

File no: F16/2533

20 July 2017

Catherine Van Laeren
Regional Director
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Dear Madam,

Gateway Submission of Planning Proposal - Altrove Estate Stage 7 - part of Lot 164 DP1218925, Veron Road, Schofields

We are submitting herewith a planning proposal for your consideration at the next available LEP Review Panel Meeting for a Gateway Determination.

Council prepared this planning proposal to amend State Environmental Planning Policy (Sydney Region Growth Centres) 2006 as it relates to part of Lot 164 DP 1218925, Veron Road, Schofields, to rezone land from SP2 Infrastructure (Drainage) to R2 Low Density and R3 Medium Density Residential.

The planning proposal document, relevant maps, supporting studies and Council Report are enclosed. We request that this matter be considered and a Gateway Determination issued to enable the planning proposal to proceed.

If you would like to discuss this matter further, please contact Strategic Planner, Wint KhinZaw on 9839 6424.

Yours faithfully,

A handwritten signature in blue ink, appearing to read "Fiona McDermott".

Fiona McDermott
Team Leader Release Areas

Encl. Planning proposal and attachments

BLACKTOWN CITY COUNCIL

PLANNING PROPOSAL

**Altrove Estate Stage 7 - Part of Lot 164 -
DP 1218925, Veron Road, Schofields**

July 2017

INTRODUCTION

Blacktown City Council has received a request from GLN on behalf of Stockland to amend *Blacktown Local Environmental Plan 2015* (the Blacktown LEP) to facilitate an amendment to *State Environmental Planning Policy (Sydney Region Growth Centres) 2006* (the Growth Centres SEPP) to rezone land in the vicinity of Veron Road and Altrove Boulevard, Schofields.



The proposal specifically relates to a parcel of land owned by Stockland within Stage 7 of the Altrove Estate. The subject land is zoned SP2 Infrastructure (Drainage) under the Growth Centres SEPP.



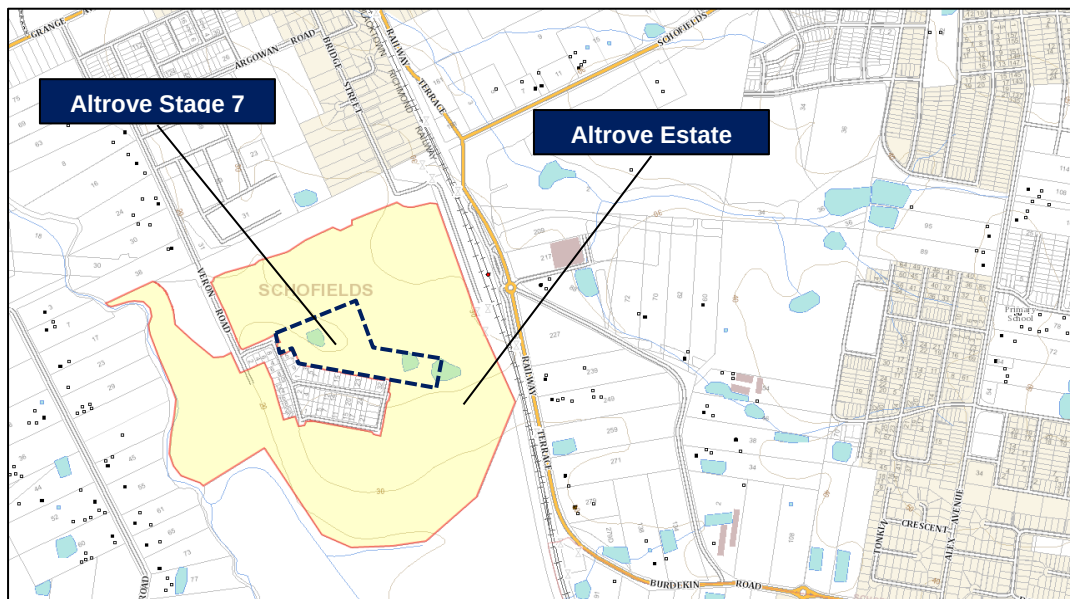
The proposal seeks to remove the portion of SP2 Infrastructure – Drainage land from the site and apply the adjoining land use zones (part R2 Low Density and part R3 Medium Density Residential) and to apply other relevant controls to the land. The request is supported by a stormwater management strategy that proposes an alternative piped drainage solution within the adjoining future road reserve.

PURPOSE

The purpose of this proposal is to facilitate the amendment of the Growth Centres SEPP to rezone the land, which may no longer be required for trunk drainage, from SP2 Infrastructure (Drainage) to part R2 Low Density Residential and part R3 Medium Density Residential and to make corresponding amendments to the Zoning, Height of Buildings, Residential Density, Floor Space Ratio and Land Reservation and Acquisition maps under the Growth Centres SEPP.

THE SITE

The subject site, known as Stage 7 of Stockland's Altrove Estate, is located at the fringe of the Schofields Town Centre. It is part of Lot 164 in DP 1218925 that has an area of 43.85 hectares. Lot 164 is a wider residue lot that will be subject to future subdivision. The site location is shown in the figure below.



The site is currently undergoing construction works to enable residential subdivision. The Richmond Rail line runs along the eastern boundary, and Schofields Station is within walking distance. To the east of the site beyond the rail line is the Alex Avenue Precinct which is the focus of new urban development.

Land to the south of the site is owned by Defence Housing Australia which is currently in the process of developing the site for urban purposes.

Land to the north of the site within the Schofields Precinct is gradually being redeveloped for residential purposes.

Eastern Creek runs along the western boundary of the site. Land beyond Eastern Creek is part of the West Schofields Precinct and is currently the subject of precinct planning.

COUNCIL CONSIDERATION

The request from GLN on behalf of Stockland to facilitate an amendment to the Growth Centres SEPP was reported to Council, at its Ordinary Meeting on 28 June 2017. At the meeting Council resolved to:

- “1. Prepare and forward a Planning Proposal to the Department of Planning and Environment requesting a Gateway Determination to rezone part of Lot 164, DP 1218925, Veron Road, Schofields from SP2 Infrastructure (Drainage) to part R2 Low Density Residential and part R3 Medium Density Residential, and make corresponding amendments to the floor space ratio, height of buildings, residential density, lot size and land reservation acquisition maps under State Environmental Planning Policy (Sydney Region Growth Centres) 2006.*
- 2. Implement any conditions attached to a Gateway Determination issued by the Greater Sydney Commission.*
- 3. Advise the proponent that Recommendation 1 does not imply or guarantee that the Planning Proposal will ultimately be supported. Council's final determination of the proposal will occur when Council resolves to adopt the Planning Proposal following exhibition and consideration of all relevant matters.*
- 4. The Planning Proposal not be finalised until Council is satisfied that satisfactory arrangements have been made to address the loss of future landscaped amenity and the increased demand for open space in the Altrove Estate.”*

Accordingly, this Planning Proposal has been prepared by Council Officers with the assistance of information provided by GLN, and in accordance with the Department of Planning & Environment's format for planning proposals as outlined in *A Guide to Preparing Planning Proposals and Guide to Preparing Local Environmental Plans*.

Consequential amendments to relevant sections of the Blacktown City Council Growth Centre Precincts Development Control Plan (BCC-GC Precincts DCP) Schedule 5 are also required to be amended to reflect the proposed changes to zoning.

This Planning Proposal is accompanied by the following supporting documents:

- Site specific Stormwater Management Report by - Mott MacDonald
- Estate wide Stormwater Manage Plan and Water Quality Report by – ADW Johnson
- Aboriginal Heritage Impact Permit (AHIP) No. 1131830 issued by – NSW Office of Environment & Heritage

THE PLANNING PROPOSAL

PART 1 - Objectives and Intended Outcomes

The objective of this Planning Proposal is:

- To facilitate the amendment of the Growth Centres SEPP to reflect the fact that an area of land in the Schofields Precinct is no longer required for stormwater drainage purposes.

The intended outcome of this Planning Proposal is to enable the affected land, which is no longer required for infrastructure purposes, to be developed in an orderly and economic manner that is consistent with adjoining lands.

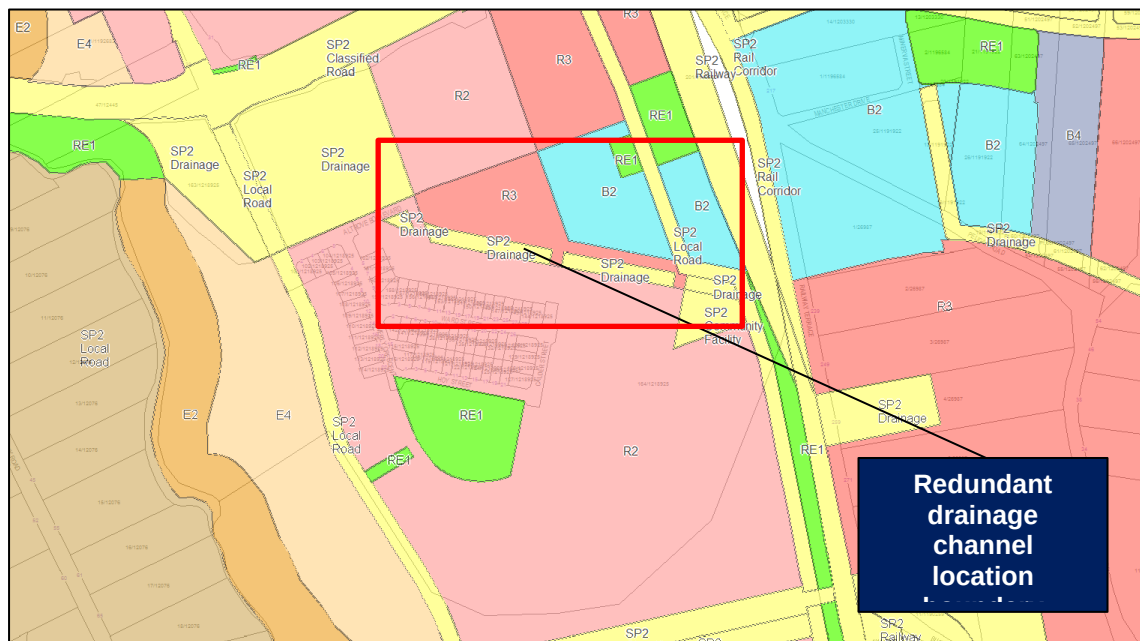


Figure 1 Current Zoning under the Growth Centres SEPP

 Subject Site

PART 2 - Explanation of Provisions

The effect of the Planning Proposal would be attained by amending the Blacktown LEP 2015 to facilitate an amendment to the Growth Centres SEPP in terms of zoning and other relevant provisions of the subject site required to achieve the objectives and intended outcomes of the Planning Proposal as outlined below:

1. Amend the Growth Centres SEPP – NWGC Land Zoning Map (Sheet 005) to remove the SP2 Infrastructure (Drainage) zone that applies to the site and replace it with an R2 Low Density Residential zone and R3 Medium Density Residential zone to be consistent with the adjoining land use zones. **Attachment 1**
2. Amend the Growth Centres SEPP – NWGC Floor Space Ratio Map (Sheet 005) to apply the floor space ratio that currently applies to the adjoining land to the north to ensure consistency. **Attachment 2**

3. Amend the Growth Centres SEPP – NWGC Dwelling Density Map (Sheet 005) to apply the 25 dwellings per hectare density to the land that will be rezoned R2 Low Density Residential and 40 dwellings per hectare to the land that will be rezoned R3 Medium Density Residential. **Attachment 3**
4. Amend the Growth Centres SEPP – NWGC Height of Buildings Map (Sheet 005) to apply the 9m height limit to the land that will be rezoned R2 Low Density Residential and apply the 16m height limit to the land that will be rezoned R3 Medium Density Residential to be consistent with the height limits that apply to adjoining land. **Attachment 4**
5. Amend the Growth Centres SEPP – NWGC Land Reservation Acquisition Map (Sheet 005) to remove the land zoned SP2 Infrastructure given the drainage function of this land is redundant. **Attachment 5**

Note: An amendment to the NWGC Lot Size Map (Sheet 005) is not required as there is no lot size provisions that apply to the subject land.

Each of the changes to these maps is explained in more detail as follows

Amendment to Land Zoning Map Sheet 005

The Land Zoning Map zones three sections of land in Altrove Stage 7 as SP2 Infrastructure – Drainage. These sections of SP2 zoned land have a combined area of 6,952m². These sections of SP2 zoned land are proposed to be deleted and replaced with 582m² R2 Low Density Residential (western wedge) and 6,370m² of R3 Medium Density Residential zoned land.

The current and proposed zones are shown side by side in **Figure 2** below.

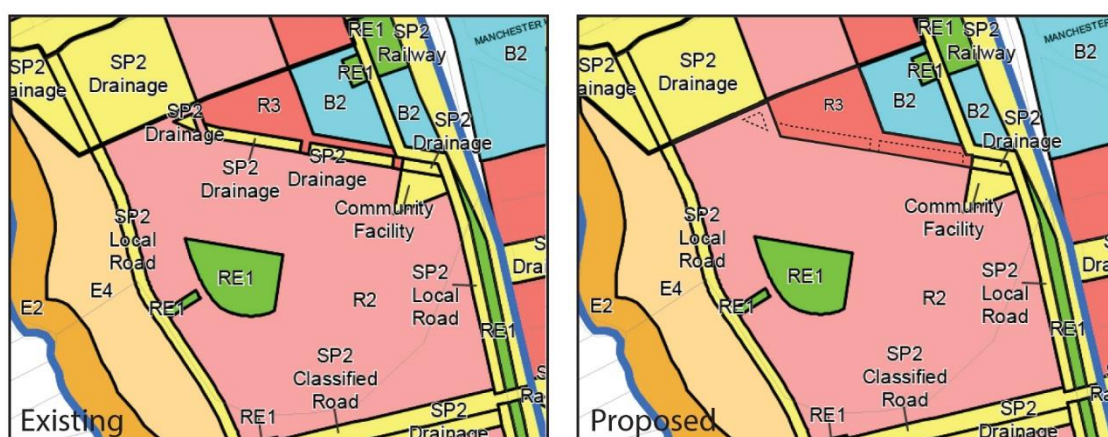


Figure 2 Changes to Land Use Zoning Map

* Note Black dashed lines on the 'Proposed' map indicate location of SP2 zoned land being deleted.

Amendment to the Floor Space Ratio Map Sheet 005

Due to the existing SP2 zoning that applies to the land, no floor space ratio currently applies to the land. For the sake of consistency, it is proposed to extend the existing floor space ratio that applies to R3 Medium Density Residential land to the north to the

sections of the SP2 zoned land that are proposed to be rezoned R3 Medium Density Residential as shown in **Figure 3** below.

For the section of SP2 zoned land that is proposed to be zoned R2 Low Density Residential, no floor space ratio is proposed to apply. This is consistent with land to the south that is zoned R2 Low Density Residential.



Figure 3 Changes to Floor Space Ratio Map

*Note Black dashed lines on the 'Proposed' map indicate location of SP2 zoned land being deleted.

Amendment to the Residential Density Map Sheet 005

Due to the existing SP2 zoning that applies to the land, no minimum residential density currently applies to the land. For the sake of consistency, it is proposed to apply a minimum dwelling density of 40 dwellings per hectare to the SP2 zoned land that will be rezoned R3 Medium Density Residential. This is consistent with the R3 zoned land to the north of the drainage channel.

For the section of SP2 zoned land proposed to be rezoned R2 Low Density Residential, it is proposed to apply a minimum dwelling density of 25 dwellings per hectare. This is consistent with the R2 zoned land to the south-west of the drainage channel. These changes are shown in **Figure 4** below.

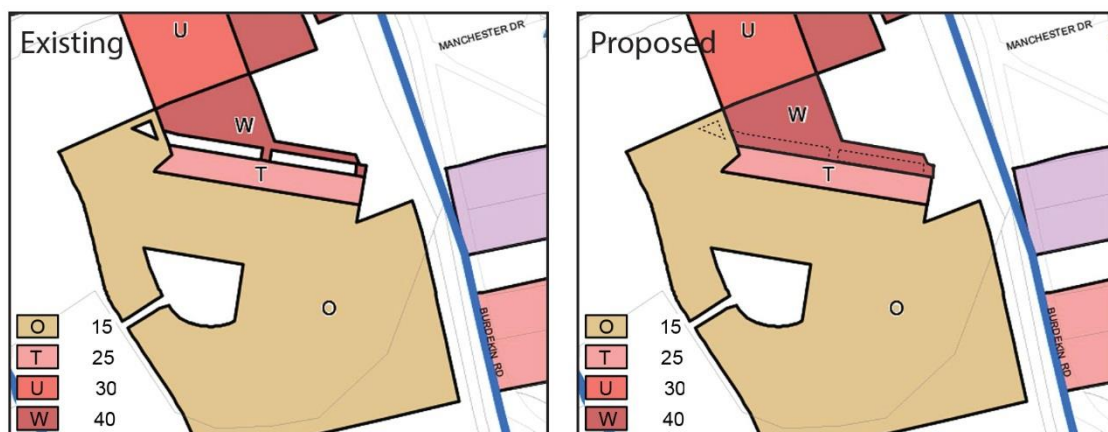


Figure 4 Changes to Residential Density Map

*Note Black dashed lines on the 'Proposed' map indicate location of SP2 zoned land being deleted.

Amendment to the Height of Buildings Map Sheet 005

Due to the existing SP2 zoning that applies to the land, no maximum building heights apply to the land. To ensure an appropriate development outcome, it is proposed to apply a maximum building height of 16m to the SP2 zoned land that will be rezoned R3 Medium Density Residential. This is consistent with the R3 zoned land to the north of the drainage channel.

For the section of SP2 zoned land proposed to be rezoned R2 Low Density Residential, it is proposed to apply a maximum building height of 9m. This is consistent with the R2 zoned land to the south-west of the drainage channel. These changes are shown in **Figure 5** below.

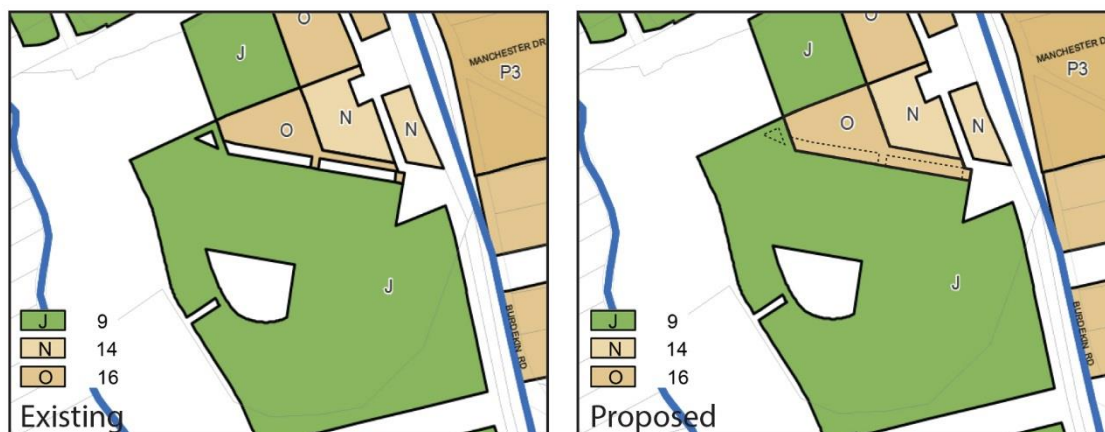


Figure 5 Changes to Height of Buildings Map

*Note Black dashed lines on the 'Proposed' map indicate location of SP2 zoned land being deleted.

Amendment to the Land Reservation Acquisition Map Sheet 005

As the SP2 zoned land was identified for a future public infrastructure item to be provided by Blacktown City Council, Council was nominated as the acquisition authority for this land on the SEPP's Land Reservation Acquisition Map.

Given the drainage channel is now redundant, it is proposed to remove this affectation from the land as shown in **Figure 6** below.

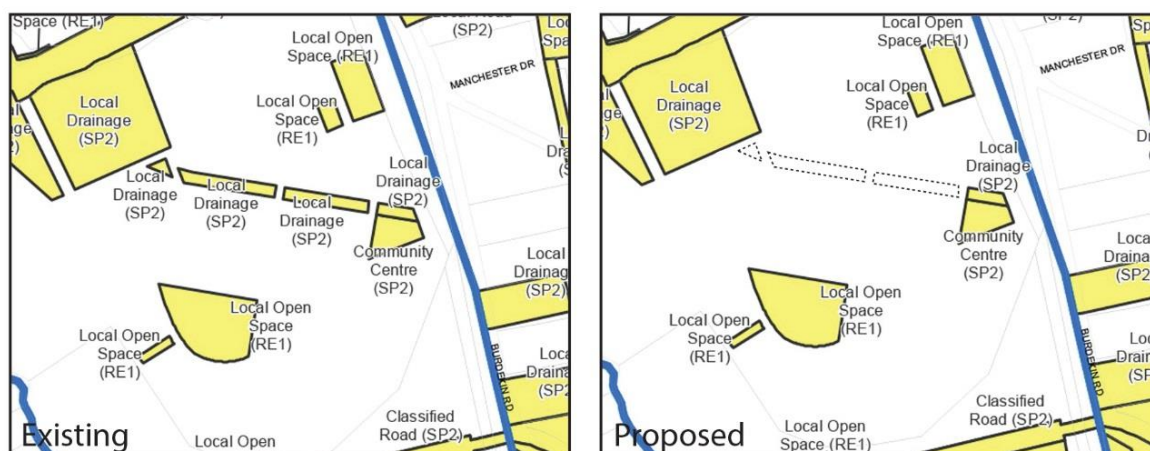


Figure 6 Changes to Land Reservation and Acquisition Map

*Note Black dashed lines on the 'Proposed' map indicate location of SP2 zoned land being deleted.

These changes will not affect the ability of these controls to maintain the development character in the vicinity.

This will facilitate the purpose of a residential development which would accommodate approximately 65 additional dwellings.

PART 3 - Justification

Section A – Need for the Planning Proposal

1. Is the Planning Proposal a result of any strategic study or report?

Strategic planning work was undertaken during the preparation of the Schofields Precinct Plan including the Indicative Layout Plan (ILP) and the SEPP Land Zoning Map.

The need for this Planning Proposal has arisen as a result of detailed design of infrastructure networks that has occurred in the vicinity of the subject site since the land was first zoned for urban purposes. It has been identified that land zoned for future trunk drainage infrastructure may no longer be required for that purpose as the alternative piped drainage solution as part of a road drainage system within the adjoining future road network, will be able to accommodate the necessary stormwater flows and flood conveyance functions. Hence the SP2 drainage zone that applies to the subject land will become redundant and the land could be suitable for residential development purposes.

The proposal is supported by Site specific Stormwater Management Report by Mott MacDonald and Estate wide Stormwater Manage Plan and Water Quality Report by ADW Johnson (Refer **Appendices A and B**).

To enable to orderly development of this land, it is necessary to amend the Growth Centres SEPP, through a planning proposal, to put appropriate zones and controls in place.

2. Is the Planning Proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

Yes. This Planning Proposal is the best means of achieving the objectives and intended outcomes of the proposal, which is to permit residential development on the subject site.

Clause 5.3 (Development near zone boundaries) of the Schofields Precinct Plan in the Growth Centres SEPP could be used to approve residential subdivision and development on the SP2 Infrastructure zoned land. However the resulting residential development parcels would be left with both an incorrect zoning and a requirement for the land to be acquired by Council for drainage purposes. This would likely confuse potential purchasers of the future development.

This Planning Proposal seeks to rectify this situation by removing the SP2 Infrastructure zoning and land acquisition affectation and replacing it with the adjoining residential zones.

In the circumstances, the Planning Proposal is the best means of achieving the objectives and intended outcomes. Amending the Growth Centres SEPP via Blacktown LEP in accordance with Section 74 of the *Environmental Planning and Assessment Act 1979*, through a Planning Proposal, is considered to be the best mechanism to make zoning and related amendments on the subject site.

Section B – Relationship to Strategic Planning Framework

3. Is the Planning Proposal consistent with the objectives and actions of the applicable regional or sub-regional strategy (including the Sydney Metropolitan Strategy and exhibited draft strategies)?

A Plan for Growing Sydney

The current Sydney metropolitan strategy *A Plan for Growing Sydney* identifies that Sydney will need around 664,000 additional homes over the next 20 years. The North West Priority Growth Area is identified within the Plan as a release growth area and includes objectives and actions to guide the development of this area which will assist with housing supply and housing choice.

The Plan identifies that greenfield development in new land releases is an important component of Sydney's overall housing supply comprising almost a quarter of Sydney's housing growth in recent years.

This proposal supports this policy by creating additional housing in an appropriate location. Development within Altrove Estate which will be assisted by clarity in the planning controls will help to achieve the aims of the Plan and assist in providing housing stock and choice that suits different needs, budgets and lifestyle choices.

West Central Subregion

Schofields is identified within the Plan as being located within the West Central Subregion of Sydney. While planning for the subregions is yet to be completed, the Plan provides guidance and overarching aims that will be further outlined as part of the detailed subregional plans.

The Planning Proposal is consistent with the objectives outlined for the West Central Subregion in that it will support the priority to 'accelerate housing supply, choice and affordability and build great places to live'.

Draft District Plan

The Draft West Central District Plan is the district strategy that applies to the Blacktown LGA. It was released in November 2016. Priorities for 'A Liveable City' are to deliver West Central District's five-year housing supply target and to deliver housing diversity.

The Planning Proposal is consistent with those priorities as it increases the capacity of residential development in the Blacktown Precincts of the North West Priority Growth Area by increasing the area of Medium Density Residential zones which also promotes greater housing diversity through an increased supply of medium density dwellings.

4. Is the Planning Proposal consistent with a Council's Local Strategy or other Local Strategic Plan?

The *Blacktown Planning Strategy 2036* is Council's key strategic land use planning document that will facilitate and manage future growth and development within the City of Blacktown to 2036. The document identifies that by 2036, Blacktown LGA is predicted to grow to approximately 500,000 people and 180,000 dwellings. A key direction under the strategy is to accommodate population and employment growth within the new release areas in the North West Priority Growth Area.

The strategic directions outlined in the plan include:

1. A vibrant and inclusive community
2. A clean and sustainable environment
3. A smart and prosperous economy
4. A growing city supported by accessible infrastructure
5. A sporting and active city
6. A leading city

The Planning Proposal is consistent with this local strategy by providing clarity to the planning controls so as to enable the provision of housing within a key growth area, along with ensuring infrastructure is provided to support the growth in population to balance demand for urban development with the need for infrastructure.

The site will be able to accommodate stormwater and ensure that pollutants are captured and not introduced into the environment achieving direction 2.

5. Is the Planning Proposal consistent with the applicable State Environmental Planning Policies?

A review of State Environmental Planning Policies (SEPPs) has been undertaken and the consistency of the Planning Proposal with the applicable SEPPs is summarised in **Attachment 1**.

This Planning Proposal does not contain provisions that will contradict or would hinder the application of these SEPPs. Further assessment against the relevant SEPPs will be undertaken during the DA stage.

The principle planning instrument affecting the Subject Site is State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (Growth Centres SEPP).

A list of SEPPs relevant to this Planning Proposal, together with notes on consistency, is shown in the table below.

SEPP	Aim	Comments
Growth Centres SEPP *Draft SEPP Amendment (Land Use & Infrastructure Implementation Plan)	Relevant aims of the Schofields Growth Centres Precinct Plan under clause 1.2 include: (a) to rezone land to allow for development to occur in the manner envisaged by the growth centre structure plan and the indicative layout for the Schofields Precinct, (b) to deliver housing choice and affordability by accommodating a wide range of residential dwelling types that cater for housing diversity, (c) to guide the bulk and scale of future development within the Precinct, *The Planning Proposal is affected by the draft SEPP which introduces density ranges and minimum lot sizes.	The Planning Proposal is consistent with the aims of the Growth Centres SEPP. The Planning Proposal seeks approval for a minor rezoning to delete redundant stormwater management infrastructure and put the adjoining land use zones and controls in place. These amendments will reduce the overall infrastructure burden on Council, allow the more orderly development of land and facilitate the aims of the Growth Centres, particular in relation to aims (a), (b) and (c). The land will be subject to a density range of 35 -55 dwellings/ha in R3 zone portion and 15-25 dwellings/ha in R2 zone portion. It will also be subject to a minimum lot size of 300m². At this stage SEPP Map amendments by this Proposal will not incorporate these proposed provisions by the draft SEPP.
SEPP 55 – Remediation of Land	Relevant considerations of SEPP 55 relating to Planning Proposals under clause 6 include: (a) the planning authority has considered whether the land is contaminated, and (b) if the land is contaminated, the planning authority is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for all the purposes for which land	By rezoning the site for urban development in May 2012, both DPE and the Minister for Planning were satisfied that the site would be suitable for residential development. This Planning Proposal remains consistent with this position. Detailed site investigations have confirmed the site is suitable for residential development subject to the removal of fly tipping material to the north of the dams. This material, as well as other remediation as required, will be carried out by Stockland as the

SEPP	Aim	Comments
	in the zone concerned is permitted to be used, and (c) if the land requires remediation to be made suitable for any purpose for which land in that zone is permitted to be used, the planning authority is satisfied that the land will be so remediated before the land is used for that purpose.	on-going development of their estate continues.

There are no other SEPPs considered to be relevant to the proposed minor amendments sought under this Planning Proposal.

6. Is the Planning Proposal consistent with applicable Ministerial Directions?

The Section 117 Ministerial Directions (under Section 117(2) of the Environmental Planning and Assessment Act 1979) provide local planning direction and are to be considered when rezoning land. The proposed amendment is consistent with Section 117 Directions issued by the Minister for Planning and Infrastructure.

The following table outlines the consistency of the Planning Proposal to relevant Section 117 directions:

Consistency with Section 117 Ministerial Directions

Direction		Consistency of Planning Proposal
1	Employment and Resources	
1.1	Rural Zones	Not applicable
1.2	Mining, Petroleum Production and Extractive Industries	Not applicable
1.3	Oyster Aquaculture	Not applicable
1.4	Rural lands	Not applicable – the site does not contain rural lands.
2	Environment and Heritage	
2.1	Environment Protection Zones	Not applicable – the subject site is clear of any vegetation and is not within an Environment Protection Zone.
2.2	Coastal Protection	Not applicable
2.3	Heritage Conservation	Not applicable –An Aboriginal Heritage Impact Permit (AHIP) has been issued over the subject site in connection with the rezoning of the site. An item of Aboriginal Archaeological significance was identified in the eastern extent of the land zoned SP2 Infrastructure as shown in the Figure 7. The AHIP permits harm to this item subject to works

		being carried out in an appropriate manner.
2.4	Recreation Vehicle Areas	Not applicable
3	Housing, Infrastructure and Urban Development	
3.1	Residential Zones	The proposal seeks minor amendments with the primary outcome being to ensure that land currently zoned for a redundant infrastructure purpose is able to be used in an economic manner. This Planning Proposal is considered to be consistent with this policy.
3.2	Caravan Parks and Manufactured Home Estates	Not applicable
3.3	Home Occupations	Not relevant to the assessment of this Planning Proposal
3.4	Integrating Land Use and Transport	Not applicable
3.5	Development Near Licensed Aerodromes	Not applicable
3.6	Shooting Ranges	Not applicable
4	Hazard and Risk	
4.1	Acid Sulphate Soils	This Planning Proposal seeks minor amendments primarily to the land use zoning. Future built form will be designed having regard to the extent, if any, of acid sulphate within the soils.
4.2	Mine Subsidence and Unstable Land	Not applicable – the site is not identified as being within a Mine Subsidence District.
4.3	Flood Prone Land	The drainage channel was identified as being flood prone on the Development Control Map in the Growth Centres SEPP. This is due to the drainage channel generally being aligned along an existing depression. The existing depression will be filled under earthworks proposed in DA-16-3946. Road No. 7A has been designed to convey stormwater flows in minor and major flood events to contain flood impacts within the road reserve. This is demonstrated in the Stormwater Management Report prepared by Mott MacDonald and accompanying DRAINS model. Earthworks over land to the north and south of Road No. 7A have been designed to ensure future dwellings will be above the 1 in 100 year Annual Recurrence Interval.
4.4	Planning for Bushfire Protection	Not applicable – the site is not bushfire prone.
5	Regional Planning	
5.1	Implementation of Regional Strategies	The Planning Proposal is consistent with the current aims outlined for the Central West Sub region under the Plan for Growing Sydney. Refer section 3.3.2 of this Planning Proposal.
5.2	Sydney Drinking Water Catchments	Not applicable

5.3	Farmland of State and Regional significance on the NSW Far North Coast	Not applicable
5.4	Commercial and Retail Development along the Pacific Highway, North Coast	Not applicable
5.5	Development in the vicinity of Ellalong, Paxton and Millfield (Cessnock LGA)	Not applicable
5.6	Sydney to Canberra Corridor	Not applicable
5.7	Central Coast	Not applicable
5.8	Second Sydney Airport: Badgerys Creek	Not applicable
6	Local Plan Making	
6.1	Approval and Referral Requirements	Not applicable
6.2	Reserving Land for Public Purposes	A Planning Proposal must not create, alter or reduce existing zonings or reservations of land for public purposes without the approval of the relevant public authority and DPE. This Planning Proposal includes the removal of an area of land nominated for acquisition under the Growth Centres SEPP map. The relevant public authority is the Council. Council agrees to its removal because the land is no longer required for the public purpose for which it was reserved for acquisition.
6.3	Site Specific Provisions	Not applicable
7	Metropolitan Planning	
7.1	Implementation of the Metropolitan Strategy	The Planning Proposal is consistent with <i>A Plan for Growing Sydney</i> and will facilitate housing growth within an identified growth area. Refer to Section B Question 3 of this Planning Proposal.

Accordingly, the proposed zoning amendment is consistent with the relevant Section 117 Directions.

Section C – Environmental, Social and Economic Impact

7. Is there any likelihood that Critical Habitat or Threatened Species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

The planning proposal will not result in any adverse effects on critical habitat, threatened species populations or ecological communities or their habitats, given the subject site is biodiversity- certified and has previously been cleared of vegetation.

8. Are there any other likely Environmental Effects as a result of the planning proposal and how are they proposed to be managed?

There are no other likely environmental effects that are anticipated to result from the zone boundary and other map adjustments.

Stormwater management

The accompanying Stormwater Management Report (**Appendix A**) confirms that stormwater flows and flood conveyance can be appropriately managed within the road reserve of Road No. 7A in accordance with Council's engineering standards.

Heritage

An item of Aboriginal Archaeological significance was identified at the eastern extent of the SP2 Infrastructure zoned land, as shown in **Figure 7** below. An AHIP has been issued for the wider Altrove estate and confirms that this item can be harmed subject to works being carried out in an appropriate manner. A copy of this AHIP is provided for Council's information at **Appendix B**.

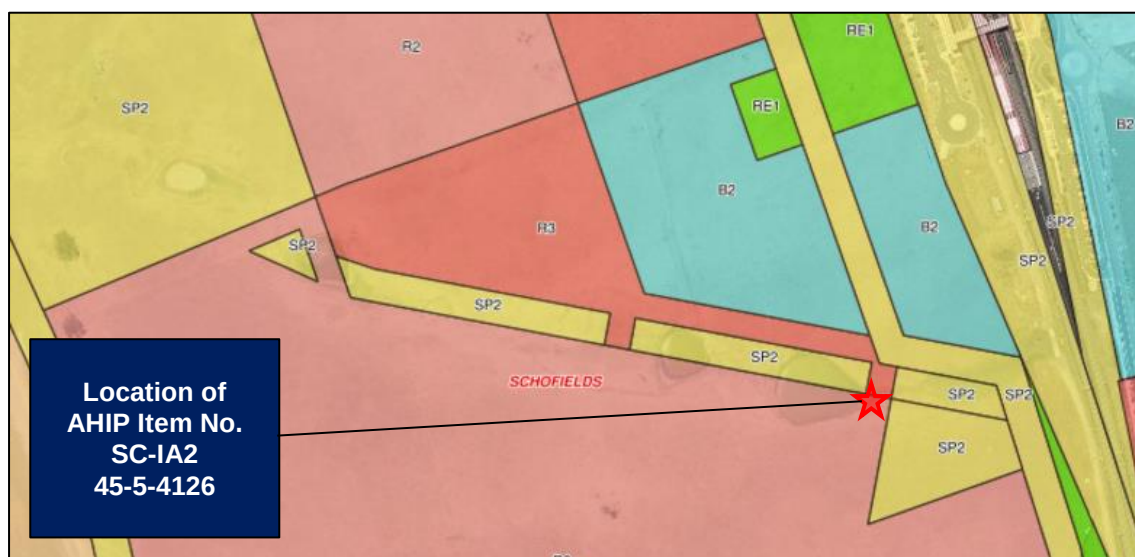


Figure 7 Location of AHIP item

Open space

The planning proposal identifies an increase of approximately 65 dwellings. Additional population could be roughly estimated as 200 people. This could in turn be translated that 0.566ha of additional open space would be required.

Stockland and GLN acknowledge the open space requirements and agree that the demand for open space will be addressed and compensated for elsewhere in the Altrove Estate in conjunction with the open space provisions required as part of Stockland's Altrove major rezoning known as Schofields Town Centre planning proposal.

9. How has the Planning Proposal adequately addressed any social and economic effects?

Social and Economic Impacts

The proposal will facilitate the delivery of residential dwellings in high demand and will not cause any significant adverse social or economic effects. Sydney is anticipated to accommodate an additional 664,000 new dwellings needed in Sydney between 2011 to 2031. Housing affordability in Sydney is a significant issue with supply being a key affordability factor. The proposal will increase the supply of residential accommodation in a strategic location, within close proximity to public transport.

The Planning Proposal seeks to improve the overall development layout of the Schofields Precinct and remove provisions that require Council to acquire drainage infrastructure land that is now not required.

The deletion of the SP2 zone from the site and application of residential zones will increase the potential residential population within the Schofields Precinct. In the context of the total 2,950 dwellings and population of 8,000 anticipated within the Schofields Precinct, this additional population is considered to be minor and will not have any significant social impacts.

The Planning Proposal removes the burden of Council having to acquire land and fund the capital cost of redundant drainage infrastructure. These cost savings are outlined in the table below. This will serve to reduce the overall cost of development contributions that apply to the Precinct.

While this does not put downward pressure on the price of land due to the cap on development contributions, it does serve to slightly reduce gap funding that could be required from the Local Infrastructure Growth Scheme.

CP Item No.	Description	Land Area	Indexed Land Value ¹	Indexed Construction Value ²
SE 5.6	Culverts	582m ²	\$32,520	\$1,018,500
SE 5.7	Open Channel	3,370m ²	\$188,280	\$636,430
SE 5.8	Culvert	N/A	\$0	\$243,720
SE 5.9	Open Channel	3,000m ²	\$167,610	\$572,570
SE 5.10	Culvert	N/A	\$0	\$220,300
SE 5.11	Open Channel	1,363m ²	\$76,150	\$255,420
Total		8,315m ²	\$464,560	\$2,946,940
Total Contribution Value Saving			\$3,411,500	

Section D – State and Commonwealth Interests

There is not considered to be any State or Commonwealth interests in this Planning Proposal other than ensuring general consistency with State Policies as detailed above.

10. Is there adequate public infrastructure for the Planning Proposal?

It is understood that the existing infrastructure has the capacity to accommodate development on the site. Accordingly, it is not anticipated that there will be any changes in demand from that associated with the approved DA development.

Any upgrades to infrastructure to support a future development on the site would be investigated and potentially form a condition of consent for the development.

The drainage channel that was to be provided on the SP2 zoned land is not required. The conveyance of the expected stormwater flows in this locality can be achieved through alternative means – i.e. within the road reserve of Road No.7A

11. What are the views of State and Commonwealth public authorities consulted in accordance with the Gateway determination?

As this rezoning is of a minor nature it is not considered necessary for the proposal to be referred to State and Federal public authorities. Consultation with the relevant State and Commonwealth public authorities can be undertaken in conjunction with the exhibition of the Planning Proposal following the Gateway Determination. Any future DA will be referred to the relevant authorities as required.

Part 4 – Mapping

The Planning Proposal is accompanied by the following relevant maps:

- Existing Land Zoning Map
- Proposed Land Zoning Map
- Existing Height of Buildings Map
- Proposed Height of Buildings Map
- Existing Floor Space Ratio Map
- Proposed Floor Space Ratio Map
- Existing Residential Density Map
- Proposed Residential Density Map
- Existing Land Reservation & Acquisition Map
- Proposed Land Reservation & Acquisition Map

These maps are compiled as **Attachment 2** to this Planning Proposal.

Part 5 - Community Consultation

The Gateway Determination will stipulate the nature and extent of required community consultation in accordance with the document 'A guide to preparing local environmental plans'.

The usual exhibition of an LEP is 28 days which is considered to be reasonable in the circumstances.

Public consultation will take place in accordance with the Gateway Determination made by the GSC in accordance with Sections 56 & 57 of the *Environmental Planning & Assessment Act 1979*.

Part 6 – Project Timeline

Mile Stones	Anticipated on the Week Commencing
☐ Forward Planning Proposal to the Department	☐ 24 July 2017
☐ Date of LEP Review Panel Meeting	☐ 21 August 2017
☐ Date of Gateway Determination	☐ 18 September 2017
☐ Completion of required technical information & Government agency consultation (Pre-exhibition)	☐ 16 October 2017
☐ Commencement of public exhibition	☐ 13 November 2017
☐ Completion of public exhibition	☐ 11 December 2017
☐ Completion of consideration of submissions & Government agency consultation (Post-exhibition)	☐ 08 January 2018
☐ Report to Council (outcome of exhibition & recommendations)	☐ 22 January 2018
☐ Council's consideration & resolution on the report	☐ 19 February 2018
☐ Date of submission to the Department to finalise the LEP	☐ 05 March 2018
☐ Finalise the LEP by the Department and Parliamentary Council	☐ 26 March 2018
☐ Publish the LEP	☐ 09 April 2018

ATTACHMENT 1

CONSISTENCY WITH SEPPs

State Environmental Planning Policies (SEPPs)	Consistent		N/A	Comment
	YES	NO		
SEPP No 1 Development Standards			✓	The Provisions of SEPP 1 do not apply to the site pursuant to Clause 1.9(2) of Appendix 7 of the Growth Centres SEPP.
SEPP No 4 Development Without Consent and Miscellaneous Exempt and Complying Development			✓	SEPP (Exempt and Complying Development Codes) 2008 applies to the site however is not relevant to the Planning Proposal.
SEPP No 6 Number of Storeys			✓	The Standard instrument definition for the number of storeys applies.
SEPP No 32 Urban Consolidation (Redevelopment of Urban Land)			✓	The SEPP is not relevant to the Planning Proposal as it is a greenfield site.
SEPP No 55 Remediation of Land			✓	Land capability and contamination assessment during the precinct planning did not identify any contamination on the subject site. Notwithstanding this, contamination will be further addressed at the DA stage.
SEPP No 60 Exempt and Complying Development			✓	SEPP (Exempt and Complying Development Codes) 2008 applies to the site however is not relevant to the Planning Proposal.
SEPP No 64 Advertising and signage			✓	SEPP 64 is not relevant to the Planning Proposal. The SEPP may be relevant to future DAs.
SEPP No 65 Design Quality of Residential Flat Development	✓			Residential flat buildings are permitted in the R3 zone under the Growth Centres SEPP and the Planning Proposal is capable of consistency with SEPP 65 for future development of the site
SEPP No.70 Affordable Housing (Revised Schemes)			✓	SEPP 70 is not relevant to proposed amendment.
SEPP (Affordable Rental Housing) 2009			✓	SEPP (Affordable Rental Housing) is not relevant to proposed amendment.
SEPP (BASIX) 2004	✓			Detailed compliance with SEPP (BASIX) will be demonstrated in a future development application for the scheme facilitated under this Planning Proposal.
SEPP (Exempt and Complying Development Codes) 2008	✓			SEPP (Exempt and Complying Development Codes) may apply to the future development of the site.
SEPP (Infrastructure) 2007	✓			SEPP (infrastructure) may apply to the future development of the site.

State Environmental Planning Policies (SEPPs)	Consistent		N/A	Comment
	YES	NO		
SEPP (State and Regional Development) 2011	✓			The future development of the site is not likely to be deemed as 'regional development' and Council will likely act as the determining authority.
Sydney Regional Environmental Plan No 18– Public Transport Corridors			✓	This SREP does not apply to the Blacktown LGA.
Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005	✓			The proposed development is not located within the foreshores and waterways area boundary. Any potential impacts as a result of development on the site, such as stormwater runoff, will be considered and addressed appropriately at DA stage.

ATTACHMENT 2

Maps

State Environmental Planning Policy (Sydney Region Growth Centres) 2006

**North West Growth Centre
Land Zoning Map - EXISTING**

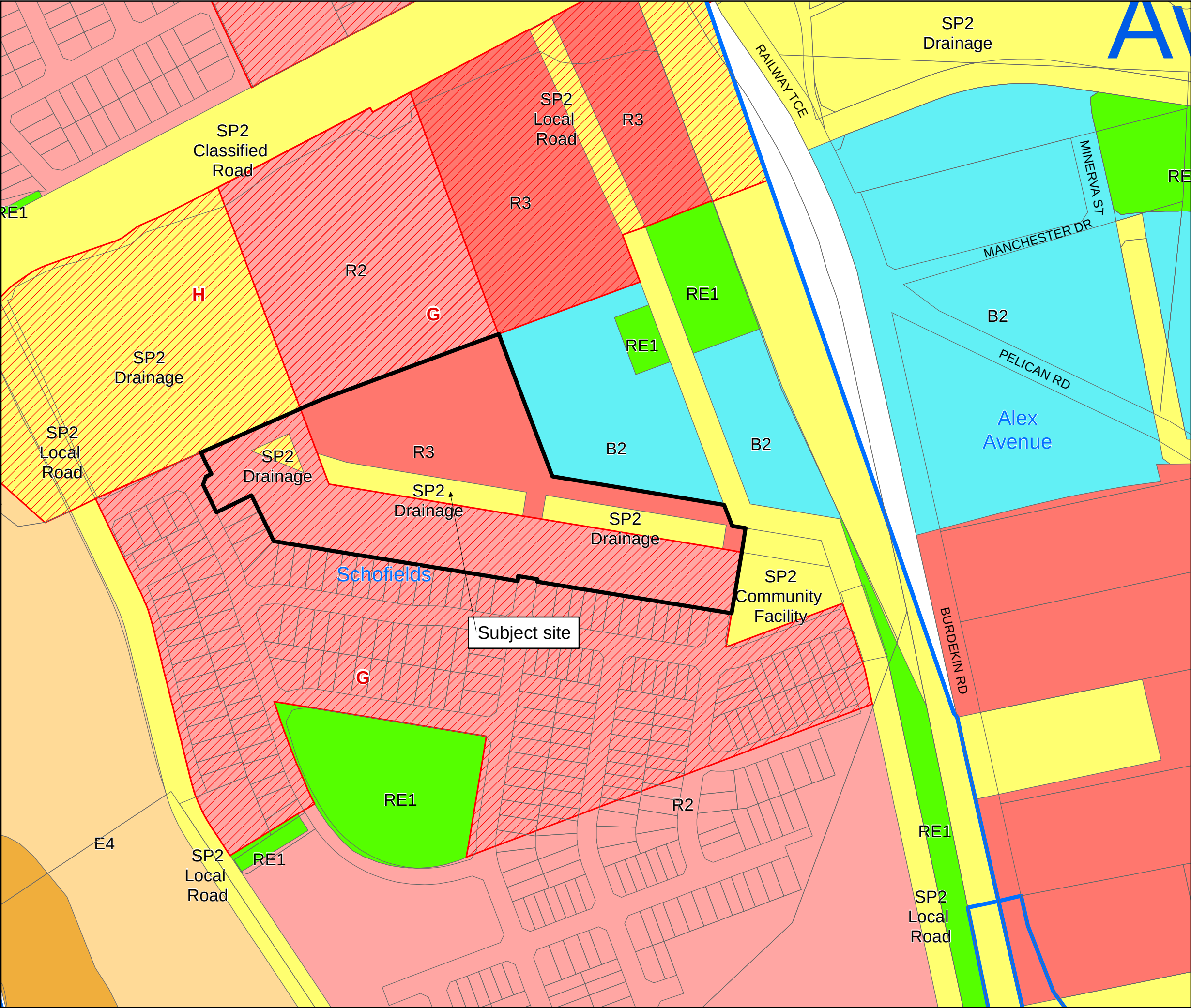
Zone	
 B1	Neighbourhood Centre
 B2	Local Centre
 B4	Mixed Use
 B5	Business Development
 B6	Enterprise Corridor
 B7	Business Park
 E2	Environmental Conservation
 E3	Environmental Management
 E4	Environmental Living
 IN1	General Industrial
 IN2	Light Industrial
 R1	General Residential
 R2	Low Density Residential
 R3	Medium Density Residential
 R4	High Density Residential
 RE1	Public Recreation
 RE2	Private Recreation
 RU6	Transition
 SP2	Infrastructure
	Subject Land
	Subject site

Special Provisions	
	Low Density Residential (multi-dwelling housing) - Appendix 4, Clause 2.5
	Riverstone Scheduled Lands - Appendix 4, Clause 6.8
	Green and Gold Bell Frog Habitat - Appendix 4, Clause 6.9
	Additional Uses - Appendix 3, Clause 6.5
	Additional permitted uses. (Clause 13)
	Take away food & drink premises permitted with consent - Appendix 5, (Schedule 1, Clause 1)
	Low Density Residential (multi-dwelling housing) - Appendix 7, Clause 2.5
	Transport Corridor Investigation Area - Appendix 7, Clause 6.10
	Transport Corridor - Appendix 12, Clause 6.10
	Food and drink premises - Appendix 12 (Schedule 1, Clause 1)
	Landfill works - Appendix 12 (Schedule 1, Clause 2)
	Gas processing system and associated plant and equipment - Appendix 12 (Schedule 1, Clause 3)

Original SEPP Zones	
	Environment Conservation
	Public Recreation - Regional

Cadastre	
	Cadastre 12/07/17 © Blacktown City Council

EXISTING



State Environmental Planning Policy (Sydney Region Growth Centres) 2006

**North West Growth Centre
Land Zoning Map - PROPOSED**

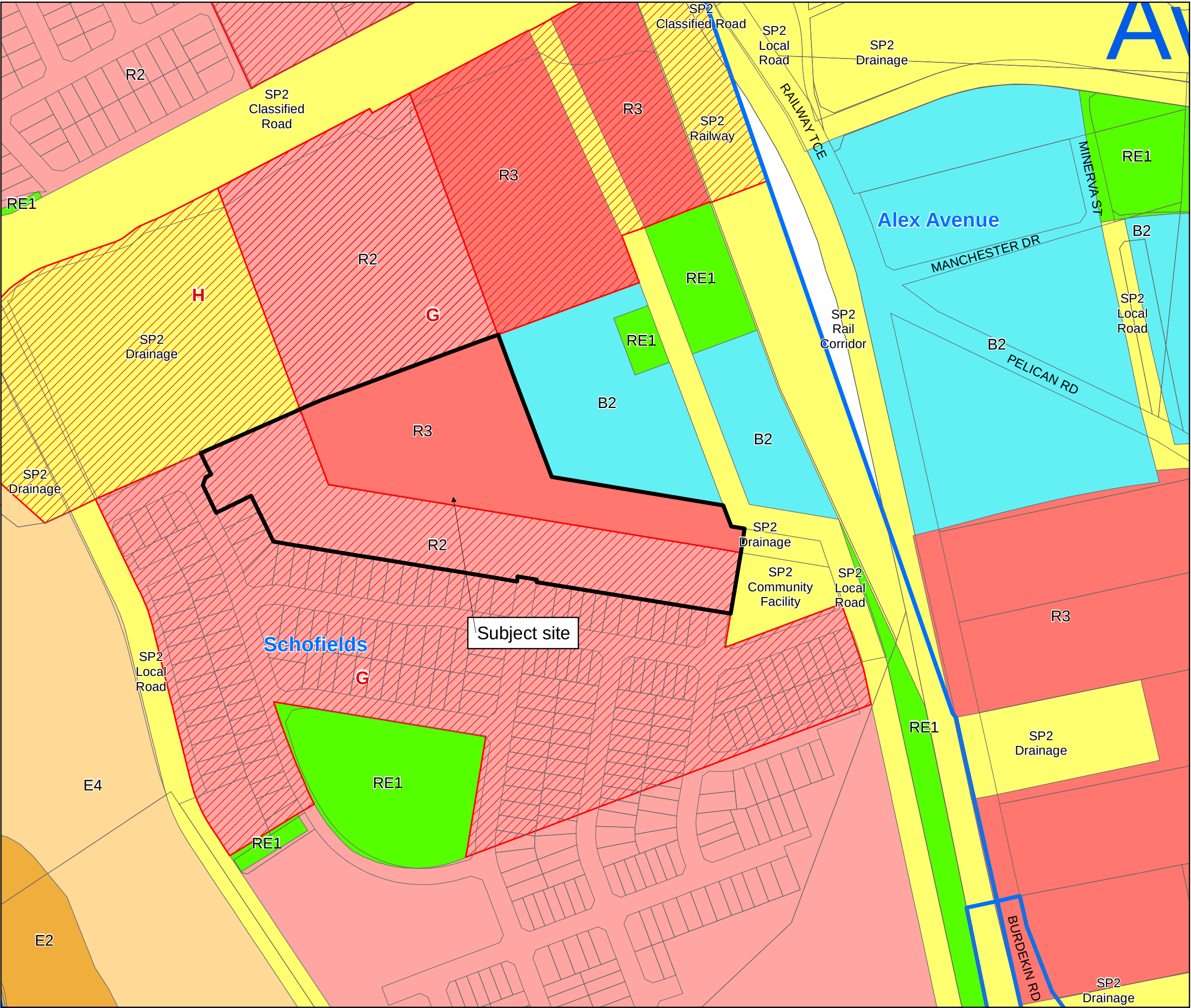
Zone	
 B1	Neighbourhood Centre
 B2	Local Centre
 B4	Mixed Use
 B5	Business Development
 B6	Enterprise Corridor
 B7	Business Park
 E2	Environmental Conservation
 E3	Environmental Management
 E4	Environmental Living
 IN1	General Industrial
 IN2	Light Industrial
 R1	General Residential
 R2	Low Density Residential
 R3	Medium Density Residential
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 RE2	Private Recreation
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 SP2	Infrastructure
	Subject Land
	Subject site

Special Provisions	
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	Transport Corridor - Appendix 12, Clause 6.10
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Original SEPP Zones	
	Environment Conservation
	Public Recreation - Regional

Cadastre	
	Cadastre 12/07/17 © Blacktown City Council

PROPOSED



State Environmental Planning
Policy (Sydney Region Growth
Centres) 2006

North West Growth Centre
Height of Building - EXISTING

LEGEND
Maximum Building Height (m)

A	0
C	5
I	8.5
J	9
K	10
M	12
N	14
O	16
P	18
P1	17
P2	17.5
P3	18.5
R	21
S	24
T1	26
T2	28

Subject site

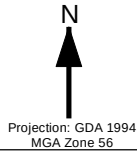
Growth Centre Boundaries

-  North West Growth Centre Boundary
-  North West Growth Centre Precinct Boundary

Cadastre

Cadastre 12/07/17 © Blacktown City Council

EXISTING



Scale: 1:3,000 @ A3



**State Environmental Planning
Policy (Sydney Region Growth
Centres) 2006**

**North West Growth Centre
Height of Building - PROPOSED**

LEGEND

Maximum Building Height (m)

A	0
C	5
I	8.5
J	9
K	10
M	12
N	14
O	16
P	18
P1	17
P2	17.5
P3	18.5
R	21
S	24
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 Subject site

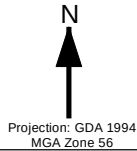
Growth Centre Boundaries

-  North West Growth Centre Boundary
-  North West Growth Centre Precinct Boundary

Cadastre

 Cadastre 12/07/17 © Blacktown City Council

PROPOSED



Projection: GDA 1994
MGA Zone 56

Scale: 1:3,000 @ A3



**State Environmental Planning
Policy (Sydney Region Growth
Centres) 2006**

**North West Growth Centre
Floor Space Ratio Map
RDN - EXISTING**

Maximum Floor Space Ratio (n:1)

B	0.4
D	0.5
F	0.6
H	0.7
I	0.75
N	1
P	1.2
S	1.5
T	2
U	2.75
V	3
W	3.5

 Subject site

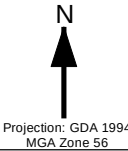
Growth Centre Boundaries

-  North West Growth Centre Boundary
-  North West Growth Centre Precinct Boundary

Cadastral

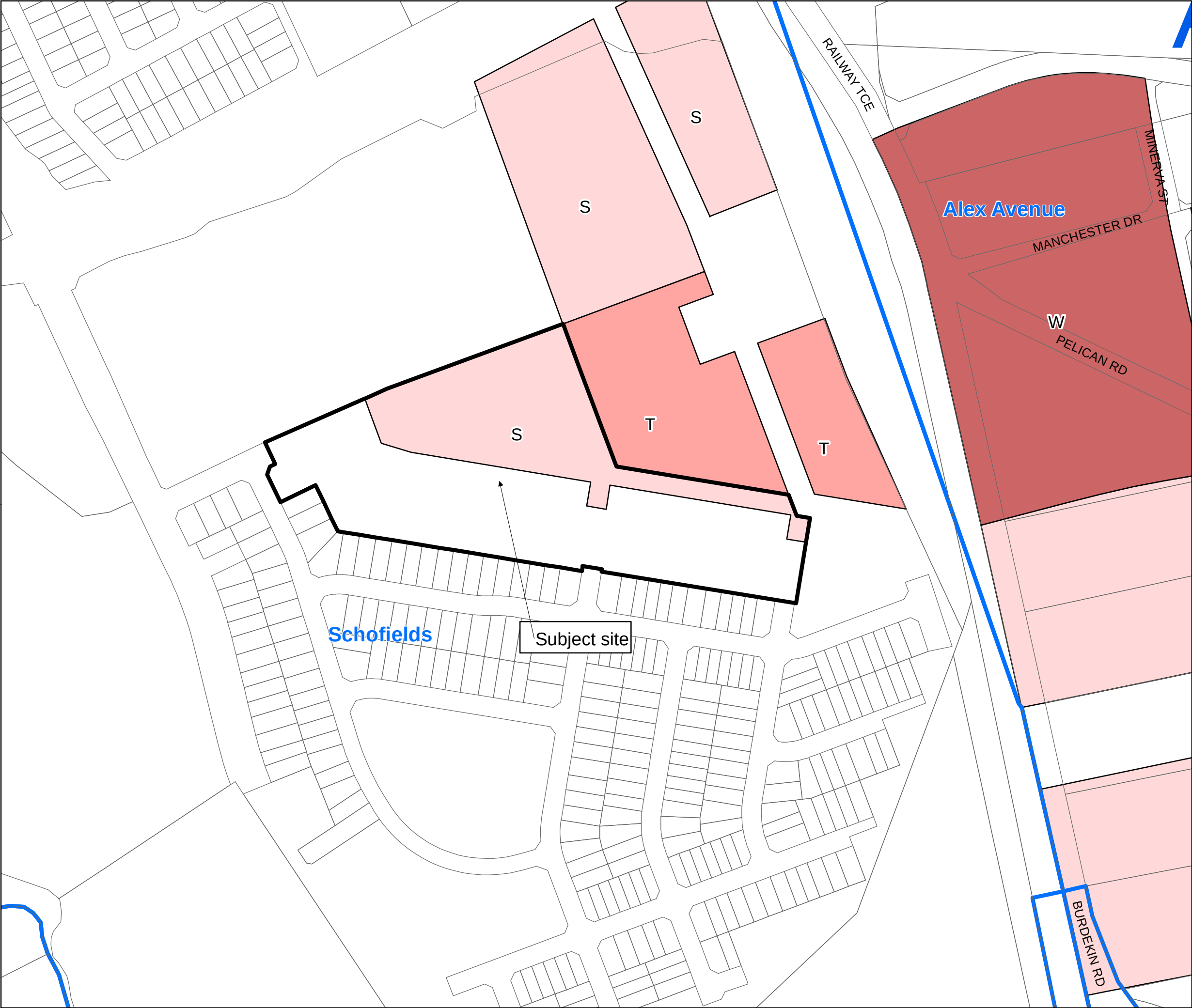
 Cadastral 12/07/17 © Blacktown City Council

EXISTING



Projection: GDA 1994
MGA Zone 56

Scale: 1:3,000 @ A3



**State Environmental Planning
Policy (Sydney Region Growth
Centres) 2006**

**North West Growth Centre
Floor Space Ratio Map
RDN - PROPOSED**

Maximum Floor Space Ratio (n:1)

B	0.4
D	0.5
F	0.6
H	0.7
I	0.75
N	1
P	1.2
S	1.5
T	2
U	2.75
V	3
W	3.5

 Subject site

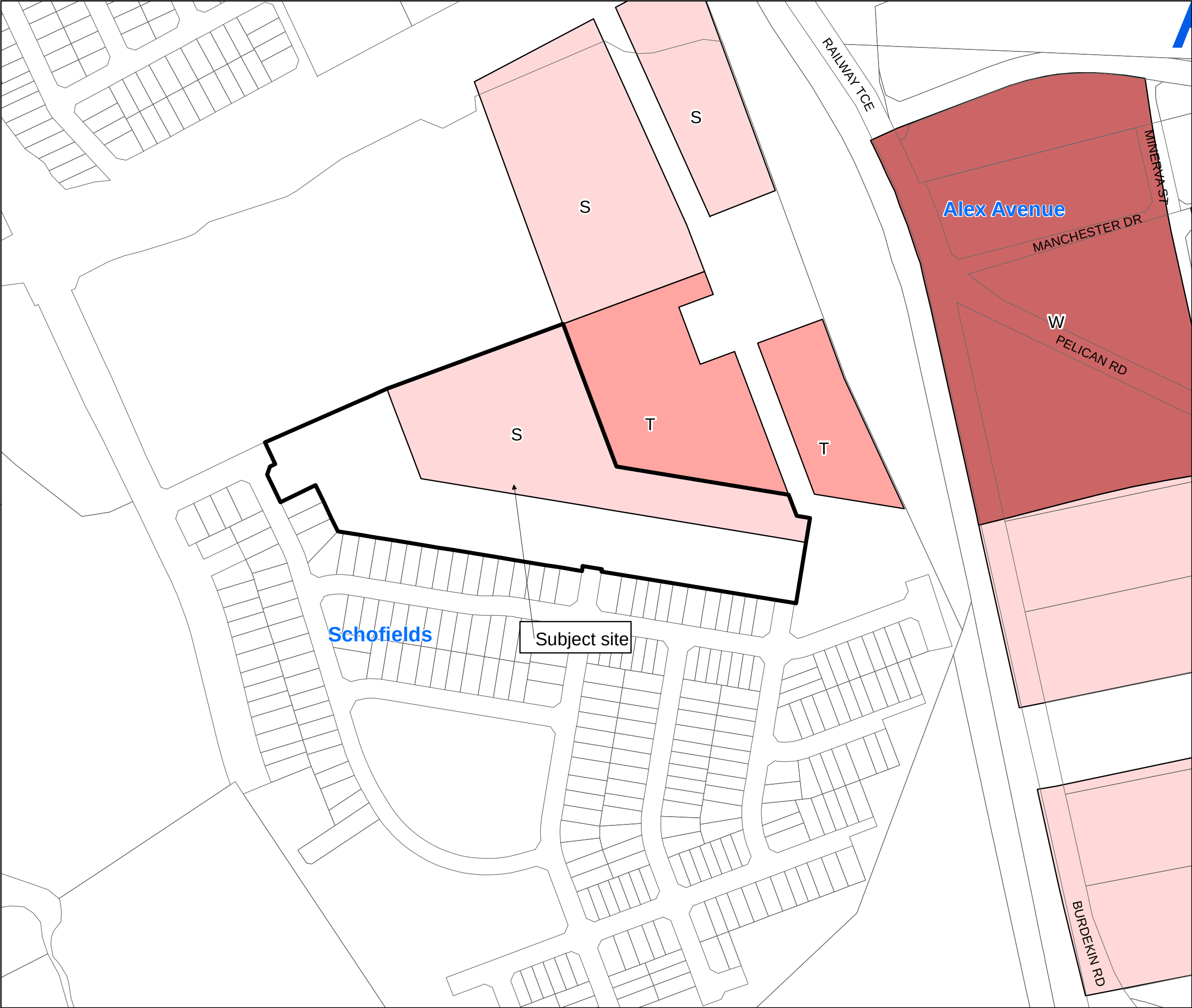
Growth Centre Boundaries

-  North West Growth Centre Boundary
-  North West Growth Centre Precinct Boundary

Cadastral

 Cadastral 12/07/17 © Blacktown City Council

PROPOSED



State Environmental Planning
Policy (Sydney Region Growth
Centres) 2006

North West Growth Centre
Residential Density Map
RDN - EXISTING

LEGEND

Dwelling Density (per hectare)

C	5
M	12.5
O	15
P	18
Q	20
T	25
U	30
W	40
X	45

Subject site

Growth Centre Boundaries

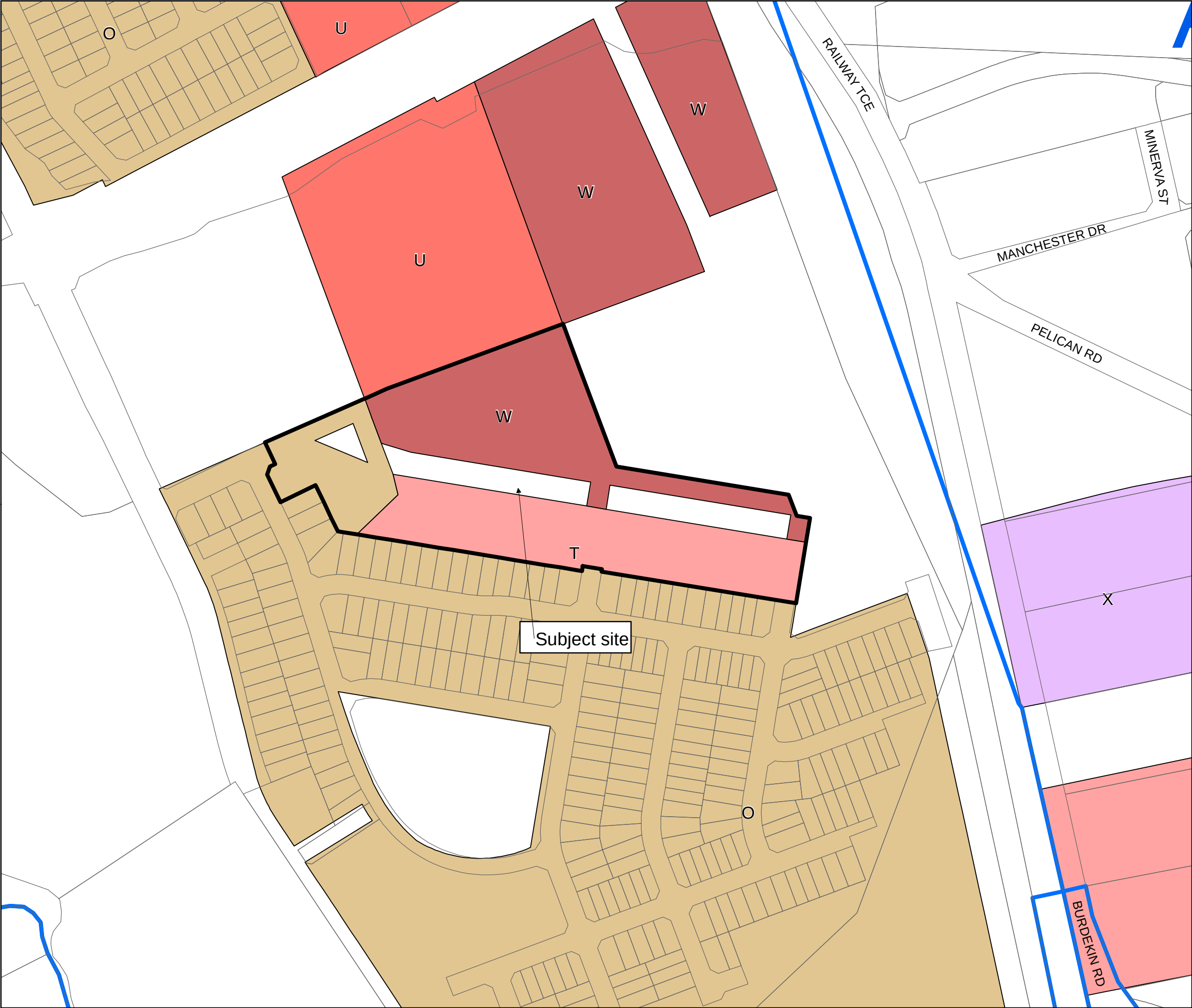
North West Growth Centre Boundary

North West Growth Centre Precinct Boundary

Cadastre

Cadastre 12/07/17 © Blacktown City Council

EXISTING



**State Environmental Planning
Policy (Sydney Region Growth
Centres) 2006**

**North West Growth Centre
Residential Density Map
RDN - PROPOSED**

Dwelling Density (per hectare)

C	5
M	12.5
O	15
P	18
Q	20
T	25
U	30
W	40
X	45

 Subject site

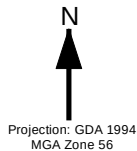
Growth Centre Boundaries

-  North West Growth Centre Boundary
-  North West Growth Centre Precinct Boundary

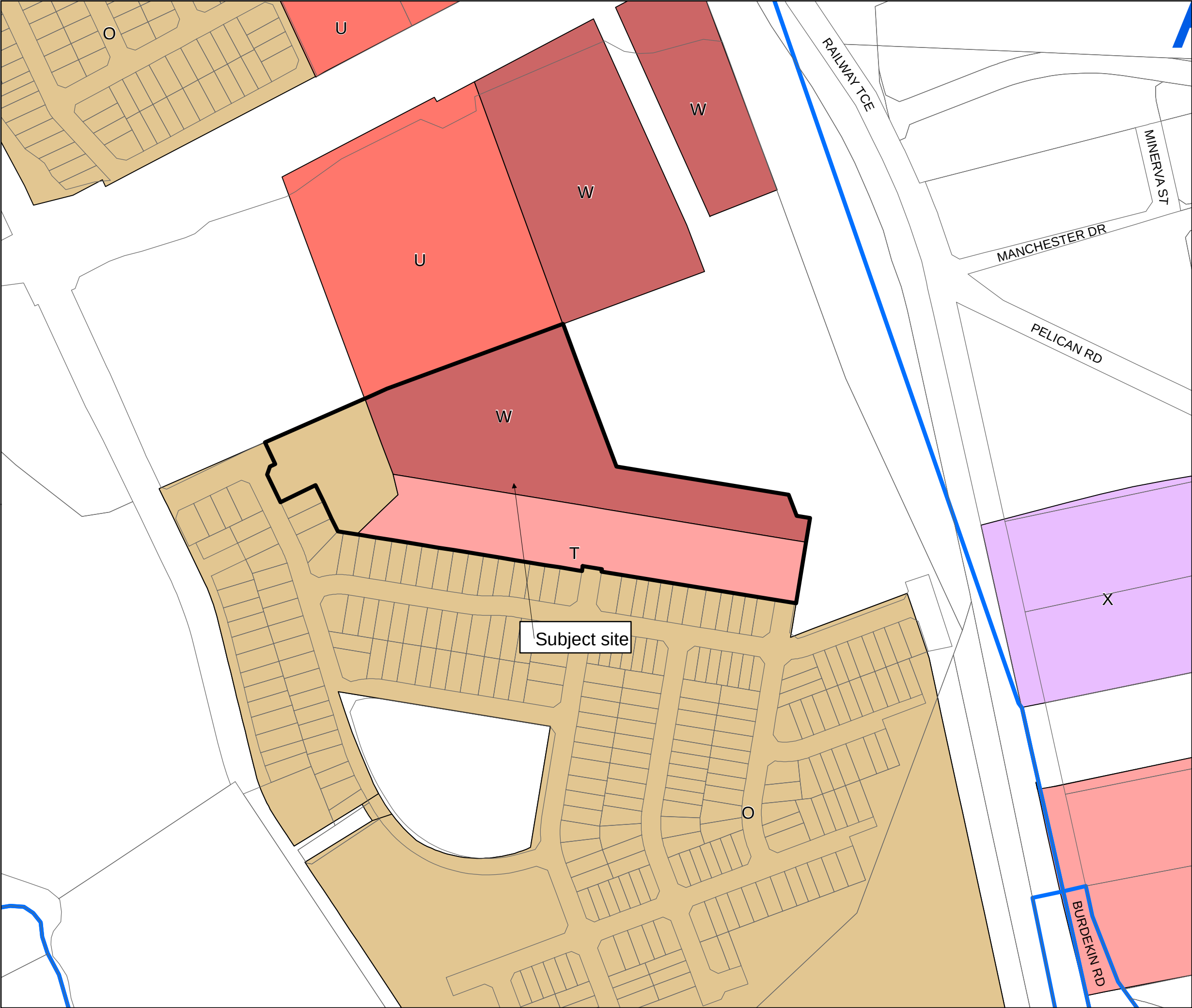
Cadastral

 Cadastral 12/07/17 © Blacktown City Council

PROPOSED



Scale: 1:3,000 @ A3



State Environmental Planning Policy (Sydney Region Growth Centres) 2006

North West Growth Centre
Land Reservation Acquisition Map
LRA - EXISTING

LEGEND

Land ReservationAcquisition

-  Classified Road (SP2)
- Classified Road Wildening (SP2)
- Community Centre (SP2)
- Environmental Conservation (E2)
- Footpath (SP2)
- Local Drainage (SP2)
- Local Open Space (RE1)
- Local Road (SP2)
- Local Road Wildening (SP2)
- Public Creation - Local (E2)
- Pumping Station (SP2)
- Railway (SP2)
- School (SP2)
- Trunk Drainage (SP2)

 Subject site

Growth Centre Boundaries

-  North West Growth Centre Boundary
-  North West Growth Centre Precinct Boundary

Cadastral

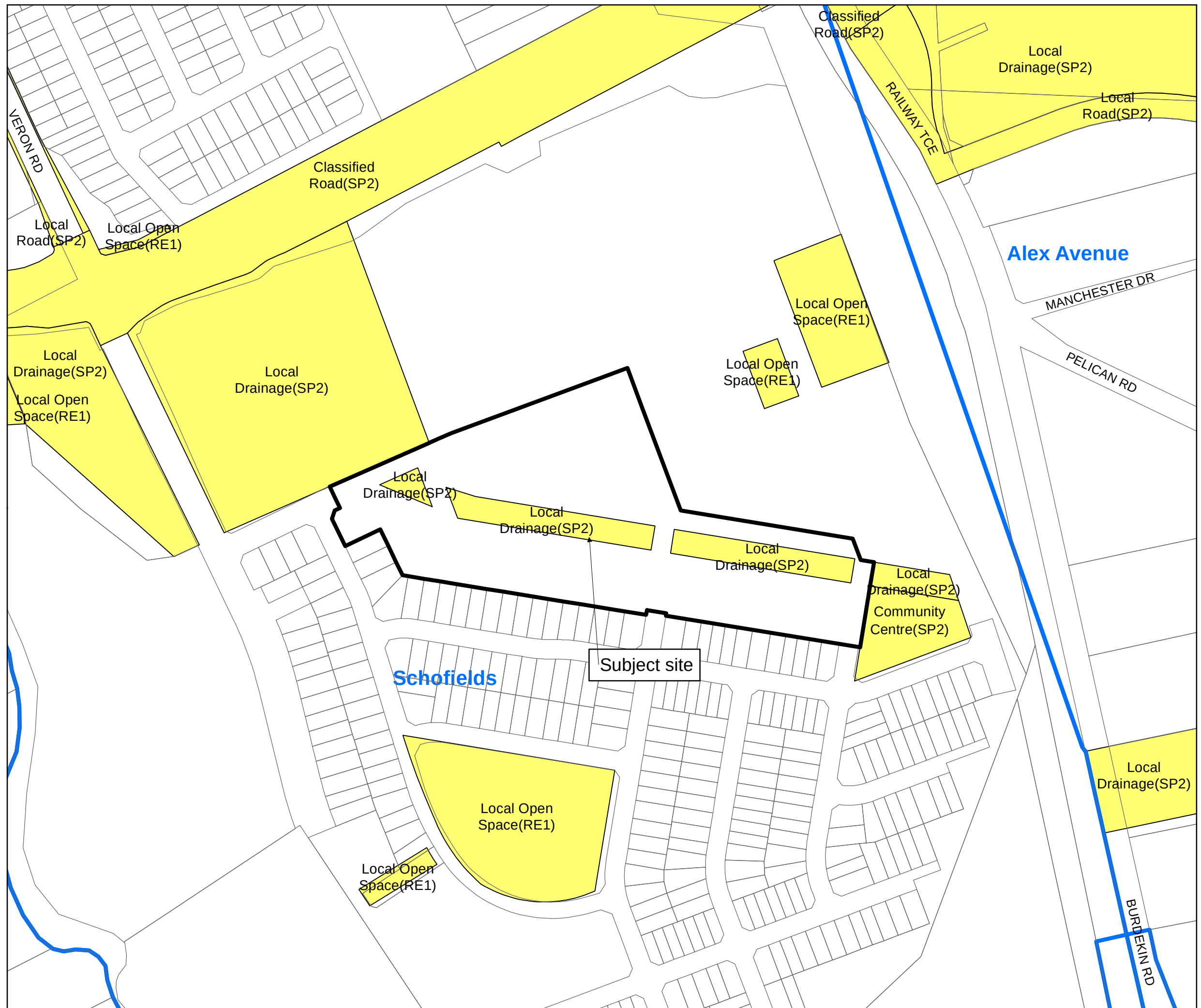
-  Cadastral 12/07/17 © Blacktown City Council

EXISTING



Projection: GDA 1994
MGA Zone 56

Scale: 1:3,000 @ A3



State Environmental Planning Policy (Sydney Region Growth Centres) 2006

North West Growth Centre
Land Reservation Acquisition Map
LRA - PROPOSED

LEGEND

Land ReservationAcquisition

-  Classified Road (SP2)
- Classified Road Wildening (SP2)
- Community Centre (SP2)
- Environmental Conservation (E2)
- Footpath (SP2)
- Local Drainage (SP2)
- Local Open Space (RE1)
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 Subject site

Growth Centre Boundaries

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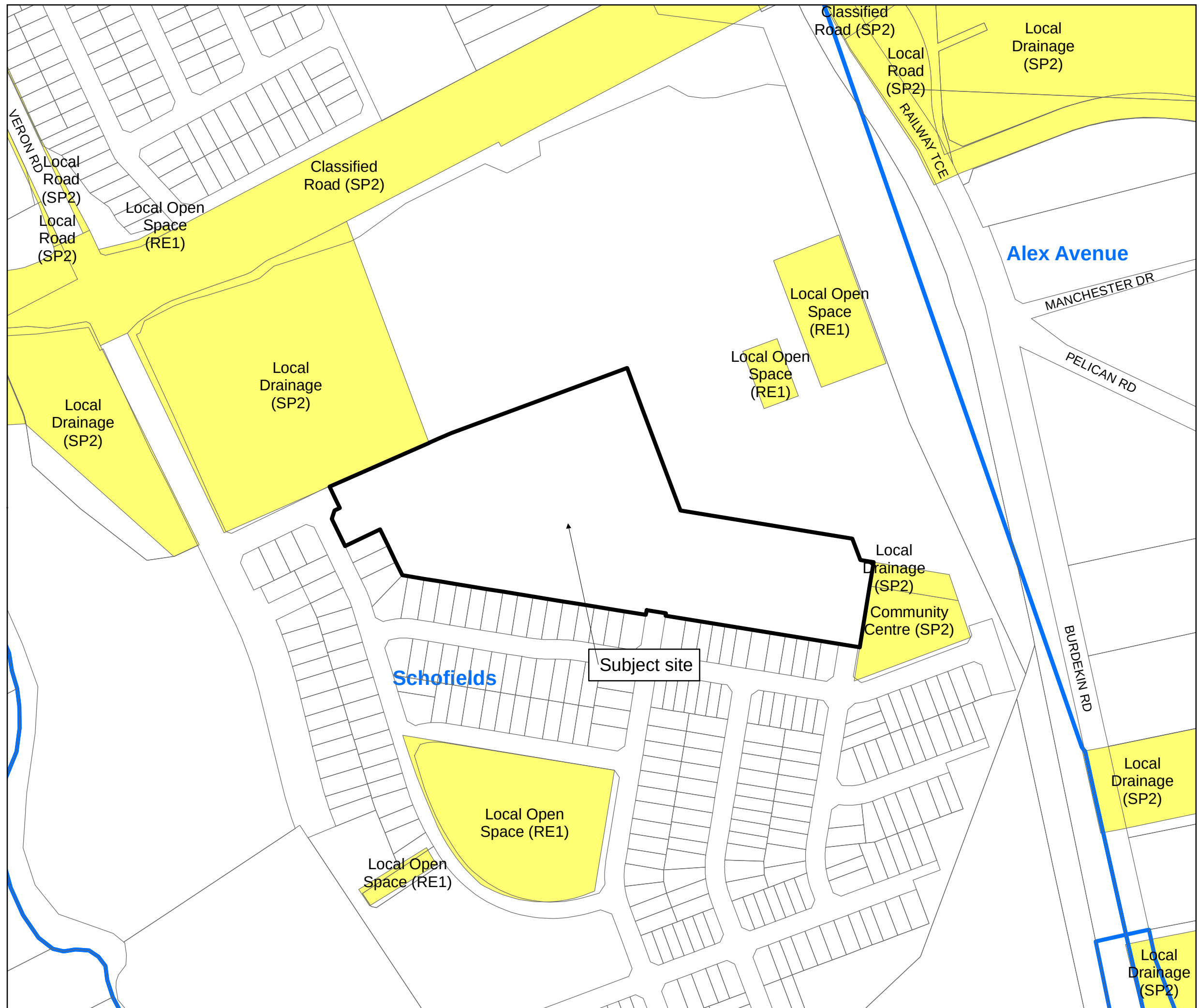
-  Cadastral 12/07/17 © Blacktown City Council

PROPOSED



Projection: GDA 1994
MGA Zone 56

Scale: 1:3,000 @ A3

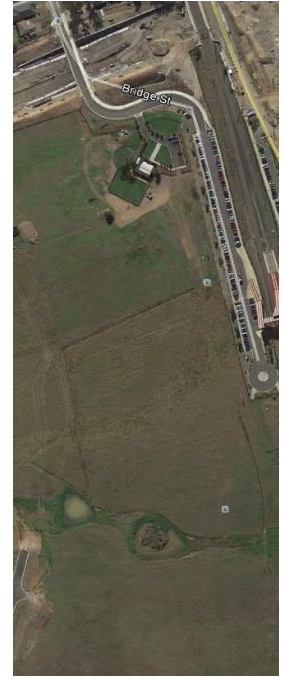


ATTACHMENT 3

Site specific Stormwater Management Report

By

Mott McDonald



Stormwater Management Report

Altrove, Stage 7A

November 2016

Stockland Development Pty Ltd

Stormwater Management Report

Altrove, Stage 7A

November 2016

Stockland Development Pty Ltd

Level 25, 133 Castlereagh Street, Sydney, NSW 2000

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description	Standard
A	10.06.16	G. Hosseini	J. Gilligan	A. Cameron	Issued For approval	
B	11.07.16	S. Reilly	J. Gilligan	A. Cameron	Issued for Approval	
C	25.10.16	J. Kafes	J. Gilligan	A. Cameron	Issued for Approval	
D	01.11.16	J. Kafes	J. Gilligan	A. Cameron	Issued for Approval	

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1 Introduction

Mott MacDonald has been commissioned by Stockland Development Pty Ltd to prepare a Stormwater Management Report for the proposed Altrove development in Schofields. The report will be lodged with Blacktown City Council to support a Development Application (DA) for Stage 7A. The report details modelling procedures undertaken and results obtained in developing a water cycle management plan for the site.

The advice, as outlined in this report, and as documented on Mott MacDonald drawings MMD-371714-C-DR-7A-DA-1000 to 1301 addresses the following engineering components:

- Understand the existing stormwater flow conditions for the site and determine requirements for post-development flows from regulatory authorities;
- Design a stormwater pipe network to convey flows throughout the site to appropriate discharge points including connecting to the existing network where applicable; and
- Assess the safety of overland flows throughout the site.

2 The Physical Environment

2.1 Site Description and Proposed Works

The site is located approximately 40km north-west of the Sydney CBD at Schofields, and falls within the Blacktown City Council Local Government Area. The proposed works are to be carried out on the vacant parcel of land adjacent to the existing development area and Schofields train station.

The proposed lot and open spaces layout has been obtained from architectural plans provided by Group GSA.

Figure 2.1: Existing Site – Stage 7A



Source: Google earth

The site area for Stage 7A of the development is approximately 2.74Ha and is bordered by:

- ☐ Schofield railway and station to the east;
- ☐ Existing industrial developments to the west;
- ☐ Developed area to the south; and
- ☐ Un-developed area to the north.

The proposed site location is shown on the General Arrangement Plan, Mott MacDonald drawing number MMD-371714-C-DR-7A-DA-1020.

2.2 Data

2.2.1 Topography

Topographic information for the site was obtained from the existing site survey provided.

2.2.2 Proposed Layout

The proposed lot layout has been obtained from the architectural plans provided by Group GSA

2.2.3 Rainfall Data

2.2.3.1 Intensity-Frequency-Duration (IFD)

IFD data was obtained from *Blacktown City Council's Engineering Guide for Development 2005*.

3 Design Controls and Guidelines

3.1 Australian Rainfall and Runoff

Prepared by Engineers Australia, *Australian Rainfall and Runoff – A Guide to Flood Estimation* was written to “provide Australian designers with the best available information on design flood estimation”. It contains procedures for estimating stormwater runoff for a range of catchments and rainfall events, and design methods for urban stormwater drainage systems.

According to the document, good water management Master Planning should take into account:

- hydrological and hydraulic processes;
- land capabilities;
- present and future land uses;
- public attitudes and concerns;
- environmental matters;
- costs and finances; and
- legal obligations and other aspects.

3.2 Development Control Plans

Development Control Plans (DCP) are an integral part of the Development Application process, providing the necessary controls for site development. Relevant Blacktown Council DCPs include:

- Blacktown City Council Development Control Plan (2006)
 - Part C – Development in the residential zones;

3.3 Drainage Design Guidelines

Council's Stormwater Drainage Design Guidelines set out the requirements for the design of stormwater drainage for urban and rural areas. The Design Guidelines outline a broad strategy for the design and development of land within the Blacktown LGA, including:

- Providing clear guidelines for drainage and civil works;
- Ensuring that developments meet all relevant standards for disposal of stormwater. Further, that developments do not increase the hazard to persons or property; and
- Catering for minor and major stormwater systems.

The policy also provides detailed requirements for hydrologic and hydraulic design with analysis of the proposed water management system including standard calculation factors.

4 Stormwater Management

4.1 Water Quantity Management

4.1.1 Major / Minor Drainage System

The major/minor approach to stormwater drainage is the recognised drainage concept for urban catchments within the Blacktown City Council Local Government Area.

The Stormwater Drainage Layout Plans, Mott MacDonald drawing numbers MMD-371714-C-DR-7A-DA-1150 and MMD-371714-C-DR-7A-DA-1153 show the proposed pipe layout for the development.

The minor drainage system is comprised of the below ground pit and pipe network and is designed to control nuisance flooding and enable effective stormwater management for the site. Council's *Engineering Guide for Development (2005)* requires urban residential developments to have the minor system designed for a minimum 10 year ARI.

The major drainage system incorporates overland flow routes through proposed hardstand, car parking and landscaped areas and is assessed against the 100 year ARI design storm event. This system also exists to cater for minor system failures. In accordance with council's requirements, the major drainage system is to be designed in a manner that ensures that personal safety is not compromised. As such, all overland flow routes for the site are to be designed so that the maximum velocity-depth product shall not exceed $0.4\text{m}^2/\text{s}$, as outlined in the NSW Floodplain Development Manual (2005).

For the purposes of this report, DRAINS software was used to calculate flows leaving the site for the proposed scenario. Stormwater pipe capacities have been designed to for the minor (10 year ARI) storm event, with safe overland flows designed for the 100 year ARI storm event. Where the major system did not meet the safety and flooding criteria, the capacity of the minor system was increased as required.

4.1.2 Detention Basins

The Stormwater Management and Trunk Drainage Strategy of Schofields report prepared by Brown Consulting indicates that On-Site Stormwater Detention requirements for the proposed development have been accommodated in a regional detention area north-west of proposed site. As such, no provision for onsite stormwater detention facilities has been modelled by Mott MacDonald as part of the Stage 7A Development Application submission.

4.2 Water Quality Management

Water quality requirements for the development area are accommodated in regional treatment facilities that are to be located downstream of the subject site. As such, provision of water quality treatment devices has not been modelled by Mott MacDonald as part of the Stage 7A Development Application submission.

5 Stormwater Modelling

5.1 Water Quantity Modelling

A hydrological model of the catchment was formulated using the DRAINS software package, and analysed to assess the performance of the site stormwater network. The DRAINS program typically performs design and analysis calculations for urban stormwater systems, modelling the flood behaviour on both rural and urban catchments.

The user data inputs required by DRAINS include: catchment areas, flow path lengths, time of concentration, pervious and impervious areas, IFD rainfall intensities and flow path roughness. Modelling is performed through the development of a network of pipes, pits and nodes to represent both the proposed and existing scenarios on site.

5.1.1 Model Parameters

In order to assess the performance of the proposed site pit and pipe network, a DRAINS base model was established with the following input parameters, as discussed below:

5.1.1.1 Hydrological Model

- Paved (impervious) area depression storage = 1 mm
- Supplementary area depression storage = 1 mm
- Grassed (pervious) area depression storage = 5 mm
- Soil type = 3

The DRAINS user guide describes type 3 soil as follows:

Type 3 (or C) slow infiltration rates (may have layers that impede downward movement of water).

5.1.1.2 Rainfall Data

- Antecedent Moisture Condition = 2.5 (10 year ARI)
- Antecedent Moisture Condition = 3.5 (100 year ARI)

Table 5.1 – DRAINS AMC Numbers

AMC Number	Description	Total Rainfall in 5 days preceding the storm (mm)
1	Completely Dry	0
2	Rather Dry	0 to 12.5
3	Rather Wet	12.5 to 25

AMC Number	Description	Total Rainfall in 5 days preceding the storm (mm)
4	Saturated	Over 25

An AMC value of 3 will generate higher runoff rates due to lower infiltration to soil when compared with lower AMC numbers. This results in a conservative approach to inlet structure, pipe and stormwater detention design.

- Design storms using IFD data obtained from Council's *Handbook for Drainage Design Criteria* were entered into DRAINS for the following durations (each for both 10 year and 100 year ARI storm events):

Storm durations: 5, 10, 15, 20, 25, 30, 45, 60, 90, 120 minute.

5.1.2 Post-Developed Catchments

In developing a DRAINS model for the proposed scenario, the site was divided into 8 main catchments. These were generally in accordance with the existing survey, proposed road level, and stage 1 to 4 drainage detail designs. From here, some of the main catchments were then consolidated into sub-catchments based on the proposed pit and pipe network, taking into account surface contours.

In order to verify the capacity of the proposed stormwater network and to minimise the number of future connections to the system, contributing flows from future residential lots adjoining the site have also been considered in the post-developed catchment layout. The catchment division for the upstream lots was based on the survey provided, with consideration given to future road and lot layouts of adjoining sites, as based on the layout from Architectural Plans provided by Group GSA.

The proposed catchment plans for the site are shown on drawings MMD-371714-C-DR-7A-DA-1300 and MMD-371714-C-DR-7A-DA1301.

5.1.3 Proposed System

For the purposes of this study, a DRAINS model was developed for the post-development scenario, which allows for the developed catchment areas upstream and downstream of the subject site with no detention facilities provided on-site.

This DRAINS model was developed based on the following methodology:

- Stormwater flows from the site are proposed to connect to the existing downstream connection pit and then into existing detention basin located at north-west of the proposed site.
- An indicative pit and pipe network was developed for the proposed siteworks (refer to civil engineering plans for details);
- Tailwater conditions at the proposed outlet for the DRAINS model have been obtained from Stormwater Management & Trunk Drainage Strategy of Schofields Tranche by Brown Consulting and it is been set as follows:
 - i. 10yr ARI = RL17.68m AHD;
 - ii. 100yr ARI = RL18.32m AHD.
- In accordance with Council's *Engineering Guide for Development*, an impervious percentage of 80% was adopted for the residential lots and 85% for the half road reserve and residential lots. For the road reserve the impervious percentage was determined from the typical road cross sections as shown on drawing MMD-371714-C-DR-7A-DA-1070;
- All paved areas are aligned within grated pits and drains;
- Due to the trapped low point at Pits A4 and B1 the piped system from Pit A4 to the outlet at A1 has been designed for 100 year storm event, with 150mm freeboard to be provided at these pits during the 100 year storm event.
- A maximum flow width in the gutter of 2m in the 10 year storm event has been designed for in accordance with Blacktown Council requirements.
- A maximum flow depth of 200mm in the 100 year storm event has been designed for in accordance with Blacktown Council requirements.
- Allowance has been made for existing and future upstream developments grading through the proposed site. Grading for the future upstream contributing development areas have yet to be finalised, however the design of the stormwater system considers the future flow contribution.
- Allowance has been made for the flows from the 2 x 675mm diameter pipes from the upstream railway corridor crossing at Pit A17. Flows at this location were provided in the Stormwater Management and Trunk Drainage Strategy, Browns October 2012. Flows of 0.8m³/s for the 10 year ARI event and 1.3m³/s for the 100 year ARI event were calculated at this point. Verification was undertaken on these flows using aerial photographs and Lidar

survey of the area. From this review the catchment area of 4.12ha with an impervious area of 5% was deemed acceptable as calculated in the Browns report. This data was input into the DRAINS model which results in flows of 0.805m³/s for the 10 year ARI event and 1.43m³/s for the 100 year ARI event. As a result the flows calculated in our verification were used as part of our design calculations.

- 10yr and 100yr ARI events were considered for all standard durations; and
- For the major system (100yr ARI storm event), a blockage factor of 0.5 for sag pits and 0.2 for on grade pits has been adopted in accordance with Blacktown Councils requirements.

5.2 DRAINS Results

Iterations were performed in the DRAINS model to determine the size of the proposed piped network, in order to satisfy major / minor system requirements as per Blacktown City Council standards.

The proposed drainage pipe system has been designed to cater for the 1 in 10 year ARI event leading to the outlet via the stormwater drainage lines. Provision has been made for overland flows regarding events greater than 1 in 10 year ARI events.

Results indicate that the major / minor system requirements are satisfied at all proposed pits in the development area and that the piped system sufficiently conveys minor storm flows with safe provision for major system flows (refer to Appendix B for DRAINS results).

Appendices

Appendix A. Catchment Plans	12
Appendix B. DRAINS Results	13

Appendix A. Catchment Plans

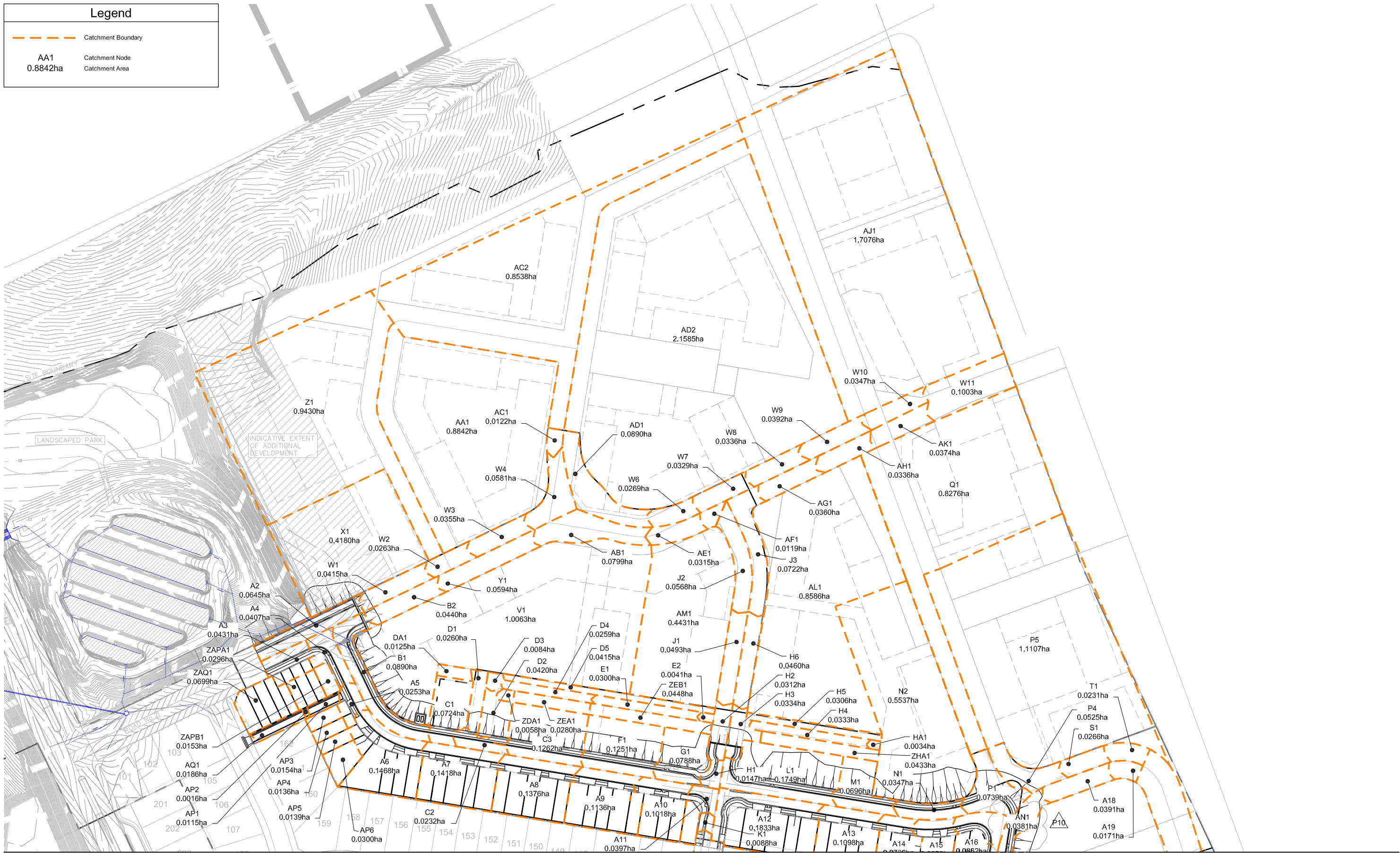
Legend

Catchment Boundary

AA1
0.8842ha

Catchment Node

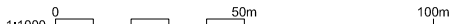
Catchment Area



For continuation refer to Dwg No 1301

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P10	01.11.16	JK	Issued for DA Approval	JG	AC
P9	25.10.16	JK	Issued for DA Approval - K3 amended	JG	AC
P8	17.10.16	JK	Issued for DA Approval	JG	AC
P7	06.09.16	AMP	Issued for DA Approval	JG	AC
P6	15.09.16	AMP	Issued for Coordination	DR	AC
P5	06.09.16	AMP	Issued for DA Approval	AC	AC
Rev	Date	Drawn	Description	Ch'k'd	App'd



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Client
Stockland Development Pty Ltd



Title
Altrove Stage 7A Schofields
Stormwater Catchment Plan
Sheet 1

Designed	G.Collins	Eng check	J.Gilligan
Drawn	A.Paciben	Coordination	J.Gilligan
Dwg check	G.Collins	Approved	A.Cameron
Scale at A1	Status	Rev	Sec
As Shown	APR	P9	STD
Drawing Number MMD-371714-C-DR-7A-DA-1300			

Preliminary - Not for Construction

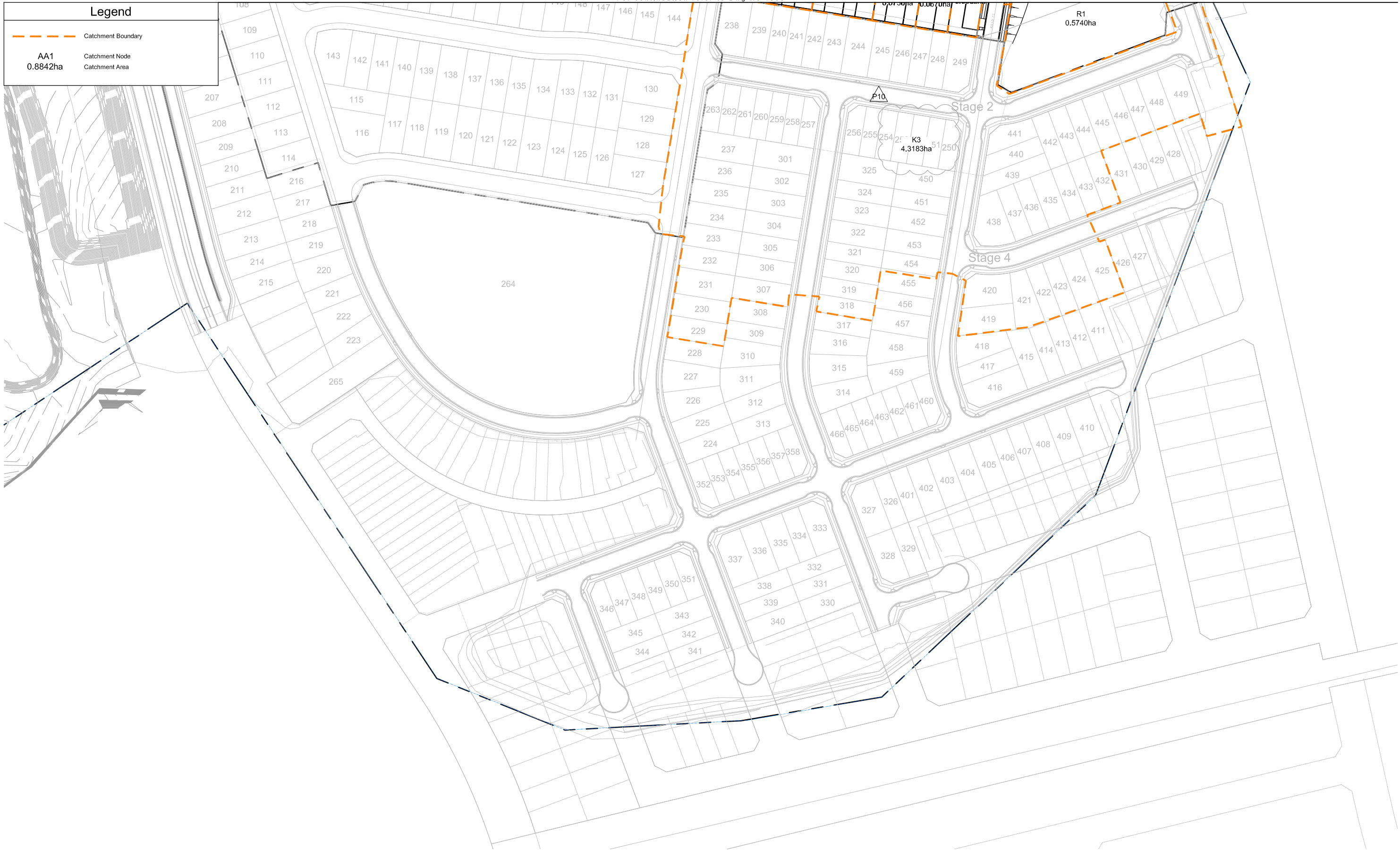
Legend

Catchment Boundary

AA1
0.8842ha

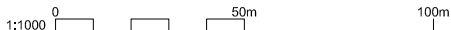
Catchment Node

Catchment Area



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P6	15.09.16	AMP	Issued for Coordination	DR	AC
P5	06.09.16	AMP	Issued for DA Approval	AC	AC
Rev	Date	Drawn	Description	Ch'k'd	App'd



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Client

Stockland Development Pty Ltd

Title
Altrove Stage 7A Schofields
Stormwater Catchment Plan
Sheet 2

Designed	G.Collins	Eng check	J.Gilligan
Drawn	A.Paciben	Coordination	J.Gilligan
Dwg check	G.Collins	Approved	A.Cameron
Scale at A1	Status	Rev	Sec
As Shown	APR	P9	STD
Drawing Number MMD-371714-C-DR-7A-DA-1301			

Preliminary - Not for Construction

Appendix B. DRAINS Results

10 YEAR ARI INPUT

PIT / NODE DETAILS

Name

Type

Family

Version 13

Size

Ponding

Volume

(cu.m)

Pressure

Change

Coeff.

Surf.

Elev. (m)

Max Pond

Depth (m)

Base

Inflow

(cu.m/s)

Blocking

Factor

x

y

Bolt-down

Id

Part Full

Shoal Loss

Inflow

Hydrograph

Pit is

New

New

New

New

New

New

New

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New

New

DETENTION BASIN DETAILS

Name

Elev

Surf. Area

Not Used

Outlet Type

K

Dia(mm)

Centre RL

Pit Family

Pit Type

x

y

HED

Crest RL

Crest Length(m)

id

81551661

SUB-CATCHMENT DETAILS

Name

Pit or

Node

Total

Area

(ha)

Paved

Area

Grass

Area

Supp

Area

Paved

Area

Grass

Time

Supp

Time

Paved

Length

Grass

Length

Supp

Length

Paved

Slope(%)

Grass

Slope

Supp

Slope

Paved

Grass

Rough

Supp

Rough

Lag

Time

Factor

Gutter

Length

Gutter

Slope

Gutter

Flow

Factor

Rainfall

Multiplier

C A22

A22

4.12

0.0862

80

20

0

5

10

C A18

A18

0.0717

80

0

5

10

0

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

C A15

A15

0.087

85

15

0

10

0

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

C A14

A14

0.0736

85

15

0

10

0

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

C A13

A13

0.1098

85

15

0

10

0

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

C A12

A12

0.1833

85

15

0

10

0

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

[illegible]

[illegible]

PIPE COVER DETAILS				
Name	Type	Dia (mm)	Rate Cover (m)	Cover (m)
P A22	RCP	675	0.6	0.6
P A21	RCP	825	0.6	0.25
P A20	RCP	825	0.6	1.01
P A19	RCP	825	0.6	0.71
P A18	RCP	825	0.6	0.69
P A17	RCP	825	0.6	0.63
P A16	RCP	825	0.6	1.25
P A15	RCP	900	0.6	0.91
P A14	RCP	1070	0.6	0.56
P A13	RCP	1070	0.6	0.56
P A12	RCP	1200	0.6	0.55
P A11	RCP	1370	0.6	0.58
P A10	RCP	1524	0.6	0.56
P A9	RCP	1524	0.6	0.56
P A8	RCP	1524	0.6	0.56
P A7	RCP	1524	0.6	0.55
P A6	RCP	1524	0.6	0.56
P A5	RCP	1524	0.6	0.56
P A4	Box Culverts	0	0.6	0.92
P A3	Box Culverts	0	0.6	1.26
P A2	Box Culverts	0	0.6	-1.8
P A1	RCP	675	0.6	-0.73
P A A1	RCP	450	0.6	0.38
P W3	RCP	1070	0.6	0.56
P W2	RCP	1070	0.6	0.56
P W1	RCP	1070	0.6	0.57
P A B1	RCP	375	0.6	0.57
P W4	RCP	1070	0.6	0.56
P A C2	RCP	450	0.6	0.6
P A C1	RCP	525	0.6	0.74
P W5	RCP	1070	0.6	0.6
P A D2	RCP	900	0.6	0.6
P A D1	RCP	900	0.6	0.67
P A E1	RCP	375	0.6	0.57
P W6	RCP	750	0.6	0.6
P A F1	RCP	375	0.6	0.57
P W7	RCP	750	0.6	0.44
P A G1	RCP	450	0.6	0.58
P W8	RCP	750	0.6	0.65
P A H1	RCP	375	0.6	0.57
P W9	RCP	750	0.6	0.6
P A J1	RCP	675	0.6	0.59
P W10	RCP	750	0.6	0.58
P A K1	RCP	375	0.6	0.57
P A L1	RCP	600	0.6	0.39
P H5	RCP	600	0.6	0.44
P H4	RCP	675	0.6	0.48
P H3	RCP	675	0.6	0.57
P H2	RCP	675	0.6	0.62
P H1	RCP	750	0.6	0.57
P A M1	RCP	375	0.6	0.44
P J1	RCP	450	0.6	0.61
P B2	RCP	375	0.6	0.48
P B1	RCP	900	0.6	0.63
P C3	RCP	375	0.6	0.59
P C2	RCP	375	0.6	0.91
P C1	RCP	375	0.6	0.93
P D5	RCP	375	0.6	0.57
P D4	RCP	375	0.6	0.51
P D3	RCP	375	0.6	0.76
P D2	RCP	375	0.6	0.79
P D1	RCP	375	0.6	0.9
P D A1	RCP	375	0.6	0.6
P F1	RCP	375	0.6	0.57
P G1	RCP	375	0.6	0.58
P H6	RCP	375	0.6	0.45
P J3	RCP	375	0.6	0.57
P J2	RCP	450	0.6	0.6
P K3	RCP	825	0.6	0.51
P K2	RCP	825	0.6	0.59
P K1	RCP	900	0.6	0.47
P L1	RCP	450	0.6	0.57
P M1	RCP	450	0.6	0.57
P N2	RCP	450	0.6	0.45
P N1	RCP	525	0.6	0.58
P P5	RCP	675	0.6	0.59
P P4	RCP	675	0.6	1.58
P P3	RCP	675	0.6	1.71
P P2	RCP	750	0.6	1.56
P P1	RCP	750	0.6	1.12
P Q1	RCP	450	0.6	0.6
P R2	RCP	375	0.6	0.59
P R1	RCP	375	0.6	1.33
P S1	RCP	375	0.6	0.58
P T1	RCP	375	0.6	0.57
P U1	RCP	600	0.6	0.58
P V1	RCP	525	0.6	0.54
P W11	RCP	750	0.6	0.57
P X1	RCP	375	0.6	0.51
P Y1	RCP	375	0.6	0.57
P Z1	RCP	450	0.6	0.53
P ZAP A1	RCP	225	0.6	1.4
P A P2	RCP	375	0.6	1.41
P A P1	RCP	375	0.6	1.2
P ZAP B1	RCP	225	0.6	1.44
P ZAP Q1	RCP	225	0.6	0.6
P A Q1	RCP	225	0.6	0.59
P Z2 A1	RCP	225	0.6	0.65
P Z2 A1	RCP	225	0.6	0.64
P E1	RCP	375	0.6	0.6
P Z2 B1	RCP	225	0.6	0.62
P E2	RCP	375	0.6	0.59
P Z2 A1	RCP	225	0.6	0.61
P H A1	RCP	375	0.6	0.6

P AP6	uPVC HD	303	0.6	0.71	
P AP5	uPVC HD	303	0.6	0.7	
P AP4	uPVC HD	303	0.6	0.7	
P AP3	RCP	375	0.6	0.55	Unsafe
P AN1	RCP	375	0.6	0.46	Unsafe
P B1	RCP	900	0.6	0.57	Unsafe
P C3	RCP	375	0.6	0.59	Unsafe
P C2	RCP	375	0.6	0.9	
P C1	RCP	375	0.6	0.77	
P D5	RCP	375	0.6	0.57	Unsafe
P D4	RCP	375	0.6	0.51	Unsafe
P D3	RCP	375	0.6	0.75	
P D2	RCP	375	0.6	0.77	
P D1	RCP	375	0.6	0.87	
P DA1	RCP	375	0.6	0.6	
P F1	RCP	375	0.6	0.57	Unsafe
P G1	RCP	375	0.6	0.58	Unsafe
P H7	RCP	600	0.6	0.45	Unsafe
P J3	RCP	375	0.6	0.57	Unsafe
P J2	RCP	450	0.6	0.6	
P K3	RCP	625	0.6	0.51	Unsafe
P L1	RCP	450	0.6	0.58	Unsafe
P M1	RCP	450	0.6	0.57	Unsafe
P N2	RCP	450	0.6	0.45	Unsafe
P N1	RCP	525	0.6	0.58	Unsafe
P P5	RCP	675	0.6	0.59	Unsafe
P P4	RCP	675	0.6	0.58	
P P3	RCP	675	0.6	1.71	
P P2	RCP	750	0.6	1.56	
P P1	RCP	750	0.6	1.36	
P Q1	RCP	450	0.6	0.6	
P R1	RCP	375	0.6	0.48	Unsafe
P S1	RCP	375	0.6	0.58	Unsafe
P T1	RCP	375	0.6	0.57	Unsafe
P U1	RCP	600	0.6	0.58	Unsafe
P V1	RCP	625	0.6	0.45	Unsafe
P W11	RCP	750	0.6	0.25	Unsafe
P X1	RCP	375	0.6	0.5	Unsafe
P Y1	RCP	375	0.6	0.57	Unsafe
P Z1	RCP	450	0.6	0.52	Unsafe
P ZAP A1	RCP	225	0.6	1.41	
P ZAP B1	RCP	225	0.6	1.43	
P ZAQ1	RCP	225	0.6	0.6	
P AQ1	RCP	375	0.6	0.59	Unsafe
P ZEA1	RCP	225	0.6	0.65	
P ZEA1	RCP	225	0.6	0.64	
P E1	RCP	375	0.6	0.6	
P ZEB1	RCP	225	0.6	0.62	
P E2	RCP	375	0.6	0.59	Unsafe
P ZHA1	RCP	225	0.6	0.61	
P HA1	RCP	375	0.6	0.59	Unsafe

10 YEAR ARI RESULTS

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS							
Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
A22	29.9		0.805		0.7	0	Headwall height/system capacity
A21	29.06		0		0.97	0	None
A20	28.78		0		1.24	0	None
A19	28.51		0.006		1.33	0	None
A18	28.12		0.014		0.93	0	None
A17	27.62		0		1.27	0	None
A16	26.93		0.031		0.88	0	None
A15	26.26		0.024		1.07	0	None
A14	25.78		0.027		1.09	0	None
A13	25.15		0.04		0.94	0	None
A12	24.7	25.31	0.067	0.3	0.55	0	Inlet Capacity
A11	24.45		0.014		0.54	0	None
A10	23.3		0.037		1.16	0	None
A9	22.72		0.041		1.16	0	None
A8	21.99		0.05		1.16	0.001	Inlet Capacity
A7	21.31		0.053		1.1	0.001	Inlet Capacity
A6	20.82		0.055		0.9	0.002	Inlet Capacity
A5	20.55		0.04		0.79	0	None
A4	20.29	21.08	0.015	0.3	0.77	0	Inlet Capacity
A3	19.82		0.016		1.5	0	None
A2	19.51	21.27	0.022	2.2	1.73		Inlet Capacity
Bioretention	17.68		0				
AA1	23.08		0.315				
W3	22.53		0.012		0.97	0	None
W2	21.94		0.009		0.9	0	None
W1	20.89		0.014		0.93	0	None
AB1	23.55		0.028		0.85	0	None
W4	23.31		0.02		1.07	0	None
AC2	25.56		0.297				
AC1	24.91		0.004		0.99	0	None
W5	24.34		0		0.85		None
AD2	24.45		0.769				
AD1	24.42	25.4	0.031	0	0.98		None
AE1	25.33		0.011		0.83	0	None
W6	25.32		0.009		0.83	0	None
AF1	25.82		0.004		0.92	0	None
W7	25.78		0.011		0.95	0	None
AG1	26.16		0.013		0.97	0	None
W8	26.13		0.012		0.97	0	None
AH1	27.03		0.012		0.91	0	None
W9	26.79		0.014		1.01	0	None
AJ1	28.25		0.608				
W10	27.92		0.012		1.06	0	None
AK1	28.09		0.013		0.9	0	None
AL1	25.13		0.306				
H5	25.11	25.75	0.011	0.3	0.62	0	Inlet Capacity
H4	24.95		0.013		0.78	0	None
H3	24.89	25.42	0.012	1.7	0.51	0	Inlet Capacity
H2	24.8	25.42	0.011	1.1	0.6	0	Inlet Capacity
H1	24.51		0.005		0.62	0	None
AM1	25.11		0.158				
J1	25.06		0.018		0.56	0	None
B2	21.04		0.015		0.78	0	None
B1	20.31	21.1	0.032	0.3	0.75	0	Inlet Capacity
C3	22.4		0.046		0.8	0	Inlet Capacity
C2	21.76		0.008		0.92	0	None
C1	21.56		0.026		0.88	0	None
D5	22.34		0.015		0.83	0	None
D4	22.31		0.017		0.86	0	None
D3	22.03		0.003		0.94	0	None
D2	21.88		0.016		0.9	0	None
D1	21.81		0.012		0.97	0	None
DA1	22.12		0.005		1.13	0.003	Inlet Capacity
F1	23.11		0.046		0.8	0	Inlet Capacity
G1	23.75		0.029		0.85	0	None
H6	25.12		0.017		0.5	0	None
J3	25.36		0.026		0.84	0	None
J2	25.25		0.021		0.95	0	None
K3	25.53		1.574				
K2	25.4		0		0.31	0	None
K1	25.07		0.003		0.53	0	None
L1	24.74	25.28	0.064	0.7	0.48	0	Inlet Capacity
M1	25.28		0.025		0.94	0	None
N2	26.42		0.197				
N1	26.22		0.012		0.81	0	None
P5	27.22		0.396				
P4	27.2		0.018		1.18	0	None
P3	27.07		0		1.31	0	None
P2	26.67		0		1.79	0	None
P1	26.41		0.026		1.56	0	None
Q1	27.18		0.288				
R2	28.45		0.204				
R1	28.12		0		0.89		None
S1	28.4		0.009		0.92	0	None
T1	28.95		0.008		0.94	0	None
U1	28.83		0.363				
V1	20.37		0.358				
W11	28.76		0.035				
X1	21.23		0.149				
Y1	22.05		0.021		0.85	0	None
Z1	22.33		0.336				
ZAPA1	20.62		0.011				
AP2	20.62		0.001		1.21	0	Inlet Capacity
AP1	20.57		0.004		1.07	0.002	Inlet Capacity
ZAPB1	20.58		0.005				
ZAQ1	20.68		0.025				
AO1	20.64		0.007		0.74	0.003	Inlet Capacity
ZDA1	22.32		0.002				
ZE1	23.17		0.01				
E1	23.05		0.012		0.93	0.007	Inlet Capacity
ZEB1	24.72		0.016				
E2	24.58		0.001		0.9	0.001	Inlet Capacity
ZHA1	25.97		0.015				
HA1	25.81		0.001		1.28	0.001	Inlet Capacity
AP6	21.33	22.27	0.011	0	0.92	0	Inlet Capacity
AP5	21.16	22.13	0.005	0	0.96	0	Inlet Capacity
AP4	21.14	22.04	0.005	0	0.9	0	Inlet Capacity
AP3	21.09	22.03	0.004	0	0.93	0	Inlet Capacity
AN1	28.13		0.014				
SUB-CATCHMENT DETAILS							
Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C A22	0.805	0.072	0.778	5	14		AR&R 10 year, 2 hours storm, average 29 mm/h, Zone 1
C A19	0.006	0.005	0.001	5	10		AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A18	0.014	0.012	0.002	5	10		AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A16	0.031	0.027	0.004	5	10		AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A15	0.024	0.022	0.002	5	10		AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A14	0.027	0.024	0.003	5	10		AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A13	0.04	0.036	0.004	5	10		AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A12	0.067	0.061	0.006	5	10		AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1

C A11	0.014	0.012	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A10	0.037	0.034	0.003	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A9	0.041	0.038	0.004	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A8	0.05	0.046	0.005	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A7	0.052	0.047	0.005	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A6	0.053	0.048	0.005	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A5	0.036	0.033	0.003	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A4	0.015	0.013	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A3	0.016	0.014	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A2	0.022	0.019	0.004	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C A A1	0.315	0.276	0.04	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C W3	0.012	0.01	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C W2	0.009	0.008	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C W1	0.014	0.012	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AB1	0.028	0.023	0.005	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C W4	0.02	0.017	0.003	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AC2	0.297	0.25	0.048	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AC1	0.004	0.004	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AD2	0.769	0.673	0.098	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AD1	0.031	0.026	0.005	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AE1	0.011	0.009	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C W6	0.009	0.008	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AF1	0.004	0.003	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C W7	0.011	0.01	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AG1	0.013	0.013	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C W8	0.012	0.01	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
CA H1	0.012	0.01	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C W9	0.014	0.011	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
CA J1	0.608	0.533	0.077	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C W10	0.012	0.01	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
CA K1	0.013	0.011	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
CA L1	0.306	0.268	0.039	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C H5	0.011	0.01	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C H4	0.012	0.011	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C H3	0.012	0.011	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C H2	0.011	0.01	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C H1	0.005	0.005	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
CA M1	0.158	0.138	0.02	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C J1	0.018	0.016	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C B2	0.015	0.013	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C B1	0.032	0.028	0.004	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C C3	0.046	0.042	0.004	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C C2	0.008	0.007	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C C1	0.026	0.024	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C D5	0.015	0.014	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C D4	0.009	0.009	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C D3	0.003	0.003	0	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C D2	0.015	0.014	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C D1	0.009	0.009	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
CA D1	0.005	0.004	0	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C F1	0.046	0.041	0.004	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C G1	0.029	0.026	0.003	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C H6	0.017	0.015	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C J3	0.026	0.024	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C J2	0.021	0.019	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C K3	1.574	1.432	0.147	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C K1	0.003	0.003	0	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C L1	0.064	0.058	0.006	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
CM1	0.025	0.023	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C N2	0.197	0.173	0.025	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C N1	0.012	0.011	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C P5	0.396	0.347	0.05	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C P4	0.018	0.015	0.003	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C P1	0.026	0.023	0.003	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C Q1	0.288	0.242	0.047	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C R1	0.204	0.179	0.026	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C S1	0.009	0.008	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C T1	0.008	0.007	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C U1	0.363	0.292	0.073	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C V1	0.358	0.314	0.046	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C W11	0.035	0.029	0.006	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C X1	0.149	0.13	0.019	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C Y1	0.021	0.017	0.003	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C Z1	0.336	0.294	0.043	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C ZAPA1	0.011	0.009	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AP2	0.001	0.001	0	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AP1	0.004	0.004	0	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C ZAPB1	0.005	0.005	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C ZAQ1	0.025	0.022	0.003	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AQ1	0.007	0.006	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C ZDA1	0.002	0.002	0	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C ZEA1	0.01	0.009	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C E1	0.011	0.01	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C ZEB1	0.016	0.014	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C E2	0.001	0.001	0	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C ZHA1	0.015	0.014	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C HA1	0.001	0.001	0	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AP6	0.011	0.011	0.001	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AP5	0.005	0.005	0	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AP4	0.005	0.005	0	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AP3	0.004	0.002	0.003	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
C AN1	0.014	0.012	0.002	5	10	0	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1

Volumes for Total Catchment (17.9 impervious + 8.22 pervious = 26.1 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 10 year, 5 minutes storm, average 140 mm/h, Zone 1	2194.99	69.0%	2000.52	194.46 (19.4%)
AR&R 10 year, 5 minutes storm, average 112 mm/h, Zone 1	1504.46	(62.2%)	1478.00	26.46 (3.5%)
AR&R 10 year, 15 minutes storm, average 93 mm/h, Zone 1	4816.41	(79.3%)	3986.11	830.29 (43.4%)
AR&R 10 year, 20 minutes storm, average 87 mm/h, Zone 1	5694.13	(80.7%)	4657.94	1036.19 (46.7%)
AR&R 10 year, 25 minutes storm, average 77 mm/h, Zone 1	6358.95	(81.1%)	5195.39	1163.56 (47.2%)
AR&R 10 year, 30 minutes storm, average 69 mm/h, Zone 1	6892.09	(81.1%)	5643.30	1248.80 (46.7%)
AR&R 10 year, 45 minutes storm, average 52 mm/h, Zone 1	8346.32	(81.9%)	6807.74	1538.58 (48.0%)
AR&R 10 year, 1 hour storm, average 44 mm/h, Zone 1	19475.56	(82.2%)	17221.29	1754.27 (48.4%)
AR&R 10 year, 1.5 hours storm, average 34 mm/h, Zone 1	11165.31	(82.3%)	9119.16	2046.15 (48.0%)
AR&R 10 year, 2 hours storm, average 29 mm/h, Zone 1	11248.14	(82.3%)	10211.86	2269.28 (47.6%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P A22	0.805	2.99	29.54	AR&R 10 year, 2 hours storm, average 29 mm/h, Zone 1	
P A21	0.805	2.76	28.942	AR&R 10 year, 2 hours storm, average 29 mm/h, Zone 1	
P A20	1.094	2.87	28.642	AR&R 10 year, 1.5 hours storm, average 34.6 mm/h, Zone 1	
P A19	1.105	3.06	28.368	AR&R 10 year, 1.5 hours storm, average 34.6 mm/h, Zone 1	
P A18	1.118	2.99	27.972	AR&R 10 year, 1.5 hours storm, average 34.6 mm/h, Zone 1	
P A17	1.304	3.99	27.399	AR&R 10 year, 1.5 hours storm, average 34.6 mm/h, Zone 1	
P A16	1.333	2.49	26.465	AR&R 10 year, 1.5 hours storm, average 34.6 mm/h, Zone 1	
P A15	1.965	3.28	26.078	AR&R 10 year, 1.5 hours storm, average 34.6 mm/h, Zone 1	
P A14	2.165	4.37	25.553	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1	
P A13	2.269	4.66	24.913	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1	
P A12	2.408	2.13	24.595	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1	
P A11	4.465	4.91	23.753	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1	
P A10	4.516	5.16	23	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1	
P A9	4.584	5.17	22.422	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1	
P A8	4.612	5.17	21.693	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1	
P A7	4.806	4.87	21.012	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1	
P A6	4.835	3.41	20.582	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1	
P A5	4.949	3.24	20.286	20.295 AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1	
P A4	5.298	2.87	19.838	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1	

P A3	5.353	4.75	19.292	19.509	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A2	8.168	2.29	18.919	18.911	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A1	2.074	3.06	18.091	17.906	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A A1	0.316	2.17	23.076	22.953	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P W3	2.126	4.92	22.283	21.943	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P W2	2.465	5.33	21.653	20.893	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P W1	2.609	4.9	20.58	20.067	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A B1	0.028	3.79	23.451	23.397	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A B1	1.915	4.65	23.098	22.786	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A C2	0.297	3.49	25.562	25.005	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A C1	0.3	3	24.813	24.342	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P W5	1.774	4.92	23.869	23.314	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A D2	0.769	4.94	24.455	24.417	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A D1	0.764	1.53	24.366	24.342	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A E1	0.012	0.28	25.321	25.323	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P W6	0.737	3.85	25.044	24.342	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A F1	0.004	0.65	25.793	25.783	AR&R 10 year, 30 minutes storm, average 65 mm/h, Zone 1
P W7	0.72	2.99	25.661	25.323	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A G1	0.012	0.9	26.124	26.126	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P W8	0.718	2.95	26.01	25.783	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A H1	0.012	4.17	26.973	26.873	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P W9	0.686	3.5	26.65	26.126	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A J1	0.608	5.43	28.252	27.921	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P W10	0.765	3.65	27.622	26.786	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A K1	0.013	4.46	28.02	27.956	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A L1	0.305	1.6	25.127	25.113	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P H5	0.327	2.05	24.978	24.954	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P H4	0.343	1.33	24.918	24.894	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P H3	0.358	1	24.824	24.8	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P H2	0.564	1.58	24.639	24.51	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P H1	0.573	1.3	24.474	24.449	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A M1	0.158	1.89	25.115	25.064	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P J1	0.209	1.33	24.951	24.8	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P B2	0.015	1.62	20.982	20.313	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P B1	0.39	0.64	20.29	20.295	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P C3	0.045	1.6	22.291	21.794	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P C2	0.141	1.35	21.685	21.558	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P C1	0.166	1.6	21.469	21.305	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P D5	0.015	0.49	22.31	22.31	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P D4	0.062	2.01	22.23	22.201	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P D3	0.067	1.51	21.961	21.983	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P D2	0.08	1.06	21.829	21.814	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P D1	0.092	0.91	21.796	21.764	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P D A1	0.002	0.66	22.107	22.031	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P F1	0.045	3.43	22.987	22.939	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P G1	0.028	5.29	23.651	23.576	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P H6	0.018	0.16	25.116	25.113	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P J3	0.026	1.37	25.303	25.254	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P J2	0.053	1.32	25.222	25.064	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P K3	1.573	2.94	25.533	25.405	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P K2	1.572	2.94	25.184	25.069	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P K1	1.556	4.41	24.583	24.449	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P L1	0.062	0.39	24.709	24.702	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P M1	0.025	1.83	25.212	25.151	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P N2	0.197	1.93	26.415	26.37	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P N1	0.213	2.75	26.084	25.978	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P O3	0.393	1.1	27.221	27.197	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P P4	0.411	1.15	27.096	27.071	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P P3	0.698	1.95	26.78	26.673	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P P2	0.7	1.59	26.5	26.41	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P P1	0.73	1.65	26.343	26.264	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P Q1	0.286	1.8	27.181	27.071	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P R2	0.205	1.86	28.454	28.123	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P R1	0.212	1.92	28.035	27.618	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P S1	0.01	2.97	28.354	28.116	AR&R 10 year, 1.5 hours storm, average 34.6 mm/h, Zone 1
P T1	0.008	2.75	28.905	28.825	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P U1	0.36	1.53	28.828	28.776	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P V1	0.359	3.67	20.372	20.313	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P W11	0.035	2.56	28.761	27.921	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P X1	0.149	1.77	21.226	21.167	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P Y1	0.021	1.11	22	21.943	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P Z1	0.346	2.31	22.333	22.218	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P Z A P A1	0.01	0.26	20.617	20.615	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A P2	0.061	0.55	20.599	20.574	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A P1	0.072	0.65	20.554	20.547	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P Z A P B1	0.005	0.14	20.577	20.574	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P Z A Q1	0.025	1.14	20.678	20.653	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A Q1	0.03	0.39	20.625	20.615	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P Z D A1	0.002	0.52	22.319	22.31	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P Z E A1	0.01	0.9	23.172	23.151	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P E1	0.031	1.4	23.023	22.31	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P Z E B1	0.016	1.04	24.718	24.697	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P E2	0.016	1.36	24.516	23.048	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P Z H A1	0.015	1.01	25.973	25.952	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P H A1	0.016	1.68	25.762	24.954	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A P6	0.011	1.37	21.277	21.157	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A P5	0.016	1.06	21.14	21.137	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A P4	0.021	1.17	21.117	21.09	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A P3	0.025	1.34	21.053	20.946	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
P A N1	0.019	0.23	28.129	28.123	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1

CHANNEL DETAILS									
Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm						
OVERFLOW ROUTE DETAILS									
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm	
F A22	0	0	19.579	0	0	0	0		
F A20	0	0.008	0.578	0.046	0.02	1.18	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F A19	0	0.014	0.699	0.043	0.03	1.08	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F A18	0	0	0.78	0	0	0	0		
F A17	0	0.031	0.78	0.065	0.04	1.84	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F A16	0	0.024	0.701	0.052	0.04	1.41	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F A15	0	0.027	0.822	0.058	0.04	1.61	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F A14	0	0.04	0.663	0.061	0.06	1.71	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F A13	0	0.047	0.674	0.065	0.06	1.84	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1		
F A12	0	0	0.443	0	0	0	0		
F A11	0	0.037	0.755	0.063	0.05	1.77	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F A10	0	0.041	0.755	0.065	0.05	1.84	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F A9	0	0.05	0.737	0.069	0.06	2.01	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1		
F A8	0.001	0.052	0.735	0.069	0.06	2.01	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1		
F A7	0.001	0.054	0.693	0.069	0.06	2.01	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1		
F A6	0.002	0.037	0.692	0.06	0.05	1.68	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1		
F A5	0	0.01	0.761	0.041	0.03	1.01	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F A4	0	0	0.443	0	0	0	0		
F A3	0	0	0.256	0	0	0	0		
F A1	5.973	5.973	0.256	0.181	0.27	40.19	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1		
F W3	0	0.009	0.634	0.036	0.03	0.85	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F W2	0	0.014	0.634	0.042	0.04	1.05	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F W1	0	0.022	0.757	0.053	0.04	1.44	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F AB1	0	0.021	0.634	0.048	0.04	1.25	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F W4	0	0.012	0.632	0.04	0.03	0.98	0.8	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1	
F A C1	0	0.02	0.559	0.045	0.04	1.15	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1		
F A E1	0	0.028	0.605	0.052	0.05	1.41	0.92	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1	
F W6	0	0.015	0.657	0.044	0.04	1.11	0.8	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1	
F A F1	0	0.011	0.729	0.041	0.03	1.01	0.67	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1	
F W7	0	0.009	0.676	0.037	0.03	0.88	0.73	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1	
F AG1	0	0.026	0.85	0.058	0.04	1.61	0.68	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1	
F W8	0	0.011	0.818	0.045	0.03	1.15	0.56	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1	
F AH1	0	0.013	0.647	0.041	0.03	1.01	0.77	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1	

F W9	0	0.012	0.678	0.04	0.03	0.98	0.76	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F W10	0	0.014	0.58	0.04	0.04	0.98	0.88	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F AK1	0	0.012	0.58	0.038	0.03	0.91	0.86	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F H5	0	0	0.443	0	0	0	0	
F H4	0	0	16.961	0	0	0	0	
F H3	0	0	0.217	0	0	0	0	
F H2	0	0	19.871	0	0	0	0	
F H1	0	0.029	0.749	0.058	0.05	1.54	0.81	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F J1	0	0.011	0.699	0.04	0.03	0.98	0.74	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F B2	0	0.01	0.547	0.034	0.03	0.78	0.91	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F B1	0	0	0.443	0	0	0	0	
F C3	0	0.016	0.639	0.043	0.04	1.08	0.85	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
F C2	0	0.026	0.832	0.06	0.04	1.68	0.63	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F C1	0	0.022	0.647	0.05	0.04	1.31	0.85	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F D5	0	0.003	0.796	0.028	0.01	0.55	0.51	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F D4	0	0.003	0.631	0.025	0.02	0.45	0.67	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F D3	0	0.011	0.799	0.045	0.02	1.15	0.52	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F D2	0	0	0.443	0	0	0	0	
F D1	0	0	0.256	0	0	0	0	
F DA1	0.003	0.01	0.759	0.04	0.03	0.98	0.66	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
F F1	0	0.046	0.755	0.068	0.06	1.94	0.83	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
F G1	0	0.046	0.755	0.068	0.06	1.94	0.82	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F H6	0	0.01	0.736	0.044	0.02	1.11	0.5	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F J3	0	0.017	0.818	0.051	0.03	1.38	0.58	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F J2	0	0.018	0.818	0.052	0.03	1.41	0.5	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F K2	0	0.003	0.858	0.029	0.01	0.58	0.48	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F K1	0	0.014	0.563	0.04	0.04	0.98	0.92	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F L1	0	0	14.846	0	0	0	0	
F M1	0	0.048	0.658	0.066	0.06	1.87	0.92	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F N1	0	0.025	0.663	0.052	0.04	1.41	0.84	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F P4	0	0	0.443	0	0	0	0	
F P3	0	0.026	0.854	0.059	0.04	1.64	0.65	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F P1	0	0.012	0.643	0.04	0.03	0.98	0.8	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F S1	0	0.018	0.659	0.047	0.04	1.21	0.81	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F T1	0	0.009	0.7	0.038	0.03	0.91	0.7	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F Y1	0	0.015	0.634	0.043	0.04	1.08	0.83	AR&R 10 year, 5 minutes storm, average 146 mm/h, Zone 1
F AP2	0	0	0.047	0	0	0	0	
F AP1	0.002	0.002	0.548	0.006	0	1.95	0.3	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
F AQ1	0.003	0.003	0.256	0.009	0	3.14	0.2	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
F Q4	0.007	0.016	0.632	0.044	0.04	1.11	0.83	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
F E2	0.001	0.012	0.77	0.043	0.03	1.08	0.64	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
F HA1	0.001	0.013	0.699	0.042	0.03	1.05	0.74	AR&R 10 year, 25 minutes storm, average 72 mm/h, Zone 1
F AP6	0	0	0.256	0	0	0	0	
F AP5	0	0	0.256	0	0	0	0	
F AP4	0	0	0.256	0	0	0	0	
F AP3	0	0	0.256	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
A1	18.91	97.1	8.047	2.074	5.973

NUITY CHECK for AR&R 10 year, 2 hours storm, average 29 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
A22	1196.93	1196.54	0	0
A21	1196.54	1197.34	0	-0.1
A20	1712.31	1711.83	0	0
A19	1732.36	1732.33	0	0
A18	1765.74	1766.61	0	0
A17	2078.36	2079.46	0	-0.1
A16	2123.53	2123.72	0	0
A15	3198.86	3198.68	0	0
A14	3537.69	3536.45	0	0
A13	3630.77	3631.92	0	0
A12	3820.04	3821.38	0	0
A11	6994.07	6989.97	0	0.1
A10	7084.92	7081.77	0	0
A9	7207.24	7203.78	0	0
A8	7276.15	7274.81	0	0
A7	7605.37	7605.14	0	0
A6	7681.94	7683.83	0	0
A5	7844.17	7847.99	0	0
A4	8450.1	8448.49	0	0
A3	8471.18	8471.31	0	0
A2	12398.88	12398.21	0	0
A1	12398.21	12398.23	-0.01	0
Bioretention	8445.9	8445.9	0	0
AA1	452.06	452.23	0	0
W3	3143.18	3141.19	0	0.1
W2	3666.02	3663.33	0	0.1
W1	3897.71	3895.51	0	0.1
AB1	39.68	39.64	0	0.1
W4	2674.15	2673.31	0	0
AC2	423.98	424.03	0	0
AC1	430.08	429.37	0	0.2
W5	2609.27	2605.67	0	0.1
AD2	1103.57	1103.53	0	0
AD1	1147.73	1102.26	0	4
AE1	15.64	15.62	0	0.1
W6	1076.19	1077.65	0	-0.1
AF1	5.91	5.91	0	0
W7	1046.2	1047.21	0	-0.1
AG1	17.88	17.85	0	0.2
W8	1026.45	1023.96	0	0.2
AH1	16.69	16.67	0	0.1
W9	993.05	991.91	0	0.1
AJ1	873.04	873.83	0	-0.1
W10	959.4	956.92	0	0.3
AK1	18.57	18.55	0	0.1
AL1	438.97	439	0	0
H5	479.25	478.99	0	0.1
H4	520.43	520.12	0	0.1
H3	537.89	537.27	0	0.1
H2	873.19	872.45	0	0.1
H1	879.96	879.37	0	0.1
AM1	226.54	226.64	0	0
J1	320.28	319.52	0	0.2
B2	21.85	21.84	0	0
B1	582.43	580.71	0	0.3
C3	66.38	66.3	0	0.1
C2	218.54	218.12	0	0.2
C1	256.2	255.99	0	0.1
D5	21.83	21.79	0	0.2
D4	93.42	93.33	0	0.1
D3	100.38	100.35	0	0
D2	122.44	122.83	0	-0.3
D1	140.45	140.39	0	0
DA1	6.57	6.58	0	0
F1	65.8	65.74	0	0.1
G1	41.44	41.4	0	0.1
H6	24.19	24.16	0	0.1
J3	37.97	37.95	0	0.1
J2	67.82	67.71	0	0.2
K3	2271.21	2270.76	0	0
K2	2270.76	2270.38	0	0
K1	2274.88	2273.05	0	0.1
L1	91.99	91.71	0	0.3
M1	36.61	36.57	0	0.1

N2	283.09	283.24	0	-0.1
N1	300.98	300.3	0	0.2
P5	567.86	567.58	0	0.1
P4	593.65	593	0	0.1
P3	1003.97	1004.22	0	0
P2	1004.22	1003.38	0	0.1
P1	1041.16	1039.87	0	0.1
Q1	410.97	410.97	0	0
R2	293.47	292.85	0	0.2
R1	312.33	311.75	0	0.2
S1	13.6	13.43	0	1.3
T1	11.81	11.8	0	0.1
U1	515.63	514.99	0	0.1
V1	514.49	515.09	0	-0.1
W11	49.81	49.79	0	0
X1	213.71	213.77	0	0
Y1	29.5	29.47	0	0.1
Z1	482.12	482.31	0	0
ZAPA1	15.13	15.14	0	0
AP2	94.54	94.39	0	0.2
AP1	108.26	108.28	0	0
ZAPB1	7.82	7.82	0	0
ZAQ1	35.74	35.76	0	-0.1
AQ1	45.54	45.52	0	0
ZDA1	2.97	2.96	0	0
ZE1	14.32	14.32	0	0
E1	55.13	55.04	0	0.2
ZEB1	22.9	22.92	0	-0.1
E2	25.08	25.03	0	0.2
ZHA1	22.14	22.15	0	-0.1
HA1	23.99	23.93	0	0.3
O AQ1	3.43	3.43	0	0
AP6	16.22	16.21	0	0
AP5	23.73	23.72	0	0
AP4	31.07	31.04	0	0.1
AP3	36.43	36.47	0	-0.1
Basin 4	3952.34	3952.34	0	0
AN1	19.48	19.48	0	0

1031 DRAINS Model Stage 7A, 7B, 7C and 7D 100 Year ARI run at 11:55:51 on 31/10/2016

No water upwelling from any pit. Freeboard was adequate at all pits.

The maximum flow in the following overflow routes is unsafe: F A1

less than 2%) in reducing peak discharge: A1 You might consider upsizing these, or removing them from the model.

he following overflow routes carried water uphill (adding energy): F A1

ould check for water flowing round in circles at these locations. You may need to reformulate the model.

100 Year ARI INPUT																			
PIT / NODE DETAILS		Type	Family	Version 13		Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down Id	id	Part Full Shock Loss	Inflow Hydrograph	Pit is	
Name	Size																		
A22	Headwall					1		30.6				303038.69	6268393.89	0	74375923				
A21	OnGrade	Junction	JP			0	0.5	30.022		0	0	303009.54	6268390.89	No	74375924	1 x Ku	No	New	
A20	OnGrade	Junction	JP			0	0.5	30.02		0	0	302972	6268380.39	Yes	74375925	1 x Ku	No	New	
A19	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	29.844		0	0	302951.16	6268370.87	No	74375926	1 x Ku	No	New	
A18	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	29.044		0	0	302914.48	6268356.67	No	74375927	1 x Ku	No	New	
A17	OnGrade	Junction	JP			0	0.5	28.889		0	0	302900.14	6268353.38		74375928	1 x Ku	No	New	
A16	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	1.5	27.815		0	0	302863.34	6268340.24	No	79860278	1 x Ku	No	New	
A15	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	27.33		0	0	302840.07	6268339.92	No	79860279	1 x Ku	No	New	
A14	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	26.875		0	0	302821.47	6268342.91	No	74375931	1 x Ku	No	New	
A13	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	26.088		0	0	302787.7	6268348.41	No	74375932	1 x Ku	No	New	
A12	Sag	Surface Inlet Grates 600 x 900 SI			1.139	0	0.5	25.25	0.108	0	0	302750.78	6268354.42	No	74375933	1 x Ku	No	New	
A11	OnGrade	NSW Dept. of Housing RM10 Inlet, 3% crossfall (all grades)				0	1.5	24.988		0	0	302715.69	6268359.12	No	74375934	1 x Ku	No	New	
A10	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	24.462		0	0	302685.29	6268364.07	No	74375935	1 x Ku	No	New	
A9	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	23.886		0	0	302651.82	6268369.52	No	74375936	1 x Ku	No	New	
A8	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	23.154		0	0	302609.46	6268376.42	No	74375937	1 x Ku	No	New	
A7	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	22.41		0	0	302566.43	6268383.42	No	74375938	1 x Ku	No	New	
A6	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	21.718		0	0	302530.97	6268405.86	No	74375939	1 x Ku	No	New	
A5	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	21.333		0	0	302523.2	6268421.62	No	74375940	1 x Ku	No	New	
A4	Sag	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)			5.412	0	1.5	21.06	0.191	0	0	302515.95	6268430.65	No	74375941	1 x Ku	No	New	
A3	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	1.5	21.315		0	0	302504.09	6268440.5	No	74375942	1 x Ku	No	New	
A2	Sag	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)			9.374	2	17.5	21.243	0.063	0	0	302499.46	6268450.4	No	74375943	1 x Ku	No	New	
Borewater																			
AA1	Node					0		23.5		0	0	302589.37	6268500.41		74375945				
W3	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	23.489		0	0	302591.91	6268494.99	No	74376014	1 x Ku	No	New	
W2	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	22.84		0	0	302568.2	6268483.55	No	74376015	1 x Ku	No	New	
W1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	21.622		0	0	302531.58	6268505.49	No	74376016	1 x Ku	No	New	
AB1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	4	24.392		0	0	302528.86	6268500.6	No	74375946	1 x Ku	No	New	
W4	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	24.389		0	0	302624.05	6268510.49	No	74376013	1 x Ku	No	New	
AC2	Node					0		26.444		0	0	302640.81	6268562.8		74375947				
AC1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	25.901		0	0	302640.66	6268547.46	No	74375948	1 x Ku	No	New	
W5	OnGrade	Junction	JP			0	2	25.188		0	0	302650.37	6268520.71	No	74376012	1 x Ku	No	New	
AD2	Node					0		26.009		0	0	302670.65	6268530.16		74375949				
AD1	Sag	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)			11.024	0	0.5	25.395	0	0	0	302665.44	6268527.04	No	74375950	1 x Ku	No	New	
AE1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	1.5	26.161		0	0	302692.31	6268552.89	No	74375951	1 x Ku	No	New	
W6	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	1.5	26.149		0	0	302692.26	6268513.89	No	74376011	1 x Ku	No	New	
AF1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	4	26.738		0	0	302723.96	6268510.75	No	74375952	1 x Ku	No	New	
W7	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	26.736		0	0	302718.75	6268520.64	No	74376010	1 x Ku	No	New	
AG1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	4	27.131		0	0	302755.11	6268525.96	No	74375953	1 x Ku	No	New	
W8	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	27.065		0	0	302748.05	6268524.77	No	74376009	1 x Ku	No	New	
AH1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	4	27.94		0	0	302786.58	6268541.14	No	74375954	1 x Ku	No	New	
W9	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	27.792		0	0	302777.35	6268548.9	No	74376008	1 x Ku	No	New	
AJ1	Node					0		28.987		0	0	302810.22	6268571.41		74375955				
W10	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	2	28.985		0	0	302813.14	6268566.16	No	74376007	1 x Ku	No	New	
AK1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	4	28.983		0	0	302817.81	6268556.2	No	74375956	1 x Ku	No	New	
AL1	Node					0		25.923		0	0	302751.4	6268406.32		74375957				
H5	Sag	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)			5	1.5	1.5	25.735	0.15	0	0	302760.85	6268403.55	No	74375978	1 x Ku	No	New	
H4	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	25.734		0	0	302749.84	6268397.62	No	74375979	1 x Ku	No	New	
H3	Sag	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)			5	1.5	0.5	25.403	0.03	0	0	302742.23	6268382.96	No	74375980	1 x Ku	No	New	
H2	Sag	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)			5	2	0.5	25.401	0.043	0	0	302731.34	6268384.07	No	74375981	1 x Ku	No	New	
H1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	25.127		0	0	302721.76	6268387.76	No	74375983	1 x Ku	No	New	
AM1	Node					0		25.86		0	0	302729.94	6268409.65		74375958				
B1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)			4.379	2	1.5	25.626	0.186	0	0	302735.36	6268408.76	No	74375987	1 x Ku	No	New	
B2	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	4	21.823		0	0	302536.39	6268456	No	74375962	1 x Ku	No	New	
B11	Sag	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	1.5	21.955		0	0	302526.55	6268439.99	No	74375963	1 x Ku	No	New	
C3	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	4	23.193		0	0	302613.43	6268386.92	No	74375964	1 x Ku	No	New	
C2	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	1.5	22.885		0	0	302584.01	6268391.71	No	74375965	1 x Ku	No	New	
C1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	1.5	22.439		0	0	302569.8	6268394.02	No	74375966	1 x Ku	No	New	
D5	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	4	23.169		0	0	302612.2	6268426.12	No	74375967	1 x Ku	No	New	
D4	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	1.5	23.167		0	0	302611.14	6268422.22	No	74375968	1 x Ku	No	New	
D3	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	1.5	22.968		0	0	302606	6268416.7	No	74375969	1 x Ku	No	New	
D2	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	1.5	22.792		0	0	302603.02	6268398.4	No	74375970	1 x Ku	No	New	
D1	OnGrade	NSW Dept. of Housing RM10 Inlet, 300mm (all grades)				0	0.5	22.781		0	0	302595.68	6268395.38	No	74375971	1 x			

[illegible]

[illegible]

Name	Type	Dia (mm)	Rate Cover (m)	Cover (m)	
P A22	RCP	675	0.6	0.6	
P A21	RCP	825	0.6	0.25	Unsafe
P A20	RCP	825	0.6	1.01	
P A19	RCP	825	0.6	0.71	
P A18	RCP	825	0.6	0.69	
P A17	RCP	825	0.6	0.63	
P A16	RCP	825	0.6	1.25	
P A15	RCP	900	0.6	0.91	Unsafe
P A14	RCP	1070	0.6	0.56	Unsafe
P A13	RCP	1070	0.6	0.56	Unsafe
P A12	RCP	1200	0.6	0.55	Unsafe
P A11	RCP	1370	0.6	0.58	Unsafe
P A10	RCP	1524	0.6	0.56	Unsafe
P A9	RCP	1524	0.6	0.56	Unsafe
P A8	RCP	1524	0.6	0.56	Unsafe
P A7	RCP	1524	0.6	0.55	Unsafe
P A6	RCP	1524	0.6	0.56	Unsafe
P A5	RCP	1524	0.6	0.56	Unsafe
P A4	Box Culverts	0	0.6	0.92	
P A3	Box Culverts	0	0.6	1.26	
P A2	Box Culverts	0	0.6	-1.8	Unsafe
P A1	RCP	675	0.6	-0.73	Unsafe
P A A1	RCP	450	0.6	0.38	Unsafe
P W3	RCP	1070	0.6	0.56	Unsafe
P W2	RCP	1070	0.6	0.56	Unsafe
P W1	RCP	1070	0.6	0.57	Unsafe
P A B1	RCP	375	0.6	0.57	Unsafe
P W4	RCP	1070	0.6	0.56	Unsafe
P A C2	RCP	450	0.6	0.6	
P A C1	RCP	525	0.6	0.74	
P W5	RCP	1070	0.6	0.6	
P A D2	RCP	900	0.6	0.6	
P A D1	RCP	900	0.6	0.67	
P A E1	RCP	375	0.6	0.57	Unsafe
P W6	RCP	750	0.6	0.6	
P A F1	RCP	375	0.6	0.57	Unsafe
P W7	RCP	750	0.6	0.44	Unsafe
P A G1	RCP	450	0.6	0.58	Unsafe
P W8	RCP	750	0.6	0.65	
P A H1	RCP	375	0.6	0.57	Unsafe
P W9	RCP	750	0.6	0.6	
P A J1	RCP	675	0.6	0.59	Unsafe
P W10	RCP	750	0.6	0.58	Unsafe
P A K1	RCP	375	0.6	0.57	Unsafe
P A L1	RCP	600	0.6	0.39	Unsafe
P H5	RCP	600	0.6	0.44	Unsafe
P H4	RCP	675	0.6	0.48	Unsafe
P H3	RCP	675	0.6	0.57	Unsafe
P H2	RCP	675	0.6	0.62	
P H1	RCP	750	0.6	0.57	Unsafe
P A M1	RCP	375	0.6	0.44	Unsafe
P J1	RCP	450	0.6	0.61	
P B2	RCP	375	0.6	0.48	Unsafe
P B1	RCP	900	0.6	0.63	
P C3	RCP	375	0.6	0.59	Unsafe
P C2	RCP	375	0.6	0.91	
P C1	RCP	375	0.6	0.93	Unsafe
P D5	RCP	375	0.6	0.57	Unsafe
P D4	RCP	375	0.6	0.51	Unsafe
P D3	RCP	375	0.6	0.76	
P D2	RCP	375	0.6	0.79	
P D1	RCP	375	0.6	0.9	
P D A1	RCP	375	0.6	0.6	
P F1	RCP	375	0.6	0.57	Unsafe
P G1	RCP	375	0.6	0.58	Unsafe
P H6	RCP	375	0.6	0.45	Unsafe
P J3	RCP	375	0.6	0.57	Unsafe
P J2	RCP	450	0.6	0.6	
P K3	RCP	825	0.6	0.51	Unsafe
P K2	RCP	825	0.6	0.59	Unsafe
P K1	RCP	900	0.6	0.47	Unsafe
P L1	RCP	450	0.6	0.57	Unsafe
P M1	RCP	450	0.6	0.57	Unsafe
P N2	RCP	450	0.6	0.45	Unsafe
P N1	RCP	525	0.6	0.58	Unsafe
P P5	RCP	675	0.6	0.59	Unsafe
P P4	RCP	675	0.6	1.58	
P P3	RCP	675	0.6	1.71	
P P2	RCP	750	0.6	1.56	
P P1	RCP	750	0.6	1.12	
P Q1	RCP	450	0.6	0.6	
P R2	RCP	375	0.6	0.59	Unsafe
P R1	RCP	375	0.6	1.33	
P S1	RCP	375	0.6	0.58	Unsafe
P T1	RCP	375	0.6	0.57	Unsafe
P U1	RCP	600	0.6	0.58	Unsafe
P V1	RCP	525	0.6	0.54	Unsafe
P W11	RCP	750	0.6	0.57	Unsafe
P X1	RCP	375	0.6	0.51	Unsafe
P Y1	RCP	375	0.6	0.57	Unsafe
P Z1	RCP	450	0.6	0.53	Unsafe
P ZAP A1	RCP	225	0.6	1.4	
P A P2	RCP	375	0.6	1.41	
P A P1	RCP	375	0.6	1.2	
P ZAP B1	RCP	225	0.6	1.44	
P ZAP Q1	RCP	225	0.6	0.6	
P A Q1	RCP	225	0.6	0.59	Unsafe
P Z2 A1	RCP	225	0.6	0.65	
P Z2 A1	RCP	225	0.6	0.64	
P E1	RCP	375	0.6	0.6	
P Z2 B1	RCP	225	0.6	0.62	
P E2	RCP	375	0.6	0.59	Unsafe
P Z2 A1	RCP	225	0.6	0.61	
P H A1	RCP	375	0.6	0.6	

P AP6	uPVC HD	303	0.6	0.71	
P AP5	uPVC HD	303	0.6	0.7	
P AP4	uPVC HD	303	0.6	0.7	
P AP3	RCP	375	0.6	0.55	Unsafe
P AN1	RCP	375	0.6	0.46	Unsafe
P B1	RCP	900	0.6	0.57	Unsafe
P C3	RCP	375	0.6	0.59	Unsafe
P C2	RCP	375	0.6	0.9	
P C1	RCP	375	0.6	0.77	
P D5	RCP	375	0.6	0.57	Unsafe
P D4	RCP	375	0.6	0.51	Unsafe
P D3	RCP	375	0.6	0.75	
P D2	RCP	375	0.6	0.77	
P D1	RCP	375	0.6	0.87	
P DA1	RCP	375	0.6	0.6	
P F1	RCP	375	0.6	0.57	Unsafe
P G1	RCP	375	0.6	0.58	Unsafe
P H7	RCP	600	0.6	0.45	Unsafe
P J3	RCP	375	0.6	0.57	Unsafe
P J2	RCP	450	0.6	0.6	
P K3	RCP	625	0.6	0.51	Unsafe
P L1	RCP	450	0.6	0.58	Unsafe
P M1	RCP	450	0.6	0.57	Unsafe
P N2	RCP	450	0.6	0.45	Unsafe
P N1	RCP	525	0.6	0.58	Unsafe
P P5	RCP	675	0.6	0.59	Unsafe
P P4	RCP	675	0.6	1.58	
P P3	RCP	675	0.6	1.71	
P P2	RCP	750	0.6	1.56	
P P1	RCP	750	0.6	1.36	
P Q1	RCP	450	0.6	0.6	
P R1	RCP	375	0.6	0.48	Unsafe
P S1	RCP	375	0.6	0.58	Unsafe
P T1	RCP	375	0.6	0.57	Unsafe
P U1	RCP	600	0.6	0.58	Unsafe
P V1	RCP	625	0.6	0.45	Unsafe
P W11	RCP	750	0.6	0.25	Unsafe
P X1	RCP	375	0.6	0.5	Unsafe
P Y1	RCP	375	0.6	0.57	Unsafe
P Z1	RCP	450	0.6	0.52	Unsafe
P ZAP A1	RCP	225	0.6	1.41	
P ZAP B1	RCP	225	0.6	1.43	
P ZAQ1	RCP	225	0.6	0.6	
P AQ1	RCP	375	0.6	0.59	Unsafe
P ZEA1	RCP	225	0.6	0.65	
P ZEA1	RCP	225	0.6	0.64	
P E1	RCP	375	0.6	0.6	
P ZEB1	RCP	225	0.6	0.62	
P E2	RCP	375	0.6	0.59	Unsafe
P ZHA1	RCP	225	0.6	0.61	
P HA1	RCP	375	0.6	0.59	Unsafe

100 YEAR ARI RESULTS

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS				Version 8	Min	Overflow	Constraint
Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Freeboard (m)	(cu.m/s)	
A22	30.7		1.435		-0.1	0.272	Headwall height/system capacity
A21	30.02		0		0		Outlet System
A20	29.88		0.272		0.14	0.272	Inlet Capacity
A19	29.56		0.009		0.28	0	None
A18	28.96		0.02		0.08	0	None
A17	28.62		0		0.27	0	None
A16	27.82		0.043		0	0.363	Outlet System
A15	27.15		0.388		0.18	0.257	Inlet Capacity
A14	26.48		0.289		0.4	0.158	Inlet Capacity
A13	25.94		0.197		0.15	0.08	Inlet Capacity
A12	25.31	25.36	0.65	1	-0.06	0.463	Outlet System
A11	24.96		0.424		0.02	0.352	Inlet Capacity
A10	23.66		0.397		0.8	0.265	Inlet Capacity
A9	23.26		0.311		0.63	0.177	Inlet Capacity
A8	22.77		0.224		0.39	0.1	Inlet Capacity
A7	22.25		0.14		0.16	0.04	Inlet Capacity
A6	21.72		0.094		0	0.057	Outlet System
A5	21.33		0.101		0	0.604	Outlet System
A4	21.02	21.25	0.621	4.6	0.04	0.203	Inlet Capacity
A3	20.29		0.219		1.02	0.101	Inlet Capacity
A2	19.59	21.3	0.122	6.8	1.65		Inlet Capacity
Bioretention	18.32		0				
AA1	23.2		0.446				
W3	22.98		0.018		0.51	0	None
W2	22.42		0.013		0.42	0	None
W1	21.44		0.021		0.39	0	None
AB1	23.6		0.04		0.79	0	None
W4	23.48		0.029		0.91	0	None
AC2	25.62		0.426				
AC1	25.15		0.006		0.75	0	None
W5	24.76		0		0.43		None
AD2	24.92		1.089				
AD1	24.89	25.4	0.044	0	0.5		None
AE1	25.61		0.016		0.55	0	None
W6	25.6		0.013		0.55	0	None
AF1	25.95		0.006		0.79	0	None
W7	25.95		0.016		0.79	0	None
AG1	26.32		0.018		0.81	0	None
W8	26.31		0.017		0.78	0	None
AH1	27.05		0.017		0.89	0	None
W9	26.9		0.02		0.89	0	None
AJ1	28.3		0.861				
W10	28.17		0.017		0.81	0	None
AK1	28.2		0.019		0.78	0	None
AL1	25.71		0.433				
H5	25.69	25.76	0.016	0.4	0.04	0	Inlet Capacity
H4	25.53		0.018		0.21	0	None
H3	25.43	25.43	0.1	4.3	-0.03	0.194	Outlet System
H2	25.37	25.44	0.172	4.3	0.03	0.1	Inlet Capacity
H1	25.03		0.107		0.1	0.025	Inlet Capacity
AM1	25.8		0.224				
J1	25.63		0.026		0	0.156	Outlet System
B2	21.17		0.022		0.65	0	None
B1	21.08	21.14	0.108	0.9	-0.02	0	Outlet System
C3	22.96		0.071		0.23	0.007	Inlet Capacity
C2	22.68		0.029		0	0.035	Outlet System
C1	22.44		0.064		0	0.072	Outlet System
D5	23.01		0.022		0.16	0	None
D4	23		0.024		0.17	0	None
D3	22.93		0.004		0.04	0	None
D2	22.78		0.028		0	0.066	Outlet System
D1	22.76		0.082		0.02	0.02	Inlet Capacity
DA1	22.94		0.006		0.31	0.004	Inlet Capacity
F1	23.31		0.065		0.59	0.005	Inlet Capacity
G1	23.83		0.061		0.77	0.004	Inlet Capacity
H6	25.62		0.041		0	0.083	Outlet System
J3	26.19		0.037		0.01	0.018	Inlet Capacity
J2	26.16		0.029		0.04	0	None
K3	26.64		2.241				
K2	26.39		0		-0.67	0	Outlet System
K1	25.71		0.004		-0.12	0.404	Outlet System
L1	25.32	25.36	0.623	2.5	-0.1	0.529	Outlet System
M1	25.96		0.036		0.27	0	None
N2	26.7		0.279				
N1	26.66		0.061		0.38	0.004	Inlet Capacity
P5	28.44		0.56				
P4	28.38		0.068		0	0.237	Outlet System
P3	28.29		0.237		0.09	0.118	Inlet Capacity
P2	27.73		0		0.73		None
P1	27.37		0.15		0.6	0.048	Inlet Capacity
Q1	28.5		0.413				
R2	29.71		0.29				
R1	29.01		0		0		Outlet System
S1	29.15		0.158		0.18	0.058	Inlet Capacity
T1	29.79		0.278		0.1	0.152	Inlet Capacity
U1	30		0.529				
V1	21.15		0.508				
W11	28.77		0.05				
X1	21.5		0.211				
Y1	22.44		0.03		0.46	0	None
Z1	22.55		0.476				
ZAPA1	21.56		0.015				
AP2	21.55		0.001		0.28	0	Inlet Capacity
AP1	21.42		0.006		0.22	0.003	Inlet Capacity
ZAPB1	21.43		0.008				
ZAQ1	21.4		0.035				
AQ1	21.38		0.01		0	0.05	Outlet System
ZDA1	23		0.003				
ZEA1	23.19		0.014				
E1	23.07		0.017		0.91	0.01	Inlet Capacity
ZEB1	24.74		0.023				
E2	24.61		0.002		0.87	0.001	Inlet Capacity
ZHA1	25.99		0.022				
HA1	25.84		0.002		1.25	0.001	Inlet Capacity
AP6	21.73	22.28	0.016	0.1	0.52	0	Inlet Capacity
AP5	21.58	22.13	0.007	0	0.54	0	Inlet Capacity
AP4	21.57	22.05	0.007	0	0.46	0	Inlet Capacity
AP3	21.56	22.03	0.007	0	0.46	0	Inlet Capacity
AN1	29.02		0.019				

SUB-CATCHMENT DETAILS							
Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm

	C A22	1.435	0.108	1.365	5	14	AR&R 100year, 25 minutes storm, average 108 mm/h, Zone 1
	C A19	0.009	0.007	0.001	5	10	AR&R 100year, 25 minutes storm, average 108 mm/h, Zone 1
	C A18	0.02	0.016	0.003	5	10	AR&R 100year, 25 minutes storm, average 108 mm/h, Zone 1
	C A16	0.043	0.036	0.007	5	10	AR&R 100year, 25 minutes storm, average 108 mm/h, Zone 1
	C A15	0.035	0.033	0.002	5	10	AR&R 100year, 5 minutes storm, average 219 mm/h, Zone 1
C A14	0.038	0.036	0.002	5	10	AR&R 100year, 5 minutes storm, average 219 mm/h, Zone 1	
	C A13	0.057	0.054	0.003	5	10	0
	C A12	0.095	0.09	0.006	5	10	AR&R 100year, 5 minutes storm, average 219 mm/h, Zone 1
	C A11	0.02	0.017	0.003	5	10	AR&R 100year, 25 minutes storm, average 108 mm/h, Zone 1
	C A10	0.053	0.05	0.003	5	10	0
	C A9	0.059	0.056	0.003	5	10	0
	C A8	0.071	0.067	0.004	5	10	0
	C A7	0.074	0.069	0.004	5	10	0
	C A6	0.076	0.071	0.004	5	10	0
	C A5	0.051	0.048	0.003	5	10	0
	C A4	0.021	0.02	0.001	5	10	0
	C A3	0.022	0.021	0.001	5	10	0
	C A2	0.032	0.025	0.007	5	10	0
	C AA1	0.446	0.371	0.075	5	10	0
	C W3	0.018	0.014	0.004	5	10	0
	C W2	0.013	0.01	0.003	5	10	0
	C W1	0.021	0.016	0.004	5	10	0
	C AB1	0.04	0.031	0.008	5	10	0
	C W4	0.029	0.023	0.006	5	10	0
	C AC2	0.426	0.336	0.09	5	10	0
	C AC1	0.006	0.005	0.001	5	10	0
	C AD2	1.089	0.907	0.182	5	10	0
	C AD1	0.044	0.035	0.009	5	10	0
	C AE1	0.016	0.012	0.003	5	10	0
	C W6	0.013	0.011	0.003	5	10	0
	C AF1	0.006	0.005	0.001	5	10	0
	C W7	0.016	0.013	0.003	5	10	0
	C AG1	0.018	0.014	0.004	5	10	0
	C W8	0.017	0.013	0.004	5	10	0
	C AH1	0.017	0.013	0.004	5	10	0
	C W9	0.02	0.015	0.004	5	10	0
	C AJ1	0.861	0.717	0.144	5	10	0
	C W10	0.017	0.014	0.004	5	10	0
	C AK1	0.019	0.015	0.004	5	10	0
	C AL1	0.433	0.361	0.073	5	10	0
	C H5	0.016	0.015	0.001	5	10	0
	C H4	0.017	0.016	0.001	5	10	0
	C H3	0.017	0.016	0.001	5	10	0
	C H2	0.016	0.015	0.001	5	10	0
	C H1	0.007	0.006	0.001	5	10	0
C AM1	0.224	0.186	0.037	5	10	0	
	C J1	0.026	0.024	0.001	5	10	0
	C B2	0.022	0.017	0.005	5	10	0
	C B1	0.045	0.037	0.008	5	10	0
	C C3	0.065	0.062	0.004	5	10	0
	C C2	0.012	0.01	0.002	5	10	0
	C C1	0.038	0.035	0.002	5	10	0
	C D5	0.022	0.02	0.001	5	10	0
	C D4	0.013	0.013	0.001	5	10	0
	C D3	0.004	0.004	0	5	10	0
	C D2	0.022	0.021	0.001	5	10	0
	C D1	0.013	0.013	0.001	5	10	0
C DA1	0.006	0.006	0	5	10	0	
	C F1	0.065	0.061	0.004	5	10	0
	C G1	0.041	0.039	0.002	5	10	0
	C H6	0.024	0.022	0.001	5	10	0
	C J3	0.037	0.035	0.002	5	10	0
	C J2	0.029	0.028	0.002	5	10	0
	C K3	2.241	2.111	0.13	5	10	0
	C K1	0.004	0.004	0.001	5	10	0
	C L1	0.091	0.085	0.005	5	10	0
	C M1	0.036	0.034	0.002	5	10	0
	C N2	0.279	0.233	0.047	5	10	0
	C N1	0.018	0.015	0.003	5	10	0
	C P5	0.56	0.466	0.094	5	10	0
	C P4	0.026	0.021	0.006	5	10	0
	C P1	0.037	0.031	0.006	5	10	0
	C Q1	0.413	0.326	0.087	5	10	0
	C R1	0.29	0.241	0.048	5	10	0
	C S1	0.013	0.011	0.002	5	10	0
	C T1	0.012	0.01	0.002	5	10	0
	C U1	0.529	0.393	0.136	5	10	0
	C V1	0.508	0.423	0.085	5	10	0
C W11	0.05	0.039	0.011	5	10	0	
	C X1	0.211	0.176	0.035	5	10	0
	C Y1	0.03	0.023	0.006	5	10	0
	C Z1	0.476	0.396	0.08	5	10	0
C ZAP1	0.015	0.012	0.002	5	10	0	
	C AP2	0.001	0.001	0	5	10	0
	C AP1	0.006	0.006	0	5	10	0
C ZAPB1	0.008	0.006	0.001	5	10	0	
C ZAQ1	0.035	0.029	0.006	5	10	0	
	C AQ1	0.01	0.009	0.001	5	10	0
C ZDA1	0.003	0.002	0	5	10	0	
C ZEA1	0.014	0.012	0.002	5	10	0	
	C E1	0.016	0.015	0.001	5	10	0
C ZEB1	0.023	0.019	0.004	5	10	0	
	C E2	0.002	0.002	0	5	10	0
C ZHA1	0.022	0.018	0.004	5	10	0	
	C HA1	0.002	0.002	0	5	10	0
	C AP6	0.016	0.016	0.001	5	10	0
	C AP5	0.007	0.007	0	5	10	0
	C AP4	0.007	0.007	0	5	10	0
	C AP3	0.007	0.002	0.005	5	10	0
	C AN1	0.019	0.016	0.003	5	10	0

olumes for Total Catchment (17.9 impervious + 8.22 pervious = 26.1 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1	167.74	3980.35 (83.5%)	3090.36 (94.5%)	890.00 (59.3%)
AR&R 100 year, 10 minutes storm, average 162.74 mm/h, Zone 1	162.74	4404.07 (88.0%)	4807.23 (96.4%)	1596.84 (69.8%)
AR&R 100 year, 15 minutes storm, average 199.91 mm/h, Zone 1	199.91	5140.12 (89.6%)	6046.36 (97.1%)	2093.76 (73.3%)
AR&R 100 year, 20 minutes storm, average 121.05 mm/h, Zone 1	121.05	4934.69 (90.5%)	7046.64 (97.5%)	2488.05 (75.0%)
AR&R 100 year, 25 minutes storm, average 107.66 mm/h, Zone 1	107.66	4684.60 (90.9%)	7882.64 (97.8%)	2801.95 (75.8%)
AR&R 100 year, 30 minutes storm, average 98.29 mm/h, Zone 1	98.29	4668.16 (91.1%)	8599.25 (98.0%)	3068.91 (76.2%)
AR&R 100 year, 45 minutes storm, average 76.29 mm/h, Zone 1	76.29	3986.56 (91.5%)	10301.34 (98.3%)	3685.23 (76.6%)
AR&R 100 year, 1 hour storm, average 66.72 mm/h, Zone 1	66.72	315799.97 (91.6%)	11644.84 (98.5%)	4155.13 (76.6%)
AR&R 100 year, 1.5 hours storm, average 52.95 mm/h, Zone 1	52.95	18663.61 (91.6%)	13794.47 (98.7%)	4869.14 (75.9%)

PIPE DETAILS					
Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P A22	1.196	1.67	30.243	AR&R 100year, 15 minutes storm, average 139 mm/h, Zone 1	
P A21	1.2	2.25	29.963	AR&R 100year, 15 minutes storm, average 139 mm/h, Zone 1	
P A20	1.478	2.76	29.719	AR&R 100year, 1 hour storm, average 66 mm/h, Zone 1	
P A19	1.494	2.8	29.378	AR&R 100year, 15 minutes storm, average 139 mm/h, Zone 1	

P A18	1.58	2.96	28.775	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P A17	1.693	3.17	28.372	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P A16	1.712	3.2	27.341	AR&R 100 year, 45 minutes storm, average 78 mm/h, Zone 1
P A15	2.414	3.79	26.796	AR&R 100 year, 1 hour storm, average 66 mm/h, Zone 1
P A14	2.735	3.04	26.245	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P A13	2.845	3.16	25.681	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P A12	3.116	2.76	25.147	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P A11	5.393	4.59	23.959	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P A10	5.471	4.11	23.306	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P A9	5.626	3.21	23.073	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P A8	5.719	3.14	22.518	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P A7	5.924	3.25	21.986	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P A6	5.932	3.25	21.447	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P A5	5.973	3.27	21.104	AR&R 100 year, 1.5 hours storm, average 52 mm/h, Zone 1
P A4	6.628	3.07	20.357	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P A3	6.711	3.86	19.633	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P A2	10.157	2.53	19.046	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P A1	1.947	2.72	18.55	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P AA1	0.445	2.85	23.196	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P W3	2.993	3.33	22.833	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P W2	3.475	3.92	22.133	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P W1	3.691	4.21	21.037	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P AB1	0.04	1.78	23.503	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P W4	2.56	5.45	23.171	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P AC2	0.427	3.77	25.625	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P AC1	0.429	2.01	25.069	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P W5	2.502	5.33	23.97	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P AD2	1.082	1.97	24.917	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P AD1	1.089	1.71	24.82	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P AE1	0.019	0.17	25.602	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P W6	1.078	3.65	24.761	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P AF1	0.009	0.16	25.948	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P W7	1.022	3.35	25.597	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P AG1	0.021	0.23	26.313	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P W8	0.994	2.97	26.137	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P AH1	0.017	5.72	26.974	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P W9	0.972	3.91	26.721	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P AJ1	0.865	5.96	28.302	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P W10	0.948	3.91	27.698	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P AK1	0.025	0.43	28.192	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P AL1	0.434	1.54	25.711	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P H5	0.463	1.64	25.565	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P H4	0.438	1.22	25.493	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P H3	0.413	1.15	25.376	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P H2	0.662	1.85	25.129	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P H1	0.692	1.57	24.981	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P AM1	0.234	2.12	25.798	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P J1	0.226	1.42	25.476	AR&R 100 year, 30 minutes storm, average 98 mm/h, Zone 1
P B2	0.034	0.67	21.106	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P B1	0.606	0.95	21.045	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P C3	0.079	0.71	22.885	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P C2	0.175	1.59	22.552	AR&R 100 year, 10 minutes storm, average 167 mm/h, Zone 1
P C1	0.19	1.72	22.321	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P D5	0.024	0.22	23.001	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P D4	0.093	0.84	22.943	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P D3	0.105	0.95	22.891	AR&R 100 year, 10 minutes storm, average 167 mm/h, Zone 1
P D2	0.113	1.02	22.767	AR&R 100 year, 10 minutes storm, average 167 mm/h, Zone 1
P D1	0.12	1.09	22.74	AR&R 100 year, 10 minutes storm, average 167 mm/h, Zone 1
P DA1	0.023	0.21	22.944	AR&R 100 year, 10 minutes storm, average 167 mm/h, Zone 1
P F1	0.059	0.54	23.282	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P G1	0.054	2.07	23.722	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P H6	0.023	0.21	25.622	AR&R 100 year, 10 minutes storm, average 167 mm/h, Zone 1
P J3	0.059	0.54	26.129	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P J2	0.113	0.71	26.164	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P K3	2.242	4.19	26.642	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P K2	2.245	4.2	25.949	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P K1	2.005	3.15	25.099	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P L1	0.214	1.35	25.315	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P M1	0.05	0.31	25.949	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P N2	0.28	1.76	26.702	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P N1	0.296	1.37	26.528	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P P5	0.562	1.57	28.443	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P P4	0.571	1.6	28.304	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P P3	0.965	2.7	27.869	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P P2	0.956	2.16	27.456	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P P1	0.985	2.23	27.266	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P Q1	0.415	2.61	28.505	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P R2	0.29	2.63	29.713	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P R1	0.307	2.78	28.927	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P S1	0.1	0.9	29.015	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P T1	0.125	1.14	29.565	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P U1	0.532	1.88	30.003	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P V1	0.508	2.34	21.15	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P W11	0.05	2.85	28.77	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P X1	0.21	1.9	21.504	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P Y1	0.034	0.3	22.426	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P Z1	0.474	2.98	22.55	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P ZAP A1	0.016	0.41	21.564	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P AP2	0.083	0.75	21.52	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P AP1	0.094	0.85	21.383	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P ZAP B1	0.008	0.21	21.422	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P ZAQ1	0.035	0.89	21.402	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P AQ1	0.045	0.41	21.384	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P ZDA1	0.003	0.08	22.997	AR&R 100 year, 30 minutes storm, average 98 mm/h, Zone 1
P ZEA1	0.014	0.99	23.186	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P E1	0.048	1.24	23.071	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P ZEB1	0.023	1.14	24.738	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P E2	0.024	1.51	24.528	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P ZHA1	0.022	1.11	25.993	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
P HA1	0.049	1.55	25.834	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
P AP6	0.032	0.45	21.595	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
P AP5	0.04	0.56	21.578	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P AP4	0.047	0.65	21.565	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P AP3	0.052	0.47	21.551	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
P AN1	0.025	0.22	29.018	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm
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OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
F A22	0.272	0.272	19.579	0.053	0.03	14.51	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1	
F A20	0.272	0.277	1.033	0.158	0.11	5.92	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1	
F A19	0	0.02	0.685	0.049	0.04	1.28	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1	
F A18	0	0	0.924	0	0	0	0	
F A17	0	0.043	0.924	0.072	0.05	2.11	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1	
F A16	0.363	0.384	0.687	0.141	0.18	4.92	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1	
F A15	0.257	0.284	0.841	0.137	0.14	4.65	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1	
F A14	0.158	0.19	0.658	0.105	0.13	3.28	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1	
F A13	0.08	0.108	0.672	0.086	0.1	2.61	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1	
F A12	0.463	0.463	13.276	0.051	0.06	14.15	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1	

	F A11	0.352	0.392	0.74	0.147	0.18	5.25	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
	F A10	0.265	0.305	0.74	0.134	0.16	4.48	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
	F A9	0.177	0.216	0.743	0.117	0.13	3.69	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
	F A8	0.1	0.133	0.737	0.097	0.1	2.98	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
	F A7	0.04	0.086	0.703	0.082	0.08	2.44	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
	F A6	0.057	0.095	0.674	0.084	0.09	2.5	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
	F A5	0.604	0.615	0.751	0.172	0.22	6.69	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
	F A4	0.203	0.203	13.276	0.037	0.03	11.45	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
F A3	0.101	0.101	7.665	0.035	0.02		11.09	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
	F A1	8.191	8.191	7.665	0.205	0.34	45.04	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
	F W3	0	0.013	0.639	0.041	0.03	1.01	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
F W1	F W2	0	0.021	0.639	0.048	0.04	1.25	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	0	0	0.032	0.771	0.06	0.05	1.68	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F AB1	0	0.03	0.639	0.054	0.05	1.48	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F W4	0	0.018	0.638	0.046	0.04	1.18	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F AC1	0	0.029	0.554	0.051	0.05	1.38	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F AE1	0	0.04	0.621	0.059	0.06	1.64	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F W6	0	0.022	0.647	0.05	0.04	1.31	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F AF1	0	0.016	0.731	0.047	0.03	1.21	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F W7	0	0.013	0.678	0.043	0.03	1.08	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F AG1	0	0.037	0.852	0.066	0.05	1.87	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F W8	0	0.016	0.889	0.051	0.03	1.38	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F AH1	0	0.018	0.661	0.047	0.04	1.21	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F W9	0	0.017	0.68	0.046	0.04	1.18	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F W10	0	0.02	0.586	0.046	0.04	1.18	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F AK1	0	0.017	0.586	0.043	0.04	1.08	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F H5	0	0	13.276	0	0	0	
	F H4	0	0	16.961	0	0	0	
	F H3	0.194	0.194	6.504	0.048	0.03	13.61	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
	F H2	0.1	0.1	19.871	0.035	0.02	10.91	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
	F H1	0.025	0.06	0.713	0.072	0.07	2.11	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
	F J1	0.156	0.169	0.685	0.103	0.12	3.22	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F B2	0	0.013	0.559	0.039	0.04	0.95	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F B1	0	0	13.276	0	0	0	
	F C3	0.007	0.027	0.622	0.052	0.05	1.41	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
	F C2	0.035	0.061	0.879	0.08	0.06	2.37	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
	F C1	0.072	0.094	0.661	0.082	0.09	2.44	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
	F D5	0	0.004	0.802	0.031	0.02	0.65	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F D4	0	0.004	0.637	0.028	0.02	0.55	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F D3	0	0.015	0.92	0.051	0.03	1.34	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F D2	0.066	0.066	13.276	0.025	0.02	8.23	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
	F D1	0.02	0.02	7.665	0.019	0.01	6.44	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
	F DA1	0.004	0.014	0.773	0.046	0.03	1.18	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F F1	0.005	0.069	0.74	0.078	0.07	2.3	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F G1	0.004	0.065	0.74	0.076	0.07	2.24	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
	F H6	0.083	0.096	0.974	0.098	0.07	3.01	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
	F J3	0.018	0.036	0.889	0.068	0.04	1.94	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F J2	0	0.026	0.889	0.059	0.04	1.64	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F K2	0	0.004	0.853	0.032	0.02	0.68	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F K1	0.404	0.422	0.558	0.133	0.22	4.43	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
	F L1	0.529	0.529	14.846	0.053	0.06	14.69	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
	F M1	0	0.068	0.675	0.073	0.07	2.14	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F N1	0.004	0.036	0.658	0.059	0.05	1.64	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
	F P4	0.237	0.237	13.276	0.039	0.04	11.81	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
	F P3	0.118	0.145	0.86	0.107	0.1	3.35	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
	F P1	0.048	0.059	0.653	0.069	0.07	2.01	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
	F S1	0.058	0.068	0.653	0.073	0.07	2.14	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
	F T1	0.152	0.157	0.687	0.101	0.11	3.11	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
	F Y1	0	0.022	0.639	0.049	0.04	1.28	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F AP2	0	0	1.829	0	0	0	
	F AP1	0.003	0.003	13.263	0.007	0	2.25	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F AQ1	0.05	0.05	7.665	0.027	0.01	9.13	AR&R 100 year, 15 minutes storm, average 139 mm/h, Zone 1
	F E1	0.01	0.023	0.638	0.05	0.04	1.31	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F E2	0.001	0.017	0.764	0.048	0.03	1.25	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F HA1	0.001	0.018	0.685	0.048	0.04	1.25	AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1
	F AP6	0	0	7.665	0	0	0	
	F AP5	0	0	7.665	0	0	0	
	F AP4	0	0	7.665	0	0	0	
	F AP3	0	0	7.665	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
A1	19.05	106	10.137	1.947	8.191

TY CHECK for AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
A22	1419.66	1419.39	0	0
A21	1322.48	1218.98	0	7.8
A20	1753.93	1752.71	0	0.1
A19	1724.64	1722.89	0	0.1
A18	1783.18	1784.34	0	-0.1
A17	2020.51	2020.83	0	0
A16	2057.07	2055.79	0	0.1
A15	2951.79	2951.71	0	0
A14	3233.24	3229.74	0	0.1
A13	3305.97	3306.41	0	0
A12	3564.53	3565.63	0	0
A11	6028.48	6019.76	0	0.1
A10	6098.75	6092.39	0	0.1
A9	6192.62	6184.58	0	0.1
A8	6243.1	6236.53	0	0.1
A7	6491.04	6485.29	0	0.1
A6	6547.39	6544.23	0	0
A5	6665.51	6666.18	0	0
A4	7174.54	7169.72	0	0.1
A3	7188.04	7223.04	0	-0.5
A2	10455.04	10037.18	0	4
A1	10037.18	10036.69	0.42	0
Bioretention	2822.17	2822.17	0	0
AA1	371.74	371.5	0	0.1
W3	2590.83	2588.22	0	0.1
W2	3020.36	3014.91	0	0.2
W1	3207.94	3205.2	0	0.1
AB1	33.2	33.14	0	0.2
W4	2205.6	2204.58	0	0
AC2	354.78	354.88	0	0
AC1	359.95	359.28	0	0.2
W5	2152.38	2148.33	0	0.2
AD2	907.48	907.6	0	0
AD1	944.58	905.9	0	4.1
AE1	13.09	13.05	0	0.3
W6	886.39	887.21	0	-0.1
AF1	4.94	4.94	0	0.1
W7	861.4	862.17	0	-0.1
AG1	14.96	14.93	0	0.2
W8	845.83	842.79	0	0.4
AH1	13.96	13.94	0	0.2
W9	818.57	816.94	0	0.2
AJ1	717.91	718.47	0	-0.1

W10	790.09	788.34	0	0.2
AK1	15.54	15.55	0	0
AL1	360.97	361.51	0	-0.1
H5	377.03	376.48	0	0.1
H4	410.28	409.45	0	0.2
H3	440.59	438.78	0	0.4
H2	677.78	676.19	0	0.2
H1	682.37	682.13	0	0
AM1	186.29	186.4	0	-0.1
J1	262.05	260.91	0	0.4
B2	18.28	18.2	0	0.4
B1	492.74	491.05	0	0.3
C3	54.76	54.49	0	0.5
C2	177.65	177.22	0	0.2
C1	208.01	208.07	0	0
D5	17.65	17.59	0	0.3
D4	75.99	75.88	0	0.2
D3	81.59	81.52	0	0.1
D2	100.83	100.63	0	0.2
D1	114.88	114.86	0	0
DA1	5.32	5.33	0	-0.3
F1	53.22	53	0	0.4
G1	35.71	35.71	0	0
H6	19.56	19.44	0	0.6
J3	30.71	30.77	0	-0.2
J2	54.93	54.68	0	0.5
K3	1836.64	1836.38	0	0
K2	1836.38	1835.96	0	0
K1	1839.66	1837.46	0	0.1
L1	180.8	180.17	0	0.4
M1	29.66	29.53	0	0.4
N2	232.79	232.91	0	-0.1
N1	250.82	250.28	0	0.2
P5	466.96	467.14	0	0
P4	501.72	500.9	0	0.2
P3	844.93	843.14	0	0.2
P2	831.62	830.99	0	0.1
P1	873.58	870.84	0	0.3
Q1	343.89	344.03	0	0
R2	241.32	240.57	0	0.3
R1	256.53	236.16	0	7.9
S1	56.55	56.61	0	-0.1
T1	106.61	107	0	-0.4
U1	439.37	438.06	0	0.3
V1	423.07	423.25	0	0
W11	41.68	41.66	0	0
X1	175.74	175.8	0	0
Y1	24.68	24.63	0	0.2
Z1	396.46	396.59	0	0
ZAPA1	12.44	12.43	0	0.1
AP2	68.44	68.09	0	0.5
AP1	79.41	79.18	0	0.3
ZAPB1	6.43	6.43	0	0.1
ZAQ1	29.39	29.38	0	0
AQ1	37.3	37.12	0	0.5
ZDA1	2.44	2.43	0	0.3
ZEA1	11.77	11.78	0	-0.1
E1	45.1	44.96	0	0.3
ZEB1	18.83	18.86	0	-0.1
E2	20.6	20.56	0	0.2
ZHA1	18.2	18.23	0	-0.1
HA1	19.69	19.63	0	0.3
O AQ1	12.14	12.14	0	0
AP6	12.91	12.89	0	0.2
AP5	18.87	18.83	0	0.2
AP4	24.68	24.64	0	0.1
AP3	30.29	30.33	0	-0.1
Basin 4	7214.52	7214.52	0	0
AN1	16.02	15.96	0	0.3

031 DRAINS Model Stage 7A, 7B, 7C and 7D 100 Year ARI run at 11:55:51 on 31/10/2016

elling occurred at AQ1 P4 K1 H6 D2 C1 C2 J1 H3 A5 A16

15m at R1 T1 P3 L1 J2 J3 D1 D3 B1 H1 H2 H5 A4 A6 A11 A12 A18 A21

The maximum flow in the following overflow routes is unsafe: F A1

ess than 2%) in reducing peak discharge: A1 You might consider upsizing these, or removing them from the model.

wing overflow routes carried water uphill (adding energy): F A1 F A12 F A4

ould check for water flowing round in circles at these locations. You may need to reformulate the model.

ATTACHMENT 4

Estate wide Stormwater Manage Plan & Water Quality Report

By

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Stormwater Management Plan

Stages 2-4 & 7 Altrove

Property:

Lot 200 DP 1140580
Veron Road Schofields

Applicant:



Date:

June 2016

Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Draft Issue	6/6/2016	BM	MK
B	First Issue	6/6/2016	BM	MK
C	Revision re: Overland Flow Path	16/6/2016	ML	MK

Executive Summary

ADW Johnson has been engaged to provide a stormwater management report for Stage 7 of the 'Altrove' subdivision at Schofields. This report also includes contributing catchments from the previously constructed Stage 1 and developing catchments from Stages 2-4 of the same development.

During the initial stages of the development, a stormwater basin was proposed in the north-western corner of the site. This basin is to provide both stormwater detention and water quality treatment and is intended to be enlarged progressively as further stages are developed. Water quality treatment is to be provided by five (5) bioretention 'cells' provided within the basin, two (2) of which have been constructed as a part of the Stage 1 works.

For detention, the basin was analysed using a RAFTS model, with Stages 1, 2, 3, 4 and 7 all fully developed to determine the peak discharges leaving the site. The post developed peak discharges were found to be less than the pre developed peak discharges for all storm events in its current arrangement.

The basin was modelled using a MUSIC model to determine the treatment capacity of the basin in its interim state. The basin was modelled in this interim state, with Stages 1, 2, 3, 4 and 7 all fully developed and it was found that the overall treatment train did not meet the water quality reduction targets set out by Blacktown City Council. It was found that constructing the third of the five (5) cells would enable the treatment train to meet the required reduction targets.

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1.0 Introduction

ADW Johnson has been engaged to provide a stormwater management report for stage 7 of the 'Altrove' subdivision at Schofields. This report also includes contributing catchments from the previously constructed stage 1 and developing catchments stages 2-4 of the same development.

During the initial stages of the development, a stormwater basin was proposed in the north-western corner of the site. This basin is to provide both stormwater detention and water quality treatment and is intended to be enlarged progressively as further stages of the development come on line. Water quality treatment is to be provided by five (5) bioretention 'cells' provided within the basin, two (2) of which have been constructed as a part of the Stage 1 works. This basin has been identified in the "Schofields Precinct Water Cycle Management Strategy Report Incorporating Water Sensitive Urban Design Techniques, Post Exhibition Report" (2012) prepared by J. Wyndham Prince.

The aim of this report is to determine the staging of the basin such that it will meet both the water quantity and water quality targets set out by Blacktown City Council (BCC) once stage 7 is constructed.

2.0 Site Description and Background Information

2.1 EXISTING SITE

The site has historically been used as farmland and is therefore sparsely vegetated with slopes ranging from 1% to 10% draining towards north-west of the site. From there flows drain to Eastern Creek to the west.

Stage 1 of the development has already been constructed, as well as interim basin and culvert works associated with the development. Works undertaken within the catchment, including interim works to Basin 4 as of March 2016, can be seen in Figure1 below.

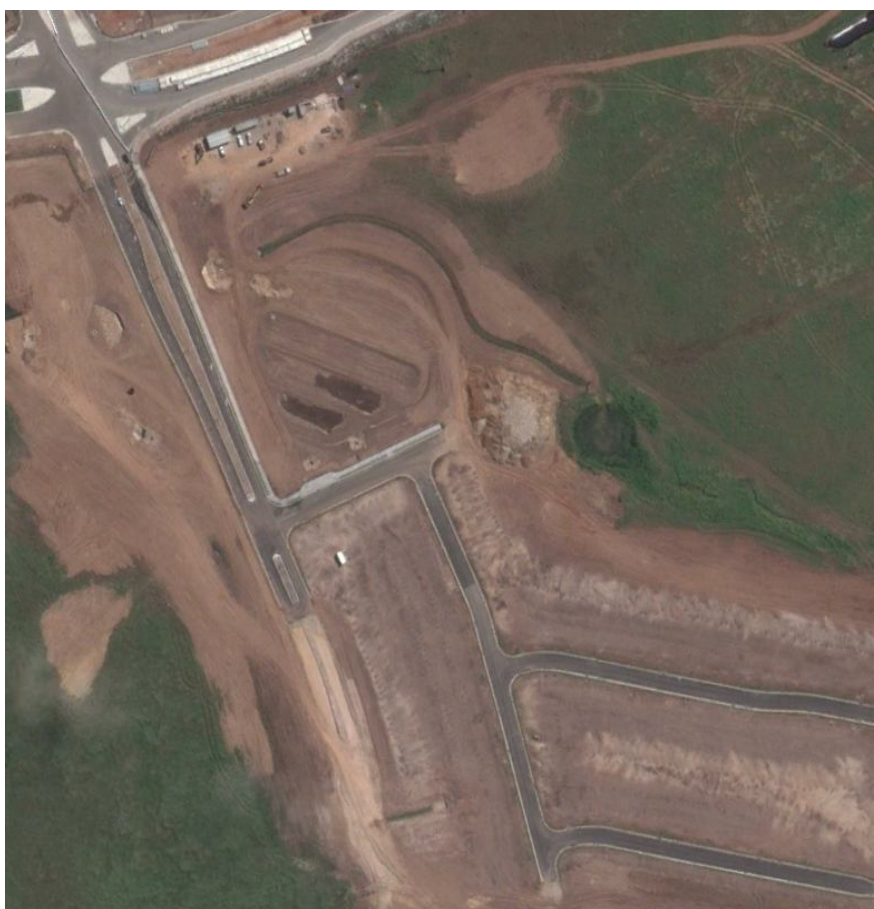


Figure 1 – Current State of Works (24/3/2016)

2.2 BACKGROUND INFORMATION

Calibre (formerly Brown Consulting) had previously developed a stormwater strategy in accordance with the J. Wyndham Prince report for the previous masterplan with their report “*Stormwater Management & Trunk Drainage Strategy – April 2016*”. This report by Calibre includes both the interim and ultimate basin designs.

Due to changing land uses within the catchment, the modelling parameters adopted within the Calibre report will be amended in this report to ensure accurate modelling of the development following construction of Stage 7.

3.0 Stormwater Requirements

The proposed development is to comply with the following Blacktown City Council (BCC) documents:

- BCC Growth Centre Precincts Development Control Plan 2010;
- BCC Engineering Guide for Development - 2005;
- BCC Developer Handbook for Water Sensitive Urban Design;
- BCC Development Control Plan 2006 – Part R.

All documents have been reviewed and there are several similar objectives and requirements relating to stormwater management. The BCC's Growth Centre Precincts Development Control Plan refers to the BCC Developer Handbook for Water Sensitive Urban Design for design objectives.

The stormwater quantity objectives are to attenuate the post developed peak flows to less than or equal to the pre developed peak flows.

The stormwater quality treatment objectives have been taken from the BCC Developer Handbook for Water Sensitive Urban Design and are summarised below in Table 1.

Table 1.

Pollutant	Stormwater Treatment Objectives
Suspended Solids	85% Retention of the AAL (Average Annual Load)
Total Phosphorus	65% Retention of the AAL
Total Nitrogen	45% Retention of the AAL
Gross Pollutants	90% Retention of the AAL, for pollutants greater than 5mm

4.0 Water Quantity Modelling

The stormwater detention basin is required to limit the post developed peak flows leaving the site to less than or equal to the pre development to ensure there are no adverse effects on downstream properties or the environment.

The peak flood level in the 1 in 100 year ARI storm event is to be checked to ensure that the basin, in its interim state, has enough capacity to handle the flows from Stages 1, 2, 3, 4 and 7.

4.1 CATCHMENTS

A pre developed model was set up to determine the target flows for the post developed model. The pre developed model was adopted from the previous Calibre report. As per the previous Calibre report, the pre developed catchment was modelled with a percentage impervious of 5%.

The size of the pre developed catchments were also adopted from the Calibre report. These catchments were assessed as being accurate. The pre developed catchment can be seen in Exhibit 1.

Catchment areas adopted for the post developed RAFTS model are as per the previous modelling done by Calibre with the exception of the amended land use areas. The catchment runoff parameters were adopted from Table 3.3 of the Blacktown City Council Engineering Guide for Development, 2005. The updated catchment plan can be seen in Exhibit 1.

4.2 BASIN

The ultimate design for the basin is to provide detention for a catchment of approximately 44ha. Currently, the basin is constructed to an interim level with the ultimate design to be completed as construction within the catchment progresses. At the completion of Stage 7, approximately 15ha is proposed to be developed.

The stage storage for the interim basin was extracted from 12d, based on the Calibre design data. The stage discharge relationship used in the model was based upon the controls used in the previous Calibre report. The stage storage relationship for the basin can be seen in Exhibit 2.

The basin is subject to tail water effects from the downstream river. The basin has been modelled with both a free draining outlet and, as per the previous Calibre report, the 1 in 100 year ARI storm event has been analysed with a tail water of 17.4m.

4.3 RESULTS

The RAFTS model was analysed to determine the peak discharge and peak flood level for a range of storm events. The results can be seen below in Table 2.

Table 2.

RAFTS Results			
ARI	Pre Developed Peak Flow (m ³ /s)	Post Developed Peak flow (m ³ /s)	Basin Stage (RL m)
2	4.34	2.13	17.36
5	6.09	2.25	17.58
20	8.54	4.13	17.68
100	11.1	4.41	17.9
100 + 17.4m Tail Water	11.1	2.98	18.31

It can be seen from Table 2 that the post developed peak discharges in all storm events are below the pre developed discharges. It can also be seen that the peak flood level in the basin is below the spillway level of 18.35m. The peak storage in the basin can be seen in Exhibit 2.

4.4 EXTERNAL CATCHMENT

Currently, an underdeveloped catchment of approximately 3.1Ha east of the subject site generates flows that are discharged through the site by existing culverts located under the rail corridor.

For this existing catchment, it is noted in the report titled *Report for Riverstone and Alex Avenue Precincts – Post Exhibition Flooding and Water Cycle Management (incl. Climate Change impact on Flooding)*, prepared by GHD that low flows from this catchment are to be diverted to the next catchment to the south along Railway Terrace and that only some of the larger flows can be directed under the railway line through a recently constructed culvert. This flow regime will only be relevant once development of the catchment is undertaken.

Notwithstanding the GHD report flows from this catchment have been accounted for through a proposed trunk drainage system to satisfy the current site conditions.

As part of the revised submission, a trunk pit and pipe drainage pipe is to be provided in lieu of the previously proposed drainage swale. At present twin 675mm Reinforced Concrete Pipes (RCP's) presently discharge under the rail corridor through the proposed development site. To provide capacity downstream of the existing twin 675mm RCP's, a 900mm single pipe is proposed with single headwall. Through providing a 900mm RCP, the capacity of the downstream system has been calculated at 2.5m³/s, and will at least match the capacity of the existing culverts whilst accepting local flows for the minor event, therefore meeting Council's requirements for both the minor and major storm events. Details of this drainage line are provided in Exhibit 2 attached.

5.0 Water Quality Modelling

The stormwater drainage system must effectively reduce the nutrients and gross pollutants leaving the site prior to the runoff entering the receiving waters to ensure impacts of development are minimised.

5.1 MODELLING

The effectiveness of the stormwater quality treatment for the development was analysed using the water quality modelling software MUSIC, which simulates the performance of stormwater management systems in removing nutrients and sediments from a catchment by evaluating the average annual pollutant load delivered to the receiving waters.

MUSIC uses a continuous simulation with a user defined time step to model the performance of a number of stormwater management measures in series and in parallel to form a treatment train.

5.2 MUSIC MODEL PARAMETERS

5.2.1 Rainfall and Potential Evapotranspiration Data

The rainfall and potential evapotranspiration data used in the MUSIC model was obtained from the BCC Developer Handbook for Water Sensitive Urban Design and input into the model using the MUSIC-Link function.

5.2.2 Catchments

The overall Stage 1, 2, 3, 4 and 7 catchment draining to the proposed basin was split into multiple subcatchments to accurately measure the pollutants being generated by the development. The proposed catchments can be seen in Exhibit 1.

In accordance with BCC guidelines, the catchment was broken into the following subcatchments:

- Lot areas;
- Road Areas;
- Other Impervious and pervious areas.

Within each of these subcatchments, the areas were further broken down to obtain the source nodes for the MUSIC model:

- Lot Areas:
 - o Roof area – Taken as 55% of the overall lot area (only 50% was directed to the rainwater tank);
 - o Road (Driveway) – Taken as 10% of the overall lot area;
 - o Other Impervious areas – Taken as 20% of the overall lot area for Stages 1-4 and 25% for Stage 7. This node represents any impervious area on the lot other than the driveway or roof;
 - o Other Pervious area – taken as 15% of the overall lot area for Stages 1-4 and 10% for Stage 7. This node represents the pervious areas on the lot;

- Road Area:
 - o Impervious Road Area – Taken as 95% of the overall road area;
 - o Pervious Road Area – Taken as 5% of the overall road area;
- Other Impervious and Pervious areas:
 - o This node was used to model the proposed open space parks within the development. In accordance with BCC guidelines, an impervious percentage of 50% was adopted for open space areas.

Pollutant loads and rainfall runoff parameters were adopted from BCC Developer Handbook for Water Sensitive Urban Design and input into the model using the MUSIC-link function. The pollutant loads were modified for each individual node to ensure the loads were appropriate for the catchment type (i.e. road, roof, impervious or pervious area).

5.2.3 Treatment Devices

The runoff from the development is to be treated using a combination of rainwater tanks, Gross Pollutant Traps and the proposed bioretention basin.

Rainwater Tanks

In accordance with BCC Developer Handbook for Water Sensitive Urban Design, an allowance has been made for a 2.5kL rainwater tank on each lot. Each tank has been set up in accordance with BCC guidelines.

Gross Pollutant Trap

Gross pollutant traps have been provided for each outlet into the basin, to remove coarse sediments and gross pollutants before they enter the basin itself.

Bioretention Basin

The proposed bioretention basin node was set up using BCC guidelines. The key parameters are summarised below:

- Extended Detention Depth – 0.3m;
- Filter Area – 783 m² (Representing the area of the two (2) constructed cells);
- Saturated hydraulic conductivity – 125 mm/hour;
- Filter Depth – 0.6m.

5.3 RESULTS

The proposed treatment train was analysed using the MUSIC program to determine the required area of bioretention cells needed to provide adequate treatment to meet the water quality treatment targets set out by BCC.

Initial modelling was undertaken with the basin in its current configuration. The results of this modelling can be seen below in Table 3.

Table 3.

MUSIC Results – 2 Cells				
Pollutant	Sources	Residual Load	% Reduction	Target % Reduction
GP (Gross Pollutants)	2260	7.65	99.7	90
TSS (Total Suspended Solids)	17800	1940	89.1	85
TP (Total Phosphorus)	33.7	10.8	68.0	65
TN (Total Nitrogen)	206	116	43.7	45

It can be seen from the results in Table 3, that the target reductions are met for all pollutants except for total nitrogen.

In order to meet the target for the total nitrogen, the bioretention node in the model was updated to include the filter area of the third of the five (5) proposed bio retention cells. The third bio retention cell has a filter area of 831m², taking the total filter area in the basin to 1614m².

The bioretention node was updated to include the larger filter area and the treatment train was re analysed. The results can be seen in Table 4.

Table 4.

MUSIC Results – 3 Cells				
Pollutant	Sources	Residual Load	% Reduction	Target % Reduction
GP (Gross Pollutants)	2260	7.69	99.7	90
TSS (Total Suspended Solids)	17800	1160	93.5	85
TP (Total Phosphorus)	33.7	7.91	76.5	65
TN (Total Nitrogen)	206	85	58.7	45

It can be seen from Table 3, that with the extra filter area from the third bioretention cell, the water quality targets are met for all pollutants. In order for the treatment train to provide adequate treatment once Stage 7 is constructed, the third bioretention cell will need to be constructed as a part of the Stage 7 works.

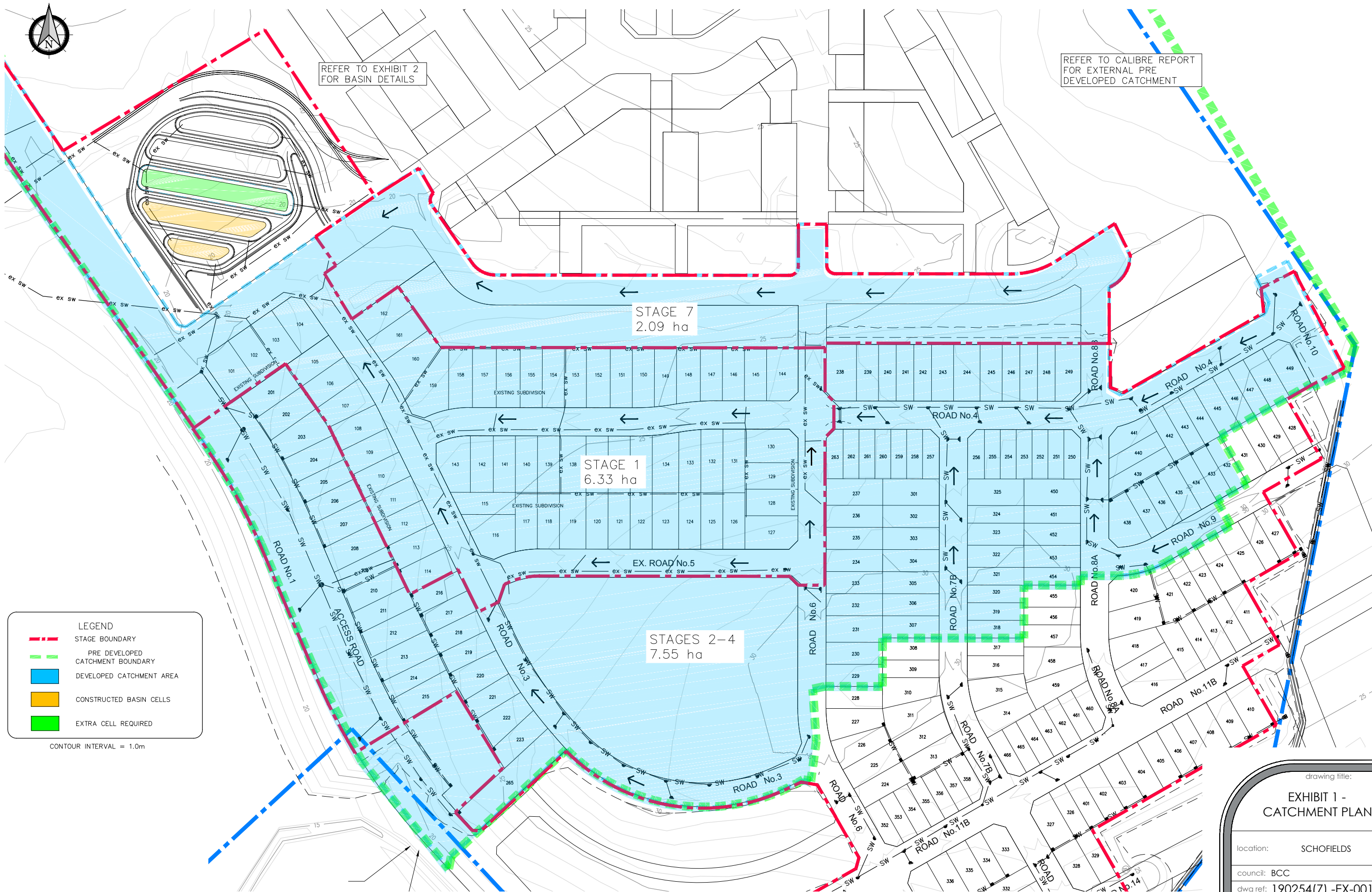
6.0 Conclusion

The interim stormwater basin in the north-western corner of the 'Altrove' subdivision was analysed to determine its peak flows and peak flood level and its treatment performance once Stage 7 of the development is constructed.

The development was modelled in RAFTS to determine the peak discharges for both the pre developed and post developed cases. It was found that in all storms, the post developed discharge was less than the pre developed discharge. It was also found that the peak flood level in the 100 year ARI storm event was below the emergency spillway level.

Two (2) of five (5) proposed bioretention cells have been constructed in the basin as a part of earlier works. The basin was modelled in this interim state and it was found that it does not have enough treatment capacity to meet the water quality reduction targets set out by Blacktown City Council, once Stage 7 is constructed. It was found that constructing the third of the five (5) cells would meet the required reduction targets.

As such, with the construction of the third bioretention cell, as recommended, it has been determined that the basin will meet BCC requirements in relation to stormwater management.



LEGEND

- STAGE BOUNDARY
- PRE DEVELOPED CATCHMENT BOUNDARY
- DEVELOPED CATCHMENT AREA
- CONSTRUCTED BASIN CELLS
- EXTRA CELL REQUIRED

CONTOUR INTERVAL = 1.0m

CATCHMENT PLAN
SCALE 1:1000

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
A	07.06.16	INITIAL ISSUE	BM	MK	DATUM: N/A CONTOUR INTERVAL: 1.0m	 SCALE 1:1000 (FULL)	

- project management
- civil engineering
- infrastructure
- superintendency
- economic analysis
- social impact
- town planning
- surveying
- development feasibility
- visualisation
- urban design

drawing title:

EXHIBIT 1 - CATCHMENT PLAN

location: SCHOFIELDS

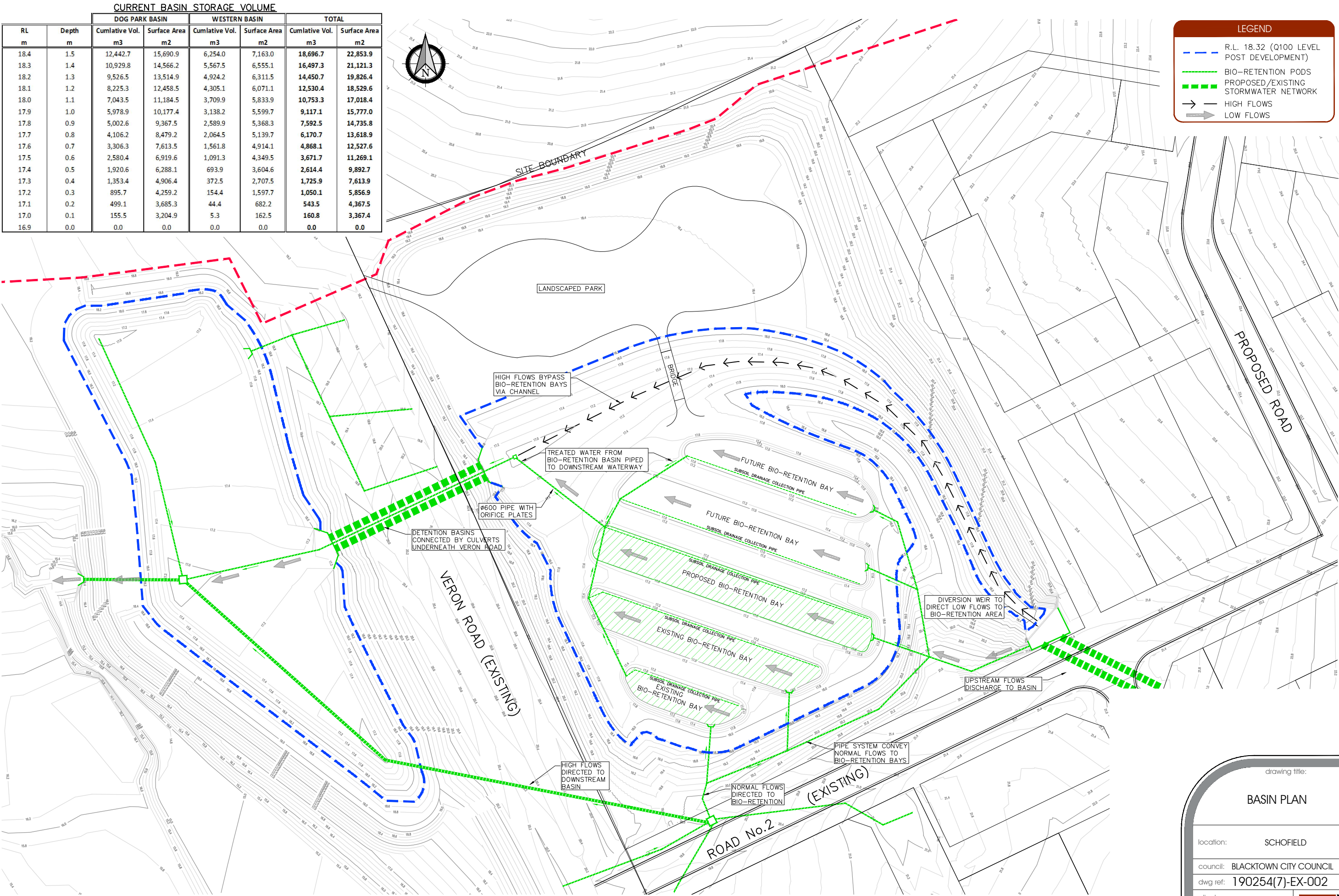
council: BCC

dwg ref: 190254(7) -EX-001

client:

central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100
www.adwjohnson.com.au

CURRENT BASIN STORAGE VOLUME							
		DOG PARK BASIN		WESTERN BASIN		TOTAL	
RL m	Depth m	Cumulative Vol. m3	Surface Area m2	Cumulative Vol. m3	Surface Area m2	Cumulative Vol. m3	Surface Area m2
18.4	1.5	12,442.7	15,690.9	6,254.0	7,163.0	18,696.7	22,853.9
18.3	1.4	10,929.8	14,566.2	5,567.5	6,555.1	16,497.3	21,121.3
18.2	1.3	9,526.5	13,514.9	4,924.2	6,311.5	14,450.7	19,826.4
18.1	1.2	8,225.3	12,458.5	4,305.1	6,071.1	12,530.4	18,529.6
18.0	1.1	7,043.5	11,184.5	3,709.9	5,833.9	10,753.3	17,018.4
17.9	1.0	5,978.9	10,177.4	3,138.2	5,599.7	9,117.1	15,777.0
17.8	0.9	5,002.6	9,367.5	2,589.9	5,368.3	7,592.5	14,735.8
17.7	0.8	4,106.2	8,479.2	2,064.5	5,139.7	6,170.7	13,618.9
17.6	0.7	3,306.3	7,613.5	1,561.8	4,914.1	4,868.1	12,527.6
17.5	0.6	2,580.4	6,919.6	1,091.3	4,349.5	3,671.7	11,269.1
17.4	0.5	1,920.6	6,288.1	693.9	3,604.6	2,614.4	9,892.7
17.3	0.4	1,353.4	4,906.4	372.5	2,707.5	1,725.9	7,613.9
17.2	0.3	895.7	4,259.2	154.4	1,597.7	1,050.1	5,856.9
17.1	0.2	499.1	3,685.3	44.4	682.2	543.5	4,367.5
17.0	0.1	155.5	3,204.9	5.3	162.5	160.8	3,367.4
16.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0



LEGEND

R.L. 18.32 (Q100 LEVEL POST DEVELOPMENT)

BIO-RETENTION PODS

PROPOSED/EXISTING STORMWATER NETWORK

HIGH FLOWS

LOW FLOWS

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
A	07.06.16	INITIAL ISSUE	B.M.	M.K.	DATUM: N/A CONTOUR INTERVAL: N/A	0 12.5 25.0m SCALE: 1:500 (FULL)	

drawing title:

BASIN PLAN

location: SCHOFIELD

council: BLACKTOWN CITY COUNCIL

dwg ref: 190254(7)-EX-002

client:

central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100

LEGEND

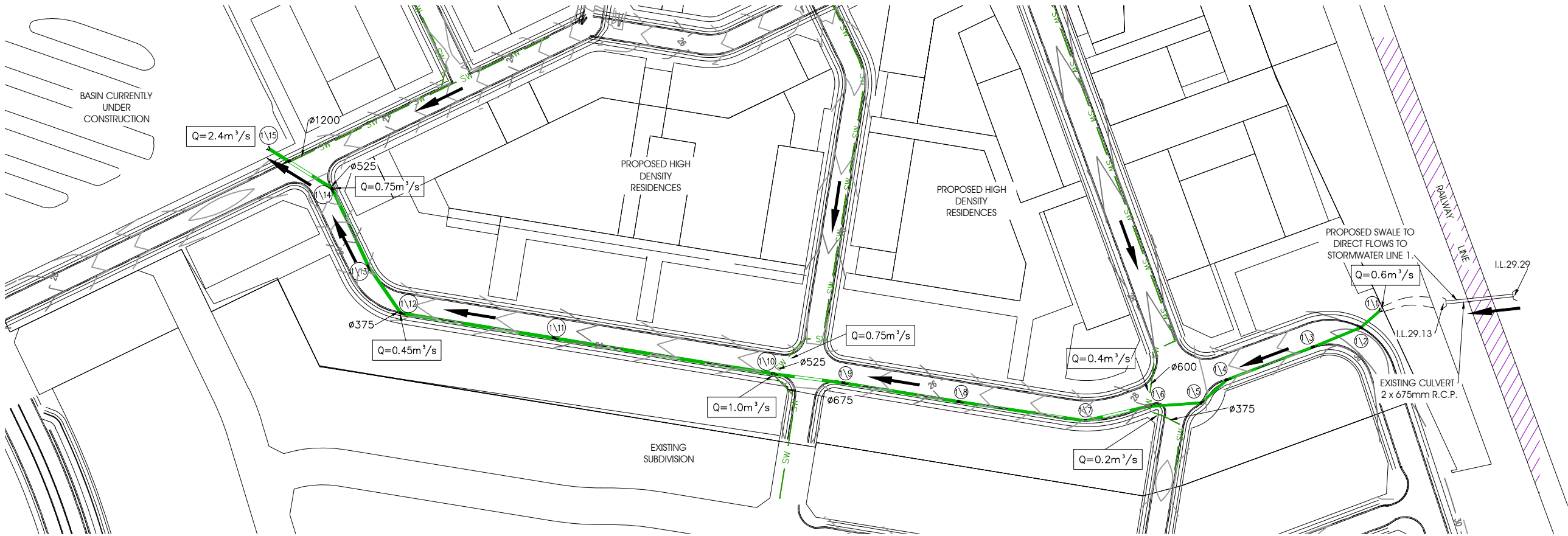
PROPOSED STORMWATER LINE

SW

FUTURE STORMWATER LINE

PROPOSED LOT BOUNDARY

CONTOUR INTERVAL 1.0m



SITE PLAN
SCALE 1:1000 (A1)

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
A	07.06.2016	INITIAL ISSUE	A.M.	M.K.	DATUM: N/A CONTOUR INTERVAL: N/A	02550m SCALE: 1:1000 (FULL)	

drawing title:
EXHIBIT 3 -
TRUNK STORMWATER
STRATEGY PLAN

location: SCHOFIELD
council: BLACKTOWN CITY COUNCIL
dwg ref: 190254(7)-REP-003
client:



central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100

ATTACHMENT 5

Aboriginal Heritage Impact Permit
(AHIP) No. 1131830

Issued by –

NSW Office of Environment & Heritage

Aboriginal Heritage Impact Permit

Section 90 of the *National Parks and Wildlife Act 1974*



Office of
Environment
& Heritage

AHIP number: 1131830

(AHIMS Permit ID: 3525)

AHIP Issued To:

STOCKLAND DEVELOPMENT PTY LTD
ABN: 71 000 064 835
Attn: Mr. Thomas Fehon, Development Manager
Level 25, 133 Castlereagh Street
SYDNEY, NSW 2000

OEH Office issuing this AHIP

Office of Environment and Heritage
Regional Operations
Greater Sydney Region
PO Box 644
PARRAMATTA NSW 2124
Telephone number: (02) 9995 6864

Additional details for public register

a) Name of development or project	Schofields Village Residential Subdivision
b) Location	Lot 4 in DP1191977 Bridge Street and Vernon Street, Schofields NSW
c) Local Government Area(s)	Blacktown City Council
d) Description of harm authorised	• Certain Aboriginal objects must not be harmed • Harm to certain Aboriginal objects through the proposed works
e) AHIP commencement date and duration	<i>Commencement: (From issue of the original AHIP) 27 March 2014</i> <i>Duration: 10 years</i>

AHIP TO HARM ABORIGINAL OBJECTS

A. Background

- (i) On 20-Mar-2012 an application was made to the Chief Executive of the Office of Environment and Heritage (OEH) for an Aboriginal Heritage Impact Permit (AHIP) pursuant to s.90 of the *National Parks and Wildlife Act 1974* (the Act).
- (ii) The construction associated with the development of Schofields Village residential subdivision will harm eight Aboriginal sites and all other Aboriginal objects within the development area; with the exception of three whole registered Aboriginal sites and two partial registered Aboriginal sites that are to be protected from harm.
- (iii) OEH considered the application and supporting information provided, and matters under section 90K of the Act and decided to issue an AHIP subject to conditions.

B. AHIP issued subject to conditions

An AHIP is issued to harm Aboriginal objects identified in Schedules B and C, in accordance with the conditions of this AHIP.

This AHIP is issued pursuant to section 90 of the Act.

C. Commencement and duration of AHIP

This AHIP commences on the date it is signed unless otherwise provided by this AHIP.

Unless otherwise revoked in writing, this AHIP remains in force for 10 years from the date of commencement, that is, **27 March 2014**.

D. Proposed Works

The development includes all those activities associated with the development of the village and associated infrastructure as per the development approval.

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.



SUSAN HARRISON
Senior Team Leader, Planning
Regional Operations
(by Delegation)
DATED: 9 July 2015

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LAND TO WHICH THIS AHIP APPLIES

Land as shown in Attachment 1: Land to which this AHIP applies.

CONDITIONS

The conditions of this AHIP specify the actions that are permitted and/or required in relation to areas and Aboriginal objects, which are detailed in the Schedules that follow.

Administrative Conditions

Responsibility for compliance with conditions of AHIP

1. The AHIP holder must ensure that all persons involved in actions or works covered by this AHIP (whether employees, contractors, sub-contractors, agents or invitees) are made aware of and comply with the conditions of this AHIP.

Project manager to oversee the actions relating to this AHIP

2. A suitably qualified and experienced individual must be appointed as a project manager who is responsible for overseeing, for and on behalf of the AHIP holder, all the actions relating to this AHIP.
3. The individual appointed as project manager must be the project manager nominated in the application form.
4. If an alternative to the nominated project manager is appointed, OEH must be notified of their contact details within 14 days of this appointment.

Actions must be in accordance with AHIP application

5. All actions on the land must be carried out in accordance with the application except as otherwise expressly provided by a condition of this AHIP.

Operational Conditions

Certain Aboriginal objects must not be harmed

6. All human remains in, on or under the land must not be harmed.
7. The Aboriginal objects described in Schedule A must not be harmed.
8. To ensure that the Aboriginal objects described in Schedule A are not harmed, the Aboriginal Heritage Management Plan, section 12.0 of the Aboriginal Cultural Heritage Assessment. Schofields Village Residential Subdivision, dated 14 February 2014, provided with the application, must be implemented as soon as practicable and complied with.

Harm of certain Aboriginal objects through the proposed works

9. The Aboriginal objects described in Schedule C may be harmed. Nothing in this condition authorised harm to Aboriginal objects described in Schedule A (whether human remains, Aboriginal objects or 'no-harm areas').

Long term management of certain Aboriginal objects

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10. Aboriginal objects that were collected as a result of the test excavation completed in accordance with the DECCW (now OEH) Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales are to be reburied within the test pit located at AHIMS#45-5-4120 (Schofields Village AS5), E302242 N6268433 as shown in Attachment 1.
11. Requirement 26 "Stone artefact deposition and storage" in the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (24 September 2010, available online at: <http://www.environment.nsw.gov.au/licences/archinvestigations.htm>) must be complied with.

Notification and Reporting Conditions

Notification of commencement and completion of actions

12. Written notice must be provided to the OEH office at least 7 days prior to the commencement of actions authorised by this AHIP.
13. Written notice must be provided to the OEH office within 7 days of the completion of actions authorised by this AHIP.

Copy of this AHIP and notices to be provided to Registered Aboriginal Parties

14. A copy of this AHIP must be provided to each Registered Aboriginal Party, within 14 days of receipt of the AHIP from OEH.
15. Where this AHIP is varied or transferred, a copy of the AHIP variation or transfer notice must be provided to each Registered Aboriginal Party, within 14 days of receipt of the notice.

Human remains

16. If any human remains (other than any human remains described in Schedule B4) are discovered and/or harmed in, on or under the land, the AHIP holder must:
 - (a) not further harm these remains
 - (b) immediately cease all work at the particular location
 - (c) secure the area so as to avoid further harm to the remains
 - (d) notify the local police and OEH's Environment Line on 131 555 as soon as practicable and provide any available details of the remains and their location, and
 - (e) not recommence any work at the particular location unless authorised in writing by OEH.

Incidents which may breach the Act or AHIP

17. The AHIP holder must notify the OEH office in writing as soon as practicable after becoming aware of:
 - (a) any contravention of s.86 of the Act not authorised by an AHIP, and/or
 - (b) any contravention of the conditions of this AHIP.

Reports about incidents which may breach the Act or AHIP

18. Where OEH suspects that an incident has occurred which may have breached the Act or AHIP, OEH may request a written incident report, which includes the following:
 - (a) the nature of the incident
 - (b) the actual or likely impact of the incident on Aboriginal objects and/or Aboriginal places

- (c) the nature and location of these Aboriginal objects and/or Aboriginal places, referring to and providing maps and photos where appropriate
 - (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 incident report must be provided to the OEH office within the timeframe specified in the request.

Provision of Aboriginal Site Impact Recording Form

20. An Aboriginal Site Impact Recording Form must be completed and submitted to the AHIMS Registrar, for each AHIMS site identified in Schedule C, within 4 months of the completion of the actions authorised by this AHIP.

Note:

- (i) The Aboriginal Site Impact Recording Form can be found on the OEH website:
<http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm>
- (ii) Contact details for the AHIMS Registrar can be found on the OEH website:
<http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm>

Report about harm to Aboriginal objects Report

21. A Report must be prepared about the actions relating to the harm of Aboriginal objects (as permitted by this AHIP). The report must:
- (a) include a short summary of the report
 - (b) describe any ongoing consultation with or involvement of representatives of Registered Aboriginal Parties in relation to this AHIP
 - (c) comment on the effectiveness of any mitigation measures that were implemented
 - (d) comment on the effectiveness of any management plan which was in place
 - (e) include a statement confirming that all Aboriginal Site Impact Recording Forms have been completed and submitted to the AHIMS Registrar.
22. The Report must be submitted to the OEH office within 4 months of the completion of the actions authorised by this AHIP.
23. A copy of the Report, including a summary of the report in plain English, must be sent by registered post to each Registered Aboriginal Party within 14 days of the report being submitted to OEH

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 Chief Executive of OEH, 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

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- (b) injury suffered or sustained (including death) by any persons arising out of or in connection with any actions 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 Chief Executive of OEH, 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 from or in connection with any actions undertaken pursuant to this AHIP.

Written notice

- 26. Any requirement to provide written notice to the OEH office in this AHIP may be complied with by faxing the notice to the OEH office's fax number or by sending by registered post to the OEH office's address. The OEH office's contact details are specified at the front of this AHIP.

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SCHEDULES

The following schedules identify the areas and Aboriginal objects that are subject to the conditions of this AHIP.

Schedule A: Aboriginal objects which must not be harmed

A1 Human remains

All human remains in, on or under the land must not be harmed.

A2 Aboriginal objects that are identified on AHIMS

The following Aboriginal objects identified on AHIMS must not be harmed, as specified by the conditions of this AHIP.

Portion of Site (whole or part)	AHIMS Site ID	Site Feature	Site Name	Information access restriction? (Y/N)	Easting	Northing	Datum
Whole	45-5-4120	Artefact Scatter	Schofields Village AS5	N	302229	6268331	GDA94 Zone 56
Whole	45-5-4121	Artefact Scatter	Schofields Village AS6	N	302372	6268163	GDA94 Zone 56
Whole	45-5-4124	Artefact Scatter	Schofields Village AS9	N	302257	6268147	GDA94 Zone 56
Partial	45-5-4116	Artefact Scatter	Schofields Village AS1	N	302202	6268541	GDA94 Zone 56
partial	45-5-4117	Artefact Scatter	Schofields Village AS2	N	302273	6268430	GDA94 Zone 56

A3 No-harm areas

Area name	Information access restriction? (Y/N)	Map Reference		
		Nodes	Easting	Northing
Schofields Village AS1 (AHIMS #45-5-4116)	N	1	302131.9	6268541
		2	302170	6268559
		3	302173	6268557
		4	302190	6268539
		5	302195	6268527
		6	302205	6268509

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		7	302205	6268506
		8	302194.7	6268507
		9	302173.3	6268509
		10	302159.6	6268512
		11	302144.4	6268518
		12	302139.4	6268524
		13	302132.8	6268530
		14	302127.5	6268536
		15	302131.9	6268541
Schofields Village AS2 (AHIMS #45-5-4117)		1	302232	6268420
		2	302218	6268444
		3	302202.6	6268414
		4	302194.7	6268418
		5	302189.8	6268423
		6	302188.1	6268429
		7	302188.9	6268436
		8	302196	6268441
		9	302203.8	6268443
Schofields Village AS5 (AHIMS #45-5-4120)		1	302215.3	6268347
		2	302215.1	6268354
		3	302219.2	6268360
		4	302227.3	6268357
		5	302233.3	6268351
		6	302235.9	6268341
		7	302239.8	6268328
		8	302241.1	6268318
		9	302244	6268308
		10	302242.2	6268302
		11	302235.1	6268301
		12	302228.6	6268308
		13	302221.6	6268322
		14	302216.6	6268340
		15	302215.3	6268347
Schofields Village AS6 (AHIMS	N	1	302366.6	6268174
		2	302369.4	6268174
		3	302372.9	6268173

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#45-5-4121)		4	302375.5	6268169
		5	302378	6268164
		6	302380.2	6268157
		7	302382.8	6268147
		8	302379.8	6268143
		9	302375.7	6268143
		10	302370.5	6268154
		11	302367	6268160
		12	302364.7	6268165
		13	302365.3	6268171
		14	302366.6	6268174
		1	302256.4	6288136
		2	302248.1	6268157
		3	302250.2	6268161
Schofields Village AS9 (AHIMS #45-5-4124)	N	4	302257.3	6268159
		5	302264.5	6268139
		6	302261.9	6268135
		7	302256.4	6268136

Schedule B: Aboriginal objects that may be harmed through the certain actions

B1 Movement only

N/A

B2 Excavations

N/A

B3 Community collection

N/A

B4 Other

N/A

Schedule C: Aboriginal objects which may be harmed through the proposed works

Aboriginal Heritage Impact Permit

Section 90 of the *National Parks and Wildlife Act 1974*



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The Aboriginal objects described in this schedule may be harmed, but only in accordance with the conditions of this AHIP (excluding any Aboriginal objects described in **Schedule A**).

C1 Harm of Aboriginal objects identified on AHIMS

Portion of Site (whole or part)	AHIMS Site ID	Site Feature	Site Name	Information access restriction? (Y/N)	Easting	Northing	Datum
Part	45-5-4116	Artefacts	Schofields Village	No	302202	6268541	GDA 94 Zone 56
Part	45-5-4117	Artefacts	Schofields Village	No	302273	6268430	GDA 94 Zone 56
Whole	45-5-4118	Artefacts	Schofields Village	No	302404	6268458	GDA 94 Zone 56
Whole	45-5-4119	Artefacts	Schofields Village	No	302478	6268554	GDA 94 Zone 56
Whole	45-5-4122	Artefacts	Schofields Village	No	302552	6268270	GDA 94 Zone 56
Whole	45-5-4123	Artefacts	Schofields Village	No	302584	6268143	GDA 94 Zone 56
Whole	45-5-4125	Artefacts	Schofields Village	No	302779	6268584	GDA 94 Zone 56
Whole	45-5-4126	Artefacts	Schofields Village	No	302779	6268654	GDA 94 Zone 56

C2 Areas where harm of Aboriginal objects is authorised

All Aboriginal objects in, on or under the land illustrated in **Attachment 1: Land to which this AHIP applies**, with the exclusion of those Aboriginal objects and areas specified in **Schedule A**.

DICTIONARY

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

Aboriginal object	has the same meaning as in the Act.
Act	means the <i>National Parks and Wildlife Act 1974</i> .
AHIMS	means the Aboriginal Heritage Information Management System maintained by OEH, as defined in s.90Q of the Act.
AHIP	means Aboriginal Heritage Impact Permit
AHIP holder	means the entity or 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.
Community collection	means the collection of Aboriginal objects by one or all Registered Aboriginal Parties or their representatives.
Community collection area	means an area described as a community collection area in Schedule B3
Harm	has the same meaning as in the Act. In relation to Aboriginal objects, harm means the movement, damage, defacement and/or destruction of Aboriginal objects. In relation to an Aboriginal place, harm means the damage, defacement and/or destruction of the Aboriginal place.
Land	means the land described under the heading "Land to which this AHIP applies".
No-harm areas	means those areas described in Schedule A3.
OEH	Office of Environment and Heritage (NSW).
OEH office	means the office listed on the cover page of this AHIP.
Proposed works	means the works described under the heading "D. Proposed Works" at the front of this AHIP.
Public register	means the public register established under s.188F of the Act, that contains details of AHIPs issued by the Chief Executive of OEH, as described under the heading "Information about this AHIP".
Registered Aboriginal Parties	means the Registered Aboriginal Parties listed in the application.
Salvage excavation	means an archaeological excavation carried out in accordance with the methodology accompanying the application, as modified by the conditions of this AHIP. The purpose of salvage excavation is to recover a sample of Aboriginal objects as an archival record of Aboriginal life from a site that will be destroyed.
Salvage excavation area	means any area described as a salvage excavation area in Schedule B2.
Test excavation	means an archaeological excavation carried out in accordance with

Aboriginal Heritage Impact Permit

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methodology accompanying the application, as modified by the conditions of this AHIP. The purpose of test excavation is to collect a sample of Aboriginal objects, in order to establish the nature and extent of sub-surface Aboriginal objects and to assist in the assessment of management options for the site.

Test excavation area means any area described as a test excavation area in Schedule B2

INFORMATION ABOUT THIS AHIP

Public Register

Under section 188F of the Act, the Chief Executive of OEH is required to keep a public register containing the details of each AHIP issued. The details of this AHIP that will be published on the public register are outlined on the front page of this AHIP.

The public register is available online at www.environment.nsw.gov.au

Appeals

Under section 90L of the Act, the AHIP holder may appeal to the Land and Environment Court if they are dissatisfied with any condition of this AHIP. The appeal must be lodged within 21 days of the date this AHIP was issued.

Penalties for breach of the Act or AHIP condition

Significant penalties can be imposed by the Land and Environment Court for harm to an Aboriginal object or Aboriginal Place other than as authorised by a condition of an AHIP, or for a breach of an AHIP condition. OEH can also issue penalty notices for a breach of the Act or AHIP condition.

Responsibility for obtaining all approvals and compliance with applicable laws

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 must be notified to the Chief Executive of OEH under s.89A of the Act using the form available online at www.environment.nsw.gov.au

Stop work orders, interim protection orders and remediation directions 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*.

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 OEH office for a variation of any conditions of an AHIP, using the AHIP variation application form available online at www.environment.nsw.gov.au. Requests for significant variations must be accompanied by evidence of further consultation with Registered Aboriginal Parties and may include payment of fees.

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The conditions of an AHIP may be varied at any time by the Chief Executive of OEH in order to correct a typographical error or to resolve an inconsistency between conditions. The AHIP holder may appeal a decision of the Chief Executive of OEH to vary the conditions of the AHIP.

Transfer of AHIP

The AHIP holder may apply to transfer this AHIP to another person by using the AHIP transfer application form available online at www.environment.nsw.gov.au.

Surrender of AHIP

The AHIP holder may apply to surrender this AHIP by using the AHIP surrender application form available online at www.environment.nsw.gov.au. The surrender must be approved by the Chief Executive of OEH and may be subject to conditions.

Suspension and revocation of AHIP

An AHIP may be suspended or revoked at any time at the discretion of the Chief Executive of OEH. Prior to suspending or 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

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 OEH's possession in accordance with any lawful requirement.

Making copies of reports

By providing a report, the AHIP holder acknowledges that OEH 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.

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

Ahip # 1131830



This is the area subject to the AHIP application

AECOM

Attached 1. Land to which this AHIP applies. (outlined in red)
Excludes areas listed in Schedule A

MANAGEMENT RECOMMENDATIONS

Schofields Village AHIP
Schofields, New South Wales

FIGURE 46



Figure 2. GPS coordinates of study area

AHIP variation application



This is an application to **vary an Aboriginal Heritage Impact Permit (AHIP)** under section 90D of the *National Parks and Wildlife Act 1974* (NPW Act).

A variation includes the substitution, omission or amendment of an existing condition, or attaching a new condition to an AHIP. If an AHIP holder wishes to seek a variation to the conditions of their AHIP, this application form needs to be filled in. You can also refer to *Applying for an Aboriginal Heritage Impact Permit, Guide to Applicants 2010* (www.environment.nsw.gov.au/licences/applyforahip.htm) for guidance.

This form should be completed, signed and sent, together with the applicable fee, to the relevant section within the Office of Environment and Heritage (OEH) (contact details are listed at the end of this form). OEH will then make a determination as to whether the variation(s) can be made. Please note that if your application is incomplete you may be requested to provide further information. If the information in your application is so insufficient that an assessment cannot be made, OEH may decide to refuse the application. You will be given notice of this proposed refusal.

Note: If you wish to transfer this AHIP, in addition to varying the AHIP conditions, you will need to apply to OEH separately using an AHIP Transfer Application form and supply any required additional information. An AHIP Variation Application will either need to be submitted to OEH prior to a transfer by the current AHIP holder, **or** by the new AHIP holder after a transfer has been granted by OEH. OEH cannot process a transfer application and a variation simultaneously, as only the AHIP holder can apply for a variation. More information on AHIP transfers is available at www.environment.nsw.gov.au/licences/applyforahip.htm, or contact your local OEH office (contact details at the end of this form).

1. Details of AHIP to be varied

1.1 AHIP number

AHIP number	
-------------	--

1.2 Name of current AHIP holder(s)

Full name(s) of AHIP holder(s)			
ACN/ABN (if applicable)	ACN:	ABN:	
Business address [#] / other address	No:	Street name:	
	Suburb:	State:	Postcode:

2. Proposed changes required to the AHIP

Please tick (✓) 'Yes' or 'No' to indicate which changes are applicable		Yes	No
Timeframes	The timeframes for undertaking the actions under the AHIP have changed and I request that these are reflected in the AHIP (see section 2.1)	☐	☐
Actions	I am applying to change the actions that are to be carried out under this AHIP (see section 2.2) Note: if the changes sought are substantial, you may need to apply for a new AHIP	☐	☐
Area of land	I would like the AHIP to be extended beyond the existing area of land, or to be varied in some other way, and my original AHIP application included information about how I assessed and consulted on the likely impacts on that area. Note: A new AHIP application will be required if the area of land was not previously the subject of an Aboriginal Cultural Heritage Assessment and community consultation.	☐	☐
Other	Other changes not listed above are requested (see section 2.4)	☐	☐

[#] Must be the registered business address as it appears in the ASIC register, for companies or individuals with an ABN.

2.1 Changes to timeframes

Please detail and provide justification for any changes required to the timeframes already outlined in the AHIP, including any extension of the time period of the AHIP.

Details of changes required to timeframes	
---	--

Please attach extra page(s) if more space is needed.

2.2 Changes required to the current AHIP or new actions proposed

2.2.1 Description of the actions covered

Write down a description of the changes that you are applying for, which would allow you to carry out the actions that are not currently covered under your existing AHIP.

Description of actions	
------------------------	--

Please attach extra page(s) if more space is needed.

2.2.2 Date for additional actions to commence

If additional actions are proposed, please answer the following question:

When are these additional actions intended to commence?	day/month/year
---	----------------

2.3 Identification of additional areas of land

If you are applying for the AHIP to cover additional areas of land, please answer the following question:

Describe the property name, street address, cadastre information such as lot and DP, local government area, parish and zone, where there are changes to this information in the existing AHIP.	
Include a topographic map clearly showing: a) the location of the land that is currently subject of the AHIP, and b) the new area that is the subject of this AHIP variation application (aerial photographs, detailed site maps and title plans may also be provided). The map should provide clear cadastre information including a lot and DP number, the local government area, parish and zone (as applicable).	

Please attach extra page(s) if more space is needed.

2.4 Details of other changes required

Your AHIP can be varied by deleting or amending a condition, or substituting one condition for another. Please provide details of any other proposed variations required which are not covered previously in this application. All proposed changes must be justified. Please note that if changes are substantial, a new AHIP may be required.

AHIP condition number (as appropriate)	Details of proposed change	Reason for proposed change

Please attach extra page(s) if more space is needed.

3. Development consent

Please tick (✓) 'Yes' or 'No'.

Original AHIP

Yes	No
☐	☐
Date:	

Was the original AHIP issued as part of the Integrated Development Approvals (IDA) process under the *Environmental Planning and Assessment Act 1974* (EP&A Act)?

If 'YES', what date was the development consent granted? *

* Note: if the original AHIP was issued as part of an integrated development approval (IDA) under the EP&A Act in the past three years, any variation and conditions of the AHIP cannot be inconsistent with the development consent.

Current proposed variation

Yes	No
☐	☐
☐	☐
☐	☐

Is development consent under the EP&A Act or another approval required (e.g. Property Vegetation Plan or approval under Part 5 EP&A Act)?

Has development consent (or other approval) been granted?

If 'YES', have you attached a copy of the development consent or other approval.

4. Impacts of the variation

Please tick (✓) 'Yes' or 'No'.

Yes	No
☐	☐
☐	☐

Does the variation increase harm to Aboriginal objects, which are not already provided for in your existing AHIP?

If yes, have you consulted in any way on the additional actions or other proposed changes, for example, with the registered Aboriginal parties that were identified during the consultation process for the original AHIP?

If 'Yes', please attach a copy of any additional evidence of the consultation process you undertook including letters, meeting minutes, submissions or feedback you received.

Note: Under clause 80E of the National Parks and Wildlife Regulation 2009, if the Director General (DG) is satisfied that the variation will result in a significant increase in harm to Aboriginal objects or places concerned, the DG will require the applicant to carry out additional consultation and determine the form of that consultation.

5. Determining the fee for AHIP variation processing

Please indicate the estimated **changes** to the original proposed development works to determine the relevant administrative fee. Payment of the fee (cheque or credit card authorisation) must be submitted with your application.

Please tick (✓) applicable fee.

Section 90D AHIP variation	Fee *		
Minor changes including timeframes, typographical errors	\$80		☐
All other changes	\$400		☐

* Processing fees are exempt from GST by the Commonwealth Treasurer's Division 81 determination under *A New Tax System (Goods and Services Tax) Act 1999*.

Please tick the method of payment.

☐ Cheque enclosed. Make cheque payable to 'Office of Environment and Heritage'.

☐ Please debit my VISA/ MASTERCARD credit card in the amount of \$_____

Card no: _____ Expiry date: ____ / ____ / ____

Cardholder's name: _____

Signature: _____ Date: ____ / ____ / ____

6. Signature of AHIP holder

Under section 90D NPW Act, an AHIP may only be varied on application of the holder of the permit.

This application may only be signed by a person(s) with the legal authority to sign it. The various ways in which the application may be signed, and the people who may sign the application, are set out in the categories below.

Please tick (✓) the box next to the category that describes how this application is being signed.

The AHIP holder is:		The application must be signed and certified by one of the following:
an individual	☐	the individual.
a company	☐ ☐ ☐ ☐	the common seal being affixed in accordance with the <i>Corporations Act 2001</i> , or two directors, or a director and a company secretary, or if a proprietary company that has a sole director who is also the sole company secretary – by that director.
a public authority other than a council	☐	the chief executive officer of the public authority, or their authorised delegate (Please note: a copy of the relevant instrument of delegation must be attached to this application).
a local council	☐ ☐	the general manager in accordance with s.377 of the <i>Local Government Act 1993</i> (LG Act), or the seal of the council being affixed in a manner authorised under the LG Act.

I/We (the AHIP holder/s):

- **would like to apply for the variation of the AHIP listed in Section 1**
- **declare that the information in this form (including any attachment) is not false or misleading.**

Applicant 1 (AHIP holder)

Signature		Signature	
Name (printed)		Name (printed)	
Position (in company or authority)		Position (in company or authority)	
Date		Date	

Seal (if signing under seal):

Applicant 2 (AHIP holder)

Signature		Signature	
Name (printed)		Name (printed)	
Position (in company or authority)		Position (in company or authority)	
Date		Date	

Seal (if signing under seal):

Additional information

1. It is an offence under s169(3) of the NPW Act to knowingly give any information in this form that is false or misleading in a material particular.
2. Details of the AHIP variation notice will appear on OEH's Public Register. OEH can be asked by any person to provide reasons for refusing or granting an AHIP variation application.
3. OEH may make copies of any report provided in relation to this AHIP variation application and may include a copy of the report on the AHIMS register. For information about how to access and use AHIMS refer to [insert link to AHIMS page].
4. If OEH does not make a determination of the AHIP variation application within 60 days it is 'deemed to be refused'. 'Deemed to be refused' means that the applicant has the right to challenge OEH's decision to refuse the application, in the Land and Environment Court. Note, OEH can still continue to process the application after 60 days and grant or refuse the AHIP variation application. You should always contact OEH in the first instance if you have any queries regarding your application.
5. Send completed form, fee and attachments to your nearest OEH office identified below.

Office of Environment and Heritage

Metro Branch

Greater Sydney Region

Senior Team Leader, Planning
PO Box 644
Parramatta NSW 2124
T: 02 8837 6000
F: 02 9995 6900

North Branch

Hunter Central Coast Region

Senior Team Leader, Planning
PO Box 488G
Newcastle 2300
T: 02 4908 6800
F: 02 4908 6810

North East Region

Senior Team Leader, Planning
Locked Bag 914
Coffs Harbour NSW 2450
T: 02 6659 8235
F: 02 6659 6187

North West Region

Senior Team Leader, Planning
PO Box 2111
Dubbo NSW 2830
T: 02 6883 5330
F: 02 6881 6326

South Branch

Illawarra Region

Senior Team Leader, Planning
PO Box 513
Wollongong NSW 2520
T: 02 4224 9600
F: 02 4224 4199

South East Region

Senior Team Leader, Planning
PO Box 733
Queanbeyan NSW 2620
T: 02 6229 7188
F: 02 6229 7006

South West Region

Senior Team Leader, Planning
PO Box 544
Albury NSW 2640
T: 02 6022 0600
F: 02 6022 0610

Transfer of Aboriginal Heritage Impact Permit



Office of
Environment
& Heritage

National Parks and Wildlife Act 1974

Your reference: Aboriginal Heritage Impact Permit 1131830 Transfer
Our reference: AHIMS No. 3525 / SF15/26163 and FIL11/4242.
Notice number: C0001173
Contact: Felicity Barry (02) 9995 6914

STOCKLAND DEVELOPMENT PTY LTD
ABN: 71 000 064 835

Attn: Mr. Thomas Fehon, Development Manager,
Level 25, 133 Castlereagh Street
SYDNEY, NSW 2000

CC: NORTON ROSE FULBRIGHT AUSTRALIA
Attn: Ms. Felicity Rourke, Partner and Head of Office
Level 18, Grosvenor Place
225 George Street,
SYDNEY NSW 2000

NOTICE OF TRANSFER OF ABORIGINAL HERITAGE IMPACT PERMIT 1131830

NOTICE TO NEW AHIP HOLDER

Issued pursuant to section 90C(4) *National Parks and Wildlife Act 1974*

BACKGROUND

- A. STOCKLAND DEVELOPMENT PTY LTD applied to the Office of Environment and Heritage (OEH) under section 90B of the *National Parks and Wildlife Act 1974* (NPW Act) for the transfer of an Aboriginal Heritage Impact Permit (AHIP) #**1131830**.
- B. OEH received the application on 22 June 2015.
- C. OEH has considered the matters set out in section 90K of the NPW Act.

TRANSFER OF AHIP

- 1. You are advised that OEH has granted the transfer of the AHIP from DAIRYCORP Pty Ltd to STOCKLAND DEVELOPMENT PTY LTD.
- 2. The transferred AHIP retains AHIP number 1131830. This transferred AHIP is enclosed. You are subject to all the conditions of this AHIP including Attachment 1.
- 3. OEH notes the request to backdate the issue of this transfer. However an AHIP transfer cannot be issued in retrospect.
- 4. The effective date of this transfer is **9 July 2015**.
- 5. OEH further advises that Lot 8 DP 1191977 is shown as part of Attachment 1 supporting this area based AHIP. However this land is now owned by the Roads and Maritime Services. **Stockland Development Pty Ltd must seek a variation to reduce the size of this area based AHIP.** This variation should be undertaken in consultation with the Roads and

Transfer of Aboriginal Heritage Impact Permit



Office of
Environment
& Heritage

National Parks and Wildlife Act 1974

Maritime Services who hold AHIP #C0000067, which was issued for the Schofields Road Upgrade 2 on 17 October 2013. A copy of the relevant AHIP map for AHIP #C0000067 is attached. **Please be advised that the new AHIP boundary for AHIP #1131830 should not overlap the boundary for AHIP #C0000067.** Until the AHIP is varied to reduce its coverage to Lot 4 DP1191977, any activity that Stockland Development Pty Ltd seeks to undertake within the RMS AHIP (and vice versa) will require a letter of authority signed by an appropriate representative of the AHIP holders. This variation will provide clarity for all parties involved in activities under these AHIPs in the event that a potential breach of the conditions occurs during construction.

6. You must provide a copy of this AHIP transfer notice to each Registered Aboriginal Party within **14 days** from the date of this notice, to inform these parties that you are the new AHIP holder. You must obtain a list of Registered Aboriginal Parties from the previous AHIP holder.

SUSAN HARRISON

Senior Team Leader, Planning

Greater Sydney Region

Regional Operations

(by Delegation)

Date: 9 July 2015

Attachment 1: A full copy of the AHIP #1131830 including Attachment 1: Land to which the AHIP applies.

Attachment 2: A copy of Attachment 1 supporting AHIP #C0000067, issued to the Roads and Maritime Services. This Attachment provides details of the Land to which the AHIP applies.

PD1048

DD370034 - Planning Proposal – Altrove Estate, Schofields F16/2533

RECOMMENDATION

1. Prepare and forward a Planning Proposal to the Department of Planning and Environment requesting a Gateway Determination to rezone part of Lot 164, DP 1218925, Veron Road, Schofields from SP2 Infrastructure (Drainage) to part R2 Low Density Residential and part R3 Medium Density Residential, and make corresponding amendments to the floor space ratio, height of buildings, residential density, lot size and land reservation acquisition maps under State Environmental Planning Policy (Sydney Region Growth Centres) 2006.
2. Implement any conditions attached to a Gateway Determination issued by the Greater Sydney Commission.
3. Advise the proponent that Recommendation 1 does not imply or guarantee that the Planning Proposal will ultimately be supported. Council's final determination of the proposal will occur when Council resolves to adopt the Planning Proposal following exhibition and consideration of all relevant matters.
4. The Planning Proposal not be finalised until Council is satisfied that satisfactory arrangements have been made to address the loss of future landscaped amenity and the increased demand for open space in the Altrove Estate.

COMMITTEE DIVISION:

Supported: Crs Griffiths; Collins; Camilleri; Israel & Bleasdale

COMMITTEE RECOMMENDATION
ADOPTED
ORDINARY MEETING

28 JUN 2017

EXCEPTION

WITHOUT CHANGE

REFERRED TO: DDD

FOR: Attention

DATE: 29.6.17



Director Design & Development

Planning, Development, Historical & Assets

Planning Proposal – Altrove Estate, Schofields

Item: **PD1048** Report: **DD370034** File: **F16/2533**

Committee Meeting on 21 June 2017

Division is required

Topic	Consideration of a request for a Planning Proposal to rezone land and amend planning controls that apply to Stockland's Altrove Estate at Schofields.
Analysis	Stockland has submitted a request to prepare a Planning Proposal to rezone land from SP2 Infrastructure (Drainage) to part R2 Low Density Residential and part R3 Medium Density Residential under State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (the Growth Centres SEPP) on their Altrove Estate at Schofields. The proposal will also require corresponding amendments to the floor space ratio, height of buildings, residential density, lot size and land reservation acquisition maps. The request is supported by a stormwater management strategy that proposes an alternative piped drainage solution within the adjoining future road reserve. The Planning Proposal will result in greater residential yield and removal of a planned landscaped open drainage corridor. The alternate drainage solution proposed by Stockland could be acceptable, subject to confirmation that future road designs can accommodate the necessary stormwater flows and flood conveyance functions, and that the loss of a landscaped open corridor and increased residential demand for open space will be compensated for elsewhere in the Altrove Estate. Attachments: Attachment 1 – Location of subject site and current zoning Attachment 2 – Existing and proposed changes to SEPP maps
Report Recommendation	1. Prepare and forward a Planning Proposal to the Department of Planning and Environment requesting a Gateway Determination to rezone part of Lot 164, DP 1218925, Veron Road, Schofields from SP2 Infrastructure (Drainage) to part R2 Low Density Residential and part R3 Medium Density Residential, and make corresponding amendments to the floor space ratio, height of buildings, residential density, lot size and land reservation acquisition maps under State Environmental Planning Policy (Sydney Region Growth Centres)

2006.

2. Implement any conditions attached to a Gateway Determination issued by the Greater Sydney Commission.
3. Advise the proponent that Recommendation 1 does not imply or guarantee that the Planning Proposal will ultimately be supported. Council's final determination of the proposal will occur when Council resolves to adopt the Planning Proposal following exhibition and consideration of all relevant matters.
4. The Planning Proposal not be finalised until Council is satisfied that satisfactory arrangements have been made to address the loss of future landscaped amenity and the increased demand for open space in the Altrove Estate.

Key reasons

1. Alternate drainage solution could be acceptable

- a. The request by Stockland to prepare a Planning Proposal seeks to increase residential use of land that may no longer be required for trunk drainage. The request has been supported by a Stormwater Management Strategy that proposes to remove a future open trunk drainage corridor and replace it with an alternate piped drainage solution within a planned future road reserve. This solution could be considered acceptable subject to further analysis of future road designs accommodating the necessary stormwater flows and flood conveyance functions.

2. Need to consider loss of future amenity and open space demand

- a. The removal of the planned open drainage corridor will result in a loss of landscaped amenity for future residents in Schofields. The increased residential yield resulting from the proposal will also create more demand for open space. These matters need to be satisfactorily addressed as part of our consideration of the proposal.

Supporting analysis

1. Additional residential yield

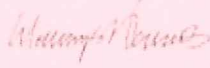
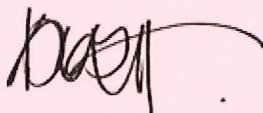
- a. The proponent has advised that the rezoning of the land from SP2 Infrastructure (Drainage) zone to part R2 Low Density Residential and part R3 Medium Density Residential could result in an increase in residential yield of 65 dwellings in the Schofields Precinct. Whilst this may be considered a minor increase when looked at in isolation, the cumulative increase in residential yield throughout the North West Priority Growth Area is affecting open space provision for future residents. It is therefore prudent to ensure that all proposals for greater residential yield address the consequential infrastructure implications, such as for open space.

Context

1. The proposal relates to Lot 164, DP 1218925, Veron Road, Schofields. The site is located in the Schofields Precinct in the North West Priority Growth Area, which has an overall total dwelling projection of 2,950 dwellings and a population of 8,000 people. The Schofields Precinct was rezoned by the Minister for Planning in May 2012 under the Growth Centres SEPP.
2. Preparing a Planning Proposal and requesting a Gateway Determination is only the first

stage in the process of our consideration of the proponent's request. Detailed consideration of the proposal will occur once we have received Gateway Determination and have undertaken consultation and public exhibition. Section 58 of the *Environmental Planning and Assessment Act 1979* provides Council with the ability to vary or not proceed with the Planning Proposal at any time during our consideration of the proposal.

Approval

Name and position	
→ Report author	Khin Zaw W., Strategic Planner
→ Endorsed by	McDermott F., Acting Manager Strategic Planning
→ Director approval	Glennys James, Director Design & Development
	Signature: 
→ General Manager approval	Kerry Robinson, General Manager
	Signature: 

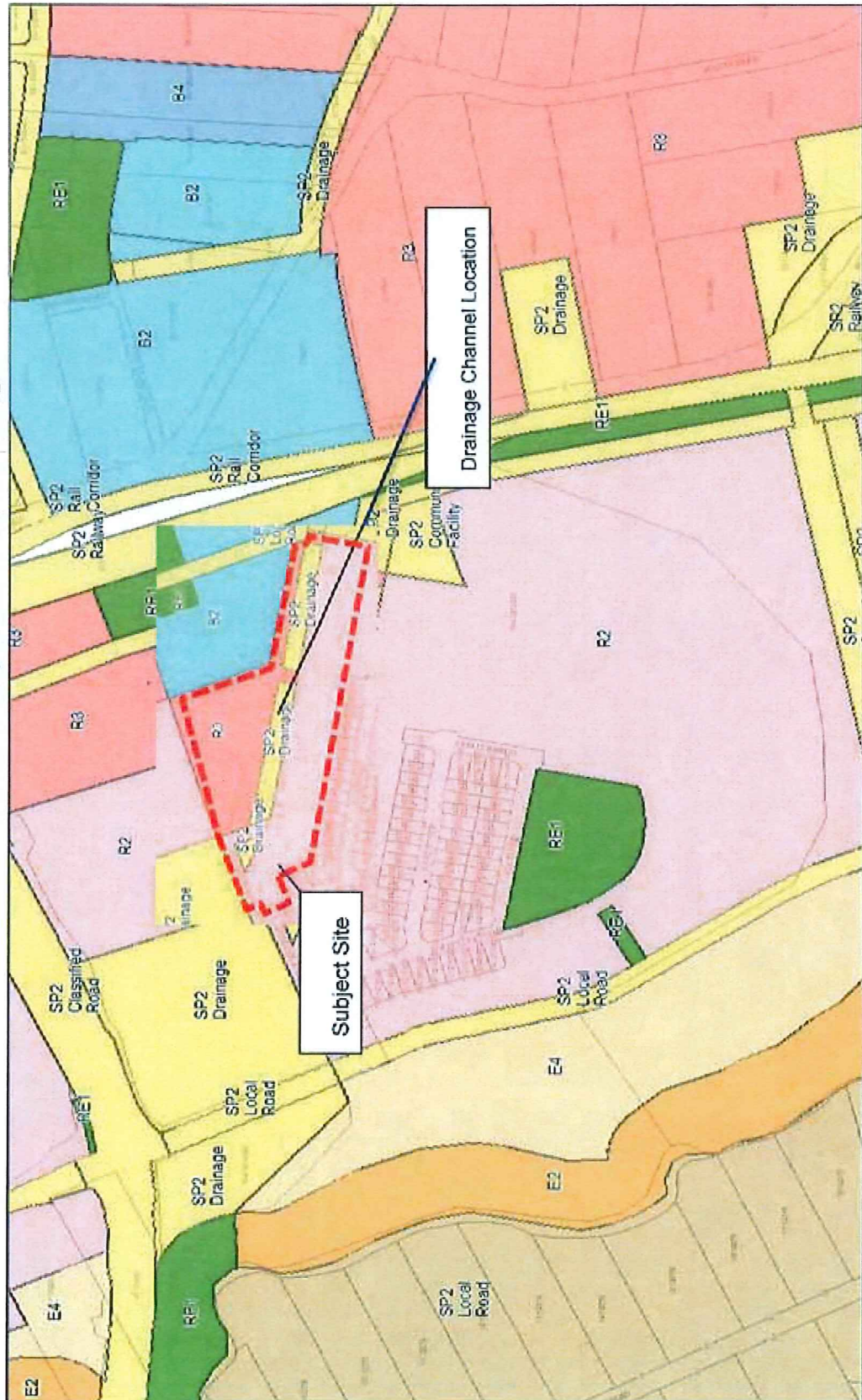
Attachments

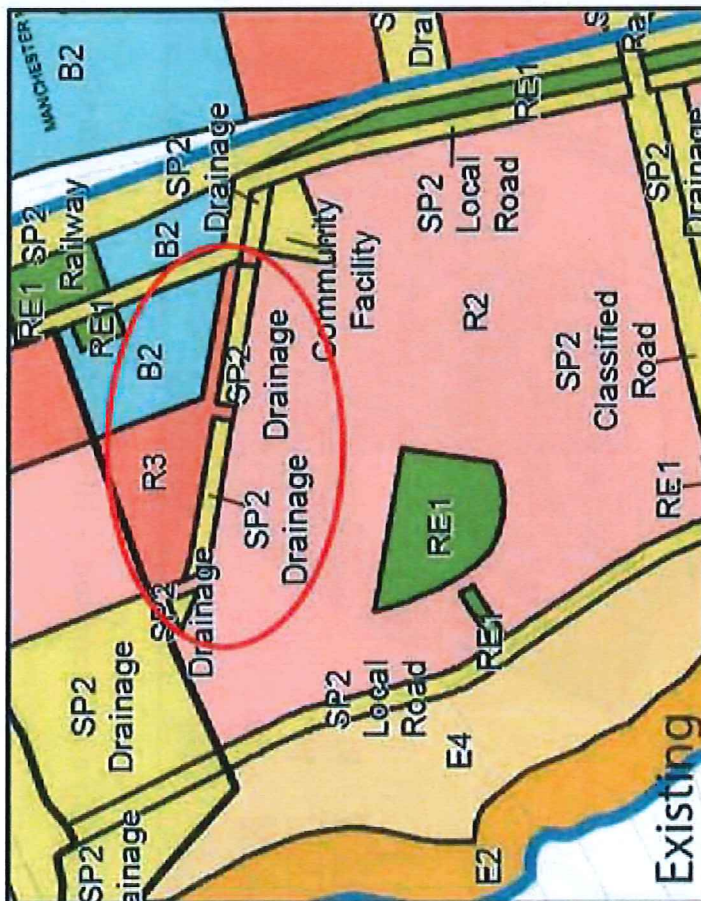
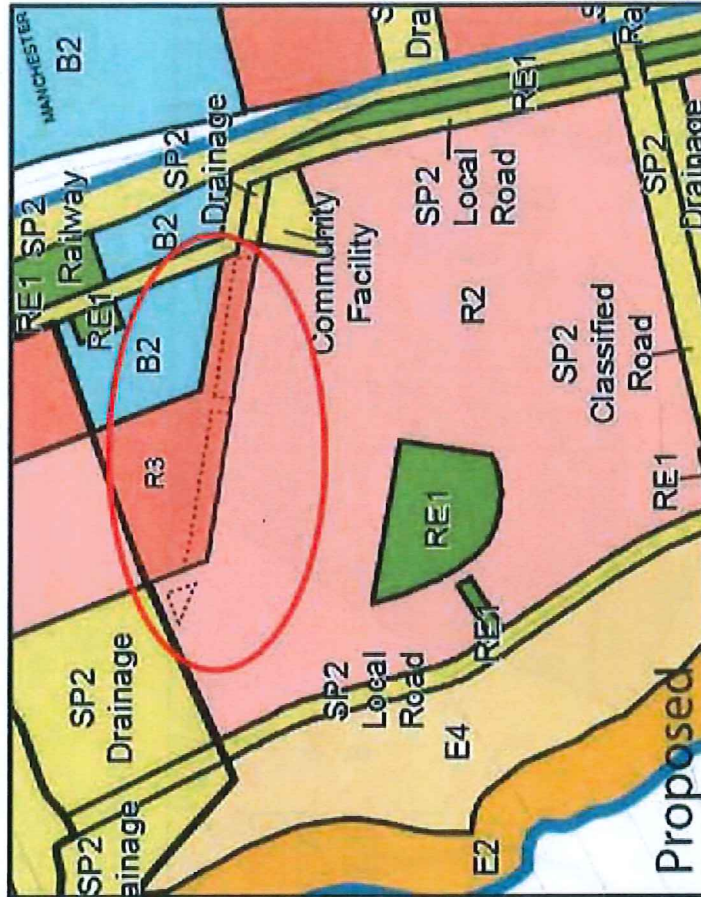
Ref	Description	Files
1		 A1DD370034.pdf
2		 A2DD370034.pdf

Recommendations

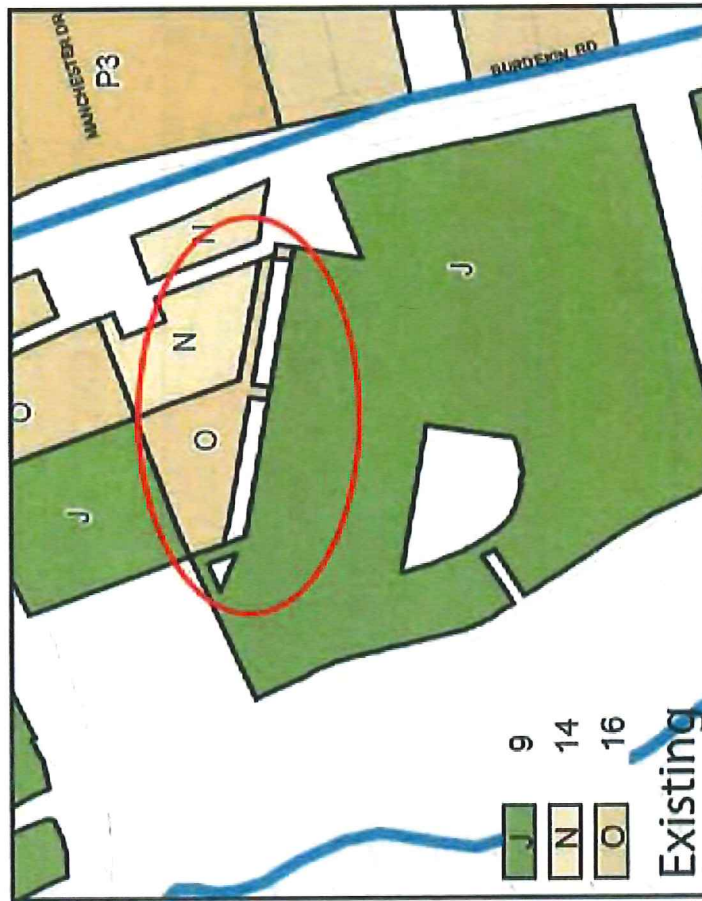
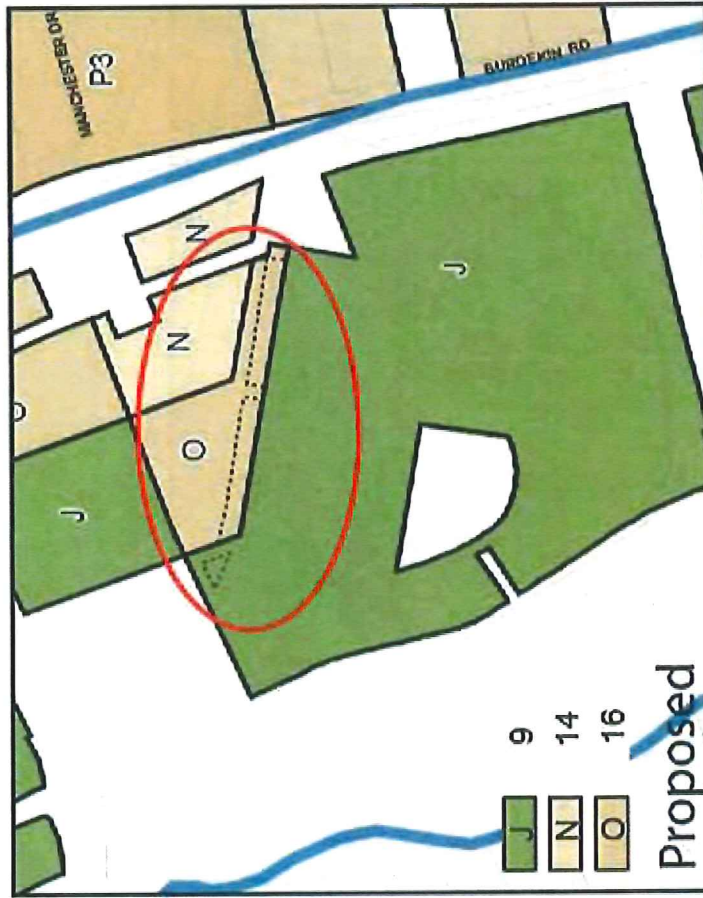
Report Recommendation	1. Prepare and forward a Planning Proposal to the Department of Planning and Environment requesting a Gateway Determination to rezone part of Lot 164, DP 1218925, Veron Road, Schofields from SP2 Infrastructure (Drainage) to part R2 Low Density Residential and part R3 Medium Density Residential, and make corresponding amendments to the floor space ratio, height of buildings, residential density, lot size and land reservation acquisition maps under State Environmental Planning Policy (Sydney Region Growth Centres) 2006. 2. Implement any conditions attached to a Gateway Determination issued by the Greater Sydney Commission. 3. Advise the proponent that Recommendation 1 does not imply or guarantee that the Planning Proposal will ultimately be supported. Council's final determination of the proposal will occur when Council resolves to adopt the Planning Proposal following exhibition and consideration of all relevant matters. 4. The Planning Proposal not be finalised until Council is satisfied that satisfactory arrangements have been made to address the loss of future landscaped amenity and the increased demand for open space in the Altrove Estate.
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Location of Subject Site & Current Zoning

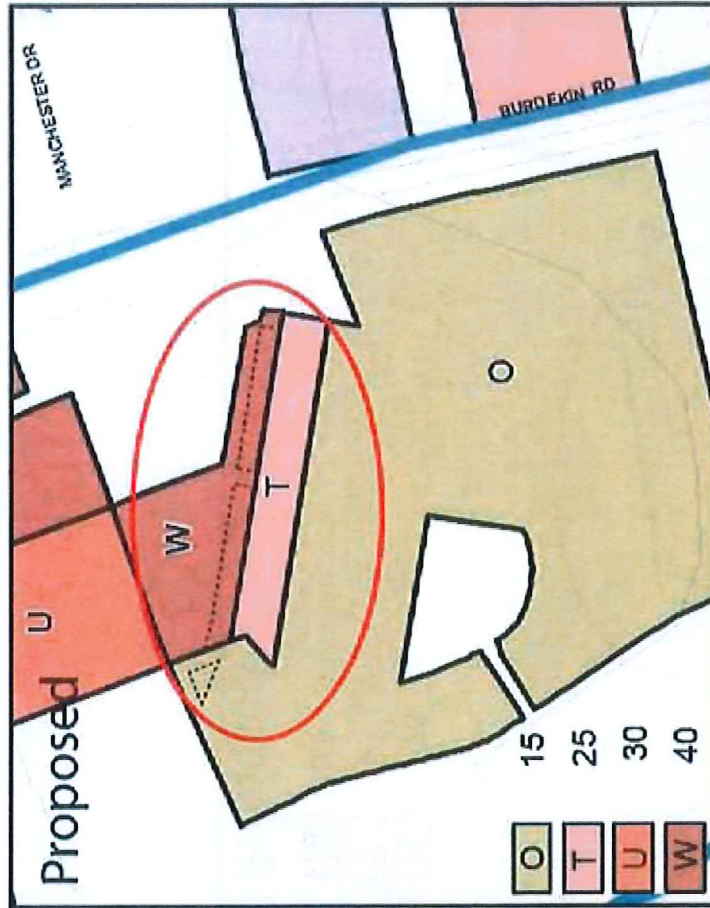
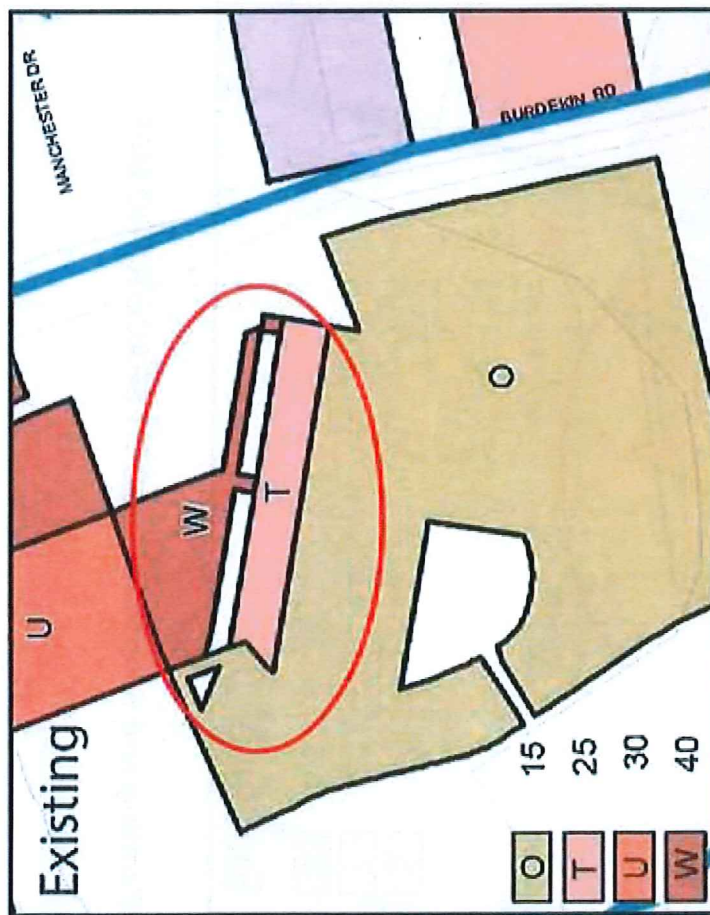




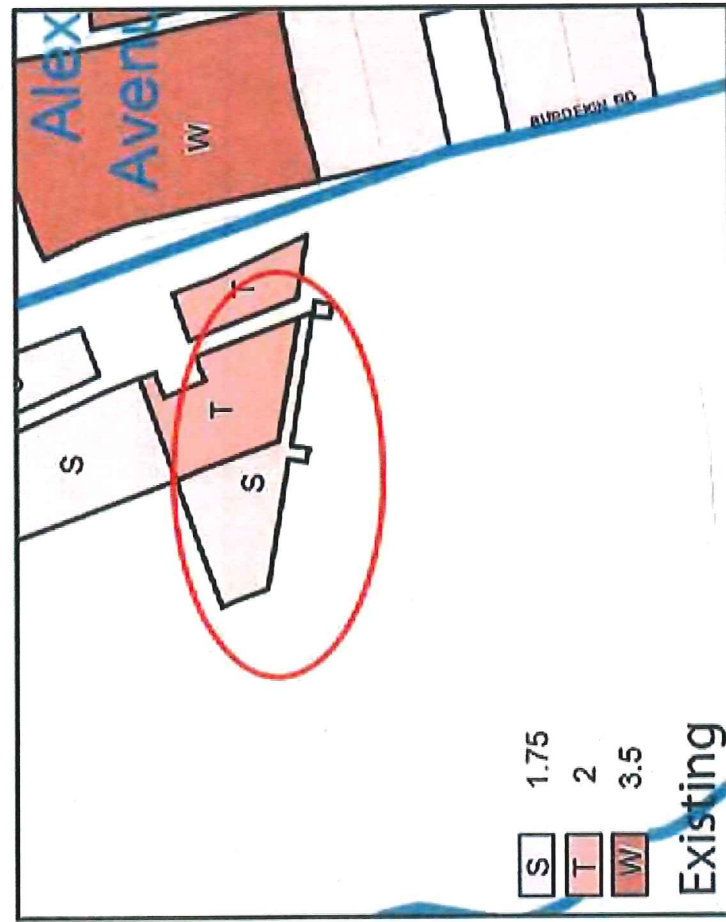
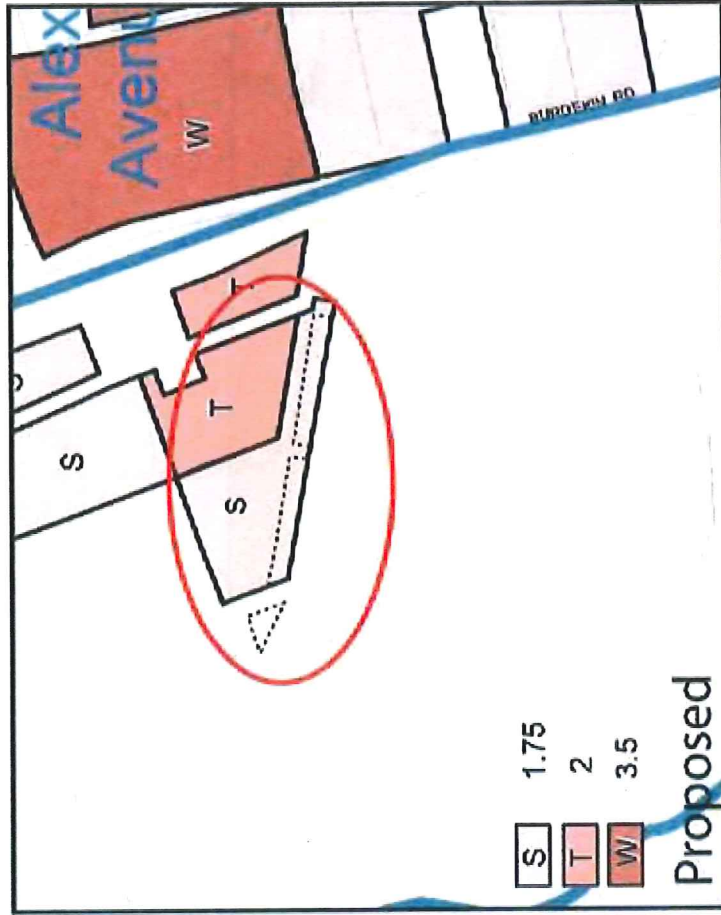
Existing and Proposed – LAND ZONING MAP



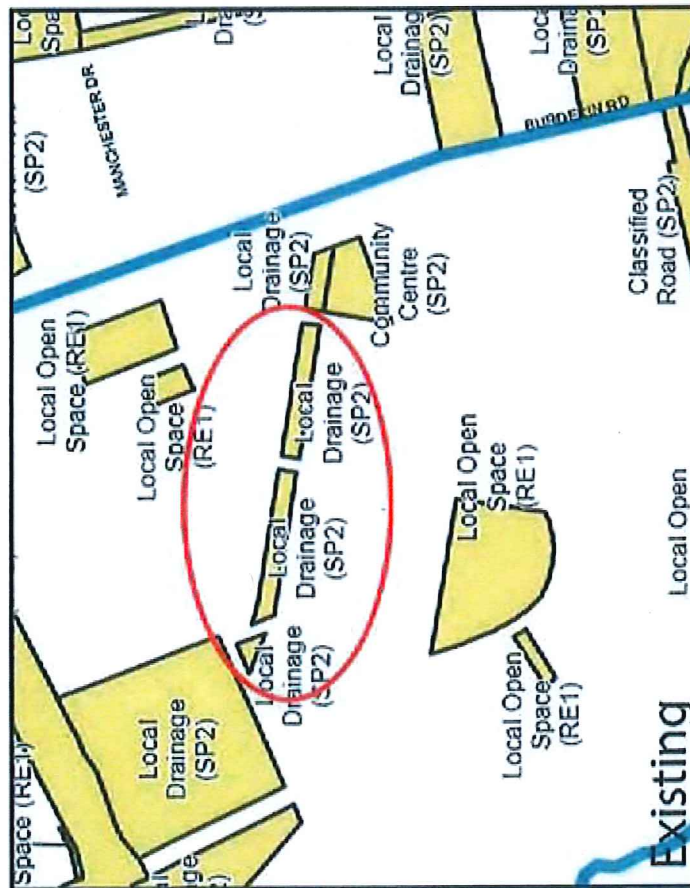
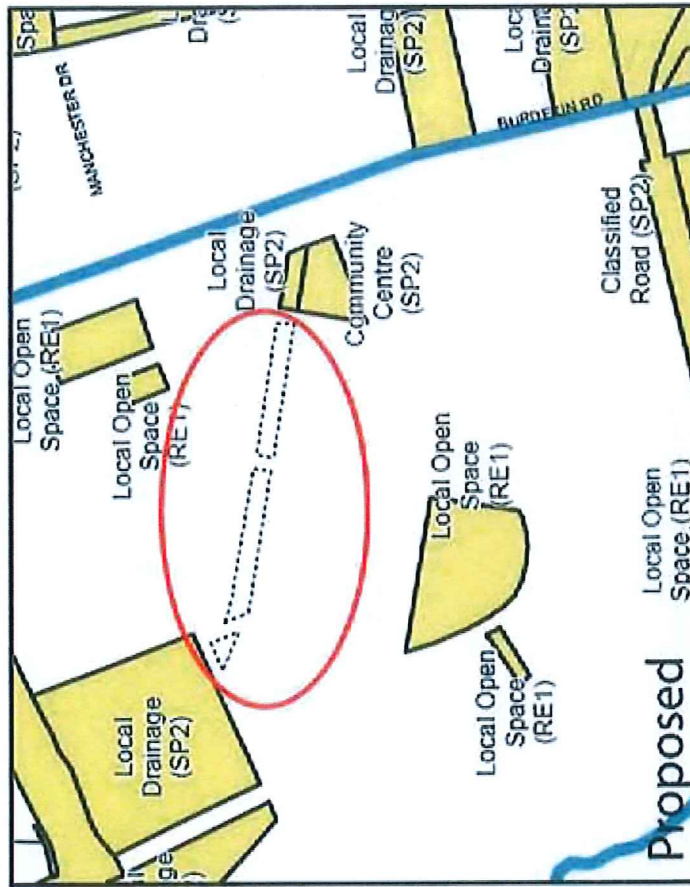
Existing and Proposed - HEIGHT OF BUILDINGS MAP



Existing and Proposed - RESIDENTIAL DENSITY MAP



Existing and Proposed – FLOOR SPACE RATIO MAP



Existing and Proposed - LAND RESERVATION AND ACQUISITION MAP

