate. The open water area provides increased exposure to sunlight, thus increasing the level of water treatment.

The macrophytes to be planted in the wetland will be selected by the landscape Architects at the detailed design stage. A preliminary list of macrophytes supplied by the Landscape Architects includes:

- *Eleocharis sphacelata*,
- *Eleocharis acuta*,
- *Bolboschoenus fluviatilis*
- *Bolboschoenus caldwellii*
- *Baumea rubiginosa*,
- *Baumea articulata*
- *Lepironia articulata*
- *Schoenoplectus validus*



- Schoenoplectus mucronatus
- Triglochin procerum
- Ludwigia peploides
- Philydrum lanuginosum
- Juncus usitatus
- Carex appressa
- Cyperus exaltatus
- Gahnia sieberiana
- Lomandra longifolia

2.2.1. Pest Plant Species

A number of undesirable weed species could potentially grow in the wetland. Therefore, maintenance staff must be familiar with the species originally planted in the wetland to enable identification of any foreign plant species. If any introduced weeds are observed, they must be removed as soon as possible to prevent infestation. Undesirable weed species could include *Isolepis prolifera*, Cumbungi *Typha* spp, *Salvinia* *Salvinia molesta*, Water Hyacinth *Eichhornia crassipes*, Cabomba *Cabomba caroliniana*, Elodea *Elodea canadensis*, Alligatorweed *Alternanthera philoxeroides*, Primrose Willow *Ludwigia peruviana*, Mexican Waterlily *Nymphaea mexicana* and Dense Waterweed *Egeria densa*. For a complete description of these weed species and their controls please refer to **Section 5** of this report.

2.2.2. Algal Growth

Algal blooms tend to develop in warm, nutrient enriched waters. The presence of algae may cause a deterioration in water quality and restrict light penetration into the water column. Algae may grow in the form of filamentous algae, such as *Enteromorpha* sp., *Spirogyra* sp. and *Cladophora* sp., which forms dense floating mats or in the form of blue-green algae, such as *Microcystis* and *Anabaena*, which forms on the surface of the water and in the water column.

Regular monitoring and maintenance of the wetland will help to minimise the likelihood of algal growth. Aquatic plants need to be maintained to enhance nutrient uptake and sediments captured in the sedimentation pond should be regularly removed to prevent the mobilisation of nutrients.



Algal blooms can be prevented using strategies such as:

- changing conditions in the water body so that algae are less likely to bloom (e.g. oxygenation, treating the sediments)
- harvesting macroalgae in shallow water or on beaches to keep the shoreline clean
- increase flushing so that more nutrients are lost from the water body

Algal blooms can be actively managed using the following management techniques (DNR 2010):

- Artificial destratification – altering the thermal layers within a waterbody which may be beneficial for algal blooms.
- Biomanipulation
- Water treatment - Algae can be removed from wetlands using a number of strategies including coagulation using aluminium and ferric iron salts or organic polymers, filtration of the water body, and the use of algicides to remove any algal blooms present.



2.3. Wildlife Management

2.3.1. Wildlife Habitat

Constructed wetlands provide a sanctuary for birds and other animals. Feeding, nesting and breeding activities are enhanced within the wetland area and the abundance and diversity of wildlife can improve the aesthetic characteristics of the wetland basin.

2.3.2. Pest Animal Species

Animal species which could potentially pose a threat to the wetland environment are mosquitoes, mosquito fish, European Carp and introduced waterbirds.

Mosquitoes pose the greatest risk to human health as they may transmit disease. A variety of design and management strategies can be employed to minimise the likelihood of large mosquito populations. These include:

- Creating a water disturbance such as a jet or cascade operated by a submersible pump to disturb the mosquito breeding cycle and kill off populations
- Vary water levels during the breeding cycle to kill populations of mosquitoes
- Implementing a deep wetland design which allows wind wave disturbance and incorporates a steep bank slope to reduce habitat sites.

If present in an artificial wetland mosquito populations can be managed using aerial larvicide application. This application can be conducted by a suitably qualified operator using a hand based applicator or in large scale cases a small helicopter. The application process should be preceded by a pre-treatment survey to determine mosquito abundance and distribution and by a post-treatment survey to determine the success of the larvicide application.

The application of larvicide is heavily dependent upon local weather conditions and environmental characteristics and should only be conducted by a certified operator.



Wetland Maintenance Operations

2.4. Routine Maintenance Tasks

A routine inspection of the wetland is required to be undertaken monthly and after storm events or any other events such as floods, fire and chemical spills that may affect the wetland's function. It is recommended that most items be inspected monthly, however, some items only require attention three-monthly, bi-annually or annually. **Table 1** outlines the frequency at which each item should be inspected and the appropriate maintenance activities associated with that item.

■ **Table 1 – Description of Routine Inspection Tasks**

Item	Inspection Frequency	Maintenance Required
Physical		
Debris and litter removal, including at the inlet, outlet and overflow structures	Monthly and immediately after storm events	Hand removal and appropriate disposal of material.
Signage	Monthly	Inspect signs for vandalism. Replace and/or repair signs as necessary.
Sedimentation	Monthly	Remove sediment from the sediment retention area when 0.3m deep using an excavator.
Erosion	Monthly or after storm events	Check the verges and record the location and extent of any erosion. Stabilise erosion sites as necessary.
Water Level	Monthly	Record any changes in water level.
Biological		
Weeds	Monthly or after storm events	Hand removal of any introduced species before the infestation becomes difficult to control.
Mosquitoes	Three-monthly	Check for presence of mosquitoes at dawn and dusk. Check for larvae in pooled water and in shallow sections of the wetland. Check for the presence of invertebrates and small fish, which help to control mosquitoes.
Birds and Other Animals	Three-monthly	Record the presence of animals, including evidence of their existence such as droppings



		or tracks.
Blue-green Algae	Monthly	Check for presence of green surface film, scum, discolouration or new odours.
Water Quality	Bi-annually	Take water samples every 6 months or as necessary, depending on water quality testing results.
Change in Waterplants	Annually	Record diagrammatically the location and abundance of waterplants and compare with original records. Note any discolouration, disease or death.
Replanting	As required	Replace plants as necessary, according to location and abundance of species.

2.5. Maintenance Checklist

A maintenance checklist has been developed which will enable all aspects of the maintenance program, both physical and biological, to be completed and verified. A copy of the maintenance checklist is attached in **Appendix C1**.

Data collected at the wetland should be recorded in a database to assist in the long-term monitoring of the site. Any information recorded in field notes taken during routine inspections and associated maintenance work, as well as results of laboratory testing should be stored in this database.

Detailed descriptions of any changes to the wetland will assist management in identifying future needs and maintenance priorities.

2.5.1. Aquatic Vegetation

Over time, there may be some changes in the distribution and abundance of aquatic species found in the wetland. Undesirable plants should be removed by hand as soon as possible to minimise further spreading and to avoid the use of pesticides.

A thorough annual inspection is recommended to document the precise location and abundance of aquatic vegetation, however, any significant changes to the wetland vegetation should be recorded when observed. The results of the inspection should be illustrated diagrammatically and compared with the initial planting guide. The condition of the plants, particularly any signs of disease, pests or stunted growth should also be noted.

2.5.2. Water Quality

Water quality changes can be accessed through physical and chemical testing. Measurements of suspended solids; nutrients including total phosphorus, total nitrogen and ammonia; heavy metals;



hydrocarbons including oils and grease; organics; pathogens including faecal coliforms; oxygen demand; pH and temperature should be recorded bi-annually, after the initial establishment of plants.

2.5.3. Basin Shape and Size

The capacity of the wetland to hold and treat stormwater is dependent upon the shape and size of the basin. Changes to embankment slope and depth may affect the volume of runoff which can be contained in the wetland. Embankments should be inspected monthly to assess any changes which may have occurred as a result of erosion, scouring or changes to vegetation cover. Any changes in water level and basin depth due to changed flow conditions, evaporation or sedimentation should also be recorded.



3. Weed Management

Why are weeds such a problem?

There are many definitions to describe what a weed is. A suitable description of a weed is an unwanted plant growing in a given area which, to reduce its effect on the economy, the environments, human health and amenity requires some form of action control or management action. Weeds are also known as invasive plants. (DEWHA 2010a, NSW DPI 2010). Weeds are among the most serious threats to Australia's natural environment and primary production industries. They displace native species, cause significant land degradation, and reduce farm and forest productivity, and generally interfere with the natural balance of ecological communities (DEWHA 2010b).

3.1. Weed Control Methods

As weeds have such a great economical and environmental impact, appropriate control and management measures are required to minimise any possible weed impacts. The most effective means of weed control is through early detection and eradication where necessary.

3.1.1. Herbicide Use and Safety

As described above weed infestations can be controlled using herbicide application. When spraying weed infestations with weeds caution should be used at all times as any 'over-spray' may have negative impacts upon non-target vegetation and the local environment. (The following parameters must be employed when using herbicide to control weed infestation:

- Only licensed operators may undertake herbicide spraying.
- Only use herbicides according to the product label instructions.
- Use only non-residual herbicide (e.g. Biactive Roundup).
- Ensure all Personal Protective Equipment (PPE) is worn; including, overalls, covered shoes, gloves, glasses and mask.)
- Monitor local weather conditions and do not spray on days which are windy, days of rain, or when rain is expected in the proceeding days.

Employees working in the wetland are advised to minimise skin contact with water in the wetland basin. Either waterproof boots, thigh boots or gum boots should be worn at all times. Other protective clothing, sunscreen and insect repellent should be provided by Council for all staff



working in and around the wetland area. The Occupational Health and Safety Act 2000 was established to protect the health, safety and welfare of people at work.

3.2. Common Aquatic Weeds

Common aquatic weeds which may be present include:

- Isolepis prolifera,
- Cumbungi (*Typha* spp.)
- Salvinia (*Salvinia molesta*)
- Water Hyacinth (*Eichhornia crassipes*)
- Cabomba (*Cabomba caroliniana*)
- Elodea (*Elodea canadensis*)
- Alligatorweed (*Alternanthera philoxeroides*)
- Primrose Willow (*Ludwigia peruviana*)
- Mexican Waterlily (*Nymphaea mexicana*) and
- Dense Waterweed (*Egeria densa*)

3.3. Noxious Weeds

The outlet from the Jordan Springs wetland discharges into South Creek which is a tributary of the Hawkesbury River. A list of declared noxious weeds in the control area of Hawkesbury River County Council is included in **Appendix C1**.



4. References

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Appendix C1 – Noxious Weeds

Weed	Class	Legal requirements
African boxthorn [<i>Lycium ferocissimum</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
African feathergrass [<i>Pennisetum macrourum</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
African olive [<i>Olea europaea subspecies cuspidata</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
African turnipweed [<i>Sisymbrium runcinatum</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
African turnipweed [<i>Sisymbrium thellungii</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Alligator weed [<i>Alternanthera philoxeroides</i>]	3	The plant must be fully and continuously suppressed and destroyed
Anchored water hyacinth [<i>Eichhornia azurea</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Annual ragweed [<i>Ambrosia artemisiifolia</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Arrowhead [<i>Sagittaria montevidensis</i>]	5	The requirements in the Noxious Weeds Act



		1993 for a notifiable weed must be complied with This is an All of NSW declaration
Artichoke thistle [<i>Cynara cardunculus</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Athel pine [<i>Tamarix aphylla</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Bathurst/Noogoora/Hunter/South American/Californian/cockle burr [<i>Xanthium</i> species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Bear-skin fescue [<i>Festuca gautieri</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Black knapweed [<i>Centaurea nigra</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Blackberry [<i>Rubus fruticosus</i> aggregate species] except cultivars Black satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smoothstem, Thornfree	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration
Bridal creeper [<i>Asparagus asparagoides</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Broomrapes [<i>Orobanch</i> species] Includes all <i>Orobanch</i> species except the native <i>O. cernua</i> variety <i>australiana</i>	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration



and <i>O. minor</i>		
Burr ragweed [<i>Ambrosia confertiflora</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cabomba [<i>Cabomba caroliniana</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cayenne snakeweed [<i>Stachytarpheta cayennensis</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Chilean needle grass [<i>Nassella neesiana</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Chinese violet [<i>Asystasia gangetica</i> subspecies <i>micrantha</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Clockweed [<i>Gaura parviflora</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Columbus grass [<i>Sorghum x alnum</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Corn sowthistle [<i>Sonchus arvensis</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Crofton weed [<i>Ageratina adenophora</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local



		control authority
Dodder [<i>Cuscuta</i> species] Includes All <i>Cuscuta</i> species except the native species <i>C. australis</i> , <i>C. tasmanica</i> and <i>C. victoriana</i>	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
East Indian hygrophila [<i>Hygrophila polysperma</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Espartillo [<i>Achnatherum brachychaetum</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Eurasian water milfoil [<i>Myriophyllum spicatum</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Fine-bristled burr grass [<i>Cenchrus brownii</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Fountain grass [<i>Pennisetum setaceum</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Gallon's curse [<i>Cenchrus biflorus</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Giant Parramatta grass [<i>Sporobolus fertilis</i>]	3	The plant must be fully and continuously suppressed and destroyed
Glaucous starthistle [<i>Carthamus glaucus</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Golden dodder [<i>Cuscuta campestris</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in



		a management plan published by the local control authority
Golden thistle [<i>Scolymus hispanicus</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Green cestrum [<i>Cestrum parqui</i>]	3	The plant must be fully and continuously suppressed and destroyed
Harrisia cactus [<i>Harrisia</i> species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration
Hawkweed [<i>Hieracium</i> species]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Horsetail [<i>Equisetum</i> species]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Hygrophila [<i>Hygrophila costata</i>]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Hymenachne [<i>Hymenachne amplexicaulis</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Italian bugloss [<i>Echium</i> species]		See Paterson's curse, Vipers bugloss, Italian bugloss
Johnson grass [<i>Sorghum halepense</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Karoo thorn [<i>Acacia karroo</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Kochia [<i>Bassia scoparia</i>]	1	except <i>B.scoparia</i> subspecies <i>trichophylla</i>



except <i>Bassia scoparia</i> subspecies <i>trichophylla</i>		The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
<i>Lagarosiphon</i> [<i>Lagarosiphon major</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
<i>Lantana</i> [<i>Lantana</i> species]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Leafy elodea [<i>Egeria densa</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
<i>Lippia</i> [<i>Phyla canescens</i>]	4	The plant must not be sold, propagated or knowingly distributed by any person other than a person involved in hay or lucerne production. The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. This is an All of NSW declaration
Long-leaf willow primrose [<i>Ludwigia longifolia</i>]	3	The plant must be fully and continuously suppressed and destroyed
Long-leaf willow primrose [<i>Ludwigia longifolia</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
<i>Ludwigia</i> [<i>Ludwigia peruviana</i>]	3	The plant must be fully and continuously suppressed and destroyed
Mexican feather grass [<i>Nassella tenuissima</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Mexican poppy [<i>Argemone mexicana</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with



		This is an All of NSW declaration
Miconia [<i>Miconia</i> species]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Mimosa [<i>Mimosa pigra</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Mossman River grass [<i>Cenchrus echinatus</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Mother-of-millions [<i>Bryophyllum</i> species and hybrids]	3	The plant must be fully and continuously suppressed and destroyed and the plant may not be sold, propagated or knowingly distributed
Noogoora burr [<i>Xanthium</i> species]		See Bathurst/Noogoora/Hunter/South American/Californian/cockle burr
Onion grass [<i>Romulea</i> species] Includes all <i>Romulea</i> species and varieties except <i>R. rosea</i> var. <i>australis</i>	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Oxalis [<i>Oxalis</i> species and varieties] Includes all <i>Oxalis</i> species and varieties except the native species <i>O. chnoodes</i> , <i>O. exilis</i> , <i>O. perennans</i> , <i>O. radicata</i> , <i>O. rubens</i> , and <i>O. thompsoniae</i>	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Pampas grass [<i>Cortaderia</i> species]	3	The plant must be fully and continuously suppressed and destroyed
Parthenium weed [<i>Parthenium hysterophorus</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Paterson's curse, Vipers bugloss, Italian bugloss [<i>Echium</i> species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Pellitory [<i>Parietaria judaica</i>]	4	The growth and spread of the plant must be



		controlled according to the measures specified in a management plan published by the local control authority
Pond apple [<i>Annona glabra</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Prickly acacia [<i>Acacia nilotica</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Prickly pear [<i>Cylindropuntia</i> species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration
Prickly pear [<i>Opuntia</i> species except <i>O. ficus-indica</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration
Privet (Broad-leaf) [<i>Ligustrum lucidum</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Privet (Narrow-leaf/Chinese) [<i>Ligustrum sinense</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Red rice [<i>Oryza rufipogon</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Rhus tree [<i>Toxicodendron</i>]	4	The growth and spread of the plant must be



<i>succedaneum</i>]		controlled according to the measures specified in a management plan published by the local control authority This is an All of NSW declaration
Rubbervine [<i>Cryptostegia grandiflora</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Sagittaria [<i>Sagittaria platyphylla</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Salvinia [<i>Salvinia molesta</i>]	3	The plant must be fully and continuously suppressed and destroyed
Sand oat [<i>Avena strigosa</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Senegal tea plant [<i>Gymnocoronis spilanthoides</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Serrated tussock [<i>Nassella trichotoma</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Siam weed [<i>Chromolaena odorata</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Smooth-stemmed turnip [<i>Brassica barraelieri</i> subspecies <i>oxyrrhina</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Soldier thistle [<i>Picnomon acarna</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration



Spiny burrgrass [<i>Cenchrus incertus</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Spiny burrgrass [<i>Cenchrus longispinus</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Spotted knapweed [<i>Centaurea maculosa</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
St. John's wort [<i>Hypericum perforatum</i>]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Texas blueweed [<i>Helianthus ciliaris</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Water caltrop [<i>Trapa</i> species]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Water hyacinth [<i>Eichhornia crassipes</i>]	3	The plant must be fully and continuously suppressed and destroyed
Water lettuce [<i>Pistia stratiotes</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Water soldier [<i>Stratiotes aloides</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Willows [<i>Salix</i> species] Includes all <i>Salix</i> species except <i>S. babylonica</i> , <i>S. x reichardtii</i> , <i>S. x calodendron</i>	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration



Witchweed [<i>Striga</i> species] Includes all <i>Striga</i> species except native species and <i>Striga parviflora</i>	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Yellow burrhead [<i>Limnocharis flava</i>]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Yellow nutgrass [<i>Cyperus esculentus</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration



Appendix C2 – Maintenance Checklist

Inspection Checklist

Name

Signature

.....

	Action Required				
Item	None ¹	Soon ²	Urgent ³	Comments ⁴	Action Taken ⁵
Physical					
Debris and litter					
Signage					
Sedimentation					
Erosion					
Water Level					
Biological					
Weeds					
Mosquitoes					
Birds / Other Animals					
Blue-green Algae					
Water Quality					
Change in Waterplants					
Replanting					

¹ The item is in good condition and no additional maintenance is required

² The item is in reasonable condition; however, further maintenance is required prior to the next inspection.

³ The item is in poor condition and requires immediate action

⁴ Describe any additional work required

⁵ Describe the date and action taken to rectify the issue

Appendix D Water Level in Lake

Estimation of Water Levels in Jordan Springs Lake, St Marys

4.1. Introduction

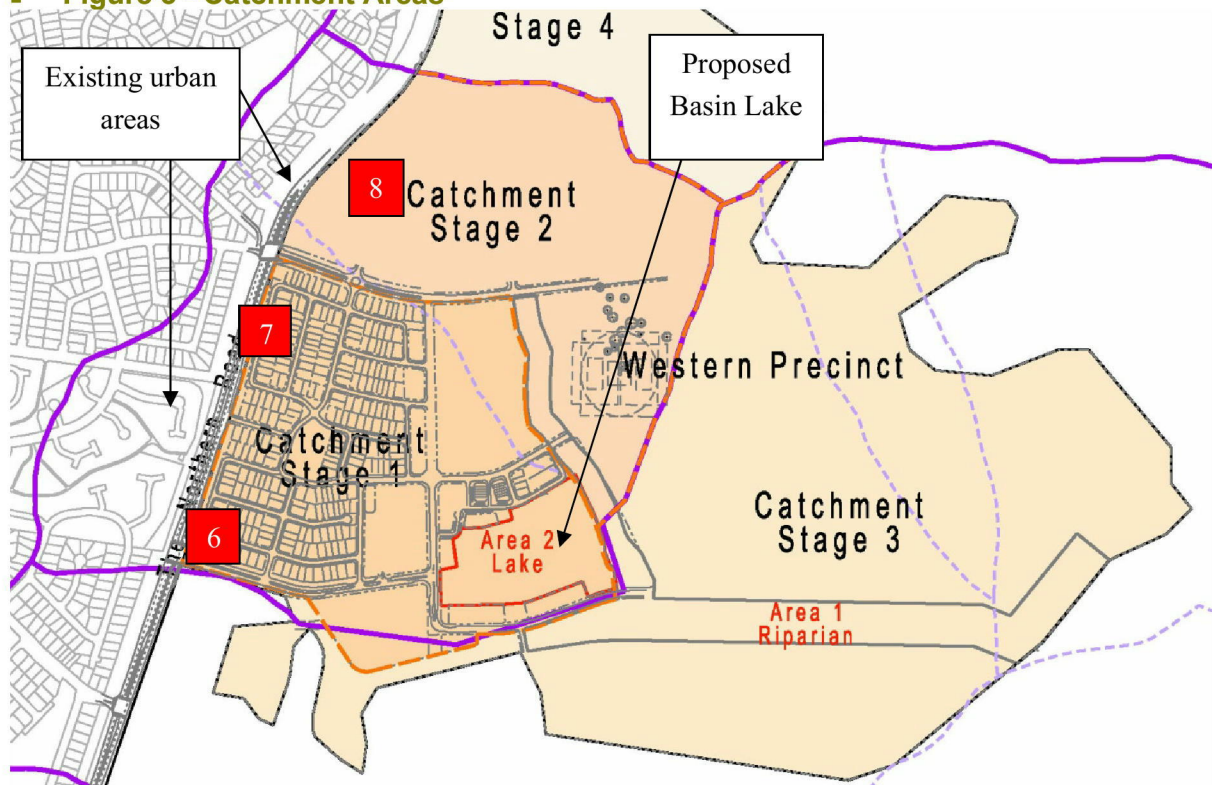
In order to analyse the drop in the water levels of the proposed Jordan Springs Lake at St Marys, which will be built as part of an urban development, a water balance model has been created to estimate the water level drops in the lake.

The study area includes a total catchment area of 109 hectares draining to the proposed basin, (catchments Stage 1 and Stage 2, including the existing urban area). The basin is located to the south-east corner of the developed area. The existing catchment areas are predominantly rural, with some urban development on the western fringes of the catchment. The catchment boundaries used in this assessment are shown in **Figure 1**.

In this assessment two scenarios have been developed. The first is for the development of Stage 1 of the project, where the lake will receive runoff from the existing urban sections of sub-catchments 6 and 7 and the newly developed stage 1 area, ie: including runoff from the undeveloped sections of catchments 6 and 7. The second scenario includes runoff the total catchment draining to the Basin including Stage 2.

For both scenarios, the effect of climate change on the lake's water levels has been analysed by comparing the model using historical rainfall data and factored rainfall data to simulate changed conditions due to climate change.

■ **Figure 3 - Catchment Areas**



4.2. Methodology

A simple rainfall model has been created to estimate daily rainfall runoff volumes on the catchments using 50 years of daily recorded rainfall data collated from the most appropriate of 9 nearby rain gauges.

Although simplified, the results do not impact significantly on the outcome of the analysis. A reduction of 1.5mm of the initial daily rainfall has been included as a conservative estimate of the absorption of rain into the catchment soil. Further conservative assumptions include the omission of evapotranspiration and the adoption of a small trickle flow value of 0.5L/s for the first scenario and 0.9L/s for the second scenario. An impermeable lining of the lake has also been assumed thus excluding water seepage from the analysis.

CSIRO estimates that by 2030 rainfall in the Hawkesbury-Nepean Catchment will have changed by $\pm 7\%$ from the current long-term average (CSIRO, 2007). Reduced rainfall in the catchment will result in lower water levels in the lake. To analyse this effect, a second model was created for each scenario, in which the daily rainfall data was reduced by 7%.

The assumptions and results of the analyses are discussed herein.

Assumptions and Parameters Used:

■ Table 2 - Rainfall Runoff Coefficients

Volumetric Urban Runoff Coefficient (Urban)	0.3
Volumetric Runoff Coefficient (Undeveloped)	0.05
Initial rainfall losses	1.5mm/day
Trickle flow (Stage 1)	0.5 L/s
Trickle flow (Stage 2)	0.9L/s

■ Table 3 –Stage 1 Catchment Areas

Catchment	Urban (ha)	Undeveloped (ha)
6	15.4	26.7
7	2.6	
Stage 1 area	16	0
Total	34	26.7

■ **Table 4 - Stage 2 Full Development Catchment Areas**

Catchment	Urban (ha)	Undeveloped (ha)
6	32	0
7	28.7	0
8	48	0
Total	108.7	0

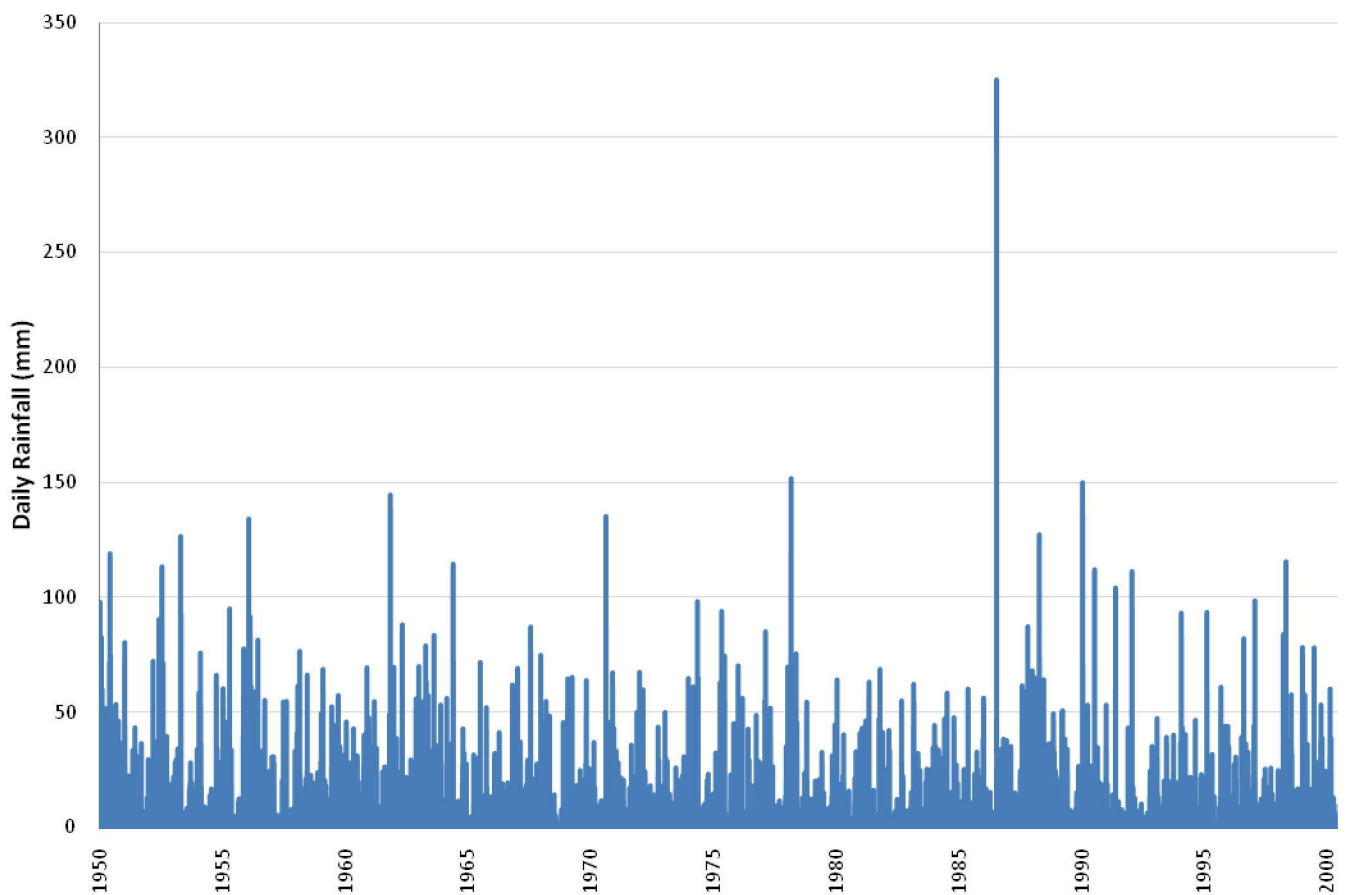
Rainfall Data Stations

Fifty years of data has been taken from the nearest nine weather stations to formulate a daily rainfall volume for the area. The stations are:

- St Marys Mwsdb;
- Quakers Hill Treatment Works;
- Blacktown Kildare Rd;
- Schofields Boundary Rd Post Office;
- Quakers Hill Douglas Rd;
- Box Hill Junction Rd;
- Willmot (Resolution Avenue);
- Minchinbury; and
- Seven Hill Collin St.

Figure 2 provides the daily rainfall data used in the analysis. The effects of climate change have been simulated by reducing these values by 7%, in accordance with CSIRO's estimated climate change projections (CSIRO, 2007).

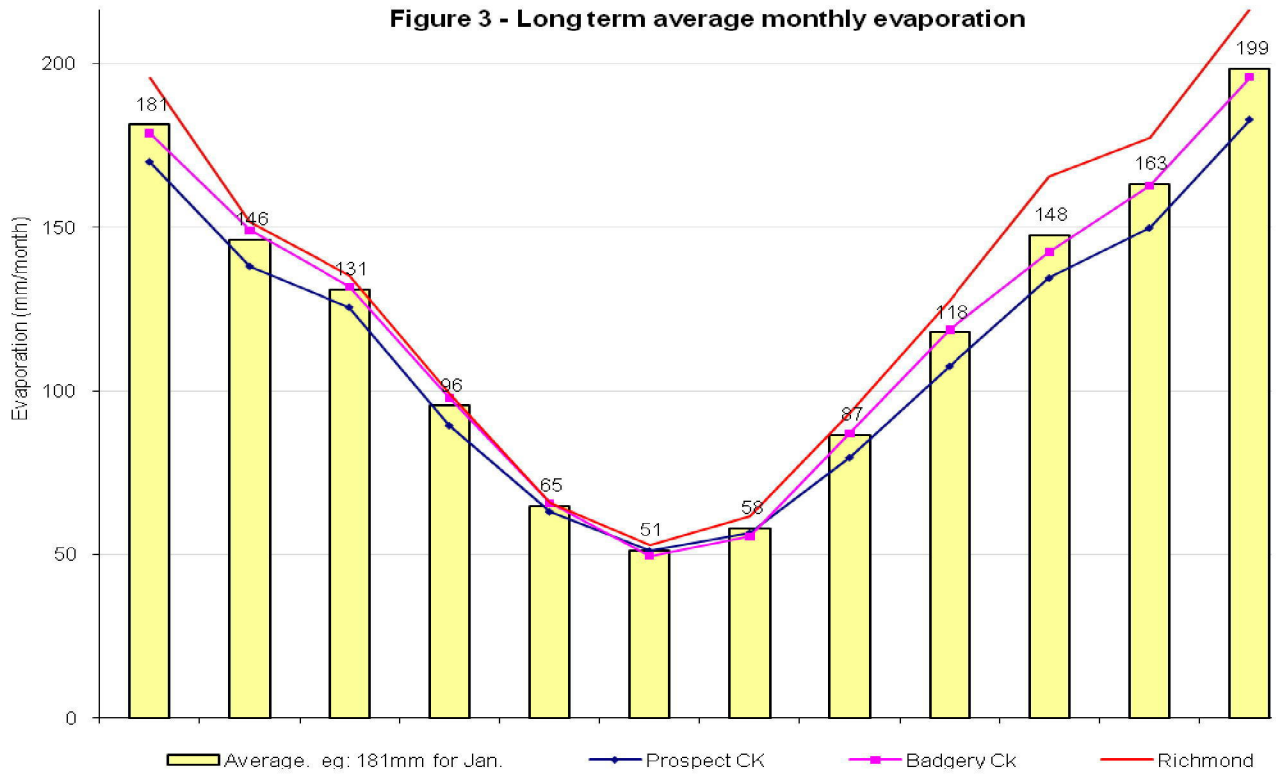
Figure 2 -Daily Rainfall Data



Evaporation Data

Monthly evaporation averages have been taken from the long term data of three nearby stations; Prospect Creek, Badgery Creek and Richmond. This has created a monthly evaporation pattern as shown in **Figure 3**.

Figure 3 - Long term average monthly evaporation

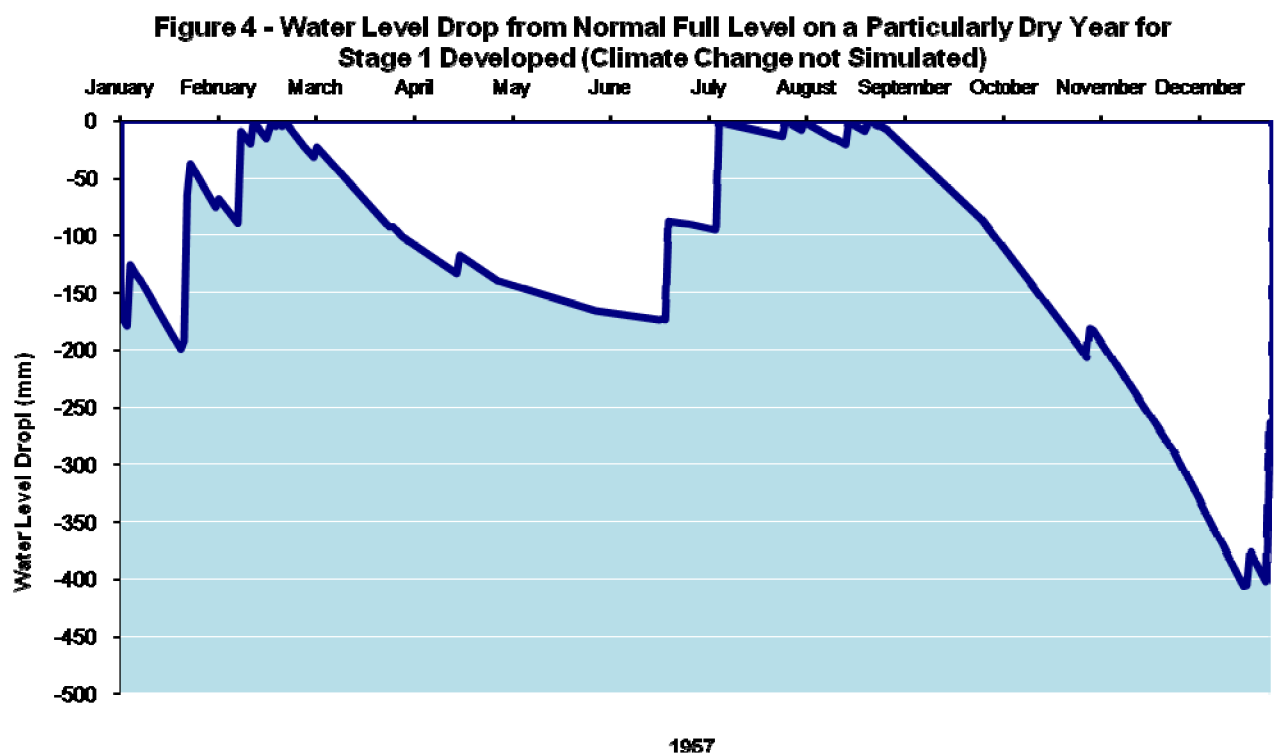




4.3. Results

4.4. Stage 1 Development Results

The water balance model for the 50 year period, without the simulated effects of climate change, calculated a maximum drop in the water level of 406mm. This occurred in December 1957, a particularly dry year. The water dropped to this level for 3 consecutive days. However, the reduced lake level during this exceptionally dry period remained at least 300mm below the normal full level for approximately 22 days. Such low levels were a rare occurrence. The water levels for that year shown in Figure 4.



For 47% of the 50 year analysis period the lake was more than 99% full. For 76% of the period the drop in water level was less than 50mm.

The effect of climate change reduced the water level to a maximum 409mm for 2 consecutive days in December 1957. The months of December 1957 and January 1958 showed the greatest drop in water levels, with 6 days of water levels lower than 400mm below the normal full level.



For 45% of the 50 year analysis period with climate change simulated, the lake was more than 99% full. For 74% of this period the drop in water level was less than 50mm

Inclusion of climate change in the model increases the drop in water levels, as expected, however these changes are not significant. The change in both maximum and average drop in water levels is 3mm. However, the frequency of drops in water levels of more than 300mm increases by almost 25%.

Table 5 lists the occurrence of a various drops in water level for both the historical rainfall model without climate change, and the model simulating a climate change effect of 7% reduced rainfall.

Figure 5 shows the water level profile for the entire 50 year period.

■ **Table 5 - Drop in Water Level and Frequency of Occurrence, with and without Effect of Climate Change**

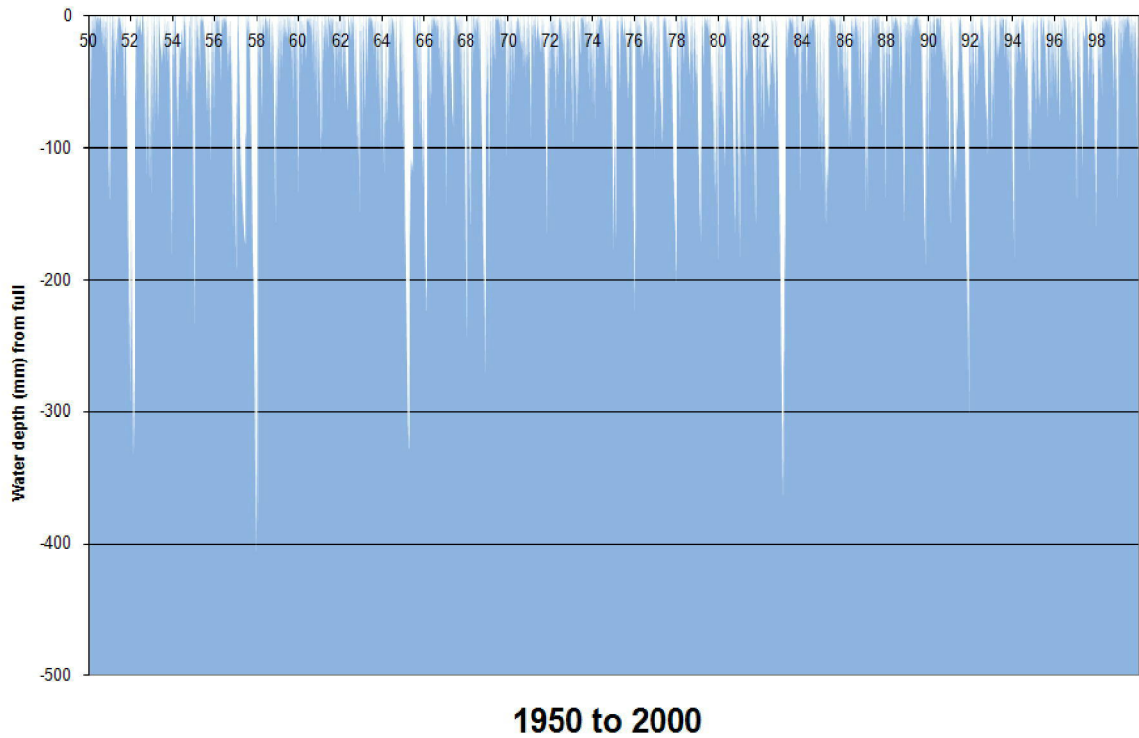
Drop (mm)	No Climate Change Simulated		With Climate change Simulated		Change
	Days in 50 years	Percentage of time	Days in 50 years	Percentage of time	
0	1323	7.2%	1258	6.9%	-5%
1-50	12524	68.5%	12235	66.9%	-2%
50-150	3547	19.4%	3776	20.7%	+6%
150-300	740	4.0%	835	4.6%	+13%
300-400	124	0.7%	153	0.8%	+23%
400+	4	0.02%	6	0.03%	+50%

■ **Table 6 - Median, Average and Maximum Drop in Water Levels, with and without Effect of Climate Change**

	No Climate Change	With Climate Change Simulated
Median drop in water level	19 mm	21 mm
Average drop in water level	39 mm	42 mm
Maximum drop in water level	406 mm	409 mm



Figure 5 – Water Level Drop from Normal Full Level for 50 year period for Stage 1 Developed (Climate Change not Simulated)



4.5. Stage 2 Development Results

The water balance model using historical rainfall data for the 50 year period calculated a maximum drop in the water level of 242mm. 11 consecutive days with a water level drop of more than 200mm occurred in December 1957. A further dry period occurred in March 1965, where 3 similar consecutive days occurred. The water levels for the exceptionally dry year of 1957 are given in Figure 6.

Figure 6 - Water Level Drop from Full Level for a particularly dry year for Stage 2 Developed (Climate Change not Simulated)





For 9% of the period, the lake was more than 99% full. For 93% of the 50 year period, the lake's water level did not drop more than 25mm below the full level.

The effect of climate change reduced the water level to a maximum 249mm. For 12 consecutive days in December 1957 the drop was greater than 200mm. In March 1965 there were 7 consecutive days with a drop of more than 200mm below the normal full level.

For 71% of the 50 year analysis period with climate change simulated, the lake was more than 99% full. For 92% of this period the drop in water level was less than 50mm

Again, the inclusion of climate change in the model increased the drop in water levels. For Stage 2 the inclusion of climate change effects only increased the average drop in water level by 1mm, however the maximum drop increased by 7mm and the frequency of reduced water levels of more than 200m grew by 43%.

Table 7 lists the occurrence of a various drops in water level for both the historical rainfall model without climate change, and the model simulating a climate change effect of 7% reduced rainfall.

Figure 7 shows the water level profile for the entire 50 year period.

■ **Table 7 - Drop in Water Level and Frequency of Occurrence, with and without Effect of Climate Change**

Drop (mm)	No Climate Change Simulated		With Climate Change Simulated		Change
	Days in 50 years	Percentage of time	Days in 50 years	Percentage of time	
0	2398	13.1%	2352	12.9%	-2%
1-25	14621	80.0%	14476	79.2%	-1%
25-49	2255	12.3%	2318	12.7%	3%
50-99	1028	5.6%	1080	5.9%	5%
100-149	258	1.4%	277	1.5%	7%
150-200	86	0.47%	91	0.5%	6%



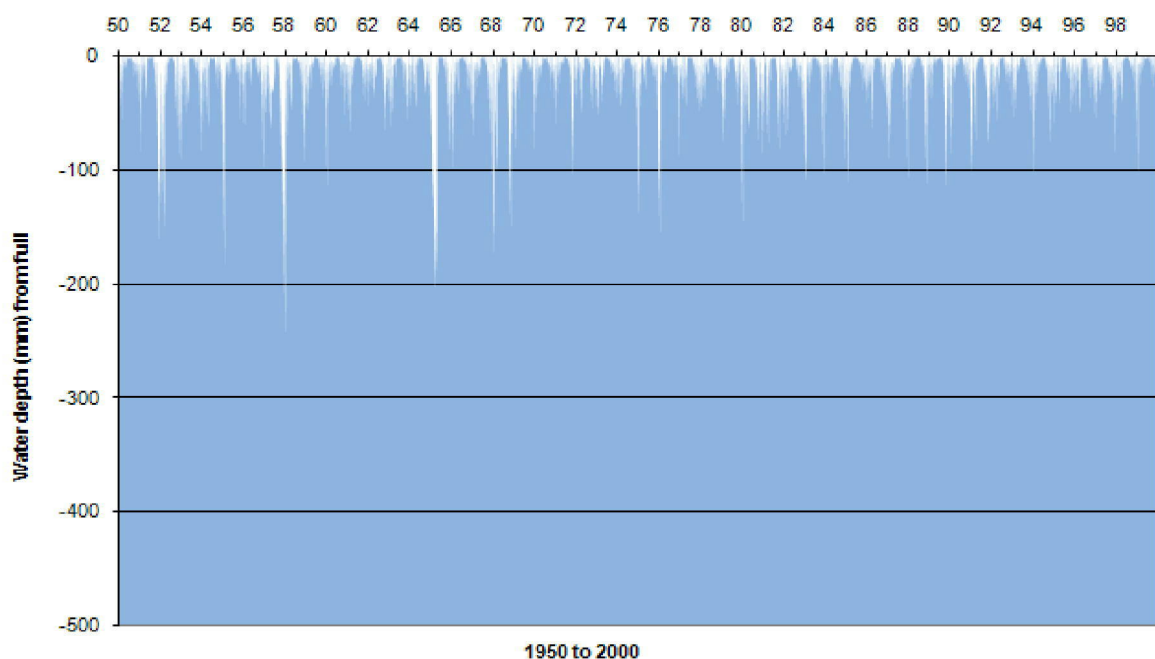
200-249	14	0.08%	20	0.11%	43%
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■ **Table 8 - Median, Average and Maximum Drop in Water Levels, with and without the Effect of Climate Change**

	No Climate Change	With Climate change
Median drop in water level	7mm	7mm
Average drop in water level	16mm	17mm
Maximum drop in water level	242mm	249mm

■

**Figure 7 – Water Level Drop from Normal Full Level for 50 year period
For Stage 2 Developed (Climate Change not Simulated)**



4.6. Conclusions

Without considering the affect of climate change, the water balance model results indicate that the drop in water levels would rarely be more than 200mm for Stage 1 and 150mm for the Ultimate Stage 2 of the development; however, during a severe drought, the water level could drop down by approximately 300 to 400mm for Stage 1 and 200mm for Stage 2.

The effect of climate change on the drop in the lake water levels is not significant; however it does increase the frequency of lower water levels in the lake.



The model provides a simplified calculation for the drop in the water level from the full level for each of the two development scenarios. The results are considered to be accurate to within $\pm 25\%$.

A temporary drop in the water level of more than 250mm may have some detrimental effect on macrophytes. The water balance model indicates that this would only occur for approximately 1.3% of the time after Stage 1 development without considering climate change, or 1.5% of the time when factoring in reduced rainfall effects due to climate change. Any water level drops of more than 200mm may have an aesthetic impact on the lake.



Appendix E Air and Noise Assessment



Construction Noise, Vibration and Air Quality Assessment

4.1. Project

SKM has been commissioned by Delfin Lend Lease to assess the potential air quality, noise and vibration impacts resulting from the construction of Basin A2 within the area of the Western Precinct of the St Mary's Development in Western Sydney.

Basin A2 is a 3.5 Ha area dam proposed for the south eastern corner of the Western Precinct (refer **Figure 0-4**). The proposed detention volume and wetland area may change as part of this proposal.

4.2. Scope of Assessment

A noise impact assessment has been undertaken to determine potential construction noise impacts at nearby sensitive receivers using the following methodology:

- Identification of nearby noise sensitive receivers;
- Identification of construction noise sources;
- Assessment of potential noise impacts during construction in accordance with the DECC Interim Construction Noise Guideline. Given the proposal is not expected to generate any substantial operational or traffic noise, impacts from these sources have not been assessed against the NSW Industrial Noise Policy and the Environmental Criteria for Road and Traffic Noise respectively
- Recommendation of noise mitigation methods as required.

A qualitative air quality assessment will focus on the potential impacts of dust generated during construction. The assessment will consider the following issues:

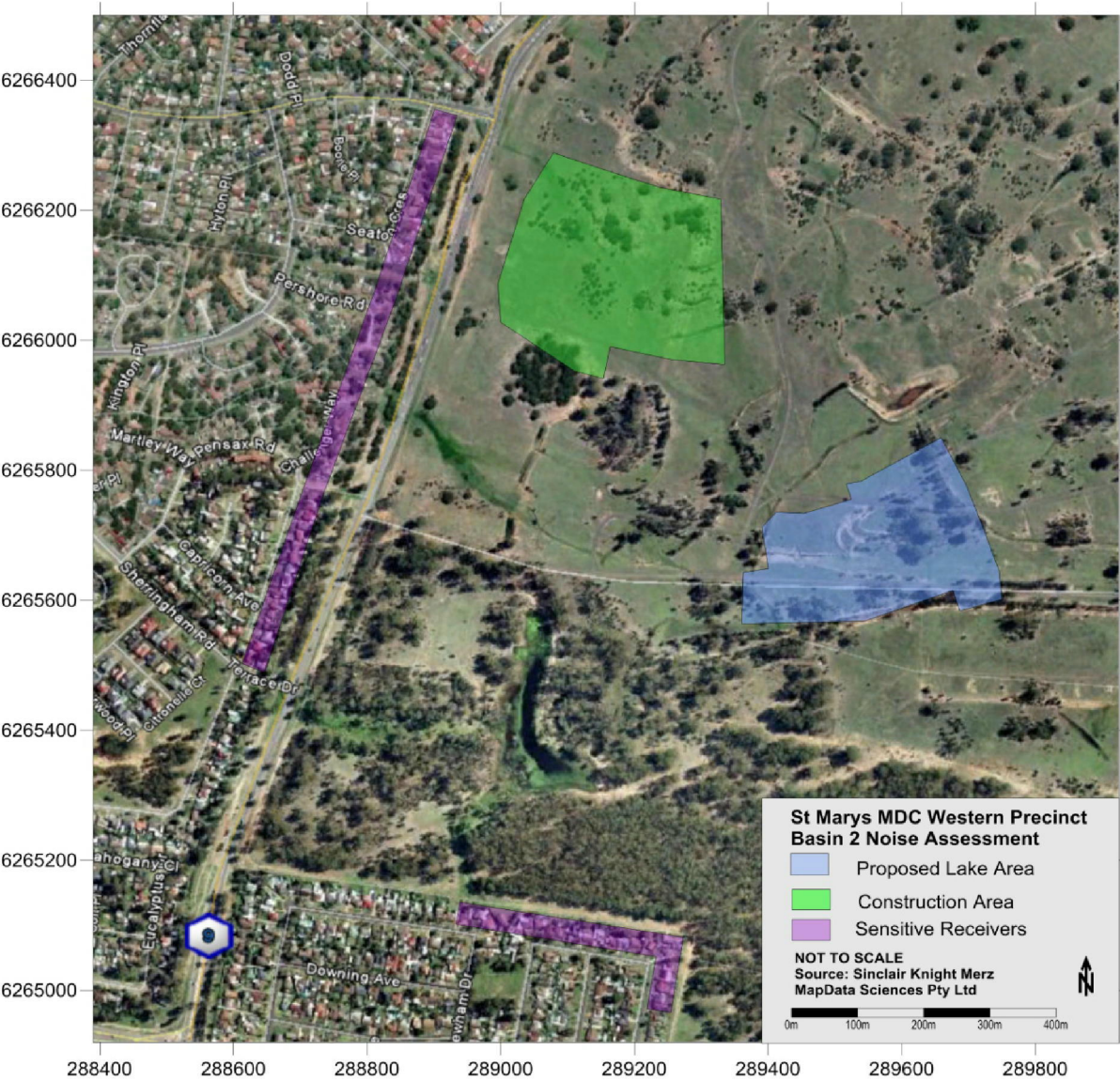
- Existing local air quality;
- Identification of dust emission sources;
- Local wind patterns for the period of construction;
- Nearby sensitive receivers; and
- Recommend suitable mitigation methods where required.



4.3. Existing Environment

Sensitive receivers in the vicinity of the Development were identified from aerial photography, and are comprised of residential properties located to the west of The Northern Road at Cranebrook, and at Summerfield Circuit in Cambridge Gardens to the south of the proposed location. Both groups of receivers are located at a distance of approximately 750m (refer **Figure 0-4**) from the main Basin site. It is anticipated that the timing for the construction of the Village Lake will likely occur before any future residents move into Stage 1 of Jordan Springs.

SKM ■ **Figure 0-4 Site Layout**





5. Noise Assessment

5.1. Environmental Noise Descriptors

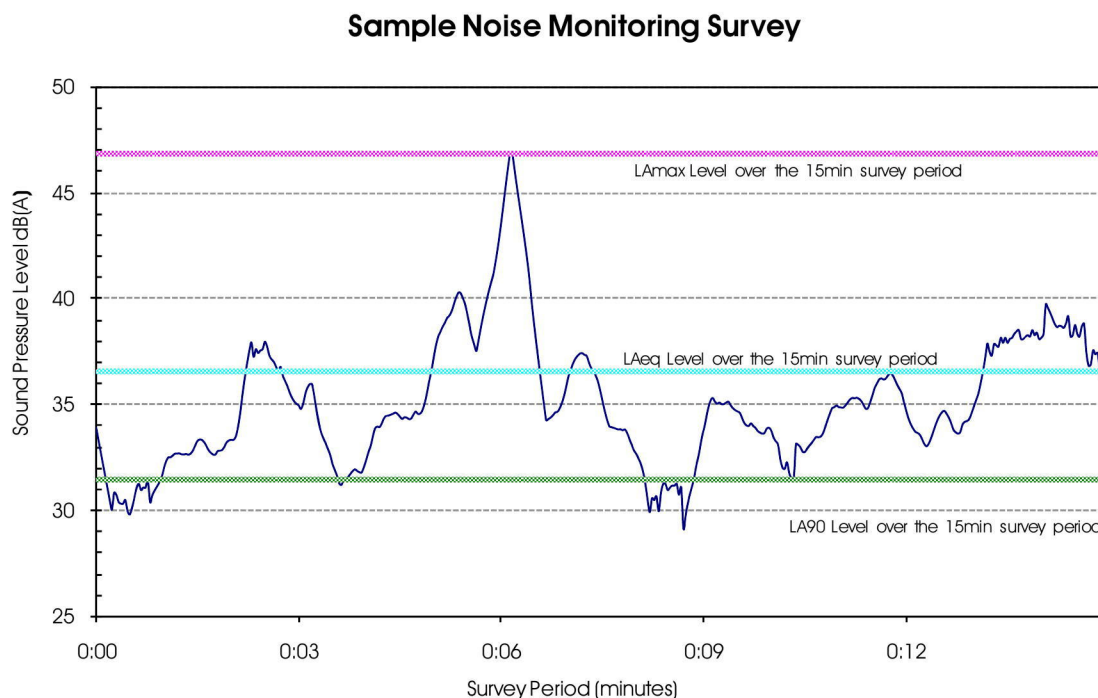
Environmental noise is described using the following indices:

- L_{A90} This is the noise level exceeded for 90% of the measurement period. For environmental noise, the interval is usually taken as 15 minutes, thus the L_{A90} represents the level corresponding to the quietest 90 seconds in a 15 minute period;
- RBL Rating Background Level. This is the lowest 10th percentile, of all of the 15 minute L_{A90} levels within any assessment period (i.e. day, evening or night-time);
- L_{Aeq} The A-Weighted energy averaged sound pressure level over the measurement period. When assessing environmental noise, the assessment period is taken to be 15 minutes (L_{Aeq} (15 minutes));
- L_{Amax} The maximum A-weighted noise level for the measurement period.

The L_{A90} , L_{Amax} and L_{Aeq} noise descriptors are shown for a hypothetical 15 minute survey in

Figure 5-1.

■ Figure 5-1: Example of Noise Indices





5.2. Existing Noise Environment

Noise monitoring was undertaken during August 2008, along the Western Site boundary of the development site. This monitoring data will be used to provide an indication of the acceptability of predicted noise as a result of construction activities.

■ **Table 5-1 Background Noise Monitoring Results**

	L_{Aeq}(dBA)	L_{A10}(dBA)	L_{A90}(dBA)
The Northern Road			
Day	62	65	53
Evening	62	65	53
Night	59	61	38

The residential properties located along The Northern Road are heavily impacted by existing road traffic noise, particularly as a result of heavy vehicles passing along the 80 km/hr speed limited road.

Traffic on The Northern Road would also be audible from Summerfield Circuit, however at a much lower level; in addition the noise environmental at this site would be influenced by typical suburban noise sources such as human activity and local traffic. In the absence of monitored noise data at this location, in order to provide a reference for the assessment of construction noise at Summerfield Circuit, estimated average noise level for areas with low density transportation have been obtained from *AS 1055.3-1997, Acoustics - Description and measurement of environmental noise, Part 3: Acquisition of data pertinent to land use*; these have been set out in **Table 5-2**.



■ **Table 5-2 AS 1055.3 Estimated Average Noise Levels (Area Category R2)**

	L_A90(dBA)
Summerfield Circuit	
Day	45
Evening	40
Night	35

5.3. Construction Noise Criteria

The risk of adverse impact of construction noise within a community is determined by the extent of its emergence above the existing background noise level, the duration of the event and the characteristics of the noise. Impacts can then be exacerbated by the proximity of construction to residences or other sensitive land uses and the times of occurrence.

The NSW DECC (2009) has prepared an Interim Construction Noise Guideline (ICNG). The guideline has been developed to assist with the management of noise impacts, rather than to present strict numeric noise criteria for construction activities.

The ICNG recommends standard hours for normal construction work as:

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No work on Sundays or public holidays

Categories of work that may be undertaken outside these hours include:

- Delivery of oversized plant or structures
- Emergency work
- Work on essential services and / or considerations of worker safety do not allow work within standard hours
- Work where the proponent demonstrates and justifies a need to operate outside the recommended standard hours. In this case approval must be explicitly given by the approval authority.

The ICNG describes two methods of assessing noise impacts from construction activities. These are:



- the quantitative method, which is suited to major and complex construction projects; and
- the qualitative method, suited to short-term (less than three weeks) works undertaken during standard construction hours.

Construction of the Proposal is anticipated to last for approximately six months, and as such a quantitative method has been used to assess the potential for construction noise impacts.

Table 5-3 outlines management levels for noise at residential receivers and how they should be applied. Restrictions to the hours of construction may apply to activities that generate noise at sensitive receivers above the ‘highly noise affected’ noise management level. The rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).



■ **Table 5-3 General Construction Noise Management Levels (NML's)**

Time	Noise Management Level (NML)	Comment
Recommended Standard hours:	Noise affected (RBL + 10 dB)	The noise affected level represents the point above which there may be some community reaction to noise.
Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Highly noise affected	Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.
Outside recommended standard hours	(>75 dB(A))	The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

Project specific noise criteria have been determined as follows:

■ **Table 5-4 Project Noise Criteria**

Location	RBL	Adjustment	NML - dB(A)
The Northern Road	53	+ 10 dB	63
Summerfield Circuit	45	+ 10 dB	55

5.4. Potential Noise Impacts

Construction activities that may result in noise impacts are most likely to occur during the earthworks stage of the Village Lake. Likely noise levels have been calculated at nominated distances. These calculations are based on measurements of typical noise levels from construction equipment taken from SKM's in house database.

It is noted that these calculations are based on all equipment operating continuously and simultaneously during the period of earthworks, and as such should be seen as an indication of potential maximum noise levels, and unlikely to be maintained for substantial periods of time.

Actual noise levels from the equipment used on site may differ marginally from those in the estimate of potential impacts at the sensitive receiver location however;

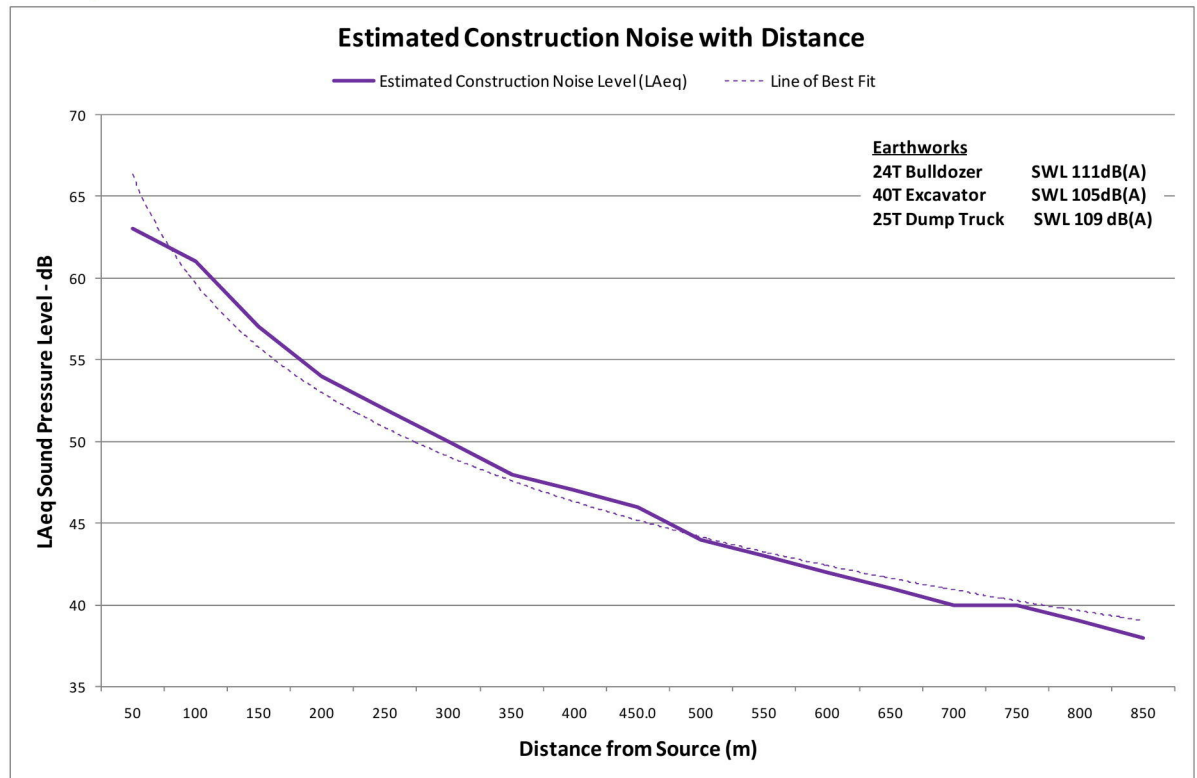


these differences are not expected to dramatically alter the conclusions of this report.

Excavation of the lake area is considered to be the major construction task associated with the proposal. Noise predictions at nominated distances from the earthworks have been given in

Figure 5-2.

■ **Figure 5-2 Construction Noise Attenuation**



The calculations above are based on simple attenuation with distance, and do not consider the absorption of noise by local geography, air or vegetation. Meteorological influences are also not considered. As such these calculations should be seen as being at the upper end of predicted noise levels, and may not be reached in actuality.

As discussed in **Section 4.3**, residential properties have been identified at distances of approximately 750m, and as such are likely to be exposed to maximum L_{Aeq} noise levels in the order of 40 dB(A). Noise levels of this magnitude are expected to easily comply with the identified Project NMLs outlined in **Table 5-4**.



5.5. Cumulative Noise Impacts

It is noted that earthworks are likely to be undertaken during the same period in an area located approximately 300m to the north west (refer **Figure 0-4**). The maximum noise level increase at a single receiver location as a result of the Lakes construction works would be in the order of

3 dB (A); that is, a doubling of the noise level. Qualitatively, an increase in noise of 3 dB(A) tends to be indiscernible or noted as a slight noise increase over other construction noise. Construction noise levels subject to an increase of this magnitude would remain within the Project NMLs outlined in **Table 5-4**.

5.6. Recommended Noise Mitigation Measures

Construction noise is not expected to result in noise impacts at surrounding receivers; however the following mitigation measures are considered standard practise for construction sites, and should be considered during all construction activities and adopted wherever they are considered reasonable and feasible in order that noise impacts during construction activities are minimised.

- Construction activities audible at sensitive receivers shall be restricted to the hours of
7 am and 6 pm Monday to Friday and 8 am to 1 pm on Saturday.
- Arrange the work site to minimise the use of movement alarms on vehicles and mobile plant;
- Examine, and implement where feasible and reasonable, the use of silenced equipment and noise shielding around stationary plant (such as generators), subject to manufacturers' design requirements;
- Ensure road plates (if used) are properly installed and maintained;
- Turn off plant that is not being used.
- Ensure plant is regularly maintained, and repair or replace equipment that becomes noisy;
- Keep staff who receive complaints informed regarding current and upcoming activities;
- Handle complaints in a prompt and responsive manner;
- Where there are complaints about noise from an identified work activity, review and implement, where feasible and reasonable, actions additional to those described above to minimise noise output.



6. Vibration Assessment

6.1. Existing Vibration Environment

No existing vibration sources have been identified in the area of the Development. Heavy vehicle passbys may generate some vibration in the area of The Northern Road, however these impacts are typical unnoticeable at distances beyond 10m. While no works for the project are expected to occur near sensitive receivers, the relevant vibration guidelines and criteria are presented below for completeness. These criteria should be referred to if any works take place near residential areas.

6.2. Vibration Guidelines

The effects of vibration can be divided into three main categories:

- Where occupants or users of the building are disturbed or inconvenienced;
- Those in which the building contents may be affected; and
- Circumstances in which the integrity of the building or the structure itself may be prejudiced.

Vibration may be transmitted through the ground or as low frequency pressure waves through the air. There are two types of vibration criteria that are used when assessing impacts. The first is the human comfort criteria, which as the name suggests is designed to minimise impacts that may disrupt day to day activities of humans. The other form of vibration criteria is designed to avoid damage to buildings and structures.

Vibration Guidelines

Human Comfort

Vibration from construction activities with regard to human comfort within a building should comply with the *Department of Environment and Conservation (DEC) Assessing Vibration: A Technical Guideline*. It is not always possible to undertake major infrastructure projects in very close proximity to residential dwellings and comply with the more stringent human comfort criterion. However, this should always be used as the objective to aim for, and be the basis of assessment.

When assessing vibration, the NSW Department of Environment and Climate Change (DECC, formerly the DEC) classifies vibration as one of three types:



- Continuous – Where vibration occurs uninterrupted and can include sources such as machinery and constant road traffic;
- Impulsive – Where vibration occurs over a short duration (typically less than 2 seconds) and occurs less than three times during the assessment period, which is not defined. This may include activities such as occasional dropping of heavy equipment or loading / unloading activities; and
- Intermittent – Occurs where continuous vibration activities are regularly interrupted, or where impulsive activities recur. This may include activities such as rock hammering, drilling, pile driving and heavy vehicle passbys.

Continuous and Impulsive Vibration Criteria

Human sensitivities to vibration differ depending on the direction of movement. For this reason, the criteria outlined below in **Table 6-1**, provides different acceptable levels for vibration based on the direction of movement.

To assess human comfort vibration the measured levels are subjected to a summation and averaging method. This yields a result referred to as a Root Mean Squared Value (rms). This value is measured in m/s^2 , and is derived from the acceleration of the measured surface as a result of the induced vibration.

- **Table 6-1 Preferred and maximum weighted rms values for continuous and impulsive vibration acceleration (m/s^2) 1- 80 Hz**

Location	Assessment Period	Preferred Values		Maximum Values	
		Z axis	X + Y axes	Z axis	X + Y axes
Critical Areas	Day + Night time	0.0050	0.0036	0.010	0.0072
Residences	Day time	0.010	0.0071	0.020	0.014
	Night time	0.007	0.005	0.014	0.010
Schools, Churches, Offices	Day + Night time	0.020	0.014	0.040	0.028
Workshops	Day + Night time	0.04	0.029	0.080	0.058

Source: The guidelines are taken from Table 2.2 of the DECC Guidelines.

Intermittent Criteria

Where vibration is classed as intermittent, the DECC uses a vibration dose value (VDV) to assess levels of vibration (refer **Table 6-2**). VDV is calculated using the



acceleration rate of the vibration event and the time over which it occurs. This method is more sensitive to the level of vibration than its duration, and is a measure of the total quantity of vibration perceived. The VDV method is the most suitable for assessing human comfort amenity from intermittent vibration sources.

■ **Table 6-2 Acceptable Vibration Dose Values (VDV's) for Intermittent Vibration ($\text{m/s}^{1.75}$) 1- 80 Hz**

Location	Day time (7am-10pm)		Night time (10pm-7am)	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Critical Areas (eg Hospitals)	0.10	0.20	0.10	0.20
Residential buildings	0.20	0.40	0.13	0.26
Offices, Schools, Churches, etc	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.6

Criteria for Building Structures

When assessing potential vibration impacts on building structures, the velocity and direction of the movement is measured. The measurement is referred to as the Peak Particle Velocity (PPV), presented in mm/s.

Vibration from construction activities, with regard to building damage, is assessed using the German standard DIN 4150: Part 3 – 1999 *Effects of Vibration on Structures* (DIN Guideline). The DIN Guideline values for PPV measured at the foundation of various structures are summarised in

Table 6-3.

■ **Table 6-3 Guideline Values of Vibration Velocity, for Evaluating the Effects of Short Term Vibration DIN 4150**

Line	Type of Structure	Guideline Values for Velocity, v_i (mm/s)			
		Vibration at the Foundation at a Frequency of			Vibration at Horizontal Plane of Highest Floor at all Frequencies
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*	
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40



Line	Type of Structure	Guideline Values for Velocity, v_i (mm/s)			
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (eg buildings that are under a preservation order)	3	8 to 10	8 to 10	8
* For frequencies above 100Hz, at least the values specified in this column shall be applied					

6.3. Potential Vibration Impacts

The prediction of vibration impacts from construction activities is not straight forward as the type and size of equipment, the proximity to a sensitive receiver and the local geology all play a significant role in the actual vibration levels experienced at a residence. Estimates of vibration levels may be made, however these are based on typical conditions and equipment types. The primary method of ensuring no adverse vibration impacts are encountered is by setting vibration limits and carrying out monitoring where vibration impacts are expected.

In addition the dropping or large rocks onto the ground or when loading trucks can generate impulsive vibration impacts in the area immediately surrounding the impact.

An indication of generally accepted minimum buffer distances is presented in **Table 6-4**. This table identifies distances where the more stringent human comfort criteria are likely to be met. These levels are for reference only and are not to be applied as project specific limits.

■ **Table 6-4 Recommended Buffer Distances for Human Comfort Impacts from Ground Vibration**

Equipment Type	Buffer Distances from Sensitive Receiver
Truck movements	10 m
Hydraulic rock breaker	15 m
Vibratory Roller	25 m

It should be noted that this discussion is based on ground borne vibration. In certain instances, vibration may also occur through the air borne transmission of low frequency sound waves. This type of vibration may travel further distances from the construction area than ground borne vibration, and its magnitude and



effects are difficult to predict. As a result, this assessment has considered ground borne vibration only, for which there are assessable guidelines.

Given the minimum separation distance between the site and the nearest receivers is in the order of 750m, vibration impacts are considered to be highly unlikely. In addition no cumulative impacts are predicted as a result of nearby earthworks (refer **Figure 0-4**).

Should the proposal be substantially altered, and construction activities are required within the distances outlined in **Table 6-4**, further assessment of potential vibration impacts should be carried out in accordance with the guidelines in **Section 6.2**. It is noted that should blasting be considered necessary for the Project, further assessment of potential vibration and overblast impacts should be conducted.

6.4. Recommended Vibration Mitigation Measures

No vibration impacts are likely to occur as a result of this project, and as such no vibration mitigation measures have been outlined in this section.



7. Air Quality Assessment

7.1. Overview

The primary air pollution impacts generated during the construction of the project are expected to occur as a result of dust created during earthworks and the storage and transport of spoil and fill.

7.2. Air Quality Legislation

The NSW ambient air quality criteria relevant to this assessment are outlined in the DECCW's *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005).

The main pollutant of interest for this project is particulate matter (ie dust). Particulate matter is generally classified according to the size of the particles, and includes particulate matter with equivalent aerodynamic diameter less than or equal to 10 microns, referred to as PM₁₀, and suspended particles of all size, referred to as Total suspended particulates (TSP). The NSW criterion for these parameters is:

■ PM ₁₀	Average annual value	30 ug/m ³
	Maximum 24 hour value	50 ug/m ³
■ TSP	Monthly 24 hour average	90 ug/m ³

7.3. Existing Air Quality

The greater Sydney metropolitan region has many sources of air pollution, including road traffic, industrial sources, bushfires and domestic wood heaters. Generally the DECCW describes the air quality in the Sydney metropolitan area as good, although there are occasional exceedances of ambient air quality criteria for PM₁₀ (small airborne particles that can be inhaled deep into the lungs). These exceedances mainly occur in summer and usually as a result of bushfires or dust storms.

PM₁₀ dust levels are monitored at Mamre Road in St Marys by the NSW Department of Climate Change and Water (DECCW). The latest annual data available from this monitoring station shows that 24 hour average PM₁₀ dust levels did not exceed either the maximum 24 hour NEPM criteria or the annual average criteria during 2007. It should be noted however that hot, dry and windy days are often precursors to high short-term PM₁₀ concentrations but smoke from bushfires



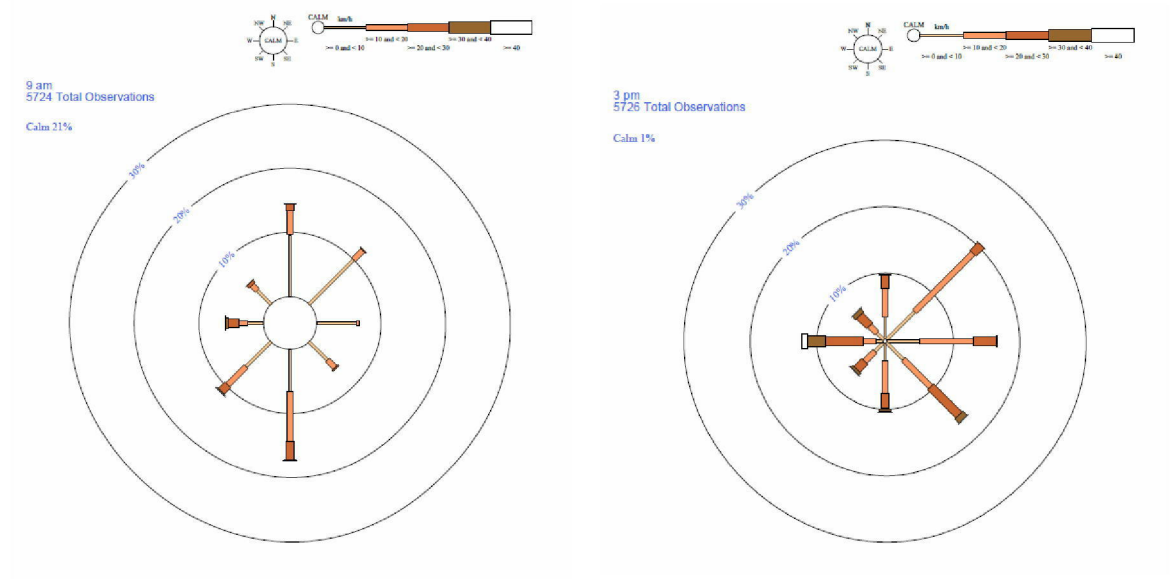
and dust storms can also cause very high levels. Localised construction activities could also contribute to exceedances of particulate matter criteria.

7.4. Meteorology

The western suburbs of Sydney region generally experience a warm temperate climate characterised by warm summers, mild winters, and moderate rainfall throughout the year. The Bureau of Meteorology operates an Automatic Weather Stations (AWS) at Richmond RAAF (Station Id 067105), and these data have been summarised in 7-1 and Figure 7-1, and reviewed below to characterise the conditions in the study area.

Climatic data recorded by the Bureau of Meteorology (BoM) show that the driest months in the region typically occur during winter, with July recording the lowest average monthly rainfall. Afternoon winds are generally from the east and are stronger than morning winds. Morning winds also show much less directional preference. Winds tend to be strongest during spring and summer and weakest in autumn, whilst relative humidity indicates a seasonal pattern, with higher humidity (75 to 80 per cent) from February to July and drier air conditions from July to January.

■ Figure 7-1 Morning and Afternoon Annual Wind Roses





9am Annual Wind Rose

3pm Annual Wind Rose

■ **Table 7-1 Summary of Meteorological Conditions (Richmond AWS)**

Parameter	Summer	Autumn	Winter	Spring
Mean maximum temperature (°C)	29	24	18	25
Mean minimum temperature (°C)	17	12	4	11
Mean rainfall (mm)	87	55	37	62
Mean 9am wind speed (km/h)	9	6	7	10
Mean 3pm wind speed (km/h)	17	14	15	19
Mean 3pm relative humidity (%)	48	51	46	41

7.5. Potential Air Quality Impacts

There would be potential for dust emissions during construction activities. These activities may include excavation of the lake, traffic travelling along unsealed roads, windblown dust from stockpiles, cleared groundcover and topsoil, and the transportation and stockpiling of spoil and construction materials.

The typical meteorological conditions outlined in **Section 7.4** are expected to impact dust generation in the following ways:

- During warmer periods, increased evaporation rates would typically allow dust to form more readily and as such the potential for elevated dust levels typically increases during summer months.
- Afternoon winds may increase dust generation during construction activities, particularly during spring and summer. These winds are likely to be from the east, and as such may potentially result in dust impacts for receivers on Northern Road.
- Decreased humidity during the latter half of the year would increase evaporation rates and lead to drier (and potentially dustier) conditions during these periods.

Given these meteorological influences, the potential for dust impacts is expected to be greatest during the warmer months, particularly during the afternoons. **Figure 7-1** shows that the dominant wind direction in Western Sydney for this time is from the north east to south east, resulting in the potential transport of dust towards receivers on The Northern Road and Summerfield Circuit. As such dust mitigation measures have been recommended below (refer **Section 7.7**).



Mobile vehicle emissions (exhausts) would also occur, as a result of combustion of petroleum products, such as diesel and gasoline. However, at the nearest sensitive receptors, the contribution of emissions from construction related equipment would be minor compared to the emissions generated by vehicles on the Northern Road.

7.6. Cumulative Air Quality Impacts

It is noted that earthworks are likely to be undertaken during the same period in an area located approximately 300m to the north west (refer **Figure 0-4**). The cumulative emission of dust from these two sites may further increase air quality impacts at sensitive receiver locations to the west and south west. As such dust mitigation methods such as those outlined below in **Section 7.7** should be considered at both sites, in particular where meteorological conditions are conducive to the generation and emission of dust.

7.7. Recommended Air Pollution Mitigation Measures

During construction the following measures would ensure that dust emissions are minimised:

- Watering of exposed soils when necessary;
- Water sprays used during dust generating excavation activities;
- Covering of truck loads when removing spoil;
- Clearly identifying and minimising the number of unsealed surfaces;
- Imposing speed limits for vehicles travelling on unsealed surfaces;
- Ensuring heavy vehicles operate only on nominated haulage routes wherever possible;
- Progressive restoration of disturbed areas;
- Maintenance of stockpiles at a height of less than 1.5 metres; and
- Should complaints be received, work shall cease until dust control measures have been implemented as required.

The primary air pollution impacts generated during the construction of the project are expected to occur as a result of dust created during earthworks and the storage and transport of spoil and fill.

Statement of Environmental Effects

JORDAN SPRINGS VILLAGE 13: 51 LOT SUBDIVISION, INCLUDING BULK EARTHWORKS AND NEW ROADS (STAGE 1) AND CONSTRUCTION OF HOUSING ON EACH ALLOTMENT (STAGE 2). LOT 21 DP 1194338 CULLEN AVENUE, JORDAN SPRINGS



Prepared by: Think Planners
Document Date: 28 November 2014
Client: Ancon Developments
Consent Authority: Penrith Council

QUALITY ASSURANCE

PROJECT: Statement of Environmental Effects– Subdivision & Housing.
Village 13- Jordan Springs

ADDRESS: LOT 21 DP 1194338

COUNCIL: Penrith City Council

CIV: \$12 million

AUTHOR: Think Planners Pty Ltd

Date	Purpose of Issue	Rev	Reviewed	Authorised
20 Oct 2014	Preliminary Issue	Draft	JW/AB	AB
28 Nov 2014	DA Lodgement Issue	Draft	JW/AB	AB

Integrated Development (under S91 of the EP&A Act). Does the development require approvals under any of the following legislation?	
Fisheries Management Act 1994	No
Heritage Act 1977	No
Mine Subsidence Act 1992	No
Mining Act 1992	No
National Parks and Wildlife Act 1974	No
Petroleum (Onshore) Act 1991	No
Protection of the Environment Operations Act 1997	No
Roads Act 1993	No
Rural Fires Act 1997	Yes ¹
Water Management Act 2000	Yes ²
Concurrence	
SEPP 1- Development Standards	No
SEPP 64- Advertising and Signage	No
SEPP 71 – Coastal Protection	No
SEPP (Infrastructure) 2007	No
SEPP (Major Development) 2005	No
SREP (Sydney Harbour Catchment) 2005	No

¹ Subdivision relates to bushfire prone land as shown in bushfire report

² Proposed works are within 40m of a watercourse



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1. Introduction and Summary

This Statement of Environmental Effects is prepared as part of the supporting documentation for a 51 lot subdivision with associated housing within the Western Precinct of Jordan Springs- specifically within Village 13. The proposal incorporates two (2) new roads and a laneway access point to a number of allotments as well as the required drainage infrastructure to convey stormwater from the development. To demonstrate the suitability of the subdivision for development the current proposal incorporates housing forms across the proposed subdivision. It is noted that the housing and landscaping plans have been approved by the Lend Lease Design Review Panel.

The proposal involves the establishment of 51 residential allotments ranging in width from 8.5m-37.65m with sizes being approximately 192m²- 942.8m².

The proposal incorporates the 'Warehouse' and 'Detached' typologies including:

- 8 x Single Storey Dwellings with a built to boundary arrangement and double garages;
- 11 x Single Storey 'Loft' Dwellings with a built to boundary arrangement and double garages;
- 25 x Two Storey Dwellings with a built to boundary arrangement and double garage;
- 6 x Two Storey Dwellings with a built to boundary arrangement and double garage with studio above given the two (2) street frontages (Lots 1, 3, 5, 7, 9, 11);
- 1 x Two Storey 'Attached Duplex' (Lot 34);

The development will be carried out in two (2) distinct stages with the first stage incorporating the subdivision and associated civil works and the second stage incorporating the housing on the allotments. It is requested that any consent conditions be formulated to enable the registration of the subdivision prior to the completion of the housing forms on the site, in order to enable sale to future residents during the construction process.

It is also noted that the proposal introduces landscape buffers to Greenwood Parkway and to the interface with the Education Land to the south.

This Statement of Environmental Effects should be read in conjunction with the plans referenced below and the consultant reports and documents submitted separately and referenced further in this statement.

- Draft Plan of Subdivision, 19170-C prepared by Vince Morgan Surveyors and dated 20/10/14;
- Engineering Plans, drawing numbers 9892/DA01-DA07 Rev A, prepared by J Wyndham Prince and dated 4 September 2014;
- Landscaping Plan- Street Tree Planting, Job No 3926, prepared by Monaco Designs and dated 25 November 2014;
- Landscape Plans- Housing, Job No 3926, prepared by Monaco Designs and dated 25 November 2014;

- Contamination Assessment Update, Job No. 11807/5, prepared by Geotechnique Pty Ltd and dated 26 November 2013.
- Bushfire Protection Assessment, Village Centre 13 and Education Site, prepared by Ecological Australia and dated 29 October 2013;
- BEP Master Plan, Dwg No. 01, Issue C, prepared by Planmaster Design Consultants and dated November 2014;
- Housing Plans for 51 Dwellings, Revision B, prepared by Planmaster Design Consultants 18 October 2014;
- Traffic Report, reference no. 14-082, prepared by Thompson Stanbury Associates and dated October 2014;
- Salinity Review, reference no. 7508/23, prepared by Geotechnique and dated 8 March 2010;
- BASIX Certificates;
- Waste Management Plan prepared by J Wyndham Prince and dated November 2014;

This Statement has been prepared having regard to the relevant State Environmental Planning Policies, Sydney Regional Environmental Plan, Local Environmental Plans and Development Control Plans & Strategies. Of particular relevance is Sydney Regional Environmental Plan No 30 – St Marys.

The subdivision has been designed to ensure consistency with Council requirements, including the adopted Precinct Plan. Having regard to the benefits of the proposal and taking into account the absence of adverse environmental, social or economic impacts, the application is submitted to Council for assessment. Think Planners Pty Ltd recommends the approval of the application, subject to necessary, relevant and appropriate conditions of consent.

2. Relevant History & Development Site

The subject site is located in the Western Precinct of the St Marys Release Area, specifically Village 13. The St Marys Western Precinct – Precinct Plan and Development Control Strategy contains a relevant description and background to the area:

'The St Marys site is located approximately 45km west of the Sydney CBD, 5km north-east of the Penrith City Centre and 12km west of the Blacktown City Centre. The main western railway line is located approximately 2.5km south of the site. The Great Western Highway is located another 1km south and the M4 Motorway a further 1.5km south.

The St Marys site has an area of 1,545 ha and stretches approximately 7km from west to east and 2km from north to south. It is bounded by Forrester Road and Palmyra Avenue in the east, The Northern Road in the west, Ninth Avenue and Palmyra Avenue in the north and the Dunheved Industrial Area, Dunheved Golf Club and the suburbs of Cambridge Gardens, Werrington Gardens and Werrington County in the south.

The Western Precinct is bounded by Ninth Avenue and rural residential development in the suburb of Llandilo to the north, The Northern Road and residential development in Cranebrook to the west, and land zoned for Regional Park to the south and east. The precinct has a total area of approximately 229 ha, including an existing education establishment (Xavier College) in the north-western portion of the precinct fronting Ninth Avenue.

Following the gazettal of Amendment No. 2 of SREP 30 in February 2009, the Western Precinct is zoned entirely Urban. Land zoned Urban is intended to accommodate primarily residential uses, with limited non-residential uses such as local retail and commercial uses.

Under Amendment No.2 the previous 28ha Employment Zone in the Western Precinct was relocated into a consolidated Employment Zone in the Central Precinct

It is anticipated that the Western Precinct will accommodate approximately 2,450 dwellings and a residential population in the order of 6,400.'

Large scale development of the residential lands as well as the retail centre has commenced on site and the progressive creation and evolution of the suburb of Jordan Springs is ongoing.

The Concept Plan extract provided over the page demonstrates that the site is within the Village Centre Character Area, noting that the subject site has been excised from the adjoining allotment to the south as the site is surplus to the requirements of the Department of Education who do not need the extent of land to deliver the future school on the site to the south. The site itself is bound by the future riparian corridor to the east, the School site to the south, Greenwood Parkway to the north, and Lakeside Parade to the west.

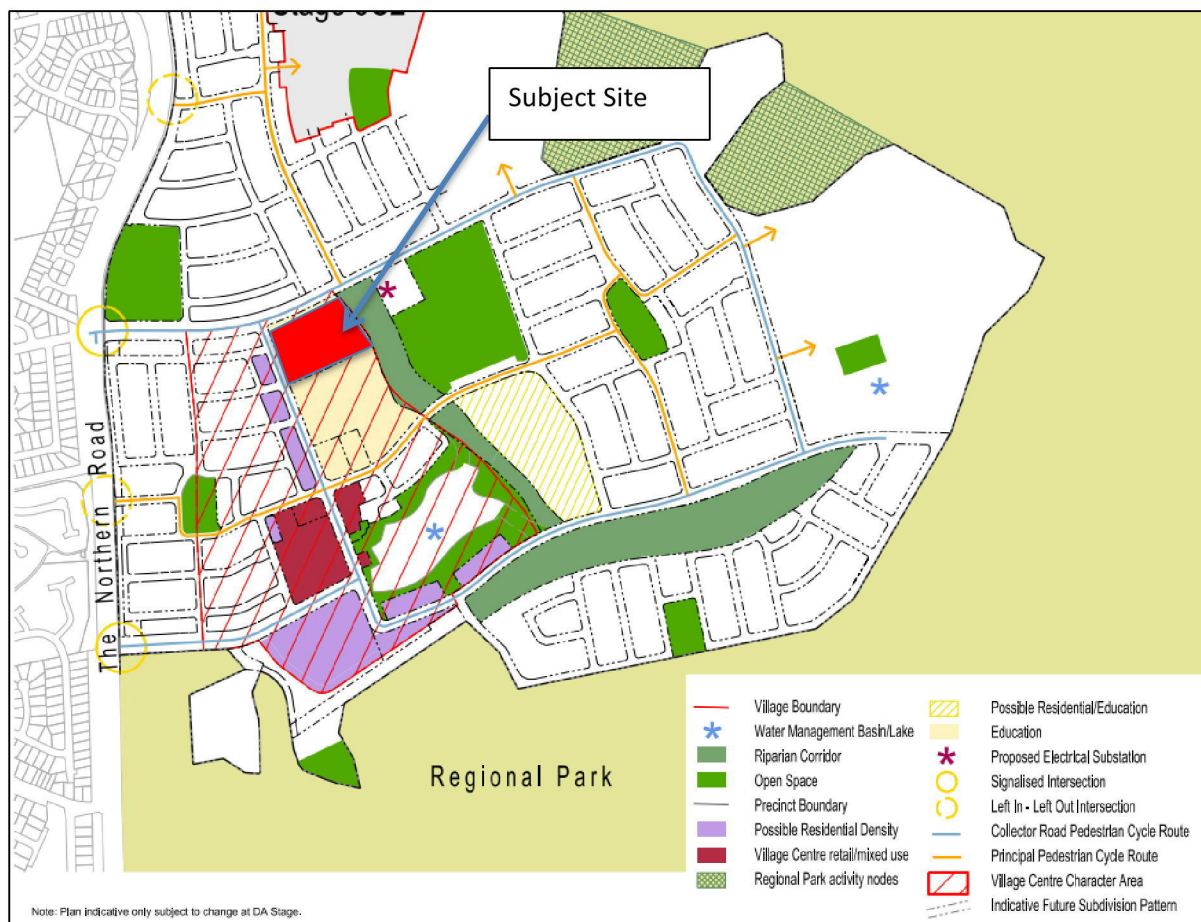


Figure 2: Village Precinct Layout, Source: Lendlease.

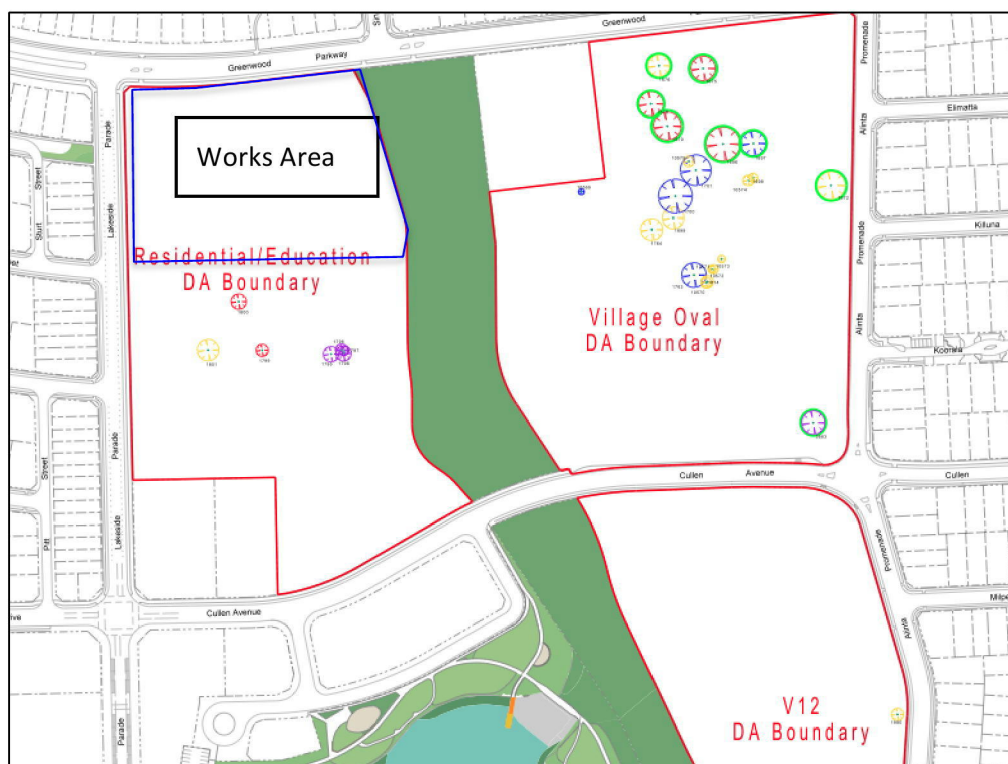


Figure 3: Village Precinct Layout, Source: Lendlease.

Aerial photographs are provided below for context showing the approximate location of the site. These photographs demonstrate that the site is largely cleared of existing vegetation, with a small number of existing trees. The site has a rectangular configuration with a total site area of 2.1Ha and a frontage of 150m to Greenwood Parkway and 121m to Lakeside Parade. The site also has a fall from west to east towards the Riparian Corridor, with the fall being approximately 4m-5m across the site. Balanced cut and fill is to be carried out to provide more level building pads and to facilitate the delivery of roads and drainage.

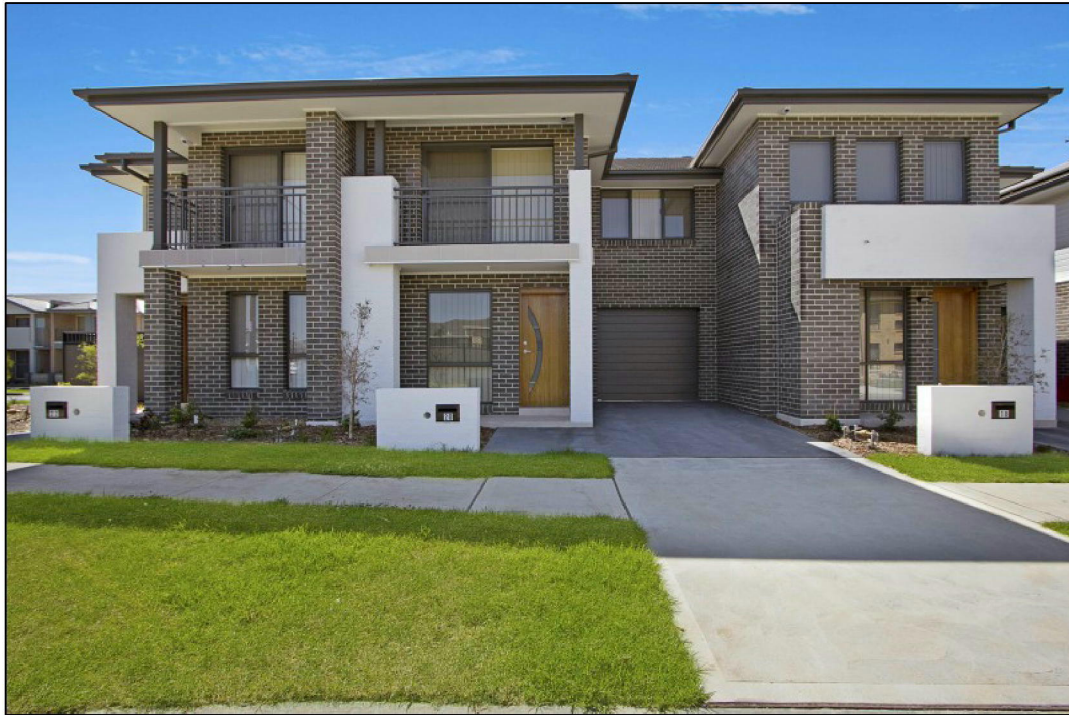


Figure 4: Aerial Photograph Extract

The photographs below show a number of recent developments by Ancon Developments located in the Blacktown side of the release area.







3. The Proposal

This Statement of Environmental Effects is prepared as part of the supporting documentation for a 51 lot subdivision with associated housing within Village 13 of the Jordan Springs release area. The subdivision relates to the subdivision of an existing residue lot, created as part of the subdivision of the existing school site that has arisen after the Department of Education determined that the area required for the future school was less than that originally envisaged.

It is noted that the housing and landscaping plans have been approved by the Lend Lease Design Review Panel.

Subdivision to Create 51 Residential Lots (Stage 1)

The proposal seeks consent for the construction of two (2) new roads drainage works, and minor earthworks to establish 51 new residential allotments in a single stage with the following lot numbers and sizes:

- Establishment of 51 residential allotments (Lots 1- 51) ranging in width from 8.5m- 37.65m with sizes being approximately 192m²- 942.8m²;

To demonstrate the suitability of the subdivision for development the current proposal incorporates housing forms across the proposed subdivision.

The development will be carried out in two (2) distinct stages with the first stage incorporating the subdivision and associated civil works and the second stage incorporating the housing on the allotments. It is requested that any consent conditions be formulated to enable the registration of the subdivision prior to the completion of the housing forms on the site, in order to enable sale to future residents during the construction process.

The development proposal contributes to the diversity of dwelling types throughout Village 13 through the provision of a diversity of lot sizes to delivery a variety of housing forms. The proposal also establishes an easement along the eastern edge of the to define the required Asset Protection Zone

The DCS establishes clear planning controls that drive key urban design outcomes. These controls relate to public urban elements such as front setbacks that contribute to establishing the character of the street, and also to private urban amenity elements such as the minimum dimensions for private open space. The current subdivision layout enables future development to be consistent with the DCP controls, noting that as the proposal includes housing layouts the end product can be assessed to demonstrate suitability of the proposed subdivision.

Housing Forms (Stage 2)

The proposal involves the construction of built forms on the proposed allotments. The proposal incorporates the 'Warehouse' and 'Detached' typologies to increase diversity across the release area and to respond to the proximity of the site to the village centre as well as the reduced allotment sizes that will enhance affordability.

Of the proposed mix the development includes:

- 18 Integrated Housing 'Detached Dwelling' Types (Lots 1-21 excluding 16-18);
- 1 Integrated Housing 'Semi-Detached' dwelling Type (Lot 34);
- 32 'Warehouse' Dwelling Types;

The proposal incorporates the following detailed breakdown of dwelling types:

- 8 x Single Storey Dwellings with a built to boundary arrangement and double garages;
- 11 x Single Storey 'Loft' Dwellings with a built to boundary arrangement and double garages;
- 25 x Two Storey Dwellings with a built to boundary arrangement and double garage;
- 6 x Two Storey Dwellings with a built to boundary arrangement and double garage with studio above given the two (2) street frontages (Lots 1, 3, 5, 7, 9, 11);
- 1 x Two Storey 'Attached Duplex' (Lot 34);

The table below provides a summary of the Lots and Dwelling Typologies, noting all dwellings have a double garage.

Lot	Total Size	Frontage	Depth	Housing Type	Beds
1	657.8m ²	12.925m & 33.53m	27.99m	2 Storey Plus Studio	5 + Studio
2	350.3m ²	9.5m	27.99m	2 Storey	5
3	266m ²	9.5m	27.99m	2 Storey Plus Studio	5 + Studio
4	294.1m ²	9.5m	27.99m	2 Storey	5
5	265.95m ²	9.5m	27.99m	2 Storey Plus Studio	5 + Studio
6	265.95m ²	9.5m	27.99m	2 Storey	5
7	265.95m ²	9.5m	27.99m	2 Storey Plus Studio	5 + Studio
8	265.95m ²	9.5m	27.99m	2 Storey	5
9	265.95m ²	9.5m	27.99m	2 Storey Plus Studio	5 + Studio
10	265.95m ²	9.5m	27.99m	2 Storey	5
11	265.95m ²	9.5m	27.99m	2 Storey Plus Studio	5 + Studio
12	410.5m ²	11.5m	34m	2 Storey	5
13	274.2m ²	12.5m	19.9m	Single Storey with Loft Bed	5

14	279.1m ²	12.5m	22.6m	Single Storey with Loft Bed	5
15	280m ²	8.5m & 19.5m	22.6m	Single Storey	3
16	192m ²	8.5 m	16m	2 Storey	4
17	200m ²	12.5m	16m	2 Storey	4
18	192m ²	8.5m	16m	2 Storey	4
19	276.6m ²	12.5m	23.4m	Single Storey	3
20	299.5m ²	12.5m	24.5m	Single Storey with Loft Bed	4
21	942.8m ²	32.79m	24.5m	Single Storey with Loft Bed	4
22	744.8m ²	37.5m	26m	2 Storey	4
23	242.5m ²	12.5m	18.8m	2 Storey	4
24	235m ²	12.5m	18.8m	2 Storey	4
25	227m ²	8.5m- 14.8m	18.8m	2 Storey	4
26	239.3m ²	13m	17.55m	Single Storey with Loft	4
27	236.2m ²	12.5m	17.55m	Single Storey with Loft	4
28	236.2m ²	12.5m	18.9m	Single Storey with Loft	4
29	236.2m ²	12.5m	18.9m	Single Storey with Loft	4
30	236.2m ²	12.5m	18.9m	Single Storey with Loft	4
31	236.2m ²	12.5m	18.9m	Single Storey with Loft	4
32	236.2m ²	12.5m	18.9m	Single Storey with Loft	4
33	319.3m ²	13.7m- 17.02	26.2m	Single Storey	3
34	584m ² A- 253.6m ² B- 326.5m ²	Irregular	26.2m & 21.4m	2 Storey Duplex	4 Each
35	202.5m ²	12.5m	16.2m	2 Storey	4

36	202.5m ²	12.5m	16.2m	2 Storey	4
37	202.5m ²	12.5m	16.2m	2 Storey	4
38	202.5m ²	12.5m	16.2m	2 Storey	4
39	202.5m ²	12.5m	16.2m	2 Storey	4
40	202.5m ²	12.5m	16.2m	2 Storey	4
41	239.3m ²	12.81m	17.55m	2 Storey	4
42	225m ²	12.5m	18m	Single Storey	3
43	225m ²	12.5m	18m	2 Storey	4
44	225m ²	12.5m	18m	Single Storey	3
45	225m ²	12.5m	18m	2 Storey	4
46	225m ²	12.5m	18m	Single Storey	3
47	225m ²	12.5m	18m	2 Storey	4
48	225m ²	12.5m	18m	Single Storey	3
49	225m ²	12.5m	18m	2 Storey	4
50	225m ²	12.5m	18m	Single Storey	3
51	599.7m ²	33.45m	18m	2 Storey	5

Ancillary Roadwork, Earthworks, and Drainage

As addressed the proposal also involves the construction of two (2) new roads to service the allotments. The roads are designed with a 15.6m wide carriageway- with the exception of eastern portion of Road 2 that has a 13.8m carriageway. The pavement width is 8m with a 1.5m footpath on both sides- excluding the reduced width portion of Road No. 2 that only features a footpath on the western side of the road. It is intended to dedicate these roads to Council upon registration of the subdivision.

The proposal involves minor earthworks to form the allotments with bulk earthworks already carried out over a large portion of the broader site. All remaining trees on the site are to be removed to make way for the development. The proposal also involves a stormwater arrangement to convey stormwater that will be subsequently connected to the broader network in Jordan Springs.

Landscape Treatments

Detailed landscape plans have been formulated as part of the design development, with a summary of the key aspects of the landscape treatment provided below:

- **Street Trees:** The street trees are designed with a cohesive clustering of species, with the Eucalyptus 'Mugga' being the dominant street tree planting. The proposal also uses feature Lacebark to the entry to the development off Greenwood Parkway and Fastigiata to the shared laneway area.
- **Verges:** Verges will be planted with Kikuyu;
- **Interface to School:** The proposal incorporates a 2m wide landscape buffer to the school site with a variety of shrubs (Lilly Pilly, Camellia,) and feature trees (Flowering Pear, Robinia, and Magnolias).
- **Interface to Greenwood Parkway:** The interface to Greenwood Parkway is treated with a landscape strip with a variety of groundcovers, hedges and feature trees.
- **Individual Dwellings:** The individual dwellings adopt a consistent palette of landscape plantings to ensure consistency and coherency, noting the use of a series of groundcovers and shrubs and feature trees strategically placed to mitigate privacy impacts between dwellings and to break down the extent of hard surfaces;

The relevant works are shown on the plans and documents referenced below:

- Draft Plan of Subdivision, 19170-C prepared by Vince Morgan Surveyors and dated 20/10/14;
- Engineering Plans, drawing numbers 9892/DA01-DA07 Rev A, prepared by J Wyndham Prince and dated 4 September 2014;
- Landscaping Plan- Street Tree Planting, Job No 3926, prepared by Monaco Designs and dated 25 November 2014;
- Landscape Plans- Housing, Job No 3926, prepared by Monaco Designs and dated 25 November 2014;
- Contamination Assessment Update, Job No. 11807/5, prepared by Geotechnique Pty Ltd and dated 26 November 2013.
- Bushfire Protection Assessment, Village Centre 13 and Education Site, prepared by Ecological Australia and dated 29 October 2013;
- BEP Master Plan, Dwg No. 01, Issue C, prepared by Planmaster Design Consultants and dated November 2014;
- Housing Plans for 51 Dwellings, Revision B, prepared by Planmaster Design Consultants 18 October 2014;
- Traffic Report, reference no. 14-082, prepared by Thompson Stanbury Associates and dated October 2014;
- Salinity Review, reference no. 7508/23, prepared by Geotechnique and dated 8 March 2010;
- BASIX Certificates;
- Waste Management Plan prepared by J Wyndham Prince and dated November 2014;

4. Assessment of Planning Issues & Controls

Environmental Planning and Assessment Act 1979

The proposed development will be assessed under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act). Division 1 of Part 4 details the provisions pertaining to Integrated Development requiring more than one approval to proceed.

In order for the proposed works to be carried out under Part 4, the development must be assessed having regard to relevant local statutory and non-statutory planning controls and consideration of the suitability of the site and the public interest. It is noted that approval under the Rural Fires Act 1997 is required as the site is bushfire prone.

The site does not have a 'watercourse' running through it however there is a mapped watercourse to the east- being the future Riparian Corridor. A Controlled Activity Approval was issued over the subject site previously as part of the original DA applying to the site however the proposal is technically 'integrated development' and requires referral to the NSW Office of Water given the current mapping and proximity to the adjoining Riparian Corridor.

State Environmental Planning Policy No.55 (SEPP 55) – Remediation of Land

There are no known contaminated sites within Village 13 and it should be noted that the provisions of SEPP 55 and the need for remediation or otherwise has been previously addressed and the site is suitable for residential development as confirmed by the Site Audit Statement prepared by HLA-Envirosciences Pty Ltd- Site Audit Statement Number CHK001/1.

Sydney Regional Environmental Plan No.20 (SREP 20) – Hawkesbury Nepean River

It is noted that the impact upon the Hawkesbury Nepean River was a key consideration in the Local Environmental Study that preceded the rezoning of the land. Notwithstanding, the Specific Planning Policies and Strategies of the SREP, state in (10) Urban Development –

- (a) When considering a proposal for the rezoning or subdivision of land which will increase the intensity of development of that land (for example, by increasing cleared or hard surface areas) so that effluent equivalent to that produced by more than 2,500 people will be generated, consider requiring the preparation of a Total Water Cycle Management Study or Plan.*
- (b) Consider urban design options to reduce environmental impacts (such as variable lot sizes and shapes, and the clustering of development).*

The above matters have been previously considered in the rezoning of the release area and the current proposal will not result in any substantive impact on the Hawkesbury Nepean River. Appropriate erosion and sediment control measures will be implemented throughout the construction phase and stormwater will be discharged initially into the street network

and eventually into the raingarden treatment systems upon completion of the drainage system in Precinct C.

Sydney Regional Environmental Plan No 30 – St Marys

Sydney Regional Environmental Plan 30 zones the subject site “urban”.

The following uses are permissible with the consent of Council on land zoned “urban” (emphasis added) –

*advertisements, amusement centres, backpackers’ hostels, bed and breakfast establishments, boarding houses, bush fire hazard reduction, child care centres, clubs, community facilities, drains, educational establishments, essential community services, exhibition homes, exhibition villages, family day-care, fast food take-away restaurants, flood mitigation works, general stores, guesthouses, home activities, home businesses, hospitals, hotels, **housing**, local retail or commercial premises, medical centres, motels, nursing homes, parks, places of assembly, places of worship, professional consulting rooms, public buildings, recreation establishments, recreation facilities, regeneration activities, restaurants, retail plant nurseries, roads, service stations, shops.*

Housing is permitted with consent and subdivision is also permitted with consent. A review of SREP 30 has been undertaken in the preparation of the application and the various elements of the SREP that have been reviewed are noted below, clarifying that the proposed development is consistent with the SREP. It is noted that a thorough review of the SREP has been undertaken to address the issues identified under the SREP.

Sydney Regional Environmental Plan No 30 – St Marys – Compliance Table			
Clause	Controls	Specific Controls	Discussion
Part 1 Introduction			
3	Aims of this Plan	The aims of this plan are to: support the St Marys Environmental Planning Strategy, 2000 of the Department of Urban Affairs and Planning by providing a framework for the sustainable development and management of the land to which this plan applies, and rezone certain land for urban and employment-generating development, and rezone land for conservation purposes and conserve the significant heritage values of the land to which this plan applies, and ensure that urban development on the land achieves desirable environmental, social and economic outcomes, and provide opportunities for recreation facilities that meet the needs of the	The proposal for subdivision and housing aligns with the aims of the plan in that the proposal provides additional housing within the Local Centre and within the catchment of local services.

		<i>regional and local community, and ensure that development of the land to which this plan applies is integrated with established surrounding areas.</i>	
6	<i>Development Structure</i>	<i>The general pattern of development proposed for the land to which this plan applies is shown on the Structure Plan.</i>	The proposal aligns with the Structure Plan noting the evolution of the site from a fully educational precinct to a split precinct having regard to the actual needs of the Department of Education.
Part 3 Precinct Plans			
8 – 18	<i>Precinct Plans</i>	<i>Requirement for Precinct Plan.</i>	The Western Precinct Plan has been prepared for the site. Is consistent with the provisions of the SREP as well as the EPS. This Precinct Plan has been taken into account and is addressed further in this SEE.
Part 4 Development Applications			
19	<i>Consent Authority</i>	<i>Penrith Council or Blacktown Council</i>	The subject site is located within the Penrith LGA and as such Penrith City Council is the consent authority.
20	<i>Development Consent Restrictions</i>	<p><i>(1) Development consent must not be granted with respect to any development on land to which this plan applies unless the consent authority:</i></p> <p><i>(a) is satisfied that the proposed development will not be inconsistent with achievement of the performance objectives, and the zone objectives and other requirements prescribed by this plan, and</i></p> <p><i>(b) has considered the development control strategies contained in the environmental planning strategy, in so far as they relate to the proposed development.</i></p> <p><i>(2) Consent must not be granted for development within a precinct unless:</i></p> <p><i>(a) there is a precinct plan for the precinct and the consent authority has taken that precinct plan into account,</i></p>	<p>The development is consistent with the performance objectives, zone objectives and other requirements contained within the REP.</p> <p>The development has been designed to align with the information within the DCS and EPS noting the diversity of housing product proposed.</p> <p>The Precinct Plan is in force and the proposal aligns with the ongoing evolution</p>

		<p>and</p> <p><i>(b) the consent authority has taken into account whether the proposed development is consistent with the terms of any relevant development agreement.</i></p> <p><i>(3) However, consent may be granted for the following development, whether or not the land concerned is within a release area declared under Part 2 or there is a precinct plan relating to the land:</i></p> <p><i>(a) on or with respect to land identified by the words “educational establishment” on the Structure Plan—development for the purpose of an educational establishment, including a subdivision to create a separate allotment for the educational establishment, and development for the purpose of related servicing infrastructure, such as roads, drainage and sewerage works, or</i></p> <p><i>(b) on or with respect to any land—development that, in the opinion of the consent authority, is of a minor nature.</i></p> <p><i>(4) Consent may also be granted for carrying out development for the purpose of any servicing infrastructure, such as roads, drainage and sewerage works, required to enable development of land in any precinct for which there is a precinct plan, whether or not the land concerned is within a release area declared under Part 2.</i></p>	<p>of the Precinct Plan.</p> <p>The development aligns with the ongoing evolution of the precinct noting that ongoing requirements of Lend Lease are unaffected by the current proposal.</p> <p>Not applicable to the current proposal.</p>
Part 5 Performance Objectives			
21	Required Outcomes for any Development	<i>The performance objectives set out in this Part describe the desired environmental, social and economic outcomes for development on the land.</i>	Noted.
22	Ecologically Sustainable Development	<i>Development on the land to which this plan applies is to be planned and carried out so that it supports the goal of ecologically sustainable development within the region declared under the Act and known as the Sydney Region.</i>	The development proposal is designed to align with ESD Principles in that the proposal aligns with the Structure Plan and DCS.

23	Air Quality	<p><i>(1) Adverse impact on the air quality of the Blacktown City and Penrith City local government areas is to be minimised through the implementation of appropriate measures as part of any development.</i></p> <p><i>(2) Development on the land to which this plan applies should contribute to improved regional air quality by containing growth in vehicle kilometres travelled, by achieving higher than normal public transport use, encouraging walking and cycling, and promoting energy-efficient businesses and homes.</i></p>	<p>This is more of a matter for the broader Precinct Planning. However the proposal does contribute to additional housing that is walkable to the community centre and open space opportunities reducing the need for local trips to be made in vehicles to reduce vehicle emissions. The site is also in proximity to the key bus route along Lakeside Parade.</p>
24	Conservation	<p><i>(1) A representative and significant proportion of the natural values of the land are to be conserved within a regional park in order to protect the variety of Western Sydney vegetation communities, native flora and fauna species and fauna habitat.</i></p> <p><i>(2) Urban design and site planning in the Employment and Urban zones are to have regard to significant stands of trees and, where practicable, retain those trees.</i></p> <p><i>(3) Adverse impacts on the vegetation and fauna habitats within the Regional Park and Regional Open Space zones resulting from the development of areas zoned Employment or Urban are to be minimised.</i></p> <p><i>(4) Infrastructure is to be designed and located to minimise potential adverse impacts on the conservation values of the land.</i></p> <p><i>(5) Infrastructure and recreational facilities within the regional park are to be sited and constructed to minimise adverse impact on the park's natural values.</i></p>	<p>Consideration of the flora and fauna impacts have been undertaken at Precinct Planning Stage and subsequent DA's for subdivision and earthworks.</p> <p>The site is predominantly cleared and grasses cover the site, noting that the remaining trees on site are to be removed.</p> <p>The development doesn't have any discernible effect on natural habitats.</p>
25	Heritage	<p><i>(1) Regard for, and education and understanding of, the identified items of environmental heritage on the land to which this plan applies are to be promoted.</i></p> <p><i>(2) Development is not to adversely affect the heritage significance of items of environmental heritage and their</i></p>	<p>The issue of Aboriginal Archaeological Heritage has been resolved as part of previous development applications on the site and the site itself is now disturbed by virtue of the bulk earthworks.</p>

		<p><i>settings.</i></p> <p><i>(3) The Aboriginal community is to be given the opportunity to comment regarding any potential impacts of development on, and proposals for mechanisms for the management of, items of Aboriginal heritage significance.</i></p>	
26	Community Services	<p><i>(1) Development of the land to which this plan applies is to integrate community services with land use planning.</i></p> <p><i>(2) The full range of human services and community facilities infrastructure appropriate to the changing needs of the community is to be provided in a timely manner, including the provision of basic or core services and facilities in the early stages of the development of each precinct.</i></p> <p><i>(3) The amenity of the Blacktown City and Penrith City local government areas is to be promoted through the provision of on-site services and facilities, and through complementing or augmenting existing service networks.</i></p> <p><i>(4) Equitable access to services and facilities is to be promoted for all groups and individuals in the community.</i></p> <p><i>(5) Community participation is to be encouraged in the identification of community service and facility needs.</i></p>	Not relevant to current development proposal.
27	Open Space and Recreation	<p><i>(1) A range of open space and recreation areas and facilities for passive and active recreation is to be provided, including local playgrounds and neighbourhood parks.</i></p> <p><i>(2) The accessibility and utility of open space areas are to be maximised to allow use by the community.</i></p> <p><i>(3) Recreational activities and facilities within each precinct are to be located and designed to maximise conservation of the cultural and natural environmental values of buildings, works and places within the precinct.</i></p>	Not relevant to current development proposal.
28	Watercycle	<p><i>(1) During and following construction, impacts upon water quality are to be minimised, through the utilisation of effective erosion and sediment control measures in accordance with industry</i></p>	The proposal provides for a stormwater management system that integrates with the remainder of the release area. During

		<p><i>standards.</i></p> <p><i>(2) The use of the land to which this plan applies is to incorporate stormwater management measures that ensure there is no net adverse impact upon the water quality (nutrients and suspended solids) in South Creek and Hawkesbury-Nepean catchments.</i></p> <p><i>(3) Water usage on and the importation of potable water on to the land to which this plan applies are to be minimised.</i></p> <p><i>(4) Development is to be designed and carried out so as to ensure that there is no significant increase in the water table level and that adverse salinity impacts will not result.</i></p> <p><i>(5) There is to be only minimal impact upon flood levels upstream or downstream of the land to which this plan applies as a consequence of its development.</i></p> <p><i>(6) Drainage lines are to be constructed and vegetated so that they approximate as natural a state as possible. Where it is necessary to modify existing drainage lines to accommodate increased stormwater runoff from urban areas, this should be done in a manner which maximises the conservation of indigenous flora in and around the drainage lines.</i></p> <p><i>(7) Development is to be carried out in a manner that minimises flood risk to both people and property.</i></p> <p><i>(8) Changes in local flow regimes due to development are to be minimised for rainfall events up to the 50% AEP rainfall event.</i></p> <p><i>(9) Gross pollutants are to be collected at, or as close as possible to, their source or at all stormwater outlets, or at both of those places, so that there is no increase in sediment/litter entering the creeks as a result of development.</i></p>	<p>construction erosion and sediment control measures will be provided to ensure downstream impacts are minimised.</p>
29	Soils	<p><i>Development is to have regard to soil constraints to ensure that the risk of adverse environmental and economic impacts is minimised.</i></p>	<p>Appropriate measures will be put in place to mitigate salinity impacts (slab treatments etc).</p>

30	Transport	<p>(1) Development should support creation of effective public transport and bicycle links to the dominant centres and major transport nodes in the Blacktown City and Penrith City local government areas.</p> <p>(2) Public transport is to be provided early in the development of the land to which this plan applies to establish use patterns.</p> <p>(3) Development of the land to which this plan applies is to maximise accessibility to services and facilities for people who do not have access to a private car.</p> <p>(4) Development of the land to which this plan applies is to effectively link that land into the surrounding road network and traffic generated by the development is to be catered for at a satisfactory level of service.</p> <p>(5) Provision of transport infrastructure and services is to be coordinated with the staging of development on the land.</p> <p>(6) Urban form is to maximise the potential for public transport, walking and cycling to replace car travel, with an overall net neighbourhood density target of at least 15 dwellings per hectare.</p> <p>(7) High trip-generating uses such as employment development, retailing and multi-unit housing are to be concentrated adjacent to major public transport routes and nodes.</p> <p>(8) The overall development of land to which this plan applies is to include a range of land uses sufficient to minimise demand for travel outside the land to which this plan applies.</p> <p>(9) Public transport infrastructure and services are to be provided to a level sufficient to achieve a significantly higher use of public transport compared to other similar development in the Blacktown City and Penrith City local government areas.</p>	<p>As addressed the proposal provides additional housing in proximity to the local centre and open space facilities. This encourages alternative means of transportation such as walking and cycling and the proposal provides for appropriate connectivity to the existing street network. The net neighbourhood density exceeds 15 dwellings per hectare.</p>
31	Urban Form	<p>(1) Development of the land to which this plan applies is to result in an attractive and safe built environment</p>	<p>The development proposal has been designed after a thorough site analysis to</p>

		<p><i>which satisfies a diverse range of community needs.</i></p> <p><i>(2) Development is to integrate the new community with existing adjoining communities.</i></p> <p><i>(3) Development on the land to which this plan applies is to include:</i></p> <p><i>(a) a diverse range of building types and designs, and</i></p> <p><i>(b) residences in close proximity (that is, a comfortable walking distance) to public transport, human services and retail, community and recreation facilities, and</i></p> <p><i>(c) clearly distinguished public and private spaces, and</i></p> <p><i>(d) a legible street layout.</i></p> <p><i>(4) The overall development of the land to which this plan applies is to incorporate urban design measures to discourage crime and facilitate safety and access for disabled persons.</i></p>	<p>ascertain the most appropriate built forms on the site and the proposal provides for a diverse range of built forms to meet the ranging needs of the local community within proximity to key public transport (bus), employment, open space, and local services.</p> <p>The development proposal provides for a legible street layout and clearly defines the public/private interface at the street frontages. The design has also had regard to the bushfire constraint applying to the site.</p>
32	Employment and Business Development	<p><i>(1) The total number of jobs generated by development on land to which this plan applies (including jobs generated on the surrounding land) is to approximate the number of workers who will be resident on the land to which this plan applies after the development has been carried out.</i></p> <p><i>(2) Retail and commercial development on the land to which this plan applies is not to undermine the regional and district retail and commercial centre hierarchy.</i></p> <p><i>(3) Local retail services are to be provided in the early stages of the development of each precinct.</i></p> <p><i>(4) Noise conflict between employment or business-related development and nearby residential development is to be minimised.</i></p>	<p>The commercial precinct is substantially constructed and operating to benefit the local community. The site is within proximity to these existing services.</p>
33	Housing	<p><i>(1) Residential development on the land to which this plan applies will provide for a choice of housing and allotment types and sizes, including multi-unit housing, attached housing and detached housing.</i></p> <p><i>(2) The residential buildings in each</i></p>	<p>As addressed previously the proposal provides a range of housing including:</p> <ul style="list-style-type: none"> • 8 x Single Storey Dwellings with a built to boundary arrangement

		<i>precinct are to contain a range of housing styles and densities.</i>	<p>and double garages;</p> <ul style="list-style-type: none"> • 11 x Single Storey 'Loft' Dwellings with a built to boundary arrangement and double garages; • 25 x Two Storey Dwellings with a built to boundary arrangement and double garage; • 6 x Two Storey Dwellings with a built to boundary arrangement and double garage with studio above given the two (2) street frontages (Lots 1, 3, 5, 7, 9, 11); • 1 x Two Storey 'Attached Duplex' (Lot 34); <p>This ensures a variety of densities and offers dwellings diversity as well as differing price points for future residents.</p>
34	Energy Efficiency	<i>Development on the land to which this plan applies is to incorporate best practice energy management and implement energy efficient principles wherever possible.</i>	The overall subdivision layout and dwelling design has been informed by the lot orientation as well as things such as prevailing breezes in winter and in summer. Living and open space areas are oriented to the north where possible and appropriate measures are proposed to ensure natural heating/cooling of the dwellings (such as eaves over north and west facing windows). In addition each dwelling is provided with a BASIX certificate demonstrating a commitment to thermal and water efficiency.
35	Waste Management	<p><i>(1) Buildings are to be designed and constructed in a way that minimises the production of unnecessary waste.</i></p> <p><i>(2) Development is to facilitate appropriately designed and scaled local</i></p>	Development will be designed and constructed to minimise extent of waste generated during construction.

		<i>activities which reuse, recycle and reprocess wastes.</i>	
Part 6 Zoning			
40	Urban Zone	<p><i>(1) The objectives of the Urban zone are:</i></p> <p><i>(a) to ensure that buildings and works within the zone are primarily used for residential purposes and associated facilities, and</i></p> <p><i>(b) to limit the range and scale of non-residential uses to ensure that they are compatible with residential amenity and primarily serve local residents, and</i></p> <p><i>(c) to provide for local retailing and related services, including supermarkets, which will complement established centres in the Blacktown City and Penrith City local government areas and not have a significant adverse effect on the viability of established retail centres, and</i></p> <p><i>(d) to provide for medium density residential development in locations which provide optimum access to employment, public transport and services, while ensuring residential amenity, and</i></p> <p><i>(e) to promote home based industries where such activities are unlikely to adversely affect the living environment of neighbours, and</i></p> <p><i>(f) to ensure that development adjacent to the Regional Park zone does not have a negative impact on biodiversity or conservation within that zone.</i></p>	<p>The development proposal provides for a diverse range of housing forms on a variety of allotment sizes to align with the objectives of the Urban Zone.</p> <p>The proposal provides for a medium density scale of development located in close proximity to public transport, employment opportunities, and local services.</p>
Part 7 Development Controls			
45	Subdivision	<i>A person may subdivide land to which this plan applies, but only with the consent of the consent authority.</i>	The proposal seeks consent for subdivision.
47	Demolition	<i>A person may demolish, in part or in whole, a building on land to which this plan applies, but only with the consent of the consent authority.</i>	Not applicable.
49	Land Below the PMF Level		Not applicable.

50	Filling of Land	<i>(1) Filling of land that is below the level of the PMF before it is filled is prohibited.</i>	Not applicable.
51	Salinity and Highly Erodible Soils	<p><i>(1) The consent authority must not grant consent to the development of any land unless it has considered:</i></p> <p><i>(a) a detailed soil assessment which includes a finding of whether or not the land is at risk from salinity or contains soils which are highly erodible, and</i></p> <p><i>(b) whether the proposed development incorporates appropriate building materials, techniques and land management measures to mitigate adverse environmental and economic impacts.</i></p> <p><i>(2) The consent authority must not consent to the development of land so found to be at risk or affected, unless it is satisfied that appropriate measures have been incorporated or are able to mitigate the potential impacts.</i></p>	A salinity report (carried out previously for the site) is attached as part of the DA submission that confirms that the soils are saline- however measures will be put in place to address saline soils as part of the CC application.
52	Tree Preservation	<p><i>(1) A person must not ringbark, cut down, lop, top, remove, injure or wilfully destroy any tree, or cause any tree to be ringbarked, cut down, topped, lopped, removed, injured or wilfully destroyed by any action (including the addition of soil or drainage works around the base of the tree), except with the consent of the consent authority.</i></p> <p><i>(2) Despite subclause (1), consent is not required where:</i></p> <p><i>(a) the tree is dead, or</i></p> <p><i>(b) the tree is declared a noxious weed under the Noxious Weeds Act 1993, or</i></p> <p><i>(c) the tree is assessed as dying, in poor condition or potentially dangerous by a qualified arborist, or</i></p> <p><i>(d) the action to the tree is taken for the purpose of bush fire hazard reduction in accordance with an approved local bush fire management plan referred to in section 52 of the Rural Fires Act 1997, or</i></p> <p><i>(e) the tree is less than five metres from a building or work for which consent has been granted or which has been approved by the consent authority, or</i></p>	<p>All existing trees and shrubs are to be removed to make way for the development. However appropriate replacements will be provided in the form of street trees and shrub plantings as part of the landscaping for the dwellings.</p> <p>The proposal will not:</p> <ul style="list-style-type: none"> a) Reduce soil stability or result in land degradation; b) Impact on scenic and environmental amenity; c) Impact on wildlife habitats and corridors noting that the Riparian Corridor is reserved for this purposes; d) Result in additional soil salinity or a rising water table.

		<p><i>(f) the action to the tree is taken in accordance with a permit issued by the consent authority.</i></p> <p><i>(3) before granting a consent or permit referred to in this clause, the consent authority must make an assessment of the importance of the tree or trees concerned in relation to the following:</i></p> <p><i>(a) soil stability and prevention of land degradation,</i></p> <p><i>(b) preservation of scenic and environmental amenity,</i></p> <p><i>(c) maintenance of vegetation systems and natural wildlife habitats and corridors,</i></p> <p><i>(d) prevention of soil salinity and a rising water table.</i></p> <p><i>(4) This clause does not apply to the lopping of trees in accordance with Part 9 of the Electricity Supply (General) Regulation 1996 or section 48 of the Electricity Supply Act 1995, or to any trees under the control of the National Parks and Wildlife Service.</i></p>	Therefore the provisions of this clause are satisfied.
53	<i>Items of Environmental Heritage</i>	<i>Items of environmental heritage are identified on the Heritage Map.</i>	Not applicable and addressed as part of previous development applications on the site.
54	<i>General Heritage Considerations</i>	<i>Consent must not be granted for development of, or in the vicinity of, an item of environmental heritage unless the consent authority has made an assessment of the effect the carrying out of that development will have on the heritage significance of the item and its setting.</i>	Not applicable and addressed as part of previous development applications on the site.
55	<i>Conservation of Items of Environmental Heritage</i>		Not applicable and addressed as part of previous development applications on the site.
56	<i>Demolition of Items of Environmental Heritage</i>		Not applicable and addressed as part of previous development applications on the site.
57	<i>Access</i>	<i>(1) Development, other than for the purpose of a public road, that would enable vehicular access to The Northern</i>	Not applicable as no access to roads referred to in the clause.

		<p>Road, Palmyra Avenue or Forrester Road is prohibited.</p> <p>(1A) The consent authority must not grant development consent for development, other than for the purpose of a public road, that would enable direct vehicular access to Ninth Avenue unless it has considered the following matters:</p> <p>(a) the capacity of Ninth Avenue to accommodate any vehicular traffic resulting from the proposed development,</p> <p>(b) the effect any such vehicular traffic may have on the existing road hierarchy in the vicinity of the proposed development,</p> <p>(c) any adverse impact of the proposed development on the rural character of Ninth Avenue or its surrounds.</p> <p>(2) This clause does not apply to land identified as “educational establishment” on the Structure Plan.</p>	
58	Certain Development Prohibited	<p>Regardless of any other provision of this plan:</p> <p>(a) development described in Schedule 3 is prohibited on land shown hatched on the Zoning Map, and</p> <p>(b) development for the purpose of housing is prohibited on land that is less than 400 metres from the land in Lot 1 DP 31910, Lot 1 DP 223888 or Lot 1 DP 803832.</p>	Not applicable to current proposal.
59	Retail and Commercial Development Restricted	<p>(1) The consent authority must not grant consent to development described in Schedule 4 on land zoned Urban...</p>	Not applicable to current proposal.
60	Services	<p>Development must not be carried out on any land to which this plan applies until arrangements have been made for the supply of water, sewerage, drainage and underground power that are satisfactory to the consent authority.</p>	All proposed allotments will be serviced as part of the proposal.

St Marys Environmental Planning Strategy 2000

The St Marys Environmental Planning Strategy 2000 contains specific objectives for future development of the St Marys Release Area. It is noted that Council has adopted a number of Precinct Plan's for the release area, most relevant to this application being the Western Precinct – Precinct Plan and Development Control Strategy. The Western Precinct – Precinct Plan and Development Control Strategy Council has been prepared in accordance with the aims and objectives of the St Marys Environmental Planning Strategy 2000. It is highlighted that the proposed development has been assessed against the relevant provisions and is consistent with the Western Precinct – Precinct Plan and Development Control Strategy. As such the proposal is therefore by proxy consistent with the St Marys Environmental Planning Strategy 2000. Specific performance criteria contained within the Environmental Planning Strategy 2000 have been addressed through the relevant attached consultant reports.

St Marys Western Precinct – Precinct Plan and Development Control Strategy

A review of the St Marys Western Precinct Plan has been undertaken in the design development of the proposal. It is noted that Part 5 comprises the Development Control Strategy, and this is the section that is to be used by Penrith City Council as the basis for the assessment of Development Applications. The elements of the Precinct Plan that set out urban structure, land uses, character areas, access etc have all been considered and the proposal is consistent with the Framework Plan and Environmental Management Strategies.

Village Centre Character Area

The Precinct Plan establishes clear parameters for the character of the Village Centre, such as the incorporation of a Main Street; housing incorporated within the retail and commercial areas; the provision of public spaces; the presence of a 2.5Ha lake; along with numerous design principles.

As the site is residue Education Land the character area provisions are not as relevant to the current proposal. The majority of the design principles guiding development of the Village Centre are not directly relevant to the proposal with other development in the locality.

An address of the key provisions of the DCS are provided in the tables below.

Development Control Strategy

An assessment pursuant to the Development Control Strategy is provided in the following compliance table.

St Marys Western Precinct – Precinct Plan and Development Control Strategy – Compliance Table			
Clause	Controls	Specific Controls for DA	Comment
Part 5 – Development Control Strategy			
5A Urban Structure and Subdivision			
4.1	Framework Plan	<p><i>1. Connecting with nature: the new community will have a strong connection with the Regional Park, drawing on the sense of space and natural beauty;</i></p> <p><i>2. Establishing a vibrant village centre: the design will incorporate a Village Centre Character Area at the heart of the community serving residents of precinct and visitors from the local region;</i></p> <p><i>3. Delivering parks and wide open spaces: a range of parklands for recreation and play;</i></p> <p><i>4. Providing diversity, choice and lifestyle: provide housing choice and options to cater for a range of active and healthy lifestyles;</i></p> <p><i>5. Opportunities for business and enterprise: provide for a range of business activities which generate jobs and support the community and surrounding region; and</i></p> <p><i>6. Achieving a sustainable future: building social capacity, viable enterprise and environmentally responsive communities.</i></p>	The proposal aligns with the framework plan and delivers a diversity of housing forms across the site, all of which are located in close proximity to the Village Centre to contribute to the demand for services and facilities.
4.2	Urban Structure and Major Land Uses	<i>Village C: 660 Dwellings</i>	The proposal will contribute to the delivery of the estimated 660 dwellings within Village C.

4.3	Future Character Areas	<p><i>Village Centre</i></p> <p><i>A concept plan setting out proposals for the development of the Village Centre is required to be lodged with the first subdivision development application relating to the Village Centre. The concept plan shall incorporate the above design principles and shall outline:</i></p> <p><i>Proposed urban structure and public domain elements, including proposed land uses and proposed relationship with the Village Centre lake.</i></p> <p><i>Proposed dwelling yield and types.</i></p> <p><i>Proposed road network and car parking arrangements.</i></p> <p><i>Proposed pedestrian and cycle network.</i></p> <p><i>Proposed staging of development.</i></p>	<p>The proposal is consistent with the Concept Plan for the Village Centre, noting the development was anticipated through the excision of the lot from the school site.</p>
4.4	Subdivision Layout Principles	<p><i>Establish a permeable modified grid street system promoting connectivity and ease of movement for pedestrians, bicycles and vehicles;</i></p> <p><i>Overlay a clear and simple hike and bike network for recreation and to provide links throughout the neighbourhoods;</i></p> <p><i>Ensure a safe environment by promoting crime prevention through urban design;</i></p> <p><i>Create a legible street hierarchy through the use of appropriate types of streets responding to intended use and scale, designed to calm traffic and help identify character areas;</i></p> <p><i>Provide views of and links to the Regional Park particularly for pedestrian access, integrated with the Plan of Management for the Regional Park;</i></p>	<p>Proposal provides for an internal loop road, however it remains a logical grid pattern.</p> <p>Proximity of the site to the local centre and facilities means that walking and cycling options existing for residents.</p> <p>The studios above garages provide for 'eyes on the street' as do the location of living spaces overlooking the street network where possible.</p> <p>The street widths of 15.6m and 13.8m are of an appropriate scale to cater for the development.</p> <p>Not applicable to current proposal.</p>

		<p><i>Promote ease of movement and walkability including short block lengths to reduce vehicle speed and minimise walking distance;</i></p> <p><i>Promote connections and permeability between neighbourhoods, to the village centre and other nodes via for a clear and simple trail and path network;</i></p> <p><i>Provide an appropriate interface between neighbourhoods and the Regional Park and activate parkland edges and building frontages to promote passive surveillance and safer communities; and</i></p> <p><i>Establish housing diversity and mix within neighbourhoods and provide a variety of block sizes, enhancing permeability</i></p>	<p>Site is walkable to local facilities and recreation opportunities and street system is designed to reduce vehicle speed.</p> <p>Proximity of the site to the local centre and facilities means that walking and cycling options existing for residents.</p> <p>N/A</p> <p>The proposal provides for a diverse range of lot sizes and dwelling types that reflect the varying block lengths and sizes and to expand housing choice.</p>
4.5	Dwelling Density	<p><i>Accordingly, the applicable target dwelling density of 15 hectares is to be considered in the broader context of all relevant opportunities and initiatives to replace car travel with public transport, walking and cycling. That is, dwelling density is to be considered in conjunction with factors such as:</i></p> <p><i>The appropriate location of land uses within the precinct, such as retail, community and open space, that maximises accessibility through walking, cycling and proximity to public transport routes.</i></p> <p><i>An appropriately designed street network that promotes permeability and accessibility for pedestrians, cyclists and public transport users.</i></p>	<p>The proposal delivers 51 dwellings across 2.1Ha, which equates to 24 dwellings per Hectare that is appropriate given the location within the Village Centre which has capacity to accommodate increased densities given walkability to public transport, open space, and local services.</p>

		<p><i>Provision of a safe and useable network of pedestrian and cycle paths.</i></p> <p><i>Developer contributions, through both State and local level agreements, towards public transport initiatives and improvements.</i></p>	
4.6	Phasing of Development		Not directly relevant to current proposal.
4.7	Access and Movement		See discussion against Part 5.
4.8	Conservation of Natural Values		Not directly relevant to current proposal.
4.9	Landscape and Open Space Networks		Not directly relevant to current proposal, noting close proximity to open space and landscaped areas in the release area.
4.10	Bushfire Measures	Western Precinct Bushfire Prone	The site is bushfire prone and the design of the development has sought to introduce a perimeter road at the interface with the future riparian corridor to mitigate bushfire impacts. In addition dwellings with interface to the riparian land will require treatment to mitigate varying BAL requirements- from 12.5 to 29.
4.11	Water Cycle and Soils	<p>Soil and Water Management</p> <p>Riparian Corridors</p>	<p>The proposal provides for appropriate stormwater measures to link to the existing stormwater network.</p> <p>The proposal also does not impact on the</p>

			revegetation of the riparian corridor.
4.12	Efficient Resource Use Strategy	<p><i>Building designs are to maximise solar access and minimise overshadowing.</i></p> <p><i>The use of shading devices on windows facing east or west, i.e. the orientations which are most intensely affected by sun.</i></p> <p><i>The use of building materials and construction methods which have low energy inputs into their production, i.e. a low 'embodied' energy.</i></p> <p><i>Integration of land use and transport planning.</i></p> <p><i>The selection of energy and water efficient building services, equipment and appliances, e.g. solar powered water heating.</i></p> <p><i>The use of mechanical and electrical systems that are designed and constructed to achieve the maximum energy efficiency achievable with current technology and best practice.</i></p>	<p>The development is designed to maximise sun access to living areas and rear yards.</p> <p>Shading on northern/western orientations are provided.</p> <p>Materials are appropriate noting BASIX Certificate for each dwelling.</p> <p>Site is walkable to local centre, bus routes, and key open space areas.</p> <p>BASIX commitments achieved for each dwellings.</p>
4.13	Cultural Heritage	Various Cultural Sites.	No cultural sites on subject site.
4.14	Infrastructure and Services	Availability of Services.	Services available and clearances to be obtained with conditions of consent to reinforce this.
4.15	Community Facilities and Services		Not directly relevant to current proposal.

Part 5 – Development Control Strategy			
5A Urban Structure and Subdivision			
5.2	Street Types	- <i>Local Street: 15.6m</i>	<p>The proposal is designed with a 15.6m local street around the majority of the site. The interface with the riparian corridor is provided with a 13.8m wide road reserve (but retains the 8m carriageway) in order to provide for a reduced 2m verge with no footpath to the riparian corridor.</p> <p>This is appropriate given the interface with the corridor and the fact there is no pedestrian pathway as there is no linkage along the riparian corridor to other land- and is therefore unnecessary.</p>
5.3 Public Domain			
5.3.2	Landscape Presentation	<ul style="list-style-type: none"> - The Urban Presentation is proposed in the Parkland, Plazas/Squares, and Open Space Water Landscape Characters, or a combination of these. - The Urban Presentation will apply to those open space areas within the Precinct that lie within the denser development zones, and which serve a higher intensity and recurrence of community use. - The levels of presentation are higher than other spaces to meet the usage demands and to compliment the urban character of their locations. Parks within the Precinct that would fall within the urban presentation category include: <ul style="list-style-type: none"> ➤ Selected area of the Central Basin Park (Park B) at the Village Centre interface. 	The proposal provides for street tree plantings and a suburban streetscape presentation.
5.3.3	Public Domain Materials and Treatments	- Provide street furniture items, including seats, bins, and picnic tables at locations where users are most likely to require them, including open space areas identified in the Western Precinct Open Space Masterplan.	Not applicable to current proposal.

		<ul style="list-style-type: none"> - Signage, street furniture and lighting is to be: <ul style="list-style-type: none"> ➤ designed to reinforce the distinct identity of the development; ➤ coordinated in design and style; and ➤ located so as to minimise visual clutter and obstruction of the public domain. - Footpath and cycle path paving should provide a hard wearing, cost effective and maintainable surface. The range of materials should be limited to make maintenance, renewal and extension works cost effective. Potential paving materials include quality stone, asphalt and exposed aggregate. - Opportunities for integration of public art into the public domain should be identified through on-going design at the relevant DA stage. 	<p>Footpath paving will meet Council requirements.</p>
5.3.4	Street Planting Tree	<ul style="list-style-type: none"> - Landscape treatment of streets is to: <ul style="list-style-type: none"> ➤ be consistently used to distinguish between public and private spaces and between different street types within the road hierarchy; ➤ minimise risk to utilities and services; ➤ be durable and suited to the road environment and, wherever practicable include endemic native species; and ➤ maintain adequate lines of sight for vehicles and pedestrians, especially around driveways and street corners. - Local streets should incorporate native tree species that are of a height and form that reinforce the lower order of these streets in the hierarchy. - The landscape treatment should provide a continuous street tree canopy located within the road reserve between the footpath and 	<p>Street tree plantings are catered for in the road reserve width and it is expected that consent conditions will nominate required species.</p>

		<p>the kerb.</p> <ul style="list-style-type: none"> - Ground surfaces to verges and medians are to vary from maintained native grasses (adjoining the Regional Park) to maintained garden bed, pavement or turf. Soft landscape treatments, where provided, should be kept simple to reduce recurrent maintenance needs. 	
5.3.5	Lighting	<ul style="list-style-type: none"> - Vehicular street lighting is to meet relevant RTA and Austroads standards. - Pedestrian lighting should be provided close to footpath lighting, typically 3.5 to 4.5 metres at 20 metre intervals, to provide optimum illumination. - Pedestrian lighting is to be pole mounted to meet relevant Australian Standards. - Major cycle routes and pedestrian access paths are to be lit for night time usage. 	Street lighting will be provided as per Council requirements, noting given scale of proposal it is not expected that significant lighting will be required.
5.4 Character Areas			
5.4	Character Areas Village Centre-	<p>Character: Urban scale, higher density and diverse built form resulting from pattern of use</p> <p>Predominant Land Uses: Mixed use with residential, commercial, retail, community and education use.</p> <p>Typical Built Form (Typology and Design): Range of attached and detached dwellings, shop-top, warehouse and urban sleeve dwellings, apartments, retail and commercial shops, education and community buildings. Building frontages to address public space and promote passive surveillance and active streets.</p> <p>Typical Building Heights: 2-4 Storeys</p> <p>Open Space: District Park part of and adjacent to the village centre, Regional Parkland terminates the main street axis, other local parks generally within 5min walk.</p> <p>Public Transport: Generally within 5-10min walking distance of a bus stop.</p>	<p>The proposal provides for a variety of housing forms and styles in a medium density scale of development, with the housing forms varying from built to boundary forms, 'fonzi flats' facing the secondary street frontage, and dual occupancy forms- all of which are of a 1-2 storey scale.</p> <p>The residential nature of the proposal is appropriate given the site is on the fringe of the Village Centre.</p>

Concept Plans			
	Concept Plans	<ul style="list-style-type: none"> - A concept plan showing the indicative urban structure of the Precinct is required to be submitted with the first subdivision DA for the Precinct. The concept plan shall demonstrate indicative information relating to: <ul style="list-style-type: none"> ➤ Road layout and subdivision pattern. ➤ Pedestrian and cycle network. ➤ Open space network. ➤ Location and type of non-residential uses. ➤ Development staging. - The concept plan shall be revised, as required, and lodged with subsequent relevant subdivision DAs as agreed with Council. 	Completed- noting proposal consistent with concept plan.
5B Built Form Housing			
5B	Built Form Housing	<ul style="list-style-type: none"> - Dwelling types in the Western Precinct include Apartments and Live / Work dwellings. - Design guidelines for each typology are provided in Section 5.6. 	
5.6 Dwelling Types			
5.6.1	Detached Dwellings	- Not applicable.	See discussion at end of table.
5.6.2	Semi-Detached Dwellings	- Not applicable.	See discussion at end of table.
5.6.4	Integrated Housing	- Not applicable.	See discussion at end of table.
5.6.5	Studio Units	- Not applicable.	See discussion at end of table.
5.6.6	Warehouse Dwellings	- Not applicable.	See discussion at end of table.
5.7 General Housing Siting and Design Controls			
5.7.1	External Built Form and Materials – Private Domain	- The Design Guidelines to be administered by the developer will address material and finishes for use for such items as fences, walls, garages, paving, planting, roofs and building colour schemes. The Building and Siting Guidelines will be enforced under the developer covenants, and details of external materials and finishes are to be submitted with a DA.	The development proposal has been reviewed by Lend Lease and found to be appropriate and consistent with the Building and Siting Guidelines.

5.7.2	Landscaping	<ul style="list-style-type: none"> - A Landscape Plan is to be lodged with all DAs for dwellings, and is to provide the following details: <ul style="list-style-type: none"> ➤ the location of any existing trees on the property, specifying those to be retained and those to be removed; and ➤ the position of each shrub and tree species proposed to be planted. Each plant is to be identified by a code referring to a plant schedule on the plan. 	A landscape plan accompanies the development application that is consistent with the DCS in that useable landscaped areas are provided and landscaping is used strategically to break down the extent of hard stand areas.
5.7.3	Visual and Acoustic Privacy	<ul style="list-style-type: none"> - Direct overlooking of main habitable areas and private open space should be minimised through building layout, window and balcony location and design, and the use of screening devices, including landscaping. - As far as practicable the windows of habitable rooms shall be screened or adequately separated from walkways, footpaths, communal areas, driveways, windows of other dwellings and balconies above. Courtyard walls, walls of the building, screen walls and the like are an acceptable method of screening of windows. - Where overlooking of habitable rooms and private open space cannot be avoided, additional visual privacy may be achieved by: <ul style="list-style-type: none"> ➤ offsetting adjacent windows; ➤ fixed window screening; ➤ providing sill heights of at least 1.5m above floor level; or ➤ providing fixed obscure glazing. - The design of attached dwellings must minimise the opportunity for sound transmission through the building structure, with particular attention given to protecting bedrooms and living areas. - Living areas and service equipment must be located away from bedrooms of neighbouring dwellings. - In attached dwellings, bedrooms of one dwelling are not to share walls with living spaces or garages of 	The development has been designed to mitigate cross-viewing and potential noise impacts between dwellings as far as practicable. The integrated subdivision and dwelling design has enabled an appropriate level of analysis of privacy impacts and the proposal has designed out privacy impacts as much as possible given the scale of the development.

		<p>adjoining dwellings, unless it is demonstrated that the shared walls and floors meet the noise transmission and insulation requirements of the Building Code of Australia.</p> <ul style="list-style-type: none"> - Noise sensitive areas are to be located away from noise emitting sources. 	
5.7.4	Fences and Walls	<ul style="list-style-type: none"> - Front fences and walls should not be higher than 1.5 metres. However, front fences and walls can be built up to 1.8 metres in height in the Northern Road Interface Character Area for noise attenuation. - The design and materials of front fences and walls is to be compatible with the desired character of the streetscape. - Side and back fences and walls can be built up to 1.8 metres in height to achieve privacy for the rear yard. 	Fencing and walls are consistent with the DCS and it is expected that conditions will address this.
5.7.5	Garages	<ul style="list-style-type: none"> - Garages should not take up more than 50 percent of the building frontage for lots 12m wide or less, unless the dwelling is integrated housing. - Materials and colours should blend the garage doors into the main building. - For 2 storey dwellings, rooms with windows or balconies should be built above garages where possible. - Garages are to be limited to a maximum capacity of two cars, with tandem garages permitted. - Garages are to be set back behind the front most element of the house and fully integrated into the front facade. 	<p>Front loaded garages are designed to be less than 50% of lot frontages with the 2 storey forms having rooms above to minimise the dominance of garages which is further established through a diversity of materials and finishes.</p> <p>The rear loaded garages fronting the internal road are approximately 63% of the lot width however given the allotments are narrower and are rear loaded the intent of the control is not as relevant. To break down the dominance of garages every 2nd garage features a studio overlooking the internal road which results in improved streetscape presentation.</p>
5.7.6	Safety	<ul style="list-style-type: none"> - Dwellings should be designed to overlook streets and other public or communal areas to provide casual surveillance. - For residential dwellings, roller 	As addressed previously the proposal provides for street activation to the proposed road network by ensuring dwellings front the street.

		<p>shutters are not be used on doors and windows facing the street. Security railings must be designed to complement the architecture of the building.</p> <ul style="list-style-type: none"> - Pedestrian and communal areas are to have sufficient lighting to ensure a high level of safety. These areas must be designed to minimise opportunities for concealment. - Avoid the creation of areas for concealment and blank walls facing the street. 	<p>In addition the studio 'fonzi flats' provide additional surveillance over the street network.</p> <p>Street networks will be adequately lit and there are limited opportunities for concealment.</p>
5.7.7	Solar Access	<ul style="list-style-type: none"> - Areas of private outdoor space should receive at least 3 hours of sunlight between 9am and 3pm at the winter solstice. - Dwellings should also be designed to avoid overshadowing of adjacent properties and to protect sunlight access to any habitable room or private outdoor living space of adjacent buildings to less than 4 hours between 9am and 3pm at the winter solstice (21 June). 	<p>The lot orientation has sought to face open space and living areas towards the north where achievable and reasonable levels of separation are provided between dwellings to enable solar access. Lots 26-41 have also been designed with a single storey dwelling (with loft) on the northern side to ensure that shadow impacts to the dwellings facing south (and there north facing open space) are limited and 3 hours of solar access are received.</p>
5.7.8	Energy and Water Efficiency	<ul style="list-style-type: none"> - BASIX Certificate is to accompany DAs for new dwellings. - The design of dwellings should minimise heat loss and the absorption of heat through measures such the use of insulation in walls and roofs. - The design of dwellings should minimise heat loss and the absorption of heat by limiting the size of windows on the western facades of buildings. 	<p>BASIX certificate accompanies the development application.</p> <p>The dwellings are also designed with eaves and other measures to mitigate the harsh summer sun.</p>
5.7.9	Servicing	<ul style="list-style-type: none"> - Development must demonstrate that the design takes into account waste storage and collection without reducing the amenity of the dwelling or neighbouring lots. 	<p>All dwellings have sufficient space for bin storage and presentation.</p>

5.7.10	Adaptability	<ul style="list-style-type: none"> - Residential dwellings shall be designed with key design features that may achieve: <ul style="list-style-type: none"> ➤ direct access; ➤ spaces for car parking; ➤ adequate access and circulation widths; and ➤ main facilities at ground floor level. 	The single storey and loft style dwellings are able to provide for future adaptability to meet the needs of persons with disabilities.
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Dwelling Types

As shown on the submitted masterplan the proposal is designed to follow the warehouse/detached typology in the DCS, noting that the proposal is an 'Integrated Housing' development. The key controls are contained below.

Detached- Integrated Housing

Lots 1- 21 (excluding 16-18) are designed as more traditional 'detached' dwellings. A summary compliance table is provided below.

<i>Relevant Control</i>	<i>Numerical Requirement</i>	<i>Compliance</i>
Lot Size	150m ² – 269m ²	192m ² -744.7m ² : Generally Consistent noting corners and interfaces with riparian increased in size due to APZ. – see discussion.
Typical Frontage	7m-15m	8.5m-16.7m: Generally Consistent except Lot 21 due to interface with riparian for APZ. – see discussion.
Typical Depth	14m-25m	16m-28m: Generally Consistent – see discussion.
Primary Setbacks Building Garage Articulation	3m 5.5m 2m	YES: 3m-5.3m YES: Min 5.5m YES: Min 2m
Secondary Setbacks Building Garage Articulation	1.5m 2.5m 1m	YES: 1m-1.5m- Variation to Lots 15+19 YES: 2.34m Variation to Lots 15+19 YES: 1m

Side Setback	0m-0.9m	YES: 0m-1.32m
Rear Setback Building	3m	YES: 3m see comment re alfresco areas
Garage	0.9m	YES: 1m
Zero Line Depth	Max 13m	YES- 12m-13m excluding alfrescos as not enclosed.
Open Space	15% & 3m	YES: > 15% and minimum 3m
Height (Storeys)	2	YES: 2 storeys
Parking	1-2 Spaces	YES: 2 Spaces
Character Area	Village Centre	Yes

Comment on Lot Sizes and Frontages

The majority of dwellings/allotments are compliant and the minor variations are considered reasonable given the site context and interface to the riparian corridor. As the proposal is an integrated housing development the proposal demonstrates that the dwelling forms are appropriate on the site and therefore the variation to the lot size and frontage widths at the interfaces with the riparian areas.

Comments on Garages and Secondary Setbacks

The secondary setbacks to Lots 15 and 19 range from 1m-2.34m and the extent of setback proposed is considered reasonable given the articulated façade and level of address provided to the street. They also interface with the transition to the 'warehouse' style dwellings with reduced setback facing the internal loop road. Given the facades are articulated and that garages are reasonably recessed the variation is considered acceptable.

Comment on Alfresco Area at Rear

The alfresco areas encroach the 3m rear setback however given they are an open element designed as an integral open space area and do not contain enclosing walls they should be excluded from the application of the rear setback control.

Semi- Detached- Integrated Housing

<i>Relevant Control</i>	<i>Numerical Requirement</i>	<i>Compliance (Lot 34)</i>
Lot Size (Each)	125-350m ²	Yes: 253-326
Typical Frontage	5m-20m	Yes: 10.5m- 21m
Typical Depth	15m-30m	Yes: 21m
Primary Setbacks Building Garage Articulation	3m 5.5m 2m	Yes: Min 3.1m Yes: Min 6.2m Yes: Min 2.6m
Secondary Setbacks Building Garage Articulation	1.5m 2.5m 1m	Yes: Min 3.1m Yes: Min 6.2m Yes: Min 2.6m
Side Setback	0m-0.9m	0m-1200mm
Rear Setback Building Garage	3m 0.9m	Corner allotment and therefore not relevant.
Zero Line Depth	N/A	
Open Space	15% & 3m	Yes: 55-78 & > 3m
Height (Storeys)	2	Yes: 2 Stories
Parking	1-2 Spaces	Yes: 2 spaces
Character Area	Village Centre	Yes

As can be seen above Lot 34 is fully compliant with the semi-detached controls.

Warehouse

Lots 16-18 & 22- 51 (excluding Lot 34) are designed as 'warehouse' dwellings given the proximity to the centre. They face the internal roads as a means of ensuring an appropriate interface at the edges of the site where the site abuts more traditional detached dwelling forms.

A summary compliance table is provided below.

Relevant Control	Numerical Requirement	Compliance
Lot Size	150-300m ²	YES: 192-242m ² Except 22, 33, 51. See discussion re lots 22, 33, 51-
Typical Frontage	10m-15m	YES: 12.5m Noting compliance relative to building line for corner lots. See discussion re lots 22, 33, 51.
Typical Depth	15m-20m	YES: 16.2m- 18.9m
Primary Setbacks Building Garage Articulation	0m 0.5m N/A	YES: 0.26m- 3m YES: 2m- 4.8m N/A
Secondary Setbacks Building Garage Articulation	0m 0.5m N/A	YES: 1m-1.92m YES: 2m-3.8m N/A
Side Setback	0m-0.9m	YES: 0m-1.4m
Rear Setback Building Garage	0m 0m	YES: 1.03m-5.04m N/A
Zero Line Depth	Max 13m	YES: 12m- Excluding Alfresco as not enclosed.
Open Space	15% & 3m	YES: >15% & 3m
Height (Storeys)	2	YES: 2
Parking	1-2 Spaces	YES: 1-2 Spaces
Character Area	Village Centre	YES: Village Centre

Comment on Lot Sizes and Frontages: Lots 22, 33, 51

The majority of dwellings/allotments are compliant and the minor variations to the above allotments are considered reasonable given the site context and interface to the riparian corridor which means that a significant portion of the site is not 'useable' and when considering only the useable portion of the sites the allotments are close to compliance. As the proposal is an integrated housing development the proposal demonstrates that the dwelling forms are appropriate on the site and therefore the variation to the lot size and frontage widths at the interfaces with the riparian areas.

Studios

<i>Relevant Control</i>	<i>Numerical Requirement</i>	<i>Compliance</i>
Minimum Size	45m ²	No
Open Space	25m ²	No
Parking	1 Space	No
Height	1 Storey	Yes

Discussion

The proposed studios are approximately 35m² in size and do not meet the 45m² size requirement, the 25m² private open space requirement, or the parking requirements. However this is a function of their location and to ensure that garages do not unreasonably dominate the streetscape by presenting a boundary to boundary garage. The size of the studios enable reasonable amenity for occupants and when considering the proximity of the site to local services, public transport, and open space areas the variations are considered reasonable.

5. Conclusion

This Statement of Environmental Effects is prepared as part of the supporting documentation for a 51 lot subdivision with associated housing within the Western Precinct of Jordan Springs- specifically within Village 13. The proposal incorporates two (2) new roads and a laneway access point to a number of allotments as well as the required drainage infrastructure to convey stormwater from the development.

To demonstrate the suitability of the subdivision for development the current proposal incorporates housing forms across the proposed subdivision.

Following a review of the relevant planning controls, it is concluded that the proposed development is consistent with the objectives, planning strategies and detailed controls of these planning documents.

Consideration has been given to the potential environmental and amenity impacts that are relevant to the proposed development and this report addresses these impacts.

Having regard to the benefits of the proposal and taking into account the absence of adverse environmental, social or economic impacts, the application is submitted to Council for assessment and granting of development consent. Think Planners Pty Ltd recommends the approval of the application, subject to necessary, relevant and appropriate conditions of consent.

It is requested that any consent conditions be formulated and worded to enable the registration of the subdivision prior to the completion of the housing forms on the site, in order to enable sale to future residents during the construction process.



Annexure 1: Reduced Subdivision Plan

