

CIVIL ENGINEERING REPORT INCORPORATING WATER CYCLE MANAGEMENT STRATEGY

**SSD-33701741
WYONG RDC EXPANSION
11 WARREN ROAD
WARNERVALE NSW**

***Prepared For:*
Woolworths Group Limited
1 Woolworths Way
BELLA VISTA NSW 2153**

***Prepared by:*
Costin Roe Consulting
Level 1, 8 Windmill Street
WALSH BAY NSW 2000**

Rev: A

DOCUMENT VERIFICATION

Project Title	Wyong RDC Expansion
Document Title	Civil Engineering Report Incorporating Water Cycle Management Strategy
Project No.	Co8318.01
Description	SSD Report for proposed industrial development
Client Contact	Woolworths Group Limited – Mr Andrew Hollander .

	Name	Signature
Prepared by	Daniel Solomon Mark Wilson	
Reviewed by	Mark Wilson	
Issued by	Denis Webber	
File Name	8318.01-03a.rpt	

Document History

Date	Revision	Issued to	No. Copies
04 March 2022	DRAFT	Woolworths, Mr Andrew Hollander .	PDF
23 March 2022	A	Woolworths, Mr Andrew Hollander	PDF

EXECUTIVE SUMMARY

Woolworths Group Limited (Woolworths - the Applicant) are seeking to expand their existing Regional Distribution Centre (RDC) at 11 Warren Road, Warnervale, NSW.

The Proposal is considered State significant development (SSD) and accordingly, an Environmental Impact Statement (EIS) has been prepared to support the SSD Application for the Proposal. This Water and Hydrology Assessment has been prepared by Costin Roe Consulting to support the preparation of the EIS and assess the Proposal's impact on the surrounding environment in relation to soils and water including stormwater and stormwater management for both construction and operational phases of the development.

Proposal overview

The proposed development is for the expansion of the existing RDC including for extensions to the ambient and temperature controlled buildings, additional hardstand, truck circulation and truck parking areas. Works will include minor earthworks, provision of services, building construction, and stormwater management measures.

Access to the development remains off Warren Road and Woolworths Way.

Purpose of this assessment

This Water and Hydrology Impact Assessment has been prepared to address the following industry specific Secretary's Environmental Assessment Requirements (SEARs):

- Item Number 12: Ground and Water Conditions**
- Item Number 13: Stormwater and Wastewater
- Item Number 14: Flooding Risk

**Note: surface water related assessments only. Refer separate report by geotechnical consultant relating to groundwater and geotechnical considerations.

Construction impacts

During the construction phase, a Sediment and Erosion Control Plan will be in place to ensure the downstream drainage system and receiving waters are protected from sediment laden runoff.

Operational impacts

During the operational phase of the development, the proposed stormwater quality treatment system incorporating the use of a treatment train of existing wetland and detention systems in conjunction with at source gross pollutant traps (GPT's) and proprietary filtration is proposed to mitigate any increase in stormwater pollutant load generated by the development. Best management practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

Further it has been confirmed that the development considers flood and overland flow planning requirements. The development does not impact or encroach on existing flood affected areas. The development discharges from the site following attenuation via an existing and modified wetland and on-site detention systems which attenuates increased runoff to existing peak flows, as such the site discharge will not adversely affect any land, drainage system or watercourse as a result of the increased development.

Conclusion

The hydrological assessment of the local site drainage confirms that recommended water quality and quantity measures will ensure that no adverse impacts result on receiving waterways as a result of the development.

The detail contained in this report provides sufficient information to show the consent authority that legal points of discharge and a suitable stormwater management strategy is available for the development and the requirements associated with the strategy. It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	(i)
1 INTRODUCTION & SCOPE	7
1.1 Introduction	7
1.2 Consultation	7
1.3 SEAR's Responses	7
2 DEVELOPMENT SITE	16
2.1 Location	16
2.2 Existing Site Description	17
2.3 Proposed Development	18
3 SOILS & SITE WORKS	19
3.1 Soil and Geological Conditions	19
3.2 Bulk Earthworks	19
3.3 Retaining Walls	20
3.4 Embankment Stability	20
3.5 Groundwater	20
3.6 Acid Sulphate Soils and Salinity	21
4 WATER CYCLE MANAGEMENT STRATEGY & DRAINAGE METHODOLOGY	22
4.1 Key Areas and Objectives	22
4.2 Existing Site Drainage	24
4.3 Proposed Surface Water Drainage System	26
4.4 Hydrologic Modelling and Analysis	28
4.4.1 Rainfall Data	28
4.4.2 Runoff Models	28
4.5 Hydraulics	28
4.5.1 General Requirements	28
4.5.2 Freeboard	29

4.5.3	Public Safety	29
4.5.4	Inlet Pit Spacing	29
4.5.5	Overland Flow (development lots)	29
5	WATER QUANTITY MANAGEMENT	30
5.1	Introduction	30
5.2	Existing & Post Development Peak Flows	30
5.3	Flow Duration and Volumetric Flow Considerations	32
5.3.1	Volumetric Flow Introduction	32
5.3.2	Summary of Ecological Engineering Modelling and Outcomes	32
5.3.3	MARV Assessment	34
5.3.4	MARV Conclusion	35
6	STORMWATER QUALITY, REUSE AND MAINTENANCE	36
6.1	Stormwater Quality Objectives	36
6.2	Proposed Stormwater Treatment System	36
6.3	Stormwater Quality Modelling	36
6.4	Stormwater Harvesting	38
6.4.1	Rainwater Tank Sizing	39
6.5	Maintenance and Monitoring	39
7	FLOODING AND OVERLAND FLOW	40
7.1	Introduction	40
7.2	Existing Overland Flow and Flood Behaviour	40
7.3	Council Floodplain Management Requirements & NSW Floodplain Management Manual Requirements	44
7.4	Flood Assessment Conclusion	45
8	WATER CYCLE MANAGEMENT	46
8.1	Water Balance Objectives	46
8.2	Water Use Management Features	46
8.2.1	Existing	46
8.2.2	Proposed	46
8.3	Water Balance Assessment	48
8.3.1	Internal Base Water Demand	48
8.3.2	External Base Water Demand	48

8.3.3	Rainwater Tank Sizing	48
8.4	Construction Impact Assessment	49
8.5	Operational Impact Assessment	49
9	CONSTRUCTION SOIL AND WATER MANAGEMENT	50
9.1	Soil and Water Management General	50
9.2	Typical Management Measures	50
9.3	Other Management Measures	51
10	CONCLUSION	52
11	REFERENCES	53

1 INTRODUCTION & SCOPE

1.1 Introduction

Costin Roe Consulting Pty Ltd has been commissioned by Woolworths to undertake a *Civil Engineering Report & Water Cycle Management Strategy* (WCMS) to accompany a State Significant Development Application (SSDA) with the NSW Department of Planning, Industry and Environment (DPIE) for the industrial development on the land.

This report presents a civil engineering assessment the property at 11 Warren Road, Warnervale in the Central Coast LGA. This report provides an assessment of the civil engineering characteristics of the development site and technical considerations of the following aspects:

- Earthworks & geotechnical considerations;
- Water Cycle Management Strategy (WCMS).

The WCMS comprises several key areas of stormwater and water management which are provided below. These key areas have been established with the aim to reduce impacts from the development on the surrounding environment and neighbouring properties. The water cycle management strategy identifies the management measures required to meet the targets set. The key water cycle management areas assessed in this report are:

- Storm Water Quantity;
- Storm Water Quality;
- Water Supply and Reuse;
- Flooding; and
- Erosion and Sediment Control

A request for Planning Secretary's Environmental Assessment Requirements (SEAR's) to the DPIE has been made by the applicant. Reference to **Appendix C** should be made for SSD-333701741 SEAR's dated 21 December 2021. **Section 1.3** of this report for specific responses to civil engineering and water management related items included in the SEAR's.

1.2 Consultation

Consideration to the various stakeholders has been made in relation to the development, including Central Coast Council has been made during the assessment period.

1.3 SEAR's Responses

This report supports the EIS for the proposal and to address the NSW Department of Planning and Environment SEARS letter dated 21 December 2021, reference SSD-333701741.

We note the below “key issues and documentation” assessments are based on the standard Warehouse and Distribution Centre SEAR’s document recently implemented (October 2021) by DPIE and following key areas in the document:

- *Item 12. Ground and Water Conditions***
- *Item 13. Stormwater and Wastewater*
- *Item 14. Flooding Risk*

****Note:** surface water related assessments only. Refer separate report by geotechnical consultant relating to groundwater and geotechnical considerations.

Table 1.1 provides a summary of the SEARs General Requirements which relate to water and hydrology, and where these have been addressed in this report.

Table 1.1. SEARs Warehouse and Distribution Centres Key Areas

SEAR’s Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Location Within This Report
12. Ground and Water Conditions	Provide an assessment of the potential impacts on soil resources, including related infrastructure and riparian lands on and near the site.	We note the site is currently significantly developed. The original development (approved in 2003 and constructed circa 2004/2005) envisaged expansion of the facility. The original construction included significant earthworks and stormwater management works completed. The site is noted to be located within an established industrial precinct. The proposed expansion project involves minor filling and some cutting to the existing site. These works are noted to be similar in nature and scale to those which have occurred on surrounding developments and the original RDC construction, and in areas that have also undergone cut and fill works. Geotechnical	Refer to Section 3 and geotechnical assessments by Geo-Logix (Report reference: 2101104GTRpt01 FinalV01_19Oct21 Date: 19 October 2021) for confirmation of soil resources and potential impacts. Refer to Section 4, 5 & 6 for assessment of water resources, hydrology (including quality and quantity), watercourses and riparian lands during operation.

SEAR's Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Location Within This Report
		investigations also confirm there will be minimal impact to existing soil resources and soils. We note there are existing wetland and riparian lands south of the subject property within a mapped Wetland Management Area. We note there are no proposed changes or impacts to areas external to the site. We also note that the development proposes some amendments to the existing detention system/ wetland on the south of the property to facilitate a truck maintenance area. The proposed stormwater management measures ensure no detention storage or flood storage is lost and that the site maintains current water quality outcomes.	
	Provide an assessment of the potential impacts on surface and groundwater resources (quality and quantity), including related infrastructure, hydrology, aquatic and groundwater dependent ecosystems, drainage lines,	We note there are existing wetland and riparian lands south of the subject property within a mapped Wetland Management Area. We note there are no proposed changes or impacts to areas external to the site. We also note that the development proposes some amendments to the existing detention system/ wetland on the south of the property to facilitate a truck maintenance area. The proposed	Refer to Section 4, 5 & 6 for assessment of water resources, hydrology (including quality and quantity), watercourses and riparian lands during operation.

SEAR's Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Location Within This Report
	downstream assets, and watercourses.	stormwater management measures ensure no detention storage or flood storage is lost and that the site maintains current water quality outcomes. Refer to Section 9 for soil and water management measures during construction, drawings in Appendix A for associated erosion and sediment control drawings, and Appendix C for a Draft Soil and Water Management Plan. These sections show proposed measures, based on the Landcom document <i>Managing Urban Stormwater – Soils & Construction Volume 1 ('Blue Book') (Landcom, 2004)</i>, are proposed during the construction of the development. Measures proposed will limit potential for offsite impact associated with water runoff and soils during construction. Consideration to management of salinity and acid sulphate has been made based on the recommendations of the geotechnical investigations and noted Landcom document.	
	Identify predicted water discharge points to	A surface water runoff including surface water runoff, water quality and	Refer to Sections 4 & 6

SEAR's Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Location Within This Report
	surface/groundwater and consider discharge quality against relevant water quality criteria	water quantity has been completed. The key stormwater objectives, based on relevant water sensitive urban design criteria, have been set out in Section 4.1 and Section 6.1 of the report. Discharge from the site is noted to be made to existing stormwater management systems and existing discharge arrangements constructed in the original RDC construction which allowed for the ultimate development conditions proposed in this application. Section 6 provides demonstration of the key criteria being met, based on MUSIC modelling. Configuration of the proposed measures are shown on the Civil Design Drawings included in Appendix A.	
	Provide a detailed site water balance including identification of water requirements for the life of the development, and measures to ensure an adequate and secure water supply.	The site is currently fully serviced with active water supply and wastewater discharge. The water demands are also supplemented by a significant roofwater reuse system. The combination of mains supply and reuse is adequate for the supply of the existing and redeveloped site.	Refer to Section 8 for water balance assessment.

SEAR's Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Location Within This Report
	Provide an assessment of salinity and acid sulfate soil impacts.	Refer to Section 3 and geotechnical assessments by Geo-Logix for confirmation of soil resources and potential impacts.	Refer to Section 3
13. Stormwater and Wastewater			
13.	Provide an Integrated Water Management Plan for the development that: - is prepared in consultation with the local council and any other relevant drainage or water authority. - details the proposed drainage design for the site including any on-site detention facilities, water quality management measures and the nominated discharge points, on-site sewage management, and measures to treat, reuse or dispose of water. - demonstrates compliance with	A surface water runoff including surface water runoff, water quality and water quantity has been completed. The key stormwater objectives, based on relevant water sensitive urban design criteria, have been set out in Section 4.1 and Section 6.1 of the report. Discharge from the site is noted to be made to existing stormwater management systems and existing discharge arrangements constructed in the original RDC construction which allowed for the ultimate development conditions proposed in this application.	Refer to Section 4, 5 & 6 for assessment of water resources, hydrology (including quality and quantity), watercourses and riparian lands during operation.

SEAR's Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Location Within This Report
	the local council or other drainage or water authority requirements and avoids adverse impacts on any downstream properties.		
	Where drainage infrastructure works are required that would be handed over to the local council, or other drainage or water authority, provide full hydraulic details and detailed plans and specification of proposed works that have been prepared in consultation with, and comply with the relevant standards of, the local council or other drainage or water authority	There are no works associated with the project that would be handed over to council or any other authority.	N.A.
14. Flooding Risk	Identify any flood risk on-site having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the	The proposal is noted to be located adjacent to an area which is affected by flooding. The site however is shown, per Central Coast Council Flood Risk Mapping, to be clear of the Probable Maximum Flood (PMF)	Refer Section 7 for assessments pertaining to flooding and overland flow.

SEAR's Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Location Within This Report
	NSW Floodplain Development Manual.	event extent and flood level. As such detailed flood modelling or flood assessments are not required to be completed. A desktop flood assessment has been included in this plan to ensure appropriate consideration to flooding has been made for the development. The development floor level has been set allowing for freeboard to the regional floodplain of greater than 0.5m during the 1% AEP flood event. The requirements of council and NSW Floodplain Development Manual are met for this development.	
	Assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required.	The proposal is noted to be located adjacent to an area which is affected by flooding. The site however is shown, per Central Coast Council Flood Risk Mapping, to be clear of the Probable Maximum Flood (PMF) event extent and flood level. As such detailed flood modelling or flood assessments are not required to be completed. A desktop flood assessment has been included in this plan to ensure appropriate flood planning considerations are met, the site has suitable flood immunity to the known	Refer Section 7 for assessments pertaining to flooding and overland flow.

SEAR's Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Location Within This Report
		flood behaviour and acceptable flood risk has been demonstrated.	

2 DEVELOPMENT SITE

2.1 Location

The site is located at 11 Warren Road, Warnervale and is legally described as Lot 413 DP 1058215. The Site is located within the Central Coast Council (CCC) local government area (LGA), as shown in **Figure 2.1**.

The site is located on the southern side of Warren Road and east of Woolworths Way in the suburb of Warnervale. The site is located within an established industrial precinct.

The M1 Pacific Motorway is approximately 500m west of the site, and the Warnervale Airport is a similar distance to the east. The nearest residential receivers are noted to be located approximately 600m west of the site on the western side of the M1 Motorway.

Porters Creek and a mapped wetland (including the Wallum Froglet habitat) is located to the south-west of the development site.



Figure 2.1. Site Location and Aerial Imagery (Source: Mecone Mosaic)

2.2 Existing Site Description

The site area is 23.16 Ha.

The site is roughly trapezoidal in shape and averages approximately 380m wide and 610m long (noting varying width and lengths are present in both directions)

Primary access to the site is via Warren Road (on the north) and secondary access via Woolworths Way (on the west). Existing industrial developments are present on the north and west of the Site, including the Sanitarium Health Food Company facility.

The site, as noted, comprises the existing RDC development and includes a single level steel framed building (500m x 100m) with a floor level of RL 10.8m AHD. External truck loading and circulation areas comprise concrete paved areas with levels in the range of RL 8.5m AHD to RL 9.5m AHD.

The site also includes a comprehensive stormwater drainage system which includes two stormwater management wetland systems on the south and west of the site. An existing easement and open channel is also present which drains Woolworths Ways and associated upstream catchments from the surrounding industrial precinct. The normal water level in the wetland is noted at RL 7.6m AHD.

The general arrangement of the existing site, per the original civil design construction drawing by Beca Pty Ltd is included as **Figure 2.2**.

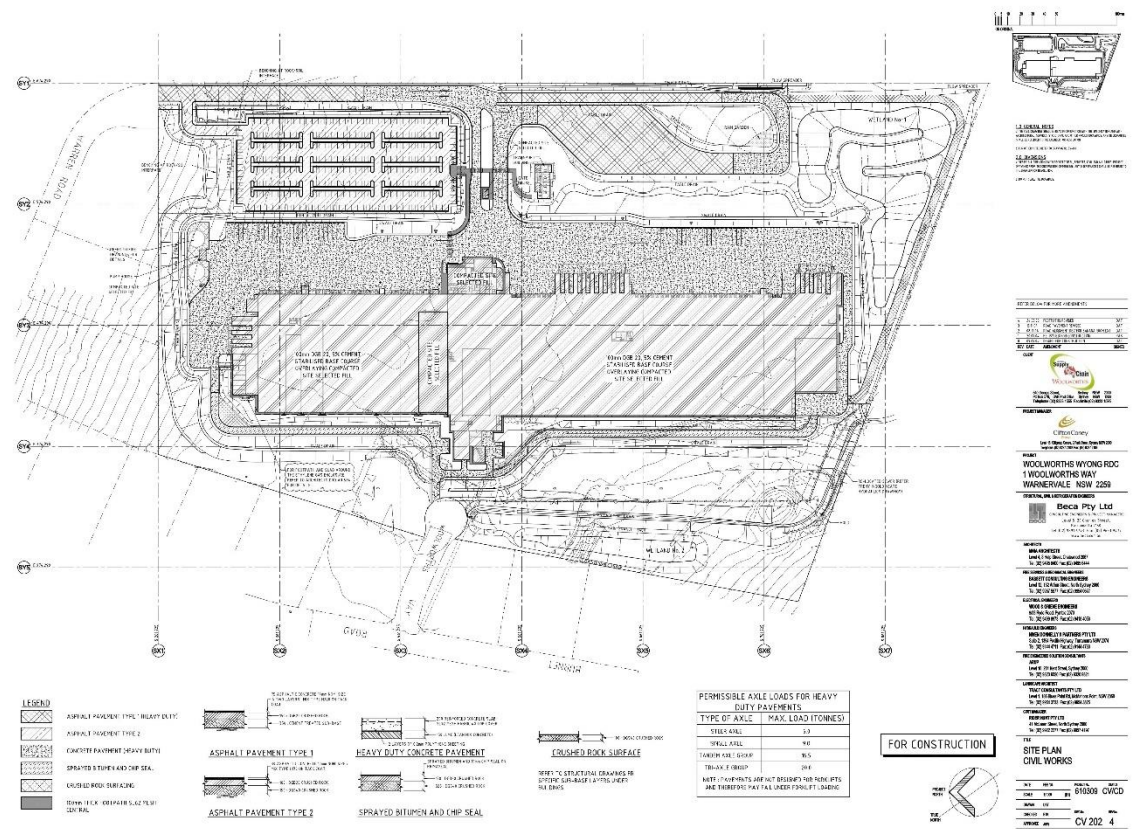


Figure 2.2. Existing Site General Layout

2.3 Proposed Development

The proposed development is for an expansion to the existing 24/7 operational warehouse and distribution centre comprising:

- Expansion of the ambient warehouse;
- A new RTF building;
- Expansion of the existing temperature controlled building;
- A new truck wash and truck maintenance building;
- New truck loading and circulation pavements to suit the above noted works;
- Additional truck parking areas;
- Earthworks involving cut and fill works to facilitate the above noted improvements;
- Site preparation works and servicing;
- Drainage modifications including adjustment to existing inground drainage conduits, new stormwater management measures and modifications to existing stormwater management measures; and
- landscaping;

The indicative site layout prepared by Watson Young has been included in **Figure 2.2**.

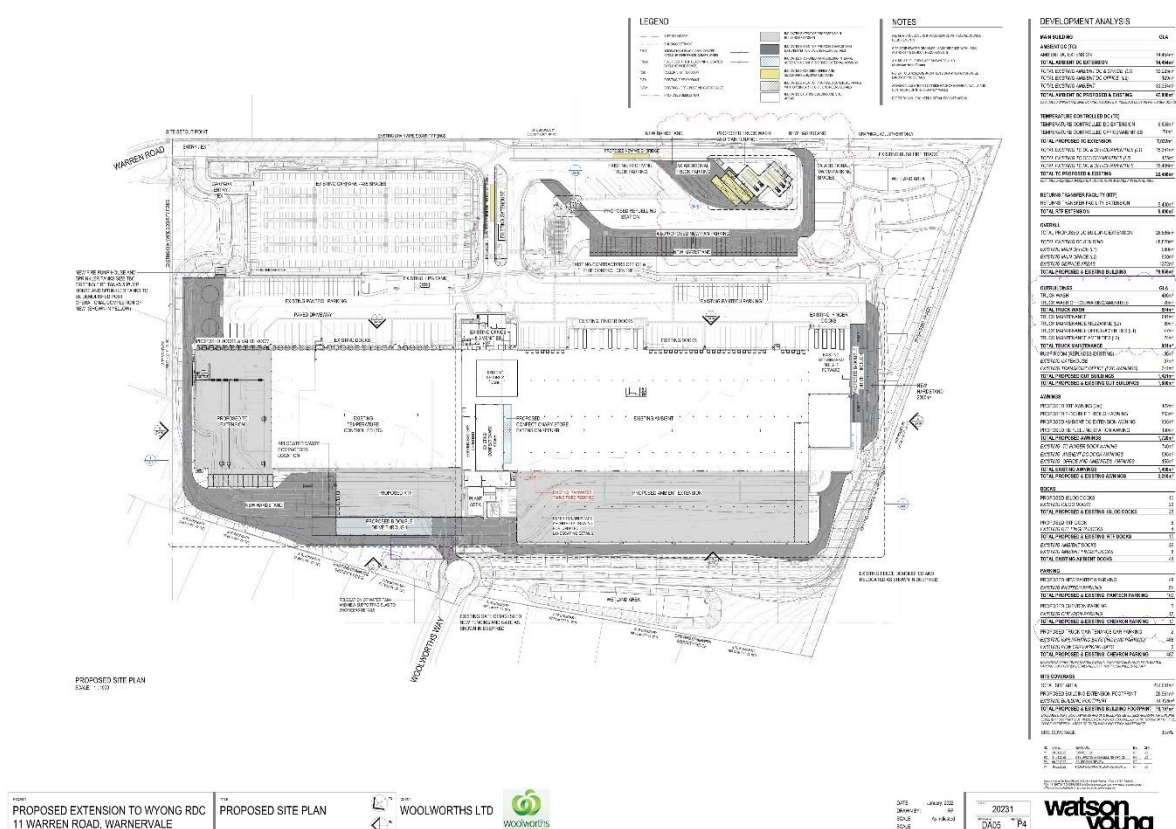


Figure 2.2. Proposed Development – Concept Layout Plan

3 SOILS & SITE WORKS

3.1 Soil and Geological Conditions

A geotechnical investigation has been completed by Geo-logix (refer report reference 2101104GTRRpt01FinalV01_19Oct21 dated 19 October 2021).

As reported by Geo-logix, the 1:100 000 Gosford-Lake Macquarie Geology Sheet (Geological Survey of NSW, 2015) indicates that the site is situated on Triassic aged red-brown claystone and siltstone, interbedded with fine to medium grained green-grey sandstone. Further that the NSW OEH online soil mapping portal (eSPADE v2.1, 2021) indicates that the site is in the Gorokan Soil Landscape, characterised by loose brown loamy sand with underlying yellowish brown hard setting clayey sands and pedal clays

Bore logs have confirmed that the site is underlain by fill material to depth of 0.3m to 1m below existing ground level (mbg) around the existing warehouse facility, transitioning to residual clay from 1.2m to 2.0mbg, then to extremely weathered rock (inferred Bringelly Shale) from 4.2m to 4.5mbg.

It is expected that some excavation through rock will be required to reach bulk excavation levels for the development at the northern parts of the development.

Acid sulphate soils are not likely to be present on the development site so are not considered to be an issue.

The residual clay material on site is likely to be classed as moderately to highly expansive. The warehouse foundations and ground floor slab will need to be designed to accommodate any shrink-swell movements. The warehouse foundations will need to be found on either stiff clay of suitable strength or engineered fill.

3.2 Bulk Earthworks

Bulk earthworks will be required to facilitate the additional development. The earthworks will be undertaken to provide additional building pads, hardstand areas and circulation zones. A high-level earthwork volume estimate assessment has been completed for the site. The estimated volumes are shown on the Costin Roe drawings in **Appendix A**.

The earthworks analysis has been completed to a level of detail to enable general pad levels to be set and to obtain an order of magnitude cut and fill volume estimate. Given the preliminary nature of the assessment, an upper and lower bound of earthworks volumes has been included to allow for contingency in cost planning estimates.

The earthworks volume estimates are as follows:

	Apparent Volume	Upper Bound (+15%)	Lower Bound (-15%)
Topsoil Strip / Slab Removal	-13,000	-14,950	-11,050
Cut (m³)	-15,800	-18,170	-13,430
Fill (m³)	+29,000	+33,350	+24,650
Detail Excavation (@ 1000m³/ Ha)	-6,500	-7,475	-5,525
Balance (m³)	+6,700	+7,705	-5,695

Table 3.1. Earthwork Volume Estimates

Earthworks allowances for services trenches, retaining walls and detailed building excavation should also be made to avoid excessive unknown exports during later stages of the project. Allowances in the range of 1250-2500m³/Ha can be expected depending on the type of development and final site layouts. This allowance is included in the earthworks assessment. As noted, an upper and lower bound of earthworks volumes has been included to allow for some of these items.

Soil Erosion and Sediment Control measures, including sedimentation basins are to be placed in accordance with submitted drawings and the *Soil and Water Management Plan* in **Section 8** and **Appendix C** of this report.

All geotechnical testing and inspections performed during the filling operations will be undertaken to Level 1 geotechnical control, in accordance with AS3798-2007.

3.3 Retaining Walls

The civil engineering objective is to minimise retaining walls within the constraints of the masterplan layout, allowable grading to suit the proposed additional development and batters in landscaped areas where possible.

Retaining will be required along the northern and western boundaries. Wall height will generally be less than 2m, however in some areas the maximum retained height will be up to 5m. We note that no new walls are visible from the public domain. The wall construction is anticipated to comprise modular masonry block system (Keystone) with reinforced soil backfill, core filled blockwork or pile and shot-crete depending on the location, height and geotechnical conditions at the location of the wall.

Retaining on the western property boundary is also required. This wall, being in cut up to 2m in height, is anticipated to comprise reinforced concrete block system.

Location and indicative heights of retaining walls are shown on drawings in **Appendix A**.

3.4 Embankment Stability

To assist in maintaining embankment stability permanent batters in clay will be no steeper than 3 horizontal to 1 vertical while temporary batters will be no steeper than 2 horizontal to 1 vertical.

Permanent batters will also be adequately vegetated or turfed which will assist in maintaining embankment stability.

Stability of batters and reinstatement of vegetation shall be in accordance with the submitted drawings and the *Soil and Water Management Plan* in **Section 8** and **Appendix C** of this report.

3.5 Groundwater

As reported by Geo-logix, groundwater inflow was not generally encountered within the investigation depth (4.5 m below ground) however was found at 5.6 m below ground in BH4 drilled to 6.0 m below ground. Shallower groundwater was encountered

at 3.5 m below ground in soil bore BH2 and is considered to be influenced by the swamp adjacent to this location. Groundwater is not expected to significantly affect construction activities on the site

Surface water management, including conveyance of surface runoff, management of water quantity (through on-site detention) and water quantity (through on-site and estate wide management systems using WSUD principles and best practice pollution reduction objectives) has been proposed in the design.

3.6 Acid Sulphate Soils and Salinity

An assessment of the potential for acid sulphate soils has been requested as part of the SEAR's requirements.

We note the Geo-logix investigation report and acid sulfate risk maps show very low potential for acid sulfate potential.

The geo-logix investigation confirms soils are non-saline to moderately saline.

4 WATER CYCLE MANAGEMENT STRATEGY & DRAINAGE METHODOLOGY

4.1 Key Areas and Objectives

Water Cycle Management (WCM) is a holistic approach that addresses competing demands placed on a region's water resources, whilst optimising the social and economic benefits of development in addition to enhancing and protecting the environmental values of receiving waters.

Developing a WCMS at the SSD stage of the land development process provides guidance on urban water management issues. This WCMS has been prepared to inform DPIE, and relevant stakeholders, that the development is able to provide and integrate WCM measures into the stormwater management strategy for the development.

The key WCM targets which have been adopted in the design are included in **Table 4.1** following, and included in the drawings found in **Appendix A**

Table 4.1. WCM Targets

Element	Target	Reference
Water Quantity	Minimise flooding from increased stormwater runoff due to development Post development runoff is to be limited to pre-development runoff for the 5%, 20% and 100% AEP events.s	Central Coast Council Civil Works Specification – Design Guideline 2020
Water Quality	Load-based pollution reduction targets based on an untreated urbanised catchment: Gross Pollutants 90% Total Suspended Solids 80% Total Phosphorus 45% Total Nitrogen 45%	Central Coast Council Civil Works Specification – Design Guideline 2020
Flooding	Buildings set 0.5m above the 1% AEP flood level.	Central Coast Council Civil Works Specification – Design Guideline 2020 NSW Floodplain Development Manual.
Water Supply	Reduce Demand on non-potable water uses. Provide minimum 50% reduction of non-potable uses and stretch target of 80%.	DPIE
Construction Stormwater Management & Erosion and Sediment Control	A construction stormwater management plan and appropriate associated erosion and sedimentation control measures must be described in the environmental assessment for all stages of construction to mitigate potential impacts to surrounding properties.	Landcom Blue Book Central Coast Council DPI

A summary of the how each of the WCM objectives will be achieved are described below. Reference to the relevant sections of the report should be made for further and technical details relating to the WCM measures:

- *Stormwater Quantity Management (Refer Section 5)*

The intent of this criterion is to reduce the impact of urban development on existing drainage system by limiting post-development discharge within the receiving waters to the pre-development peak, and to ensure no affectation of upstream, downstream, or adjacent properties.

Attenuation of stormwater runoff from the development is required. The site currently comprises two stormwater management systems on the west and south-east of the property prior to discharge offsite to the mapped wetland area south of the property. The performance of the existing systems have been assessed in the greenfield conditions, current development and re-developed conditions. The assessment shows that augmentation by providing increased storage of 1274.5m³ to Basin 1 and 660m³ to Basin 2. Further we note minor amendments to the footprint of Basin 1 is required to suit the new truck workshop to the north of Basin 2.

Additional metrics relating to stream health and discharge criteria have been considered for the additional development based on the measures included in the approval of the original facility. An assessment using MUSIC has been completed to assess existing baseline conditions in relation to volumetric discharge, flow duration which has been compared to the outcomes of the original approval and modelling completed for Wyong Shire Council by *Ecological Engineering* in 2004.

Refer to **Section 5** of the document for further discussion pertaining to water quantity management.

- *Stormwater Quality Management (Refer Section 6)*

There is a need to target pollutants that are present in stormwater runoff to minimise the adverse impact these pollutants could have on downstream receiving waters.

The required pollutant reductions are included in **Table 4.1** of this document and MUSIC modelling has been completed to confirm the reduction objectives can be met for the estate.

A series of Stormwater quality improvement devises (SQID's) have been incorporated in the redevelopment design. The proposed management strategy which includes maintaining and augmenting existing measures will include the following measures:

- Primary treatment of new external areas will be made via pit inserts.
- Tertiary treatment of the development will be made via the two existing wetland systems, and new bio-retention and proprietary filtration systems. The treatment systems are proposed to be syphon actuated filtration systems housed in underground tanks. Refer to drawings **Co8318.01-SSDA40, SSDA41 & SSDA42**.
- Some treatment will also be present by provision of rainwater reuse tanks on development sites through reuse and settlement within the tanks.

Reference to **Section 6** of this document should be made for detailed Stormwater Quality modelling and measures.

- *Flood Management (refer Section 7)*

The proposed development considered flooding and large rainfall events in relation to the adjacent wetland area. It is noted that the site is clear of 1% and PMF flood extents, as such no specific flood modelling or further impact assessments are necessary for the redevelopment of the site.

Confirmation of flood requirements has been made via a desktop assessment included in **Section 7** of this report.

The following measures have been incorporated in the design:

- All buildings are sited 500mm above the 1% AEP design flood level of local flow paths.
 - Overland flow paths to manage runoff in large storm events have been made including achieving at least 500mm freeboard to building levels from the flow paths, noting that a greater level of flood immunity is provided to the building than that required by planning to ensure an appropriate level of risk to the building for the intended use.
 - *Water Demand Reduction/ Rainwater Reuse (refer Section 6.6)*
- Rainwater reuse measures will be provided as part of future building development designs. Rainwater reuse will be required to reduce demand on non-potable uses by 80%. The reduction in demand will target non-potable uses such as toilet flushing and irrigation. **Refer Section 6.6.**
- *Stormwater Management During Construction (refer Section 9)*
- A construction stormwater management plan and associated erosion and sediment control measures is proposed based on *Landcom Blue Book* and Council requirements. The management measures take a staged approach from initial site establishment, construction stages and the period between the completion of the estate infrastructure works and development of individual lots.

4.2 Existing Site Drainage

The site is currently developed industrial zoned land, which has been described in **Section 2.2**.

The existing RDC currently includes a detailed site drainage and drainage management system which includes inground drainage, open drainage channels and two stormwater management basins. With reference to **Figure 4.1**, *Stormwater Management System 1*, located on the south-east of the property, comprises a wetland with an area of 8,600m² and extended detention volume of 5,760m³. *Stormwater Management System 2*, located on the south-west of the property, comprises a wetland with an area of 1,900m² and extended detention volume of 950m³. Stormwater runoff is conveyed through the site from north to south to each of the existing management basins, and noted Discharge Locations 1 and 2. Offsite discharge is noted to Porters Creek and a mapped wetland

(including the Wallum Froglet habitat) which is located to the south-west of the development site.

Conveyance of flow from upstream catchments from the Warnervale Business Park is also allowed for through the property. The conveyance system comprises an open vegetated channel and associated easement.

Assessments of the pre-development (ie prior to the current development), existing conditions and post-development conditions are included in **Sections 5 & 6** of this document, pertaining to stormwater discharge conditions for water quantity and quality.

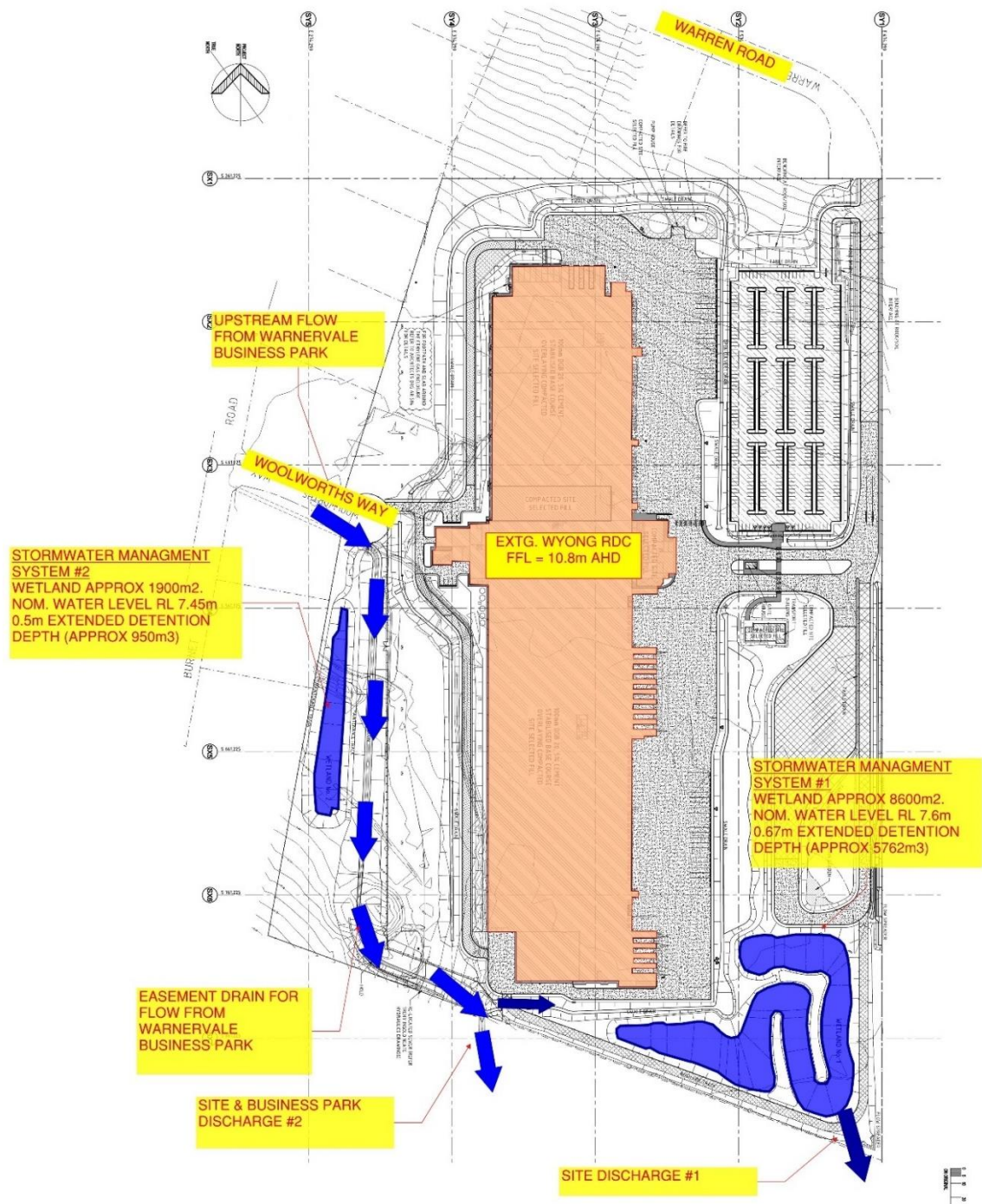


Figure 4.1. Existing Site Drainage Overview Layout

4.3 Proposed Surface Water Drainage System

The inground drainage system is to consist of a piped drainage system which has been designed to accommodate the 1 in 20-year ARI storm event (Q20). This results in the piped system being able to convey all stormwater runoff up to and including the Q20 event.

A major (Q100 overland) and minor (Q20 inground) drainage system, typically adopted as general engineering practice and the minimum requirements of Council, to safely and efficiently convey collected stormwater run-off from the development to the legal point of discharge is also included in the design, consistent with the constructed system and proposed measures for the redeveloped site. The major system will employ the use of defined overland flow paths, such as roads and open channels, to safely convey excess run-off from the site.

The design of the stormwater system for this site will be based on relevant national design guidelines, Australian Standard Codes of Practice, the standards of CCC and accepted engineering practice. Runoff from buildings will generally be designed in accordance with *AS 3500.3 National Plumbing and Drainage Code Part 3 – Stormwater Drainage*. Overall site runoff and stormwater management will generally be designed in accordance with the Institution of Engineers, Australia publication “*Australian Rainfall and Runoff*” (2019 Edition), Volumes 1 and 2 (AR&R).

Water quality and re-use are to be considered in the design to ensure that any increase in the detrimental effects of pollution are mitigated, Council Water Quality Objectives are met and that the demand on potable water resources is reduced.

The proposed drainage system will be required to convey the overland flow from upstream catchments, from the Warnervale Business Park west of the property, through the site. There are no proposed changes nor impacts associated with the existing upstream catchment conveyance system.

The legal point of discharge is a point specified by Council where stormwater from a property can be discharged. The legal point of discharge is usually Council's stormwater infrastructure (where available), the street kerb and channel for smaller developments or downstream receiving waters like an existing stream or gully, lake, pond or waterbody. Legal discharge for this site is via the existing discharge points on the south of the property.

With reference to the drawings in **Appendix A**, the drainage system proposed can be described as follows:

- In-ground piped drainage system designed to the 5% AEP (1 in 20yr ARI);
- Site discharge via the two existing discharge locations (refer **Figure 4.1**).
- The existing bypass channel, “easement drain for flow from Warnervale Business Park”, is to be maintained with no proposed changes;
- Treatment of stormwater via one of two existing wetlands (noting minor reconfiguration of *Stormwater Management System 1*);
- Augmentation of existing measures including *Stormwater Management System 1 & 2*; and
- Additional proprietary filtration systems, raingardens and swales to compensate for the increased impervious surfaces and modifications to existing systems.

4.4 Hydrologic Modelling and Analysis

4.4.1 Rainfall Data

Rainfall intensity Frequency Duration (IFD) data used as a basis for DRAINS modelling for the 2 to 100 Year ARI events, was taken from The Bureau of Meteorology Online IFD Tool.

4.4.2 Runoff Models

In accordance with the recommendations and standards of Council, the calculation of the runoff from storms of the design ARI has been calculated with the catchment modelling software DRAINS for internal drainage only.

Detailed hydraulic assessment of the internal drainage system will be calculated at detail/construction certificate stage.

The design parameters for the DRAINS model are to be based on the recommendations as defined by council and parameters for the area and are as follows:

Table 4.1. DRAINS Parameters

Model	Model for Design and analysis run	Rational method	
	Rational Method Procedure	ARR2019	
	Soil Type-Normal	3.0	
	Paved (Impervious) Area Depression Storage	1	mm
	Supplementary Area Depression Storage	1	mm
	Grassed (Pervious) Area Depression Storage	5	mm
AMC	Antecedent Moisture Condition (ARI=1-5 years)	2.5	
AMC	Antecedent Moisture Condition (ARI=10-20 years)	3.0	
AMC	Antecedent Moisture Condition (ARI=50-100 years)	3.5	
	Sag Pit Blocking Factor (Minor Systems)	0	
	On Grade Pit Blocking Factor (Minor Systems)	0	
	Sag Pit Blocking Factor (Major Systems)	0.5	
	On Grade Pit Blocking Factor (Major Systems)	0.2	

4.5 Hydraulics

4.5.1 General Requirements

Hydraulic calculations will be carried out utilising DRAINS modelling software during the detail design stage to ensure that all surface and subsurface drainage systems perform to or exceed the required standard.

4.5.2 Freeboard

The calculated water surface level in open junctions of the piped stormwater system will not exceed a freeboard level of 150mm below the finished ground/ grate level, for the peak runoff from the Minor System runoff.

The calculated water surface for the peak runoff from the Major System runoff will not exceed a freeboard level of 500mm below the finished floor level of the building.

4.5.3 Public Safety

For all areas subject to pedestrian traffic, the product (dV) of the depth of flow d (in metres) and the velocity of flow V (in metres per second) will be limited to 0.4, for all storms up to the 100-year ARI.

For other areas, the dV product will be limited to 0.6 for stability of vehicular traffic (whether parked or in motion) for all storms up to the 100-year ARI.

4.5.4 Inlet Pit Spacing

The spacing of inlets throughout the site will be such that the depth of flow, for the Major System design storm runoff, will not exceed the top of the kerb (150mm above gutter invert).

4.5.5 Overland Flow (development lots)

Dedicated flow paths have been designed to convey all storms up to and including the 100-year ARI. These flow paths will convey stormwater from the site to the detention systems prior to discharge.

5 WATER QUANTITY MANAGEMENT

5.1 Introduction

Central Coast Council's Developers Guideline require management of stormwater quantity for developments, with the intent of minimising flooding from the increased stormwater run-off due to the development. Central Coast Council requires water quantity to be managed to limit the runoff discharged from private property to pre-developed flow for the 5%, 20% and 100% AEP storm events. We have also assessed the 1% AEP and confirmed ability to attenuate the major storm runoff event. Water quantity management is sometimes referred to as stormwater detention, or on-site detention (OSD).

The existing site has two stormwater management systems, as described in **Section 2** and **4.2** of this report. The existing management measures are based on the stormwater management system concept proposed and assessed by Ecologic Engineering as part of the original 2004 approval (DA0187/2003B dated 2 July 2004) – refer to **Appendix F** for their report “*Woolworths RDC Water Cycle Management Strategy – Criteria for Integrated Water Cycle Management*”. This system was then detail designed by BECA and subsequently constructed.

A assessment of the of the performance of the stormwater management system has been completed based on the Ecological Engineering report, the BECA detail design drawings, survey and site inspections. This has been completed for both water quantity and quality. In relation to water quantity, review of pre and post development flow rates has been reviewed, in addition to flow duration and volumetric discharge (as required o the noted 2004 consent). Our review considers runoff from the existing development and the proposed redevelopment subject to this application and is summarised in **Section 5.3**.

5.2 Existing & Post Development Peak Flows

Intensity/Frequency/Duration (IFD) data was adopted from councils Development Guidelines used in conjunction with rational method calculations to estimate peak flows for the site and surrounding catchments.

The two existing systems are considered (System P1 and System 2) to confirm the existing and baseline conditions, then assessment of augmentation and redevelopment conditions have been assessed.

The attenuation volume requirements have been assessed based on attenuating the post development flow to pre-development flow for storms ranging from 100% AEP to the 5% AEP per central coast councils engineering policy.

ARI / AEP	Peak Flow (m ³ /s)							
	Existing Development Flows				Proposed Development Flows			
	Basin 1	Basin 2	Bypass	Total	Basin 1	Basin 2	Bypass	Total
Q1 / 100%	0.162	0.143	0.112	0.417	0.163	0.159	0.056	0.378
Q5 / 20%	0.208	0.194	0.290	0.692	0.205	0.201	0.147	0.553
Q20 / 5%	0.542	0.235	0.446	1.223	0.511	0.296	0.224	1.031
Q100 / 1%	0.880	0.896	0.623	2.399	0.880	0.994	0.314	2.188

Table 5.1. System 1 & 2 Existing Development & Proposed Development Flows

Post development site discharge volumes, as well as the provided detention volumes and depths for System 1 are provided in **Table 5.3** & System 2 are provided in **Table 5.4** below.

ARI	Duration (mins)	Peak Flow (m³/s)				Depth (mm)	Storage (m³)
		No Attenuation	With Attenuation				
			Low Flow	High Flow	Total		
Q1	12hr	2.733	0.163	0	0.163	720	4019
Q5	12hr	4.980	0.205	0	0.205	1160	8359
Q20	12hr	7.305	0.239	0.272	0.511	1560	12572
Q100	12hr	10.013	0.258	0.622	0.880	1820	15428

Table 5.3. Detention System Flow and Volume Requirements – System 1

ARI	Duration (mins)	Peak Flow (m³/s)					Depth (mm)	Storage (m³)
		No Attenuation	With Attenuation					
			Low Flow	High Flow	Bypass	Total		
Q1	2hr	1.734	0.158	0	0.056	0.214	690	1266
Q5	6hr	3.123	0.201	0	0.146	0.347	1110	2783
Q20	12hr	4.576	0.241	0.055	0.225	0.521	1590	4833
Q100	12hr	6.471	0.253	0.741	0.314	1.308	1750	5627

Table 5.4. Detention System Flow and Volume Requirements – System 2

As shown in **Table 5.3** and **Table 5.4** above, an active detention storage of 15,428m³ and 5,627m³ is required in Systems 1 and 2, respectively, to attenuate the post development flows to pre-development flows for the 23.1 Ha site catchment.

5.3 Flow Duration and Volumetric Flow Considerations

5.3.1 Volumetric Flow Introduction

An assessment of volumetric discharge has been completed to ensure that there are no unacceptable impacts on the Porters Creek Wetland or Wallum Froglet as required of the SEAR's.

This assessment considers the existing facility development conditions and the proposed development conditions. The assessment has been completed using MUSIC, and considers the volumetric flow requirements set out in the original approval document by Ecologic Engineering in their report "*Woolworths RDC Water Cycle Management Strategy – Criteria for Integrated Water Cycle Management*" – refer to **Appendix F**.

5.3.2 Summary of Ecological Engineering Modelling and Outcomes

Wyong Council commissioned Ecological Engineering during the approval assessment phase for the construction of the existing RDC to ensure sustainable management of stormwater within the RDC, and also the adjacent Warnervale Business Park.

Ecological Engineering completed MUSIC modelling for the RDC and surrounding business park, using an 80yr data set of recorded rainfall.

The objectives of the water cycle management plan are as follows:

- Maintain existing flow paths along the lower eastern boundary as identified by Stephen Bell's "Vegetation and Terrestrial Orchid Survey of the Warnervale Industrial Lands" May 2003;
- Limit total annual flow volumes entering the sensitive habitat to pre-development conditions (as much as possible);
- Limit the frequency of individual flows (as shown in a flow duration curve) to that of pre-development conditions (including cease to flow conditions, low flows and high flows);
- Provide attenuation of flow to account for reduced time of concentration under 'developed' conditions;
- Maintain cease-to-flow conditions including median cease to flow period and number of cease to flow days to pre-development;
- Reduce stormwater pollutants to acceptable levels as indicated in Councils Stormwater Management Plan; and
- Maintain pre-development pH of stormwater runoff in the range of 4.5 to 7.0.

The Ecological Engineering MUSIC model encompassed the RDC site and surrounding catchments, which total an approximate area of 83Ha. **Figure 5.1** shows the approximate catchment assessed by Ecological Engineering noting the RDC site, being 23Ha in area, is 27.7% of the total catchment draining to the wetland.



Figure 5.1. Approximate Catchment Assessed by Ecological Engineering

Ecological Engineering reviewed key metrics for the pre and post hydrology including volumetric discharge, dry spells and percentiles of daily flow volume for the 83Ha catchment. The results of the volumetric discharge is included in **Figure 5.2**. Their assessment shows that, with WSUD measures, the Mean Annual Volume from the catchment is 327 ML, or 3.94 ML/Ha/yr.

Review of the full report in **Appendix F** can be made for detailed assessments of the other metrics noted above as required.

(ii) Descriptive Statistics

Mean annual results (based on daily volumes for 80years of data)

	Mean Annual Volume (ML)		
	Eastern Waterway	Southern Waterway	Total Flow
Pre Development Flow	9.0	98	107
Existing Flow	16.0	212	228
Post Development (NO WSUD)	–	–	424
Post Development with WSUD	9.3	318	327

Figure 5.2. Mean Annual Runoff Volumes**5.3.3 MARV Assessment**

MUSIC modelling for the 23Ha development site has been completed and a comparison of the Mean Annual Runoff Volume (MARV) – refer **Table 5.5** – has been made with the outcomes completed by Ecological Engineering. A pre-development model was prepared by Costin Roe Consulting, based on the information in the Ecological Engineering Report. The model outcomes were verified with those of the Ecological Engineering report, prior to then assessing post development conditions and confirmation of acceptable outcomes.

As noted in **Section 5.3.2**, a MARV of 3.94 ML/Ha/yr for the 83Ha catchment and existing RDC facility was determined by Ecological Engineering. The truncated model completed by our office shows a MARV of 3.83 ML/Ha/yr. The minor difference between the Costin Roe Consulting Model compared to Ecological Engineering can be attributed to the following reasons:

- 80yr rainfall data set used by Ecologic Engineering compared to 10yr rainfall data set in Costin Roe Consulting model.
- 83Ha catchment used by Ecologic Engineering compared to 23Ha catchment in Costin Roe Consulting model.
- 2004 version of MUSIC used by Ecologic Engineering compared to 2022 MUSICX used by Costin Roe Consulting.

Overall the minor difference in the modelled MARV is considered immaterial and as such the truncated Costin Roe Consulting model suitable to use as a baseline to assess the post development conditions for the additional development of the RDC.

Table 5.5 shows the post development conditions for the increase development footprint, and augmentation of the existing wetland and detention systems proposed to mitigate any impacts due to the additional impervious site areas.

The developed MARV, at 3.83 ML/Ha/year, is less than the existing conditions. As such considered to be consistent with the approved and constructed system. Further, as there are no changes to the discharge controls proposed for either Wetland 1 or Wetland 2, and the proposed augmentation of these systems, metrics such as stream duration, cease to flow, number of dry days, will all remain generally consistent with those modelled by Ecological Engineering.

Table 5.5. Existing and Proposed MARV

	Mean Annual Runoff Volume (MARV)
Existing Development Conditions	3.83 ML/ha/year
Proposed Development Conditions	3.83 ML/ha/year

5.3.4 MARV Conclusion

Table 5.5 provides result of the assessment and confirmation of target requirements and those achieved. Comparing the existing development conditions and the proposed development conditions confirms there is neutral or beneficial effect on the existing system associated with the proposed additional development of the property.

As noted, the developed MARV, at 3.83 ML/Ha/year, is less than the existing conditions. As such considered to be consistent with the approved and constructed system. Further, as there are no changes to the discharge controls proposed for either Wetland 1 or Wetland 2, and the proposed augmentation of these systems, metrics such as stream duration, cease to flow, number of dry days, will all remain generally consistent with those modelled by Ecological Engineering and acceptable outcomes in relation to stormwater impacts have been demonstrated.

6 STORMWATER QUALITY, REUSE AND MAINTENANCE

6.1 Stormwater Quality Objectives

There is a need to provide a design which incorporates the principles of Water Sensitive Urban Design (WSUD) and to target pollutants that are present in the stormwater so as to minimise the adverse impact these pollutants could have on receiving waters and to also meet the requirements specified by Council.

Central Coast Council has nominated, in *Table 11.1* of their *Civil Works Specification – Design Guideline* and *Section 2.8* of their *Warnervale Business Park DCP*, the requirements for stormwater quality to be performed on a catchment wide basis. These are presented in terms of annual percentage pollutant reductions on a developed catchment and are included in **Table 4.1**.

6.2 Proposed Stormwater Treatment System

Developed impervious areas including roof, hardstand, car parking, roads and other extensive impervious areas are required to be treated by the Stormwater Treatment Measures (STM's). The STM's shall be sized according to the whole catchment area of the development. The STM's for the development shall be based on a treatment train approach to ensure that all the objectives above are met.

Components of the treatment train for the development are as follows:

- Primary treatment to the proposed additional hardstand / carpark is to be performed via the provision of pit inserts to all proposed grated pits;
- Tertiary treatment is to be performed via the two wetlands prior to discharge from the site;
- A portion of the roof will also be treated via rainwater reuse and settlement within the rainwater tank.

6.3 Stormwater Quality Modelling

The MUSIC model was chosen to model water quality. By simulating the performance of stormwater management systems, MUSIC can be used to predict if the proposed systems and changes to land use are appropriate for their catchments and capable of meeting specified water quality objectives (CRC 2002). The water quality constituents modelled in MUSIC, of relevance to this report, include Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

The pollutant retention criteria set as required by Council and nominated in **Section 4.1** of this report were used as a basis for assessing the effectiveness of the selected treatment trains.

The parameters used in the MUSIC model are presented in **Appendix B. Figure 6.1 & Figure 6.2** below shows the MUSIC model layout.

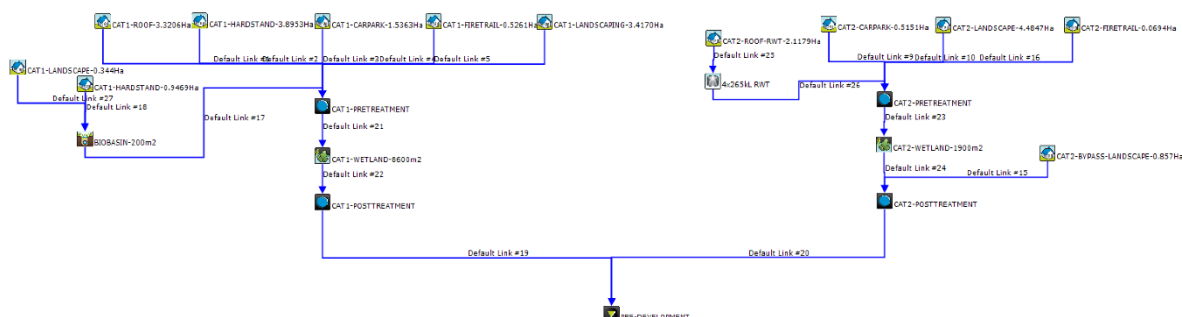


Figure 6.1. MUSIC model layout (Existing Development)

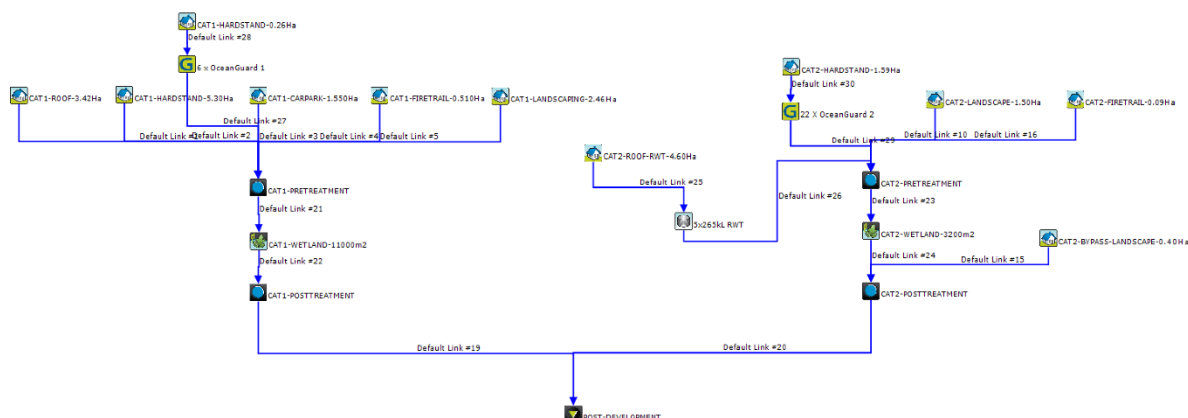


Figure 6.2. MUSIC model layout (Proposed Development)

Tables 6.1 shows the results of the MUSIC analysis. The reduction rate is expressed as a percentage and compares the post-development pollutant loads without treatment versus post-development loads with treatment.

Table 6.1. MUSIC analysis results - % Reduction Redeveloped System

	Source	Residual Load	% Reduction
Total Suspended Solids (kg/yr)	4.094 E+04	1.281 E+04	68.72
Total Phosphorus (kg/yr)	73.85	27.75	62.42
Total Nitrogen (kg/yr)	476.9	203.5	57.33
Gross Pollutants (kg/yr)	4896	0	100

MUSIC modelling has been performed to assess the effectiveness of the selected treatment trains and to ensure that the pollutant retention requirements of Council's engineering guidelines have been met.

The MUSIC modelling has shown that the proposed treatment train of STM will provide stormwater treatment which will meet Council's and typical growth centre water quality reduction objective requirements in an effective and economical manner.

Given the expected low source loadings of hydrocarbons and oil/grease and removal efficiencies of the treatment devices we consider that the requirements of the Council have been met. Further discussion on hydrocarbons can be found in **Appendix B**.

6.4 Stormwater Harvesting

Stormwater harvesting refers to the collection of stormwater from the developments internal stormwater drainage system for re-use in non-potable applications. Stormwater from the stormwater drainage system can be classified as either rainwater where the flow is from roof areas, or stormwater where the flow is from all areas of the development.

For the purposes of this development, we refer to a rainwater harvesting system, where benefits of collected stormwater from roof areas over a stormwater harvesting system can be made as rainwater is generally less polluted than stormwater drainage.

Rainwater harvesting is proposed for this development with re-use for non-potable applications. Internal uses include such applications as toilet flushing and cooling while external applications will be used for irrigation.

In general terms the rainwater harvesting system will be an in-line tank for the collection and storage of rainwater. At times when the rainwater storage tank is full rainwater can pass through the tank and continue to be discharged via gravity into the stormwater drainage system. Rainwater from the storage tank will be pumped for distribution throughout the development in a dedicated non-potable water reticulation system. This however would be subject to future detail design.

Rainwater tanks have been designed, using MUSIC software to balance the supply and demand, based on the below base water demands. Rainwater tank reuse demands were calculated based on typical water demands of toilets and irrigation of landscaped areas. Water demands for toilets was calculated using 0.1kL/day/ toilet. Water demands for irrigation of landscaped areas was calculated using 0.3kL/year/m².

The above rates result in the following internal non-potable demand:

25 Toilets	2.5 kL/day
------------	------------

The above regime for the landscaped area for the site gives the following yearly outdoor water demand:

Irrigated Area (0.4kL/year/m ²)	30,500 kL/year
Cooling	27,300 kL/year
TOTAL	57,800 kL/year

6.4.1 Rainwater Tank Sizing

The use of rainwater reduces the mains water demand and the amount of stormwater runoff. By collecting the rainwater run-off from roof areas, rainwater tanks provide a valuable water source suitable for flushing toilets and landscape irrigation.

Rainwater tanks have been designed, using M12USIC software to balance the supply and demand, based on the calculated base water demands and proposed roof catchment areas.

Table 6.4. Rainwater Reuse Requirements

Roof Catchment (m ²)	Highflow Bypass (L/s)	Tank Size in MUSIC (kL)	Predicted Demand Reduction (%)	Provided Tank (kL)
32700	100	5 * 265kL	39	4 * 265kL

The MUSIC model, results summarised in **Table 6.4**, predicts that the reuse demands of 39% for the development.

We note that the final configuration and sizing of the rainwater tanks is subject to detail design considerations and optimum site utilisation and the existing cooling system.

6.5 Maintenance and Monitoring

It is important that each component of the stormwater system and water quality treatment train is properly operated and maintained. In order to achieve the design treatment objectives, an indicative maintenance schedule has been prepared and included as **Appendix D** to assist in the effective operation and maintenance of the various water quality components.

Inspection frequency may vary depending on site specific attributes and rainfall patterns in the area. In addition to the nominated frequency it is recommended that inspections are made following large storm events.

7 FLOODING AND OVERLAND FLOW

7.1 Introduction

An assessment pertaining to flooding and overland flow has been completed for the development.

The site is noted to be located adjacent to a mapped wetland, and has an inter-allotment drainage channel which conveys runoff from the Warnervale Business Park located on the west of the development site which is present south of Woolworths Way to the wetland (refer **Figure 4.1** “*Easement Drain for Runoff from Warnervale Business Park*”).

We provide the following assessments pertaining to overland flow and flooding associated with the mapped wetland and trunk drainage system.

Our assessment relating to flooding and overland flow is based on the following information sources:

- Central Coast Council Flood Mapping.
- Works As Constructed Engineering Drawings.

7.2 Existing Overland Flow and Flood Behaviour

Regional Flooding

The 1% AEP flood extent, as sourced from Central Coast Councils online mapping tool, is depicted on **Figure 7.1** below. Councils defined flood precincts are shown in **Figure 7.2**.

Figure 7.1 shows the site is free from 1% AEP regional flooding by at least 290m. Councils flood maps do not include flood levels, however based on the mapped extent and contours, the 1% AEP flood level is estimated at RL 6.0m to RL 6.5m AHD.

Figure 7.2 shows the site is generally free from the PMF flood extent, though has some minor intrusion which follows the path of the trunk drainage system which runs between Woolworths Way and the wetland on the west of the site. The PMF water level is estimated to be between RL 7.5m AHD and 8.0m AHD.



Figure 7.1. 1% AEP Flood Extent vis Central Coast Council and direction of flow

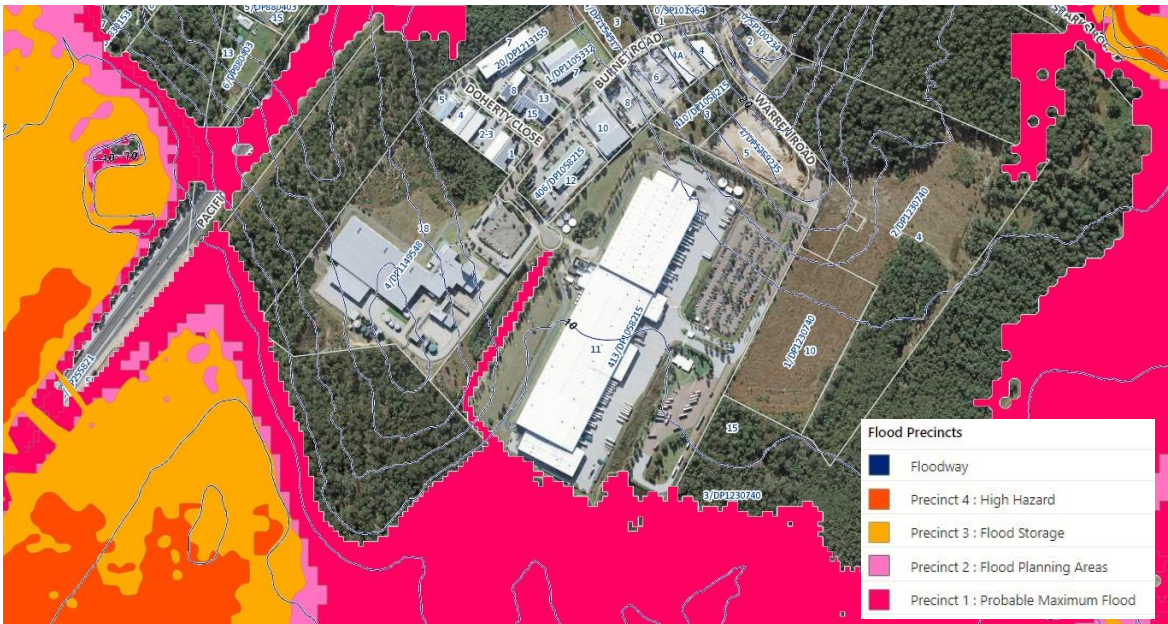


Figure 7.2. Flood Precincts vis Central Coast Council

Local Flooding/ Overland Flow

As noted, an inter-allotment drainage channel which conveys runoff from the Warnervale Business Park through the development site is present on the west of the site. The drain begins at the bottom of Woolworths Way and extends to the wetland (refer **Figure 4.1** “Easement Drain for Runoff from Warnervale Business Park”).

“For Construction” engineering design information for the inter-allotment drainage channel, per Beca Pty Ltd 2004, has been reviewed and included in **Figure 7.3** to **7.5**, and a full set of the Beca engineering drawings (at higher resolution) can be found in **Appendix D**. The site survey shows the construction to be generally consistent with the design information.

As shown in **Figure 7.5**, the 1% AEP design flow is $11.8\text{m}^3/\text{s}$ and the design water level in the channel varies between RL 8.71m AHD near Woolworths Way, to RL 8.33m AHD near the site discharge. The 1% AEP water level is noted to be greater than 0.6m below the nominal pavement level of RL 9.3m AHD and 1.8m below the facility floor level (Building Floor Level is RL 10.5m AHD).

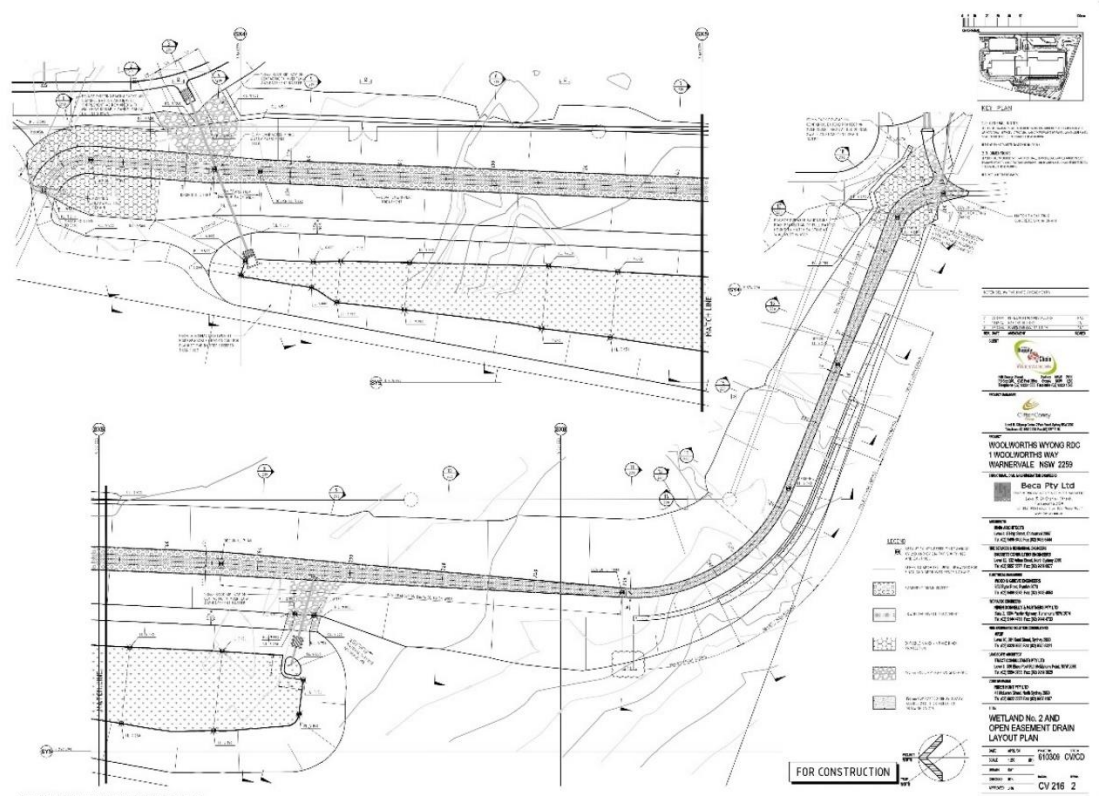


Figure 7.3. Inter-allotment Drainage Channel Plan

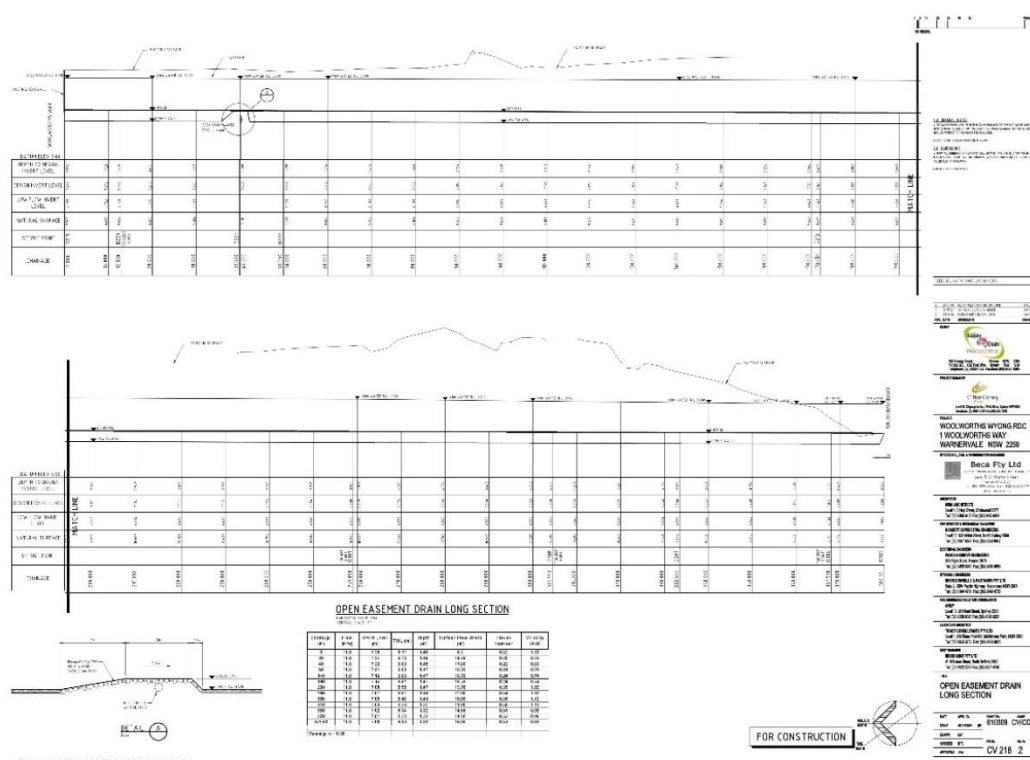


Figure 7.4. Inter-allotment Drainage Channel Long Section

Chainage (m)	Flow (m³/s)	Invert Level (m)	TWL (m)	Depth (m)	Surface Flow Width (m)	Froude Number	Velocity (m/s)
0	11.8	7.25	8.71	1.46	8.7	0.32	1.12
20	11.8	7.24	8.70	1.46	14.76	0.25	0.78
40	11.8	7.23	8.68	1.45	17.60	0.22	0.69
60	11.8	7.21	8.68	1.47	16.76	0.24	0.74
140	11.8	7.16	8.63	1.47	16.76	0.24	0.74
180	11.8	7.14	8.61	1.47	16.76	0.24	0.74
260	11.8	7.08	8.56	1.47	13.76	0.35	1.02
280	11.8	7.07	8.51	1.44	12.00	0.34	1.03
300	11.8	7.05	8.46	1.41	10.00	0.35	1.12
340	11.8	7.03	8.38	1.35	11.80	0.39	1.14
360	11.8	7.02	8.34	1.32	14.56	0.33	0.96
370	11.8	7.01	8.33	1.32	14.56	0.33	0.96
379.63	11.8	7.00	8.33	1.33	16.05	0.31	0.89

Mannings n = 0.03

Figure 7.5. Channel Hydraulic Design Information (1% AEP)

7.3 Council Floodplain Management Requirements & NSW Floodplain Management Manual Requirements

Councils *Development Control Plan Part 3: Floodplain Management (2013)* and the *NSW Floodplain Management Manual 2005* provides relevant policy requirements relating to development in and around identified flood affected development sites.

The intent of the document is to ensure that new developments do not experience undue flood risk and that existing development is not adversely flood affected through increased damage or hazard as a result of new development.

Flood Planning Levels

The flood planning level (FPL) for business/ industrial to be at or above the 1% AEP (1 in 100-year ARI) flood level plus 0.5m freeboard.

The FPL for this site is based on the overland flow level within the inter-allotment drainage channel. Allowing for 0.5m freeboard to the 1% AEP level of RL 8.71m, the FPL is confirmed at RL 9.21m AHD.

There is no flood planning requirement associated with regional flooding.

We note the existing and proposed building level is RL 10.5m AHD. The building is as such confirmed to meet FPL requirements.

Safety

The PMF or extreme event provides an upper limit of flooding and associated consequences for the problem being investigated. It is used for emergency response planning purposes to address the safety of people.

Given the site is generally flood free in the PMF event, there are no specific requirements associated with the PMF event.

Flood Impact

In relation to flood impact on the development or impact from the development on regional flooding, it is noted that the modelled 1% AEP flood extent does not encroach the subject property, hence no adverse impact to existing flood conditions or surrounding developments are associated with the proposed development.

In regard to the inter-allotment drainage channel, there are no proposed modifications to the channel or impact on the channel in relation to the new development works. As such there are no adverse impacts associated with the development in relation to the inter-allotment drainage channel.

Overall flood risk for the development, and from the development is considered low to negligible, and the development meets current council flood policy.

7.4 Flood Assessment Conclusion

A review of available flood and overland flow information has been made to determine flood behaviour in relation to the proposal.

Review of the available information, including Council's flood information and construction drawings has been made. This information confirms the site is not subject to mainstream regional flooding, however, needs to consider the inter-allotment drainage channel/ overland flow path from the Warnervale Business Park.

The existing inter-allotment drainage channel will remain as currently constructed without modification or impact. Review of the design flow levels confirms the existing building and proposed building expansion meet councils flood planning requirements and safety considerations.

8 WATER CYCLE MANAGEMENT

8.1 Water Balance Objectives

A daily water balance analysis was undertaken to determine the feasibility of the proposed rain and stormwater harvesting scheme and in particular the effects of various storage sizes for stormwater harvesting along with changes to demand.

The water balance utilised flows generated using a simple runoff calculation using historical rainfall data, analysed for various rainfall patterns including dry, mean and wet rainfall years. The purpose for modelling dry, mean and wet years was to assess the performance of various tank sizes given the changes to rainfall patterns.

8.2 Water Use Management Features

8.2.1 Existing

Existing water use features comprise Central Coast Water Mains supply.

There are also existing rainwater harvesting systems, water reuse associated with cooling systems and landscape irrigation.

The main item to note is the four existing 265kL tanks, equalling a total estimated storage capacity of 1060kL. These tanks are utilised for an existing cooling system. The water usage rate varies based on the season and external air temperature.

The usage rate measured between 17/01/22 to 13/02/22 equals 2,141.03kL (4 week period), this rate has been pro-rated to a reuse rate of 14700kL/year.

8.2.2 Proposed

Proposed management measures for water use are as follows:

- Existing Central Coast Water mains supply is proposed to be maintained throughout the duration of the Proposal;
- Stormwater harvesting through rainwater reuse to reduce demand on non-potable water uses;
- Sprinkler water storage via Central Coast Water mains (noting >80% of sprinkler test water to be recycled as part of the operational requirements).
- Rainwater storage via 5 * 265kL tanks for the cooling system.

A concept diagram for the proposed re-use scheme on site is shown in **Figure 5.1** below.

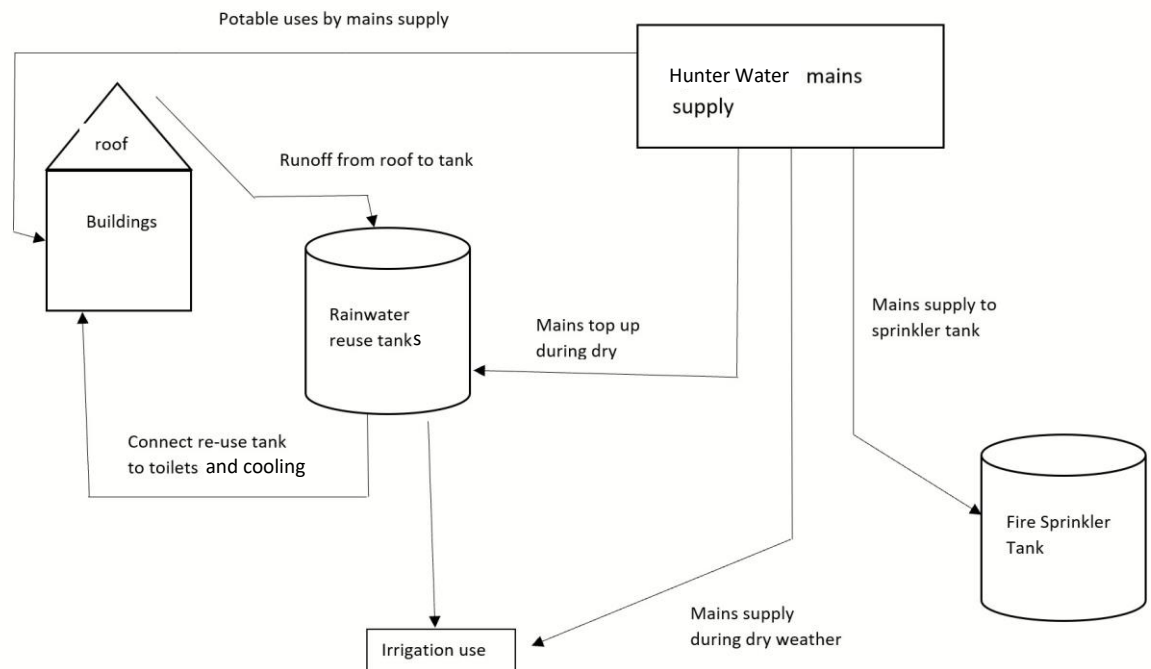


Figure 5.1. Water Cycle Management Schematic

A short description of the expected stormwater harvesting for the development is described below.

Stormwater Harvesting

Stormwater harvesting refers to the collection of stormwater from the developments internal stormwater drainage system for re-use in non-potable applications. Stormwater from the stormwater drainage system can be classified as either rainwater, where the flow is from roof areas only, or stormwater where the flow is from all areas of the development.

Rainwater harvesting is proposed for this development, and rainwater tank sizing will be designed during detail design stage by the hydraulic consultant via a water balance assessment. Rainwater tanks are to be sized with reference to the NSW Department of Environment and Conservation document *Managing Urban Stormwater: Harvesting and Reuse*, using a simple water balance analysis to balance the supply and demand, based on the base water demands and the requirements of Council.

The water balance assessment will be based on local rainfall data and specific utilisation rates for the facility for re-use of non-potable applications. The expected reuse applications include internal uses such as toilet flushing, and external applications including irrigation. The aim is to reduce the water demand for the development and to satisfy the requirements of Council to provide an 80% reduction in water demand.

In general terms the rainwater harvesting system will be comprised the following elements:

- In-line tank for the collection and storage of rainwater.

- Overflow to the in-ground stormwater drainage system sized to cater for the catchment being drained to the tank. This will operate at times when the rainwater storage tank is full so that rainwater can pass through the tank and continue to be discharged via gravity into the stormwater drainage system.
- Rainwater from the storage tank will be pumped for distribution throughout the development in a dedicated non-potable water reticulation system to toilets, the cooling system and external irrigation areas.
- Mains top up to Central Hunter Water system for prolonged periods of dry weather.
- First flush diverter and filters to ensure adequate quality of reuse water.
- Tank will be an underground concrete structure to minimise visual impact.

Refer drawings in **Appendix A**.

8.3 Water Balance Assessment

8.3.1 Internal Base Water Demand

Indoor water demand has been based an allowance of 0.1kL/day/ toilet or urinal. No allowance is required for disabled toilets.

The above rates result in the following internal non-potable demand:

Internal Demand	10 Toilets	1.0kL/day
-----------------	------------	-----------

The final number of toilets & subsequent re-use for the development shall be confirmed during detailed design.

8.3.2 External Base Water Demand

The external base water demand has been based on an allowance of 0.4kL/year/m² as PET-Rain for irrigation.

The above regime for the landscaped area for the site gives the following yearly outdoor water demand:

External Demand (0.4kL/year/m ²)	30,500 kL/year
Cooling	27,300 kL/year

8.3.3 Rainwater Tank Sizing

The use of rainwater reduces the mains water demand and the amount of stormwater runoff. By collecting the rainwater run-off from roof areas, rainwater tanks provide a valuable water source suitable for flushing toilets and landscape irrigation.

Rainwater tanks have been designed, using a simple water balance calculation to balance the supply and demand, based on the calculated base water demands and proposed roof catchment areas. Allowances in the calculation have been made for efficiency of collection, absorption/ evaporation losses.

Table 5.2. Rainwater Reuse Requirements

Tanks	Roof Catchment to Rainwater Tank (m ²)	Tank Size (kL)	Tank Size in MUSIC (kL)	Predicted Non-Potable Demand Reduction (%)
5	32,700	5*265kL	5*265kL	40

The water balance assessment predicts 40% reduction in non-potable will be met for the development with the provision of a total of 1325 kL of rainwater tank storage.

We note that the final configuration and sizing of the rainwater tanks is subject to detail design considerations and optimum site utilisation.

8.4 Construction Impact Assessment

Construction works will require minimal water demand to service site sheds, dust suppression and other construction related operations.

Water supply for these activities during the construction period will be made via existing Central Coast Water supply.

It is considered that impact associated with water use during construction is limited and an existing supply is available through the whole of the construction works period.

8.5 Operational Impact Assessment

Rainwater harvesting is proposed to reduce demand on non-potable applications.

An existing and reliable water supply is available during operations.

Impact on environment from water use is considered to be acceptable.

9 CONSTRUCTION SOIL AND WATER MANAGEMENT

9.1 Soil and Water Management General

Without any mitigation measures and during typical construction activities, site runoff would be expected to convey a significant sediment load. A *Soil and Water Management Plan* (SWMP) and *Erosion and Sediment Control Plan* (ESCP), or equivalent, would be implemented for the construction of the Proposal. The SWMP and ESCPs would be developed in accordance with the principles and requirements of *Managing Urban Stormwater – Soils & Construction Volume 1 ('Blue Book')* (Landcom, 2004) with a staged approach.

In accordance with the principles included in the Blue Book, a number of controls have been incorporated into a preliminary Staged ESCP (refer to accompanying Drawings in **Appendix A**) and draft SWMP in **Appendix C**. The Staged ESCP considers initial site establishment, requirements during construction of roads and infrastructure and estate earthworks, completion of estate works and the period between this and development of individual lots.

Section 1 provides a summary of the construction works for the Proposal. While all construction activities have the potential to impact on water quality, the key activities are:

- Erosion and sediment control installation.
- Grading of existing earthworks to suit building layout, drainage layout and pavements.
- Stormwater and drainage works.
- Service installation works.
- Building construction works.

The sections below outline the proposed controls for management of erosion and sedimentation during construction of the Proposal. The staged approach is noted to consider initial site establishment, construction of the estate and the period between completed of the estate infrastructure works and development of individual lots in the estate as included in the ESCP drawings **Appendix A**.

9.2 Typical Management Measures

Sediment Basins

Sediment basins have been sized (based on 5 day 85th percentile rainfall) and located to ensure sediment concentrations in site runoff are within acceptable limits. Preliminary basin sizes have been calculated in accordance with the Blue Book and are based on 'Type F' soils. These soils are fine grained and require a relatively long residence time to allow settling.

Sediment basins for 'Type F' soils are typically wet basins which are pumped out following a rainfall event when suspended solids concentrations of less than 50 mg/L have been achieved.

Sediment Fences

Sediment fences are located around the perimeter of the site to ensure no untreated runoff leaves the site. They have also been located around the existing drainage channels to minimise sediment migration into waterways and sediment basins.

Stabilised Site Access

For the proposal, stabilised site access is proposed at one location at the entry to the works area. This will limit the risk of sediment being transported onto public roads.

9.3 Other Management Measures

Other management measures that will be employed are expected to include:

- Minimising the extent of disturbed areas across the site at any one time.
- Progressive stabilisation of disturbed areas or previously completed earthworks to suit the proposal once trimming works are complete.
- Regular monitoring and implementation of remedial works to maintain the efficiency of all controls.

It is noted that the controls included in the preliminary ESCP are expected to be reviewed and updated as the design, staging and construction methodology is further developed for the Proposal.

10 CONCLUSION

This Civil Engineering Report has been prepared to support the State Significant Development Application for the proposed expansion of Woolworths existing Regional Distribution Centre at Warnervale, NSW.

A civil engineering strategy for the site has been developed which provides a best practice solution within the constraints of the existing landform, existing facility, existing stormwater management measures and proposed development layout. Within this strategy a stormwater quantity and quality management strategy has been developed to consider peak flows and reduce pollutant loads in stormwater leaving this site. The stormwater management for the development has been designed in accordance with Central Coast Council requirements and ensuring acceptable impacts relating to the development.

The existing infrastructure, including the two on-site wetlands and detention systems, will be augmented to ensure the increased runoff can be managed for water quantity and quality. As such the increase in local post development flows from the site will be managed prior to discharge to downstream waterways and will not adversely affect any land, drainage system or watercourse as a result of the development.

During the construction phase, a Sediment and Erosion Control Plan will be in place to ensure the downstream drainage system and receiving waters are protected from sediment laden runoff.

During the operational phase of the development, a treatment train incorporating the use of an augmented wetland, raingardens and swales is proposed to mitigate any increase in stormwater pollutant load generated by the development. MUSIC modelling results indicate that the proposed STM are effective in reducing pollutant loads in stormwater discharging from the site and meet the requirements of Council's pollution reduction targets. Best management practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

11 REFERENCES

- Civil Works Specification 1 – Design Guideline (2020), Central Coast Council
- Civil Works Specification 2 – Construction (2020), Central Coast Council
- Civil Works Specification 3 – Standard Drawings (2020), Central Coast Council
- Development Control Plan Part 3: Floodplain Management (2013), Central Coast Council
- Development Control Plan Part 6: Warnervale Business Park (2013), Central Coast Council
- NSW Government (2005). *Floodplain Development Manual*.
- Managing Urban Stormwater: Harvesting and Reuse – 2006 (NSW DEC);
- Managing Urban Stormwater: Source Control – 1998 (NSW EPA);
- Managing Urban Stormwater: Treatment Techniques – 1997 (NSW EPA);
- Landcom (2004). *Managing Urban Stormwater – Soils and Construction* – 4th Edition.

Appendix A

DRAWINGS BY COSTIN ROE CONSULTING

*WOOL WORTHS WYONG SSDA
PROPOSED EXPANSION
11 WARREN ROAD, WARNERVILLE, 2259, NSW*

DRAWING LIST

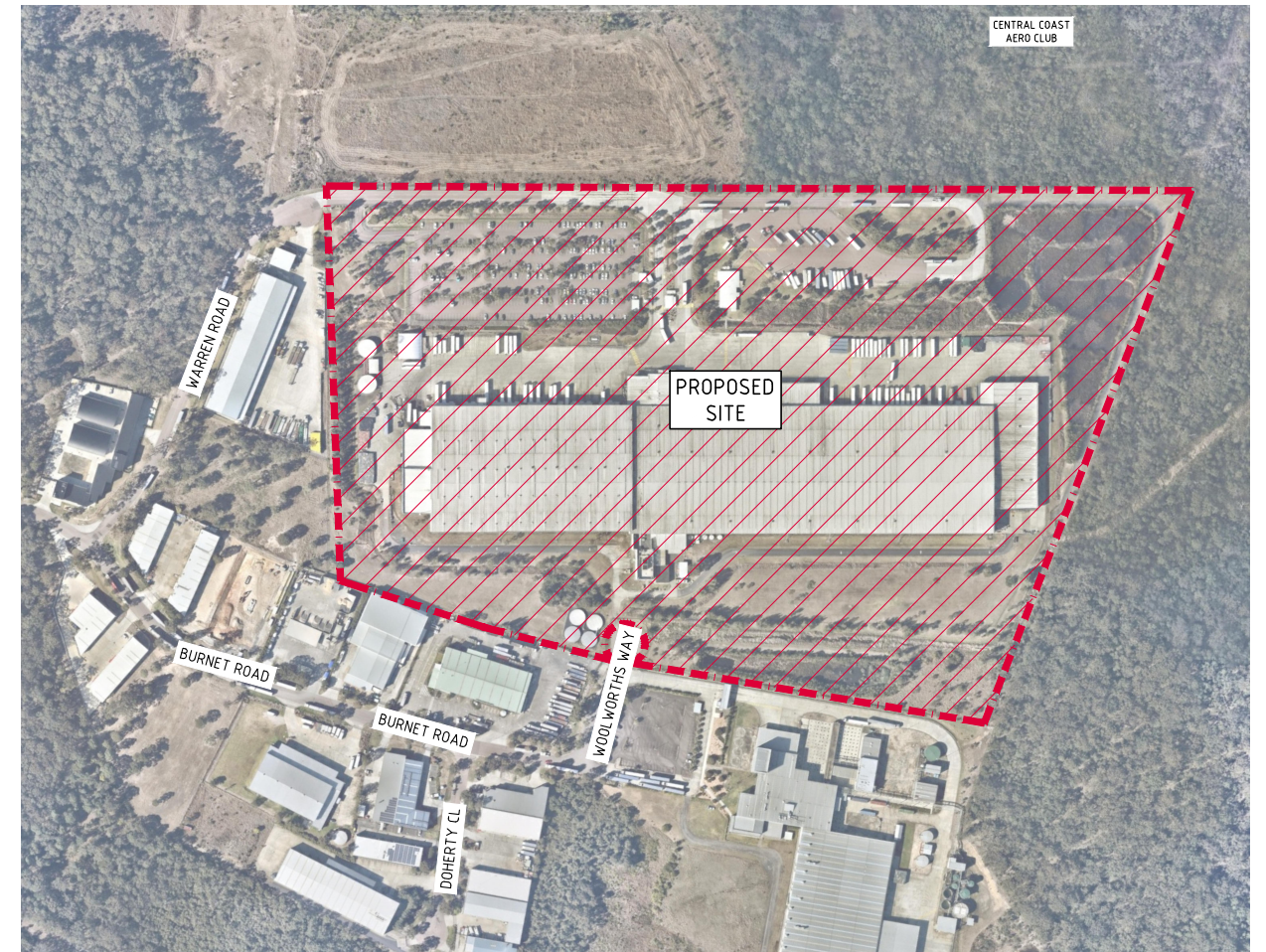
DRAWING NO.	DRAWING TITLE
CO8318.01-DA10	DRAWING LIST AND LOCALITY PLAN
CO8318.01-DA20	EROSION & SEDIMENT CONTROL PLAN
CO8318.01-DA25	EROSION & SEDIMENT CONTROL DETAILS - SHEET 1
CO8318.01-DA26	EROSION & SEDIMENT CONTROL DETAILS - SHEET 2
CO8318.01-DA30	BULK EARTHWORKS PLAN
CO8318.01-DA35	BULK EARTHWORKS SECTIONS
CO8318.01-DA40	STORMWATER DRAINAGE MASTERPLAN
CO8318.01-DA41	STORMWATER DRAINAGE PLAN - SHEET 1
CO8318.01-DA42	STORMWATER DRAINAGE PLAN - SHEET 2
CO8318.01-DA43	STORMWATER DRAINAGE PLAN - SHEET 3
CO8318.01-DA44	STORMWATER DRAINAGE PLAN - SHEET 4
CO8318.01-DA45	STORMWATER DRAINAGE DETAILS - SHEET 1
CO8318.01-DA46	STORMWATER DRAINAGE DETAILS - SHEET 2
CO8318.01-DA47	STORMWATER EASEMENT PLAN
CO8318.01-DA50	FINISHED LEVELS MASTERPLAN
CO8318.01-DA51	FINISHED LEVELS PLAN - SHEET 1
CO8318.01-DA52	FINISHED LEVELS PLAN - SHEET 2
CO8318.01-DA53	FINISHED LEVELS PLAN - SHEET 3
CO8318.01-DA54	FINISHED LEVELS PLAN - SHEET 4
CO8318.01-DA55	TYPICAL SECTIONS - SHEET 1
CO8318.01-DA56	TYPICAL SECTIONS - SHEET 2
CO8318.01-DA65	RETAINING WALL DETAILS - SHEET 1
CO8318.01-DA66	RETAINING WALL DETAILS - SHEET 2

GENERAL NOTES:

1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
2. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT AND CURRENT STANDARDS AUSTRALIA CODES AND WITH THE BY-LAWS AND ORDINANCES OF THE RELEVANT BUILDING AUTHORITIES EXCEPT WHERE VARIED BY THE PROJECT SPECIFICATION.
3. ALL DIMENSIONS SHOWN SHALL BE VERIFIED BY THE BUILDER ON SITE.
ENGINEER'S DRAWINGS SHALL NOT BE SCALED FOR DIMENSIONS
ENGINEER'S DRAWINGS ISSUED IN ANY ELECTRONIC FORMAT MUST NOT BE USED FOR DIMENSIONAL SETOUT.
REFER TO THE ARCHITECT'S DRAWINGS FOR ALL DIMENSIONAL SETOUT INFORMATION.
4. DURING CONSTRUCTION THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED. TEMPORARY BRACING SHALL BE PROVIDED BY THE BUILDER TO KEEP THE WORKS AND EXCAVATIONS STABLE AT ALL TIMES.
5. UNLESS NOTED OTHERWISE ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES.
6. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH ACCEPTABLE SAFETY STANDARDS & APPROPRIATE SAFETY SIGNS SHALL BE INSTALLED AT ALL TIMES DURING THE PROGRESS OF THE JOB.

ELECTRONIC INFORMATION NOTES:

1. THE ISSUED DRAWINGS IN HARD COPY OR PDF FORMAT TAKE PRECEDENCE OVER ANY ELECTRONICALLY ISSUED INFORMATION, LAYOUTS OR DESIGN MODELS.
2. THE CONTRACTOR'S DIRECT AMENDMENT OR MANIPULATION OF THE DATA OR INFORMATION THAT MIGHT BE CONTAINED WITHIN AN ENGINEER-SUPPLIED DIGITAL TERRAIN MODEL AND ITS SUBSEQUENT USE TO UNDERTAKE THE WORKS WILL BE SOLELY AT THE DISCRETION OF AND THE RISK OF THE CONTRACTOR.
3. THE CONTRACTOR IS REQUIRED TO HIGHLIGHT ANY DISCREPANCIES BETWEEN THE DIGITAL TERRAIN MODEL AND INFORMATION PROVIDED IN THE CONTRACT AND/OR DRAWINGS AND IS REQUIRED TO SEEK CLARIFICATION FROM THE SUPERINTENDENT.
4. THE ENGINEER WILL NOT BE LIABLE OR RESPONSIBLE FOR THE POSSIBLE ON-GOING NEED TO UPDATE THE DIGITAL TERRAIN MODEL, SHOULD THERE BE ANY AMENDMENTS OR CHANGES TO THE DRAWINGS OR CONTRACT INITIATED BY THE CONTRACTOR.



SITE LOCATION PLAN
SCALE 1:5000

FOR DEVELOPMENT APPLICATION

						ARCHITECT			CLIENT			PROJECT			CONSULT AUSTRALIA			Costin Roe Consulting Pty Ltd. Consulting Engineers ACT 005 000 440 Level 4, 8 Windmill Street Walsh Bay, Sydney NSW 2000 Tel: (02) 9251-7090 Fax: (02) 9241-3731 email: mail@costinroe.com.au ©			Costin Roe Consulting			DRAWING TITLE DRAWING LIST AND LOCALITY PLAN														
ISSUED FOR DEVELOPMENT APPLICATION			23.03.22			C									DESIGNED D.S. B1			DATE MAR. 2022			CHECKED M.W. B1			SCALE AS SHOWN			CAD REF: C08318.01-DA.10			PRECISION | COMMUNICATION | ACCOUNTABILITY			DRAWING No C08318.01-DA10			ISSUE No		
ISSUED FOR INFORMATION			04.03.22			B																																
ISSUED FOR INFORMATION			03.03.22			A																																
AMENDMENTS			DATE			ISSUE			AMENDMENTS			DATE			ISSUE																							

SEDIMENTATION BASIN NOTE:

FOR SEDIMENT & EROSION CONTROL DETAILS REFER TO DRAWING C08318.01-DA25.
SEDIMENTATION BASIN SIZING BASED ON RECOMMENDATIONS OF 'SOILS AND CONSTRUCTION, MANAGING URBAN STORMWATER-THE BLUE BOOK'.
CAPACITY BASED UPON 5 DAY RAINFALL DEPTH AT 85th PERCENTILE INTENSITY (24.4mm).

APPROXIMATE AREA OF DISTURBED SITE = 5.0ha

SEDIMENT BASIN 1:
CATCHMENT AREA = 5.0ha
REQUIRED BASIN VOLUME = 1680m³
BASE DIMENSIONS (L X W) = 41.0m x 20.0m
TOP DIMENSIONS (L X W) = 50.0m x 29.0m
MAX SIDE SLOPE = 1V:3H
DEPTH = 1.5m
PROVIDED BASIN VOLUME = 1680m³

SEDIMENTATION BASINS TO COLLECT RUN-OFF IN EXTREME RAINFALL EVENTS. COLLECTED RUN-OFF TO BE ASSESSED BY A QUALIFIED LABORATORY FOR DOUSING RATES OF ALUM OR GYPSUM TO ENSURE COAGULATION OF SEDIMENTS PRIOR TO WATER BEING DISCHARGED TO COUNCIL STORMWATER SYSTEM.

EACH BASIN IS TO HAVE A MARKER PLACED AS PER THE DETAIL TO INDICATE WHEN SEDIMENT IS TO BE REMOVED. REMOVED SEDIMENT IS TO BE CLASSED AND DEWATERED PRIOR TO REMOVAL FROM SITE.

ALLOWANCE TO BE MADE DURING BENCHING OF SITE TO ENSURE RUN-OFF IS DIRECTED TO SEDIMENTATION BASINS.

NOTES:

1. ASSUME TYPE D SOIL (CLAY/SILTY CLAY)
2. ASSUME GROUP D SOIL (HIGH PLASTICITY AND SHRINK/SWELL PROPERTIES)

RUSLE CALCULATION:

DISTURBED CATCHMENT AREA BYPASSING SEDIMENT BASIN = 2.1 ha

$A = R \times K \times LS \times P \times C$

1. 2-yr, 6-hr ARI (S) = 10.10;
2. RAINFALL EROSIVITY FACTOR (R)
 $R = 164.74(1.1177)^S S^{0.8444} = 2250$;
3. SOIL ERODIBILITY FACTOR (K) = 0.075;
4. LENGTH/GRADIENT FACTOR (LS) = 0.25;
5. EROSION CONTROL PRACTICE FACTOR (P) = 1.3;
6. COVER FACTOR (C) = 1.0

SOIL LOSS (A) = $54.84m^3/ha/yr$
= $115.16m^3/yr$

PER BLUE BOOK GUIDELINES SECTION 6.3.2.d, FOR SITES WITH AVERAGE ANNUAL SOIL LOSS (A) < 150m³/yr, A SEDIMENT RETENTION BASIN MAY BE CONSIDERED UNNECESSARY.

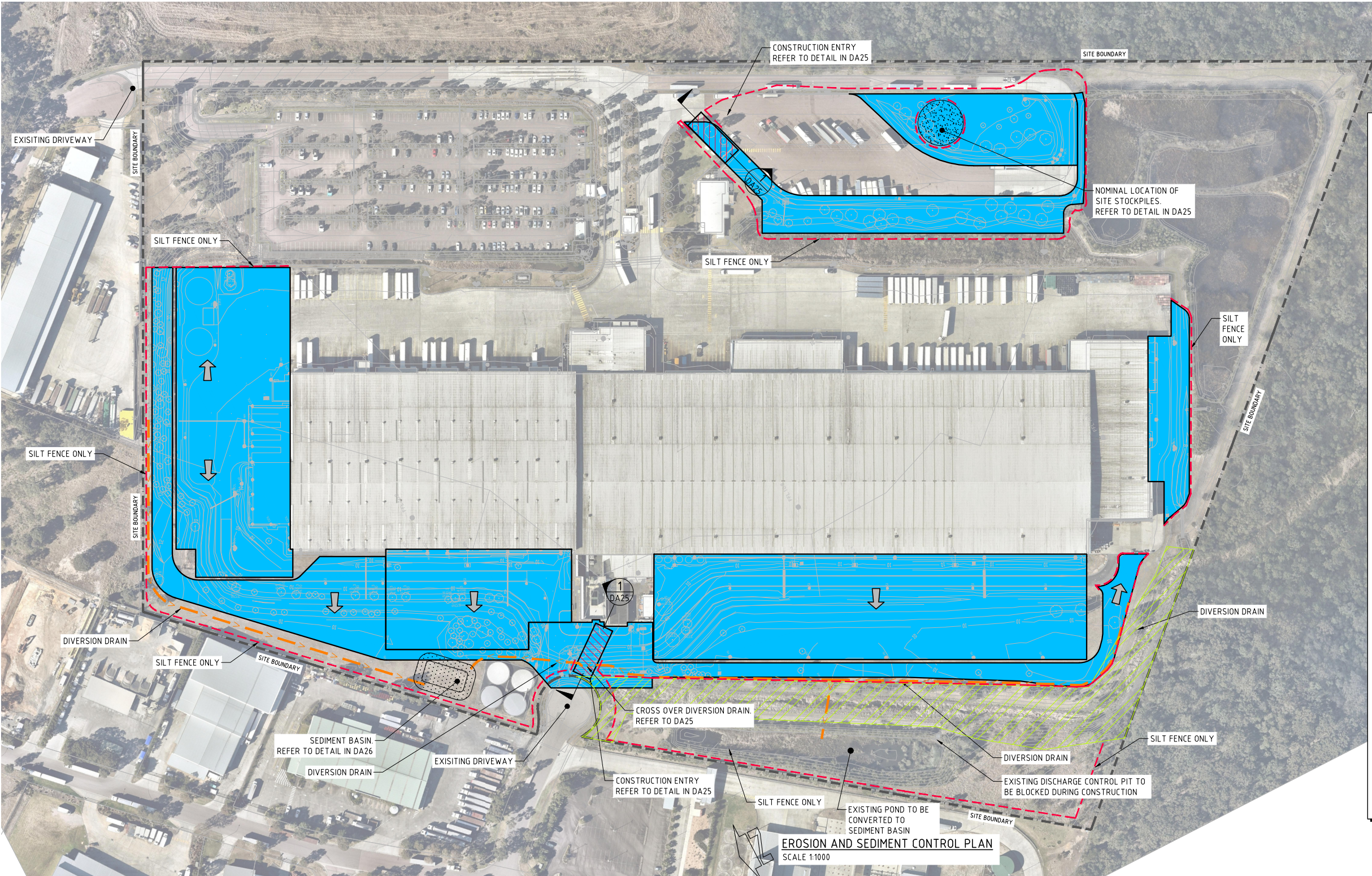
DUST CONTROL NOTES:

1. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE DUST CONTROL MEASURES ARE APPLIED AND MAINTAINED IN ACCORDANCE WITH THE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN.
2. THE APPLICATION OF LIQUID BASED DUST SUPPRESSION MEASURES MUST BE SUCH THAT SEDIMENT LADEN RUNOFF RESULTING FROM SUCH MEASURES DOES NOT CREATE A TRAFFIC OR ENVIRONMENTAL HAZARD. (EG USING HAY BALES)
3. DUST GENERATION ASSOCIATED WITH WIND EROSION TO BE CONTROLLED USING WATER TRUCKS, DUST SUPPRESSING FOG, MIST GENERATORS, SEALANT PLACED OVER THE SOIL, SURFACE ROUGHENING OR RE-VEGETATION.
4. THE FOLLOWING ACTIVITIES SHALL BE ADOPTED, IF NECESSARY, TO MANAGE DUST CONTROL ON SITE:
 - LIMITING THE AREA OF SOIL DISTURBANCE AT ANY GIVEN TIME
 - REPLACING TOPSOIL AFTER COMPLETION OF EARTHWORKS.
 - PROGRAMMING WORK TO MINIMISE THE LIFE OF STOCKPILES.
 - TEMPORARILY STABILISING LONG-TERM STOCKPILES.
 - GRAVELLING UNSEALED ACCESS AND HAUL ROADS.
 - MINIMISING TRAFFIC MOVEMENT ON EXPOSED SURFACES.
 - LIMITING VEHICULAR TRAFFIC TO 15km/h.
 - RETAINING EXISTING VEGETATION AS WIND BREAKS.
5. OIL, LANDFILL GAS CONDENSATE OR ANY CONTAMINATED LEACHATE OR STORMWATER IS NOT TO BE USED FOR DUST SUPPRESSION.

LEGEND:

PROVIDE 1m RETURNS TO SILT FENCE AT 30m MAX. INTERVALS. TYPICAL (N.S.O.P.)

- DENOTES DIVERSION DRAIN
- DENOTES SILT FENCE WITH CATCH DRAIN
- DENOTES SILT FENCE ONLY
- DENOTES SITE BOUNDARY
- DENOTES CONSTRUCTION ENTRY
- DENOTES DISTURBED AREA



EROSION CONTROL NOTES:

ALL CONTROL WORK INCLUDING DIVERSION BANKS AND CATCH DRAINS, V-DRAINS AND SILT FENCES SHALL BE COMPLETED DIRECTLY FOLLOWING THE COMPLETION OF THE EARTHWORKS.

1. SILT FENCES AND SILT FENCE RETURNS SHALL BE ERECTED CONVEX TO THE CONTOUR TO POND WATER.
2. HAY BALE BARRIERS AND GEOFABRIC FENCES ARE TO BE CONSTRUCTED TO TOE OF BATTER, PRIOR TO COMMENCEMENT OF EARTHWORKS, IMMEDIATELY AFTER CLEARING OF VEGETATION AND BEFORE REMOVAL OF TOP SOIL.
3. ALL TEMPORARY EARTH BERMS, DIVERSION AND SILT DAM EMBANKMENTS ARE TO BE MACHINE COMPACTED, SEEDED AND MULCHED FOR TEMPORARY VEGETATION COVER AS SOON AS THEY HAVE BEEN FORMED.
4. CLEAR WATER IS TO BE DIVERTED AWAY FROM DISTURBED GROUND AND INTO THE DRAINAGE SYSTEM.
5. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING AND PROVIDING ON GOING ADJUSTMENT TO EROSION CONTROL MEASURES AS REQUIRED DURING CONSTRUCTION.
6. ALL SEDIMENT TRAPPING STRUCTURES AND DEVICES ARE TO BE INSPECTED AFTER STORMS FOR STRUCTURAL DAMAGE OR CLOGGING, TRAPPED MATERIAL IS TO BE REMOVED TO A SAFE, APPROVED LOCATION.
7. ALL FINAL EROSION PREVENTION MEASURES INCLUDING THE ESTABLISHMENT OF GRASSING ARE TO BE MAINTAINED UNTIL THE END OF THE DEFECTS LIABILITY PERIOD.
8. ALL EARTHWORKS AREAS SHALL BE ROLLED ON A REGULAR BASIS TO SEAL THE EARTHWORKS.
9. ALL FILL AREAS ARE TO BE LEFT WITH A BUND AT THE TOP OF THE SLOPE AT THE END OF EACH DAYS EARTHWORKS. THE HEIGHT OF THE BUND SHALL BE A MINIMUM OF 200mm.
10. ALL CUT AND FILL SLOPES ARE TO BE SEEDED AND HYDROMULCHED WITHIN 10 DAYS OF COMPLETION OF FORMATION.
11. AFTER REVEGETATION OF THE SITE IS COMPLETE AND THE SITE IS STABLE IN THE OPINION OF A SUITABLY QUALIFIED PERSON ALL TEMPORARY WORK SUCH AS SILT FENCE, DIVERSION DRAINS ETC SHALL BE REMOVED.
12. ALL TOPSOIL STOCKPILES ARE TO BE SUITABLY COVERED TO THE SATISFACTION OF THE SITE MANAGER TO PREVENT WIND AND WATER EROSION.
13. ANY AREA THAT IS NOT APPROVED BY THE CONTRACT ADMINISTRATOR FOR CLEARING OR DISTURBANCE BY THE CONTRACTOR'S ACTIVITIES SHALL BE CLEARLY MARKED AND SIGN POSTED, FENCED OFF OR OTHERWISE APPROPRIATELY PROTECTED AGAINST ANY SUCH DISTURBANCE.
14. ALL STOCKPILE SITES SHALL BE SITUATED IN AREAS APPROVED FOR SUCH USE BY THE SITE MANAGER. A 6m BUFFER ZONE SHALL EXIST BETWEEN STOCKPILE SITES AND ANY STREAM OR FLOW PATH. ALL STOCKPILES SHALL BE ADEQUATELY PROTECTED FROM EROSION AND CONTAMINATION OF THE SURROUNDING AREA BY USE OF THE MEASURES APPROVED IN THE EROSION AND SEDIMENTATION CONTROL PLAN. ACCESS AND EXIT AREAS SHALL INCLUDE SHAKE-DOWN OR OTHER METHODS APPROVED BY THE SITE MANAGER FOR THE REMOVAL OF SOIL MATERIALS FORM MOTOR VEHICLES.
15. THE CONTRACTOR IS TO ENSURE RUNOFF FROM ALL AREAS WHERE THE NATURAL SURFACE IS DISTURBED BY CONSTRUCTION, INCLUDING ACCESS ROADS, DEPOT AND STOCKPILE SITES, SHALL BE FREE OF POLLUTANTS BEFORE IT IS EITHER DISPERSED TO STABLE AREAS OR DIRECTED TO NATURAL WATERCOURSES.
16. THE CONTRACTOR SHALL PROVIDE AND MAINTAIN SLOPES, CROWNS AND DRAINS ON ALL EXCAVATIONS AND EMBANKMENTS TO ENSURE SATISFACTORY DRAINAGE AT ALL TIMES WATER SHALL NOT BE ALLOWED TO POND ON THE WORKS UNLESS SUCH PONDING IS PART OF AN APPROVED ESCP / SWMP.

FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION	23.03.22	C
ISSUED FOR INFORMATION	04.03.22	B
ISSUED FOR INFORMATION	03.03.22	A
AMENDMENTS	DATE	ISSUE

ARCHITECT
watson young

CLIENT
woolworths

PROJECT
WOOLWORTHS WYONG EXPANSION
11 WARREN ROAD, WARNERVALE, 2259, NSW

DESIGNED D.S. DRAWN D.W. DATE MAR 2022 CHECKED M.W. SIZE B1 SCALE AS SHOWN CAD REF: C08318.01-DA20

COSTIN ROE CONSULTING AUSTRALIA
Costin Roe Consulting Pty Ltd.
Consulting Engineers
Level 4, 8 Windmill Street
Wahib Bay, Sydney NSW 2000
Tel: (02) 9551-7000 Fax: (02) 9541-3731
email: mail@costinroe.com.au ©

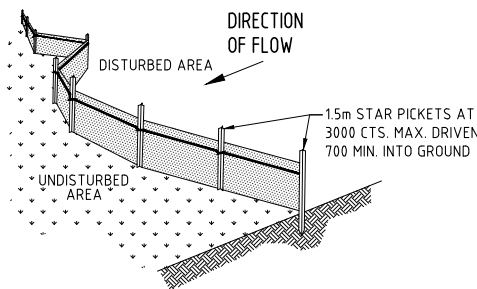
Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
EROSION AND SEDIMENT
CONTROL PLAN

DRAWING No C08318.01-DA20

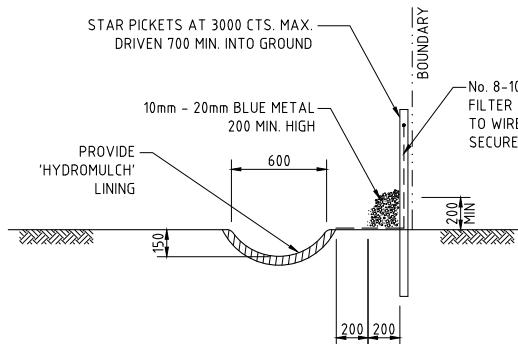
ISSUE
C



TYPICAL SILT FENCE DETAIL

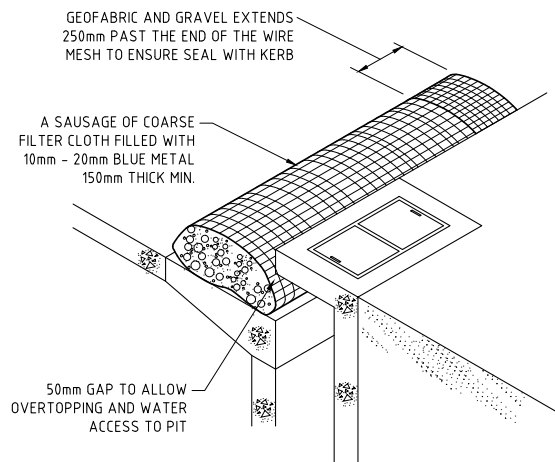
N.T.S

NOTE: PROVIDE 1m RETURNS AT 30m INTERVALS. TYPICAL



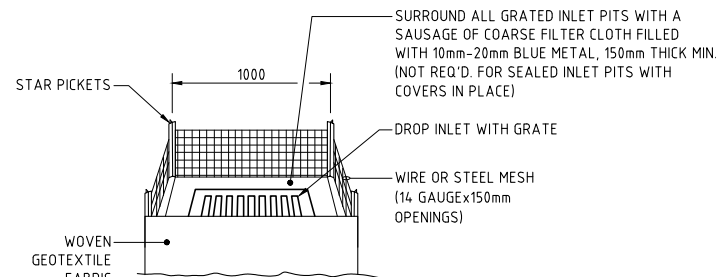
TYPICAL OPEN DRAIN & SILT FENCE

SCALE 1:20



KERB INLET CONTROL

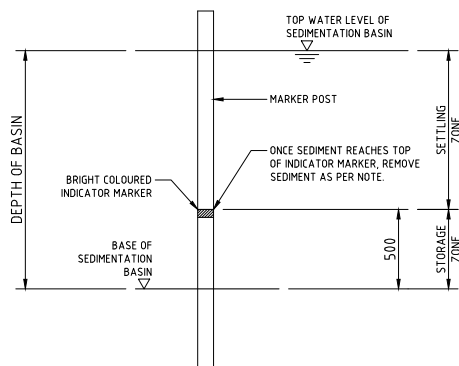
N.T.S



GRADED INLET PIT FILTER DETAIL

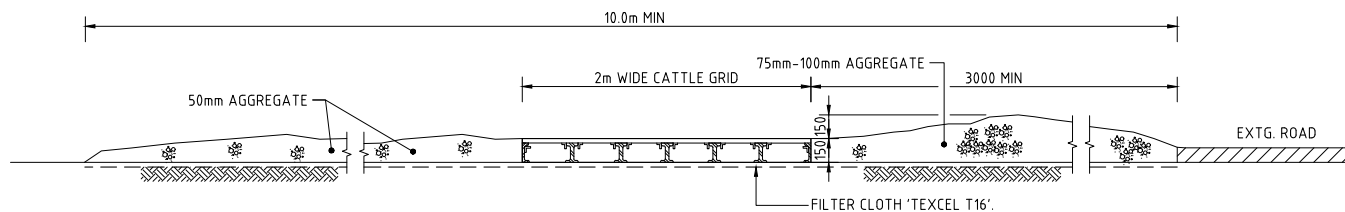
N.T.S

NOTE :
ADOPT ABOVE DETAILS AROUND ALL PITS WITHIN AREA ENCOMPASSED BY SILT FENCE & TO PITS ON THE ROAD ADJACENT TO SITE BOUNDARY.



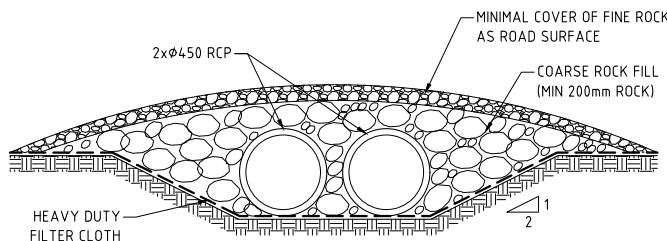
SEDIMENT STORAGE MARKER

SCALE 1:20



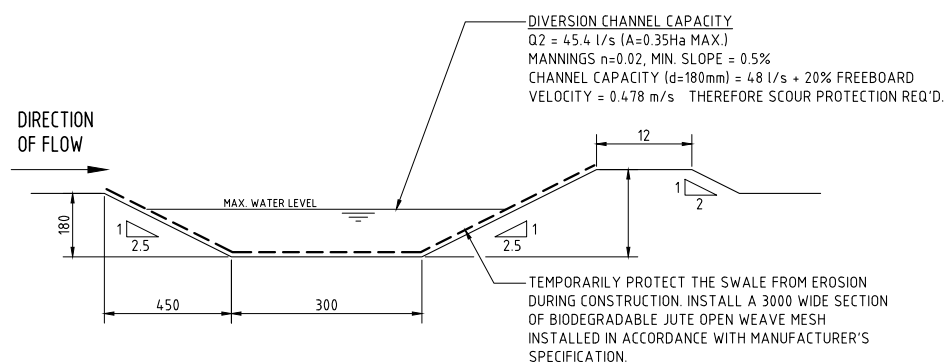
SECTION 1:20 : STABILISED CONSTRUCTION ENTRANCE 'TRUCK SHAKER'

1
DA20



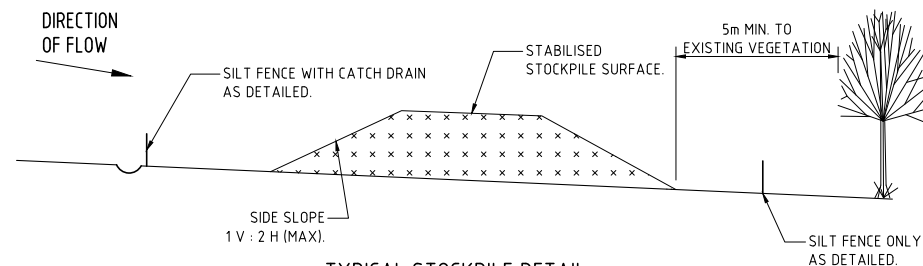
TYPICAL CROSSING OVER DIVERSION CHANNEL

SCALE 1:20



DIVERSION DRAIN SECTION

SCALE 1:20



TYPICAL STOCKPILE DETAIL

N.T.S

STOCKPILE NOTES

1. PLACE ALL STOCKPILES IN LOCATIONS MORE THAN 5m FROM EXISTING VEGETATION, ROADS & HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT ELONGATED MOUNDS. SIDE SLOPE TO BE 1 V: 2 H MAX.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2m IN HEIGHT.
4. WHERE STOCKPILES ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE USING WOOD CHIP MULCH - 16 TONNE/Ha.
5. CONSTRUCT SILT FENCE WITH CATCH DRAIN ON UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES & SILT FENCE ONLY 1 TO 2m DOWNSLOPE AS SHOWN.

200mm 0 500 1000 1500 2000mm
SCALE 1:20 AT B1 SIZE SHEET

FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION	23.03.22	B
ISSUED FOR INFORMATION	03.03.22	A
AMENDMENTS	DATE	ISSUE

ARCHITECT
watson young

CLIENT
woolworths

PROJECT
WOOLWORTHS WYONG EXPANSION
11 WARREN ROAD, WARNERVALE, 2259, NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF.
D.S.	D.W.	MAR 2022	M.W.	B1	AS SHOWN	C08318.01-DA25

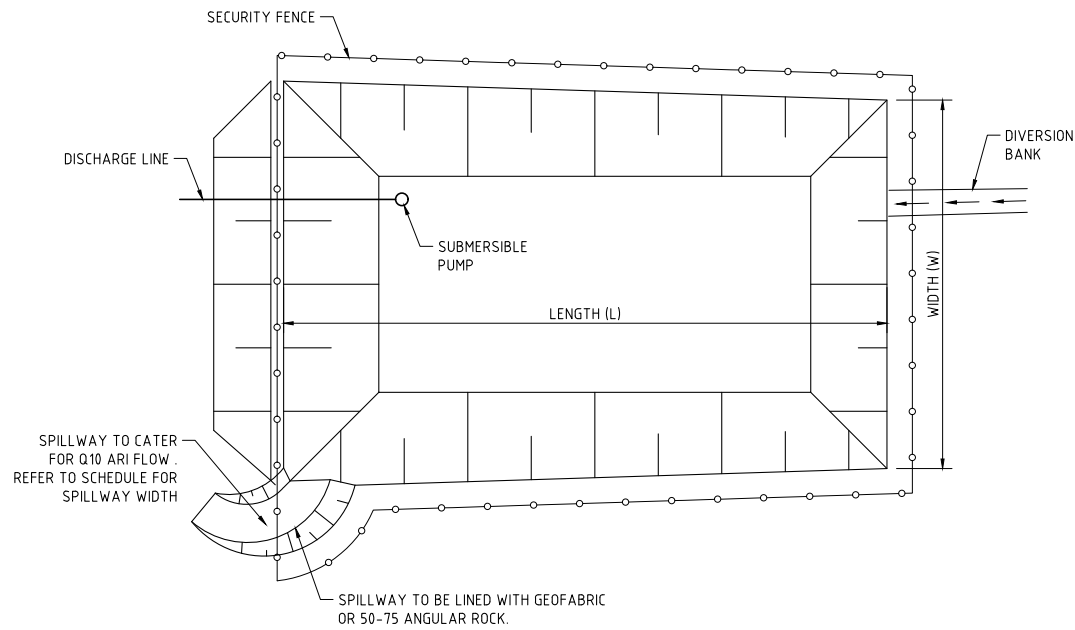
COSTIN ROE CONSULTING AUSTRALIA
Costin Roe Consulting Pty Ltd.
Consulting Engineers
Level 4, 8 Windmill Street
Wahib Bay, Sydney NSW 2000
Tel: (02) 9551-7000 Fax: (02) 9544-3731
email: mail@costinroe.com.au ©

Costin Roe Consulting

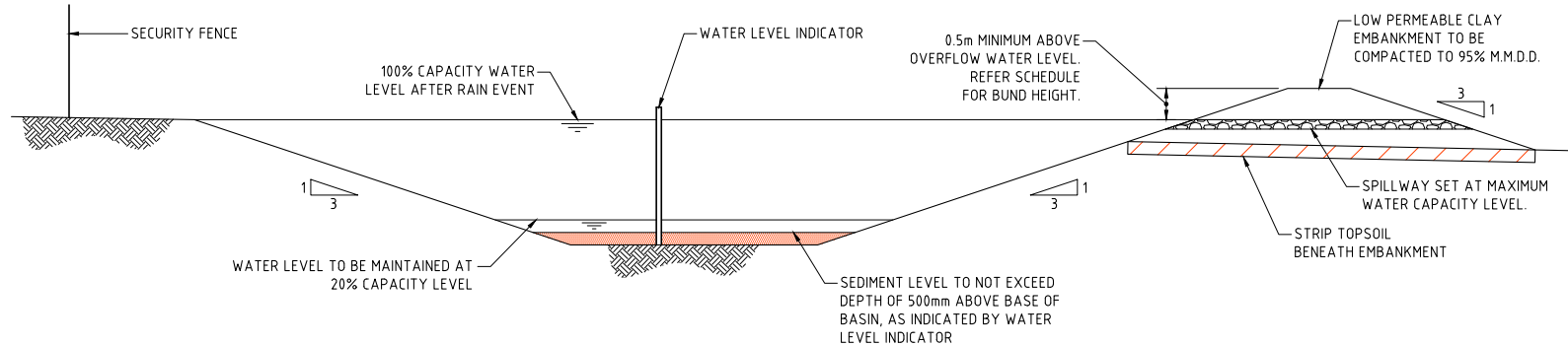
PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
EROSION AND SEDIMENT CONTROL DETAILS SHEET 1

DRAWING No C08318.01-DA25 ISSUE B

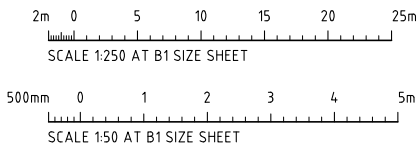


TYPICAL SEDIMENT CONTROL POND PLAN
SCALE 1:250

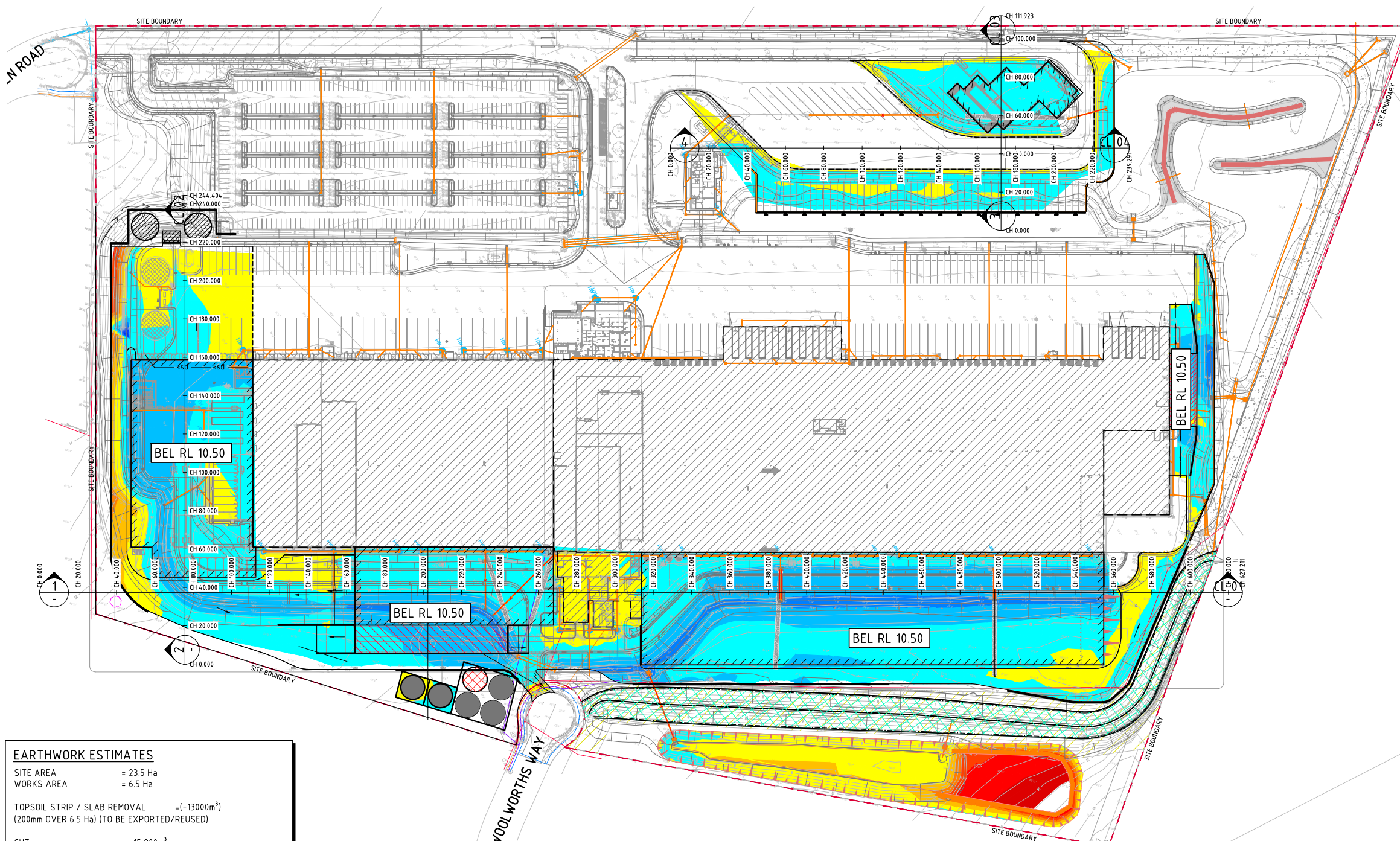


TYPICAL SEDIMENT CONTROL BASIN SECTION
SCALE 1:50

SPILLWAY DETAIL & SCHEDULE					
CATCHMENT (Ha)	FLOW (m³/s)	WIDTH (mm)	FLOW DEPTH (mm)	ROCK SIZE (mm)	BUND HEIGHT ABOVE SPILLWAY (mm)
0.20	0.14	1000	200	-	600
0.5	0.2	2000	200	-	600
1	0.3	2000	200	-	700
2	0.6	4000	200	-	700
5	1.4	5000	300	200	800
10	2.8	8000	350	200	850
20	5.5	14000	400	250	900
40	11.0	20000	500	250	1000



FOR DEVELOPMENT APPLICATION



LEGEND:
LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY ADW JOHNSON DATED 21.10.07.

— 50.00 — - EXISTING CONTOUR (0.2m INTERVAL)
+50.00 - B.E.L. SPOT LEVEL

PAVEMENT
BASE/SUBBASE CAPPING COURSES
SUBGRADE 600 MIN THICK SANDSTONE CBR-20%
PAVEMENT FFL
DEPTH OF PAVEMENT. REFER TO STRUCTURAL PLANS FOR DETAILS.
NOMINATED B.E. LEVEL

NOMINATED B.E.L. DETAIL
NTS

- SITE PREPARATION NOTES:**
- ALL EARTHWORKS IS TO BE COMPLETED UNDER LEVEL 1 GEOTECHNICAL SUPERVISION
 - ALL EARTHWORKS SHALL BE COMPLETED GENERALLY IN ACCORDANCE WITH THE GUIDELINES SPECIFIED BY THE GEOTECHNICAL REPORT '2101104GTRPT01FINALV01_190CT21' PROVIDED BY GEO-LOGIX DATED 05/10/2021.
 - EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY ADW JOHNSON DATED 21.10.07.
 - COMPLETE CUT TO FILL EARTHWORKS TO ACHIEVE THE REQUIRED LEVELS AS INDICATED ON THE DRAWINGS WITHIN A TOLERANCE OF +0mm/-10mm THROUGH BUILDING PADS/PAVEMENTS AND +0mm/-20mm ELSEWHERE.
 - PREPARE STEEP BATTERS TO RECEIVE FILL BY CONSTRUCTING BENCHING TO FACILITATE FILL PLACEMENT AND COMPACTION.
 - AREAS TO RECEIVE FILL (THAT ARE NOT ON BENCHED BATTERS) AND AREAS IN CUT SHALL BE PROOF ROLLED TO IDENTIFY ANY SOFT HEAVING MATERIAL. SOFT MATERIAL SHALL BE BOXED OUT AND REMOVED PRIOR TO FILL PLACEMENT. PROOF ROLLING TO BE INSPECTED BY A GEOTECHNICAL ENGINEER OR THE EARTHWORKS DESIGNER.
 - SITE WON FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HLF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HLF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
 - IMPORTED FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HLF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HLF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
 - ALL ENGINEERED FILL PARTICLES SHALL BE ABLE TO BE INCORPORATED WITHIN A SINGLE LAYER. FURTHER, LESS THAN 30% OF PARTICLES SHALL BE RETAINED ON THE 37.5 mm SIEVE. ENGINEERED FILL SHALL BE ABLE TO BE TESTED IN ACCORDANCE WITH THE STANDARD COMPACTION METHOD (AS1289.5.4.1) OR HLF TEST METHOD (AS1289.5.7.1). THESE METHODS REQUIRE LESS THAN 20% RETAINED ON THE 37.5 mm SIEVE. WHERE BETWEEN 20% AND 30% OF PARTICLES ARE RETAINED ON THE 37.5 mm SIEVE THE ABOVE TEST METHODS SHALL STILL BE ADOPTED AND TEST REPORTS ANNOTATED APPROPRIATELY. THESE REQUIREMENTS SHOULD BE MET BY THE MATERIAL AFTER PLACEMENT AND COMPACTION
 - ALL THE EARTHWORKS UNDERTAKEN AND THE SUBGRADE CONDITION IN THE CUT AREAS (IN THE STATED PERIOD) ARE DOCUMENTED IN THE REPORTS AND HAVE BEEN UNDERTAKEN IN ACCORDANCE WITH THE SPECIFICATION (EG. COSTIN ROE SITE PREPARATION NOTES IN DWG C013003.01-EWC10)
 - PRIOR TO ANY EARTHWORKS, EROSION CONTROL AS OUTLINED IN THE EROSION AND SEDIMENTATION CONTROL PLAN SHALL BE COMPLETED.
 - EXISTING ROCK, IF ANY, SHALL BE REMOVED BY HEAVY ROCK BREAKING OR RIPPING.
 - MATCH EXISTING LEVELS AT BATTER INTERFACE.
 - CONTRACTOR TO MATCH EXISTING LEVELS AT THE INTERFACE OF EARTHWORKS AND EXISTING SURFACE AT BATTER LOCATIONS OR WHERE NO RETAINING WALLS ARE PRESENT. ANY DISCREPANCY BETWEEN DESIGN AND EXISTING LEVELS TO BE REFERRED TO THE ENGINEER FOR DIRECTION OR ADJUSTMENTS TO DESIGN LEVELS.
 - DURING EARTHWORKS THE CONTRACTOR IS TO ENSURE ALL AREAS ARE FREE DRAINING & WILL NOT RETAIN WATER DURING RAINFALL. PROVIDE TEMPORARY MEASURES AS REQUIRED TO ENSURE FREE FLOWING RUNOFF THROUGH MANAGED DRAINAGE PATHS, DIVERSION DRAINS OR OTHER SUITABLE DISPOSAL METHOD AS AGREED DURING THE WORKS. REFER ANY CONCERNS TO THE ENGINEER. REFER TO EROSION AND SEDIMENT CONTROL DRAWINGS AND NOTES.

EARTHWORK ESTIMATES

SITE AREA = 23.5 Ha
WORKS AREA = 6.5 Ha

TOPSOIL STRIP / SLAB REMOVAL = (-13000m³)
(200mm OVER 6.5 Ha) (TO BE EXPORTED/REUSED)

CUT = -15,800m³
FILL = +29,000m³

ALLOWANCES
DETAILED EXCAVATION = -6500m³
(1000m³/Ha)

DIFFERENCE = +6700m³ (i.e. FILL OVER CUT)

NOTE:
VOLUMES BASED ON 200mm TOPSOIL STRIP AND REMOVAL OF EXISTING SLAB OVER THE NOMINATED AREA. EARTHWORKS VOLUMES ARE APPROXIMATE ONLY.
NO ALLOWANCE HAS BEEN MADE FOR DELETERIOUS MATERIAL, EROSION AND SEDIMENT CONTROL, BULKING OR COMPACTION OF FILLED SOILS, THE REMOVAL OF UNCONTROLLED OR CONTAMINATED MATERIAL OR ANY OTHER UNSPECIFIED EXCAVATION RELATED TO CONSTRUCTION ACTIVITIES. DETAILED EXCAVATION ALLOWANCE IS APPROXIMATE ONLY AND ACCOUNTS FOR STORMWATER/SERVICES TRENCHING AND FOUNDATIONS. THE DETAILED EXCAVATION VOLUMES ARE TO BE CONFIRMED BY THE CONTRACTOR. REFER ANY CONCERNS TO ENGINEER.

ALLOWANCES FOR STRUCTURE

DEPTH OF PAVEMENT

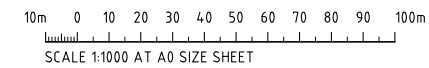
INTERNAL WAREHOUSE 300mm

EXTERNAL HARDSTAND 300mm

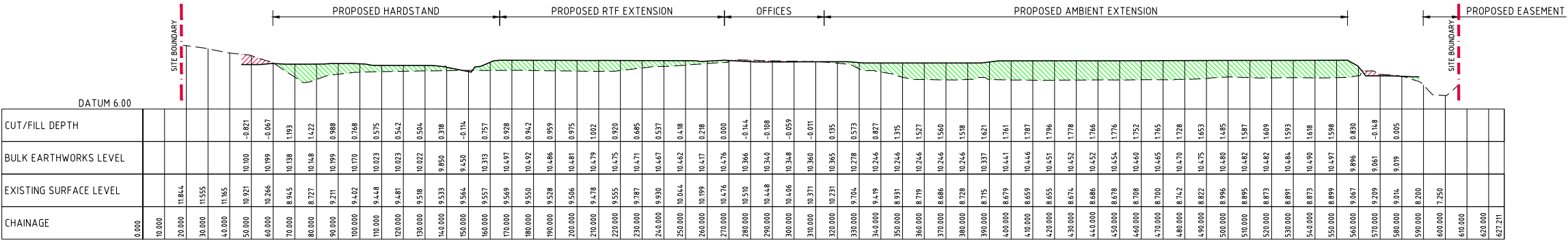
LEVELS NOTE:
LEVELS SHOWN TO BE +/-500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.

BULK EARTHWORKS PLAN
SCALE 1:1000

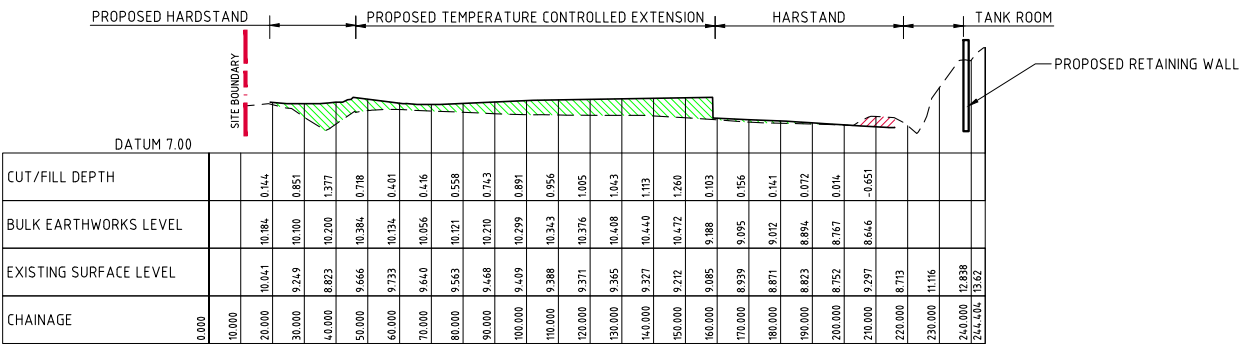
DEPTH RANGE			
No.	FROM DEPTH	TO DEPTH	COLOR
1	-6.000	-5.000	Red
2	-5.000	-4.000	Red
3	-4.000	-3.000	Orange
4	-3.000	-2.000	Orange
5	-2.000	-1.000	Yellow
6	-1.000	0.000	Yellow
7	0.000	1.000	Light Blue
8	1.000	2.000	Light Blue
9	2.000	3.000	Blue
10	3.000	4.000	Blue
11	4.000	5.000	Blue
12	5.000	6.000	Blue



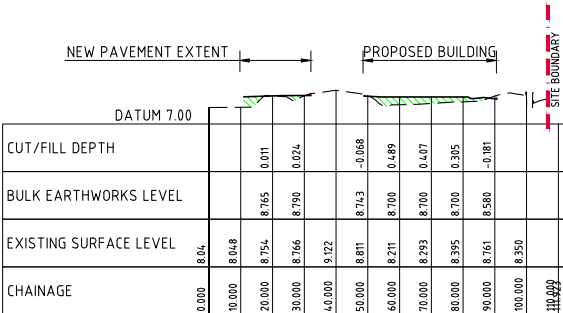
FOR DEVELOPMENT APPLICATION



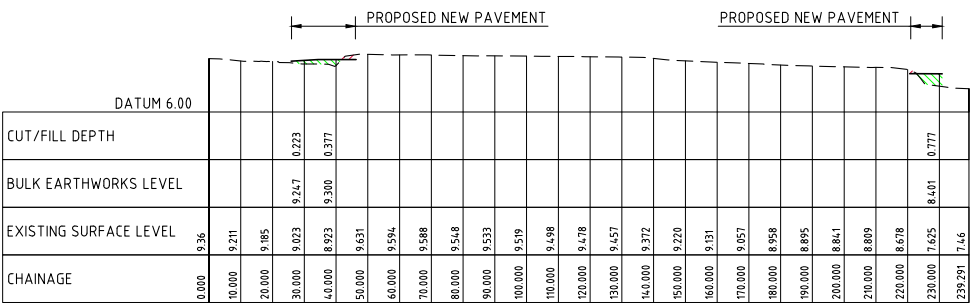
SECTION CL 01
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200



SECTION CL 02
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200



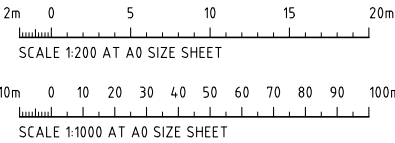
SECTION CL 03
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200



SECTION CL 04
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

LEGEND:

- DENOTES BULK EARTHWORKS PROFILE
- DENOTES EXISTING PROFILE
- DENOTES AREA IN CUT
- DENOTES AREA IN FILL



FOR DEVELOPMENT APPLICATION

EXISTING DRAINAGE IS TO BE MAINTAINED THROUGHOUT UNLESS NOTED OTHERWISE.

LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY ADW JOHNSON DATED 21.10.07.

- | | | | |
|--------------------------------------|---|--|--------------------------------------|
| - SGGP, SINGLE GRATED GULLY PIT | - EXISTING SWALE | - SUBSOIL LINE | - DENOTES EXISTING BUILDINGS |
| - SJP, SEALED JUNCTION PIT | - EXISTING DRAINAGE LINE TO BE DECOMMISSIONED | - PROPOSED SYPHONIC LINE | - DENOTES PROPOSED CONCRETE PAVEMENT |
| - GD, GRATED DRAIN (300W x 225D UNO) | - PROPOSED CONCRETE ENCASEMENT | - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS | - OVERLAND FLOW DIRECTION |
| - PROPOSED DRAINAGE LINE | - ROOFWATER DOWNPIPE (INDICATIVE) | - FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS | |
| - EXISTING DRAINAGE LINE | - ROOFWATER LINE | | |

STORMWATER DRAINAGE NOTES:

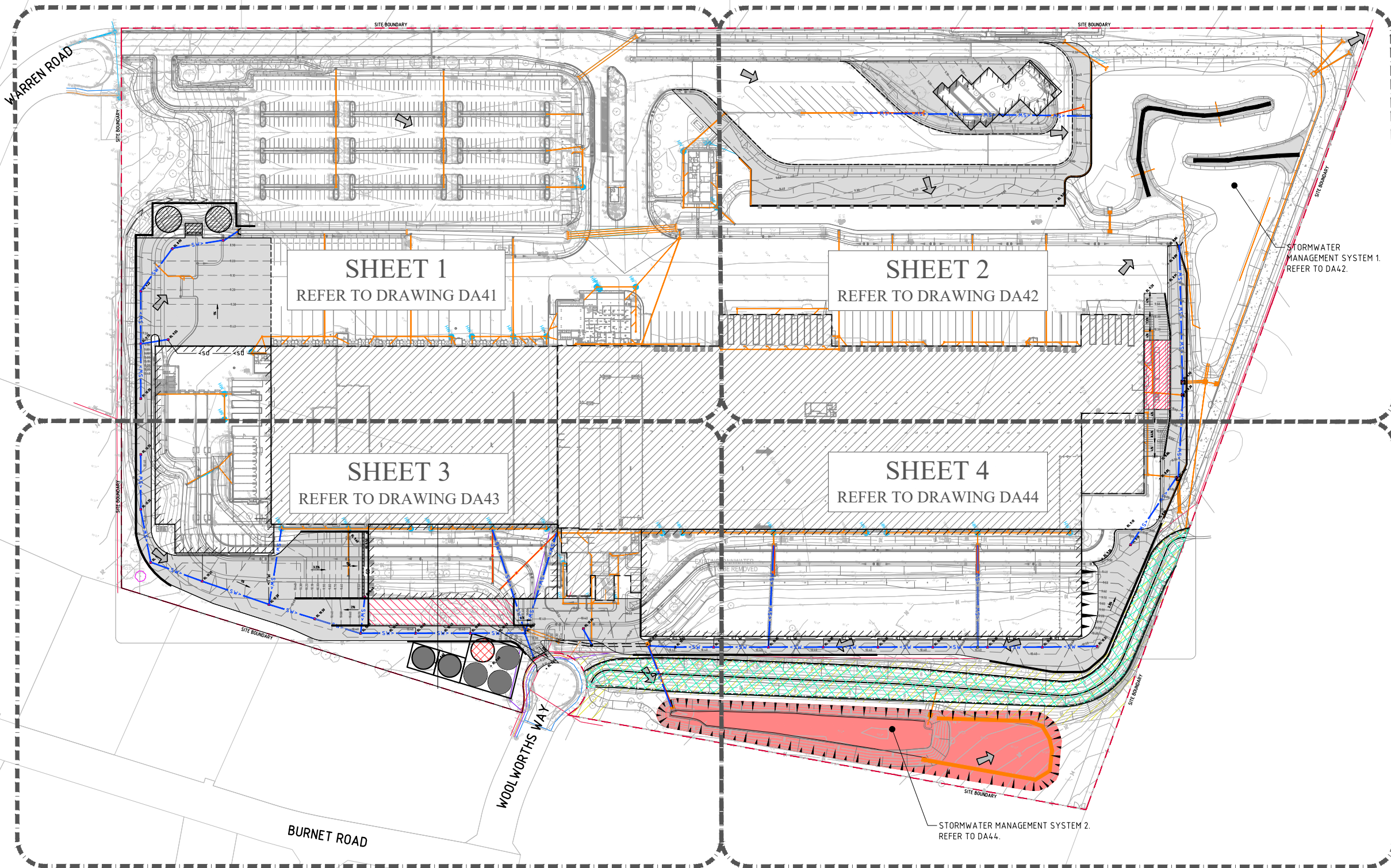
- ALL STORMWATER WORKS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS3500.3:2018 PLUMBING AND DRAINAGE, PART 3: STORMWATER DRAINAGE.
- THE MINOR (PIPED) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 20 YEAR ARI STORM EVENT AND THE MAJOR (OVERLAND) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 100 YEAR ARI STORM EVENT.
- ALL FINISHED PAVEMENT LEVELS SHALL BE AS INDICATED ON FINISHED LEVELS PLANS DA50.
- PIT SIZES SHALL BE AS INDICATED IN THE SCHEDULE WHILE PIPE SIZES AND DETAILS ARE PROVIDED ON PLAN.
- EXISTING STORMWATER PIT LOCATIONS AND INVERT LEVELS TO BE CONFIRMED BY SURVEY PRIOR TO COMMENCING WORKS ON SITE.
- ALL STORMWATER PIPES $\phi 375$ OR GREATER SHALL BE CLASS 2 (WITH HS2 SUPPORT) REINFORCED CONCRETE WITH RUBBER RING JOINTS UNLESS NOTED OTHERWISE.
- ALL PIPES UP TO AND INCLUDING $\phi 300$ TO BE uPVC GRADE SN8 UNO.
- PIPE CLASS NOMINATED ARE FOR IN-SERVICE LOADING CONDITIONS ONLY. CONTRACTOR IS TO MAKE ANY NECESSARY ADJUSTMENTS REQUIRED FOR CONSTRUCTION CONDITIONS.
- ALL CONCRETE PITS GREATER THAN 1000mm DEEP SHALL BE REINFORCED USING N12-200 EACH WAY CENTERED IN WALL AND BASE. LAP MINIMUM 300mm WHERE REQUIRED. ALL CONCRETE FOR PITS SHALL BE F'c=25 MPa. PRECAST PITS MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
- IN ADDITION TO ITEM 6 ABOVE, ALL CONCRETE PITS GREATER THAN 3000mm DEEP SHALL HAVE WALLS AND BASE THICKNESS INCREASED TO 200mm.
- PIPES SHALL BE LAID AS PER PIPE LAYING DETAILS. PARTICULAR CARE SHALL BE TAKEN TO ENSURE THAT THE PIPE IS FULLY AND EVENLY SUPPORTED. RAM AND PACK FILLING AROUND AND UNDER BACK OF PIPES AND PIPE FAUCETS, WITH NARROW EDGED RAMMERS OR OTHER SUITABLE TAMPING DETAILS.
- CONCRETE PIPES UNDER, OR WITHIN THE ZONE OF INFLUENCE OF PAVED AREAS SHALL BE LAID USING HS2 TYPE SUPPORT, AS A MINIMUM, IN ACCORDANCE WITH AS 3725. AGGREGATE BACKFILL SHALL NOT BE USED FOR PIPE BEDDING AND OR HAUNCH/SIDE SUPPORT.
- WHERE PIPE LINES ENTER PITS, PROVIDE 2m LENGTH OF STOCKING WRAPPED SLOTTED $\phi 100$ uPVC TO EACH SIDE OF PIPE.
- ALL SUBSOIL DRAINAGE LINES SHALL BE $\phi 100$ SLOTTED uPVC WITH APPROVED FILTER WRAP LAID IN 300mm WIDE GRANULAR FILTER UNLESS NOTED OTHERWISE. LAY SUBSOIL LINES TO MATCH FALLS OF LAND AND/OR 1 IN 200 MINIMUM. PROVIDE CAPPED CLEANING EYE (RODDING POINT) AT UPSTREAM END OF LINE AND AT 30m MAX. CTS. PROVIDE SUBSOIL LINES TO ALL PAVEMENT / LANDSCAPED INTERFACES, TO REAR OF RETAINING WALLS (AS NOMINATED BY STRUCTURAL ENGINEER) AND AS SHOWN ON PLAN.
- ALL PIPE GRADES 1 IN 200 MINIMUM UNO.
- PROVIDE STEP IRONS IN PITS DEEPER THAN 1000mm.
- MIN. 600 COVER TO PIPE OBVERT BENEATH ROADS & MIN. 400 COVER BENEATH LANDSCAPED AND PEDESTRIAN AREAS.
- PIT COVERS IN TRAFFICABLE PAVEMENT SHALL BE CLASS D 'HEAVY DUTY'. THOSE LOCATED IN NON-TRAFFICABLE AREAS SHALL BE CLASS B 'MEDIUM DUTY' U.N.O.
- PROVIDE CLEANING EYES (RODDING POINTS) TO PIPES AT ALL CORNERS AND T-JUNCTIONS WHERE NO PITS ARE PRESENT.
- DOWN PIPES (DP) TO BE AS PER HYDRAULIC ENGINEERS DETAILS WITH CONNECTOR TO MATCH DP SIZE U.N.O. ON PLAN. PROVIDE CLEANING EYE AT GROUND LEVEL.
- PIPE LENGTHS NOMINATED ON PLAN OR LONGSECTIONS ARE MEASURED FROM CENTER OF PITS TO THE NEAREST 0.5m AND DO NOT REPRESENT ACTUAL LENGTH. THE CONTRACTOR IS TO ALLOW FOR THIS.
- WHERE CONNECTION TO EXISTING INGROUND DRAINAGE SYSTEMS, OPEN SWALES, CHANNELS OR ANY OTHER EXISTING SYSTEM, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION AND INVERT ON SITE AT THE BEGINNING OF THE CONSTRUCTION PERIOD. REFER ANY VARIANCE FROM DOCUMENTATION OR SURVEYS TO THE ENGINEER FOR CLARIFICATION.

NOTE:

PITS TO BE FITTED WITH OCEAN PROTECT OCEAN GUARD OG200 PIT INSERTS SHOWN THUS TOTAL NO OF PIT INSERTS = 26

LEVELS NOTE:

LEVELS SHOWN TO BE +/-500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.



STORMWATER DRAINAGE MASTERPLAN
SCALE 1:1000

FOR DEVELOPMENT APPLICATION

10m 0 10 20 30 40 50 60 70 80 90 100m
SCALE 1:1000 AT B1 SIZE SHEET

ISSUED FOR DEVELOPMENT APPLICATION				PROJECT				CLIENT				CONSULTING ENGINEERS				DRAWING TITLE			
ISSUED FOR INFORMATION				WOOLWORTHS WYONG EXPANSION				11 WARREN ROAD, WARNERVALE, 2259, NSW				Costin Roe Consulting Pty Ltd.				STORMWATER DRAINAGE			
ISSUED FOR INFORMATION				11 WARREN ROAD, WARNERVALE, 2259, NSW				Level 4, 8 Windmill Street				Waltham Bay, Sydney NSW 2000				MASTER PLAN			
ISSUED FOR INFORMATION				11 WARREN ROAD, WARNERVALE, 2259, NSW				Tel: (02) 9551-7000 Fax: (02) 9541-3731				email: mail@costinroe.com.au @				DRAWING No			
AMENDMENTS				DESIGNED				D.S.				C08318.01-DA40				C08318.01-DA40			
				DRAWN				D.W.				MAR 2022				PRECISION | COMMUNICATION | ACCOUNTABILITY			
				CHECKED				M.W.				B1				ISSUE			
				SCALE				AS SHOWN				C08318.01-DA40				D			
				DATE				DATE				DATE				DATE			
				ISSUE				ISSUE				ISSUE				ISSUE			

NOTES:
1. REFER TO DRAWING DA40 FOR STORMWATER DRAINAGE NOTES.

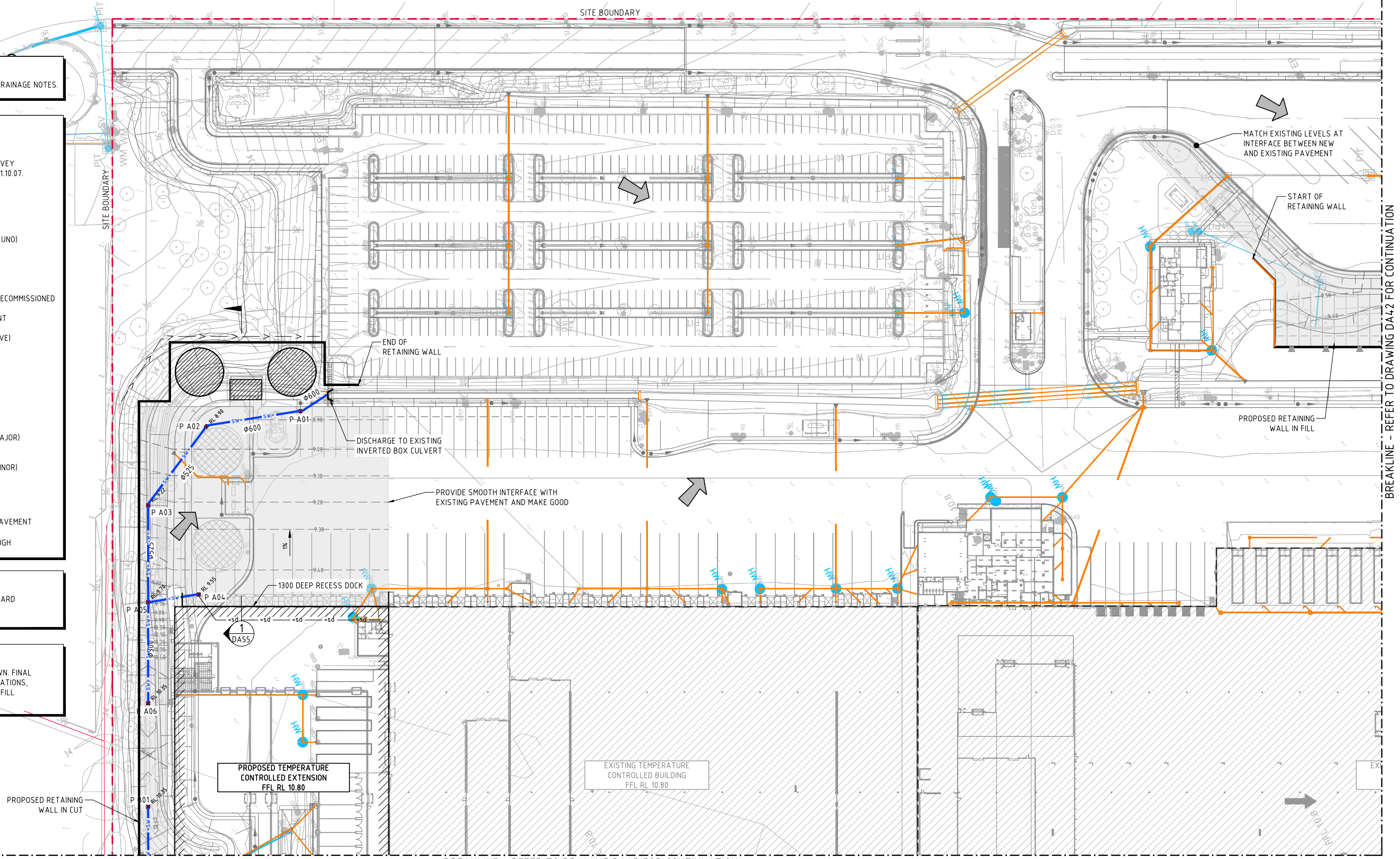
LEGEND:
LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY ADW JOHNSON DATED 21.10.07.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- GD, GRATED DRAIN (300W x 225D UNO)
- PROPOSED DRAINAGE LINE
- EXISTING DRAINAGE LINE
- EXISTING DRAINAGE LINE TO BE DECOMMISSIONED
- PROPOSED CONCRETE ENCASEMENT
- ROOFWATER DOWNPIPE (INDICATIVE)
- ROOFWATER LINE
- PROPOSED SYPHONIC LINE
- SUBSOIL LINE
- OVERLAND FLOW DIRECTION
- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- DENOTES EXISTING BUILDINGS
- DENOTES PROPOSED CONCRETE PAVEMENT
- DENOTES B-DOUBLE DRIVE THROUGH

NOTE:
PITS TO BE FITTED WITH OCEAN PROTECT OCEAN GUARD OG200 PIT INSERTS SHOWN THUS

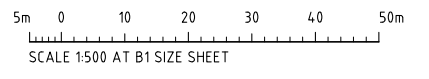
LEVELS NOTE:
LEVELS SHOWN TO BE $\pm 7-500$ mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.



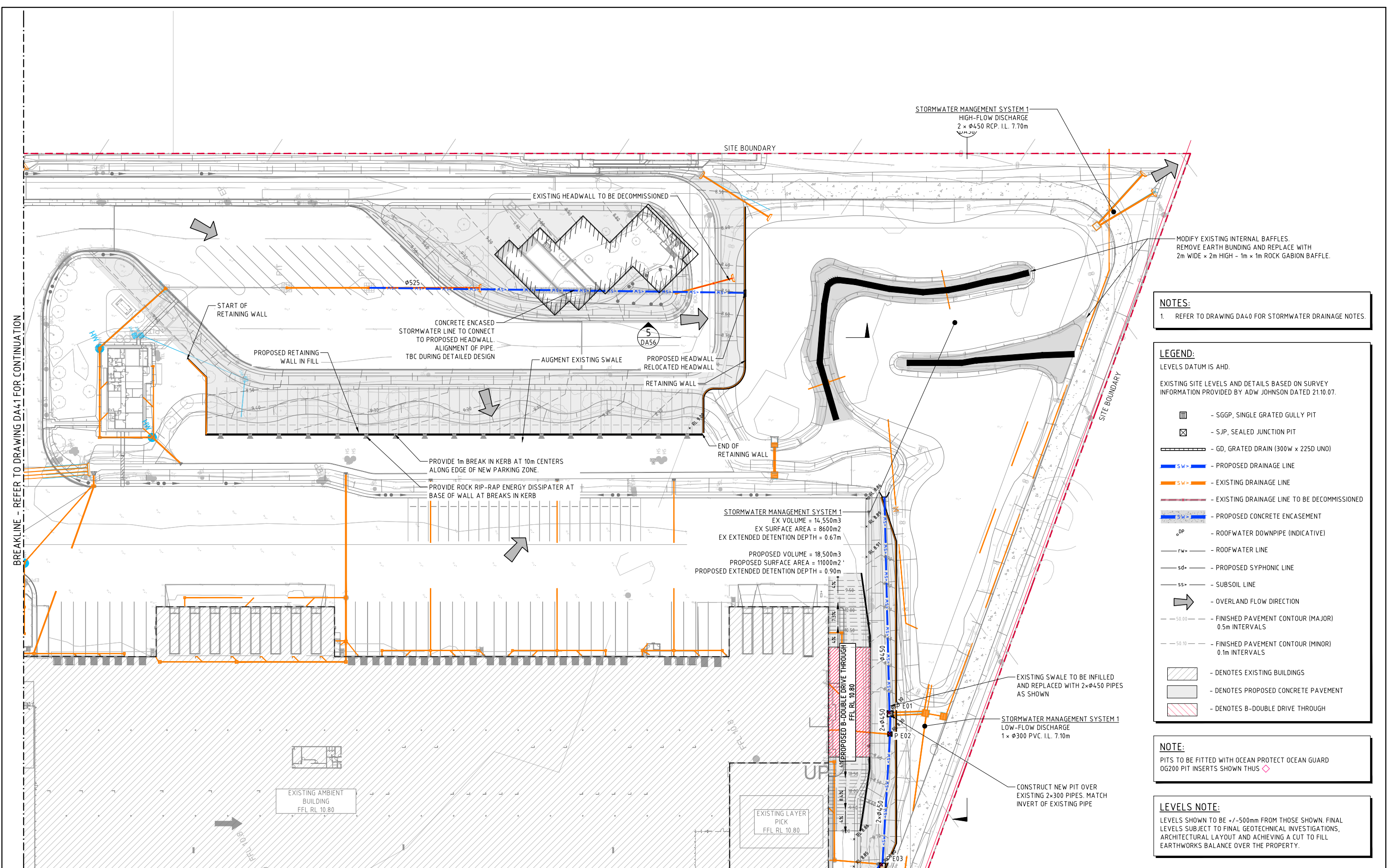
BREAKLINE - REFER TO DRAWING DA43 FOR CONTINUATION

STORMWATER DRAINAGE PLAN - SHEET 1
SCALE 1:500

FOR DEVELOPMENT APPLICATION



ISSUED FOR DEVELOPMENT APPLICATION				23.03.22				C			
ISSUED FOR INFORMATION				04.03.22				B			
ISSUED FOR INFORMATION				03.03.22				A			
AMENDMENTS				DATE	ISSUE	AMENDMENTS	DATE	ISSUE	AMENDMENTS	DATE	ISSUE
PROJECT				woolworths				woolworths			
CLIENT				woolworths				woolworths			
PROJECT				WOOLWORTHS WYONG EXPANSION				11 WARREN ROAD, WARNERVALE, 2259, NSW			
CONSULTANT				Costin Roe Consulting Pty Ltd.				Level 4, 8 Windmill Street			
DESIGNED				D.S.				D.W.			
DRAWN				MAR 2022				M.W.			
CHECKED				B1				AS SHOWN			
SCALE				1:500				1:500			
CAD REF:				C08318.01-DA41				C08318.01-DA41			
PRECISION				COMMUNICATION				ACCOUNTABILITY			
DRAWING TITLE				STORMWATER DRAINAGE PLAN				SHEET 1			
DRAWING No				C08318.01-DA41				C08318.01-DA41			
ISSUE				C				C			



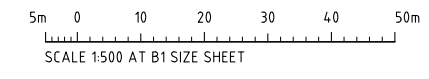
NOTES:
1. REFER TO DRAWING DA40 FOR STORMWATER DRAINAGE NOTES.

- LEGEND:**
LEVELS DATUM IS AHD.
- EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY ADW JOHNSON DATED 21.10.07.
- SGGP, SINGLE GRATED GULLY PIT
 - SJP, SEALED JUNCTION PIT
 - GD, GRATED DRAIN (300W x 225D UNO)
 - PROPOSED DRAINAGE LINE
 - EXISTING DRAINAGE LINE
 - EXISTING DRAINAGE LINE TO BE DECOMMISSIONED
 - PROPOSED CONCRETE ENCASEMENT
 - ROOFWATER DOWNPIPE (INDICATIVE)
 - ROOFWATER LINE
 - PROPOSED SYPHONIC LINE
 - SUBSOIL LINE
 - OVERLAND FLOW DIRECTION
 - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
 - FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
 - DENOTES EXISTING BUILDINGS
 - DENOTES PROPOSED CONCRETE PAVEMENT
 - DENOTES B-DOUBLE DRIVE THROUGH

NOTE:
PITS TO BE FITTED WITH OCEAN PROTECT OCEAN GUARD OG200 PIT INSERTS SHOWN THUS

LEVELS NOTE:
LEVELS SHOWN TO BE +/- 500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.

BREAKLINE - REFER TO DRAWING DA44 FOR CONTINUATION
STORMWATER DRAINAGE PLAN - SHEET 2
SCALE 1:500



FOR DEVELOPMENT APPLICATION

BREAKLINE - REFER TO DRAWING DA41 FOR CONTINUATION

NOTES:
1. REFER TO DRAWING DA40 FOR STORMWATER DRAINAGE NOTES.

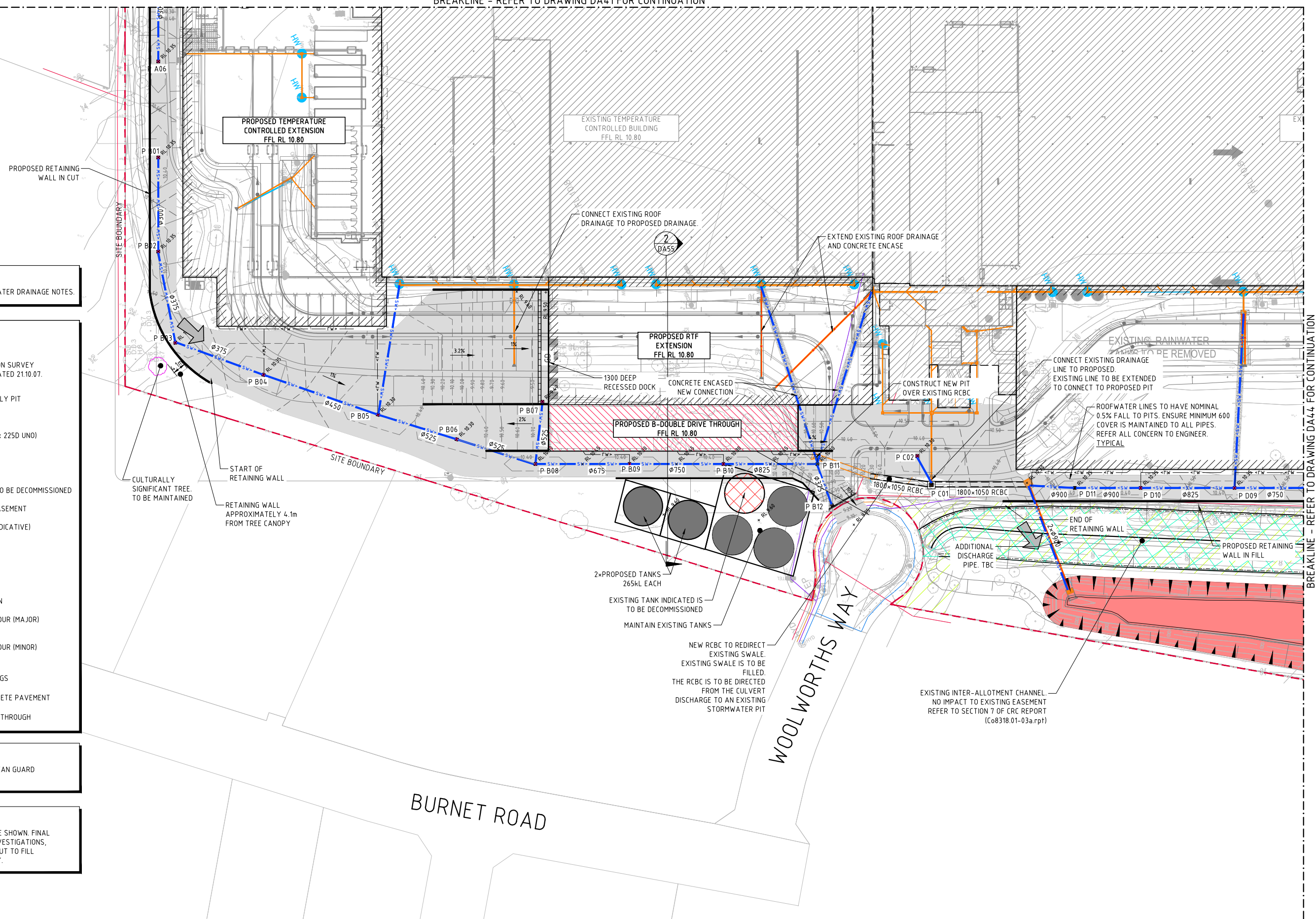
LEGEND:
LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY ADW JOHNSON DATED 21.10.07.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- GD, GRATED DRAIN (300W x 225D UNO)
- SW> - PROPOSED DRAINAGE LINE
- SW> - EXISTING DRAINAGE LINE
- SW> - EXISTING DRAINAGE LINE TO BE DECOMMISSIONED
- SW> - PROPOSED CONCRETE ENCASEMENT
- DP - ROOFWATER DOWNPIPE (INDICATIVE)
- RW> - ROOFWATER LINE
- SD> - PROPOSED SYPHONIC LINE
- SS> - SUBSOIL LINE
- OVERLAND FLOW DIRECTION
- 50.00 - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 - FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- DENOTES EXISTING BUILDINGS
- DENOTES PROPOSED CONCRETE PAVEMENT
- DENOTES B-DOUBLE DRIVE THROUGH

NOTE:
PITS TO BE FITTED WITH OCEAN PROTECT OCEAN GUARD OG200 PIT INSERTS SHOWN THUS 

LEVELS NOTE:
LEVELS SHOWN TO BE +/-500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.



STORMWATER DRAINAGE PLAN - SHEET 3
SCALE 1:500

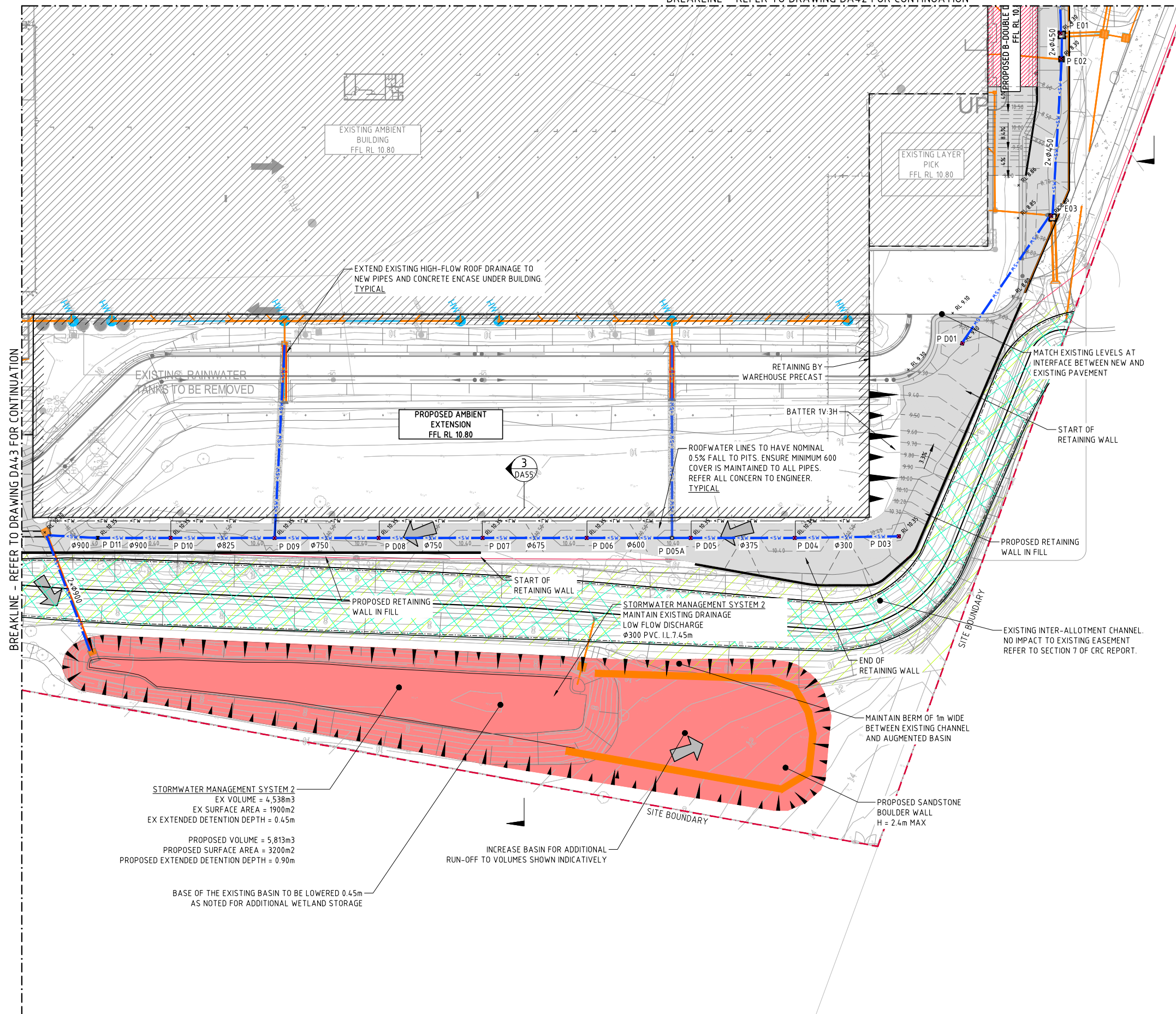
FOR DEVELOPMENT APPLICATION

5m 0 10 20 30 40 50m
SCALE 1:500 AT B1 SIZE SHEET

			ARCHITECT		CLIENT		PROJECT				Costin Roe Consulting Pty Ltd. Consulting Engineers  Level 4, 8 Windmill Street Wahia Bay, Sydney NSW 2000 Tel: (02) 9551-7000 Fax: (02) 9541-3751 email: mail@costinroe.com.au @				DRAWING TITLE STORMWATER DRAINAGE PLAN SHEET 3			
ISSUED FOR DEVELOPMENT APPLICATION 23.03.22 D							WOOLWORTHS WYONG EXPANSION								DRAWING No		C08318.01-DA43	
ISSUED FOR INFORMATION 09.03.22 C							11 WARREN ROAD, WARNERVALE, 2259, NSW								ISSUE		D	
ISSUED FOR INFORMATION 04.03.22 B																		
ISSUED FOR INFORMATION 03.03.22 A																		
AMENDMENTS			DATE	ISSUE	AMENDMENTS		DATE	ISSUE										

BREAKLINE - REFER TO DRAWING DA42 FOR CONTINUATION

BREAKLINE - REFER TO DRAWING DA43 FOR CONTINUATION





1. PROPRIETARY T-PIECE CONNECTORS SHALL BE USED TO WHERE DIRECT CONNECTIONS ARE REQUIRED TO uPVC PIPES.
2. ALL JOINTS TO BE SEALED WITH SOLVENT WELDED JOINTS.
3. THE PVC PIPE SHALL NOT PROTRUDE BEYOND THE INNER SURFACE OF THE STORMWATER PIPE.

SECTION 1:20

TYPICAL ACROSS PIPE

1

-

NOTE :
DURING THE ENCASEMENT PROCESS THE CONTRACTOR IS TO PROVIDE SUPPORT TO THE PIPE TO PREVENT PIPE MOVEMENT AND/OR FLOAT. CONCRETE ENCASEMENT TO BE INSTALLED IN 2 POURS.



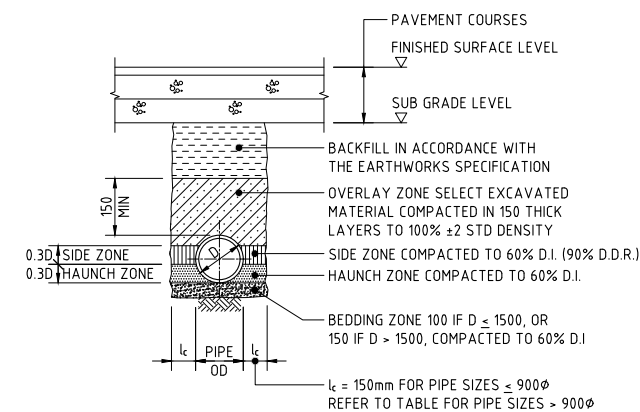
The diagram illustrates the cross-section of a trench for pipe bedding. The layers and dimensions are as follows:

- FINISHED SURFACE LEVEL**: Indicated by a triangle symbol (∇) at the top of the trench.
- BACKFILL IN ACCORDANCE WITH THE EARTHWORKS SPECIFICATION**: The top layer of the trench, shown with a dashed pattern.
- OVERLAY ZONE SELECT EXCAVATED MATERIAL COMPACTED IN 150 THICK LAYERS TO 90% STD. DENSITY**: A layer 300 units thick, shown with a diagonal hatching pattern.
- HAUNCH ZONE COMPACTED TO 60% D.I.**: A layer 0.3D units thick, shown with a cross-hatching pattern.
- 100 BEDDING COMPACTED TO 60% D.I.**: The base layer of the trench, shown with a brick-like pattern.
- PIPE**: The pipe itself, with diameter ϕ and outside diameter OD .
- Dimensions**:
 - l_c : The length of the bedding on either side of the pipe.
 - $l_c = 150\text{mm}$ FOR PIPE SIZES $\leq 900\phi$
 - REFER TO TABLE FOR PIPE SIZES $> 900\phi$

TYPE H1 SUPPORT TO CONCRETE PIPES AT LANDSCAPED AREAS
SCALE 1:20

SIDE ZONE WIDTH	
PIPE SIZE (mm)	ℓ (mm)
≤ 900φ	150
1050φ	175
1200φ	200
1350φ	225
1500φ	250
1650φ	275
1800φ	300

ENGINEER TO SPECIFY TRENCH WIDTHS FOR PIPE SIZES GREATER THAN 1800φ



TYPE HS2 SUPPORT TO CONCRETE PIPES UNDER PAVEMENT

SCALE 1:20
D ≤ 1350, MAX FILL = 4.0m
D > 1350, MAX FILL = 3.0m

The diagram illustrates the cross-section of a pipe installation. Key components and labels include:

- PAVEMENT COURSES**: Indicated at the top right.
- FINISHED SURFACE LEVEL**: Marked with a downward arrow and a triangle symbol.
- SUB GRADE LEVEL**: Marked with a downward arrow and a triangle symbol.
- BACKFILL IN ACCORDANCE WITH THE EARTHWORKS SPECIFICATION**: The material filling the trench above the bedding zone.
- OVERLAY ZONE SELECT EXCAVATED MATERIAL COMPACTED IN 150 THICK LAYERS TO 100% $\pm$ STD DENSITY**: A layer within the backfill.
- SIDE ZONE COMPACTED TO 70% D.I. (95% D.D.R.)**: The material on the sides of the pipe.
- HAUNCH ZONE COMPACTED TO 70% D.I.**: The material directly above the pipe.
- BEDDING ZONE 100 IF D $\leq$ 1500, OR 150 IF D > 1500, COMPACTED TO 70% D.I.**: The layer directly beneath the pipe.
- PIPE**: The main component being installed, with **OD** (Outside Diameter) labeled.
- Dimensions**:
 - 150 MIN**: Minimum thickness of the bedding zone.
 - 0.30 SIDE ZONE** and **0.30 HAUNCH ZONE**: Indicated on the left side of the pipe.
 - l_c** : Compaction length, shown at the bottom of the bedding zone.

Additional notes at the bottom of the diagram:

- $l_c = 150\text{mm}$ FOR PIPE SIZES $\leq 900\phi$
- REFER TO TABLE FOR PIPE SIZES $> 900\phi$

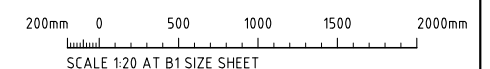
TYPE HS3 SUPPORT TO CONCRETE PIPES UNDER PAVEMENT

SCALE 1:20
 $D \leq 1050$, MAX FILL = 6.0m
 $D > 1050$, MAX FILL = 4.8m

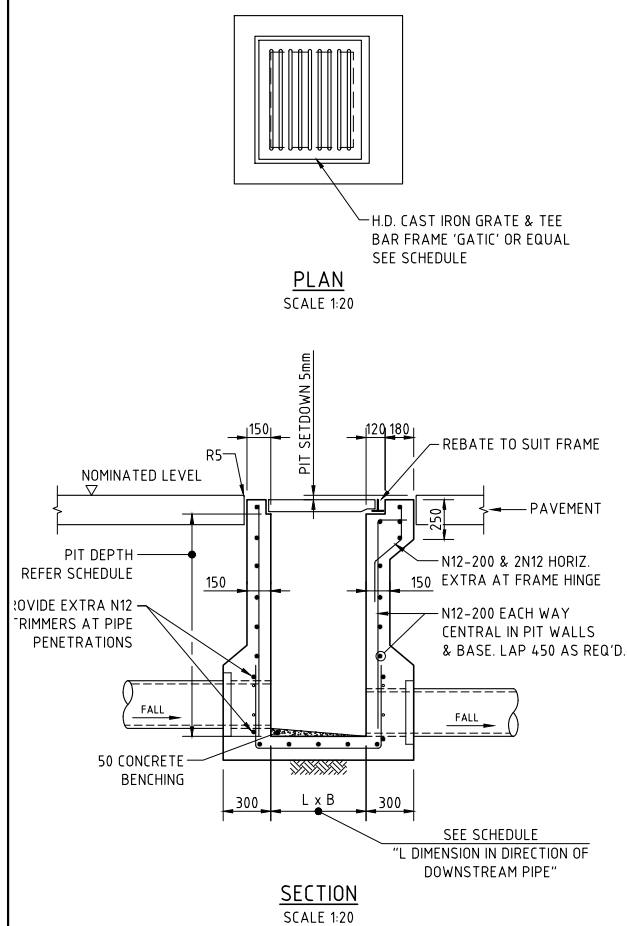
SIDE ZONE WIDTH	
PIPE SIZE (mm)	t_c (mm)
$\leq 900 \phi$	150
1050 ϕ	175
1200 ϕ	200
1350 ϕ	225
1500 ϕ	250
1650 ϕ	275
1800 ϕ	300
ENGINEER TO SPECIFY TRENCH WIDTHS FOR PIPE SIZES GREATER THAN 1800 ϕ .	

SIDE ZONE MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
9.5	100 TO 50
2.6	100 TO 30
0.60	50 TO 15
0.075	25 TO 0

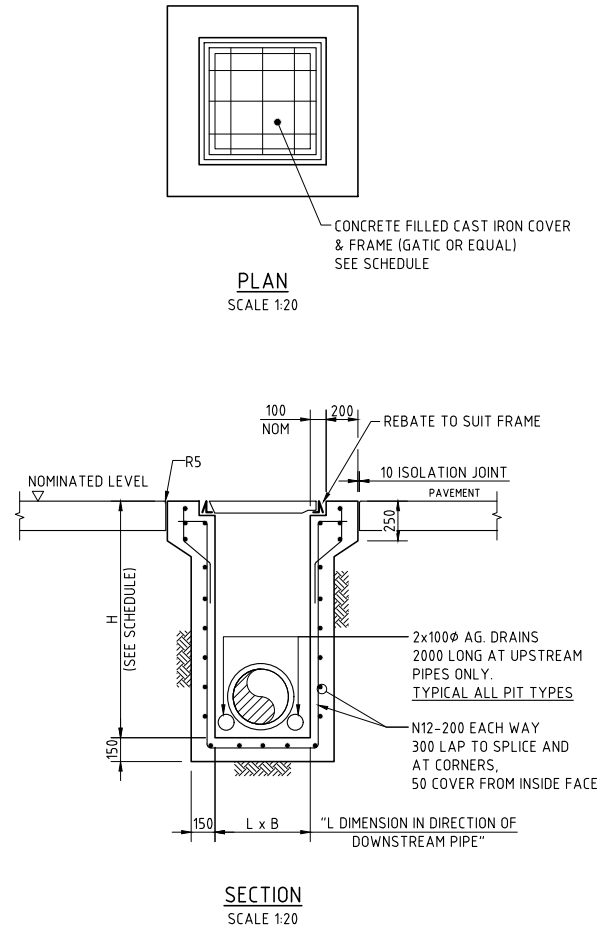
SELECT FILL MATERIAL IN ACCORDANCE WITH
TABLE 1.A.5.2.2.5.



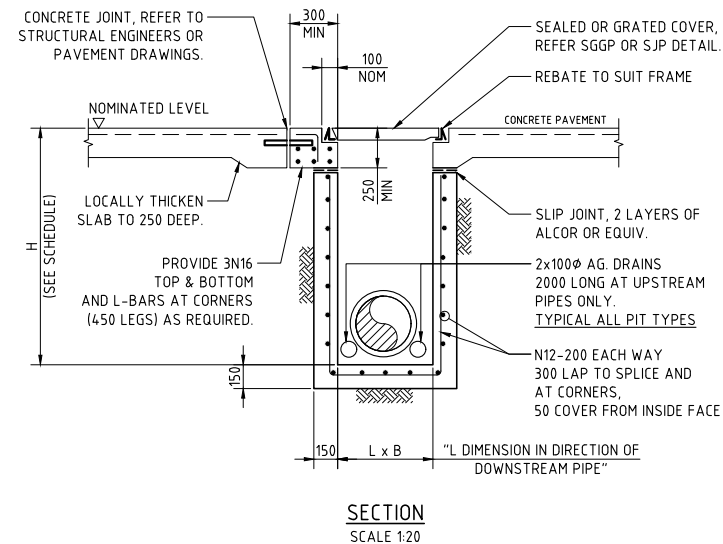
FOR DEVELOPMENT APPLICATION



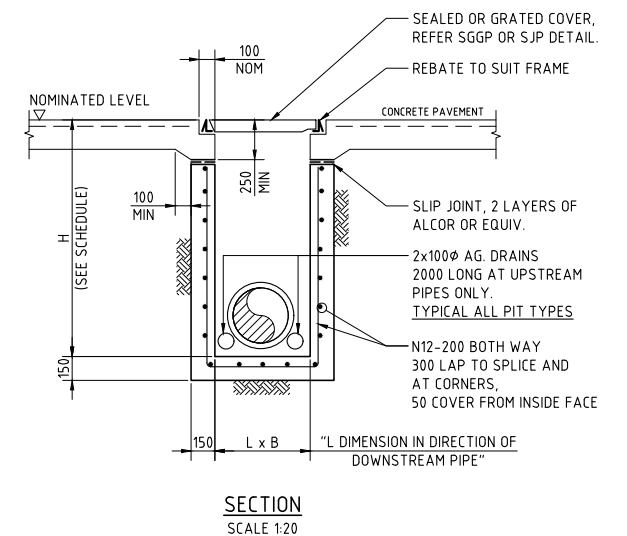
SINGLE GRATED GULLY PIT - SGGP



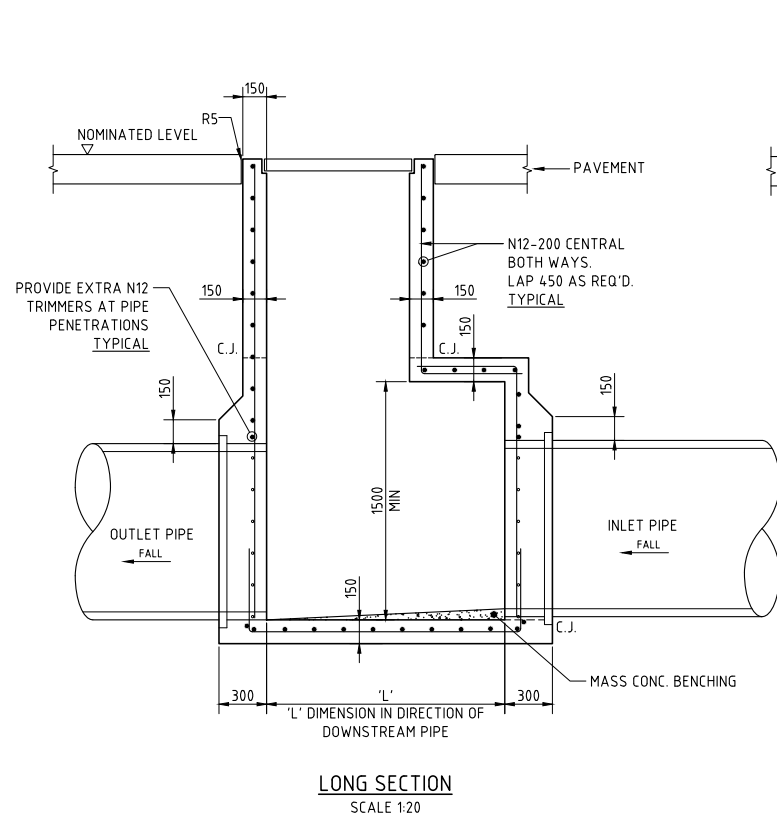
SEALED JUNCTION PIT - SJP



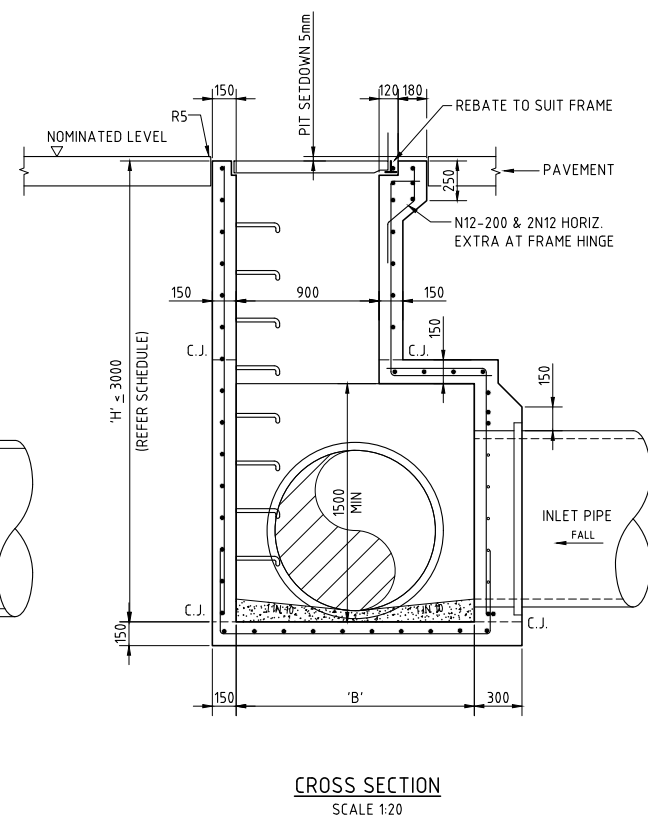
**SJP/CIS & SGGP/CIS (CAST IN SLAB) PIT DETAIL
GRATE/COVER SUPPORT
CAST-INTO PAVEMENT SLAB
(ADOPT IN CONCRETE PAVEMENT FOR SGGP's & SJP's,
WHERE PITS ARE LOCATED IN THE CORNER OF SLAB
PANELS OR ADJACENT TO SLAB PANEL JOINTS)**



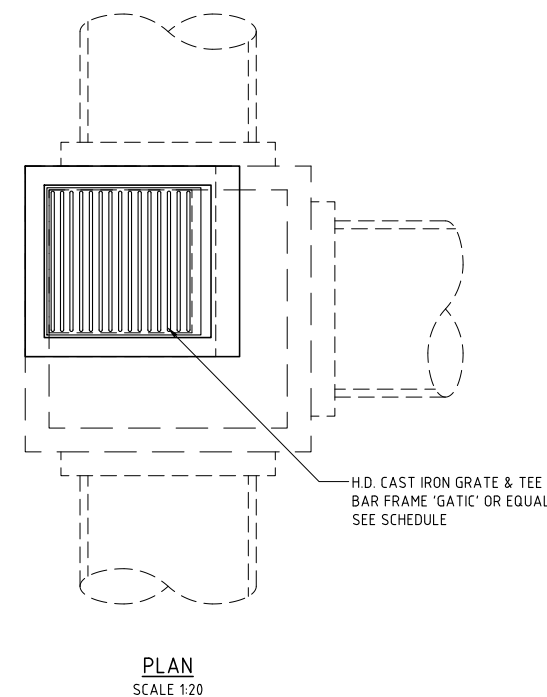
**SJP/CIS & SGGP/CIS (CAST IN SLAB) PIT DETAIL
GRATE/COVER SUPPORT
CAST-INTO PAVEMENT SLAB
(ADOPT IN CONCRETE PAVEMENTS FOR SGGP's & SJP's, WHERE
JOINTS ARE NOT LOCATED WITHIN PROXIMITY OF THE GRATE)**



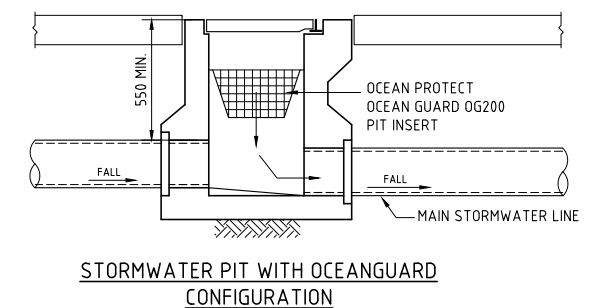
**LONG SECTION
SCALE 1:20**



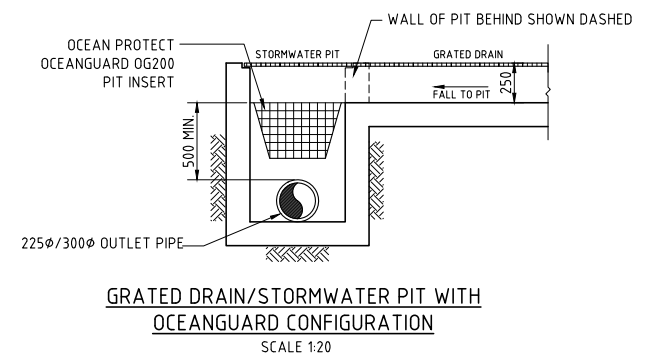
**CROSS SECTION
SCALE 1:20**



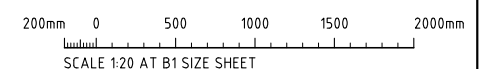
**TAPERED SINGLE GRATED GULLY PIT - SGGP
SUBSOIL NOT SHOWN
FOR CLARITY**



**STORMWATER PIT WITH OCEANGUARD
CONFIGURATION**



**GRATED DRAIN/STORMWATER PIT WITH
OCEANGUARD CONFIGURATION
SCALE 1:20**



FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION ISSUED FOR INFORMATION AMENDMENTS	22.03.22 03.03.22 DATE ISSUE AMENDMENTS DATE ISSUE	ARCHITECT watson young	CLIENT woolworths	PROJECT WOOLWORTHS WYONG EXPANSION 11 WARREN ROAD, WARNERVALE, 2259, NSW	CONSULTING ENGINEERS Costin Roe Consulting Pty Ltd. Level 4, 8 Windmill Street Wah Bay, Sydney NSW 2000 Tel: (02) 9551-7000 Fax: (02) 9541-3731 email: mail@costinroe.com.au ©	Costin Roe Consulting PRECISION | COMMUNICATION | ACCOUNTABILITY	DRAWING TITLE STORMWATER DRAINAGE DETAILS SHEET 2 DRAWING No C08318.01-DA46 ISSUE B
---	---	---	--	--	---	---	---

LEGEND:

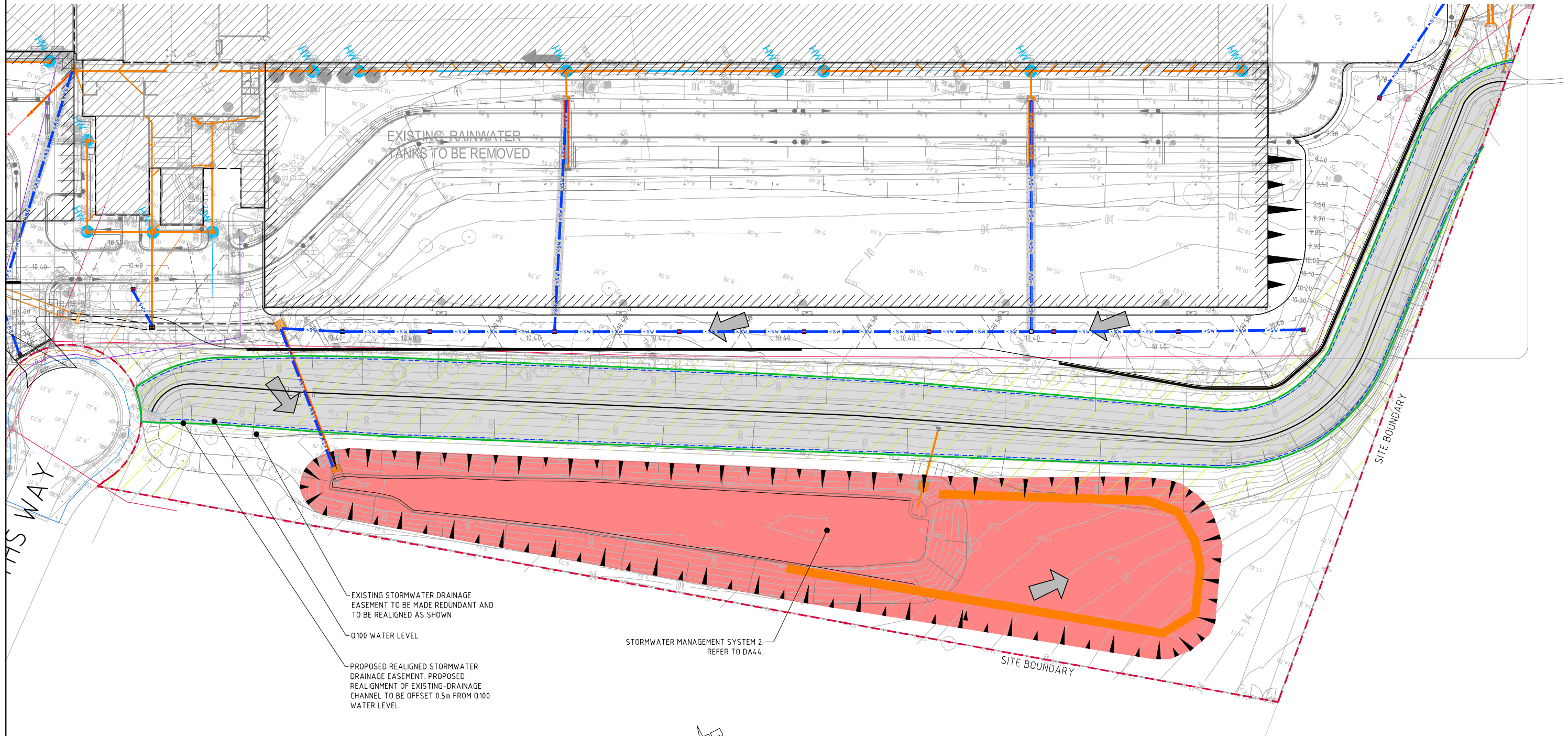
LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY ADW JOHNSON DATED 21.10.07.

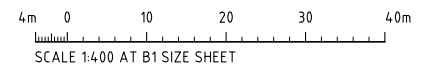
- | | | | | | | | | | |
|---|--------------------------------------|---|---|---|--|---|--------------------------------------|---|---|
|  | - SGGP, SINGLE GRATED GULLY PIT |  | - EXISTING SWALE |  | - SUBSOIL LINE |  | - DENOTES EXISTING BUILDINGS |  | - DENOTES EXISTING STORMWATER EASEMENT |
|  | - SJP, SEALED JUNCTION PIT |  | - EXISTING DRAINAGE LINE TO BE DECOMMISSIONED |  | - PROPOSED SYPHONIC LINE |  | - DENOTES PROPOSED CONCRETE PAVEMENT |  | - DENOTES REALIGNED STORMWATER EASEMENT |
|  | - GD, GRATED DRAIN (300W x 225D UNO) |  | - PROPOSED CONCRETE ENCASEMENT |  | - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS |  | - OVERLAND FLOW DIRECTION |  | - DENOTES BASIN |
|  | - PROPOSED DRAINAGE LINE |  | - ROOFWATER DOWNPIPE (INDICATIVE) |  | - FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS | | | | |
|  | - EXISTING DRAINAGE LINE |  | - ROOFWATER LINE | | | | | | |

LEVELS NOTE:

LEVELS SHOWN TO BE +/-500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.

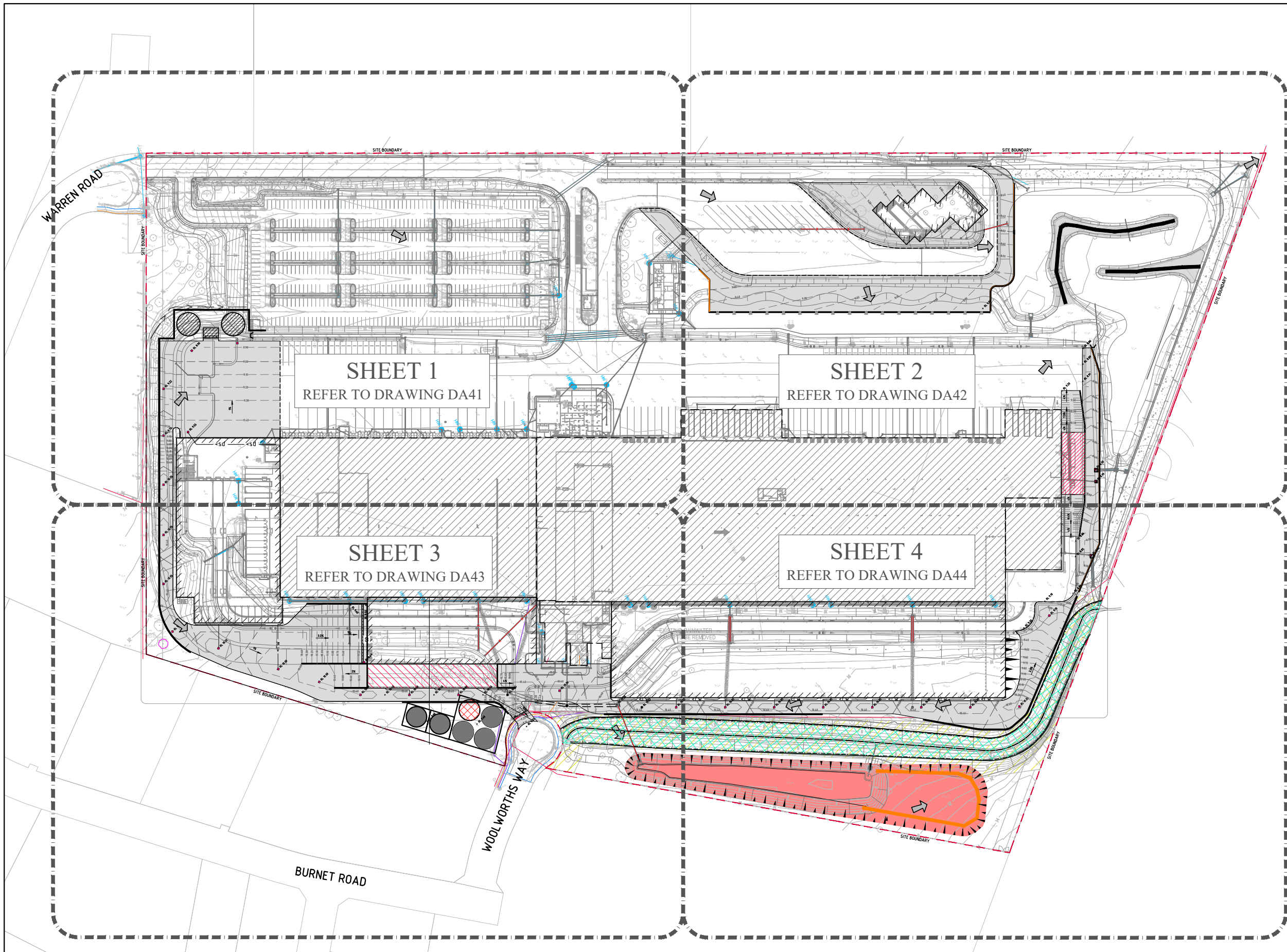


STORMWATER EASEMENT PLAN
SCALE 1:400



FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION		23.03.22	A	AMENDMENTS	DATE	ISSUE	ARCHITECT	CLIENT	PROJECT	DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF.	Costin Roe Consulting Pty Ltd. Consulting Engineers Level 4, 8 Windmill Street Wahib Bay, Sydney NSW 2000 Tel: (02) 9551-7000 Fax: (02) 9541-3731 email: mail@costinroe.com.au @		Costin Roe Consulting		DRAWING TITLE	DRAWING No	ISSUE
AMENDMENTS		DATE	ISSUE	AMENDMENTS	DATE	ISSUE	watson young	woolworths	WOOLWORTHS WYONG EXPANSION 11 WARREN ROAD, WARNERVALE, 2259, NSW	D.S.	D.W.	MAR 2022	M.W.	B1	AS SHOWN	C08318.01-DA47					STORMWATER EASEMENT PLAN	C08318.01-DA47	A



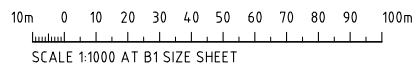
LEGEND:
LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- GD, GRATED DRAIN (300W x 225D UNO)
- 50.00 - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 - FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS

- FINISHED LEVELS PLAN NOTES:**
- LEVELS DATUM IS AUSTRALIAN HEIGHT DATUM (A.H.D.).
 - GRADING REQUIREMENTS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS2890.1, AS2890.2 AND AS2890.6.
 - ALL CONTOUR LINES & SPOT LEVELS INDICATE FINISHED PAVEMENT LEVELS U.N.O. ON PLAN.
 - CONTOUR INTERVALS
 - THE MINOR CONTOUR INTERVAL IS 0.1m.
 - THE MAJOR CONTOUR INTERVAL IS 0.5m.
 - HARDSTAND GRADING
 - MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%).
 - GRADING OF ON-GRADE DOCKS TO BE 1:100 (1%) FALL AWAY FROM THE DOCK FACE FOR A LENGTH OF 15m U.N.O.
 - GRADING OF TRUCK CIRCULATION ZONES TO BE MINIMUM AS NOTED ABOVE, 3-4% NOMINAL AND MAX. 5%.
 - CAR PARKING AREA GRADES
 - MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%), DESIRABLE MINIMUM GRADE 1:50 (2%).
 - MAXIMUM PAVEMENT GRADE IS TO BE 1:20 (5%) IN CARPARKING AREAS AND 1:25 (4%) ELSEWHERE.
 - DISABLED ACCESS PARKING ZONES AND SHARED SPACE TO BE MAXIMUM OF 1:33 (3%) IN ASPHALT PAVEMENT AND MAXIMUM OF 1:40 (2.5%) IN CONCRETE PAVEMENT.
 - CARPARK RAMP GRADES TO BE MAX 1:5 WITH 2.5m SMOOTH TRANSITION AT TOP AND BOTTOM U.N.O.
 - TRUCK RAMP GRADES
 - MAXIMUM B-DOUBLE OR 19.0m AV RAMP GRADES ARE TO BE 1:8.3 (12%) U.N.O. ON PLAN
 - PROVIDE MINIMUM 4.0m LONG TRANSITION WHERE CHANGES OF GRADE EXCEED 1:20 (5%) AT A CREST U.N.O.
 - PROVIDE MINIMUM 3.0m LONG TRANSITION WHERE CHANGE OF GRADE EXCEED 1:20 (5%) AT A SAG U.N.O.
 - TRANSITIONS ARE TO PROVIDE A SMOOTH CONTINUOUS CIRCULAR AND TANGENTIAL CHANGE IN GRADE TO ENSURE NO SHARP OR ACUTE CHANGES IN GRADE ARE PRESENT.
 - WHERE FIRE BRIGADE ACCESS IS REQUIRED, MAXIMUM RAMP GRADIENTS ARE TO BE 1:6 (16.6%), DESIRABLE RAMP GRADIENTS ARE TO BE 1:8 (12.5%) WITH 7m TRANSITION TOP AND BOTTOM U.N.O. ON PLAN.
 - PERMANENT BATTER SLOPES ARE TO HAVE A MAXIMUM GRADE OF 1V:3H U.N.O. BASED ON GEOTECHNICAL ASSESSMENT. PROVIDE MINIMUM 0.5m BERM BETWEEN THE BACK OF KERB OR PAVEMENT EDGES AND THE TOP OR TOE OF A BATTER.
 - ALL BATTER SLOPE WITH GRADES AT OR EXCEEDING 1V:6H ARE TO BE TURFED IMMEDIATELY OR APPROPRIATE EROSION CONTROL IS TO BE PROVIDED TO THE SATISFACTION OF THE ENGINEER.
 - ALL FOOTPATHS ARE TO FALL AWAY FROM THE BUILDING AT 2.5% NOMINAL GRADE.
 - ALL PAVEMENTS ARE TO BE SET AT 30mm BELOW THE FINISHED FLOOR LEVEL OF THE WAREHOUSE AND OFFICE AREAS. PROVIDE LOCAL FEATHERING AT DOORWAYS OR ROLLER SHUTTERS TO PROVIDE FLUSH FINISH AS REQUIRED.
 - WHERE NEW AND EXISTING INTERFACING IS REQUIRED, MATCH EXISTING LEVELS AND PROVIDE SMOOTH INTERFACE BETWEEN NEW AND EXISTING GRADIENTS. REFER ANY CONCERNS TO THE ENGINEER.

LEVELS NOTE:
LEVELS SHOWN TO BE +/-500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.

FINISHED LEVELS MASTER PLAN
SCALE 1:1000



FOR DEVELOPMENT APPLICATION

LEGEND:
LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- GD, GRATED DRAIN (300W x 225D UNO)
- 50.00 - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 - FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- DENOTES NEW WETLAND OFFSET
- DENOTES EXISTING BUILDINGS
- DENOTES PROPOSED CONCRETE PAVEMENT

NOTES:
1. REFER TO DRAWING DA50 FOR FINISHED LEVELS NOTES.

LEVELS NOTE:
LEVELS SHOWN TO BE +/-500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.

PROPOSED RETAINING WALL IN CUT TYPE 2 CANTILEVER BLOCK AND PILE WALL
L = 300m
H = 5.0m MAX
A = 1,000m² (APPROX)

PROPOSED TEMPERATURE CONTROLLED EXTENSION
FFL RL 10.80

EXISTING TEMPERATURE CONTROLLED BUILDING
FFL RL 10.80

PROPOSED RETAINING WALL IN FILL REINFORCED EARTH
L = 200m
H = 1.2m MAX
A = 240m² (APPROX)

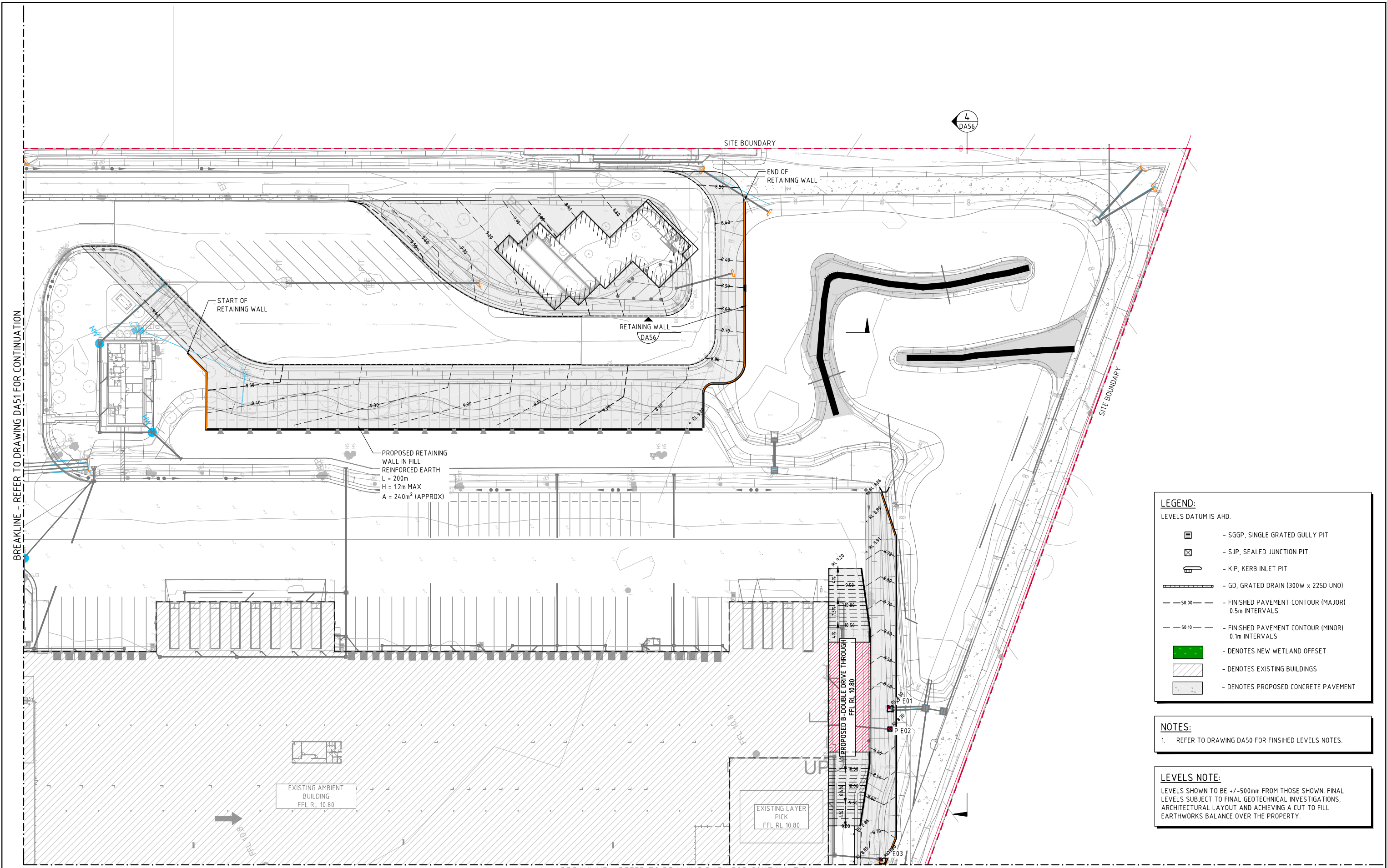
BREAKLINE - REFER TO DRAWING DA53 FOR CONTINUATION

FINISHED LEVELS PLAN - SHEET 1
SCALE 1:500

5m 0 10 20 30 40 50m
SCALE 1:500 AT B1 SIZE SHEET

FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION ISSUED FOR INFORMATION ISSUED FOR INFORMATION AMENDMENTS				23.03.22 04.03.22 03.03.22 DATE				C B A ISSUE				AMENDMENTS DATE ISSUE				ARCHITECT watson young				CLIENT woolworths				PROJECT WOOLWORTHS WYONG EXPANSION 11 WARREN ROAD, WARNERVALE, 2259, NSW				CONSULTING ENGINEERS Costin Roe Consulting Pty Ltd. Level 4, 8 Windmill Street Wahib Bay, Sydney NSW 2000 Tel: (02) 9551-7000 Fax: (02) 9541-3731 email: mail@costinroe.com.au @				DRAWING TITLE FINISHED LEVELS PLAN SHEET 1				DRAWING No C08318.01-DA51				PRECISION | COMMUNICATION | ACCOUNTABILITY				ISSUE C			
--	--	--	--	--	--	--	--	----------------------	--	--	--	-----------------------------	--	--	--	---------------------------	--	--	--	----------------------	--	--	--	--	--	--	--	---	--	--	--	--	--	--	--	------------------------------	--	--	--	--	--	--	--	------------	--	--	--



BREAKLINE - REFER TO DRAWING DA51 FOR CONTINUATION

BREAKLINE - REFER TO DRAWING DA54 FOR CONTINUATION

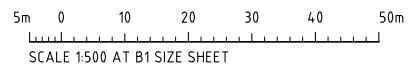
FINISHED LEVELS PLAN - SHEET 2
SCALE 1:500

LEGEND:
LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- GD, GRATED DRAIN (300W x 225D UNO)
- 50.00 - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 - FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- DENOTES NEW WETLAND OFFSET
- DENOTES EXISTING BUILDINGS
- DENOTES PROPOSED CONCRETE PAVEMENT

NOTES:
1. REFER TO DRAWING DA50 FOR FINISHED LEVELS NOTES.

LEVELS NOTE:
LEVELS SHOWN TO BE +/-500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.



FOR DEVELOPMENT APPLICATION

BURNET ROAD

WOOLWORTHS WAY

LEGEND:
LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- GD, GRATED DRAIN (300W x 225D UNO)
- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- DENOTES NEW WETLAND OFFSET
- DENOTES EXISTING BUILDINGS
- DENOTES PROPOSED CONCRETE PAVEMENT

NOTES:
1. REFER TO DRAWING DA50 FOR FINISHED LEVELS NOTES.

LEVELS NOTE:
LEVELS SHOWN TO BE +/-500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.

PROPOSED RETAINING WALL IN CUT TYPE 2 CANTILEVER BLOCK AND PIPE WALL
L = 300m
H = 5.0m MAX
A = 1,000m² (APPROX)

PROPOSED TEMPERATURE CONTROLLED EXTENSION
FFL RL 10.80

EXISTING TEMPERATURE CONTROLLED BUILDING
FFL RL 10.80

PROPOSED RTF EXTENSION
FFL RL 10.80

PROPOSED B-DOUBLE DRIVE THROUGH
FFL RL 10.80

EXISTING RAINWATER TANKS TO BE REMOVED

PROPOSED RETAINING WALL IN FILL REINFORCED EARTH
L = 130m
H = 2.0m MAX
A = 100m² (APPROX)

BREAKLINE - REFER TO DRAWING DA51 FOR CONTINUATION

BREAKLINE - REFER TO DRAWING DA54 FOR CONTINUATION

	- SGGP, SINGLE GRATED GULLY PIT
	- SJP, SEALED JUNCTION PIT
	- KIP, KERB INLET PIT
	- GD, GRATED DRAIN (300W x 225D UNO)
	- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
	- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
	- DENOTES NEW WETLAND OFFSET
	- DENOTES EXISTING BUILDINGS
	- DENOTES PROPOSED CONCRETE PAVEMENT

1. REFER TO DRAWING DA50 FOR FINISHED LEVELS NOTES.

LEVELS SHOWN TO BE +/-500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.

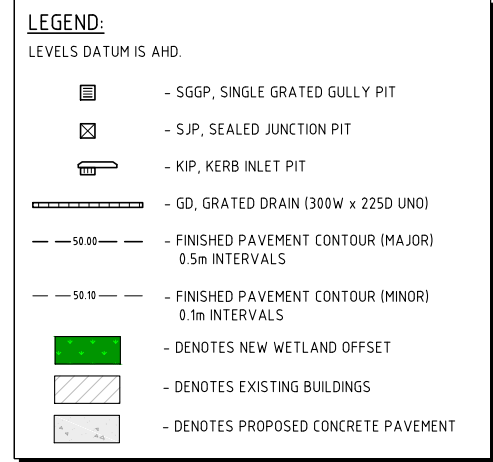
BREA KLINE - REFER TO DRAWING D434 FOR CONTINUATION

FOR DEVELOPMENT APPLICATION

5m 0 10 20 30 40 50m
SCALE 1:500 AT B1 SIZE SHEET

			ARCHITECT		CLIENT		PROJECT				Costin Roe Consulting Pty Ltd. Consulting Engineers  Level 4, 8 Windmill Street Walsh Bay, Sydney NSW 2000 Tel: (02) 9551-7000 Fax: (02) 9541-3751 email: mail@costinroe.com.au @				DRAWING TITLE FINISHED LEVELS PLAN SHEET 3	
ISSUED FOR DEVELOPMENT APPLICATION	23.03.22	D					WOOLWORTHS WYONG EXPANSION 11 WARREN ROAD, WARNERVALE, 2259, NSW						PRECISION | COMMUNICATION | ACCOUNTABILITY		DRAWING No C08318.01-DA53	
ISSUED FOR INFORMATION	09.03.22	C							DESIGNED D.S. MAR '2022						ISSUE D	
ISSUED FOR INFORMATION	04.03.22	B							DRAWN D.W.							
ISSUED FOR INFORMATION	03.03.22	A							CHECKED M.W.							
AMENDMENTS	DATE	ISSUE	AMENDMENTS		DATE		ISSUE		SIZE B1							
									SCALE AS SHOWN							
									CAD REF: C08318.01-DA53							

BREAKLINE - REFER TO DRAWING DA53 FOR CONTINUATION



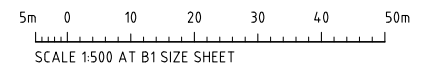
NOTES:

1. REFER TO DRAWING DA50 FOR FINISHED LEVELS NOTES.

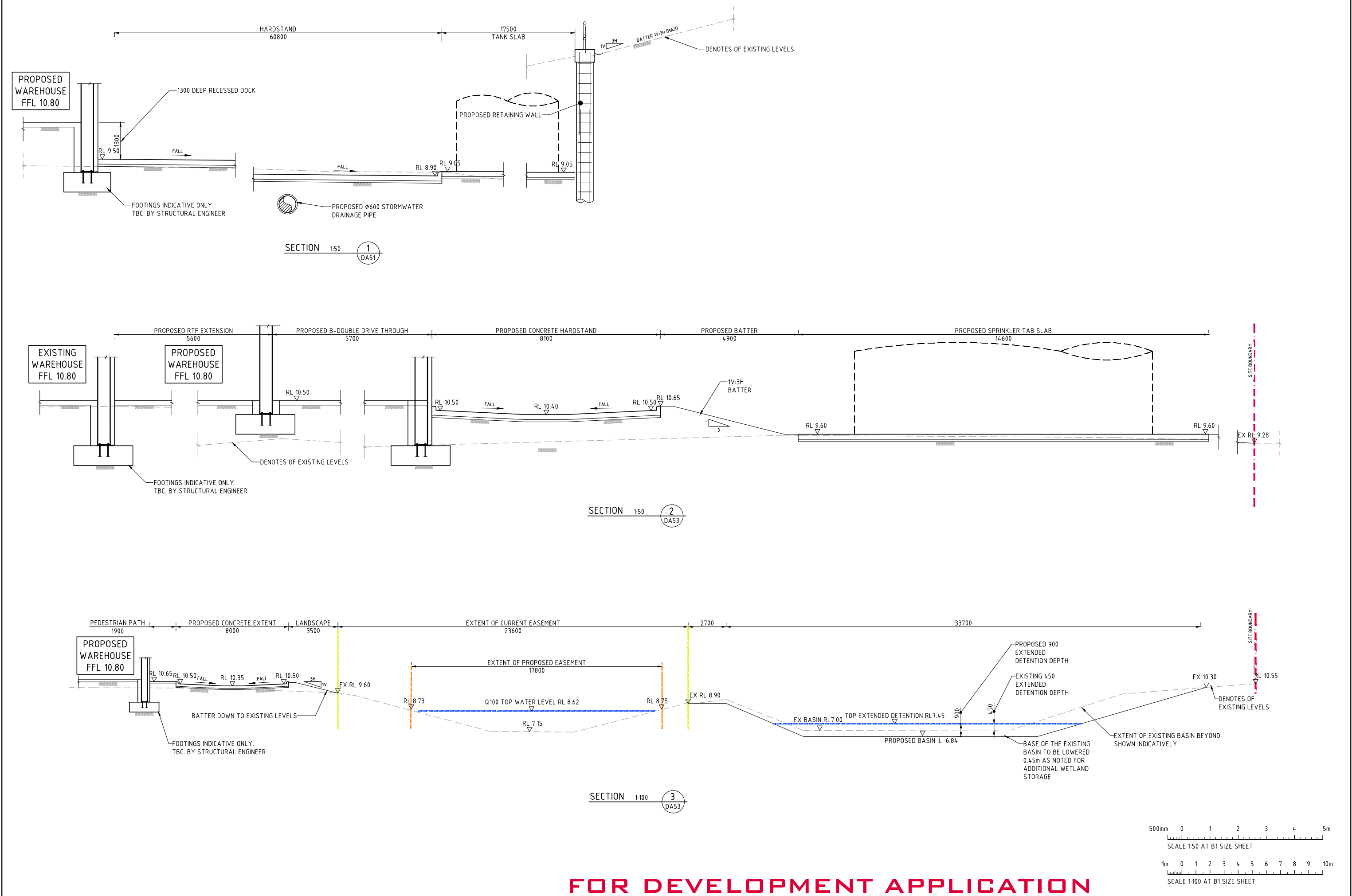
LEVELS NOTE:
LEVELS SHOWN TO BE +/-500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.

FINISHED LEVELS PLAN - SHEET 4
SCALE 1:500

FOR DEVELOPMENT APPLICATION

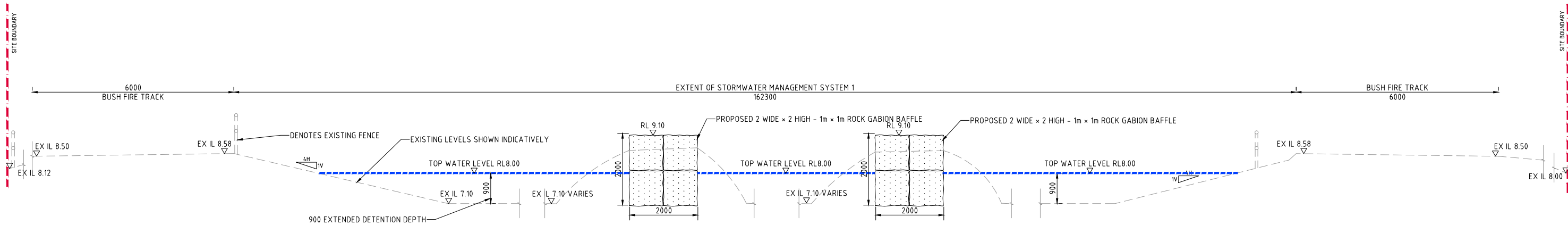


						ARCHITECT		CLIENT		PROJECT		CONSULTANT		DRAWING TITLE	
										WOOLWORTHS WYONG EXPANSION 11 WARREN ROAD, WARNERSVALE, 2259, NSW				FINISHED LEVELS PLAN SHEET 4	
ISSUED FOR DEVELOPMENT APPLICATION 23.03.22 C															
ISSUED FOR INFORMATION 04.03.22 B															
ISSUED FOR INFORMATION 03.03.22 A															
AMENDMENTS DATE ISSUE AMENDMENTS DATE ISSUE														PRECISION | COMMUNICATION | ACCOUNTABILITY	
										DESIGNED D.S. DRAWN D.W. DATE MAR' 2022 CHECKED M.W. SIZE B1 SCALE AS SHOWN		CAD REF: C08318.01-DA54		DRAWING No C08318.01-DA54 ISSUE C	

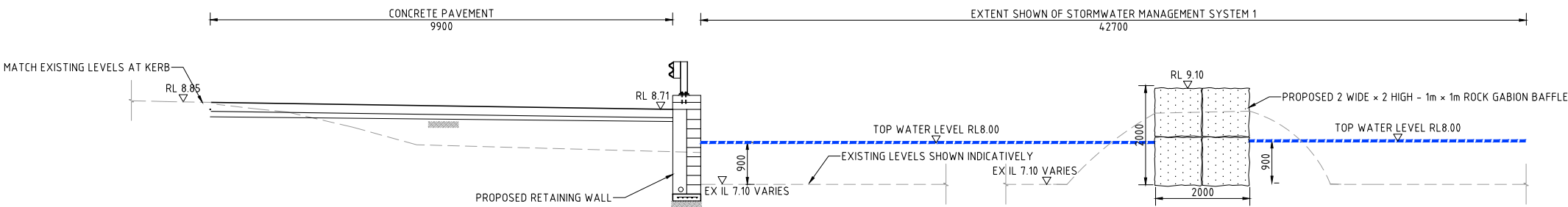


FOR DEVELOPMENT APPLICATION

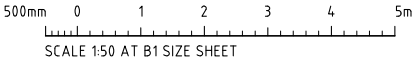




SECTION 1:50 4 DA52

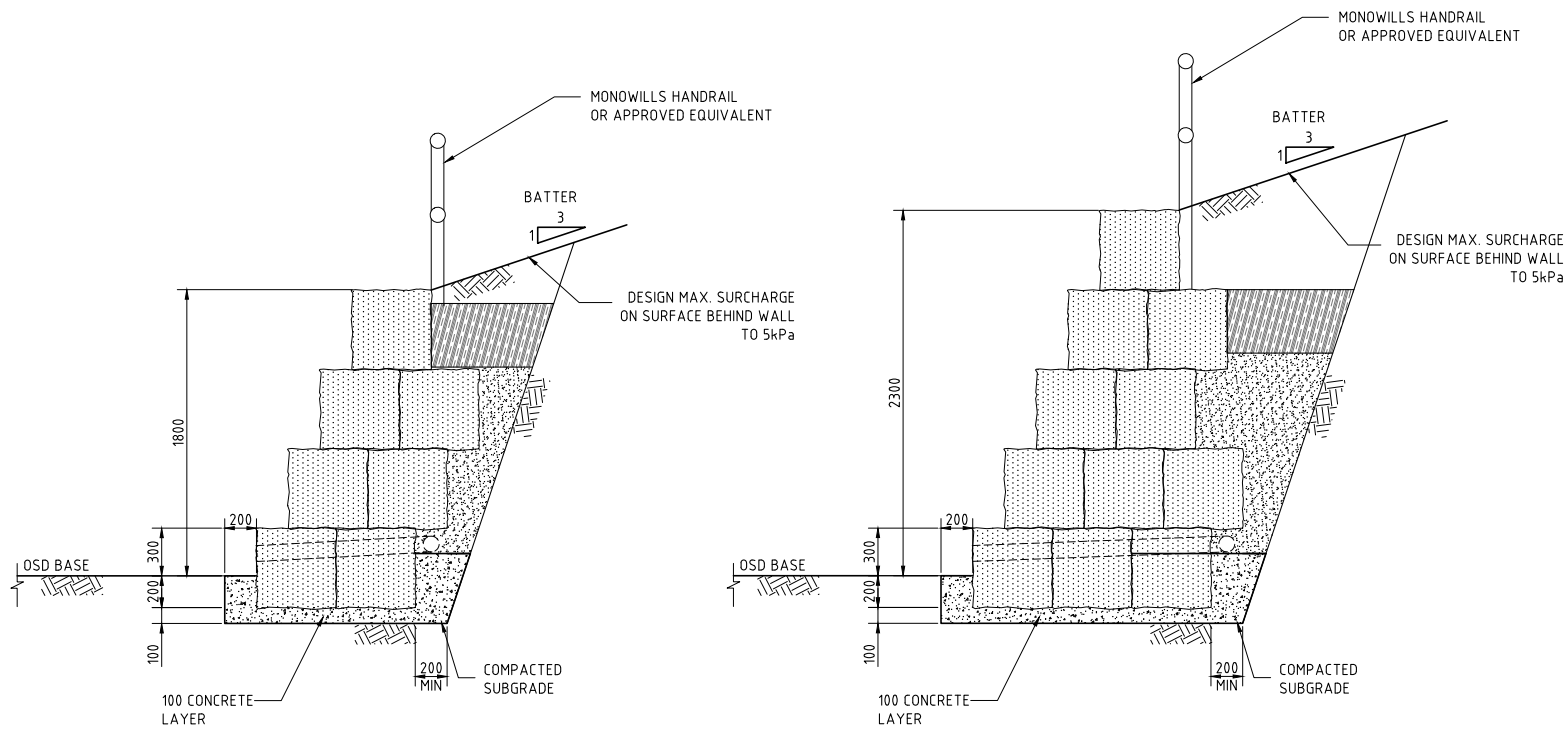


SECTION 1:50 5 DA52



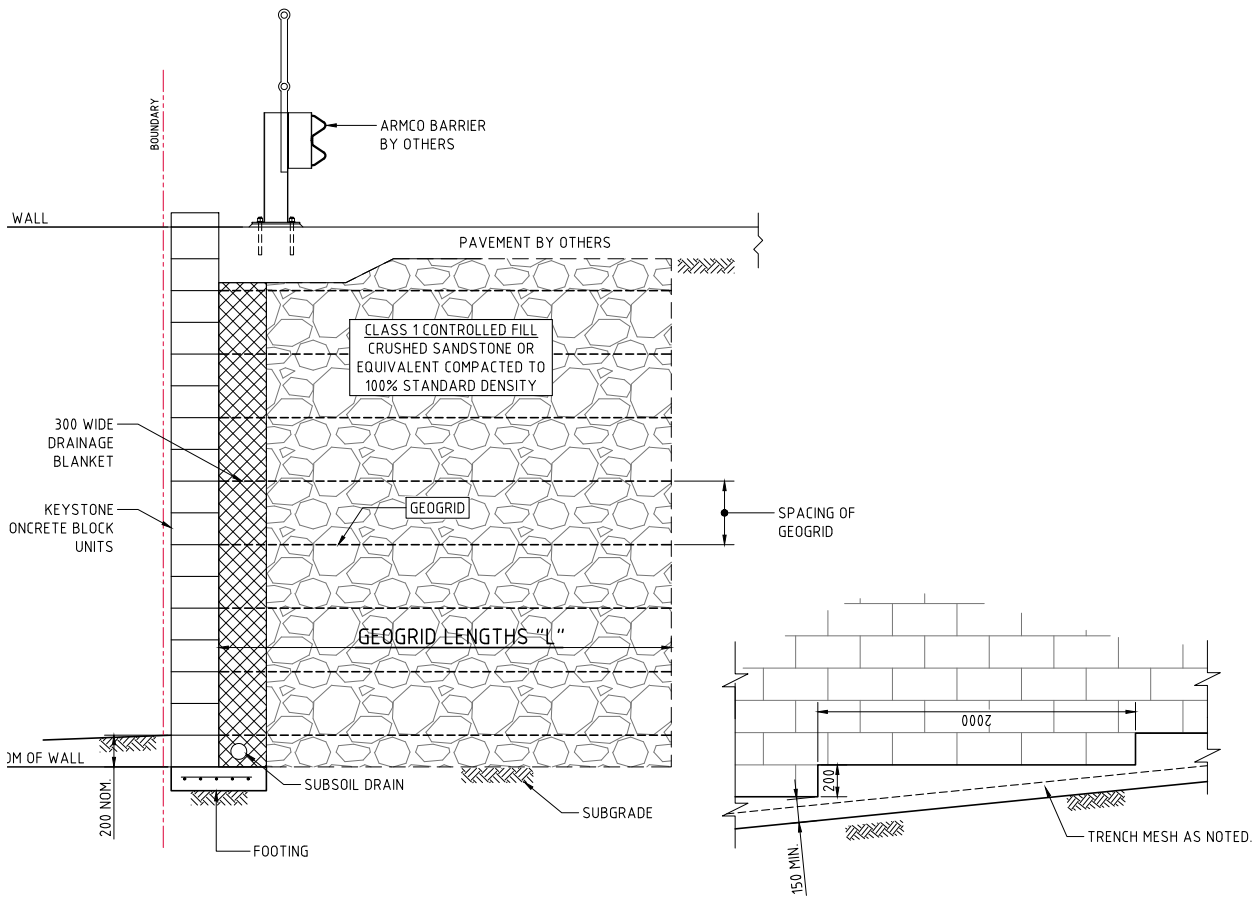
FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION			23.03.22			A			AMENDMENTS			DATE			ISSUE		
AMENDMENTS			DATE			ISSUE			DATE			ISSUE					
ARCHITECT			CLIENT			PROJECT			CONSULTING ENGINEERS			DRAWING TITLE			DRAWING No		
watson young			woolworths			WOOLWORTHS WYONG EXPANSION			Costin Roe Consulting Pty Ltd.			TYPICAL SECTIONS - SHEET 2			C08318.01-DA56		
11 WARREN ROAD, WARNERVALE, 2259, NSW			CONSULTING ENGINEERS			DESIGNED			Level 4, 8 Windmill Street			D.S.			Walsh Bay, Sydney NSW 2000		
CONSULTING ENGINEERS			DRAWN			DATE			Tel: (02) 9551-7000 Fax: (02) 9544-3731			D.W.			email: mail@costinroe.com.au		
11 WARREN ROAD, WARNERVALE, 2259, NSW			CHECKED			M.W.			C08318.01-DA56			PRECISION | COMMUNICATION | ACCOUNTABILITY			ISSUE		
PRECISION | COMMUNICATION | ACCOUNTABILITY			SCALE			AS SHOWN			A								



SANDSTONE WALL DETAIL (UP TO 1800mm HIGH)
SCALE 1:20

SANDSTONE WALL DETAIL (UP TO 2300mm HIGH)
SCALE 1:20



RETAINING WALL TYPE 2
(REINFORCED EARTH WALL)
SCALE 1:20

REINFORCED EARTH WALL TYPICAL LEVELLING STRIP STEP DETAIL
SCALE 1:20

REINFORCED EARTH RETAINING WALL
STRUCTURAL DESIGN TO UCBC DETAILS.

RETAINING WALL DETAILS ARE
INDICATIVE **ONLY** AND SUBJECT TO
DETAILED DESIGN BY D+C CONTRACTOR

REINFORCED EARTH RETAINING WALL NOTES:

- ALL COMPONENTS AND INSTALLATION SHALL COMPLY WITH AS4678 AND THE STANDARDS REFERRED TO THEREIN.
- MINIMUM GEOGRID LENGTH TO BE 4.50m.
- MINIMUM BEARING CAPACITY OF FOUNDATION (BASED ON MINIMUM H/L RATIO OF 1.0) TO BE AS FOLLOWS:
 - H MAX. 2.8m = 125 kPa
 - H MAX. 3.8m = 175 kPa
- BEFORE COMMENCEMENT OF CONSTRUCTION THE FOUNDATION SHALL BE INSPECTED AND VERIFIED BY A QUALIFIED GEOTECHNICAL ENGINEER.
- WHERE MINIMUM BEARING IS NOT ACHIEVABLE OR NOT MEETING DESIGN REQUIREMENT, THE FOUNDATION MATERIAL IS TO BE EXCAVATED AND REPLACED WITH APPROVED MATERIAL PLACED IN ACCORDANCE WITH THE FILLING SPECIFICATION TO A MINIMUM COMPACTION OF 100% SMDD AND PLACED WITHIN 2% OF OMC.
- MINIMUM SURCHARGE LOADS TO BE APPLIED AS FOLLOWS U.N.O. ON PLAN:
 - LIVE LOAD = 5 kPa
 - DEAD LOAD = 5 kPa
 - CONSTRUCTION TRAFFIC LIVE LOAD = 10 kPa (MIN 1.5m FROM FACE OF WALL)
- THE GEOGRIDS SHALL BE OF THE TYPE AND INDEX STRENGTH NOMINATED ON THE DRAWINGS. THE MINIMUM GEOGRIDS SHALL BE A SINGLE LENGTH IN THE DIRECTION OF DESIGN TENSION, NOT LAPPED, MAKING PROVISION FOR CONNECTION TO THE FACING ACROSS THE WHOLE WIDTH OF THE FACING AND PROVIDING FOR THE SPECIFIED ANCHORAGE WITHIN THE DESIGNATED ANCHORAGE ZONE. GEOGRIDS SHALL COVER THE WHOLE OF THE PLAN AREA BEHIND THE WALL FOR THE SPECIFIED ANCHORAGE LENGTH AND SHALL BE LAPPED WITH ADJACENT SECTIONS IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
- MINIMUM WALL EMBEDMENT AT THE TOE OF THE WALL TO BE AS SHOWN.
- DESIGN LIFE OF STRUCTURE IS TO BE 100 YEARS.
- SELECT BACKFILL MATERIAL WITHIN THE REINFORCED SOIL BLOCK SHALL BE SOUND GRANULAR MATERIAL OF NATURAL OR INDUSTRIAL ORIGIN, NON-EXPANSIVE, FREE FROM ORGANIC OR OTHER DELETERIOUS MATERIAL CONFORMING TO THE PHYSICAL, CHEMICAL AND ELECTROCHEMICAL LIMITS AS SPECIFIED AND SHALL NOT BE SUBJECT TO BREAKDOWN UNDER COMPACTION. THE SELECT BACKFILL MATERIAL IS TO HAVE THE FOLLOWING PARAMETERS:
 - MINIMUM INTERNAL FRICTION, $\phi = 34^\circ$
 - EFFECTIVE COHESION, $C' = 0$ kPa
 - UNIT WEIGHT = 21 kN/m³
 - PH BETWEEN 4 AND 9.
- SELECT BACKFILL IS TO BE PLACED AND COMPACTED IN LAYERS NOT MORE THAN 300mm (LOOSE). COMPACTION TO NOT LESS THAN 100% SMDD WILL BE ACHIEVED AND MATERIAL PLACED WITHIN 2% OF OMC. DENSITY TESTING SHALL BE PERFORMED IN EACH COMPACTED LIFT IN ACCORDANCE WITH AS3798.
- PROVIDE A DRAINAGE LAYER DIRECTLY BEHIND THE FACING UNITS IN A MINIMUM 300mm WIDE 12-20mm AGGREGATE LAYER. FACING UNIT VOIDS TO BE FILLED WITH AGGREGATE. PROVIDE 100mm MINIMUM AG. DRAIN IN GEOTEXTILE SOCK AT TOE OF WALL FACING AND CONNECT TO DRAINAGE SYSTEM AT 30m MAX. SPACING.
- THE NEED FOR A CHIMNEY DRAIN OR DRAINAGE AT THE REAR OF THE MASS SOIL BLOCK IS TO BE CONFIRMED ON SITE BY THE GEOTECHNICAL ENGINEER AND DESIGNER FOLLOWING PREPARATION OF THE FOUNDATION AND PRIOR TO CONSTRUCTION OF THE MASS SOIL BLOCK.
- CONSTRUCTION EQUIPMENT WEIGHING MORE THAN 500KG STATIC WEIGHT IS TO BE KEPT BACK 1.5m FROM THE REAR FACE OF THE WALL FACING UNITS. COMPACTION OF THE SELECT FILL MATERIAL WITHIN THE 15m STRIP ADJACENT TO THE WALL SHALL BE ACHIEVED BY LIGHT MECHANICAL TAMPERS (VIBRATING PLATE, TRENCH COMPACTOR OR SIMILAR) TO GIVE THE SAME DENSITY AS IN THE REMAINDER OF THE SELECT FILL.

NOTE:

- BASED ON 500x500x2000 LONG STANDARD CUT SANDSTONE BLOCKS LAID IN INTERLOCKING BRICK PATTERN:
- FIRST TWO COURSES TO BE 2xSANDSTONE BLOCKS IN 100 MASS CONCRETE BEDDING.
 - STEP EACH SUCCESSIVE COURSES 200mm BACK
 - MINIMUM BEARING CAPACITY OF FOUNDATION TO BE 100kPa ASSUMING THE FOLLOWING:
 - CLAY FOUNDATION $C_u=50$ kPa, $\phi=0$
 - SLIDING STABILITY IS BASED ON THE FOLLOWING
 - FRICTION ANGLE OF BOULDER WALL : NOT LESS THAN 40°
 - EFFECTIVE FRICTION ANGLE OF SOIL SUBGRADE: NOT LESS THAN 30° FOR SOIL OR 35° FOR ROCK
 - SOIL AND ROCK DESIGN PARAMETERS SHALL BE CONFIRMED BY GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF BOULDERS OR CONCRETE BED.
 - DENSITY OF INDIVIDUAL BOULDERS SHALL BE MINIMUM 2.5 TONNES/m
 - NO STRUCTURE TO BE BUILT WITHIN H1 FROM THE BACK OF THE TOP OF THE WALL (WHERE H1=HEIGHT OF WALL), UNLESS THE STRUCTURE IS FOUNDED ON ROCK WITH $SBV>150$ kPa
 - CONSTRUCTION METHODS AND SEQUENCE TO ENSURE THAT DESIGN MAX. SURCHARGE OF 5kPa IS NOT EXCEEDED.
 - CONSTRUCTION TO BE IN ACCORDANCE WITH AS 4678:2002

FOR DEVELOPMENT APPLICATION

200mm 0 500 1000 1500 2000mm
SCALE 1:20 AT B1 SIZE SHEET

ISSUED FOR DEVELOPMENT APPLICATION	23.03.22	B
ISSUED FOR INFORMATION	04.03.22	A
AMENDMENTS	DATE	ISSUE
AMENDMENTS	DATE	ISSUE



PROJECT
WOOLWORTHS WYONG EXPANSION
11 WARREN ROAD, WARNERVALE, 2259, NSW



Costin Roe Consulting Pty Ltd.
Consulting Engineers
Level 4, 8 Windmill Street
Wahib Bay, Sydney NSW 2000
Tel: (02) 9551-7090 Fax: (02) 9541-3731
email: mail@costinroe.com.au @

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF.
D.S.	D.W.	MAR 2022	M.W.	B1	AS SHOWN	C08318.01-DA65

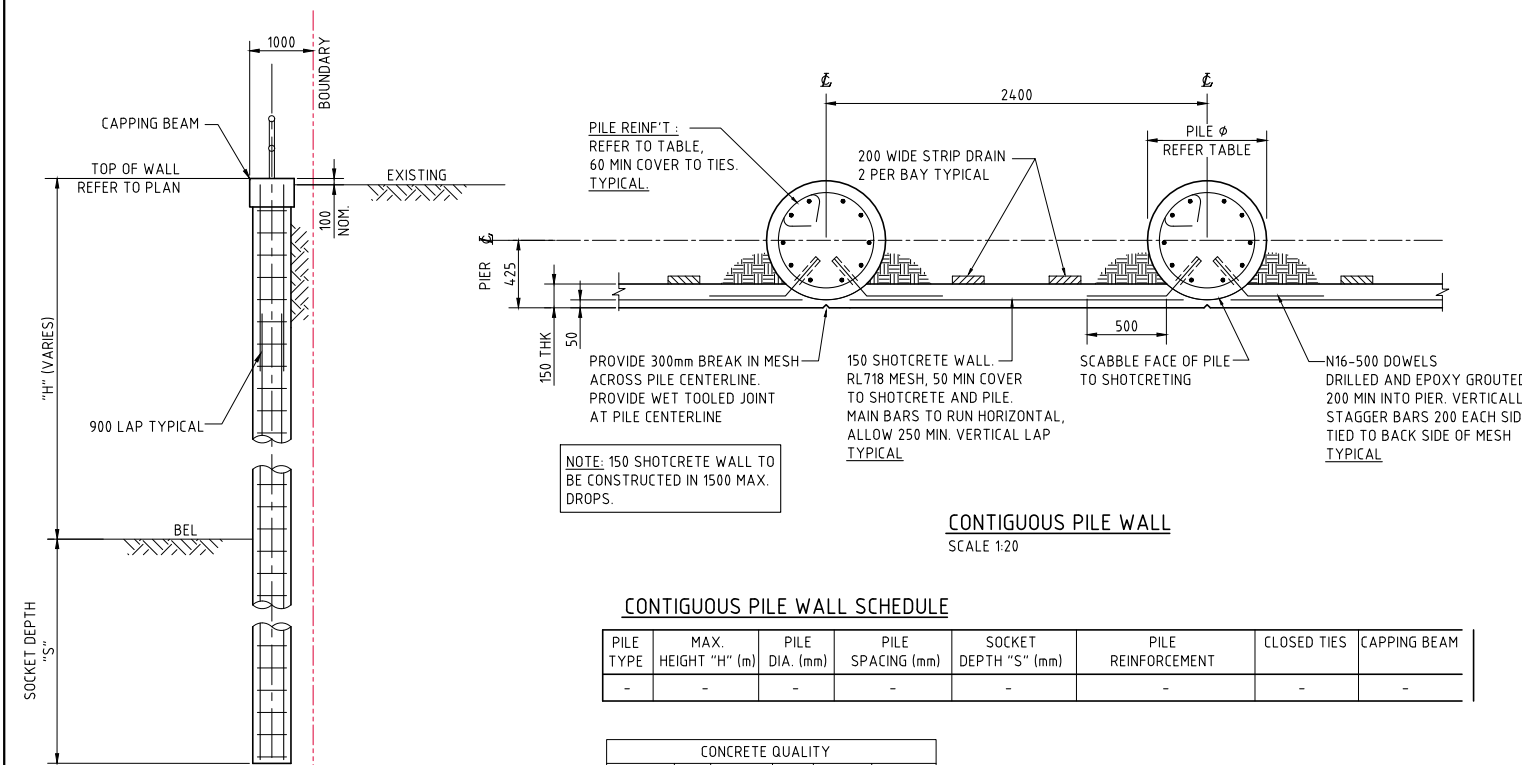
Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
RETAINING WALL DETAILS
SHEET 1

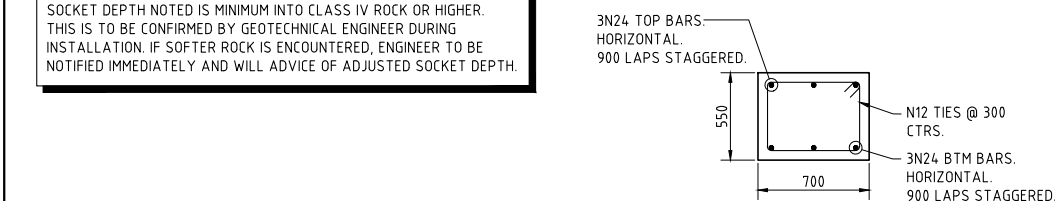
DRAWING No
C08318.01-DA65

ISSUE
B



SCALE 1:50

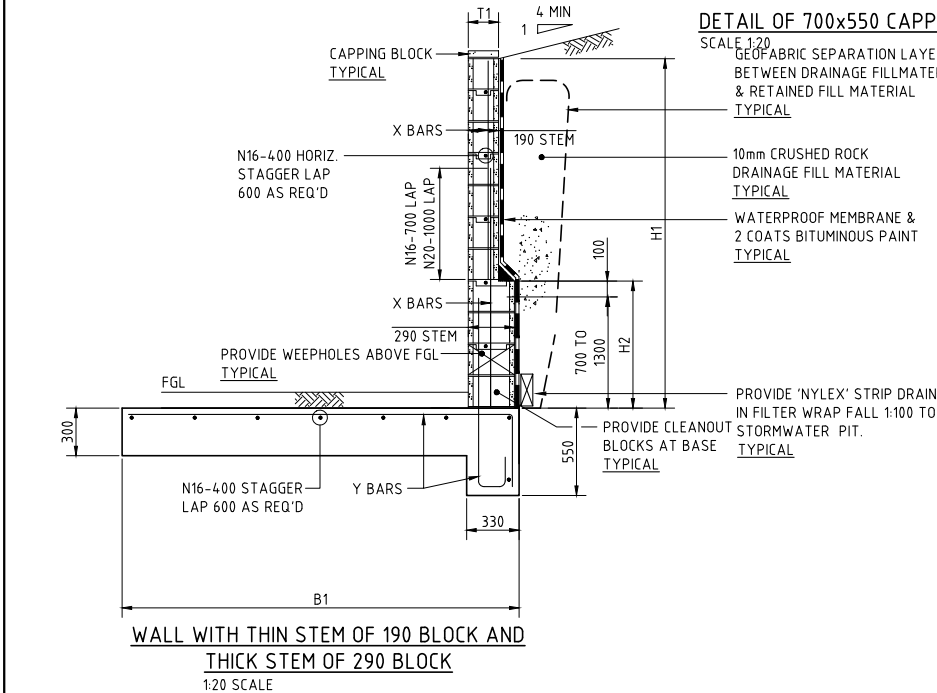
NOTE:
SOCKET DEPTH NOTED IS MINIMUM INTO CLASS IV ROCK OR HIGHER. THIS IS TO BE CONFIRMED BY GEOTECHNICAL ENGINEER DURING INSTALLATION. IF SOFTER ROCK IS ENCOUNTERED, ENGINEER TO BE NOTIFIED IMMEDIATELY AND WILL ADVISE OF ADJUSTED SOCKET DEPTH.



DETAIL OF 700x550 CAPPING BEAM

SCALE 1:20

GEOTEXTILE SEPARATION LAYER BETWEEN DRAINAGE FILL MATERIAL & RETAINED FILL MATERIAL
TYPICAL
10mm CRUSHED ROCK DRAINAGE FILL MATERIAL
TYPICAL
WATERPROOF MEMBRANE & 2 COATS BITUMINOUS PAINT
TYPICAL



TYPE 2 CANTILEVER BLOCK WALL

1:20 SCALE

CONTIGUOUS PILE WALL

SCALE 1:20

CONTIGUOUS PILE WALL SCHEDULE

PILE TYPE	MAX. HEIGHT "H" (m)	PILE DIA. (mm)	PILE SPACING (mm)	SOCKET DEPTH "S" (mm)	PILE REINFORCEMENT	CLOSED TIES	CAPPING BEAM
-	-	-	-	-	-	-	-

CONCRETE QUALITY					
ELEMENT	SLUMP	AGGREGATE (MAX. SIZE)	CEMENT TYPE	ADMIXTURE	F _{ck} (MPa)
PILES	80	20	SL	NIL	32
SHOT CRETE	230	10	SL	NIL	32
CAPPING	80	20	GP	NIL	32

CONCRETE

- C1 ALL WORKMANSHIP AND MATERIAL SHALL BE IN ACCORDANCE WITH AS3600 CURRENT EDITION WITH AMENDMENTS, EXCEPT WHERE VARIED BY THE CONTRACT DOCUMENTS.
- C2 READYMIX CONCRETE SUPPLY SHALL COMPLY WITH AS1379.
- C3 CONCRETE QUALITY
ALL THE REQUIREMENTS OF THE ACSE SPECIFICATION DOCUMENT 1 (EDITION 6) SHALL APPLY TO THE FORMWORK, REINFORCEMENT AND CONCRETE UNLESS NOTED OTHERWISE.
- C4 PROJECT CONTROL TESTING SHALL BE CARRIED OUT IN ACCORDANCE AS1379.
- C5 NO ADMIXTURES SHALL BE USED IN CONCRETE UNLESS APPROVED IN WRITING.
- C6 CLEAR CONCRETE COVER TO ALL REINFORCEMENT FOR DURABILITY SHALL BE AS FOLLOWS UNLESS SHOWN OTHERWISE.

EXPOSURE CLASSIFICATION TO AS3600:	CONCRETE GRADE:	CAST AGAINST GROUND:	CAST IN FORMS AND EXPOSED:	CAST IN FORMS NOT EXPOSED:
A1&A2	25	50mm	30mm	20mm(A1)
B1	32	60mm	40mm	-
B2	40	65mm	45mm	-

COVER REQUIREMENTS MAY NEED TO BE INCREASED TO SUIT FIRE RATING. EXPOSURE CLASSIFICATION SHALL BE AS INDICATED ON THE DRAWING.

DURABILITY REQUIREMENTS FOR CONCRETE.

EXPOSURE CLASSIFICATION TO AS3600:	MINIMUM CEMENT CONTENT:	MAXIMUM W/C RATIO:
A1&A2	280	0.56
B1	320	0.56
B2	390	0.46
C	450	0.40

- C7 ALL REINFORCEMENT SHALL BE FIRMLY SUPPORTED ON MILD STEEL PLASTIC TIPPED CHAIRS, PLASTIC CHAIRS OR CONCRETE CHAIRS AT 1 METRE CENTRES MAXIMUM BOTH WAYS. BARS SHALL BE TIED AT ALTERNATE INTERSECTIONS. USE PLASTIC CHAIRS IN EXPOSURE CONDITION GREATER THAN B1.

- C8 CONCRETE SIZES DO NOT INCLUDE THICKNESSES OF APPLIED FINISHES.
- C9 DEPTHS OF BEAMS ARE GIVEN FIRST AND INCLUDE SLAB THICKNESS.
- C10 REFER TO ARCHITECT'S DETAILS, FOR CHAMFERS, DRIP GROOVES, REGLETS, ETC., MAINTAIN COVER TO REINFORCEMENT AT THESE DETAILS.
- C11 NO HOLES, CHASES OR EMBEDMENT OF PIPES OTHER THAN THOSE SHOWN ON THE STRUCTURAL DRAWINGS SHALL BE MADE IN CONCRETE MEMBERS WITHOUT THE PRIOR WRITTEN APPROVAL OF THE ENGINEER.
- C12 CONSTRUCTION JOINTS WHERE NOT SHOWN SHALL BE LOCATED TO THE APPROVAL OF THE ENGINEER.
- C13 ALL CONCRETE INCLUDING SLABS ON GROUND AND FOOTINGS SHALL BE COMPACTED WITH MECHANICAL VIBRATORS.
- C14 USE ALIPHATIC ALCOHOLS SPRAYED OVER THE SURFACE PRIOR TO AND AFTER FINISHING TO REDUCE RATE OF EVAPORATION FROM THE SURFACE AND HELP CONTROL PLASTIC SHRINKAGE CRACKING. NOTE THAT THE USE OF ALIPHATIC ALCOHOLS IS NOT A SUBSTITUTE FOR CURING.
- C15 COMMENCE CURING OPERATIONS PROMPTLY AFTER SURFACE FINISHING IS COMPLETE. CURING COMPOUNDS ARE TO BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS AND ARE TO BE CHECKED FOR COMPATIBILITY WITH PROPOSED FLOOR FINISHES. SOME COMPOUNDS MAY REQUIRE REMOVAL FOR GLUED DOWN FLOOR COVERINGS OR WET CURING AS DESCRIBED BELOW.
- C16 PROPPING WHICH SUPPORTS CONSTRUCTION OVER IS TO BE LEFT IN PLACE AS REQUIRED TO AVOID OVER STRESSING THE STRUCTURE DUE TO CONSTRUCTION LOADING
- C17 THE ENGINEER SHALL BE GIVEN 48 HOURS NOTICE FOR REINFORCEMENT INSPECTIONS AND CONCRETE SHALL NOT BE DELIVERED UNTIL ENGINEERS APPROVAL IS OBTAINED.
- C18 CONDUITS, PIPES ETC. SHALL ONLY BE LOCATED IN THE MIDDLE ONE THIRD OF SLAB DEPTH AND SPACED AT NOT LESS THAN 3 DIAMETERS OF THE CONDUIT, PIPES ETC. PIPES OR CONDUITS SHALL NOT BE PLACED WITHIN THE COVER TO REINFORCEMENT.

CONCRETE IS TO BE CURED BY KEEPING THE SURFACES CONTINUOUSLY WET FOR A PERIOD OF 3 DAYS, AND PREVENTING THE LOSS OF MOISTURE FOR A FURTHER 7 DAYS FOLLOWED BY A GRADUAL DRYING OUT.

NOTE:

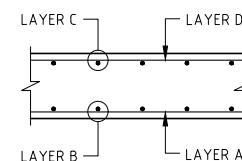
ATTENTION IS DRAWN TO THE FACT THAT DUE TO THE NATURE OF CONCRETE, CRACKING OF A NON-STRUCTURAL NATURE MAY OCCUR. REINFORCEMENT HAS BEEN ADDED TO THE SLABS TO MITIGATE THE EXTENT OF CRACKING, HOWEVER IT IS NOT POSSIBLE TO GUARANTEE COMPLETE ELIMINATION OF SLAB CRACKING.

MASONRY BLOCKWORK

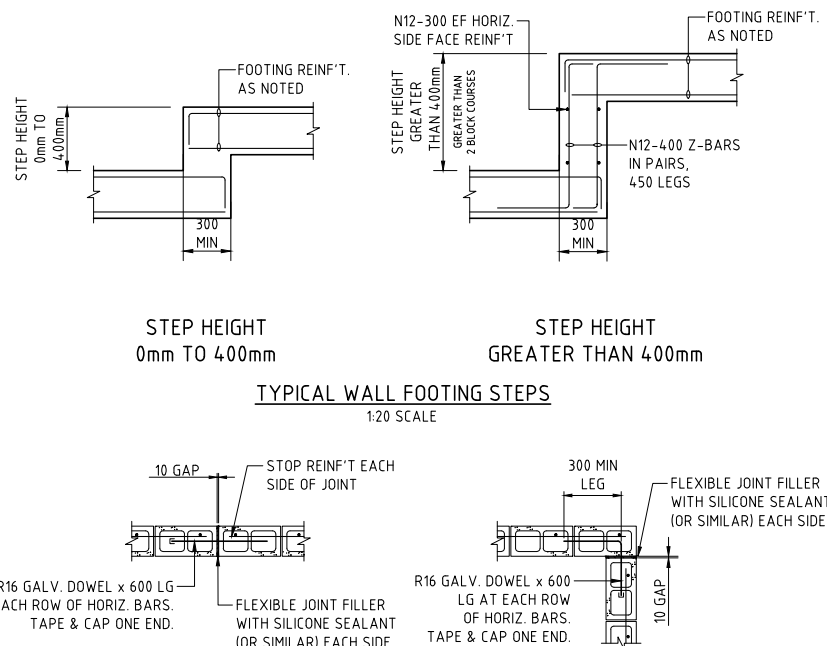
- M1 ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS3700.
- M2 CLASS OF BLOCKS AND TYPE OF MORTAR SHALL BE AS LISTED BELOW:
MATERIAL: CHARACTERISTIC UNCONFINED COMPRESSIVE STRENGTH, F_{ck}
MORTAR CLASSIFICATION:
CONCRETE BLOCKS 15 MPa M3
- M3 MORTAR ADMIXTURES SHALL NOT BE USED WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER.
- M4 ALL MASONRY WALLS AND PIERS SUPPORTING SLABS AND BEAMS SHALL HAVE A PRE-GREASED GALVANISED STEEL SLIP JOINT BETWEEN CONCRETE SOFFIT AND THE TOP OF OF THE MASONRY ELEMENT U.N.O.
- M5 ALL MASONRY SUPPORTING OR SUPPORTED BY CONCRETE FLOORS SHALL BE PROVIDED WITH VERTICAL JOINTS TO MATCH ALL CONTROL JOINTS IN THE CONCRETE.
- M6 NON LOAD BEARING WALLS SHALL BE SEPARATED FROM CONCRETE ABOVE BY A 12mm THICK CLOSED CELL POLYETHYLENE STRIP.
- M7 NO CHASES OR RECESSES ARE PERMITTED IN LOAD BEARING MASONRY WITHOUT THE APPROVAL OF THE ENGINEER.
- M8 PROVIDE CLEANOUT HOLES AT BASE OF ALL WALLS. ROD CORE HOLES TO REMOVE PROTRUDING MORTAR FOLLOWING APPROVAL FROM THE ENGINEER.
- M9 CORE FILLING GROUT TO HAVE A CHARACTERISTIC STRENGTH OF 20 MPa, 10mm AGGREGATE, 230mm SLUMP, MINIMUM CEMENT CONTENT = 300 kg/m³. GROUT FILL ALL BLOCK CORES.
- M10 PROVIDE 65mm COVER TO REINFORCING BARS FROM THE OUTSIDE FACE OF THE BLOCKWORK IF REINFORCEMENT IS NOT TO BE PLACED CENTRALLY.
- M11 PROVIDE VERTICAL CONTROL JOINTS AT 10 METRE MAX CENTRES, AND AT 5 METRE MAXIMUM FROM CORNERS IN ALL BRICKWORK WALLS
- M12 PROVIDE VERTICAL CONTROL JOINTS AT 8 METRE MAX CENTRES, AND AT 4 METRE MAXIMUM FROM CORNERS IN ALL CONCRETE BLOCK WALLS.
- M13 BACKFILL TO RETAINING WALLS TO BE FREE DRAINING GRANULAR MATERIAL U.N.O. PROVIDE SUBSOIL DRAIN BEHIND WEEP HOLES.
- M14 DO NOT CONSTRUCT MASONRY WALLS ON SUSPENDED CONCRETE UNTIL SLAB HAS BEEN STRIPPED AND DE-PROPPED.
- M15 ALL CAVITY CONSTRUCTION TO HAVE GALVANISED OR STAINLESS STEEL WALL TIES INSTALLED AS PER AS3700

REINFORCEMENT

- R1 ALL REINFORCEMENT BARS ARE TO BE D500 U.N.O.
- R2 ALL REINFORCEMENT WELDED MESHES TO BE GRADE 500L U.N.O.
- R3 WELDING OF REINFORCEMENT SHALL NOT BE PERMITTED UNLESS SHOWN ON THE STRUCTURAL DRAWINGS OR APPROVED BY THE ENGINEER.



REINFORCEMENT PLACEMENT DETAIL



VERTICAL JOINT DETAIL

PROVIDE VERTICAL JOINTS IN BLOCKWORK 8.0M MAX. CENTRES

RETAINING WALL BLOCKWORK JOINTING DETAILS

1:20 SCALE

CORNER DETAIL

FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION	23.03.22	B
ISSUED FOR INFORMATION	04.03.22	A
AMENDMENTS	DATE	ISSUE

ARCHITECT
watson young

CLIENT
woolworths

PROJECT
WOOLWORTHS WYONG EXPANSION
11 WARREN ROAD, WARNERVALE, 2259, NSW

DESIGNED D.S. DRAWN D.W. DATE MAR 2022 CHECKED M.W. SIZE B1 SCALE AS SHOWN CAD REF: C08318.01-DA66

COSTIN ROE CONSULTING PTY LTD.
Consulting Engineers
Level 4, 8 Windmill Street
Wahbi Bay, Sydney NSW 2000
Tel: (02) 9551-7000 Fax: (02) 9541-3731
email: mail@costinroe.com.au ©

Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
RETAINING WALL DETAILS
SHEET 2

DRAWING No C08318.01-DA66

ISSUE
B

Appendix B

MUSIC MODEL CONFIGURATION & PARAMETERS

B.1 Introduction

The MUSIC modelling software was chosen to model water quality. This model has been released by the Cooperative Research Centre for Catchment Hydrology (CRCCH) and is a standard industry model for this purpose. MUSIC (the Model for Urban Stormwater Improvement Conceptualisation) is suitable for simulating catchment areas of up to 100 km² and utilises a continuous simulation approach to model water quality.

By simulating the performance of stormwater management systems, MUSIC can be used to predict if these proposed systems and changes to land use are appropriate for their catchments and are capable of meeting specified water quality objectives (CRC 2002). The water quality constituents modelled in MUSIC and of relevance to this report include Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

The pollutant retention criteria set out in Central Coast Council and nominated in **Section 4.1** of this report were used as a basis for assessing the effectiveness of the selected treatment trains.

The MUSIC model “Co8318.01 Rev.1.sqz” was set up to examine the effectiveness of the water quality treatment train and to predict if council requirements have been achieved. The model was set up using the latest Central Coast Council *MUSICLINK* parameters for clay soil and the layout of the MUSIC model is presented in **Appendix B**.

B.2 Rainfall Data

As per the recommendation of Council, six-minute pluviographic data for the Sydney Meteorological Office Station was sourced from the Bureau of Meteorology (BOM) as nominated below. Evapo-transpiration data for the period was sourced from the Sydney Monthly Areal PET data set supplied with the MUSIC software.

Input	Data Used
Rainfall Station	066062 Sydney Observatory Hill
Rainfall Period	1 January 1974 – 31 December 1993 (20 years)
Mean Annual Rainfall (mm)	1273
Evapotranspiration	Sydney Monthly Areal PET
Model Timestep	6 minutes

B.3 Rainfall Runoff Parameters

Parameter	Value
Rainfall Threshold	1
Soil Storage Capacity (mm)	250
Initial Storage (% capacity)	30
Field Capacity (mm)	100
Infiltration Capacity Coefficient a	200
Infiltration Capacity exponent b	1

Initial Depth (mm)	10
Daily Recharge Rate (%)	4
Daily Baseflow Rate (%)	2
Daily Seepage Rate (%)	0.4

B.4 Pollutant Concentrations & Source Nodes

Pollutant concentrations for source nodes are based on parameters adopted as per **Table B.1**.

Flow Type	Surface Type	TSS (log ₁₀ values)		TP (log ₁₀ values)		TN (log ₁₀ values)	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Baseflow	Roof	1.1	0.17	-0.82	0.19	0.32	0.12
	Roads	1.20	0.17	-0.85	0.19	0.11	0.12
	Landscaping	1.15	0.17	-1.22	0.19	-0.05	0.12
	Carpark	1.2	0.17	-0.85	0.19	0.11	0.12
Stormflow	Roof	1.3	0.32	-0.89	0.25	0.30	0.19
	Roads	2.43	0.32	-0.30	0.25	0.34	0.19
	Landscaping	1.95	0.32	-0.66	0.25	0.3	0.19
	Carpark	2.15	0.17	-0.6	0.25	0.3	0.19

Table B.1. Pollutant Concentrations

The MUSIC model has been setup with a treatment train approach based on the pollutant concentrations in **Table B.1** above.

The relevant stormwater catchment sizes are listed below in **Table B.2** and their configuration within the MUSIC model.

Catchment	Area (Ha)	Source Node	% Impervious	Stormwater Treatment
Cat1-Roof	3.42	Roof	100%	Wetland 1
Cat1-Hardstand	5.30	Sealedroad	100%	Wetland 1
Cat1-Hardstand	0.26	Sealedroad	100%	Wetland 1 + OG200 Pit Inserts
Cat1-Carpark	1.55	Industrial	90%	Wetland 1
Cat1-Firetrail	0.51	Unsealed Road	50%	Wetland 1
Cat1-Landscape	2.46	Landscape	0%	Wetland 1
Cat2-Roof-RWT	4.60	Roof	100%	RWT + Wetland 2
Cat2-Hardstand	1.59	Sealedroad	100%	Wetland 2 + OG200 Pit Inserts
Cat2-Landscape	1.50	Landscape	0%	Wetland 2
Cat2-Firetrail	0.09	Unsealed Road	50%	Wetland 2
Cat2-Bypass-Landscape	0.43	Landscape	0%	Bypass

Table B.2. Music Model Source Nodes

B.5 Treatment Nodes

Gross Pollutant Trap nodes have been used in the modelling of the development as provided by the suppliers of the products based on testing completed by the product manufacturers. Detention basin nodes were also introduced to the model using typical parameters contained in MUSIC modelling guidelines.

Gross Pollutant Trap

Parameter	Value
Treatable Flow	0.020m ³ /s (per OceanGuard)
<u>Pollutant Reductions</u>	
Per Ocean Protect Technical Guidelines	

B.6 Results

Table B.6 shows the results of the MUSIC analysis. The reduction rate is expressed as a percentage and compares the post-development pollutant loads without treatment versus post-development loads with treatment.

	Source	Residual Load	% Reduction
Total Suspended Solids (kg/yr)	4.094E+04	1.281E+04	68.72
Total Phosphorus (kg/yr)	73.85	27.75	62.42
Total Nitrogen (kg/yr)	476.9	203.5	57.33
Gross Pollutants (kg/yr)	4896	0	100

Table B.6. MUSIC analysis results

The model results indicate that, through the use of the STM in the treatment train, pollutant load reductions for Total Suspended Solids, Total Phosphorous, Total Nitrogen and Gross Pollutants will meet the requirements of Council's *DCP* on an overall catchment basis.

B.7 Modelling Discussion

MUSIC modelling has been performed to assess the effectiveness of the selected treatment trains and to ensure that the pollutant retention requirements of Council have been met.

The MUSIC modelling has shown that the proposed treatment train of STM will provide stormwater treatment which will meet Council's requirements in an effective and economical manner.

Hydrocarbon and oil & grease removal cannot be modelled with MUSIC software. As an industrial estate with users for individual development sites not known, the exact levels of hydrocarbons would not be known however given the expected use of the site as a warehouse distribution centre these pollutants would not be expected to be large.

Potential sources of hydrocarbons and/or oil & grease which drain to the stormwater system would be limited to leaking engine sumps or for accidental fuel spills/leaks and leaching of bituminous pavements (car parking only). The potential for these pollutants is low and published data from the CSIRO indicates that average concentrations from industrial sites are in the order of 10mg/L and we would expect source loading from this site to be near to or below this concentration. Hydrocarbon pollution would also be limited to surface areas which will be treated via OceanProtect OceanGuard absorbent material which are predicted to reduce this pollutant.

Further, the provision of an oil baffle within the treatment system which captures and contains hydrocarbons and oils has been included. This is considered a deemed to comply solution by Central Coast Council.

Given the expected low source loadings of hydrocarbons and oil/grease and removal efficiencies of the treatment devices and filtration systems we consider that the requirements of the Council have been met.

Appendix C

DRAFT SOIL AND WATER MANAGEMENT PLAN

C.1 Introduction

An erosion and sediment control plan (ESCP) is shown on drawing **Co8319.01-SSDA20** with details on **SSDA25**. These are conceptual plans only providing sufficient detail to clearly show that the works can proceed without undue pollution to receiving waters. A detailed plan will be prepared once consent is given and before works start.

The Staged ESCP considers initial site establishment, requirements during construction of roads and infrastructure and estate earthworks, completion of estate works and the period between this and development of individual lots.

C.2 General Conditions

1. The ESCP will be read in conjunction with the engineering plans, and any other plans or written instructions that may be issued in relation to development at the subject site.
2. Contractors will ensure that all soil and water management works are undertaken as instructed in this specification and constructed following the guidelines stated in *Managing Urban Stormwater, Soils and Construction (2004) "The Blue Book"* and Central Coast Council specifications.
3. All subcontractors will be informed of their responsibilities in minimising the potential for soil erosion and pollution to down slope areas.

C.3 Land Disturbance

1. Where practicable, the soil erosion hazard on the site will be kept as low as possible and as recommended in Table C.1.

Land Use	Limitation	Comments
Construction areas	Limited to 5 (preferably 2) metres from the edge of any essential construction activity as shown on the engineering plans.	All site workers will clearly recognise these areas that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope), or similar materials.
Access areas	Limited to a maximum width of 5 metres	The site manager will determine and mark the location of these zones onsite. They can vary in position so as to best conserve existing vegetation and protect downstream areas while being considerate of the needs of efficient works activities. All site workers will clearly recognise these boundaries.
Remaining lands	Entry prohibited except for essential management works	

Table C.1 Limitations to access

C.4 Erosion Control Conditions

1. Clearly visible barrier fencing shall be installed as shown on the plan and elsewhere at the discretion of the site superintendent to ensure traffic control and prohibit unnecessary site disturbance. Vehicular access to the site shall be limited to only those essential for construction work and they shall enter the site only through the stabilised access points.
2. Soil materials will be replaced in the same order they are removed from the ground. It is particularly important that all subsoils are buried and topsoils remain on the surface at the completion of works.
3. Where practicable, schedule the construction program so that the time from starting land disturbance to stabilisation has a duration of less than six months.
4. Notwithstanding this, schedule works so that the duration from the conclusion of land shaping to completion of final stabilisation is less than 20 working days.
5. Land recently established with grass species will be watered regularly until an effective cover has properly established and plants are growing vigorously. Further application of seed might be necessary later in areas of inadequate vegetation establishment.
6. Where practical, foot and vehicular traffic will be kept away from all recently established areas
7. Earth batters shall be constructed in accordance with the Geotechnical Engineers Report or with as low a gradient as practical but not steeper than:
 - 2H:1V where slope length is less than 7 metres
 - 2.5H:1V where slope length is between 7 and 10 metres
 - 3H:1V where slope length is between 10 and 12 metres
 - 4H:1V where slope length is between 12 and 18 metres
 - 5H:1V where slope length is between 18 and 27 metres
 - 6H:1V where slope length is greater than 27 metres
8. All earthworks, including waterways/drains/spillways and their outlets, will be constructed to be stable in at least the design storm event.
9. During windy weather, large, unprotected areas will be kept moist (not wet) by sprinkling with water to keep dust under control. In the event water is not available in sufficient quantities, soil binders and/or dust retardants will be used or the surface will be left in a cloddy state that resists removal by wind.

C.5 Pollution Control Conditions

1. Stockpiles will not be located within 5 metres of hazard areas, including likely areas of high velocity flows such as waterways, paved areas and driveways. Silt/ sediment fences and appropriate stabilisation of stockpiles are to be provided as detailed on the drawings.
2. Sediment fences will:
 - a) Be installed where shown on the drawings, and elsewhere at the discretion of the site superintendent to contain the coarser sediment fraction (including aggregated fines) as near as possible to their source.
 - b) Have a catchment area not exceeding 720 square meters, a storage depth (including both settling and settled zones) of at least 0.6 meters, and internal dimensions that provide maximum surface area for settling, and
 - c) Provide a return of 1 metre upslope at intervals along the fence where catchment area exceeds 720 square meters, to limit discharge reaching each section to 10 litres/second in a maximum 20-year t_c discharge.
3. Sediment removed from any trapping device will be disposed in locations where further erosion and consequent pollution to down slope lands and waterways will not occur.
4. Water will be prevented from directly entering the permanent drainage system unless it is relatively sediment free (i.e., the catchment area has been permanently landscaped and/or likely sediment has been treated in an approved device). Nevertheless, stormwater inlets will be protected.
5. Temporary soil and water management structures will be removed only after the lands they are protecting are stabilised.

C.6 Waste Management Conditions

Acceptable bind will be provided for any concrete and mortar slurries, paints, acid washings, lightweight waste materials and litter. Clearance service will be provided at least weekly.

C.7 Site Inspection and Maintenance

1. A self-auditing program will be established based on a Check Sheet. A site inspection using the Check Sheet will be made by the site manager:
 - At least weekly.
 - Immediately before site closure.
 - Immediately following rainfall events in excess of 5mm in any 24-hour period.

The self-audit will include:

- Recording the condition of every sediment control device
- Recording maintenance requirements (if any) for each sediment control device

- Recording the volumes of sediment removed from sediment retention systems, where applicable
 - Recording the site where sediment is disposed
 - Forwarding a signed duplicate of the completed Check Sheet to the project manager/developer for their information
2. In addition, a suitably qualified person will be required to oversee the installation and maintenance of all soil and water management works on the site. The person shall be required to provide a short monthly written report. The responsible person will ensure that:
- The plan is being implemented correctly
 - Repairs are undertaken as required
 - Essential modifications are made to the plan if and when necessary

The report shall carry a certificate that works have been carried out in accordance with the plan.

3. Waste bins will be emptied as necessary. Disposal of waste will be in a manner approved by the Site Superintendent.
4. Proper drainage will be maintained. To this end drains (including inlet and outlet works) will be checked to ensure that they are operating as intended, especially that,
- No low points exist that can overtop in a large storm event
 - Areas of erosion are repaired (e.g., lined with a suitable material) and/or velocity of flow is reduced appropriately through construction of small check dams or installing additional diversion upslope.
 - Blockages are cleared (these might occur because of sediment pollution, sand/soil/spoil being deposited in or too close to them, breached by vehicle wheels, etc.).
5. Sand/soil/spoil materials placed closer than 2 meters from hazard areas will be removed. Such hazard areas include and areas of high velocity water flows (e.g., waterways and gutters), paved areas and driveways.
6. Recently stabilised lands will be checked to ensure that erosion hazard has been effectively reduced. Any repairs will be initiated as appropriate.
7. Excessive vegetation growth will be controlled through mowing or slashing.
8. All sediment detention systems will be kept in good, working condition. In particular, attention will be given to:
- a) Recent works to ensure they have not resulted in diversion of sediment laden water away from them
 - b) Degradable products to ensure they are replaced as required, and
 - c) Sediment removal, to ensure the design capacity or less remains in the settling zone.
9. Any pollutants removed from sediment basins or litter traps will be disposed of in areas where further pollution to down slope lands and waterways should not occur.

10. Additional erosion and/or sediment control works will be constructed as necessary to ensure the desired protection is given to down slope lands and waterways, i.e., make ongoing changes to the plan where it proves inadequate in practice or is subjected to changes in conditions at the work site or elsewhere in the catchment.
11. Erosion and sediment control measures will be maintained in a functioning condition until all earthwork activities are completed and the site stabilised
12. Litter, debris and sediment will be removed from the gross pollutant traps and trash racks as required.

EROSION AND SEDIMENT CONTROL WEEKLY SITE INSPECTION SHEET

LOCATION
 INSPECTION OFFICER DATE
 SIGNATURE

Legend: ☐ OK ☐ Not OK N/A Not applicable

Item	Consideration	Assessment
1	Public roadways clear of sediment.	.....
2	Entry/exit pads clear of excessive sediment deposition.	.....
3	Entry/exit pads have adequate void spacing to trap sediment.	.....
4	The construction site is clear of litter and unconfined rubbish.	.....
5	Adequate stockpiles of emergency ESC materials exist on site.	.....
6	Site dust is being adequately controlled.	.....
7	Appropriate drainage and sediment controls have been installed prior to new areas being cleared or disturbed.	.....
8	Up-slope “clean” water is being appropriately diverted around/through the site.	.....
9	Drainage lines are free of soil scour and sediment deposition.	.....
10	No areas of exposed soil are in need of erosion control.	.....
11	Earth batters are free of “rill” erosion.	.....
12	Erosion control mulch is not being displaced by wind or water.	.....
13	Long-term soil stockpiles are protected from wind, rain and stormwater flow with appropriate drainage and erosion controls.	.....
14	Sediment fences are free from damage.	.....
15	Sediment-laden stormwater is not simply flowing “around” the sediment fences or other sediment traps.	.....
16	Sediment controls placed up-slope/around stormwater inlets are appropriate for the type of inlet structure.	.....
17	All sediment traps are free of excessive sediment deposition.	.....
18	The settled sediment layer within a sediment basin is clearly visible through the supernatant prior to discharge such water.	.....
19	All reasonable and practicable measures are being taken to control sediment runoff from the site.	.....
20	All soil surfaces are being appropriately prepared (i.e. pH, nutrients, roughness and density) prior to revegetation.	.....
21	Stabilised surfaces have a minimum 70% soil coverage.	.....
22	The site is adequately prepared for imminent storms.	.....
23	All ESC measures are in proper working order.	.....

Appendix D

STORMWATER SYSTEM

DRAFT MAINTENANCE SCHEDULE

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
SWALES/ LANDSCAPED AREAS			
Check density of vegetation and ensure minimum height of 150mm is maintained. Check for any evidence of weed infestation	Six monthly	Maintenance Contractor	Replant and/or fertilise, weed and water in accordance with landscape consultant specifications
Inspect swale for excessive litter and sediment build up	Six monthly	Maintenance Contractor	Remove sediment and litter and dispose in accordance with local authorities' requirements.
Check for any evidence of channelisation and erosion	Six monthly/ After Major Storm	Maintenance Contractor	Reinstate eroded areas so that original, designed swale profile is maintained
Weed Infestation	Three Monthly	Maintenance Contractor	Remove any weed infestation ensuring all root ball of weed is removed. Replace with vegetation where required.
Inspect swale surface for erosion	Six Monthly	Maintenance Contractor	Replace topsoil in eroded area and cover and secure with biodegradable fabric. Cut hole in fabric and revegetate.
WETLAND AND OSD BASIN			
Landscape & Vegetation	Refer to Above	Refer to Above	Refer to Above
Inspect and remove any blockage from orifice	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen to inspect orifice.
Inspect trash screen and clean	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen if required to clean it.
Inspect flap valve and remove any blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate. Ensure flap valve moves freely and remove any blockages or debris.

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
Inspect pit sump for damage or blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate & screen. Remove sediment/ sludge build up and check orifice and flap valve is clear.
Inspect storage areas and remove debris/ mulch/ litter etc likely to block screens/ grates.	Six Monthly	Maintenance Contractor/ Owner	Remove debris and floatable materials.
Check attachment of orifice plate and screen to wall of pit	Annually	Maintenance Contractor	Remove grate and screen. Ensure plate or screen mounted securely, tighten fixings if required. Seal gaps if required.
Check orifice diameter is correct and retains sharp edge.	Five yearly	Maintenance Contractor	Compare diameter to design (see Work-as-Executed) and ensure edge is not pitted or damaged.
Check screen for corrosion	Annually	Maintenance Contractor	Remove grate and screen and examine for rust or corrosion, especially at corners or welds.
Inspect overflow weir and remove any blockage	Six monthly	Maintenance Contractor/ Owner	Ensure weir is free of blockage.
Inspect walls for cracks or spalling	Annually	Maintenance Contractor	Remove grate to inspect internal walls, repair as necessary.
Check step irons	Annually	Maintenance Contractor	Ensure fixings are secure and irons are free from corrosion.
INLET & JUNCTION PITS			
Inside of pits	Six Monthly	Maintenance Contractor	Remove grate and inspect internal walls and base, repair where required. Remove any collected sediment, debris, litter.

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
Outside of pits	Four Monthly/ After Major Storm	Maintenance Contractor	Clean grate of collected sediment, debris, litter and vegetation.
PROPRIETARY TREATMENT DEVICES			
Refer to Manufacturers Operation and Maintenance Manual	Annually	Maintenance Contractor	Refer to Manufacturers Operation and Maintenance Manual
RAINWATER TANK			
Check for any clogging and blockage of the first flush device	Monthly	Maintenance Contractor	First flush device to be cleaned out
Check for any clogging and blockage of the tank inlet - leaf/litter screen	Six monthly	Maintenance Contractor	Leaves and debris to be removed from the inlet leaf/litter screen
Check the level of sediment within the tank	Every two years	Maintenance Contractor	Sediment and debris to be removed from rainwater tank floor if sediment level is greater than the maximum allowable depth as specified by the hydraulic consultant
STORMWATER SYSTEM			
General Inspection of complete stormwater drainage system	Bi-annually	Maintenance Contractor	Inspect all drainage structures noting any dilapidation in structures and carry out required repairs.
TANKS			
Inspect and remove any blockage from orifice	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen to inspect orifice.
Inspect trash screen and clean	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen if required to clean it.
Inspect flap valve and remove any blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate. Ensure flap valve moves freely and remove any blockages or debris.

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
Inspect pit sump for damage or blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate & screen. Remove sediment/ sludge build up and check orifice and flap valve are clear.
Inspect storage areas and remove debris/ mulch/ litter etc likely to block screens/ grates.	Six Monthly	Maintenance Contractor/ Owner	Remove debris and floatable materials.
Check attachment of orifice plate and screen to wall of pit	Annually	Maintenance Contractor	Remove grate and screen. Ensure plate or screen mounted securely, tighten fixings if required. Seal gaps if required.
Check orifice diameter is correct and retains sharp edge.	Five yearly	Maintenance Contractor	Compare diameter to design (see Work-as-Executed) and ensure edge is not pitted or damaged.
Check screen for corrosion	Annually	Maintenance Contractor	Remove grate and screen and examine for rust or corrosion, especially at corners or welds.
Inspect overflow weir and remove any blockage	Six monthly	Maintenance Contractor/ Owner	Ensure weir is free of blockage.
Inspect walls for cracks or spalling	Annually	Maintenance Contractor	Remove grate to inspect internal walls, repair as necessary.
Check step irons	Annually	Maintenance Contractor	Ensure fixings are secure and irons are free from corrosion.

ADDITIONAL WETLAND MAINTENANCE ACTIONS

ITEM	WHAT TO CHECK FOR	ACTION	FREQUENCY
Civil Components			
Inlet	No evidence of erosion, blockage, damage or standing water.	Clear inlet of accumulated sediment or debris. Eroded areas should be locally re-profiled or reinforced, and re-planted if necessary.	Storm events 3 months
Outlet	No evidence of erosion, blockage, damage or standing water Outlet freely draining.	Clear outlet of accumulated sediment or debris. Seek specialist advice if standing (backwatering into the raingarden) is present.	Storm events 3 months
Other Structures	No evidence of erosion and damage to other structures, e.g. pits, pipes, access ramps, walls and rock protection.	Repair minor damage to structures. Eroded areas should be repaired (reinforced). This may involve minor re-profiling or re-planting works. For severe damage, i.e. where flows have scoured down the side of a structure seek specialist advice.	3 months
Batter & Bunds	No evidence of erosion	Eroded areas should be locally re-profiled or reinforced, and re-planted if necessary.	Annually
Hydraulic Conductivity	Filter media is draining freely. No water ponded on the surface of the raingarden for more than 12 hours after rainfall.	If water is ponded on the surface of the raingarden for more than 12 hours after rainfall, seek specialist advice. Note: the disposal of raingarden filter material must comply with EPA guidelines for the disposal of contaminated soil.	Storm events
Sediment Accumulation	Sediment forebay less than 75% full. No major sediment accumulation on surface of the raingarden.	Clean out accumulated sediment from the sediment forebay. Accumulated sediment to be removed from the surface of the raingarden and the system replanted as required.	Annually

ITEM	WHAT TO CHECK FOR	ACTION	FREQUENCY
Filter Media Surface	No surface scour, depressions	Filter surface to be repaired. This may involve evening out the surface, importing additional filter media and replanting.	3 months
Fine Sediment Surface Crust	No impermeable or clayey surface on the filter media. No major surface crusting (<3mm depth across less than 10% of the filter area is permissible)	Repair surface layer by scarify filter media surface, re-profiling and re-establishing vegetation, if required. If the problem persists refer to seek specialist advice.	3 months
Mulch Layer	Even depth and distribution of the mulch layer. Surface of the mulch layer is at least 100 mm below the top of the outflow pit. Mulch is not touching the plant stems	Re-distribute or replace mulch that has been washed out or displaced. This may involve retaining mulch using jute mats or nets. Remove mulch that is touching plant stems.	3 months
Algal or Moss Growth	No major algal growth (less than 10% of raingarden area is permissible). No moss growth.	If significant patches of algal growth or moss persist across the surface of the raingarden (i.e. greater than 10% of the surface) then seek specialist advice.	3 months
Inspection Opening	Water level is below filter media layer. No sediment accumulation in underdrain system.	Seek specialist advice if standing water is present in the filter media layer. Flush the underdrain system using low pressure water jet to remove accumulated sediment.	Annually
Landscape Components			
Vegetation Cover – Filter Media	Greater than 90% vegetation cover. Plants healthy, free from disease and vigorously growing.	Remove any dead or diseased vegetation. Replant individual bare patches (greater than 5% of the area) using either new plants or by dividing and translocating existing plants. If bare areas represent greater than 30% of the raingarden area, seek specialist advice.	3 months
Vegetation Cover – Batters	Continuous vegetation cover along the lower batter. Greater than 90% vegetation cover. Plants healthy, free	Remove any dead or diseased vegetation. Replant individual bare patches (greater than 5% of the area) using	3 months

ITEM	WHAT TO CHECK FOR	ACTION	FREQUENCY
	from disease and vigorously growing.	either new plants or by dividing and translocating existing plants.	
Weeds -filter media - batters	Less than 10% of the filter media surface area and batters covered in weeds.	Physically remove weeds from filter media surface and batters. Do not use herbicides as these may harm the desirable raingarden vegetation and contaminate the filter media. Seek specialist advice if weed ingress is a persistent problem (i.e. weed coverage is persistently greater than 30%).	3 months
Litter	Filter media surface and batters free of litter (i.e. less than 1 piece litter per 4m ²).	Remove all litter and excessive debris	3 months
Pests	No damage by pest animals and insects.	Seek specialist advice if persistent insect damage is observed.	3 months

Appendix E

EXISTING FACILITY CIVIL ENGINEERING DESIGN DRAWINGS

BECA PTY LTD 2004

DRAWING INDEX

DRAWING No.

TITLE

610309-CV-100

GENERAL NOTES - CIVIL WORKS

610309-CV-201
610309-CV-202

SITE PLAN - EXISTING CONDITIONS
SITE PLAN - CIVIL WORKS

610309-CV-211
610309-CV-212
610309-CV-213
610309-CV-214
610309-CV-215
610309-CV-216
610309-CV-217
610309-CV-218
610309-CV-219
610309-CV-220

SETOUT DETAIL PLAN SHEET 1 OF 4
SETOUT DETAIL PLAN SHEET 2 OF 4
SETOUT DETAIL PLAN SHEET 3 OF 4
SETOUT DETAIL PLAN SHEET 4 OF 4
SITE SECTIONS
WETLAND No.2 AND OPEN EASEMENT DRAIN LAYOUT PLAN
WETLAND No. 1 SITE SECTIONS AND GABION DETAILS
WETLAND No. 2 AND OPEN EASMENT DRAIN LONG SECTION
WETLAND No. 2 AND OPEN EASMENT DRAIN SECTIONS SHEET 1 OF 2
WETLAND No. 2 AND OPEN EASMENT DRAIN SECTIONS SHEET 2 OF 2

610309-CV-221
610309-CV-222

CARPARK SETOUT DETAIL PLAN
CARPARK SECTIONS

610309-CV-231
610309-CV-232
610309-CV-233
610309-CV-234
610309-CV-235
610309-CV-236
610309-CV-237
610309-CV-238
610309-CV-239
610309-CV-240

DRAINAGE PLAN SHEET 1 OF 4
DRAINAGE PLAN SHEET 2 OF 4
DRAINAGE PLAN SHEET 3 OF 4
DRAINAGE PLAN SHEET 4 OF 4
DRAINAGE DETAILS SHEET 1 OF 6
DRAINAGE DETAILS SHEET 2 OF 6
SPARE
DRAINAGE DETAILS SHEET 4 OF 6
DRAINAGE DETAILS SHEET 5 OF 6
DRAINAGE DETAILS SHEET 6 OF 6

610309-CV-245
610309-CV-246
610309-CV-247

EAST BOUNDARY FLOW SPLITTER LAYOUT
FLOW SPREADER No. 1 REINFORCEMENT PLAN AND DETAILS
FLOW SPREADER No. 3 AND 4 REINFORCEMENT PLAN AND DETAILS

610309-CV-249

REINFORCEMENT DETAILS FOR PITS P122 AND P309

610309-CV-251
610309-CV-252
610309-CV-253
610309-CV-254
610309-CV-255
610309-CV-256

EXTERNAL PAVEMENT DETAIL PLAN SHEET 1 OF 4
EXTERNAL PAVEMENT DETAIL PLAN SHEET 2 OF 4
EXTERNAL PAVEMENT DETAIL PLAN SHEET 3 OF 4
EXTERNAL PAVEMENT DETAIL PLAN SHEET 4 OF 4
EXTERNAL PAVEMENT DETAILS SHEET 1 OF 2
EXTERNAL PAVEMENT DETAILS SHEET 2 OF 2

GENERAL

REFER TO NETWORK GEOTECHNICS GEOTECHNICAL REPORT G23006/1-A APRIL 2003.

1. NO PROVING OF EXISTING SERVICES HAS BEEN UNDERTAKEN THE CONTRACTOR SHALL PROVE ALL SERVICES BEFORE COMMENCING CONSTRUCTION AND ADVISE THE SUPERINTENDENT OF ANY DISCREPANCIES IN THE CONTRACT DOCUMENTS BEFORE PROCEEDING. ALLOW FOR ALL SITE CONDITIONS. THE CONTRACTOR MUST COORDINATE WITH ALL OTHER BURIED SERVICES.

2. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATIONS, ALL ARCHITECTURAL AND OTHER CONSULTANTS DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT.

3. PIPEWORK ROUTES ARE GENERALLY DIAGRAMMATIC, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE OVERALL COORDINATION OF STORMWATER DRAINAGE WITH OTHER BUILDING SERVICES AND IN COMPLIANCE WITH AUTHORITY REGULATIONS.

4. ALL INVERT LEVELS OF SWALES/TABLE DRAINS AND RL'S ARE FINISHED SURFACE LEVELS U.N.O.

5. ALL DIMENSIONS SHOWN SHALL BE VERIFIED ON SITE. DRAWINGS SHALL NOT BE SCALED.

6. ALL DIMENSIONS NOTED ARE IN MILLIMETERS AND PIPEWORK SIZES SHOWN ARE IN NOMINAL BORE DIAMETER UNLESS NOTED OTHERWISE.

7. ALLOW FOR DEWATERING OF DRAINS IN UNSTABLE, OR WATER-CHARGED GROUND. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CHECK INFORMATION FROM BORE LOGS, TEST PITS AND SITE INVESTIGATION REPORTS, FROM WHICH A REASONABLE ASSESSMENT MAY BE MADE OF THE NATURE OF MATERIALS EXISTING BELOW THE SURFACE. IT SHALL BE DEEMED THAT THE CONTRACT SUM INCLUDES FULL PROVISION FOR ALL DRAINAGE WORK REQUIRED FOR CONSTRUCTION AND SATISFACTORY COMPLETION OF THE WORKS. THE CONTRACTOR SHOULD MAKE THEMSELVES AWARE OF SUCH DOCUMENTS AND ALLOW FOR NECESSARY WORKS IN THE TENDER. NO ADDITIONAL PAYMENT FOR FILLED, UNSTABLE OR WATER-CHARGED GROUND DRAINAGE CONSTRUCTION WILL BE CONSIDERED.

SEDIMENTATION & EROSION CONTROL

THE CONTRACTOR SHALL REFER TO EROSION AND SEDIMENT CONTROL - CONCEPT PLAN DWG No. 610309-SE-101-D AND SUBMIT ENVIRONMENTAL MANAGEMENT DRAWINGS FOR COUNCIL APPROVAL TO CONFIRM THAT THEIR PROPOSED SEDIMENT AND EROSION CONTROL MEASURES AND MAINTENANCE ACTIONS ARE IN ACCORDANCE WITH THE FOLLOWING WORKS AND SEQUENCING, COUNCIL REQUIREMENTS (DCP 67) AND THE RELEVANT INDUSTRY GUIDELINES.

STAGE 1 - PRE-CONSTRUCTION
CONTRACTOR TO ASSESS THE RISK OF A HAZARD ARISING AT WARNERVALE AIRPORT FROM WIND BLOWN DUST FROM THE SITE AND UNDERTAKE CONTROL MEASURES AS REQUIRED (e.g. WATER CART, MINIMISING EXPOSED CUT AREAS).
CONTRACTOR TO INITIATE AND ENSURE REGULAR LIAISON WITH WARNERVALE AIRPORT OPERATIONS AND TO REMAIN AWARE OF ANY LIKELY RISK OF DUST NUISANCE OR POTENTIAL WILDFOWL HAZARD ARISING FROM THE SITE ACTIVITIES.

PROVIDE SUB-BASE FOR ACCESS ROADS, SITE STORAGE, TEMPORARY AMENITIES AREAS. INSTALL SHAKER RAMP AT THE MAIN ENTRY/EXIT ROAD.
SUPPLY AND FIX GEOTEXTILE FABRIC, 10 HIGH, TO PERIMETER SITE FENCES AS SHOWN ON SK101-D.

STAGE 2 - EARLY CONSTRUCTION
RETAIN AS MUCH EXISTING LOW-LEVEL / SHRUB VEGETATION AS POSSIBLE, PARTICULARLY ON THE ELEVATED AREAS AND AS A BUFFER STRIP NEXT TO THE BOUNDARY FENCES.
CONSTRUCT EARTHWORKS FOR SWALES, OPEN EASEMENT DRAIN AND WETLAND / DETENTION PONDS PRIOR TO BULK EARTHWORKS FOR BUILDING PLATFORMS.
CONSTRUCT SILT FENCES ACROSS THE SWALES AT APPROXIMATELY 50M INTERVALS. PROVIDE CUTOFF DRAINS AS REQUIRED AROUND MAJOR EARTHWORKS AND DIRECT TO THE SWALE OR POND.

STAGE 3 - POST-EARTHWORKS
VEGETATE WETLANDS, SWALES, BATTERS AND STRIPPED AREAS OUTSIDE THE BUILDING ENVELOPE IN ACCORDANCE WITH THE CIVIL AND LANDSCAPE DRAWINGS.

REGULARLY MAINTAIN SEDIMENT AND EROSION CONTROL STRUCTURES TO ENSURE AFTER EACH RAINFALL THEY ARE IN GOOD CONDITION FOR THE NEXT EVENT.
PROVIDE A WATER CART FOR PERIODIC DAMPENING OF ACCESS ROADS, ETC.

EARTHWORKS

1(a). STRIP ALL TOPSOIL, EXISTING FILL AND OTHER DELETERIOUS MATERIAL FROM BUILDING PLATFORMS, PAVEMENTS, SWALES ETC. NOMINAL STRIP DEPTH 25mm. TOPSOIL IS TO BE SEPARATED FROM FILL/DELETERIOUS MATERIAL & STOCKPILED SEPARATELY. CONFIGURATION OF STOCKPILE TO BE DETERMINED ON SITE IN CONJUNCTION WITH SUPERINTENDENT.
DELETERIOUS MATERIAL TO BE REMOVED FROM SITE.

1(b). FOR ALL PAVEMENT AND BUILDING PLATFORMS, SCARIFY EXPOSED SUBGRADE TO 150mm DEPTH, MOISTURE CONDITION TO +2% OF OMC. ANY SOFT SPOTS SHOULD BE REMOVED AND REPLACED WITH SUITABLE SITE MATERIAL. IN AREAS WHERE IN-SITU ROCK IS EXPOSED, IT SHOULD BE RIPPED 300mm DEPTH AND RECOMPACTED AS ABOVE.

1(c). MINIMUM COMPACTION FOR FILL (FROM SITE OR IMPORTED) TO BE 98% OF MAXIMUM DRY DENSITY OF STANDARD COMPACTION TEST AND WITH MOISTURE CONTENT WITHIN +2% OF STANDARD OMC. THE UPPER 300mm TO PAVEMENT SUBGRADE SHALL BE COMPACTED TO MINIMUM 100% STANDARD.

1(d). EARTHWORKS TESTING IS TO BE CARRIED OUT TO LEVEL 1 REQUIREMENTS OF AS 3798.

2. BATTER TO CUT / FILL SLOPES AND SWALES TO BE 1V TO 6H UNLESS NOTED OTHERWISE.

3. ALL EXCAVATIONS SHALL BE INSPECTED AND APPROVED BY THE GEOTECHNICAL ENGINEER BEFORE PLACEMENT OF FILL OR PAVEMENT OVER

4(a). ON ALL BATTER SLOPES, SWALES AND TABLE DRAINS AND SIMILAR EXPOSED SUBGRADES TO HAVE 50mm LAYER OF SELECTED SITE TOPSOIL BELOW FINISHED SURFACE LEVEL U.N.O.

ANY SURPLUS TOPSOIL IS TO BE STOCKPILED & SHAPED INTO ROUNDED MOUND AS DIRECTED BY THE SUPERINTENDENT.

4(b). ON ALL BATTERS AND INVERTS OF SWALES (OPEN EASEMENT DRAIN WETLANDS 1 & 2 'RAIN GARDEN' TYPE 1 & 2 SWALES & TABLE DRAINS) SUBGRADE IS TO BE SCARIFIED (SURFACE ROUGHENED) PRIOR TO PLACEMENT OF TOPSOIL. ALL REMAINING AREAS TO HAVE SUBGRADE CULTIVATED TO 150mm DEPTH PRIOR TO PLACING TOPSOIL.

4(c). ALL CARPARK SWALE END-ISLANDS TO HAVE 300mm THICK TOPSOIL OVER 150mm CULTIVATED SUBGRADE.

5. ALL NON-CONSTRUCTION AREAS BOUNDED BY 'NEW PAVEMENT' BATTERS AND SWALES ARE TO BE SUITABLY GRADED (EITHER CUT OF FILL) BETWEEN DESIGN RL'S OF CONSTRUCTED WORKS SO AS TO AVOID PONDING AND HIGH SPOTS. ALLOW TO COVER WITH SITE SELECTED TOPSOIL.

6. EXISTING GEOTECHNICAL TEST PITS ON SITE ARE TO BE CLEANED TO A FIRM BASE AND BACKFILLED AS PER NOTE 1(c).

PAVEMENTS

1. MINIMUM DESIGN CBR OF PAVEMENT SUBGRADE IS 2.5%. PROOF ROLL SUB-GRADE TO ACHIEVE THIS SOAKED CBR BEFORE FILLING.

2. NOTE: SERVICE ROAD (SPRAY SEAL) ON SOUTH WEST SIDE OF MAIN BUILDING IS NOT DESIGNED FOR FORKLIFTS AND WILL FAIL UNDER THIS LOADING.

3. NOTE: CONCRETE PAVEMENTS ARE NOT DESIGNED FOR HEAVY FORKLIFT TRAFFIC.

4. LINE MARKING TO BE 100mm WIDE WHITE LINE U.N.O. DISABLED PARKING SYMBOLS TO BE BLUE REFER TO ARCHITECTURAL DRAWINGS.

5. GUARD FENCE TO BE IN ACCORDANCE WITH VICROADS TYPE D GUARD FENCE WITH STEEL POSTS, STD DRG. SD 3640 OR RTA EQUIVALENT.

6. CONCRETE BARRIER (NEW JERSEY) TO BE IN ACCORDANCE WITH VICROADS TYPE F - SHAPE 250mm CAST-IN-PLACE, STD DRG. SD 3900 OR RTA EQUIVALENT.

7. REFER TO ARCHITECTURAL DRAWINGS FOR BOLLARD TYPES AND LOCATIONS. ALLOW BLOCKOUTS IN CONCRETE PAVEMENT TO NOMINATED SIZE

8. HEAVY DUTY PAVEMENTS DESIGNED TO ACCOMMODATE 40 TRUCKS PER HOUR, 22 HOURS PER DAY EACH DAY OVER 40 YEAR DESIGN LIFE.

STORMWATER DRAINAGE

1. PIPES 225mm DIA AND ABOVE SHALL BE CLASS 2 REINFORCED CONCRETE PIPES, RUBBER RINGED JOINTED UNLESS NOTED OTHERWISE.

2. PIPES LESS THAN 225mm DIA SHALL BE PVC CLASS SEWER EXTRA HEAVY, SOLVENT WELD JOINTED UNLESS NOTED OTHERWISE.

3. PIPES TO GRADE AT 1 IN 100 MINIMUM U.N.O. AGI PIPES TO GRADE AT 1 IN 200 MINIMUM U.N.O. AND DISCHARGE TO SWALE 200mm ABOVE INVERT. PROVIDE CONCRETE MORTAR BENCHING BETWEEN INVERTS U.N.O.

4. ALIGN OVERTS OF MAIN INLET AND OUTLET PIPES U.N.O.

5. PIT LOCATIONS AND RL'S SHOWN SHALL BE CHECKED RELATIVE TO PAVEMENT LEVELS AND CONCRETE JOINTS U.N.O.

6. PIT COVERS AND GRATES TO HAVE CLASS D LOAD RATING IN ACCORDANCE WITH AS 3996 IN PAVEMENT AREAS U.N.O.

7. PIT COVERS AND GRATES TO HAVE CLASS B LOAD RATING IN ACCORDANCE WITH AS 3996 IN NON-PAVEMENT AREAS U.N.O.

8. PIT COVERS IN LANDSCAPED AREAS TO BE PRECAST CONCRETE FLUSH WITH ADJACENT SURFACE U.N.O.

9. ALL PITS OVER 12m DEEP SHALL HAVE HD GALVANIZED STEP IRONS PROVIDE CONCRETE MORTAR BENCHING BETWEEN INVERTS U.N.O.

10. CULVERT LL'S AT ENTRY/EXIT TO MATCH POND/SWALE RL'S U.N.O.

11. CONTRACTOR SHALL TAKE DUE AND NECESSARY CARE TO PREVENT DAMAGE TO ALL STORMWATER PIPES DURING CONSTRUCTION PHASE. CONTRACTOR SHALL BE RESPONSIBLE FOR COSTS ASSOCIATED WITH NECESSARY AND PROPER REPAIR.

12. ALL DCL PIPES TO HAVE PROPRIETARY PLASTIC SLEEVES, RCP PIPES TO HAVE PROPRIETARY PLASTIC SLEEVES.

OPEN EASEMENT DRAIN

1. CHECK EXISTING DRAIN INVERT LEVELS AT BOUNDARY CROSSINGS AND ADVISE ENGINEER OF ANY DISCREPANCY PRIOR TO ANY CONSTRUCTION. DRAIN TO GRADE EVENLY BETWEEN EXISTING LEVELS.

2. CONNECT EXISTING DRAIN INTO NEW DRAIN, AT UPSTREAM END, ONLY AFTER COMPLETION OF ALL NEW WORKS FOR CHANNEL AND WETLANDS

3. PRIOR TO BACKFILL OF EXISTING DRAIN CLEAN OUT ALL SOFT MATERIAL BACK TO A FIRM BASE.

4. MACCAFERRI GABIONS TO BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATION TS08
WIRE DIA. 2.7mm PVC COATED
ROCKFILL SHALL BE AS PER CLAUSE 2.8 OF TS08
GEOTEXTILE AROUND GABIONS SHALL BE AS PER CLAUSE 2.9 OF TS08

VEGETATION

1. REFER TO LANDSCAPE DRAWINGS FOR WETLAND AND VEGETATION REQUIREMENTS.



1.0 GENERAL NOTES

1. THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

2. FOR OTHER NOTES REFER TO DRAWING No. CV-100

2.0 DIMENSIONS

3. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

4. DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

1	28.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
8	09.09.04	ISSUED FOR CONSTRUCTION	DAT
REV.	DATE	AMENDMENT	SIGNED

CLIENT



640 George Street,
PO Box 470,
Telephone (02) 9323 1555

Sydney NSW 2000
Sydney NSW 1220
Facsimile (02) 9323 1565

PROJECT MANAGER



Level 10, Clifton Coney Centre, 2 Park Street, Sydney NSW 2000
Telephone (02) 9337 2100 Fax (02) 9337 2100

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS



Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel. (02) 9691 6773 Fax (02) 9633 9477
www.becca.com.au

ARCHITECTS

BMIA ARCHITECTS
Level 4, 8 Help Street, Chalmerswood 2087
Tel: (02) 9469 9400 Fax: (02) 9469 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9667 6677 Fax: (02) 9664 0677

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS
903 Ryde Road, Pymble 2073
Tel: (02) 9469 8673 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1364 Pacific Highway, Tuncumbra NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

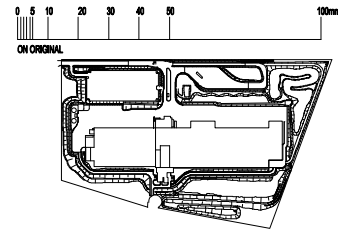
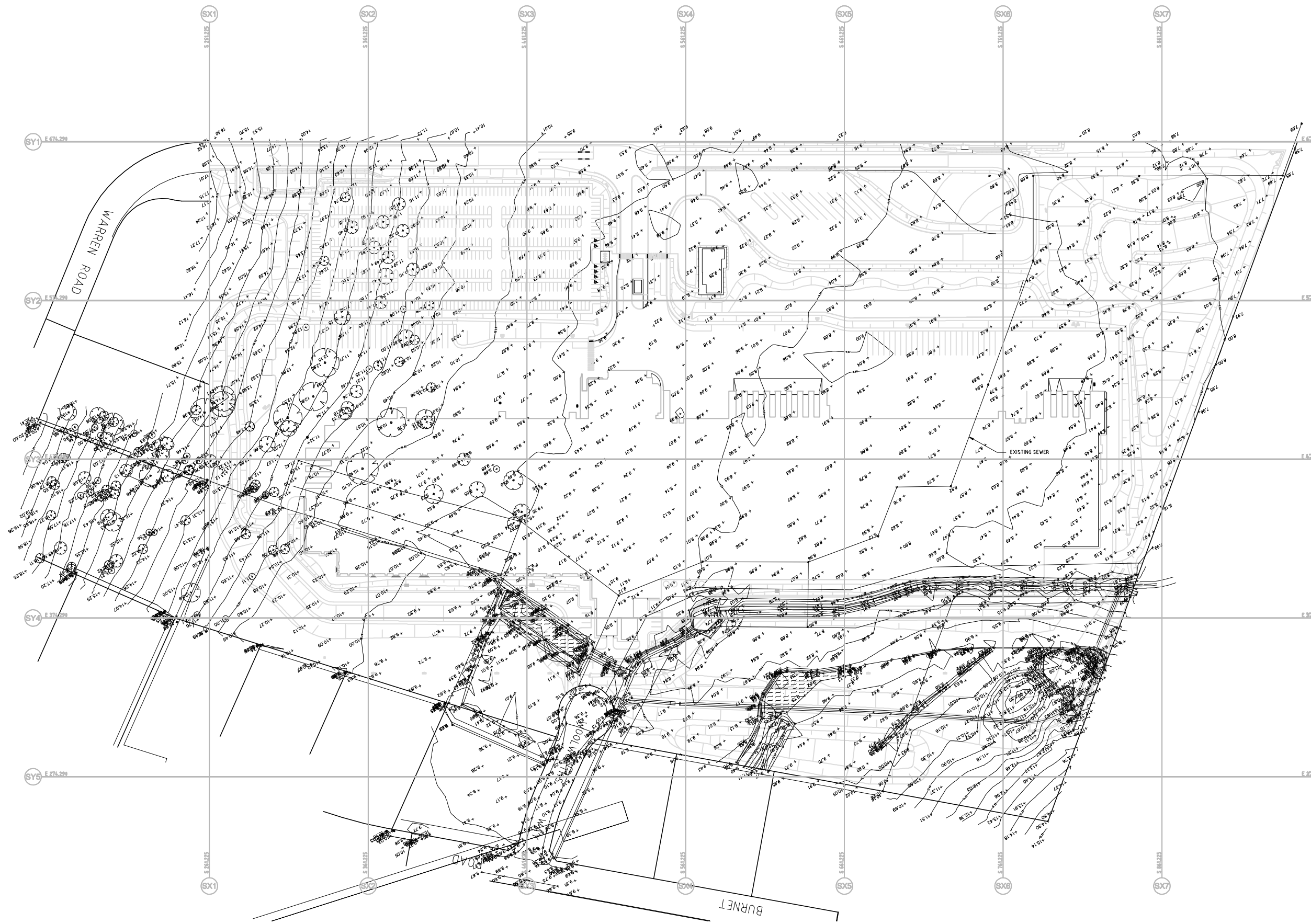
TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9664 3733 Fax: (02) 9664 3825

COST MANAGER

RIDDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9022 2277 Fax: (02) 9667 4197

TITLE			
GENERAL NOTES CIVIL WORKS			
DATE	APRIL 04	PROJECT No.	STATUS
SCALE	N.T.S.	(B1)	610309 CV/CD
DRAWN	PAS	DWG No.	REV No.
CHECKED	BTX	CV 100 1	
APPROVED	JAH		

FOR CONSTRUCTION



1.0 GENERAL NOTES
a) THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b) FOR OTHER NOTES REFER TO DRAWING No. CV-100
2.0 DIMENSIONS
a) VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b) DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

1	28.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
2	09.09.04	ISSUED FOR CONSTRUCTION	DAT
REV.	DATE	AMENDMENT	SIGNED

CLIENT

540 George Street, Sydney NSW 2000
PO Box 470, CVO Post Office, Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1565

PROJECT MANAGER

Level 18, Clifton Coney Group, 2 Park Street, Sydney NSW 2000
Telephone (02) 9327 2100 Fax (02) 9327 2108

PROJECT
**WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259**

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel. (02) 9891 6773 Fax (02) 9633 9477
www.becca.com.au

ARCHITECTS

BMA ARCHITECTS
Level 4, 8 Help Street, Chalmers 2087
Tel: (02) 9465 6400 Fax: (02) 9465 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9857 5577 Fax: (02) 9854 0577

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel: (02) 9469 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Turrum NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

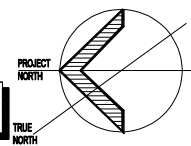
TRACT CONSULTANTS PTY LTD
Level 1, 185 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9554 3733 Fax: (02) 9554 3825

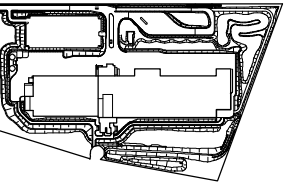
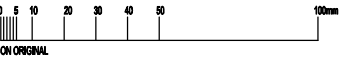
COST MANAGER

RYDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9822 2277 Fax: (02) 9857 4187

TITLE			
SITE PLAN EXISTING CONDITIONS			
DATE	FEB 04	PROJECT No.	610309 CV/CD
SCALE	1:1000	(B1)	
DRAWN	DAT		
CHECKED	BTB	DWG No.	REV No.
APPROVED	JAH	CV 201	1

FOR CONSTRUCTION





- 1.0 GENERAL NOTES**
a) THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b) FOR OTHER NOTES REFER TO DRAWING No. CV-00
- 2.0 DIMENSIONS**
a) VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b) DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
4	24.03.05	FOOTPATHS REVISED	DAT
3	15.11.04	ROAD PAVEMENT REVISED	DAT
2	08.10.04	ROAD ALIGNMENT REV FOR BANANA ROOM EXT.	DAT
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

Supply Chain Woolworths
540 George Street, Sydney NSW 2000
PO Box 470, Chiswick Post Office Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1595

PROJECT MANAGER
Clifton Coney
Level 15, Clifton Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9287 2100 Fax: (02) 9287 2108

PROJECT
WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS
Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel: (02) 9891 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS
BBMA ARCHITECTS
Level 4, 8 Help Street, Chiswood 2067
Tel: (02) 9495 9400 Fax: (02) 9495 8444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9557 5577 Fax: (02) 9554 0677

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
933 Ryde Road, Pymble 2073
Tel: (02) 9499 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS
WYER DONNELLY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Tuncurry NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

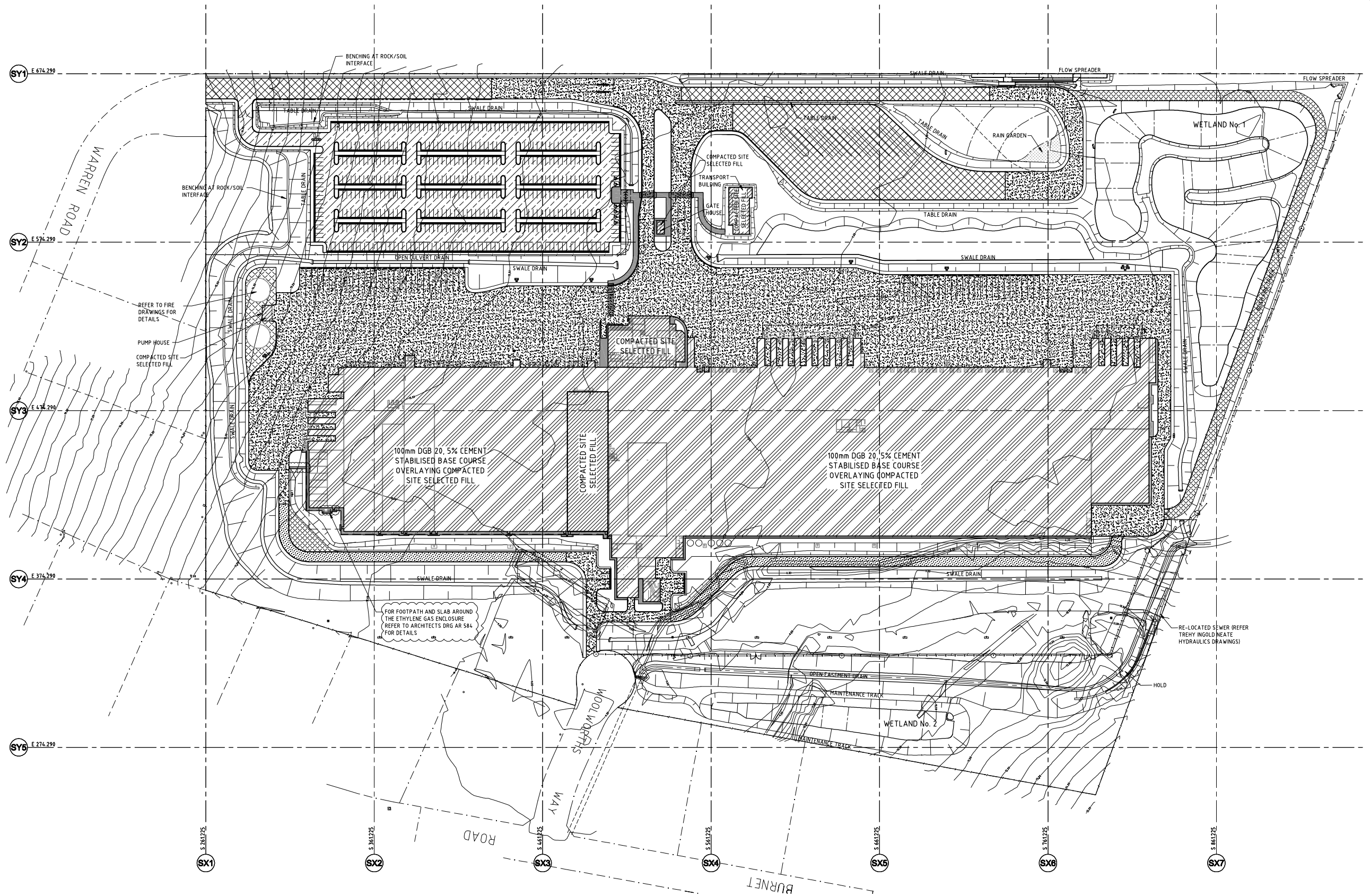
FIRE ENGINEERED SOLUTION CONSULTANTS
ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 106 Blues Point Rd, McMahon's Point, NSW 2060
Tel: (02) 9554 3733 Fax: (02) 9554 3825

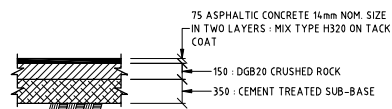
COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9622 2277 Fax: (02) 9657 4197

TITLE
SITE PLAN
CIVIL WORKS

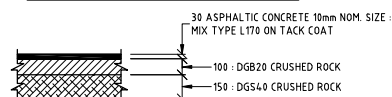
DATE	FEB 04	PROJECT No.	610309	610309
SCALE	1:1000	(B1)	CV/CV	
DRAWN	DAT			
CHECKED	STK	DATE		
APPROVED	SHW	DATE		



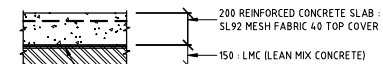
- LEGEND**
- ASPHALT PAVEMENT TYPE 1 (HEAVY DUTY)
 - ASPHALT PAVEMENT TYPE 2
 - CONCRETE PAVEMENT (HEAVY DUTY)
 - SPRAYED BITUMEN AND CHIP SEAL
 - CRUSHED ROCK SURFACING
 - 100mm THICK FOOTPATH SL62 MESH CENTRAL



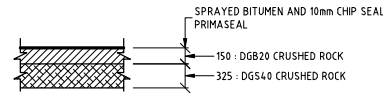
ASPHALT PAVEMENT TYPE 1



ASPHALT PAVEMENT TYPE 2



HEAVY DUTY CONCRETE PAVEMENT



SPRAYED BITUMEN AND CHIP SEAL

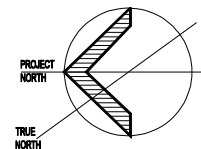


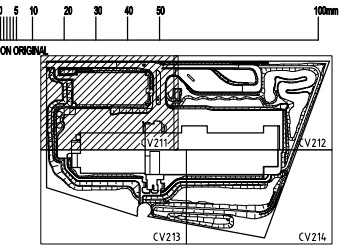
CRUSHED ROCK SURFACE

REFER TO STRUCTURAL DRAWINGS FOR SPECIFIC SUB-BASE LAYERS UNDER BUILDINGS

PERMISSIBLE AXLE LOADS FOR HEAVY DUTY PAVEMENTS	
TYPE OF AXLE	MAX. LOAD (TONNES)
STEER AXLE	6.0
SINGLE AXLE	9.0
TANDEM AXLE GROUP	16.5
TRI-AXLE GROUP	20.0
NOTE: PAVEMENTS ARE NOT DESIGNED FOR FORKLIFTS AND THEREFORE MAY FAIL UNDER FORKLIFT LOADING	

FOR CONSTRUCTION





KEY PLAN

1.0 GENERAL NOTES

1.1 THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

1.2 FOR OTHER NOTES REFER TO DRAWING No. CV-101

2.0 DIMENSIONS

2.1 VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

2.2 DO NOT SCALE THE DRAWINGS.

REFER TO ARCHITECTS DRAWINGS FOR SETOUT DETAILS OF FOOTPATH AROUND TRANSPORT CONTRACTORS BUILDING, GATEHOUSE & TURNSTILE. REFER TO STRUCTURAL DWGS FOR CONSTRUCTION DETAILS AROUND GATEHOUSE AND TRANSPORT CONTRACTORS BUILDING.

LEGEND

INDICATES FALL

INDICATES POINT LOCATED IN TABLE

INDICATES LEVEL POINT

POSITION OF LEVELS SHOWN ON PLAN AT KERB AND CHANNEL TYPE 2 AND 3 REFER TO DRG. CV 255 FOR DETAILS.

POSITION OF LEVELS AND TABLE POINTS SHOWN ON PLAN AT FLUSH KERBS TYPE 1 REFER TO DRG. CV 255 FOR DETAILS.

POSITION OF TABLE POINTS SHOWN ON PLAN AT KERB AND CHANNEL TYPE 2 AND 3 REFER TO DRG. CV 255 FOR DETAILS.

TYPICAL HEADWALL ENTRY/EXIT REFER TO DRAWING CV 236 FOR DETAILS

EXTERNAL BOLLARD REFER TO ARCHITECTURAL DRAWINGS FOR DETAILS

STORMWATER PITS REFER TO CV 231 TO CV 234 FOR LOCATIONS

DENOTES TABLE DRAIN REFER TO DRAWING CV 236 FOR DETAILS

DENOTES BENCH AT ROCK/SOIL INTERFACE. LOCATION IS INDICATIVE.

DENOTES SWALE TYPE 1 REFER TO DRAWING CV 236 FOR DETAILS

DENOTES SWALE TYPE 2 REFER TO DRAWING CV 236 FOR DETAILS

DENOTES INVERTED BOX CULVERT REFER TO DRAWING CV 236 FOR DETAILS

DENOTES BATTER DIRECTION ALL SLOPES TO BE 1 IN 6 U.N.O.

FOOTPATH CROSSING TO SUIT 3m WIDE CROSSING. MAXIMUM CROSSFALL 1 IN 8

GUARD FENCE REFER TO GENERAL NOTES ON DRG. CV 100

REFER TO ARCHITECTURAL DRAWINGS FOR FINAL AND APPROVED FENCE LAYOUT.

ROAD SHOULDER WIDTH 2m U.N.O.

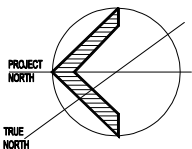
FOR CONTINUATION REFER TO DRAWING 610309-CV-212

FOR CONTINUATION REFER TO DRAWING 610309-CV-213

REF.	SOUTHING Mtr.	EASTING Mtr.	REF.	SOUTHING Mtr.	EASTING Mtr.	REF.	SOUTHING Mtr.	EASTING Mtr.	REF.	SOUTHING Mtr.	EASTING Mtr.
B1	261.225	671.790	B23	NOT USED	NOT USED	C2	299.224	497.065	C24	284.771	505.925
B2	261.225	659.290	B28	556.433	636.694	C3	299.645	506.485	C25	284.709	549.340
B3	277.975	659.290	B29	549.475	617.483	C4	303.159	514.971	C26	294.709	559.340
B4	291.475	659.290	B30	549.475	577.050	C5	303.159	525.940	C27	302.959	559.340
B9	361.225	671.790	B31	537.475	574.000	C6	301.659	527.440	C28	293.159	500.000
B10	361.225	659.290	B32	537.475	643.483	C7	300.659	527.440	C29	286.710	477.760
B11	461.225	671.790	B33	535.278	648.787	C8	300.659	536.840	C30	499.975	548.340
B12	461.225	659.290	B34	531.743	652.322	C9	301.659	536.840	D4	377.943	652.097
B13	477.715	659.290	B35	527.475	650.554	C10	303.159	538.340	D5	386.786	651.744
B14	480.452	659.038	B36	519.975	635.073	C11	303.159	544.340	D6	436.184	651.549
B15	503.625	654.737	B37	519.975	601.233	C12	311.975	544.340	D7	448.285	651.156
B16	520.152	671.790	B38	517.975	589.890	C13	316.975	549.340	D1	NOT USED	NOT USED
B17	526.547	670.751	B39	517.975	566.352	C14	316.975	559.340	D2	NOT USED	NOT USED
B18	537.552	667.237	B40	527.475	574.000	C15	414.975	559.340	D3	NOT USED	NOT USED
B19	543.475	666.291	B41	438.840	671.790	C16	414.975	549.340	D8	500.167	650.746
B20	535.985	662.290	B42	438.840	659.290	C17	419.975	544.340	D9	511.830	647.016
B21	540.882	658.290	B43	543.475	658.290	C18	422.414	544.340	D10	513.813	637.423
B22	540.882	656.290	B44	573.975	656.290	C19	427.590	545.021	D11	513.799	607.963
B24	561.775	648.290	B45	543.475	646.911	C20	439.975	548.340	D12	324.878	562.513
B25	573.844	648.290	B46	527.275	602.255	C21	536.790	539.825	D13	417.215	562.513
B26	573.844	640.290	B47	537.675	602.255	C22	533.976	558.693	D14	505.844	560.735
B27	564.114	640.290	C1	286.709	488.579	C23	567.475	559.050	D15	564.871	564.848

NOTE COORDINATES ARE TO SITE GRID ORIENTATED TO PROJECT NORTH. FOR SET OUT POINTS FOR GRID REFER TO ARCHITECTS DRAWINGS.

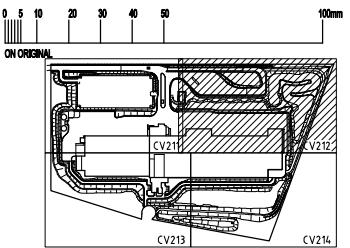
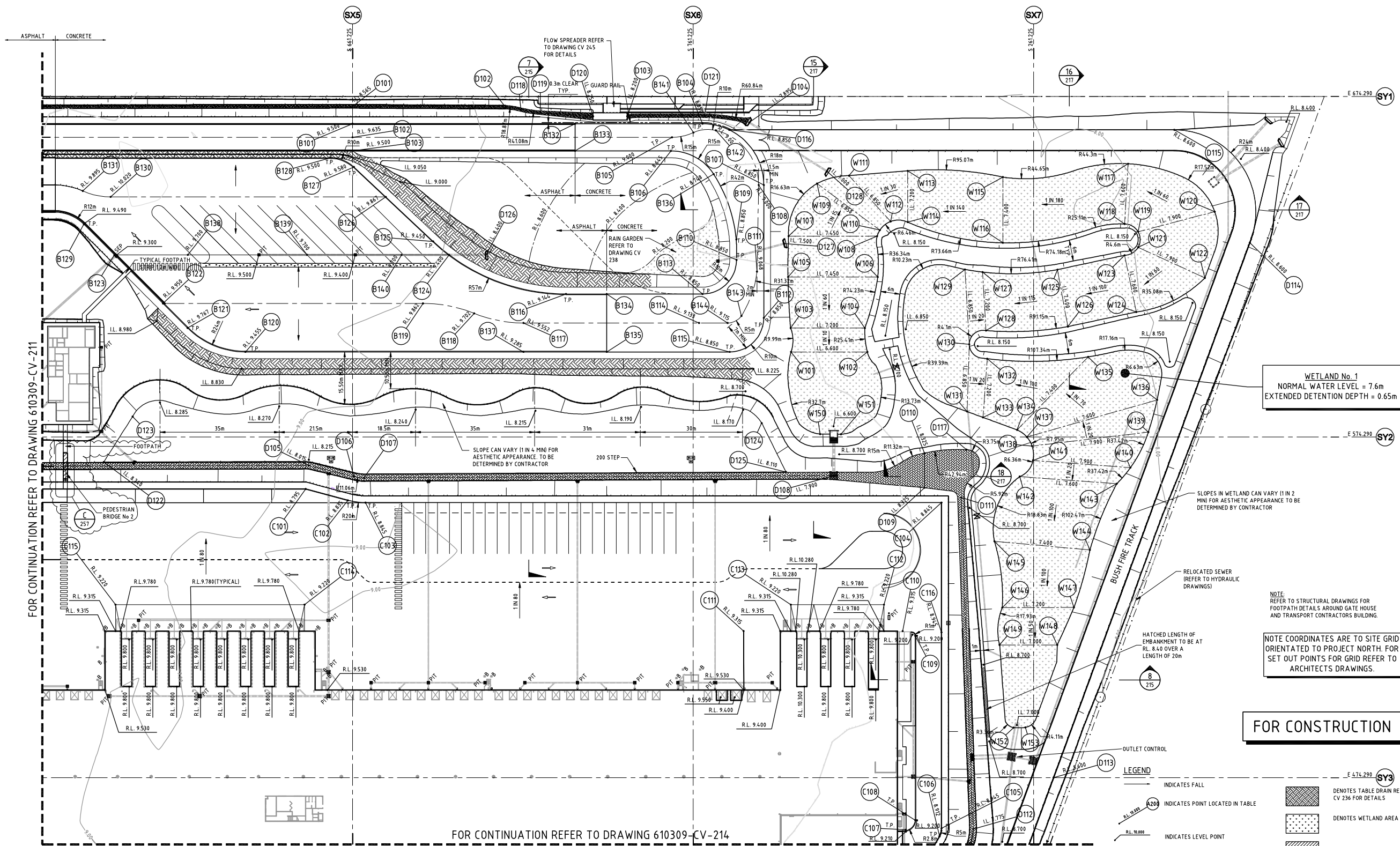
FOR CONSTRUCTION



TITLE

SETOUT DETAIL PLAN
SHEET 1 OF 4

DATE	APRIL '14	PROJECT No.	610309
SCALE	1:500 (B1)	C/V/C/D	
DRAWN	DAT	DWG No.	
CHECKED	BTX	REV No.	
APPROVED	JHW	CV 211	4



KEY PLAN

- 1.0 GENERAL NOTES**
- A) THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- B) FOR OTHER NOTES REFER TO DRAWING NO. CV-100
- 2.0 DIMENSIONS**
- A) VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- B) DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SKETCHED
5	28.11.05	PEDESTRIAN BRIDGE No 2 AMENDED	AGF
4	22.07.05	FOOTPATH AMENDED	AGF
3	02.06.05	B108 AND B116 R.L.'S REVISED	DAT
2	22.03.05	TRUCK TURNING SUPER-ELEVATION ADDED	DAT
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT

Supply Chain Woolworths

540 George Street, Sydney NSW 2000
PO Box 070, QVB Post Office Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1595

PROJECT MANAGER

CliftonConey Group

Level 14, CliftonConey Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 8287 2100 Fax: (02) 8287 2188

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & RECREATION ENGINEERS

Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street, Parramatta 2150
Tel: (02) 9851 6713 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS

MINA ARCHITECTS
Level 4, 8 Hilly Street, Cheshamwood 2087
Tel: (02) 9495 0400 Fax: (02) 9495 0444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9557 5577 Fax: (02) 9554 0577

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS
933 Ryde Road, Pymble 2073
Tel: (02) 9490 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

WYCH DOWHOLLY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Tuncurry NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERING SOLUTION CONSULTANTS

ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9520 9320 Fax: (02) 9520 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD
Level 1, 188 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9554 3733 Fax: (02) 9554 3825

COST MANAGER

RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9522 2277 Fax: (02) 9557 4197

TITLE

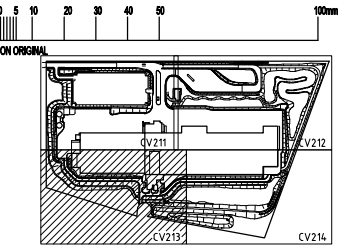
SETOUT DETAIL PLAN
SHEET 2 OF 4

DATE	APRIL '04	PROJECT NO.	STATUS
SCALE	1:500	610309	CV/CD
DRAWN	DAT		
CHECKED	BTX	DWG NO.	REV NO.
APPROVED	JMH	CV 212	5

FOR CONTINUATION REFER TO DRAWING 610309-CV-214

REF.	EASTING Mtr.	NORTHING Mtr.	REF.	EASTING Mtr.	NORTHING Mtr.	REF.	EASTING Mtr.	NORTHING Mtr.	REF.	EASTING Mtr.	NORTHING Mtr.	REF.	EASTING Mtr.	NORTHING Mtr.	REF.	EASTING Mtr.	NORTHING Mtr.
B101	661.225	666.290	B125	684.923	631.727	C105	834.155	459.426	D113	867.054	474.290	W109	797.643	648.701	W133	844.354	580.070
B102	661.225	662.290	B126	671.004	644.790	C106	833.597	457.131	D114	924.687	631.364	W110	816.064	635.038	W134	856.357	576.394
B103	661.225	658.290	B127	661.636	653.582	C107	823.655	459.020	D115	902.521	664.490	W111	807.019	651.009	W135	877.218	597.829
B104	763.980	666.290	B128	654.793	656.290	C108	826.455	461.820	D116	771.826	664.490	W112	819.218	637.588	W136	897.468	585.196
B105	755.028	662.290	B129	582.329	636.775	C109	826.455	515.950	D117	841.491	570.621	W113	824.225	652.433	W137	859.252	574.299
B106	754.707	658.290	B130	590.207	644.790	C110	822.764	517.350	D118	710.651	670.402	W114	824.225	637.393	W138	860.771	571.662
B107	781.980	648.290	B131	582.025	646.540	C111	776.054	517.350	D119	716.320	669.507	W115	852.182	650.606	W139	894.885	575.743
B108	780.480	648.290	B132	726.582	666.290	C112	817.275	525.100	D120	731.875	668.440	W116	852.191	631.323	W140	889.639	565.323
B109	773.920	632.295	B133	726.582	658.290	C113	789.915	525.100	D121	764.628	668.582	W117	888.961	654.518	W141	861.010	567.426
B110	773.980	626.290	B134	735.855	616.290	C114	647.130	566.975	D122	596.653	580.290	W118	887.922	636.852	W142	857.148	562.696
B111	779.993	622.869	B135	735.855	599.290	C115	591.630	525.100	D123	781.368	651.481	W119	891.896	634.561	W143	885.625	560.605
B112	781.980	609.290	B136	767.273	614.881	C116	834.155	516.950	D124	781.368	578.388	W120	914.379	640.455	W144	877.725	541.149
B113	763.980	616.290	B137	711.407	599.290	D101	661.226	671.382	D125	788.490	564.063	W121	891.896	629.999	W145	849.708	543.701
B114	762.980	607.790	B138	612.845	627.790	D102	706.165	671.137	D126	700.353	627.639	W122	911.478	621.013	W146	852.022	524.246
B115	771.980	599.290	B139	647.883	627.790	D103	761.904	668.441	D127	787.926	631.070	W123	887.943	627.647	W147	873.054	524.290
B116	723.930	616.290	B140	675.645	627.790	D104	777.740	666.642	D128	800.525	652.299	W124	891.346	611.011	W148	868.145	513.290
B117	711.407	607.790	B141	761.329	663.797	D105	648.392	565.939	W101	789.995	565.939	W125	868.227	623.445	W149	851.202	513.290
B118	696.944	610.610	B142	767.914	664.314	D106	661.624	562.712	W102	812.408	599.290	W126	871.254	606.737	W150	798.531	575.146
B119	681.916	613.540	B143	775.409	609.835	D107	664.571	562.320	W103	789.859	606.290	W127	846.226	622.726	W151	804.647	575.124
B120	629.755	599.290	B144	771.357	607.790	D108	802.572	562.958	W104	811.641	606.290	W128	847.219	605.568	W152	855.314	489.003
B121	672.785	606.319	C101	647.475	559.050	D109	829.155	559.420	W105	789.102	621.290	W129	841.055	623.500	W153	858.774	489.061
B122	605.564	613.540	C102	659.860	555.731	D110	829.155	569.567	W106	815.441	621.290	W130	842.318	601.532	-	-	-
B123	591.314	627.790	C103	665.036	555.050	D111	839.909	556.583	W107	789.269	633.287	W131	841.687	581.784	-	-	-
B124	689.597	627.790	C104	834.155	555.050	D112	843.424	459.172	W108	815.278	633.290	W132	847.581	597.285	-	-	-

FOR CONTINUATION REFER TO DRAWING 610309-CV-211



KEY PLAN

1.0 GENERAL NOTES

A) THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

B) FOR OTHER NOTES REFER TO DRAWING No. CV-101

2.0 DIMENSIONS

A) VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

B) DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
5	28.09.05	COALESCE PLATE BUND ADDED	PAS
4	26.09.05	DETAIL A ADDED; PAVEMENT REVISED	DAT
3	15.11.04	C256, C257 AND C258 ADDED	DAT
2	08.10.04	ROAD ALIGNMENT REV FOR BANANA ROOM EXT.	DAT
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT



540 George Street, Sydney NSW 2000
PO Box 470, QVB Post Office, Sydney NSW 1230
Telephone (02) 9323 1555 Facsimile (02) 9323 1595

PROJECT MANAGER



Level 10, Clifton Coney Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9287 2100 Fax: (02) 9287 2188

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS



CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel: (02) 9891 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS

MMA ARCHITECTS
Level 4, 8 Help Street, Chatswood 2067
Tel: (02) 9495 6400 Fax: (02) 9495 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9557 5577 Fax: (02) 9554 0677

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS
933 Ryde Road, Pymble 2073
Tel: (02) 9498 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

WYDEN DOWNEY & PARTNERS PTY LTD
Suite 2, 1384 Pacific Highway, Tuncurry NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD
Level 1, 106 Blues Point Rd, Malletts Point, NSW 2060
Tel: (02) 9954 3793 Fax: (02) 9954 3825

COST MANAGER

RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9622 2277 Fax: (02) 9657 4197

TITLE

SETOUT DETAIL PLAN
SHEET 3 OF 4

DATE: APRIL '14 PROJECT No.: 610309 CV/CDD

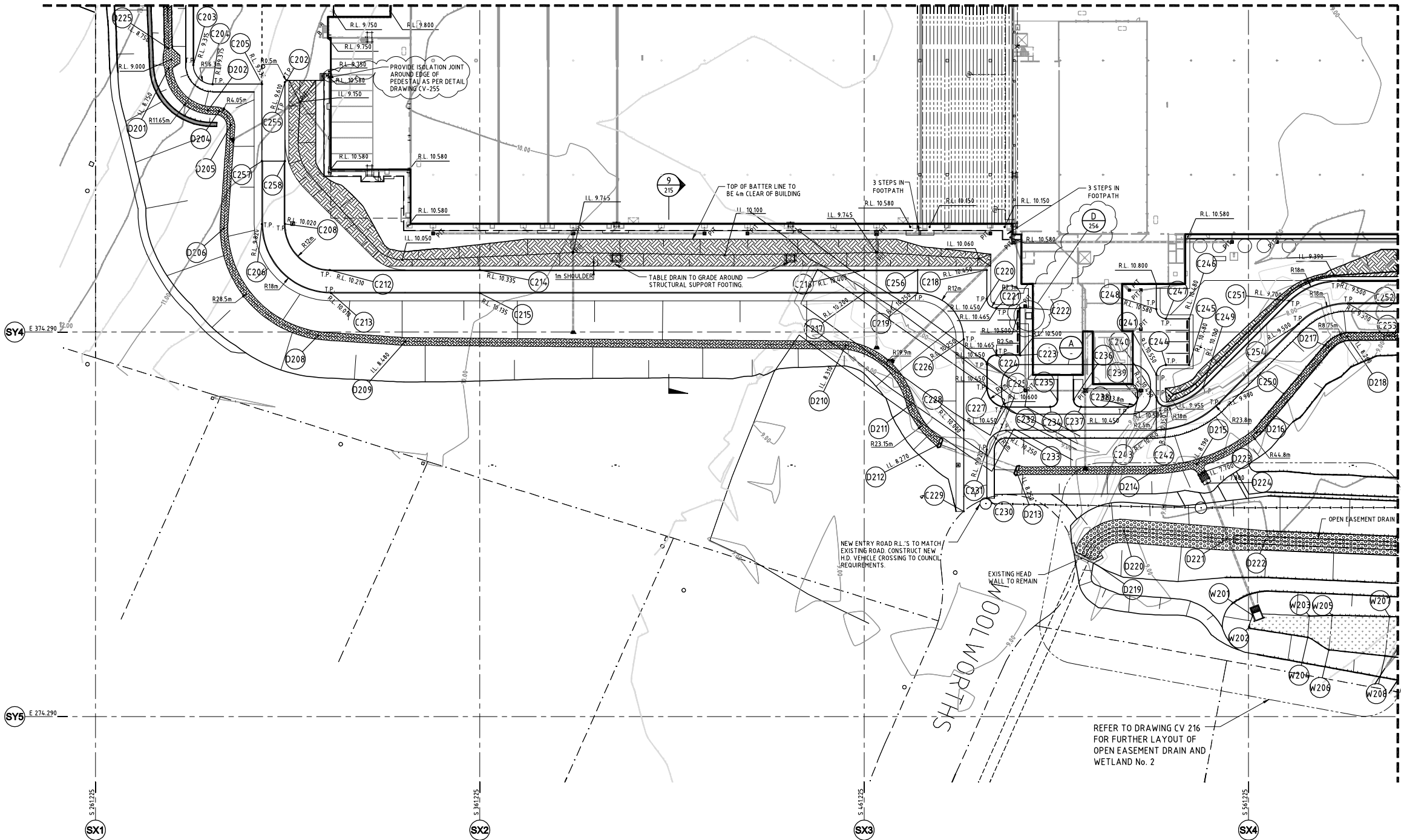
SCALE: 1:500 (B1)

DRAWN: DAT

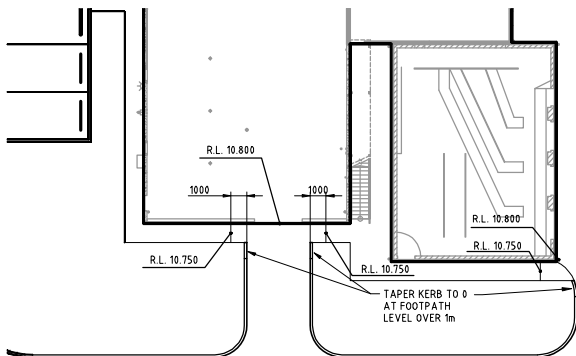
CHECKED: BTK

APPROVED: JAW

CV 213 5



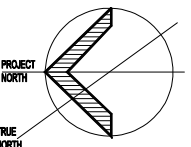
REF.	SOUTHING Mtr.	EASTING Mtr.	REF.	SOUTHING Mtr.	EASTING Mtr.	REF.	SOUTHING Mtr.	EASTING Mtr.
C201	NOT USED	NOT USED	C226	487.129	372.430	C251	571.827	382.418
C202	311.034	439.750	C227	493.279	359.720	C252	584.555	387.690
C203	286.709	443.760	C228	487.129	348.720	C253	587.040	381.690
C204	291.709	438.760	C229	487.129	327.665	C254	574.313	376.418
C205	304.534	438.760	C230	493.129	331.090	C255	310.534	439.250
C206	304.534	402.367	C231	493.129	343.720	C256	475.129	390.430
C207	NOT USED	NOT USED	C232	498.129	354.870	C257	304.534	418.760
C208	310.534	402.430	C233	498.129	348.720	C258	310.534	418.760
C209	NOT USED	NOT USED	C234	509.630	354.870	D201	280.297	442.945
C210	NOT USED	NOT USED	C235	511.480	356.720	D202	290.517	431.976
C211	NOT USED	NOT USED	C236	515.780	356.720	D204	293.377	431.742
C212	322.185	390.435	C237	517.630	354.870	D205	296.451	428.130
C213	322.491	384.430	C238	529.930	354.870	D206	294.657	401.265
C214	361.225	390.430	C239	532.280	357.220	D207	NOT USED	NOT USED
C215	361.225	384.430	C240	537.230	357.320	D208	319.185	373.397
C216	461.225	390.430	C241	537.230	363.250	D209	361.802	371.839
C217	461.225	384.430	C242	540.217	354.868	D210	456.442	370.880
C218	493.129	390.430	C243	537.230	348.723	D211	473.286	355.396
C219	475.129	384.430	C244	539.730	365.750	D212	481.244	345.371
C220	493.129	382.910	C245	545.765	365.750	D213	500.682	338.419
C221	495.629	380.610	C246	545.765	377.750	D214	536.819	338.433
C222	501.814	380.610	C247	539.730	377.750	D215	547.775	339.999
C223	501.814	368.260	C248	537.230	380.250	D216	563.290	348.182
C224	495.629	368.260	C249	549.401	359.992	D217	581.989	370.481
C225	493.279	365.910	C250	553.644	355.749	D218	586.841	373.128



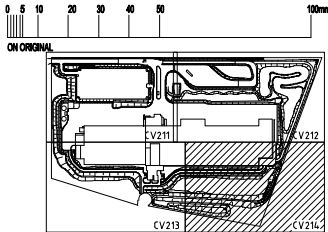
DETAIL A
1:200

NOTE COORDINATES ARE TO SITE GRID
ORIENTATED TO PROJECT NORTH. FOR
SET OUT POINTS FOR GRID REFER TO
ARCHITECTS DRAWINGS.

FOR CONSTRUCTION



FOR CONTINUATION REFER TO DRAWING 610309-CV-212



KEY PLAN

1.0 GENERAL NOTES

A THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

B FOR OTHER NOTES REFER TO DRAWING No. CV-101

2.0 DIMENSIONS

A VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

B DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
2	28.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
1	13.09.04	GABIONS DELETED	DAT
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT
Supply Chain Woolworths
640 George Street, Sydney NSW 2000
PO Box 471, CVO Post Office Sydney NSW 1220
Telephone (02) 9522 1555 Facsimile (02) 9522 1565

PROJECT MANAGER
Clifton Coney Group
Level 10, Clifton Coney, 2 Park Street, Sydney NSW 2000
Telephone (02) 9287 2100 Fax (02) 9287 2100

PROJECT
**WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259**

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS
Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel. (02) 9691 6773 Fax. (02) 9633 9477
www.eca.com.au

ARCHITECTS
BMIA ARCHITECTS
Level 4, 8 Help Street, Chalmers 2087
Tel. (02) 9465 6400 Fax. (02) 9465 6444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel. (02) 9667 5677 Fax. (02) 9664 0677

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel. (02) 9469 8873 Fax. (02) 9418 4053

HYDRAULIC ENGINEERS
NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1364 Pacific Highway, Turrum NSW 2074
Tel. (02) 9144 4711 Fax. (02) 9144 4733

FIRE ENGINEER SOLUTION CONSULTANTS
ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel. (02) 9320 9320 Fax. (02) 9320 9321

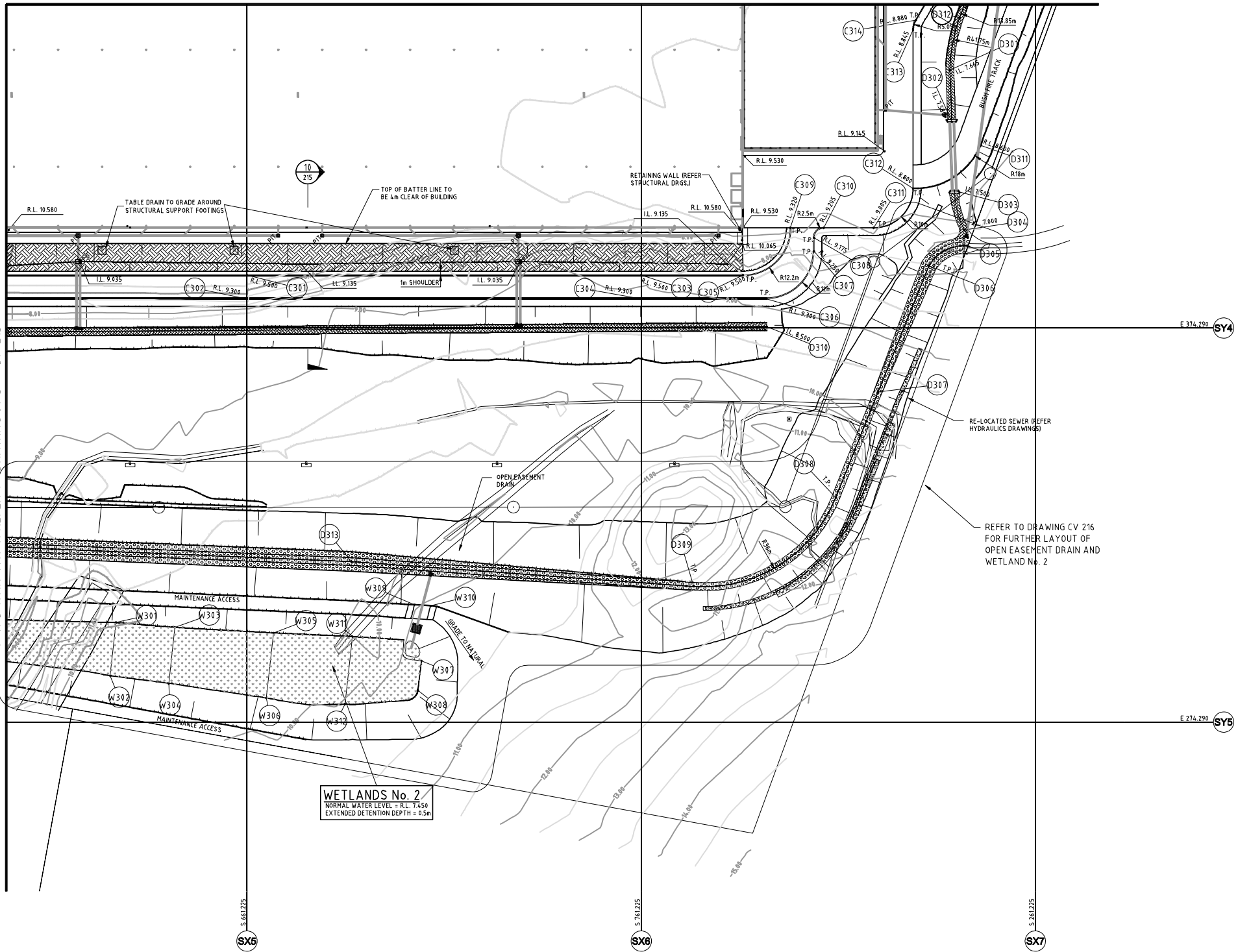
LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, Mclellens Point, NSW 2060
Tel. (02) 9654 3733 Fax. (02) 9654 3825

COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel. (02) 9622 2277 Fax. (02) 9657 4187

TITLE
**SETOUT DETAIL PLAN
SHEET 4 OF 4**

DATE	APRIL 04	PROJECT No.	610309 CV/CD
SCALE	1:500	(B1)	
DRAWN	DAT		
CHECKED	BTM		
APPROVED	JAH		
		DATE	REV
		CV 214	2

FOR CONTINUATION REFER TO DRAWING 610309-CV-213

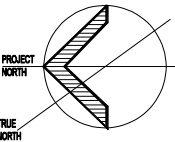


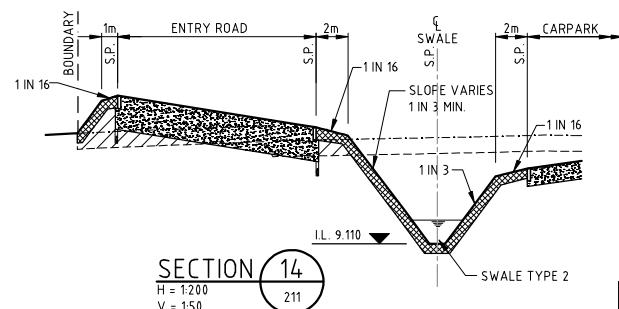
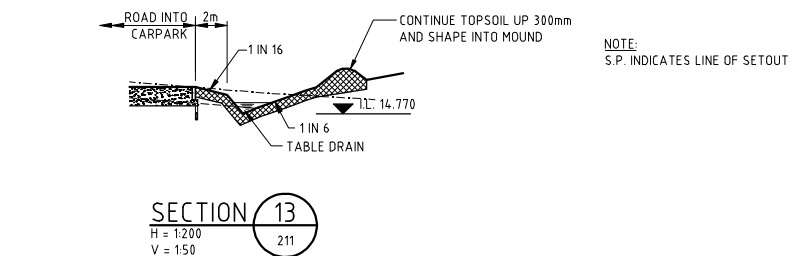
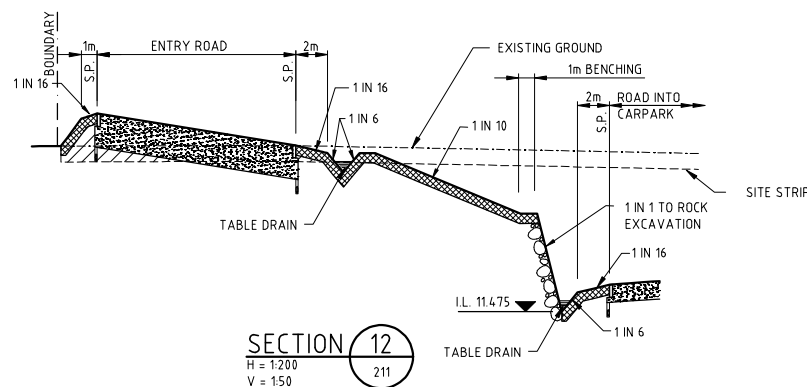
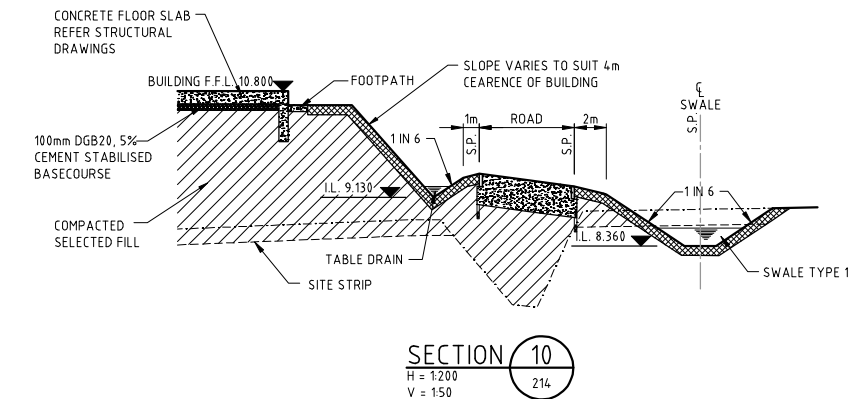
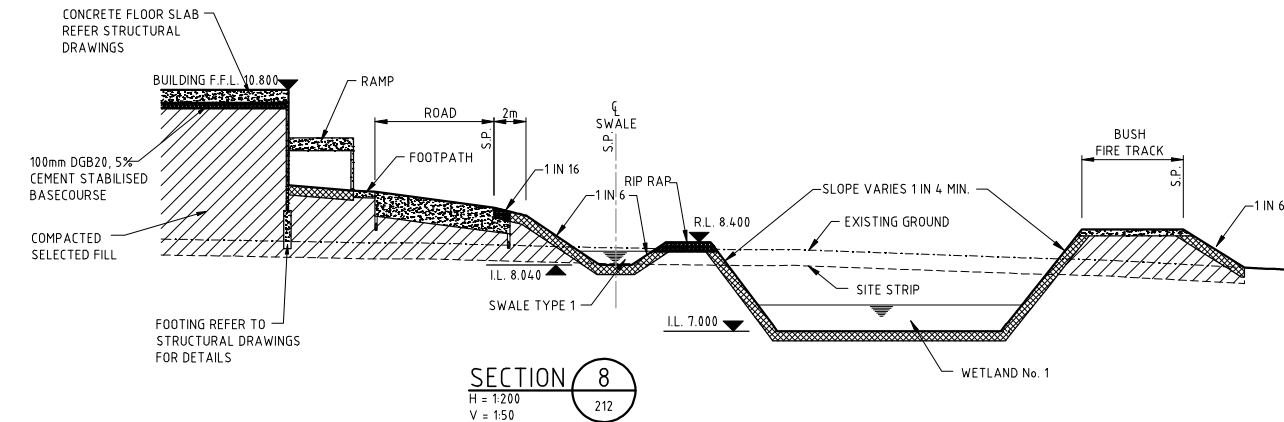
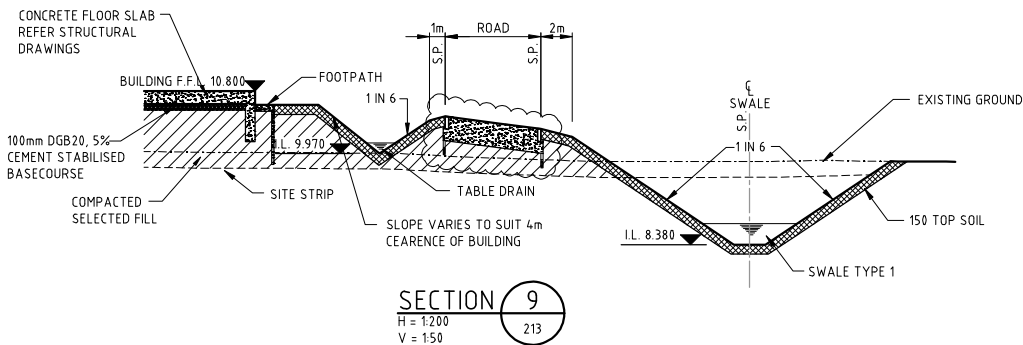
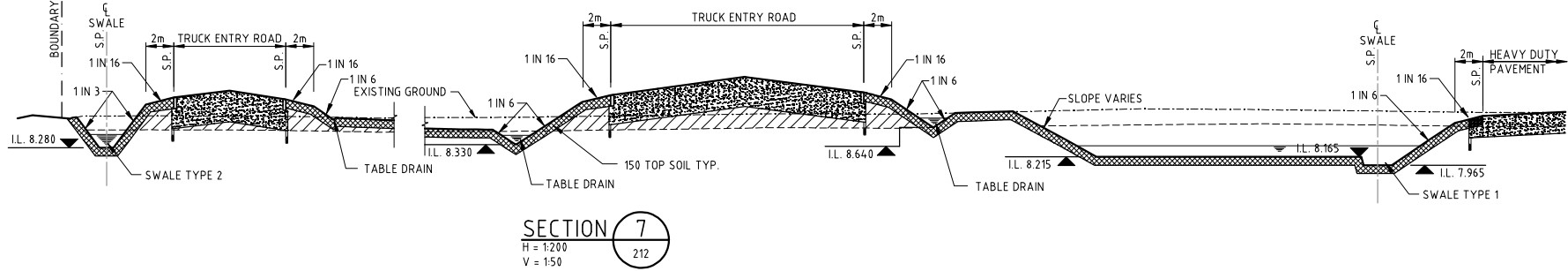
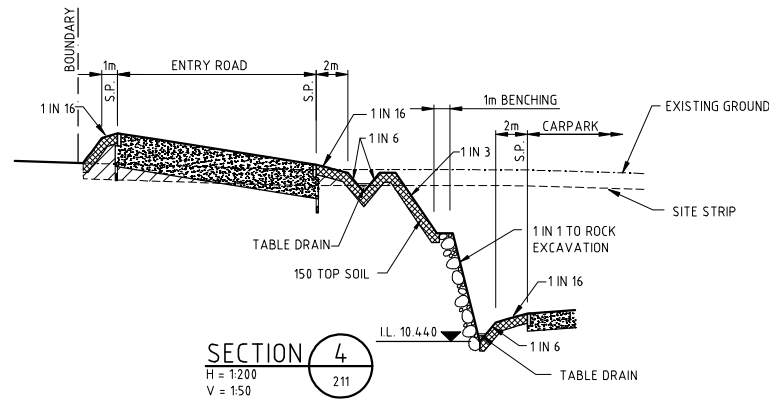
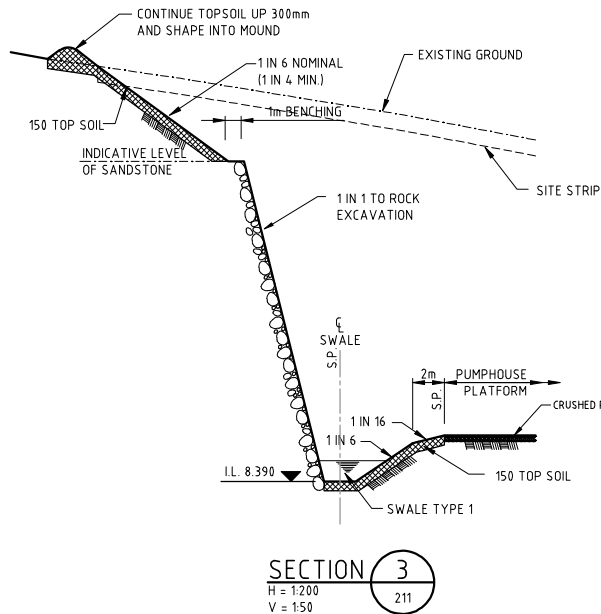
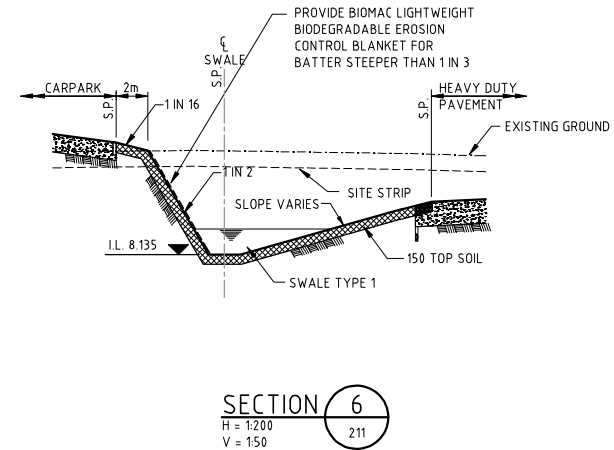
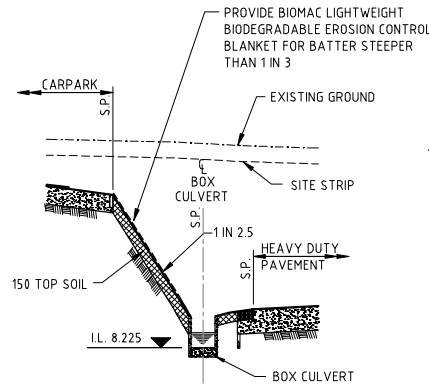
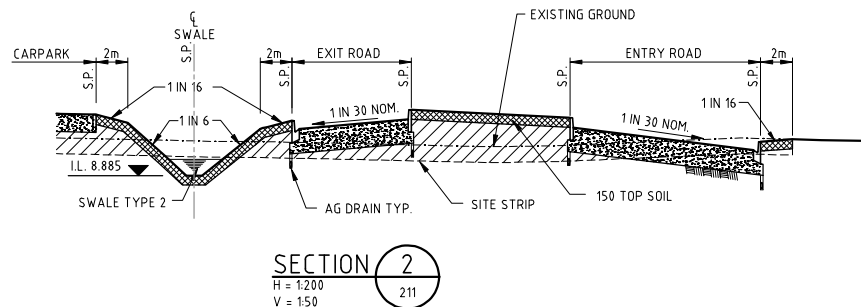
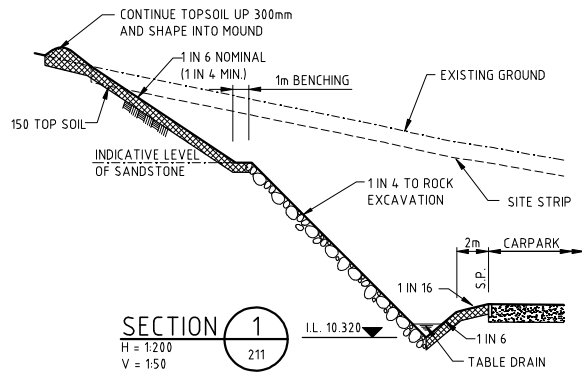
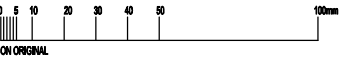
WETLANDS No. 2
NORMAL WATER LEVEL = R.L. 7.450
EXTENDED DETENTION DEPTH = 0.5m

REF.	SOUTHING Mtr.	EASTING Mtr.	REF.	SOUTHING Mtr.	EASTING Mtr.	REF.	SOUTHING Mtr.	EASTING Mtr.
C301	661.225	387.690	D302	840.027	426.641	W304	641.354	284.046
C302	661.225	381.690	D303	840.785	409.102	W305	667.964	296.879
C303	761.225	387.690	D304	843.216	399.133	W306	666.094	289.377
C304	761.225	381.690	D305	846.184	395.070	W307	705.481	289.815
C305	787.054	387.690	D306	836.287	390.656	W308	704.592	282.340
C306	793.054	381.690	D307	821.291	358.027	W309	703.730	304.028
C307	805.054	393.690	D308	816.577	331.244	W310	707.801	303.768
C308	805.054	397.190	D309	774.544	308.784	W311	687.988	295.967
C309	799.054	399.690	D310	793.083	374.638	W312	686.045	278.809
C310	807.554	399.690	D311	847.356	420.612	-	-	-
C311	820.214	399.690	D312	842.088	453.069	-	-	-
C312	830.214	449.690	D313	687.737	315.009	-	-	-
C313	830.214	449.923	W301	628.010	299.536	-	-	-
C314	839.885	452.423	W302	626.487	286.948	-	-	-
D301	839.544	439.742	W303	642.962	298.290	-	-	-

NOTE COORDINATES ARE TO SITE GRID
ORIENTATED TO PROJECT NORTH. FOR
SET OUT POINTS FOR GRID REFER TO
ARCHITECTS DRAWINGS.

FOR CONSTRUCTION





FOR CONSTRUCTION

1.0 GENERAL NOTES
1.1 THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

1.2 FOR OTHER NOTES REFER TO DRAWING NO. CV-00

2.0 DIMENSIONS
2.1 VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

2.2 DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
2	15.11.04	SECTION REVISED	DAT
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT
Supply Chain Woolworths
540 George Street, Sydney NSW 2000
PO Box 470, Chiswick Post Office Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1555

PROJECT MANAGER
CliftonConey Group
Level 15, CliftonConey Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9287 2100 Fax: (02) 9287 2108

PROJECT
WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS
Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel: (02) 9591 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS
WMA ARCHITECTS
Level 4, 8 Help Street, Chiswood 2057
Tel: (02) 9495 6400 Fax: (02) 9495 6444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9557 5577 Fax: (02) 9554 0677

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
933 Ryde Road, Pymble 2073
Tel: (02) 9499 8673 Fax: (02) 9418 4053

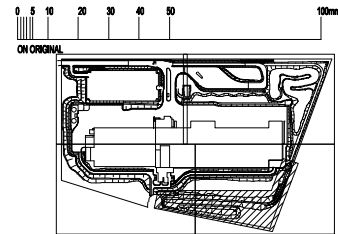
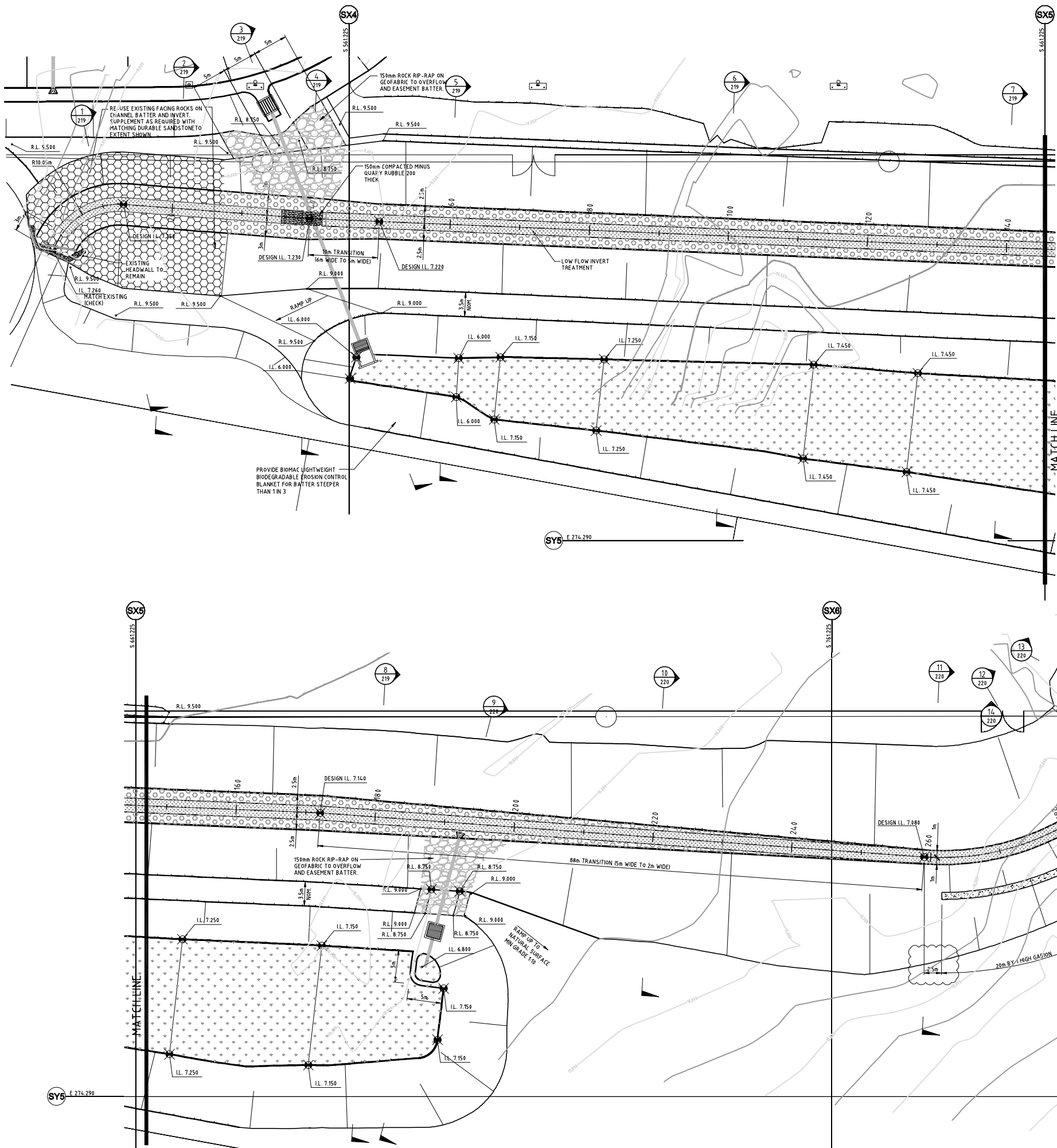
HYDRAULIC ENGINEERS
WYER DONNELLY & PARTNERS PTY LTD
Suite 2, 194 Pacific Highway, Tuncurry NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS
ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 106 Blues Point Rd, McLahons Point, NSW 2060
Tel: (02) 9954 3733 Fax: (02) 9954 3825

COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9622 2277 Fax: (02) 9657 4197

TITLE			
SITE SECTIONS			
DATE	APRIL 14	PROJECT No.	610309 CV/CD
SCALE	AS SHOWN (B1)		
DRAWN	DAT	CHKD	REV.
CHECKED	STK		
APPROVED	JHW		CV 215 2



KEY PLAN

1.0 GENERAL NOTES

- THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- FOR OTHER NOTES REFER TO DRAWING No. CV-101
- 2.0 DIMENSIONS
A VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
2	28.09.14	RE-ISSUED FOR CONSTRUCTION	PAS
1	13.09.14	GABIONS DELETED	DAT
0	09.09.14	ISSUED FOR CONSTRUCTION	DAT

CLIENT
Supply Chain Woolworths
540 George Street, Sydney NSW 2000
PO Box 470, CVO Post Office Sydney NSW 2220
Telephone (02) 9323 1555 Facsimile (02) 9323 1565

PROJECT MANAGER
CliftonConey Group
Level 18, CliftonConey Centre, 2 Park Street, Sydney NSW 2000
Telephone (02) 9327 2100 Fax (02) 9327 2108

PROJECT
**WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259**

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS
Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street, Parramatta 2150
Tel: (02) 9891 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS
BMIA ARCHITECTS
Level 4, 8 Help Street, Chalmers 2087
Tel: (02) 9465 6400 Fax: (02) 9465 6444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9857 5577 Fax: (02) 9854 0577

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel: (02) 9469 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS
NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Turrum NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS
ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9854 3733 Fax: (02) 9854 3825

COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9822 2277 Fax: (02) 9857 4187

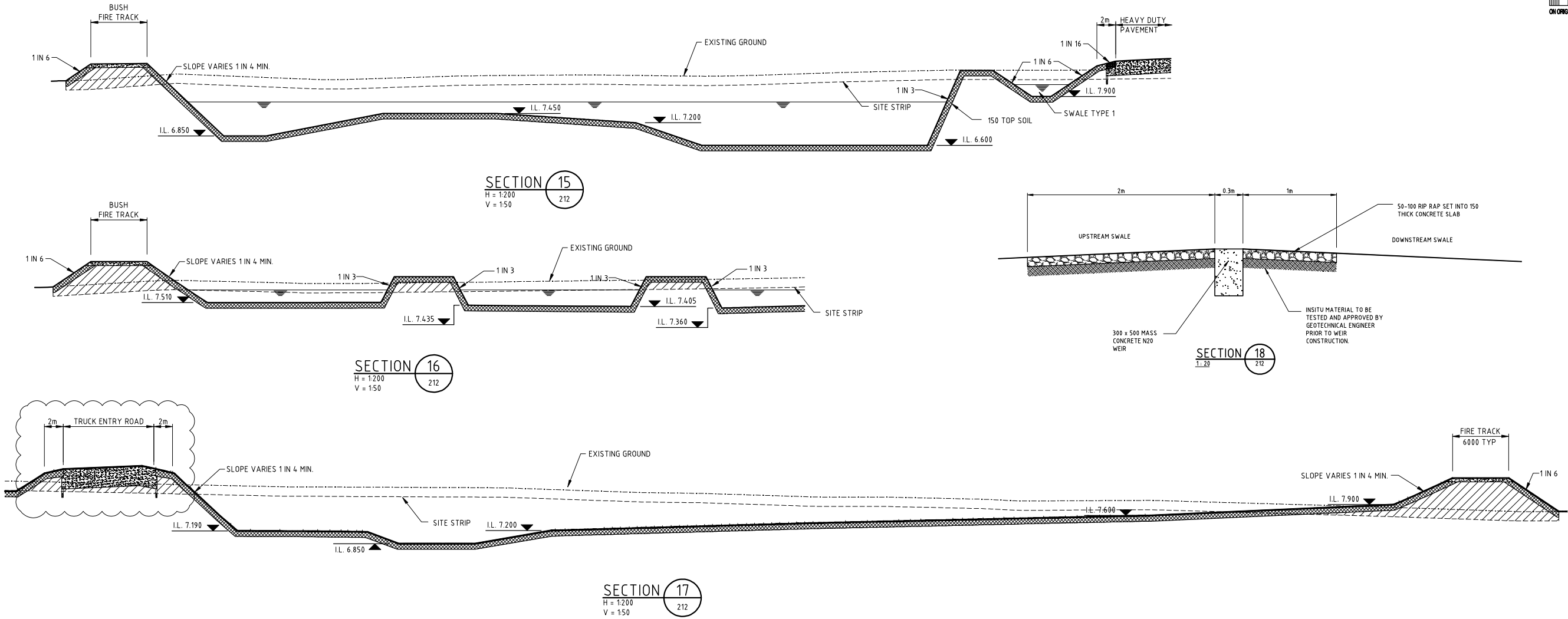
TITLE
**WETLAND No. 2 AND
OPEN EASEMENT DRAIN
LAYOUT PLAN**

DATE	PROJECT No.	STATUS
APRIL 14	610309	CV/CDD
SCALE	DRAWN	CHECKED
1:250	DAT	BTX
APPROVED	DATE	REV.
JAN	CV 216	2

LEGEND

- SETOUT POINTS REFER TO DRAWINGS CV 213 AND CV 214 FOR SOUTHINGS AND EASTINGS.
- REFER TO ARCHITECTURAL DRAWINGS FOR FINAL AND APPROVED FENCE LAYOUT.
- EASEMENT DRAIN INVERT
- LOW FLOW INVERT TREATMENT
- DURABLE SAND - STONE ROCK PROTECTION
- 150mm ROCK RIP-RAP ON GEOFABRIC
- 150mm COMPACTED MINUS QUARRY RUBBLE 200 THICK REFER TO DRAWING CV 218

FOR CONSTRUCTION



1.0 GENERAL NOTES
a) THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b) FOR OTHER NOTES REFER TO DRAWING No. CV-500

2.0 DIMENSIONS
a) VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b) DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS			
REV.	DATE	AMENDMENT	SIGNED
2	22.03.05	SECTION 17 REVISED	DAT
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT
CLIENT			
540 George Street, Sydney NSW 2000 PO Box 470, QVB Post Office Sydney NSW 1220 Telephone (02) 9323 1555 Facsimile (02) 9323 1595			

PROJECT MANAGER

Level 18, CliftonConey Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9287 2100 Fax: (02) 9287 2108

PROJECT
WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel: (02) 9891 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS
BMMA ARCHITECTS
Level 4, 8 Help Street, Chiswick 2057
Tel: (02) 9495 9400 Fax: (02) 9495 8444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9557 5577 Fax: (02) 9554 0677

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
933 Ryde Road, Pymble 2073
Tel: (02) 9490 8873 Fax: (02) 9418 4053

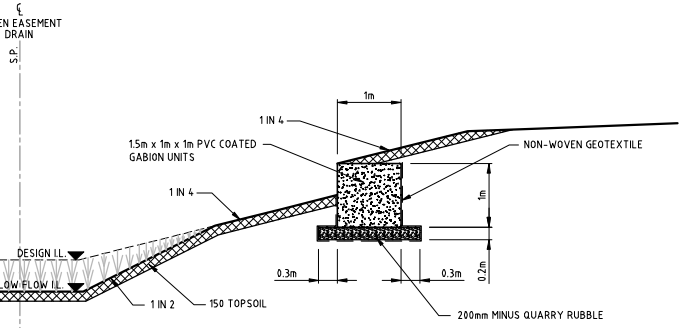
HYDRAULIC ENGINEERS
WYDEN DOWNEY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Tuncurry NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS
ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

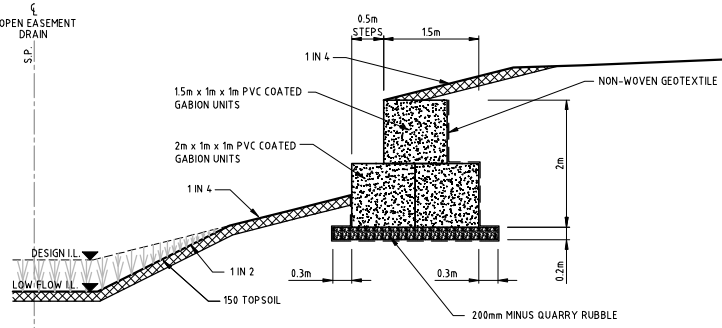
LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 106 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9554 3733 Fax: (02) 9554 3825

COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9622 2277 Fax: (02) 9657 4197

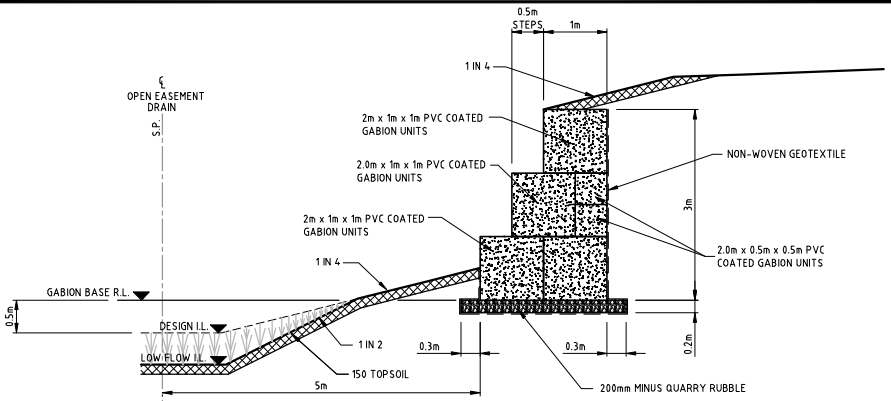
TITLE			
WETLAND No. 1			
SITE SECTIONS AND			
GABION DETAILS			
DATE	APRIL 14	PROJECT No.	610309 CV/CD
SCALE	AS SHOWN (B1)	DWG No.	
DRAWN	DAT	REV.	
CHECKED	BTX		
APPROVED	JHW		



TYPICAL 1 HIGH GABION ARRANGMENT
SCALE 1 : 50

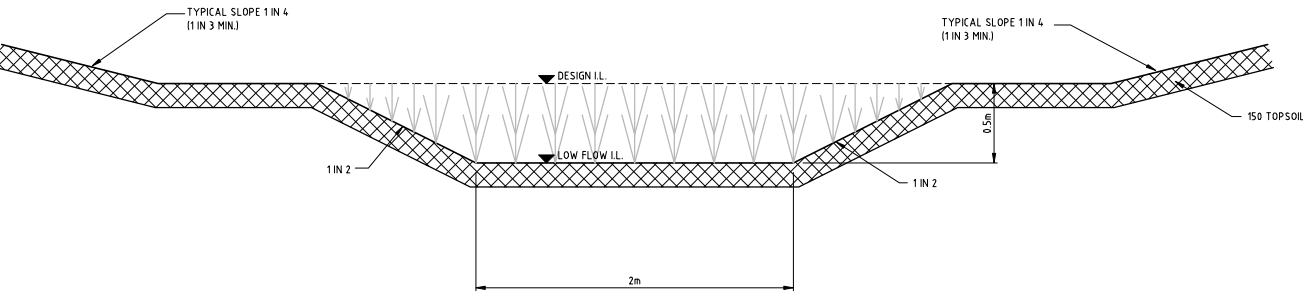


TYPICAL 2 HIGH GABION ARRANGMENT
SCALE 1 : 50

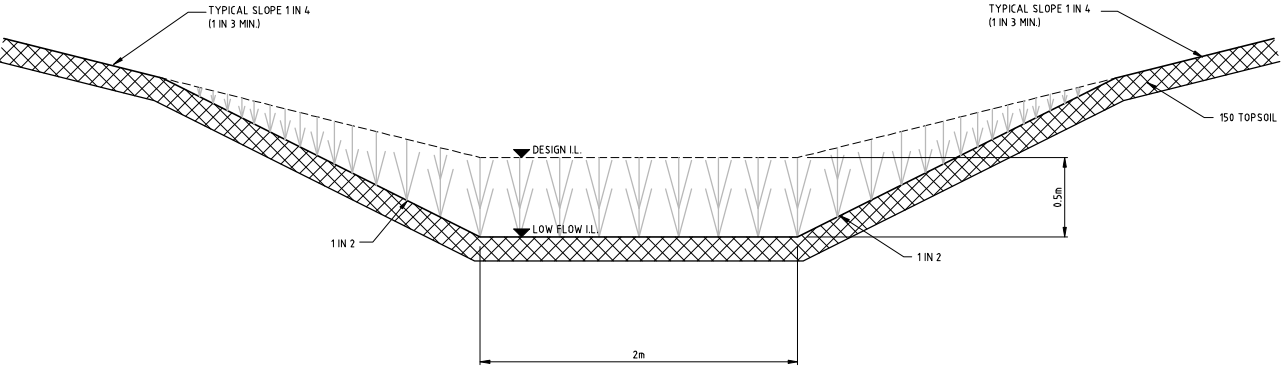


TYPICAL 3 HIGH GABION ARRANGMENT
SCALE 1 : 50

OFFSET TO GABIONS FROM CENTERLINE
AND BASE R.L. IS TYPICAL FOR ALL
SECTIONS

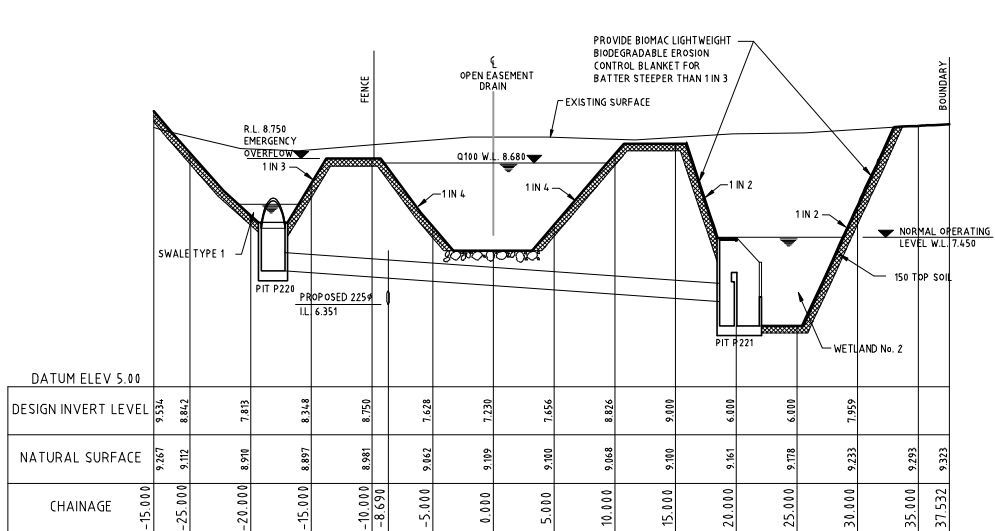
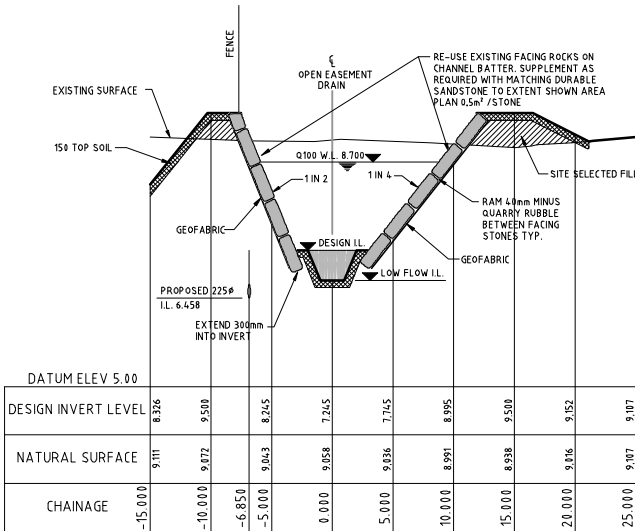
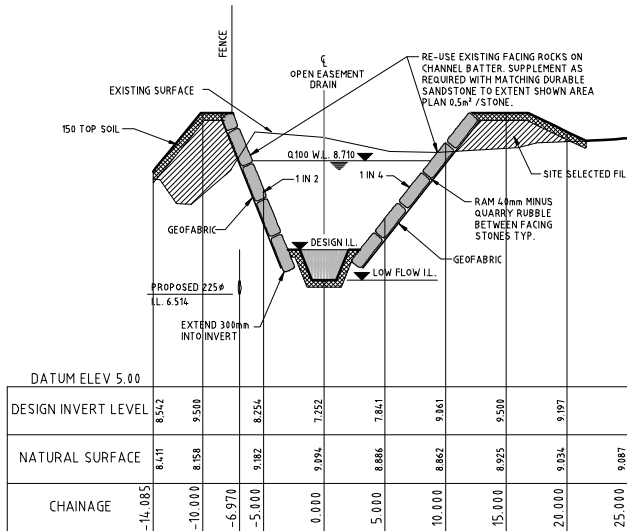


**TYPICAL SECTION THROUGH NEW OPEN
EASEMENT DRAIN**
SCALE 1 : 20



**TYPICAL SECTION THROUGH NEW OPEN
EASEMENT DRAIN GABION AREA**
SCALE 1 : 20

FOR CONSTRUCTION



1.0 GENERAL NOTES
a. THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b. FOR OTHER NOTES REFER TO DRAWING No. CV-101
2.0 DIMENSIONS
a. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b. DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
2	09.09.04	ISSUED FOR CONSTRUCTION	DAT
REV.	DATE	AMENDMENT	SIGNED

CLIENT
Supply Chain Woolworths
540 George Street, Sydney NSW 2000
PO Box 470, QVB Post Office Sydney NSW 1220
Telephone (02) 9523 1555 Facsimile (02) 9323 1565

PROJECT MANAGER
Clifton Coney Group
Level 18, Clifton Coney, 2 Park Street, Sydney NSW 2000
Telephone (02) 9327 2100 Fax (02) 9327 2100

PROJECT
WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WANNERVILLE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS
Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street, Parramatta 2150
Tel. (02) 9891 6773 Fax. (02) 9633 9477
www.becca.com.au

ARCHITECTS
BMIA ARCHITECTS
Level 4, 8 Help Street, Chalmers 2087
Tel. (02) 9485 6400 Fax. (02) 9485 6444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel. (02) 9857 5077 Fax. (02) 9854 0877

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel. (02) 9489 8873 Fax. (02) 9418 4053

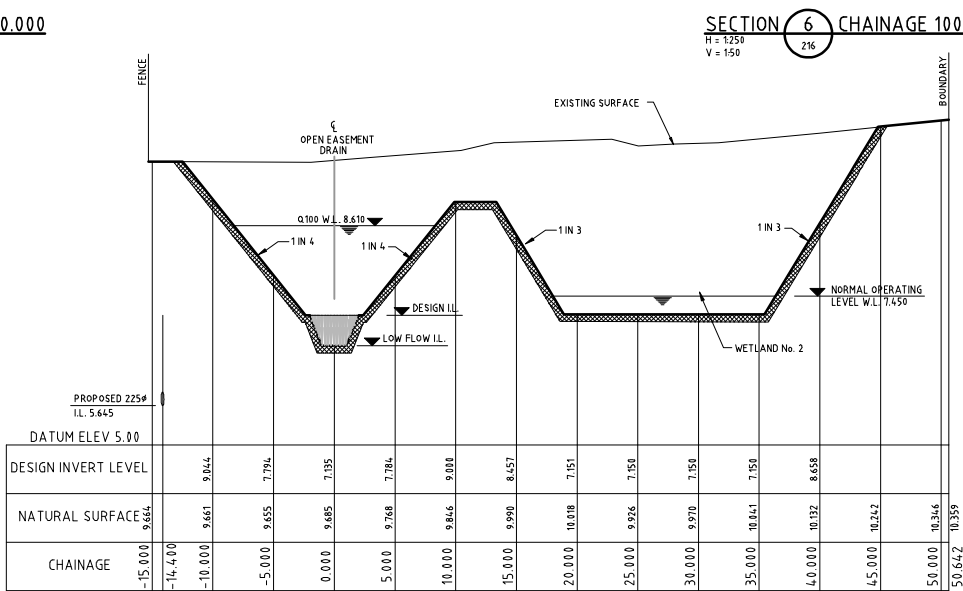
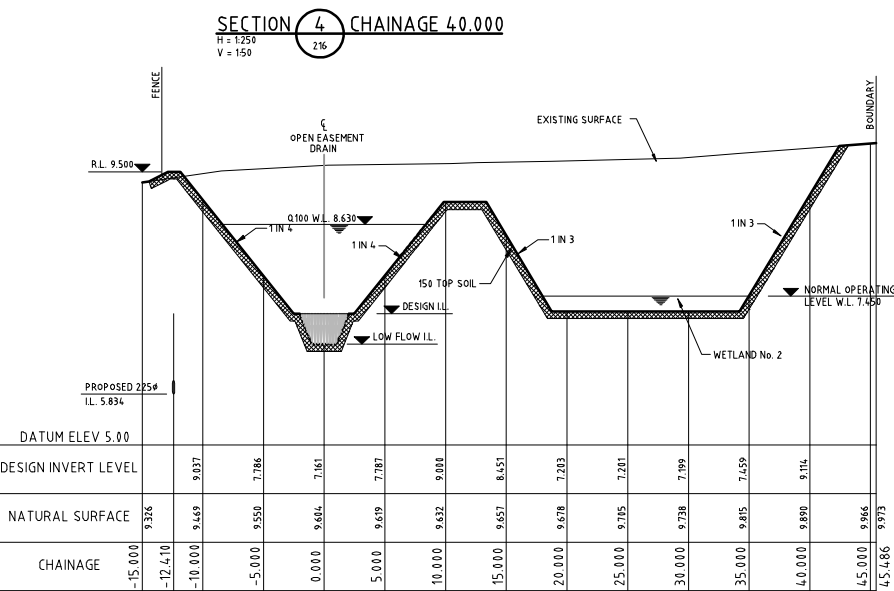
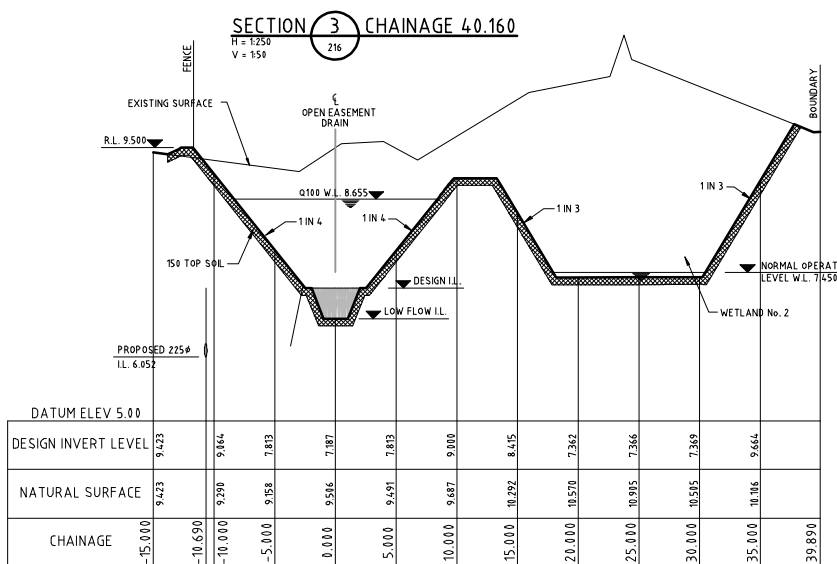
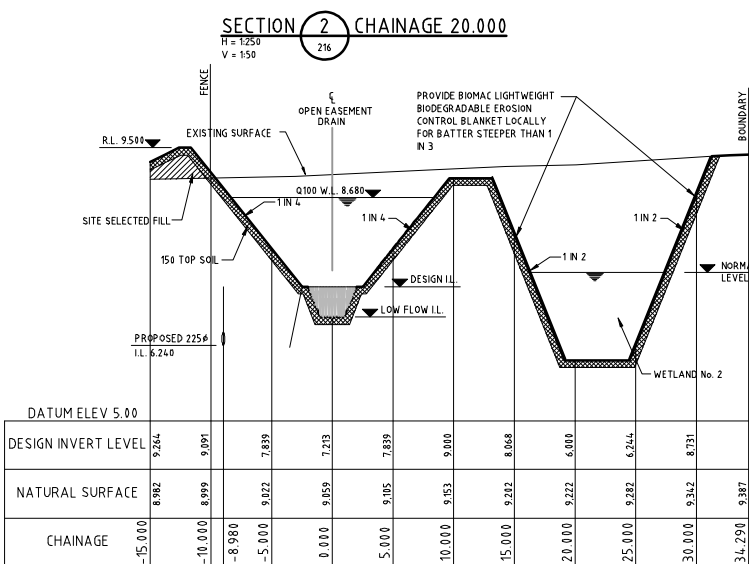
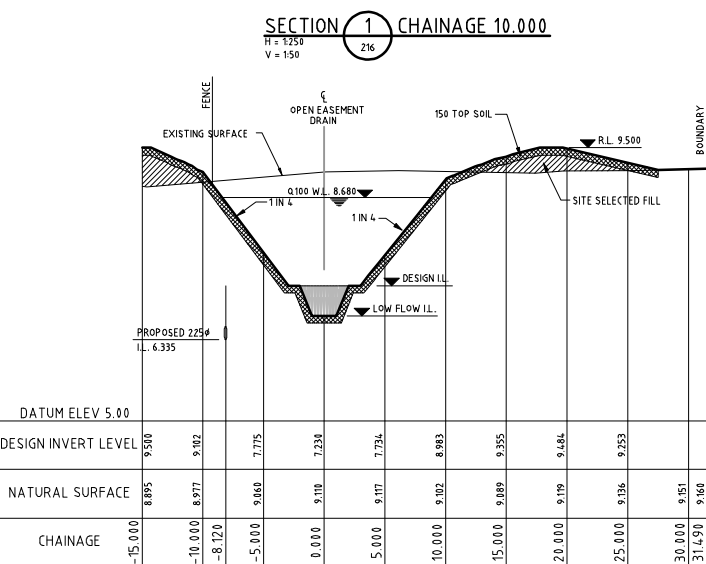
HYDRAULIC ENGINEERS
NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1384 Pacific Highway, Turramurra NSW 2074
Tel. (02) 9144 4711 Fax. (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS
ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel. (02) 9320 9320 Fax. (02) 9320 9321

LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel. (02) 9554 3733 Fax. (02) 9554 3825

COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel. (02) 9322 2277 Fax. (02) 9557 4187

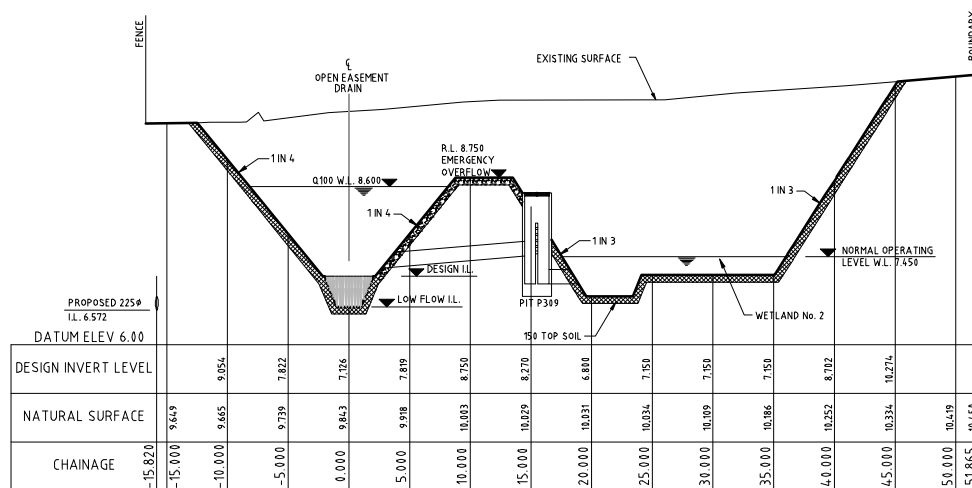
TITLE
WETLAND No. 2 AND
OPEN EASEMENT DRAIN
SECTIONS SHEET 1 OF 2
DATE APRIL 04 PROJECT No. 610309 STATUS CV/CD
SCALE AS SHOWN (B1)
DRAWN DAT
CHECKED BTK
APPROVED JAH
DWG No. REV No.
CV 219 1



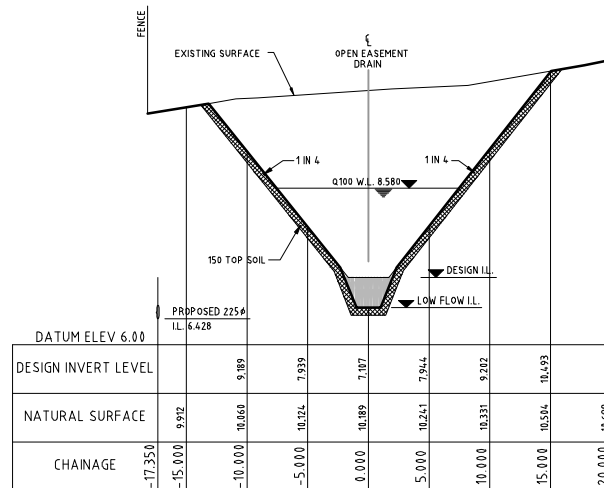
FOR CONSTRUCTION



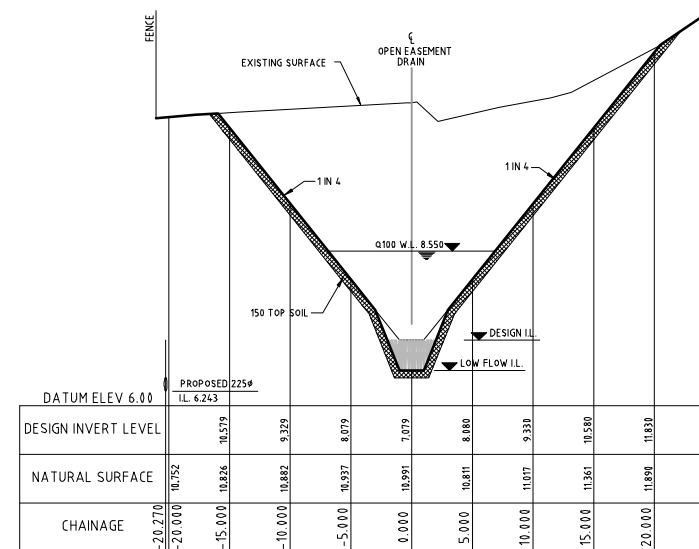
- 1.0 GENERAL NOTES
- 4 THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- 5 FOR OTHER NOTES REFER TO DRAWING No. CV-109
- 2.0 DIMENSIONS
- 4 VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- 5 DO NOT SCALE THE DRAWINGS.



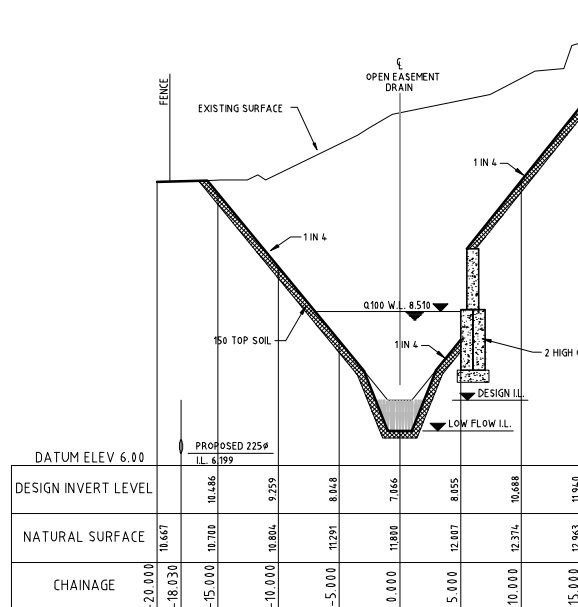
SECTION 9 CHAINAGE 192.640
H = 1.250
V = 150



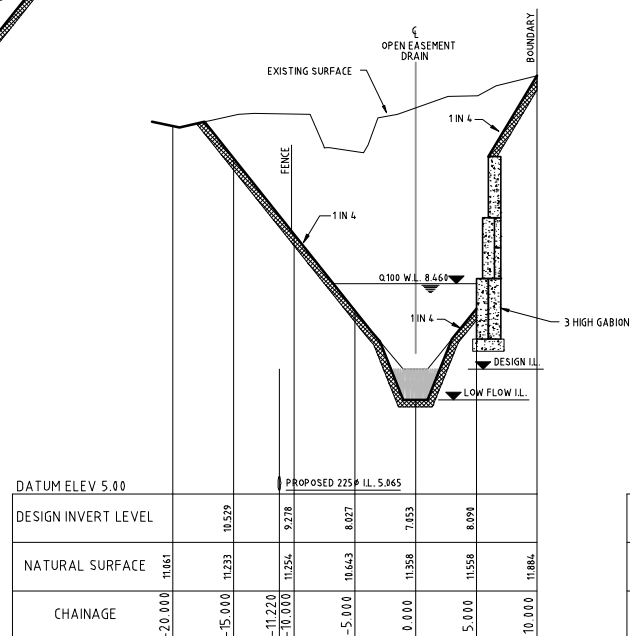
SECTION 10 CHAINAGE 220.000
H = 1.250
V = 150



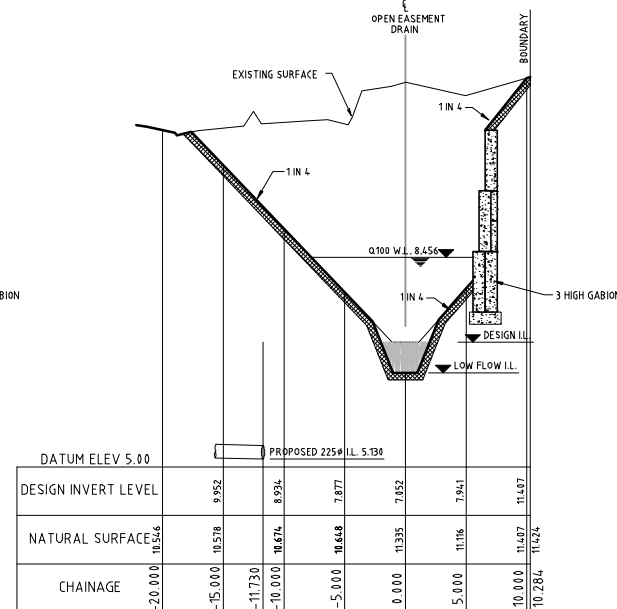
SECTION 11 CHAINAGE 260.000
H = 1.250
V = 150



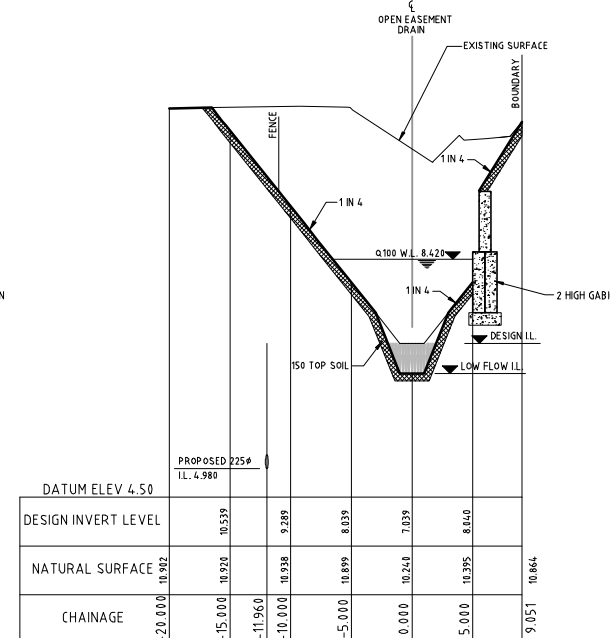
SECTION 12 CHAINAGE 280.000
H = 1.250
V = 150



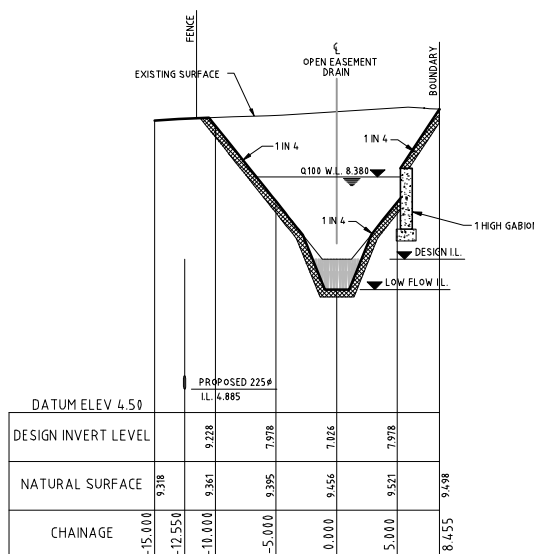
SECTION 13 CHAINAGE 300.000
H = 1.250
V = 150



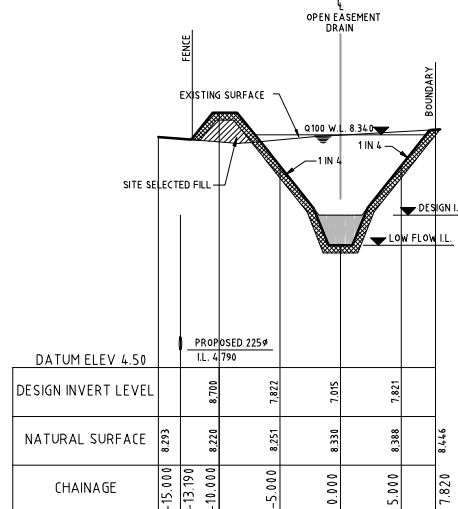
SECTION 14 CHAINAGE 302.030
H = 1.250
V = 150



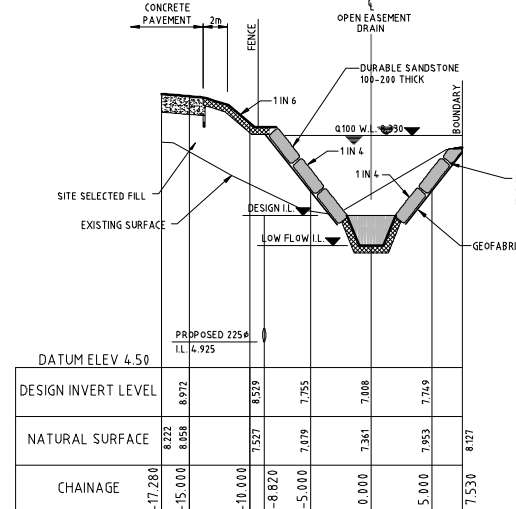
SECTION 15 CHAINAGE 320.000
H = 1.250
V = 150



SECTION 16 CHAINAGE 340.000
H = 1.250
V = 150



SECTION 17 CHAINAGE 360.000
H = 1.250
V = 150

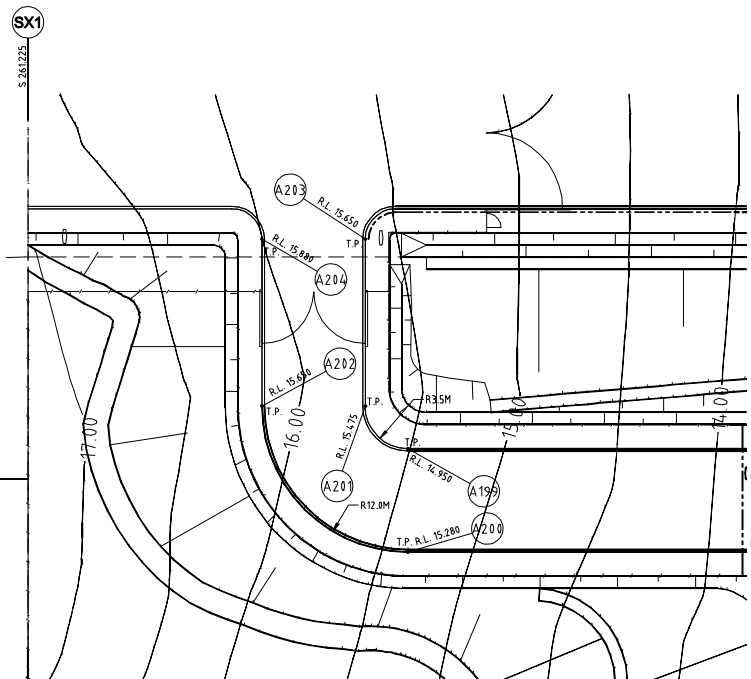
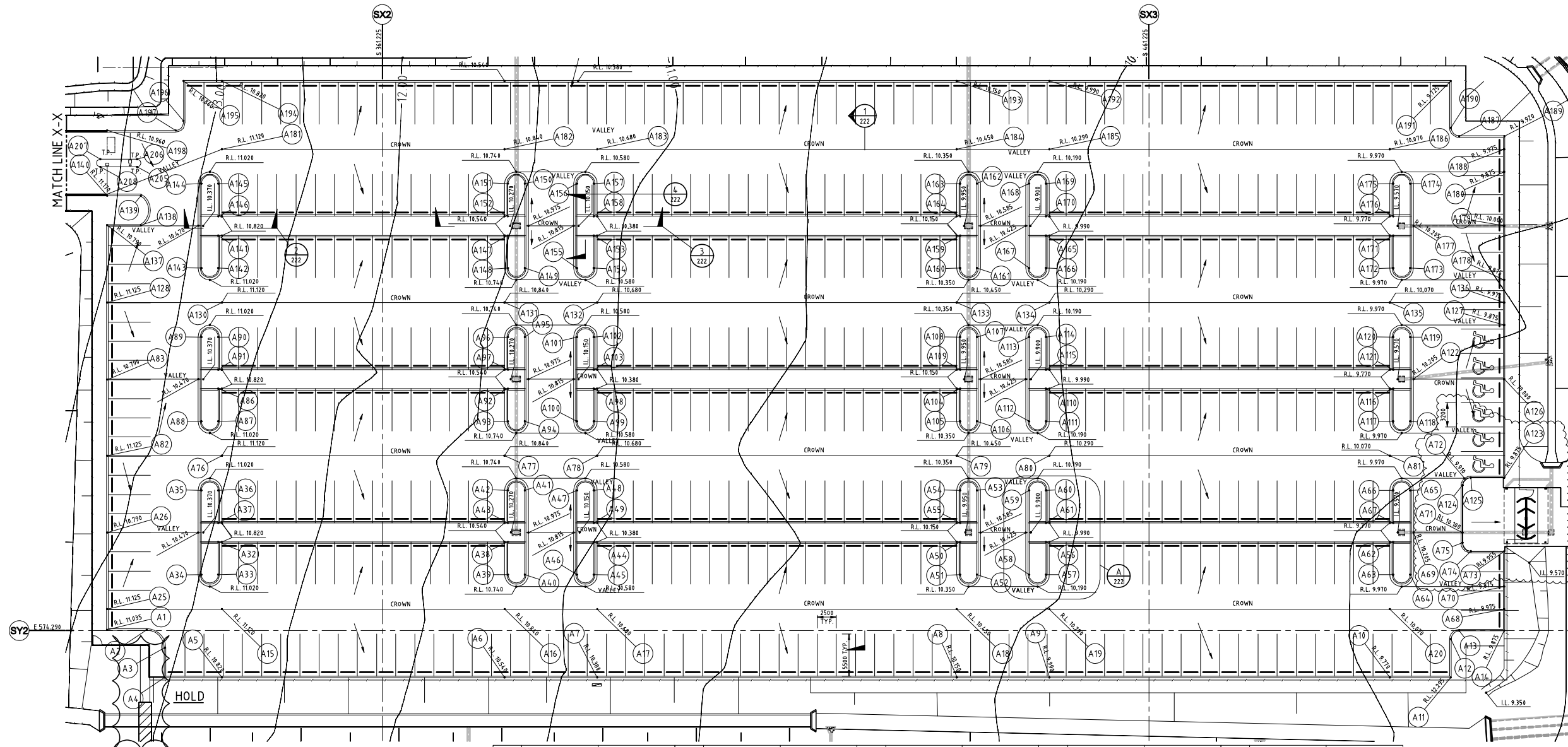


SECTION 18 CHAINAGE 370.000
H = 1.250
V = 150

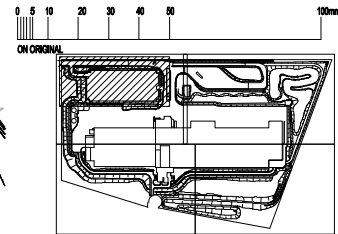
FOR CONSTRUCTION

REFER BELOW FOR MORE AMENDMENTS			
2	28.09.14	RE-ISSUED FOR CONSTRUCTION	PAS
1	13.09.14	GABIONS DELETED FROM SECTIONS 13, 14 & 15	DAT
0	09.19.14	ISSUED FOR CONSTRUCTION	DAT
REV.	DATE	AMENDMENT	SIGNED
CLIENT			
PROJECT MANAGER			
PROJECT			
WOOLWORTHS WYONG RDC			
1 WOOLWORTHS WAY			
WARRNEVALE NSW 2259			
STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS			
ARCHITECTS			
BMA ARCHITECTS			
Level 4, 8 Help Street, Chalmers NSW 2087			
Tel: (02) 9485 6400 Fax: (02) 9485 6444			
FIRE SERVICES & MECHANICAL ENGINEERS			
BASSETT CONSULTING ENGINEERS			
Level 12, 132 Arthur Street, North Sydney NSW 2060			
Tel: (02) 9867 5577 Fax: (02) 9864 0877			
ELECTRICAL ENGINEERS			
WOOD & GRIEVE ENGINEERS			
9/33 Ryde Road, Pymble NSW 2073			
Tel: (02) 9489 8873 Fax: (02) 9418 4053			
HYDRAULIC ENGINEERS			
NIVEN DONNELLY & PARTNERS PTY LTD			
Suite 2, 1384 Pacific Highway, Tuncurry NSW 2074			
Tel: (02) 9144 4711 Fax: (02) 9144 4733			
FIRE ENGINEERED SOLUTION CONSULTANTS			
ARUP			
Level 10, 201 Kent Street, Sydney NSW 2000			
Tel: (02) 9320 9320 Fax: (02) 9320 9321			
LANDSCAPE ARCHITECT			
TRACT CONSULTANTS PTY LTD			
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060			
Tel: (02) 9854 3733 Fax: (02) 9854 3825			
COST MANAGER			
RIDER HUNT PTY LTD			
41 McLaren Street, North Sydney NSW 2060			
Tel: (02) 9822 2277 Fax: (02) 9857 4187			

TITLE			
WETLAND No. 2 AND			
OPEN EASEMENT DRAIN			
SECTIONS SHEET 2 OF 2			
DATE	APRIL 14	PROJECT No.	610309 CV/CDD
SCALE	AS SHOWN	(B1)	
DRAWN	DAT	DWG No.	
CHECKED	BTM	REV No.	
APPROVED	JMH	CV 220	2



REF.	SOUTHING Mtr.	EASTING Mtr.	REF.	SOUTHING Mtr.	EASTING Mtr.	REF.	SOUTHING Mtr.	EASTING Mtr.	REF.	SOUTHING Mtr.	EASTING Mtr.
A1	325.325	574.390	A51	436.625	581.590	A94	379.825	601.590	A136	507.625	617.890
A2	330.475	574.390	A52	438.825	581.590	A95	379.825	612.590	A137	325.325	627.190
A3	332.825	572.840	A53	438.825	592.590	A96	377.625	612.590	A138	329.725	627.190
A4	332.825	568.190	A54	436.625	592.590	A97	377.625	608.340	A139	329.725	631.040
A5	340.275	568.190	A55	436.625	588.340	A98	388.825	605.840	A140	325.325	631.040
A6	377.175	568.190	A56	447.825	585.840	A99	388.825	601.590	A141	339.825	625.840
A7	389.275	568.190	A57	447.825	581.590	A100	386.625	601.590	A142	339.825	621.590
A8	436.175	568.190	A58	445.625	581.590	A101	386.625	612.590	A143	337.625	621.590
A9	448.275	568.190	A59	445.625	592.590	A102	388.825	612.590	A144	337.625	632.590
A10	492.675	568.190	A60	447.825	592.590	A103	388.825	608.340	A145	339.825	632.590
A11	500.625	568.190	A61	447.825	588.340	A104	436.625	605.840	A146	339.825	628.340
A12	500.625	573.190	A62	493.125	585.840	A105	436.625	601.590	A147	377.625	625.840
A13	501.725	574.290	A63	493.125	581.590	A106	438.825	601.590	A148	377.625	621.590
A14	507.625	574.290	A64	495.325	581.590	A107	438.825	612.590	A149	379.825	621.590
A15	340.275	577.090	A65	495.325	592.590	A108	436.625	612.590	A150	379.825	632.590
A16	377.196	577.090	A66	493.125	592.590	A109	436.625	608.340	A151	377.625	632.590
A17	389.275	577.090	A67	493.125	588.340	A110	447.825	605.840	A152	377.625	628.340
A18	436.175	577.090	A68	507.625	577.090	A111	447.825	601.590	A153	388.825	625.840
A19	448.275	577.090	A69	495.775	587.090	A112	445.625	601.590	A154	388.825	621.590
A20	492.675	577.090	A70	507.625	580.040	A113	445.625	612.590	A155	386.625	621.590
A25	325.325	577.090	A71	502.775	587.090	A114	447.825	612.590	A156	386.625	632.590
A26	325.325	587.090	A72	502.413	594.140	A115	447.825	608.340	A157	388.825	632.590
A32	339.825	585.840	A73	507.625	584.640	A116	493.125	605.840	A158	388.825	628.340
A33	339.825	581.590	A74	503.275	584.640	A117	493.125	601.590	A159	436.625	625.840
A34	337.625	581.590	A75	502.775	585.740	A118	495.325	601.590	A160	436.625	621.590
A35	337.625	592.590	A76	340.275	597.090	A119	495.325	612.590	A161	438.825	621.590
A36	339.825	592.590	A77	377.175	597.090	A120	493.125	612.590	A162	438.825	632.590
A37	339.825	588.340	A78	389.275	597.090	A121	493.125	608.340	A163	436.625	632.590
A38	377.625	585.840	A79	436.175	597.090	A122	495.775	607.090	A164	436.625	628.340
A39	377.625	581.590	A80	440.275	597.090	A123	507.625	594.240	A165	447.825	625.840
A40	379.825	581.590	A81	492.675	597.090	A124	502.175	593.240	A166	447.825	621.590
A41	379.825	592.590	A82	325.325	597.090	A125	503.225	594.240	A167	445.625	621.590
A42	377.625	592.590	A83	325.325	607.042	A126	507.625	607.090	A168	445.625	632.590
A43	377.625	588.340	A86	339.825	605.840	A127	507.625	614.140	A169	447.825	632.590
A44	388.825	585.840	A87	339.825	601.590	A128	502.175	617.090	A170	447.825	628.340
A45	388.825	581.590	A88	337.625	601.590	A130	340.275	617.090	A171	493.125	625.840
A46	386.625	581.590	A89	337.625	612.590	A131	377.175	617.090	A172	493.125	621.590
A47	386.625	592.590	A90	339.825	612.590	A132	389.275	617.090	A173	495.325	621.590
A48	388.825	592.590	A91	339.825	608.340	A133	436.175	617.090	A174	495.325	632.590
A49	388.825	588.340	A92	377.625	605.840	A134	448.275	617.090	A175	493.125	632.590
A50	436.625	585.840	A93	377.625	601.590	A135	492.675	617.090	A176	493.125	628.340



KEY PLAN

1.0 GENERAL NOTES

1. THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

2. FOR OTHER NOTES REFER TO DRAWING NO. CV-100

2.0 DIMENSIONS

3. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

4. DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
2	22.07.05	CAR PARK AND FOOTPATH AMENDED	AGF
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT

Supply Chain Woolworths

540 George Street, Sydney NSW 2000
PO Box 470, CVO Post Office Sydney NSW 1220
Telephone (02) 9523 1555 Facsimile (02) 9523 1565

PROJECT MANAGER

Clifton Coney

Level 18, Clifton Coney, 2 Park Street, Sydney NSW 2000
Telephone (02) 9527 2100 Fax (02) 9527 2100

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd

CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street, Parramatta 2150
Tel: (02) 9691 6773 Fax: (02) 9633 9477
www.eca.com.au

ARCHITECTS

IMA ARCHITECTS

Level 4, 8 Help Street, Chalmers 2087
Tel: (02) 9465 6400 Fax: (02) 9465 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS

Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9667 5077 Fax: (02) 9664 0577

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS

9/33 Ryde Road, Ryde 2112
Tel: (02) 9469 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD

Suite 2, 1394 Pacific Highway, Turramurra NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

ARUP

Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD

Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9554 3733 Fax: (02) 9554 3825

COST MANAGER

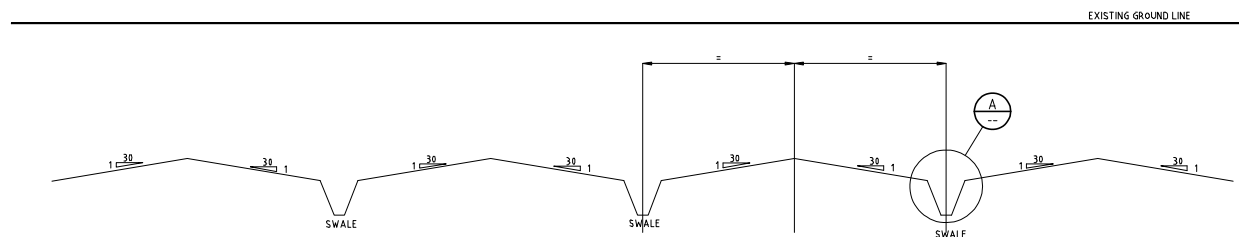
RIDER HUNT PTY LTD

41 McLennan Street, North Sydney 2060
Tel: (02) 9522 2277 Fax: (02) 9557 4187

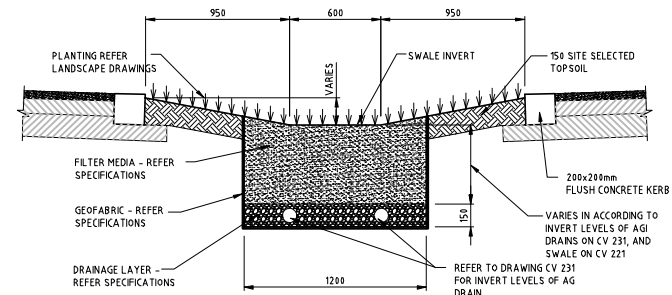
TITLE

CARPARK SETOUT
DETAIL PLAN

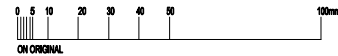
DATE	FEB 04	PROJECT NO.	610309	STATUS	CV/CD
SCALE	1:250	(B)			
DRAWN	J.C.				
CHECKED	BTM				
APPROVED	JAH				
		DWG. NO.	CV 221	REV. NO.	2



SECTION 1 CARPARK
1:200 HORIZ. 221
1:20 VERT. TYPICAL



DETAIL  CARPARK SWALE
1:20 TYPICAL PROFILE



1.0 GENERAL NOTES

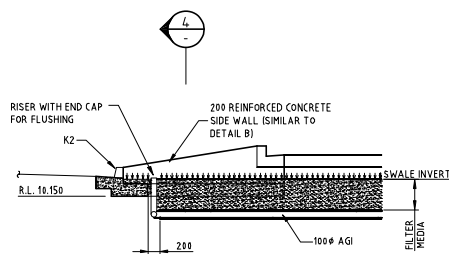
A. THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, STRUCTURAL, UTILITIES, AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

IF FOR OTHER NOTES REFER TO DRAWING No. CV-100

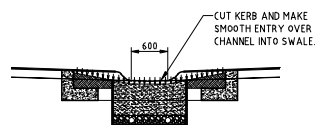
2.0 DIMENSIONS

A. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS. IN CONSTRUCTION COMMENTING, ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

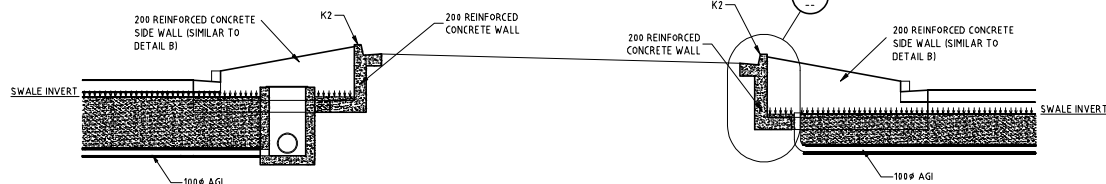
IF DO NOT SCALE THE DRAWINGS.



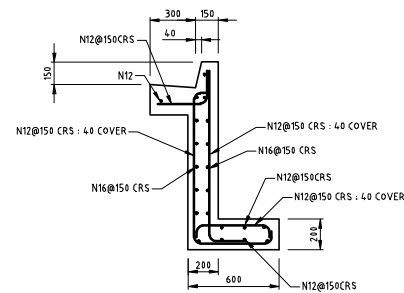
SECTION 2 UPSTREAM SWALE END
1:50 221 TYPICAL



SECTION 4
1:50



SECTION 3 CARPARK SWALE LINKS
1:50 221 TYPICAL



DETAIL B
1:20

REFER BELOW FOR MORE AMENDMENTS

1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT
REV.	DATE	AMENDMENT	SIGNED

CLIENT



540 George Street, Sydney NSW 2000
PO Box Q70, QVB Post Office Sydney NSW 1230
Telephone (02) 9323 1555 Facsimile (02) 9323 1565

PROJECT MANAGER



Level 18, Citigroup Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9287 2100 Fax: (02) 9287 2188

PROJECT
WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS



Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel. (02) 9891 6773 Fax. (02) 9633 9477
www.eca.com.au

ARCHITECTS
MIMA ARCHITECTS
Level 4, 8 Help Street, Chatswood 2067
Tel: (02) 9495 6400 Fax: (02) 9495 6444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9957 5577 Fax: (02) 9954 0677

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel: (02) 9499 8973 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS
NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Turramurra NSW 2074
Tel (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS
ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

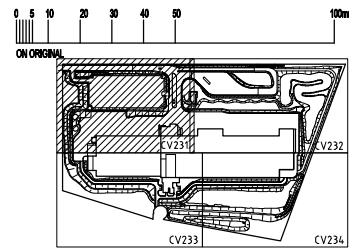
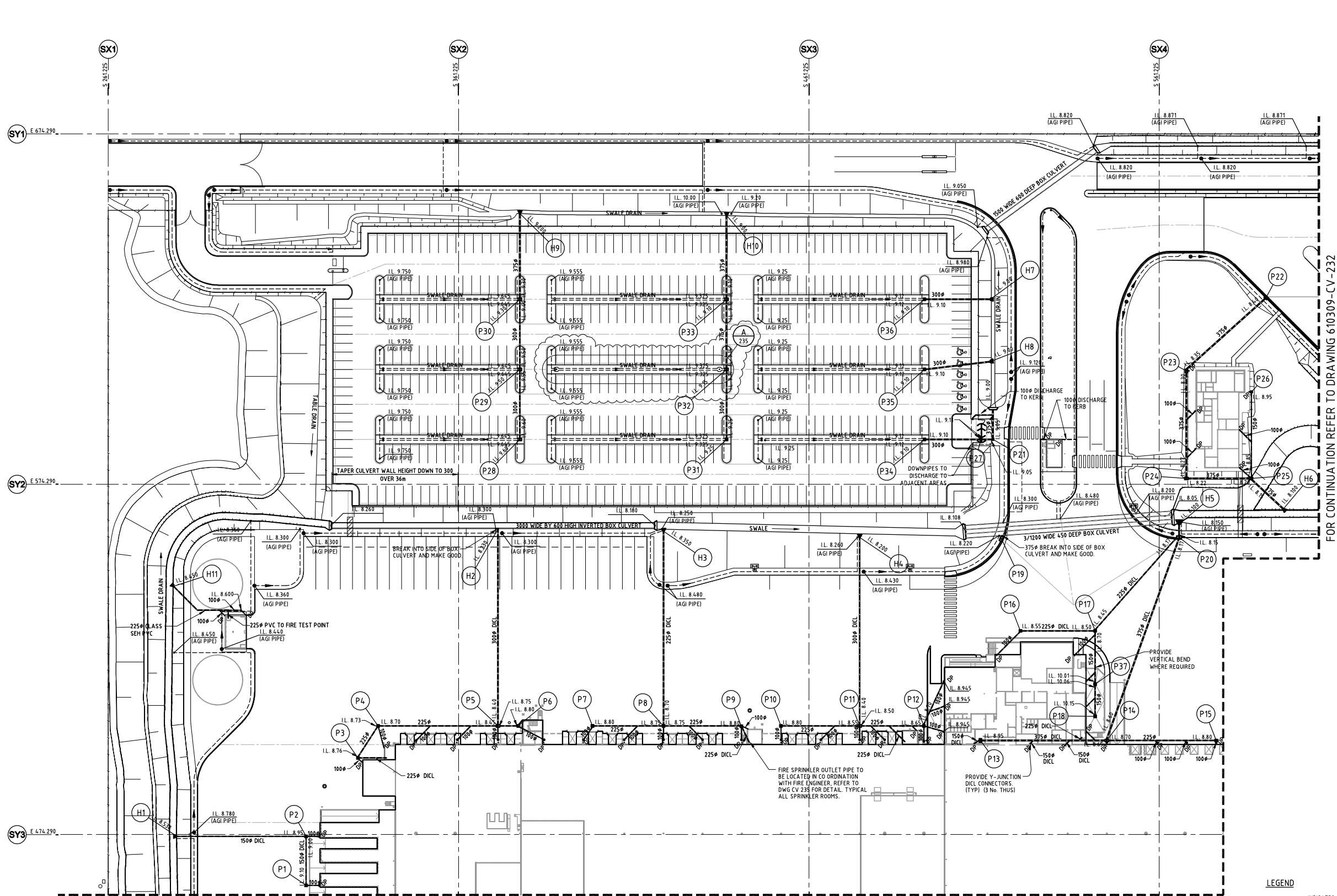
LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9954 3733 Fax: (02) 9954 3825

COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9922 2277 Fax: (02) 9957 4197

TITLE
CARPARK
SECTIONS

DATE	MAR '04	PROJECT No.	STATUS
SCALE	1:500 (B1)	610309	CV/CD
DRAWN	J.C.		
CHECKED	BTk	DWG No.	REV No.
APPROVED	JHW	CV 222	1

FOR CONSTRUCTION



1.0 GENERAL NOTES
2.0 DIMENSIONS

Table with 4 columns: REV, DATE, AMENDMENT, SIGNED. It lists revision history for the drawing.

CLIENT: Supply Chain Woolworths
540 George Street, Sydney NSW 2000
PO Box 470, QVB Post Office, Sydney NSW 1230
Telephone (02) 9323 1555 Facsimile (02) 9323 1595

PROJECT MANAGER: CliftonConey Group
Level 18, CliftonConey Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9287 2100 Fax: (02) 9287 2188

PROJECT: WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS: Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street, Parramatta 2150
Tel: (02) 9591 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS: MMA ARCHITECTS
Level 4, 8 Help Street, Chiswood 2067
Tel: (02) 9495 6400 Fax: (02) 9495 6444

FIRE SERVICES & MECHANICAL ENGINEERS: BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9557 5577 Fax: (02) 9554 0677

ELECTRICAL ENGINEERS: WOOD & GRIEVE ENGINEERS
933 Ryde Road, Pymble 2073
Tel: (02) 9498 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS: WYTHE DOWNEY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Tuncurry NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS: ARIUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT: TRACT CONSULTANTS PTY LTD
Level 1, 106 Blues Point Rd, Maclemons Point, NSW 2060
Tel: (02) 9554 3733 Fax: (02) 9554 3825

COST MANAGER: RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9622 2277 Fax: (02) 9657 4197

TITLE: DRAINAGE PLAN
SHEET 1 OF 4

Table with 4 columns: DATE, SCALE, DRAWN, CHECKED, APPROVED, PROJECT No., and REV. It contains project metadata.

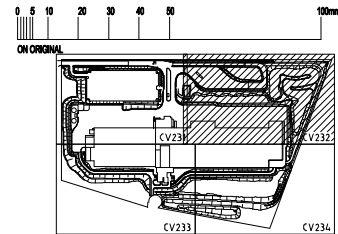
- LEGEND
- INDICATES STORMWATER
 - INDICATES 1000mm DRAIN COIL (AGI PIPE)
 - INDICATES FLUSHOUT RISER ON DRAIN COIL
 - INDICATES STORMWATER PITS REFER TO DRAWINGS CV 235 FOR DETAILS
 - INDICATES DOWNPIPE
 - INDICATES PIT NUMBER AND LOCATION OF CENTER OF PIT
 - INDICATES EROSION PROTECTION OUTLET REFER DRG CV 236 FOR DETAILS

DRAINAGE SYSTEM DESIGNED FOR 20 YEARS ARI EXCEPT FOR DRAINAGE UNDER CONCRETE PAVEMENT ON PROJECT EAST SIDE OF THE BUILDING. THIS PIPED SYSTEM IS DESIGNED FOR SMALL NOTIONAL FLOWS WITH THE PRIMARY FLOW PATH BEING OVER THE CONCRETE PAVEMENT

FOR CONSTRUCTION

Table with 3 columns: REF, SOUTHWING Mtr, EASTING Mtr, and Pit Size. It lists pit details for various locations.

FOR PIT TYPES AND CLASS OF COVERS/GRATES REFER TO DRG. No. CV-235
PIT COVER/GRATE LEVELS ARE INDICATIVE ONLY AND ARE TO MATCH FINISHED SURFACE LEVELS U.O.



KEY PLAN

- 1.0 GENERAL NOTES
1. THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
2. FOR OTHER NOTES REFER TO DRAWING No. CV-100
- 2.0 DIMENSIONS
3. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
4. DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

1	28.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
2	09.09.04	ISSUED FOR CONSTRUCTION	DAT
REV.	DATE	AMENDMENT	SIGNED

CLIENT

Supply Chain Woolworths

540 George Street, Sydney NSW 2000
PO Box 470, CVO Post Office Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1565

PROJECT MANAGER

Clifton Coney Group

Level 18, Clifton Coney, 2 Park Street, Sydney NSW 2000
Telephone (02) 9287 2100 Fax (02) 9287 2100

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel. (02) 9691 6773 Fax (02) 9633 9477
www.becca.com.au

ARCHITECTS

BMIA ARCHITECTS
Level 4, 8 Help Street, Chalmers 2087
Tel: (02) 9465 6400 Fax: (02) 9465 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9667 5677 Fax: (02) 9664 0577

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel: (02) 9469 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1364 Pacific Highway, Turramurra NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9664 3733 Fax: (02) 9664 3825

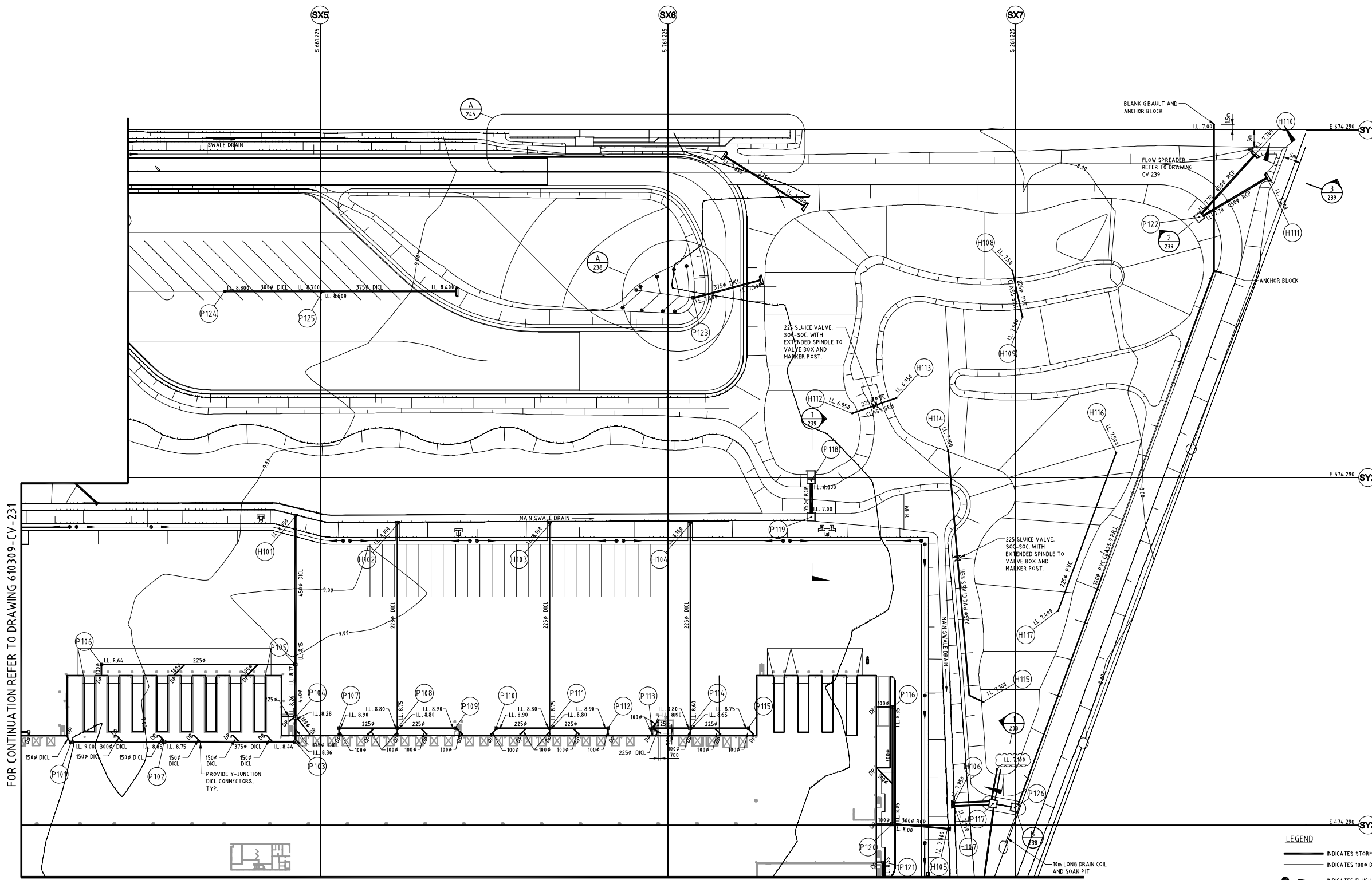
COST MANAGER

RIDER HUNT PTY LTD
41 McLennan Street, North Sydney 2060
Tel: (02) 9622 2277 Fax: (02) 9657 4187

TITLE

DRAINAGE PLAN
SHEET 2 OF 4

DATE	APRIL 04	PROJECT No.	STATUS
SCALE	1:500	(B1)	610309 CV/CD
DRAWN	DAT		
CHECKED	-	DWG No.	REV No.
APPROVED	-	CV 232	1



FOR CONTINUATION REFER TO DRAWING 610309-CV-231

FOR CONTINUATION REFER TO DRAWING 610309-CV-234

REF.	SOUTHING Mtr.	EASTING Mtr.	Pit Size	Pit Type	Top of Pit	Cover Type	Top of Cover	REF.	SOUTHING Mtr.	EASTING Mtr.	Pit Size	Pit Type	Top of Pit	Cover Type	Top of Cover
P101	589.775	498.250	900 x 900	TYPE 1			R.L. 10.80	P114	767.680	522.200	600 x 900	TYPE 1			R.L. 9.50
P102	616.335	498.250	900 x 900	TYPE 1			R.L. 10.80	P115	786.480	522.200	600 x 600	TYPE 1			R.L. 9.39
P103	654.180	498.250	900 x 900	TYPE 1			R.L. 10.80	P116	825.880	508.325	600 x 900	TYPE 5			R.L. 9.35
P104	654.180	505.300	900 x 900	TYPE 1			R.L. 9.47	P117	854.747	489.447	REF CV238				R.L. 9.40
P105	654.180	520.500	600 x 900	TYPE 1			R.L. 9.28	P118	802.523	573.497	REF CV239				R.L. 8.40
P106	598.380	520.500	600 x 600	TYPE 1			R.L. 9.50	P119	802.524	562.967	REF CV239				R.L. 9.50
P107	666.680	502.200	600 x 600	TYPE 1			R.L. 9.50	P120	825.880	474.610	900 x 900	TYPE 5			R.L. 9.35
P108	683.480	502.200	600 x 600	TYPE 1			R.L. 9.50	P121	823.215	463.660	600 x 900	TYPE 5			R.L. 9.40
P109	706.120	502.200	600 x 600	TYPE 1			R.L. 9.50	P122	916.091	649.195	REF CV239				R.L. 9.50
P110	711.824	502.200	600 x 600	TYPE 1			R.L. 9.50	P123	768.517	625.950	600 x 600	TYPE 5			R.L. 8.40
P111	727.280	502.200	600 x 600	TYPE 1			R.L. 9.50	P124	633.740	627.790	600 x 600	TYPE 1			R.L. 9.50
P112	744.080	502.200	600 x 600	TYPE 1			R.L. 9.50	P125	662.025	627.790	600 x 600	TYPE 1			R.L. 9.40
P113	756.735	502.200	600 x 600	TYPE 1			R.L. 9.50	P126	861.046	479.333	REF CV238				R.L. 9.40

FOR PIT TYPES AND CLASS OF COVERS/GRATES REFER TO DRG. No. CV-235
PIT COVER/GRATE LEVELS ARE IDICATIVE ONLY AND ARE TO MATCH FINISHED SURFACE LEVELS U.N.O.

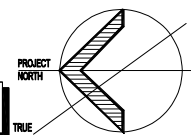
* REFER NOTE 3

- NOTES:
- FOR PIT TYPES AND CLASS OF COVERS/GRATES REFER TO DRG. No. CV-235.
 - PIT COVER/GRATE LEVELS ARE IDICATIVE ONLY AND ARE TO MATCH FINISHED SURFACE LEVELS U.N.O.
 - MARKER POSTS TO BE LOCATED BESIDE PIPE END: 100 x 100 IRONBARK OR SIMILAR. EMBED 600mm AND EXTEND TO R.L. 8.00. PAINT TOP 200mm WHITE.

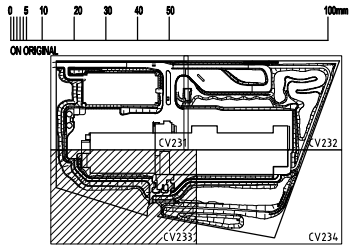
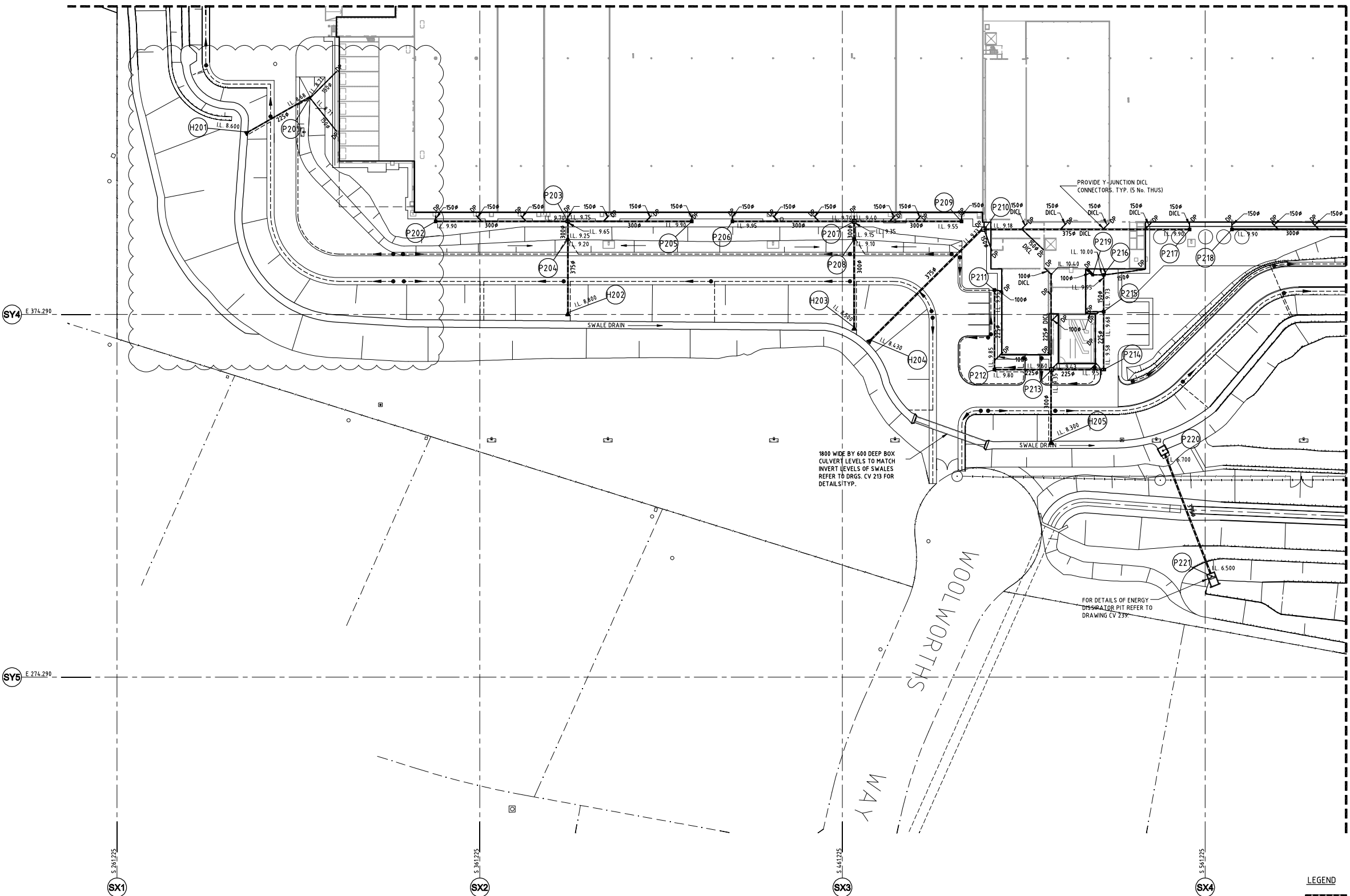
DRAINAGE SYSTEM DESIGNED FOR 20 YEARS ARI
EXCEPT FOR DRAINAGE UNDER CONCRETE
PAVEMENT ON PROJECT EAST SIDE OF THE
BUILDING. THIS PIPED SYSTEM IS DESIGNED FOR
SMALL NOTIONAL FLOWS WITH THE PRIMARY FLOW
PATH BEING OVER THE CONCRETE PAVEMENT

- LEGEND
- INDICATES STORMWATER
 - INDICATES 100# DRAIN COIL (AGI PIPE)
 - INDICATES FLUSHOUT RISER ON DRAIN COIL.
 - INDICATES STORMWATER PITS REFER TO DRAWINGS CV 235 FOR DETAILS
 - INDICATES DOWNPIPE
 - INDICATES PIT NUMBER AND LOCATION OF CENTER OF PIT.
 - INDICATES EROSION PROTECTION OUTLET REFER DRG CV 236 FOR DETAILS

FOR CONSTRUCTION



FOR CONTINUATION REFER TO DRAWING 610309-CV-231



KEY PLAN

1.0 GENERAL NOTES
a) THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

b) FOR OTHER NOTES REFER TO DRAWING No. CV-00

2.0 DIMENSIONS
a) VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

b) DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
2	08.10.04	ROAD ALIGNMENT REV FOR BANANA ROOM EXT.	DAT
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT
Supply Chain Woolworths
540 George Street, Sydney NSW 2000
PO Box 470, Chis Post Office Sydney NSW 1230
Telephone (02) 9323 1555 Facsimile (02) 9323 1555

PROJECT MANAGER
CliftonConey Group
Level 15, CliftonConey Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9287 2100 Fax: (02) 9287 2108

PROJECT
WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS
Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel: (02) 9891 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS
BMMA ARCHITECTS
Level 4, 8 Help Street, Chiswood 2057
Tel: (02) 9495 6400 Fax: (02) 9495 6444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9557 5577 Fax: (02) 9554 0677

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
933 Ryde Road, Pymble 2073
Tel: (02) 9490 8673 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS
WYHER DONNELLY & PARTNERS PTY LTD
Suite 2, 194 Pacific Highway, Tuncurry NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS
ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 106 Blues Point Rd, McLahons Point, NSW 2060
Tel: (02) 9554 3733 Fax: (02) 9554 3825

COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9822 2277 Fax: (02) 9557 4197

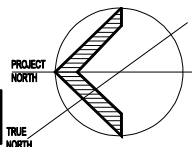
TITLE
DRAINAGE PLAN
SHEET 3 OF 4

DATE	APRIL 14	PROJECT No.	610309 CV/C
SCALE	1:500 (B1)	DATE	08/08
DRAWN	DAT	DATE	
CHECKED	BTX	DATE	
APPROVED	JHW	DATE	

REF.	SOUTHING Mtr.	EASTING Mtr.	Pit Size	Pit Type	Top of Pit	Cover Type	Top of Cover	REF.	SOUTHING Mtr.	EASTING Mtr.	Pit Size	Pit Type	Top of Pit	Cover Type	Top of Cover
P201	314.441	434.152	450 x 450	TYPE 3		GRATE	R.L. 9.10	P212	503.130	359.082	600 x 600	TYPE 5			R.L. 10.65
P202	349.065	399.930	600 x 600	TYPE 5			R.L. 10.58	P213	518.880	359.082	900 x 900	TYPE 5			R.L. 10.65
P203	385.495	399.930	600 x 900	TYPE 5			R.L. 10.58	P214	533.230	359.082	600 x 900	TYPE 1			R.L. 10.48
P204	385.495	394.988	450 x 450	TYPE 3		GRATE	R.L. 9.70	P215	533.230	375.036	600 x 600	TYPE 1			R.L. 10.53
P205	419.685	399.930	600 x 600	TYPE 5			R.L. 10.58	P216	533.230	385.188	600 x 600	TYPE 1			R.L. 10.58
P206	430.875	399.930	600 x 600	TYPE 5			R.L. 10.58	P217	556.925	397.730	600 x 600	TYPE 5			R.L. 10.58
P207	464.445	399.930	900 x 900	TYPE 5			R.L. 10.58	P218	568.595	397.730	600 x 600	TYPE 5			R.L. 10.58
P208	464.445	395.044	600 x 600	TYPE 3		GRATE	R.L. 9.70	P219	530.237	385.188	450 x 450	TYPE 1			R.L. 10.58
P209	494.045	399.930	600 x 600	TYPE 5			R.L. 10.15	P220	549.590	336.732	REF CV239				R.L. 7.70
P210	500.280	397.730	900 x 900	TYPE 5			R.L. 10.58	P221	562.999	302.119	REF CV239				R.L. 7.80
P211	503.130	381.030	600 x 600	TYPE 5			R.L. 10.65								

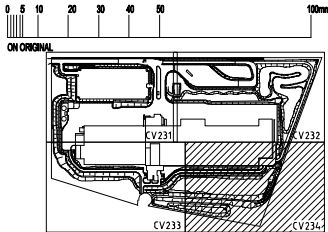
DRAINAGE SYSTEM DESIGNED FOR 20 YEARS ARI EXCEPT FOR DRAINAGE UNDER CONCRETE PAVEMENT ON PROJECT EAST SIDE OF THE BUILDING. THIS PIPED SYSTEM IS DESIGNED FOR SMALL NOTIONAL FLOWS WITH THE PRIMARY FLOW PATH BEING OVER THE CONCRETE PAVEMENT

FOR CONSTRUCTION



FOR PIT TYPES AND CLASS OF COVERS/GRATES REFER TO DRG. No. CV-235
PIT COVER/GRATE LEVELS ARE INDICATIVE ONLY AND ARE TO MATCH FINISHED SURFACE LEVELS U.N.O.

FOR CONTINUATION REFER TO DRAWING 610309-CV-232



KEY PLAN

1.0 GENERAL NOTES

A THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

B FOR OTHER NOTES REFER TO DRAWING No. CV-101

2.0 DIMENSIONS

A VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

B DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT

Supply Chain Woolworths

540 George Street, Sydney NSW 2000
PO Box 470, CVO Post Office Sydney NSW 1220
Telephone (02) 9523 1555 Facsimile (02) 9323 1565

PROJECT MANAGER

Clifton Coney Group

Level 18, Clifton Coney, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9357 2100 Fax: (02) 9357 2100

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd

CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel: (02) 9691 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS

BMIA ARCHITECTS

Level 4, 8 Help Street, Chalmerswood 2087
Tel: (02) 9465 6400 Fax: (02) 9465 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS

Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9667 5577 Fax: (02) 9664 0577

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS

9/33 Ryde Road, Pymble 2073
Tel: (02) 9459 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD

Suite 2, 1364 Pacific Highway, Turramurra NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

ARUP

Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD

Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9664 3733 Fax: (02) 9664 3825

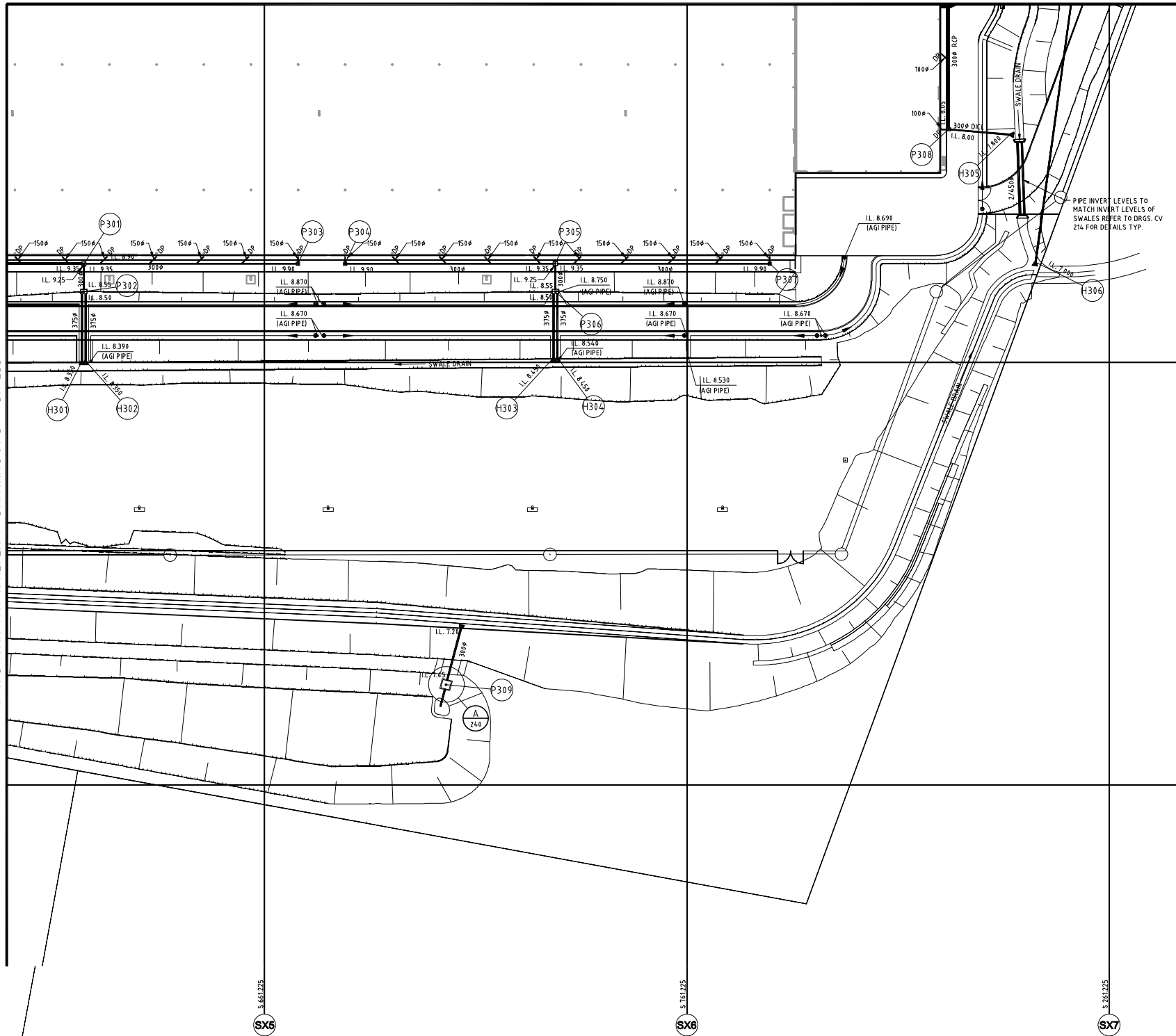
COST MANAGER

RIDER HUNT PTY LTD

41 McLaren Street, North Sydney 2060
Tel: (02) 9022 2277 Fax: (02) 9657 4197

DATE	APRIL 04	PROJECT No.	STATUS
SCALE	1:500	(B1)	610309 CV/CD
DRAWN	DAT		
CHECKED	BTX	DWG No.	REV No.
APPROVED	JHW	CV 234	1

FOR CONTINUATION REFER TO DRAWING 610309-CV-233



REF.	SOUTHING Mtr.	EASTING Mtr.	Pit Size	Pit Type	Top of Pit	Cover Type	Top of Cover	REF.	SOUTHING Mtr.	EASTING Mtr.					
P301	618.410	397.722	900 x 900	TYPE 5			R.L. 10.58	H301	617.960	374.688					
P302	618.410	391.160	900 x 1400	TYPE 3		GRATE	R.L. 8.99	H302	618.860	374.688					
P303	669.125	397.730	600 x 600	TYPE 5			R.L. 10.58	H303	729.660	375.591					
P304	680.295	397.730	600 x 600	TYPE 5			R.L. 10.58	H304	730.560	375.591					
P305	730.110	397.754	900 x 900	TYPE 5			R.L. 10.58	H305	837.761	428.314					
P306	730.110	391.115	900 x 1400	TYPE 3		GRATE	R.L. 8.99	H306	843.800	398.101					
P307	780.825	397.730	600 x 600	TYPE 5			R.L. 10.58								
P308	823.215	429.560	600 x 900	TYPE 1			R.L. 9.10								
P309	704.186	298.006	REF CV240												

NOTES:

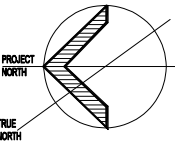
- FOR PIT TYPES AND CLASS OF COVERS/GRATES REFER TO DRG. No. CV-235.
- PIT COVER/GRATE LEVELS ARE INDICATIVE ONLY AND ARE TO MATCH FINISHED SURFACE LEVELS UNO.

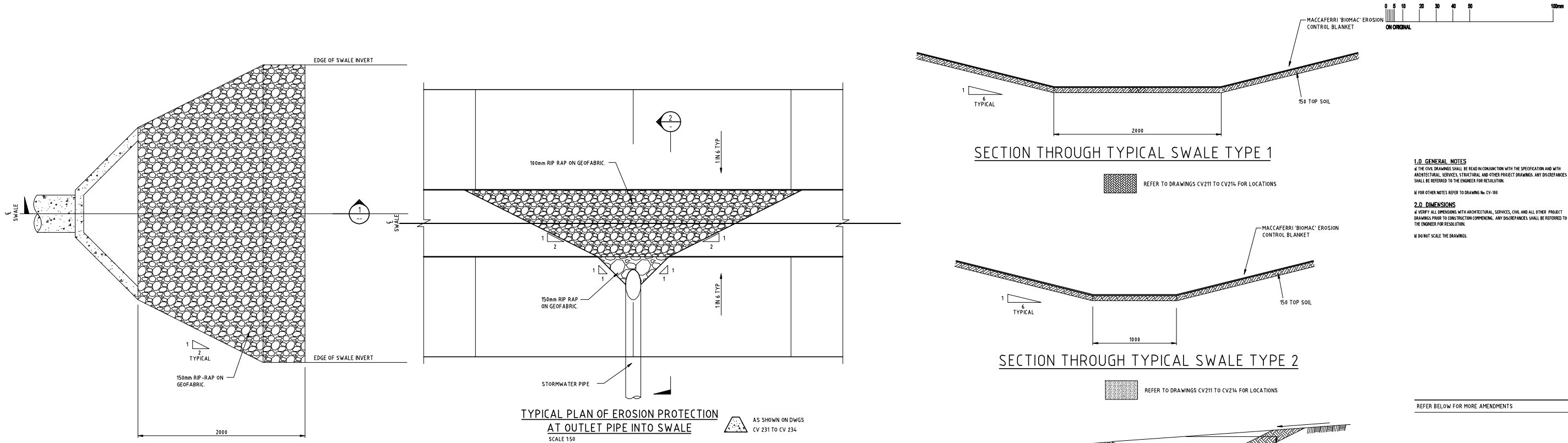
DRAINAGE SYSTEM DESIGNED FOR 20 YEARS ARI EXCEPT FOR DRAINAGE UNDER CONCRETE PAVEMENT ON PROJECT EAST SIDE OF THE BUILDING. THIS PIPED SYSTEM IS DESIGNED FOR SMALL NOTIONAL FLOWS WITH THE PRIMARY FLOW PATH BEING OVER THE CONCRETE PAVEMENT

LEGEND

- INDICATES STORMWATER
- INDICATES 100# DRAIN COIL (AGI PIPE)
- INDICATES FLUSHOUT RISER ON DRAIN COIL.
- INDICATES STORMWATER PITS REFER TO DRAWINGS CV 235 FOR DETAILS
- INDICATES DOWNPIPE
- INDICATES PIT NUMBER AND LOCATION OF CENTER OF PIT.
- INDICATES EROSION PROTECTION OUTLET REFER DRG CV 236 FOR DETAILS

FOR CONSTRUCTION





TYPICAL PLAN OF HEADWALL ENTRY/EXIT

TYPICAL PLAN OF EROSION PROTECTION
AT OUTLET PIPE INTO SWALE

SECTION THROUGH TYPICAL SWALE TYPE 1

SECTION THROUGH TYPICAL SWALE TYPE 2

SECTION THROUGH TYPICAL TABLE DRAIN

1.0 GENERAL NOTES
a) THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b) FOR OTHER NOTES REFER TO DRAWING No. CV-101
2.0 DIMENSIONS
a) VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b) DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
1	20.09.14	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.14	ISSUED FOR CONSTRUCTION	DAT

CLIENT
Supply Chain Woolworths
540 George Street, Sydney NSW 2000
PO Box 471, CVO Post Office Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1565

PROJECT MANAGER
CliftonConey Group
Level 18, CliftonConey Centre, 2 Park Street, Sydney NSW 2000
Telephone (02) 9337 2100 Fax (02) 9337 2100

PROJECT
WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS
Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel. (02) 9891 6773 Fax. (02) 9633 9477
www.becca.com.au

ARCHITECTS
BMA ARCHITECTS
Level 4, 8 Help Street, Chalmers 2087
Tel: (02) 9465 6400 Fax: (02) 9465 6444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9867 5577 Fax: (02) 9864 0577

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel: (02) 9469 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS
NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Turrum NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS
AIRUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

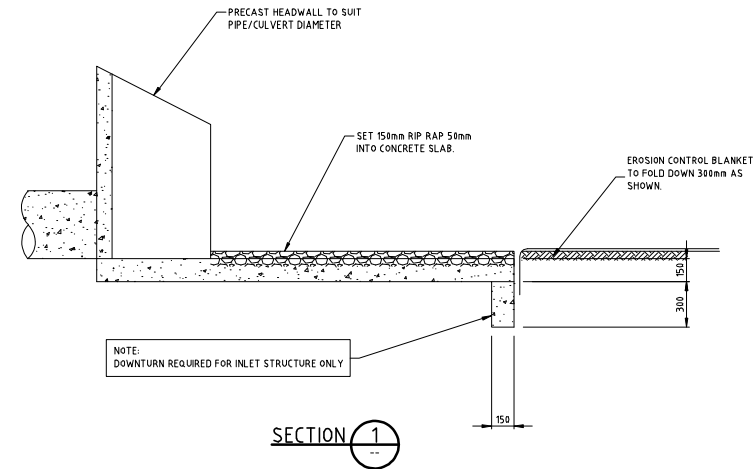
LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9854 3733 Fax: (02) 9854 3825

COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9022 2277 Fax: (02) 9857 4187

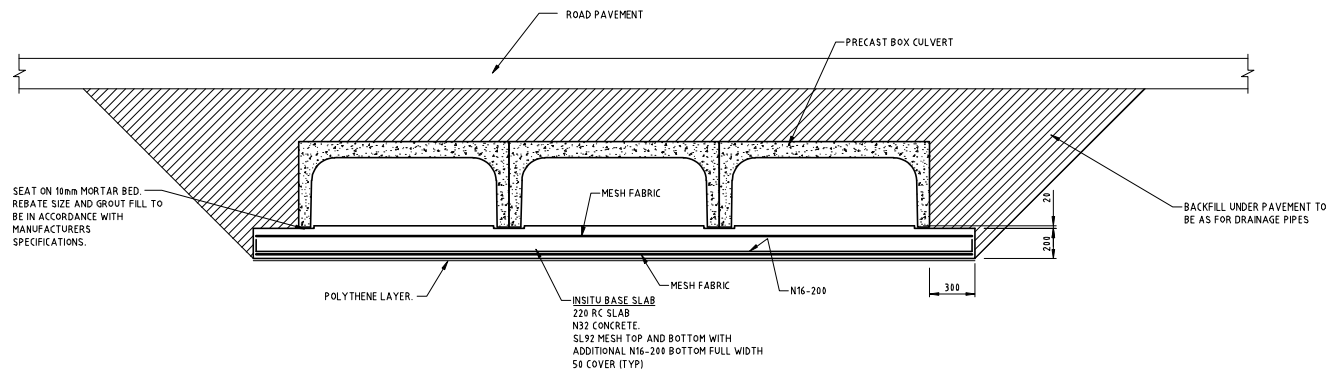
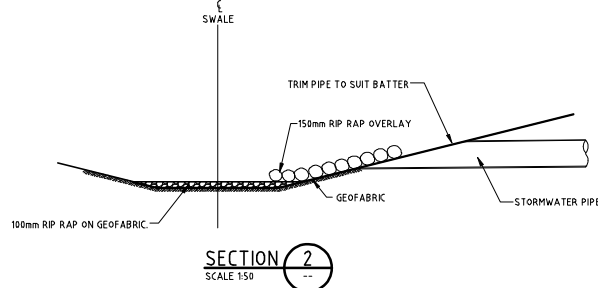
TITLE
DRAINAGE DETAILS
SHEET 2 OF 6

DATE	APRIL 04	PROJECT No.	610309	STATUS	CV/CD
SCALE	1:20 UNO.	(B1)			
DRAWN	PAS				
CHECKED	BTX				
APPROVED	JAH				
DATE	APRIL 04	PROJECT No.	610309	STATUS	CV/CD
SCALE	1:20 UNO.	(B1)			
DRAWN	PAS				
CHECKED	BTX				
APPROVED	JAH				
DATE	APRIL 04	PROJECT No.	610309	STATUS	CV/CD
SCALE	1:20 UNO.	(B1)			
DRAWN	PAS				
CHECKED	BTX				
APPROVED	JAH				

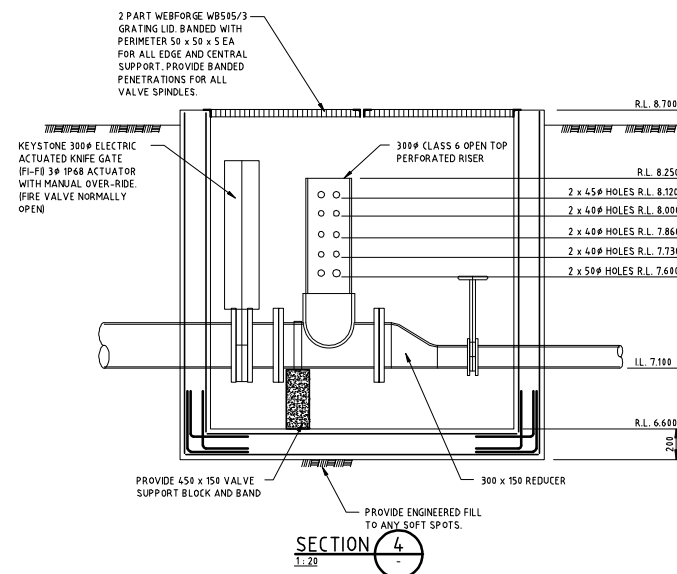
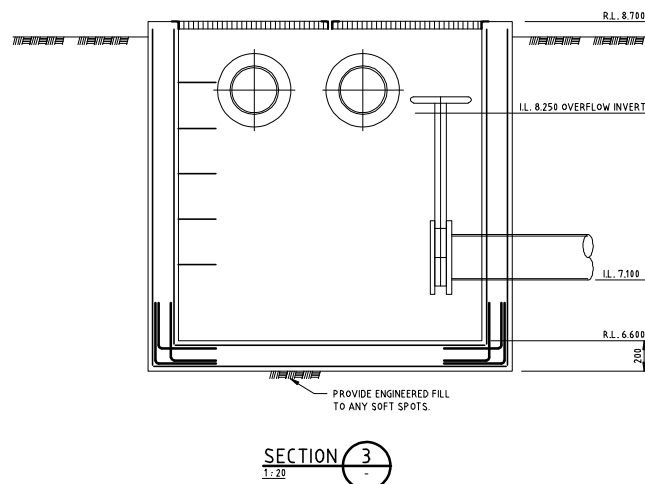
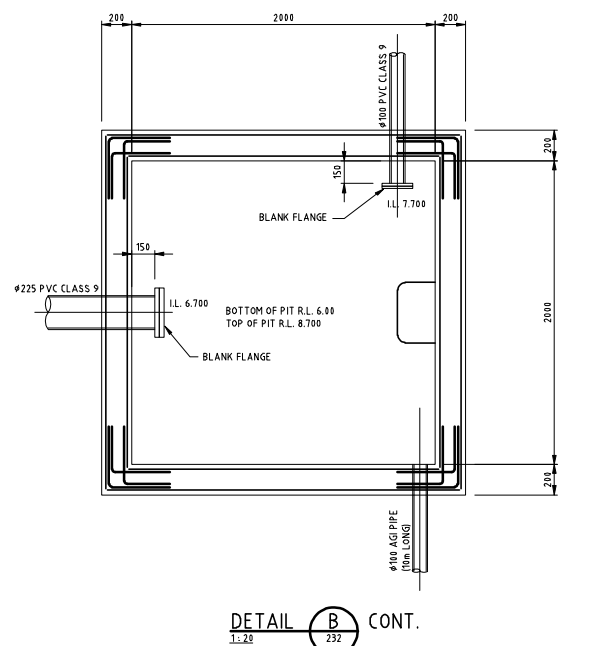
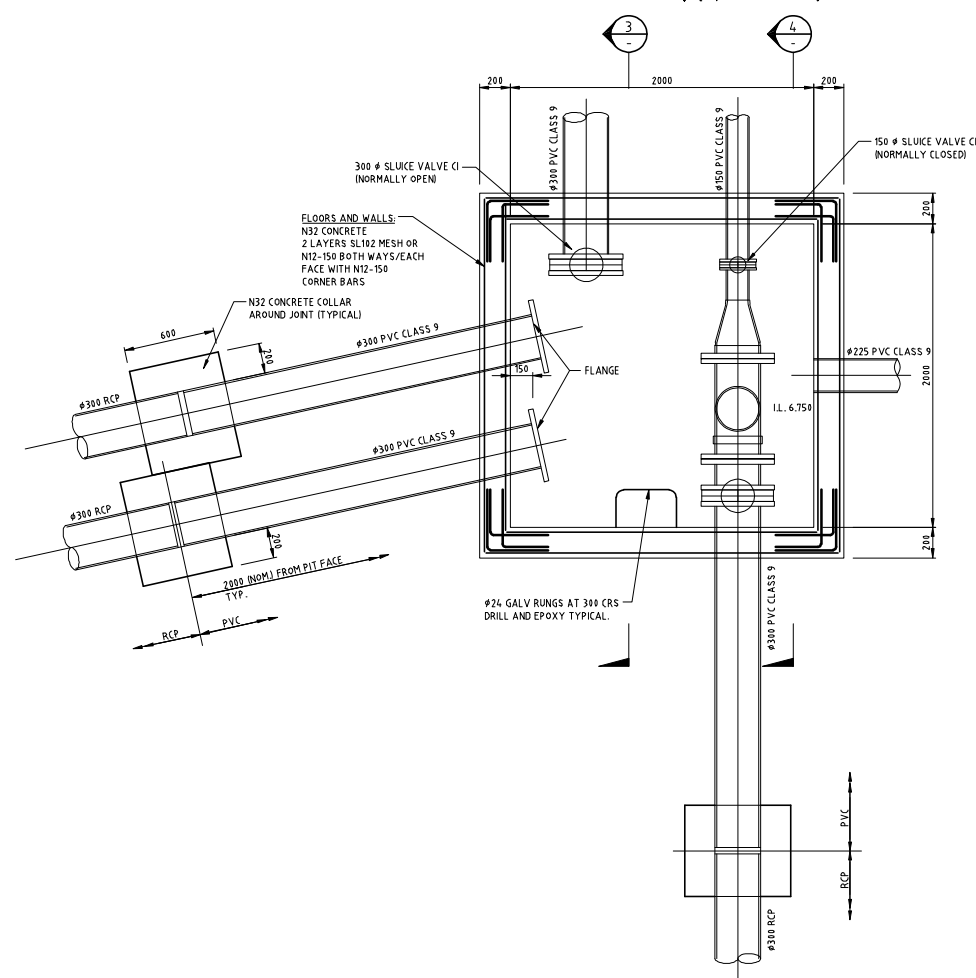
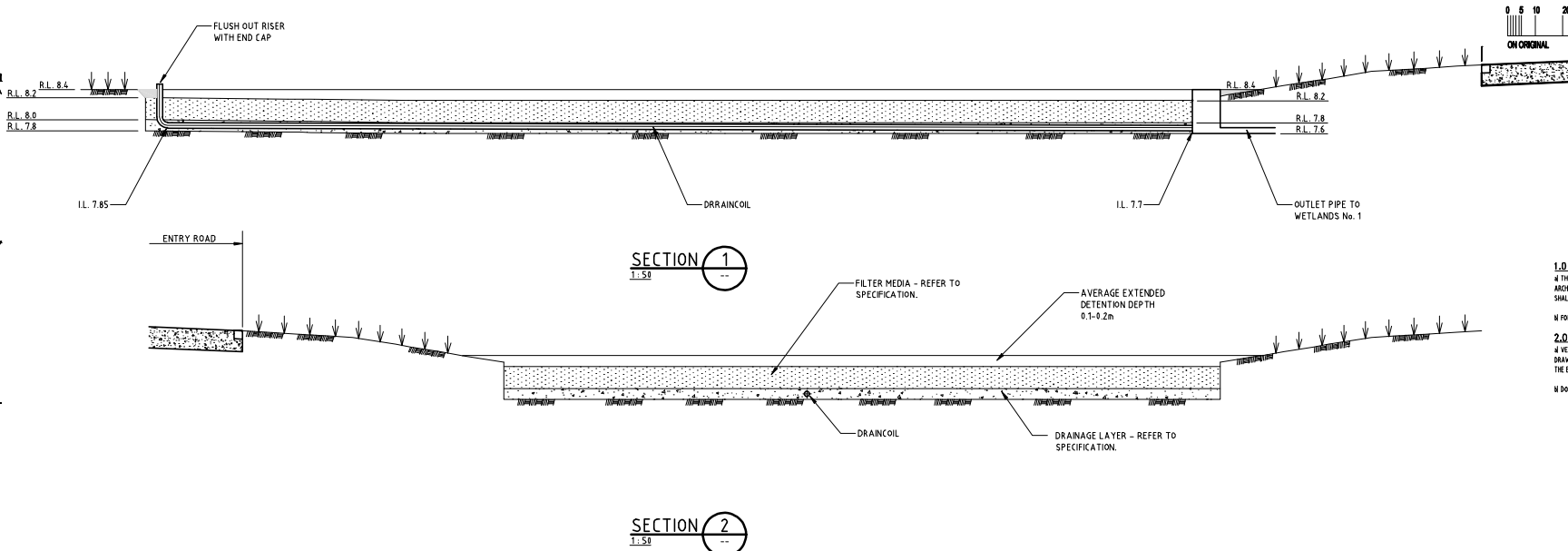
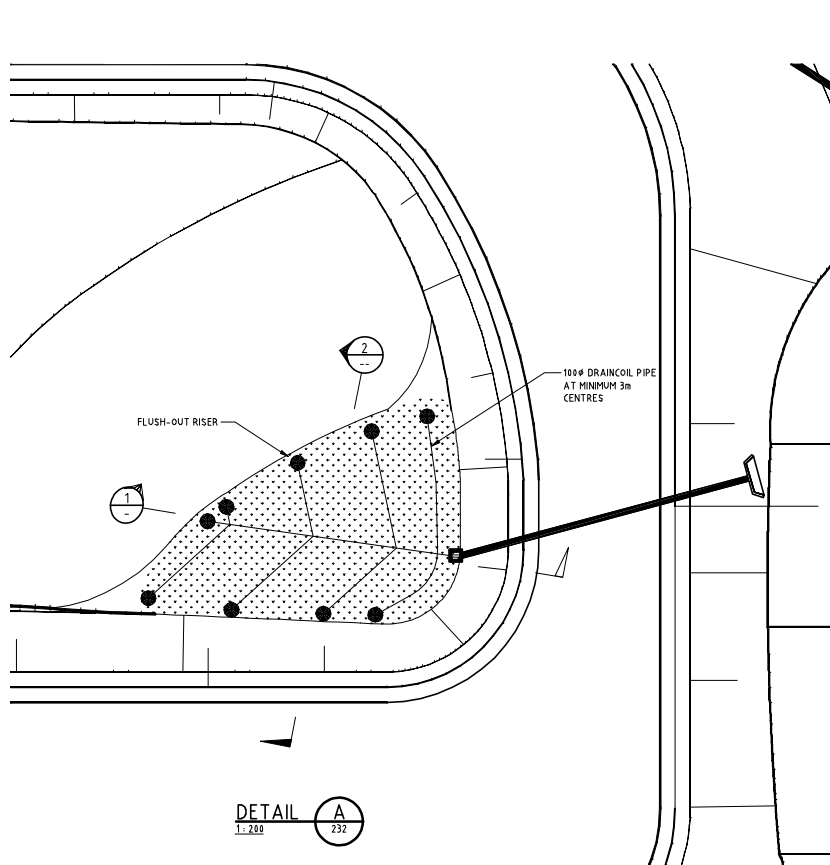
FOR CONSTRUCTION



TYPICAL SECTION THROUGH INVERTED CULVERT

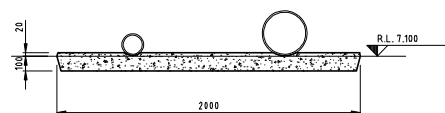
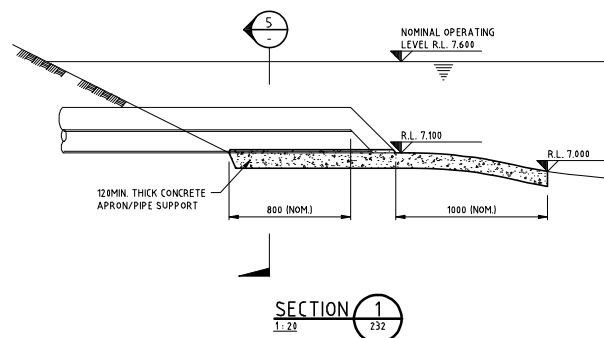


TYPICAL SECTION THROUGH BOX CULVERT
SINGLE BOX CULVERTS SIMILAR



WETLAND OUTLET PIT P117

PIT P126



FOR CONSTRUCTION

1.0 GENERAL NOTES
 a) THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
 b) FOR OTHER NOTES REFER TO DRAWING No. CV-100
2.0 DIMENSIONS
 a) VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
 b) DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
1	28.09.14	RE-ISSUED FOR CONSTRUCTION	PAS
8	09.09.14	ISSUED FOR CONSTRUCTION	DAT

CLIENT
 Supply Chain
 Woolworths
 540 George Street, Sydney NSW 2000
 PO Box 470, CVO Post Office Sydney NSW 1220
 Telephone (02) 9323 1555 Facsimile (02) 9323 1565

PROJECT MANAGER
 Clifton Coney
 Level 18, Clifton Coney, 2 Park Street, Sydney NSW 2000
 Telephone (02) 9327 2100 Fax (02) 9327 2100

PROJECT
WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS
Beca Pty Ltd
 CONSULTING ENGINEERS & PROJECT MANAGERS
 Level 5, 20 Charles Street, Parramatta 2150
 Tel: (02) 9891 6773 Fax: (02) 9633 9477
 www.becca.com.au

ARCHITECTS
BMIA ARCHITECTS
 Level 4, 8 Help Street, Chalmers 2087
 Tel: (02) 9465 6400 Fax: (02) 9465 6444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
 Level 12, 132 Arthur Street, North Sydney 2060
 Tel: (02) 9867 5577 Fax: (02) 9864 0577

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
 9/33 Ryde Road, Pymble 2073
 Tel: (02) 9469 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS
NIVEN DONNELLY & PARTNERS PTY LTD
 Suite 2, 1364 Pacific Highway, Turramurra NSW 2074
 Tel: (02) 9144 4711 Fax: (02) 9144 4733

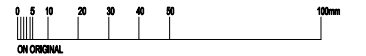
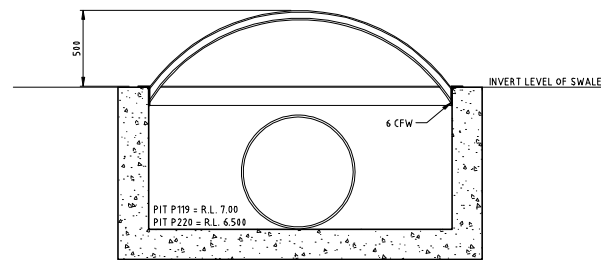
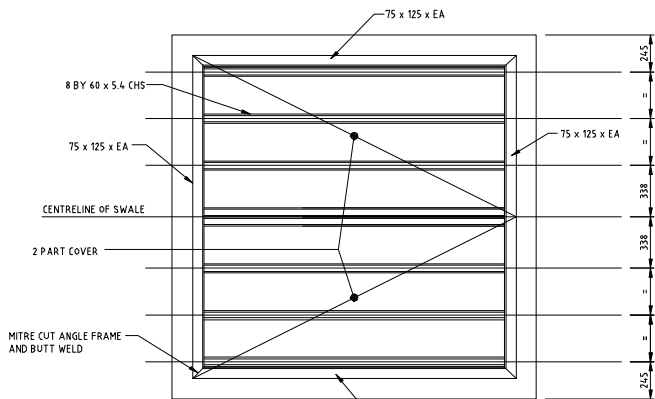
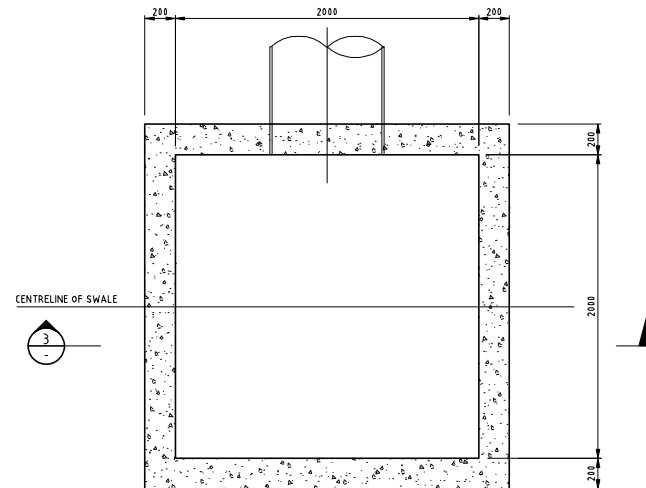
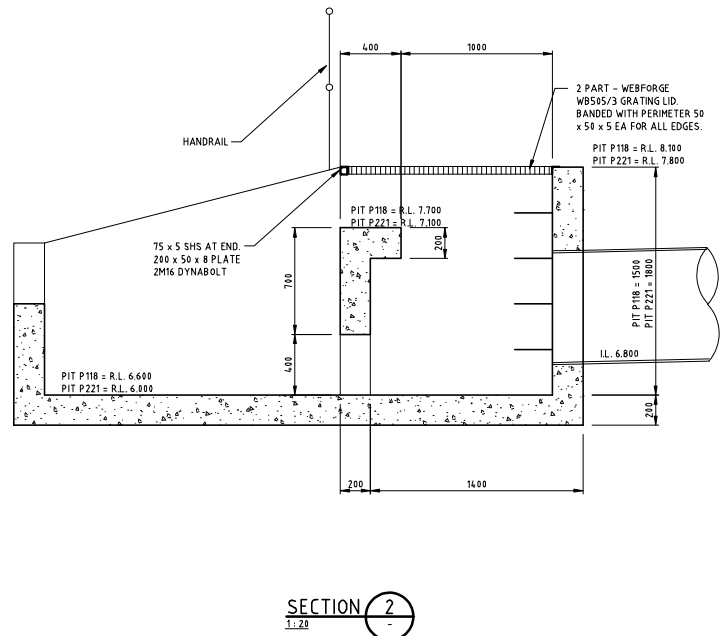
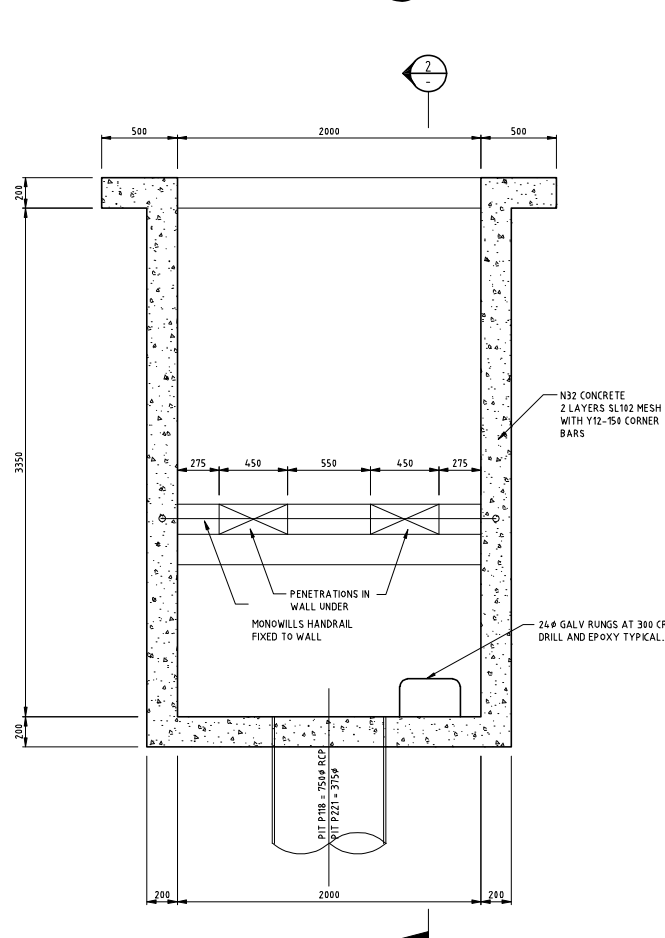
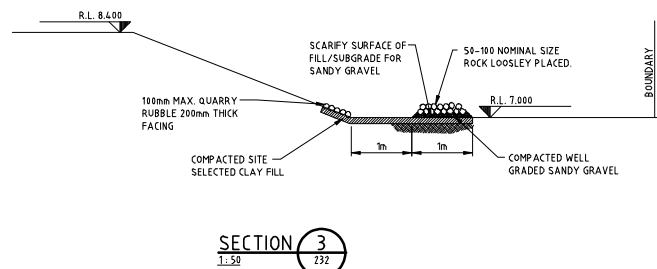
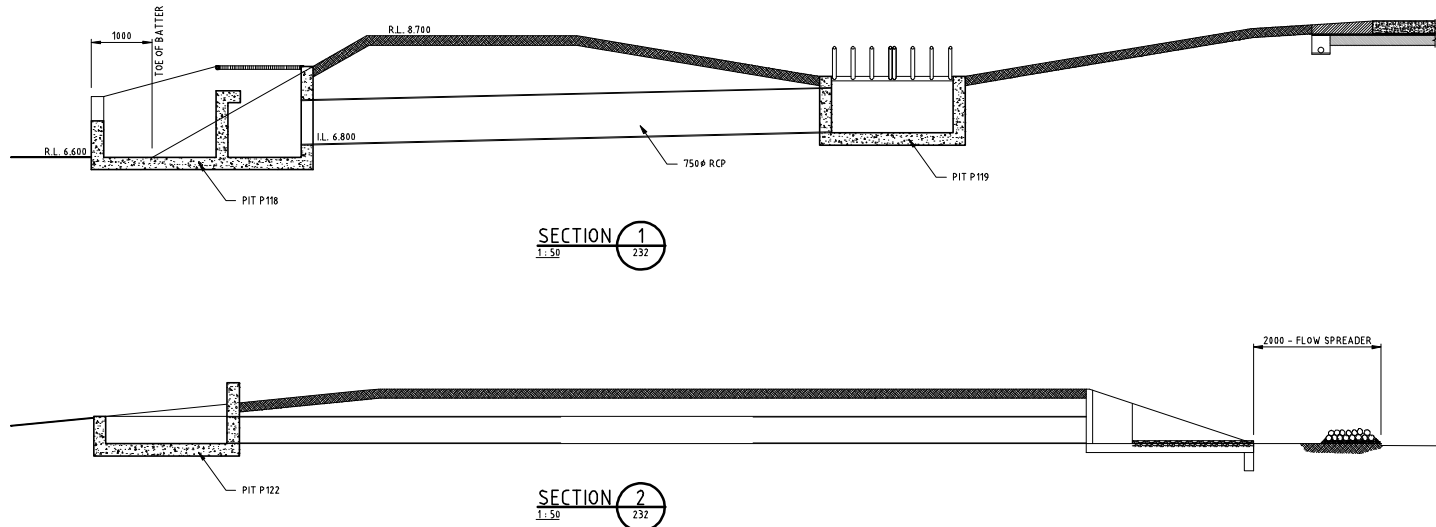
FIRE ENGINEERED SOLUTION CONSULTANTS
AIRUP
 Level 10, 201 Kent Street, Sydney 2000
 Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
 Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
 Tel: (02) 9554 3733 Fax: (02) 9554 3825

COST MANAGER
RIDER HUNT PTY LTD
 41 McLaren Street, North Sydney 2060
 Tel: (02) 9022 2277 Fax: (02) 9057 4197

TITLE
DRAINAGE DETAILS
SHEET 3 OF 6

DATE	JULY 04	PROJECT No.	610309	STATUS	CV/CD
SCALE	AS SHOWN	(B)			
DRAWN	DAT				
CHECKED	BTX	DWG No.		REV No.	
APPROVED	JAH		CV 238	1	



1.0 GENERAL NOTES
a THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b FOR OTHER NOTES REFER TO DRAWING No. CV-100
2.0 DIMENSIONS
a VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
b DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	DAT
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT
Supply Chain Woolworths
540 George Street, Sydney NSW 2000
PO Box 470, CVO Post Office Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1565

PROJECT MANAGER
CliftonConey Group
Level 18, CliftonConey Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9287 2100 Fax: (02) 9287 2100

PROJECT
WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS
Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel: (02) 9691 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS
BMA ARCHITECTS
Level 4, 8 Help Street, Chalmerswood 2087
Tel: (02) 9465 9400 Fax: (02) 9465 9444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9667 6677 Fax: (02) 9664 0677

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel: (02) 9469 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS
NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1364 Pacific Highway, Turramurra NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS
AIRUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

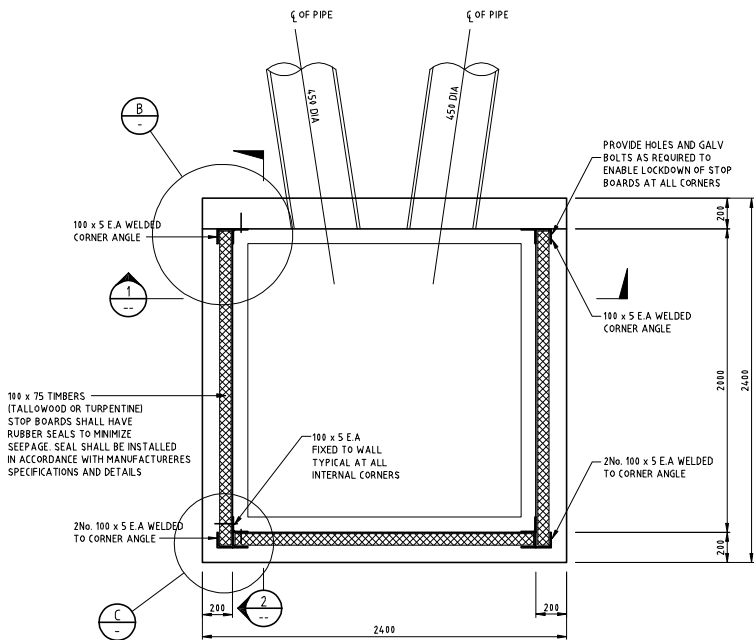
LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9654 3733 Fax: (02) 9654 3825

COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9222 2277 Fax: (02) 9657 4197

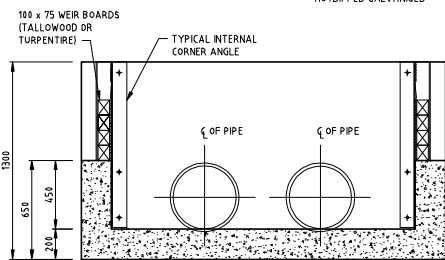
TITLE
DRAINAGE DETAILS
SHEET 5 OF 6

DATE	JULY 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	DAT				
CHECKED	BTX	DRAWN		REV No.	
APPROVED	JAH				CV 239 1

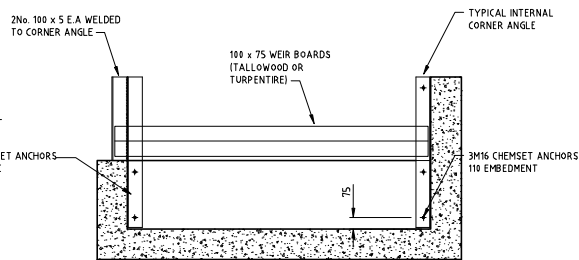
FOR CONSTRUCTION



P122 LAYOUT PLAN
WETLAND No. 1 SOUTH-EAST CORNER OUTLET PIT
1:20



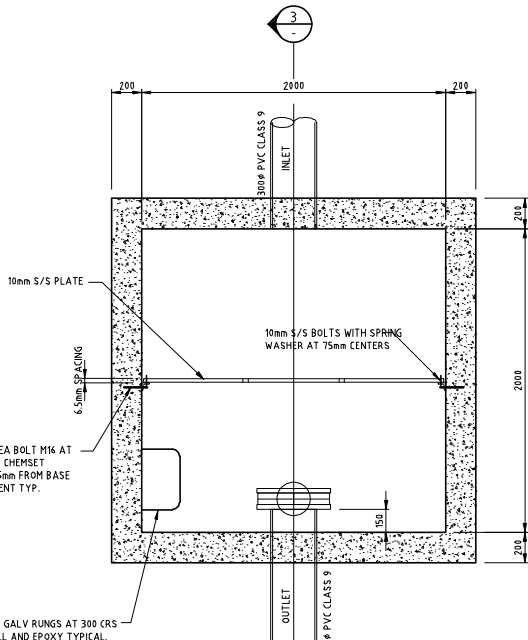
SECTION 1
1:20



SECTION 2
1:20

REINFORCEMENT SIMILAR TO PIT P117 ON DRAWING CV 238. PROVIDE 4M2 TRIMMERS (CRANKED AS REQUIRED) 1300 LONG CENTRAL AROUND EACH 450# PIPE.

- NOTE:
1. STOP BOARDS TO HAVE RUBBER SEALS TO MINIMIZE SEEPAGE.
 2. STOP BOARDS TO BE ABLE TO BE LOCKED IN PLACE.
 3. AT CONSTRUCTION STOP BOARDS TO BE INSTALLED TO SET WEIR CREST AT R.L. 8.35
 4. ADDITIONAL STOP BOARDS TO BE PROVIDED TO ENABLE WEIR CREST TO BE RAISED UP TO R.L. 8.55

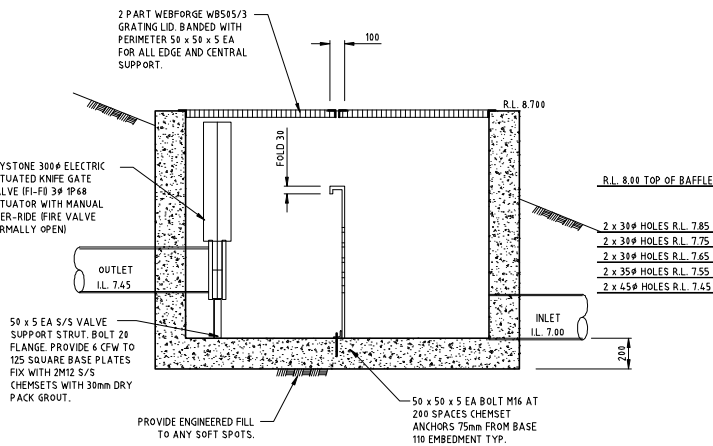


DETAIL A
1:20

WETLAND No. 2 - OUTLET PIT P309

REINFORCEMENT AND GRATE TYPE SIMILAR TO PIT P117 ON DRAWING CV 238. 150 BAFFLE WALL TO HAVE N12-150 EACH WAY CENTRAL.

- NOTE:
1. CONTRACTOR TO ENSURE S/S PLATE AND SUPPORTS PREVENT PASSAGE OF WATER AT EDGES USING APPROPRIATE RUBBER SEALS.



SECTION 3
1:20

- 1.0 GENERAL NOTES
- # THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- # FOR OTHER NOTES REFER TO DRAWING No. CV-00
- 2.0 DIMENSIONS
- # VERIFY ALL DIMENSIONS WITH ARCHITECTURAL SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- # DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
2	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT

Supply Chain Woolworths

540 George Street, Sydney NSW 2000
PO Box 470, C/O Woolworths Sydney NSW 1220
Telephone (02) 9523 1555 Facsimile (02) 9323 1565

PROJECT MANAGER

Clifton Coney Group

Level 18, Clifton Coney Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9387 2100 Fax: (02) 9387 2100

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd

CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street, Parramatta 2150
Tel: (02) 9691 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS

BMIA ARCHITECTS

Level 4, 8 Help Street, Chalmerswood 2087
Tel: (02) 9465 6400 Fax: (02) 9465 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS

Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9567 5577 Fax: (02) 9564 0877

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS

9/33 Ryde Road, Pymble 2073
Tel: (02) 9469 8873 Fax: (02) 9419 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD

Suite 2, 1364 Pacific Highway, Turrum NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

ARUP

Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD

Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9554 3733 Fax: (02) 9554 3825

COST MANAGER

RIDER HUNT PTY LTD

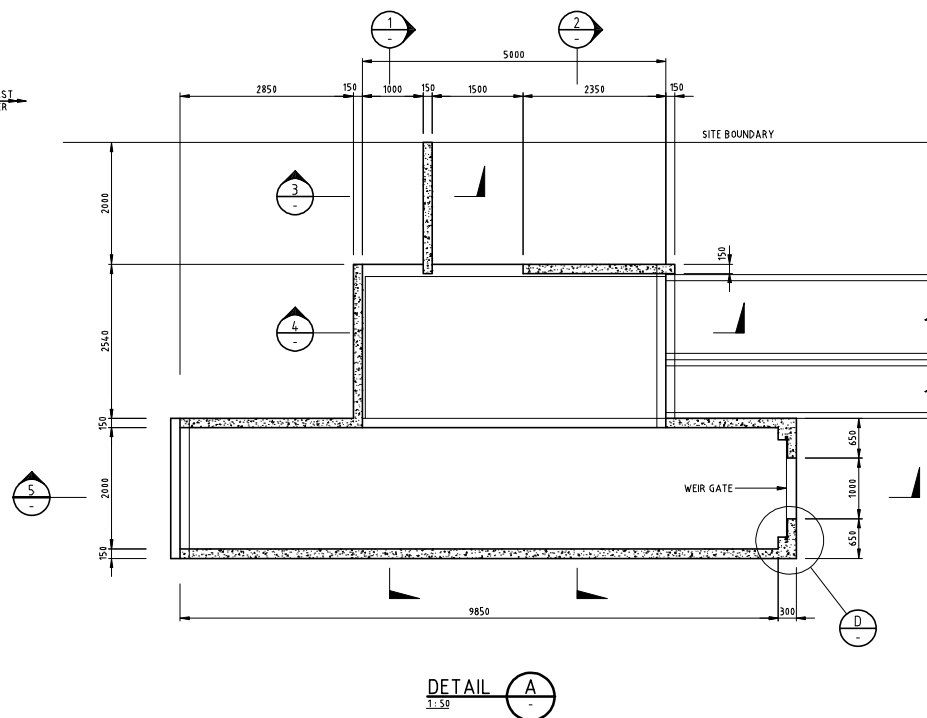
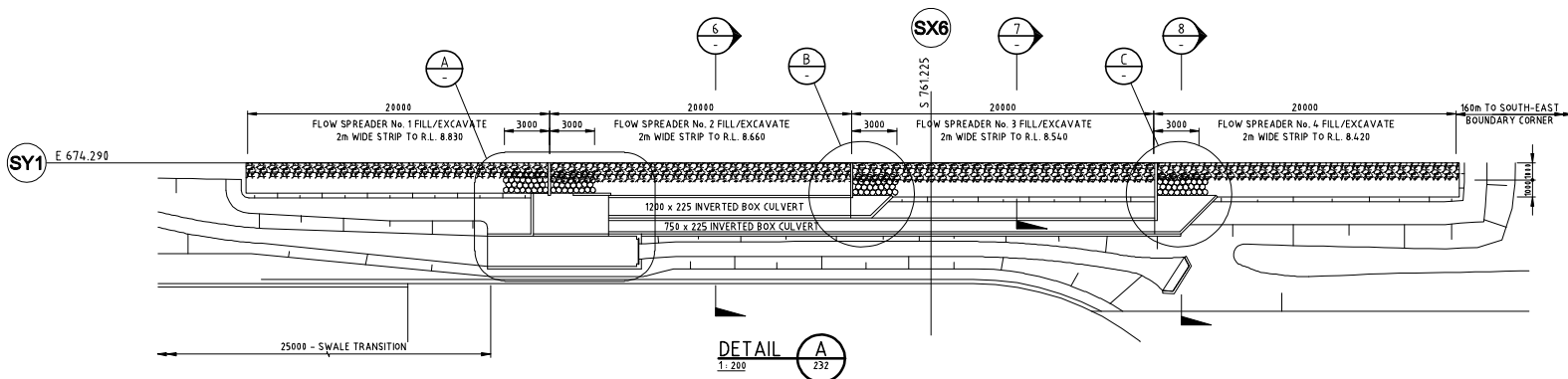
41 McLennan Street, North Sydney 2060
Tel: (02) 9522 2277 Fax: (02) 9557 4197

TITLE

DRAINAGE DETAILS
SHEET 6 OF 6

DATE	JULY 04	PROJECT No.	610309	STATUS	CV/CD
SCALE	AS SHOWN (B1)				
DRAWN	DAT				
CHECKED	BTX	DWG No.		REV No.	
APPROVED	JAH		CV 240	1	

FOR CONSTRUCTION



- 1.0 GENERAL NOTES
- A THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- B FOR OTHER NOTES REFER TO DRAWING No. CV-00
- 2.0 DIMENSIONS
- A VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- B DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
2	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT

Supply Chain Woolworths

540 George Street, Sydney NSW 2000
PO Box 470, QVB Post Office Sydney NSW 1220
Telephone (02) 9523 1555 Facsimile (02) 9323 1565

PROJECT MANAGER

Clifton Coney Group

Level 18, Clifton Coney, 2 Park Street, Sydney NSW 2000
Telephone (02) 9287 2100 Fax (02) 9287 2100

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street, Parramatta 2150
Tel. (02) 9691 6773 Fax (02) 9633 9477
www.eca.com.au

ARCHITECTS

BMIA ARCHITECTS
Level 4, 8 Help Street, Chalmers 2057
Tel. (02) 9465 6400 Fax (02) 9465 6444

PIPE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel. (02) 9557 5577 Fax (02) 9554 0877

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel. (02) 9469 8873 Fax (02) 9419 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Turramurra NSW 2074
Tel. (02) 9144 4711 Fax (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel. (02) 9320 9320 Fax (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel. (02) 9554 3733 Fax (02) 9554 3825

COST MANAGER

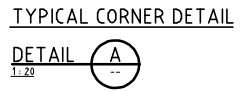
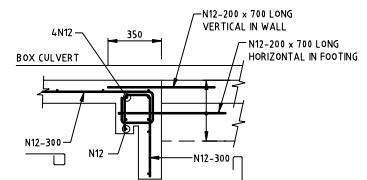
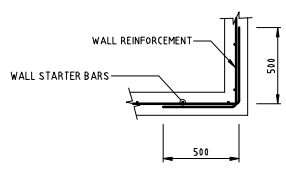
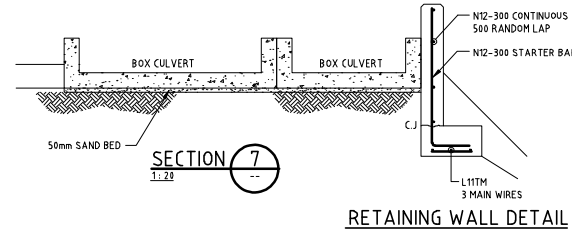
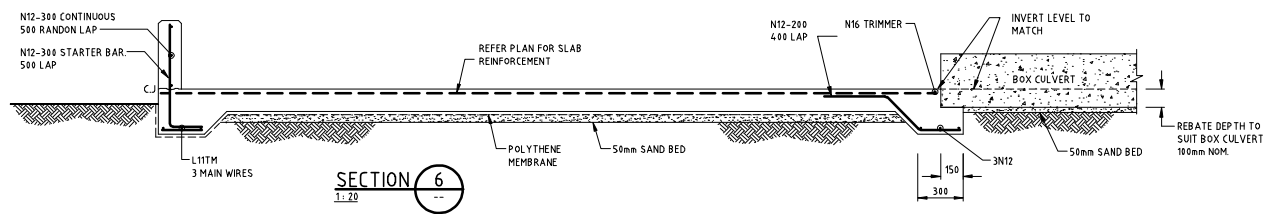
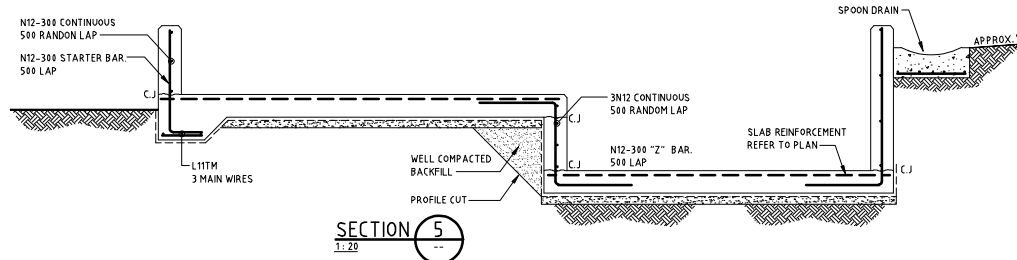
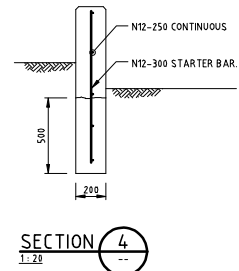
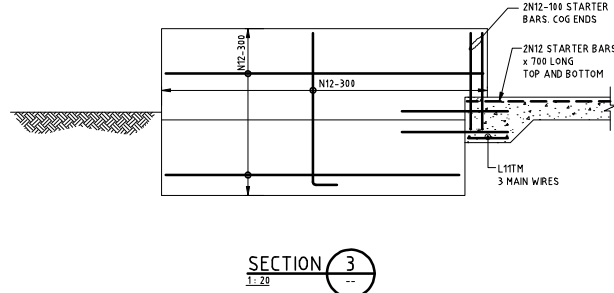
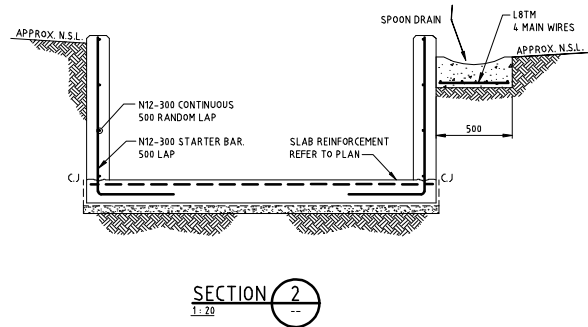
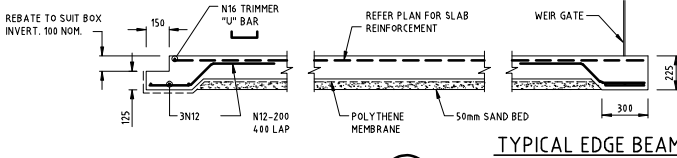
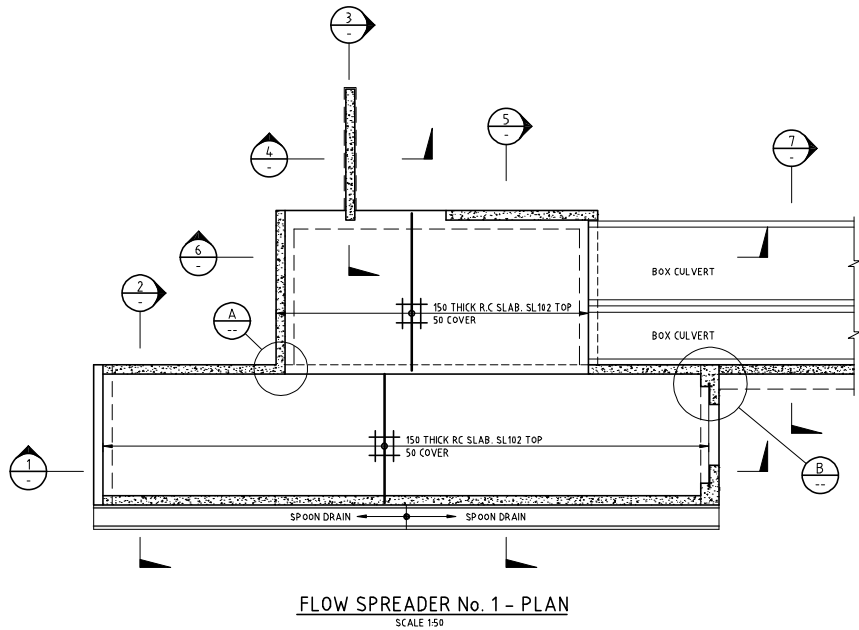
RIDER HUNT PTY LTD
41 McLennan Street, North Sydney 2060
Tel. (02) 9522 2277 Fax (02) 9557 4197

TITLE

EAST BOUNDARY FLOW SPLITTER LAYOUT

DATE	JULY 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	DAT				
CHECKED	BTM				
APPROVED	JAN				
DATE		REV.			
		CV 245	1		

FOR CONSTRUCTION



1.0 GENERAL NOTES

1. THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

2. FOR OTHER NOTES REFER TO DRAWING No. CV-00

2.0 DIMENSIONS

3. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

4. DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
2	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT

Supply Chain Woolworths

540 George Street, Sydney NSW 2000
PO Box 470, C/O B Post Office Sydney NSW 1220
Telephone (02) 9523 1555 Facsimile (02) 9523 1565

PROJECT MANAGER

Clifton Coney

Level 18, Clifton Coney, 2 Park Street, Sydney NSW 2000
Telephone (02) 9287 2100 Fax (02) 9287 2100

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd

CONSULTING ENGINEERS & PROJECT MANAGERS

Level 5, 20 Charles Street,
Parramatta 2150
Tel. (02) 9591 6773 Fax (02) 9433 9477
www.eca.com.au

ARCHITECTS

BMIA ARCHITECTS

Level 4, 8 Help Street, Chalmers 2057
Tel. (02) 9465 9400 Fax (02) 9465 9444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS

Level 12, 132 Arthur Street, North Sydney 2060
Tel. (02) 9567 5577 Fax (02) 9564 0877

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS

9/33 Ryde Road, Pymble 2073
Tel. (02) 9469 8873 Fax (02) 9419 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD

Suite 2, 1394 Pacific Highway, Turrum NSW 2074
Tel. (02) 9144 4711 Fax (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

ARUP

Level 10, 201 Kent Street, Sydney 2000
Tel. (02) 9320 9320 Fax (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD

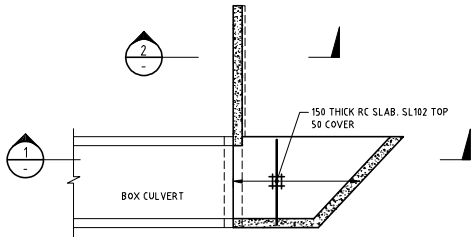
Level 1, 185 Blues Point Rd, McMahons Point, NSW 2060
Tel. (02) 9554 3733 Fax (02) 9554 3825

COST MANAGER

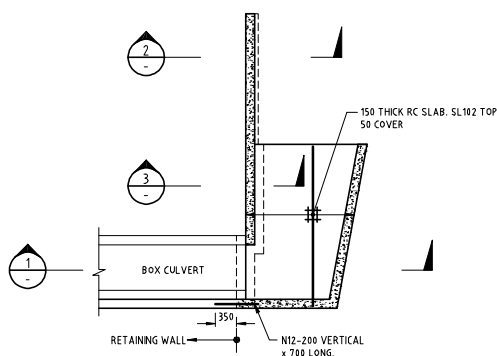
RIDER HUNT PTY LTD

41 McLaren Street, North Sydney 2060
Tel. (02) 9522 2277 Fax (02) 9557 4197

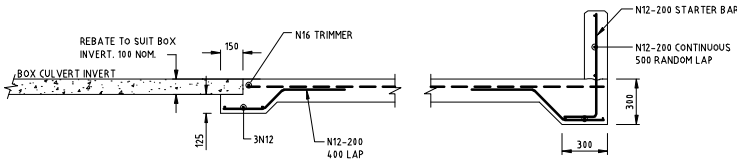
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				
TITLE	FLOW SPREADER No.1 REINFORCEMENT PLAN AND DETAILS				
DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CDD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX				
APPROVED	JAH				



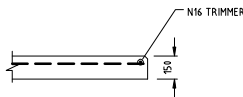
FLOW SPREADER No. 3 - PLAN
SCALE 1:50



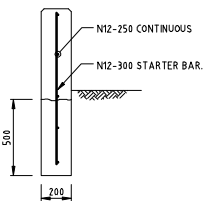
FLOW SPREADER No. 4 - PLAN
SCALE 1:50



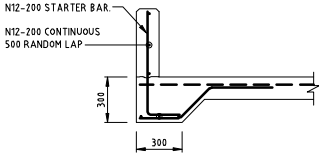
SECTION 1
1:20



TYPICAL EDGE WITHOUT REBATE
1:20



SECTION 2
1:20



SECTION 3
1:20

1.0 GENERAL NOTES

1.1 THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

1.2 FOR OTHER NOTES REFER TO DRAWING No. CV-101

2.0 DIMENSIONS

2.1 VERIFY ALL DIMENSIONS WITH ARCHITECTURAL SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

2.2 DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT

540 George Street, Sydney NSW 2000
PO Box 470, CVO Post Office Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1565

PROJECT MANAGER

Level 18, Clifton Coney, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9337 2100 Fax: (02) 9337 2108

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel: (02) 9691 6773 Fax: (02) 9633 9477
www.beca.com.au

ARCHITECTS

BMIA ARCHITECTS
Level 4, 8 Help Street, Chalmerswood 2087
Tel: (02) 9469 6400 Fax: (02) 9469 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9667 6677 Fax: (02) 9664 0677

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel: (02) 9469 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1364 Pacific Highway, Turrum NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

AIRUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

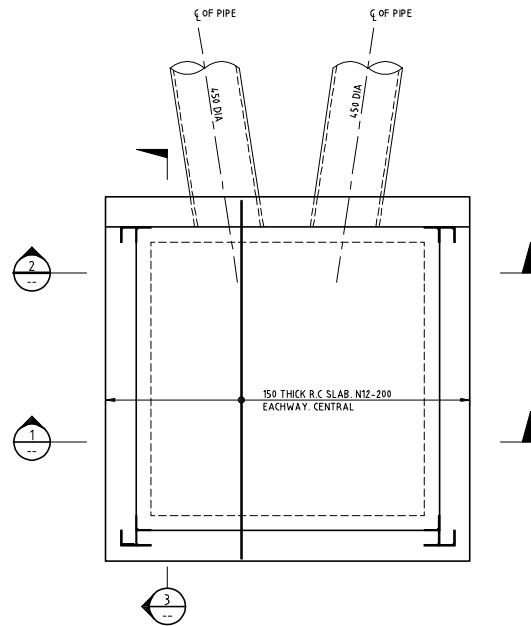
TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9664 3733 Fax: (02) 9664 3825

COST MANAGER

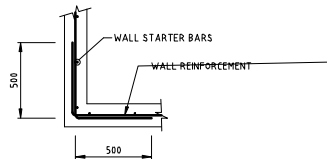
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9822 2277 Fax: (02) 9857 4187

DATE	JUL 04	PROJECT No.	STATUS
SCALE	AS SHOWN	610309	CV/CD
DRAWN	SC		
CHECKED	BTX	DWG No.	REV No.
APPROVED	JAH	CV 247	1

FOR CONSTRUCTION

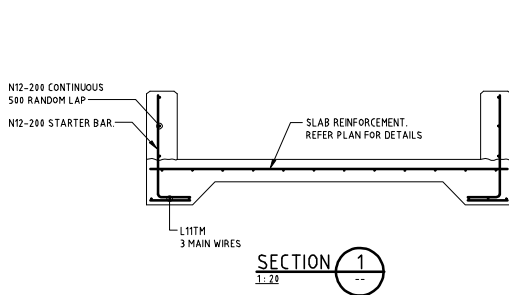


P122 REINFORCEMENT PLAN
WETLANDS SOUTH-EAST CORNER OUTLET PIT
1:20

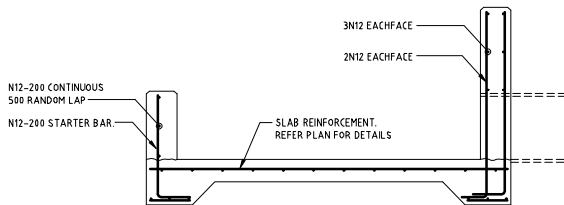


TYPICAL CORNER DETAIL

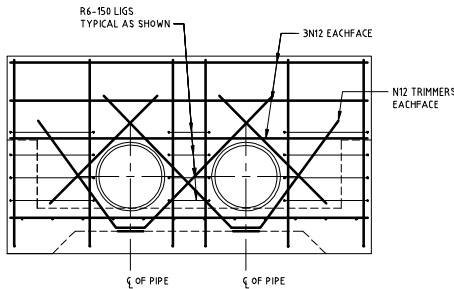
DETAIL A
1:20



SECTION 1
1:20



SECTION 3
1:20



SECTION 2
1:20

1.0 GENERAL NOTES

1. THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

2. FOR OTHER NOTES REFER TO DRAWING No. CV-100

2.0 DIMENSIONS

3. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

4. DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT

Supply Chain Woolworths

540 George Street, Sydney NSW 2000
PO Box 470, CVO Post Office Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1565

PROJECT MANAGER

Clifton Coney

Level 18, Clifton Coney, 2 Park Street, Sydney NSW 2000
Telephone (02) 9337 2100 Fax (02) 9337 2108

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel: (02) 9691 6773 Fax: (02) 9633 9477
www.eca.com.au

ARCHITECTS

BMIA ARCHITECTS
Level 4, 8 Help Street, Chalmers 2057
Tel: (02) 9465 6400 Fax: (02) 9465 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9667 5577 Fax: (02) 9664 0577

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel: (02) 9469 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1364 Pacific Highway, Turramurra NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

AIRUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD
Level 1, 185 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9664 3733 Fax: (02) 9664 3825

COST MANAGER

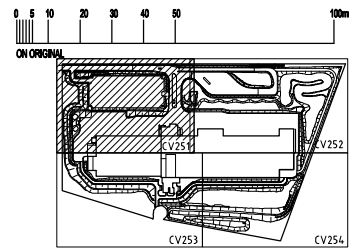
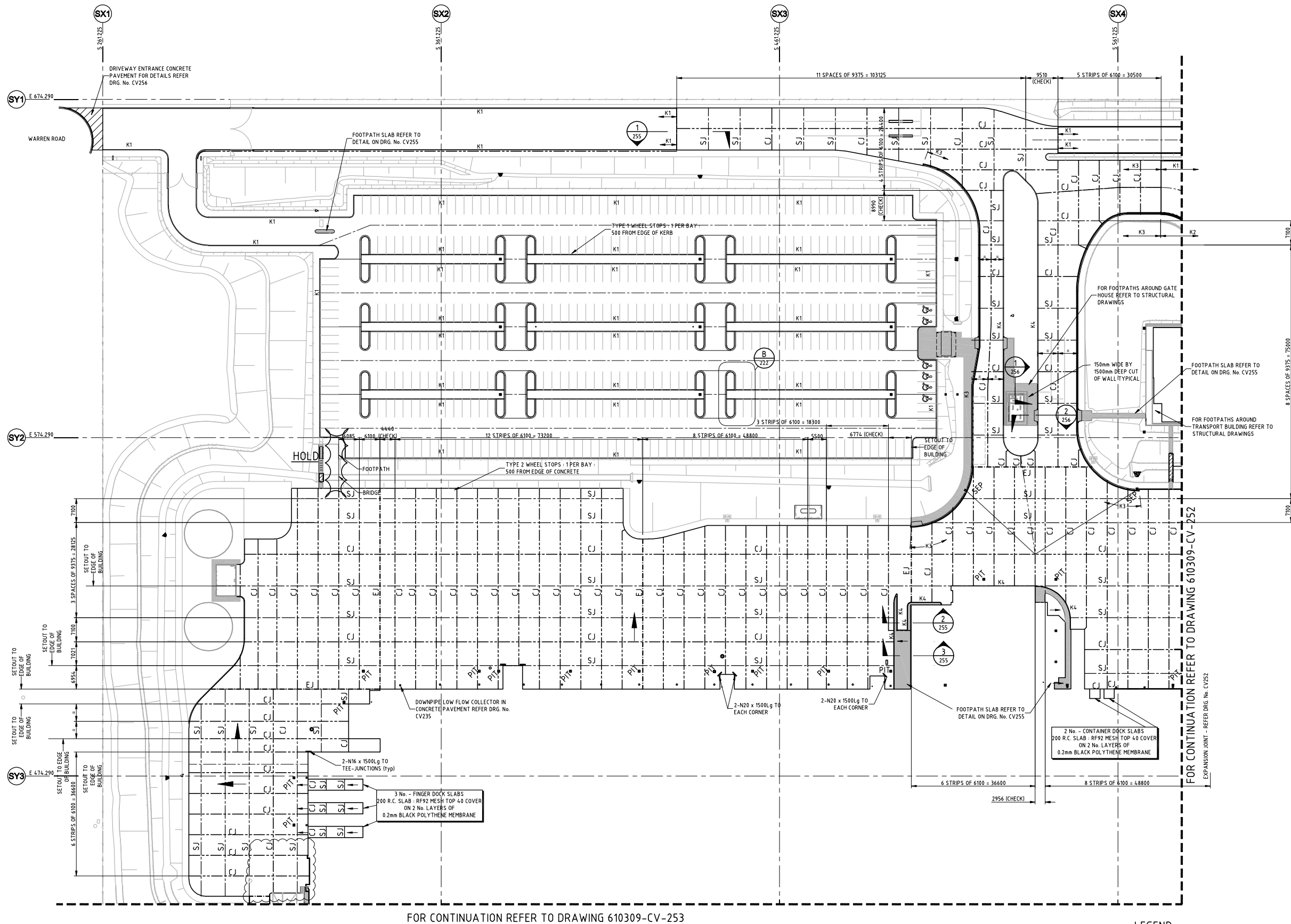
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9622 2277 Fax: (02) 9657 4187

TITLE

REINFORCEMENT DETAILS
FOR PIT P122 AND P309

DATE	JUL 04	PROJECT No.	610309	STATUS	CV/CD
SCALE	AS SHOWN	(B1)			
DRAWN	SC				
CHECKED	BTX	DWG No.		REV No.	
APPROVED	JAH		CV 249	1	

FOR CONSTRUCTION



KEY PLAN

- 1.0 GENERAL NOTES
- 1.1 THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- 1.2 FOR OTHER NOTES REFER TO DRAWING No. CV-50
- 2.0 DIMENSIONS
- 2.1 VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- 2.2 DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
4	26.09.05	PAVEMENT REVISED	DAT
3	22.07.05	CAR PARK AND FOOTPATH AMENDED	AGF
2	20.07.05	WARREN ROAD ENTRY DETAIL ADDED	AGF
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	P.A.S
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT

Supply Chain Woolworths

540 George Street, Sydney NSW 2000
PO Box 470, Chiswick Post Office, Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1595

PROJECT MANAGER

Clifton Coney Group

Level 15, Clifton Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9287 2100 Fax: (02) 9287 2188

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel: (02) 9591 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS

BIMA ARCHITECTS
Level 4, 8 Help Street, Chiswick 2057
Tel: (02) 9495 6400 Fax: (02) 9495 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9557 5577 Fax: (02) 9554 0677

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS
933 Ryde Road, Pymble 2073
Tel: (02) 9499 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

WYHER DONNELLY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Tuncurry NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD
Level 1, 106 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9554 3733 Fax: (02) 9554 3825

COST MANAGER

RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9622 2277 Fax: (02) 9657 4197

TITLE

**EXTERNAL PAVEMENT
DETAIL PLAN
SHEET 1 OF 4**

DATE	FEB 04	PROJECT No.	610309
SCALE	1:500 (B1)	CV/CN	
DRAWN	DAT	DRG No.	
CHECKED	STK	REV No.	
APPROVED	JHW	CV 251	4

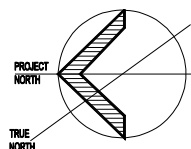
LEGEND

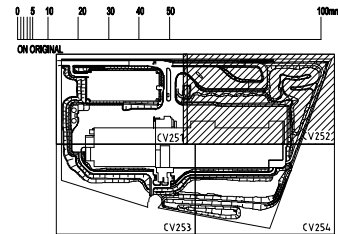
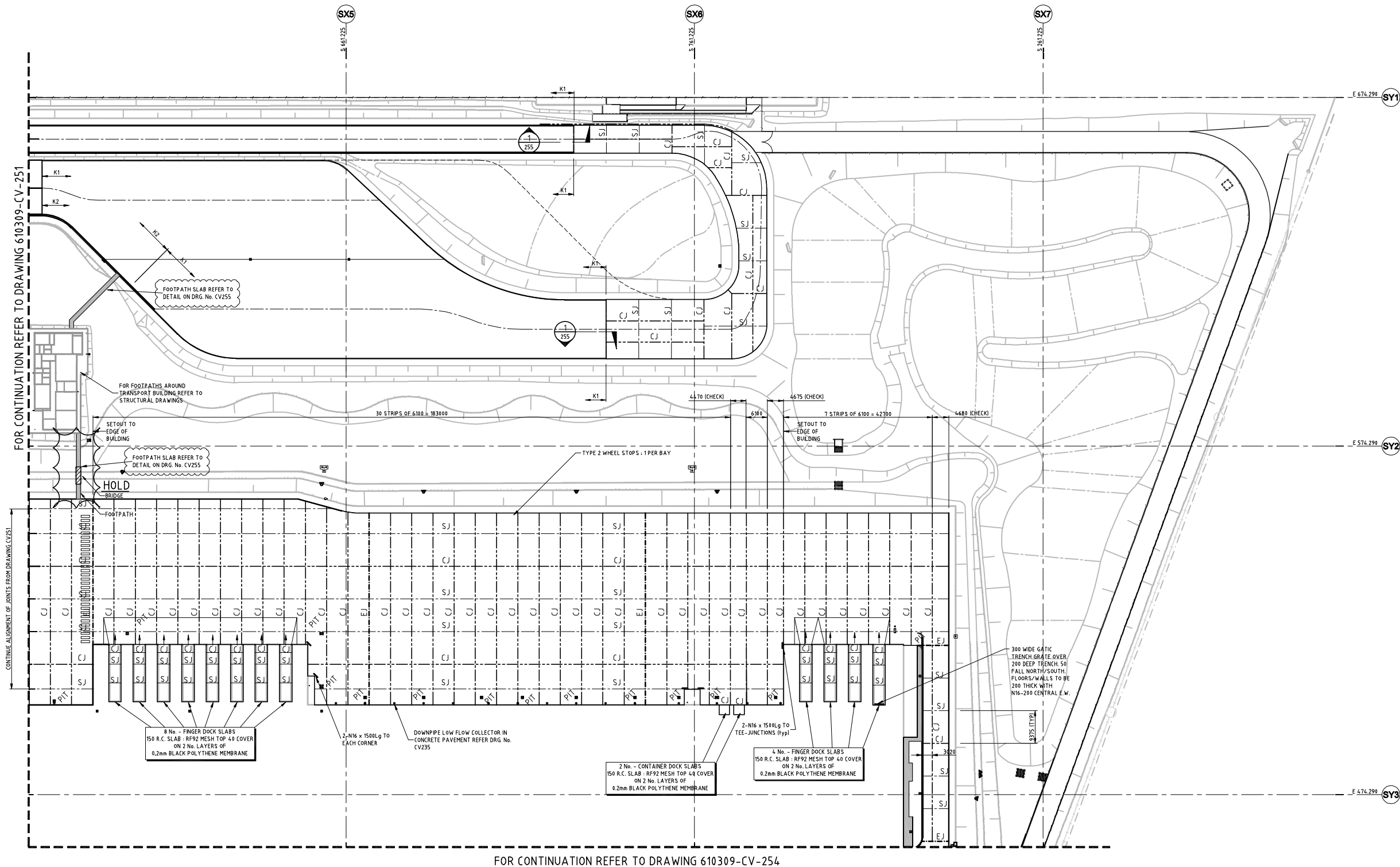
↗ DENOTES DIRECTION OF FALL

NOTE:

1. NOT ALL PITS WITHIN THE CONCRETE PAVEMENT ARE NECESSARILY SHOWN. REFER TO EACH DISCIPLINE DRAWINGS FOR PIT LOCATIONS.

FOR CONSTRUCTION





KEY PLAN

1.0 GENERAL NOTES

A THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

B FOR OTHER NOTES REFER TO DRAWING No. CV-100

2.0 DIMENSIONS

A VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

B DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SIGNED
3	22.07.05	FOOTPATH AMENDED	AUF
2	05.11.04	TRENCH NOTE ADDED	DAT
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT
Supply Chain Woolworths
540 George Street, Sydney NSW 2000
PO Box 470, CVO Post Office Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1565

PROJECT MANAGER
Clifton Coney Group
Level 18, Clifton Coney, 2 Park Street, Sydney NSW 2000
Telephone (02) 9337 2100 Fax (02) 9337 2100

PROJECT
WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVILLE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS
Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel. (02) 9691 6773 Fax: (02) 9633 9477
www.eca.com.au

ARCHITECTS
BMIA ARCHITECTS
Level 4, 8 Help Street, Chalmerswood 2087
Tel: (02) 9465 9400 Fax: (02) 9465 9444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9657 5577 Fax: (02) 9654 0877

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel: (02) 9469 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS
NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1384 Pacific Highway, Turrum NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS
AIRUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9654 3733 Fax: (02) 9654 3825

COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9022 2277 Fax: (02) 9657 4197

TITLE			
EXTERNAL PAVEMENT DETAIL PLAN SHEET 2 OF 4			
DATE	PROJECT	PROJECT No.	STATUS
FEB 04	(B1)	610309	CV/CN
SCALE	1:500		
DRAWN	DAT		
CHECKED	BTX	DWG No.	REV No.
APPROVED	JAH	CV 252	3

LEGEND

↗ DENOTES DIRECTION OF FALL

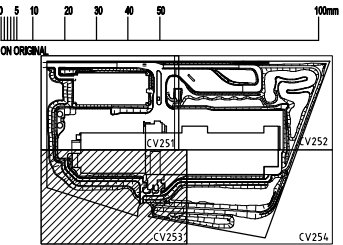
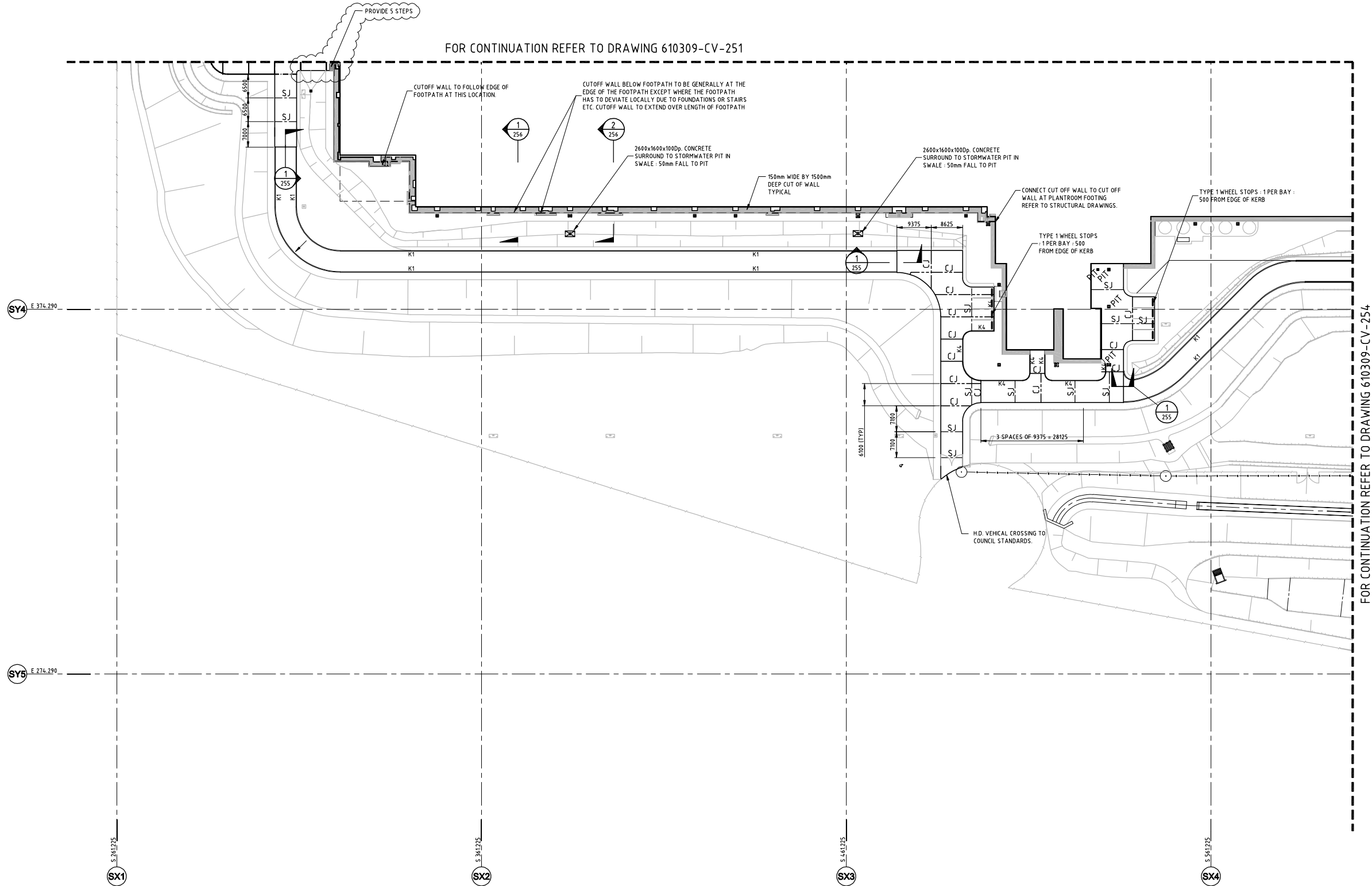
NOTE:

1. NOT ALL PITS WITHIN THE CONCRETE PAVEMENT ARE NECESSARILY SHOWN. REFER TO EACH DISCIPLINE DRAWINGS FOR PIT LOCATIONS.

CONCRETE NOTES

FOR CONCRETE NOTES REFER TO DRG. No. CV-251

FOR CONSTRUCTION



KEY PLAN

1.0 GENERAL NOTES

A) THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

B) FOR OTHER NOTES REFER TO DRAWING No. CV-50

2.0 DIMENSIONS

A) VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

B) DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

REV.	DATE	AMENDMENT	SKIPPED
4	29.09.05	PAVEMENT REV. NOTE ADDED	DAT
3	15.11.04	ROAD PAVEMENT REVISED	DAT
2	08.10.04	ROAD ALIGNMENT REV FOR BANANA ROOM EXT.	DAT
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT

CLIENT



540 George Street, Sydney NSW 2000
PO Box 070, QVB Post Office, Sydney NSW 1220
Telephone (02) 9323 1555 Facsimile (02) 9323 1555

PROJECT MANAGER



Level 18, CliftonConey Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 8387 2100 Fax: (02) 8387 2108

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS



Beca Pty Ltd

CONSULTING ENGINEERS & PROJECT MANAGERS

Level 5, 20 Charles Street,

Parramatta 2150

Tel. (02) 9891 6773 Fax (02) 9633 9477

www.becca.com.au

ARCHITECTS

MINA ARCHITECTS

Level 4, 8 Hilly Street, Chalmerswood 2087

Tel (02) 9495 6400 Fax: (02) 9495 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS

Level 12, 132 Arthur Street, North Sydney 2060

Tel (02) 9557 5577 Fax: (02) 9554 0577

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS

933 Ryde Road, Pymble 2073

Tel (02) 9498 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

WYVER DOWNELLY & PARTNERS PTY LTD

Suite 2, 1394 Pacific Highway, Tuncurry NSW 2074

Tel (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

ARUP

Level 10, 201 Kent Street, Sydney 2000

Tel (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD

Level 1, 188 Blues Point Rd, McMahons Point, NSW 2060

Tel (02) 9554 3733 Fax: (02) 9554 3825

COST MANAGER

RIDER HUNT PTY LTD

41 McLaren Street, North Sydney 2060

Tel (02) 9822 2277 Fax: (02) 9557 4197

TITLE

**EXTERNAL PAVEMENT
DETAIL PLAN
SHEET 3 OF 4**

DATE	FEB '04	PROJECT No.	STATUS
SCALE	1:500 (B1)	610309 CV/CN	
DRAWN	DAT	DRG No.	REV No.
CHECKED	8TK		
APPROVED	JHW	CV 253 4	

LEGEND

✓ DENOTES DIRECTION OF FALL

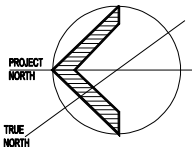
NOTE:

1. NOT ALL PITS WITHIN THE CONCRETE PAVEMENT ARE NECESSARILY SHOWN. REFER TO EACH DISCIPLINES DRAWINGS FOR PIT LOCATIONS.

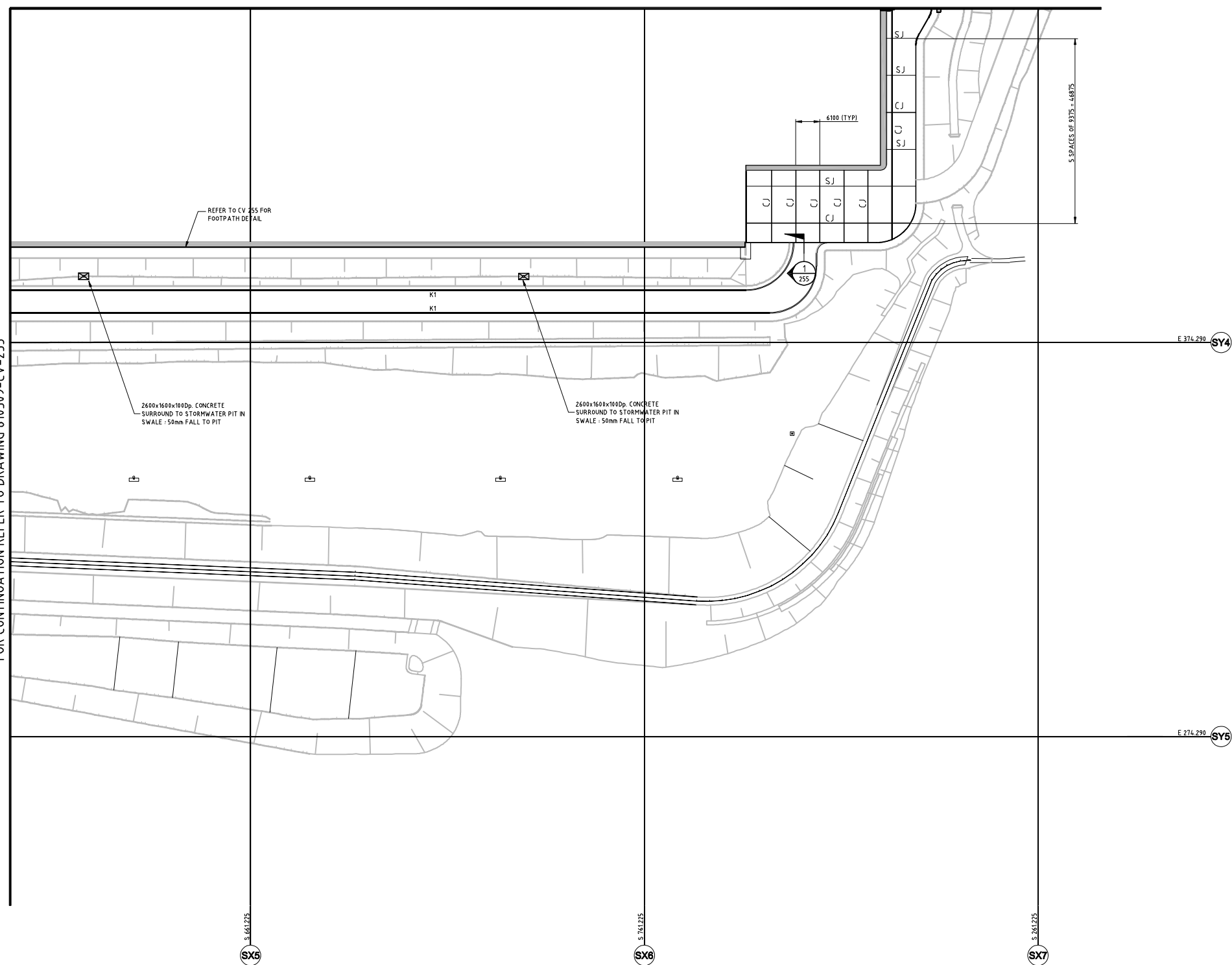
CONCRETE NOTES

FOR CONCRETE NOTES REFER TO DRG. No. CV-251

FOR CONSTRUCTION



FOR CONTINUATION REFER TO DRAWING 610309-CV-253



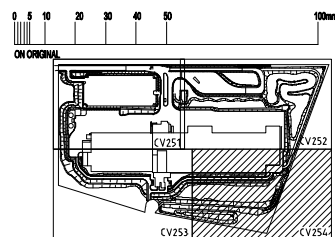
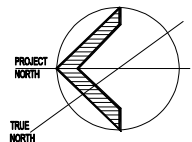
 DENOTES DIRECTION OF FALL

NOTE:

1. NOT ALL PITS WITHIN THE CONCRETE PAVEMENT ARE NECESSARILY SHOWN. REFER TO EACH DISCIPLINE'S DRAWINGS FOR PIT LOCATIONS.

FOR CONCRETE NOTES REFER TO DRG. No. CV-251

FOR CONSTRUCTION



KEY PLAN

1.0 GENERAL NOTES

1.0 GENERAL NOTES

a) THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

N) FOR OTHER NOTES REFER TO DRAWING No. CV-100

2.0 DIMENSIONS

2.0 DIMENSIONS
a) VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.

WE DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS

1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT
REV.	DATE	AMENDMENT	SIGNED

CLIENT



540 George Street, Sydney NSW 2000
PO Box Q70, QVB Post Office Sydney NSW 1230
Telephone (02) 8323 1555 Facsimile (02) 8323 1595

PROJECT MANAGER



Level 18, Citigroup Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9287 2100 Fax: (02) 9287 2188

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS



Beca Pty Ltd

Level 5, 20 Charles Street,
Parramatta 2150
Tel. (02) 9891 6773 Fax. (02) 9633 9477
www.beca.com.au

ARCHITECTS

MINIA ARCHITECTS
Level 4, 8 Help Street, Chatswood 2067
Tel: (02) 9495 6400 Fax: (02) 9495 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 8957 5577 Fax: (02) 8954 0677

ELECTRICAL ENGINEER:

WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel (02) 9499 8973 Fax (02) 9418 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Turrum NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS

FIRE ENGINEERED SOLUTION CONSULTANTS
ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahon's Point, NSW 2060
Tel: (02) 9954 3733 Fax: (02) 9954 3825

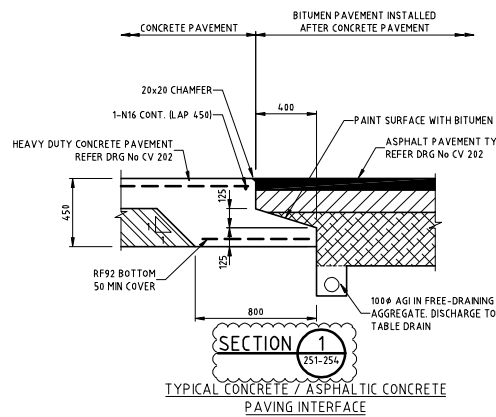
COST MANAGER

RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9922 2277 Fax: (02) 9957 4197

TITLE

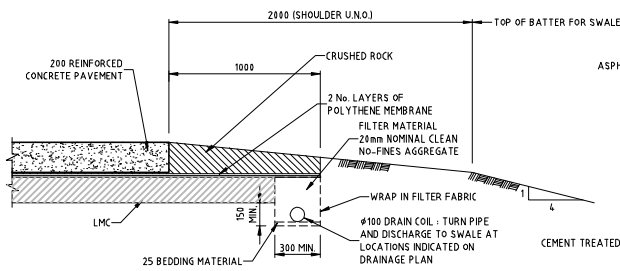
EXTERNAL PAVEMENT
DETAIL PLAN
SHEET 4 OF 4

DATE	FEB 04	PROJECT No.	610309	STATUS	CV/CN
SCALE	1:500 (BT)				
DRAWN	DAT				
CHECKED	BTk	DWG No.	CV 254	REV No.	1
APPROVED	JHW				

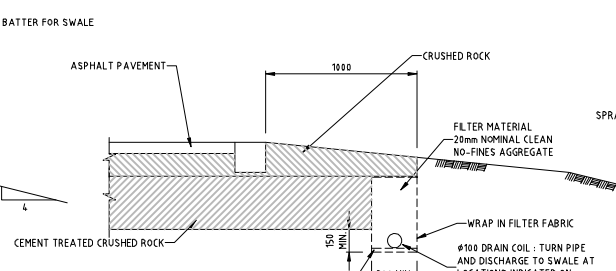


TYPICAL TRUCK WHEEL STOP DETAIL

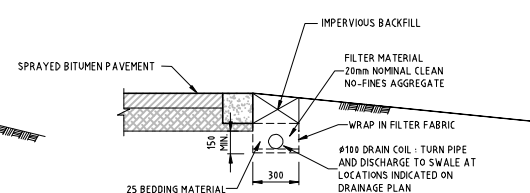
WHEEL STOPS 2.0m LONG U.N.O.



CONCRETE PAVEMENT EDGE DETAIL

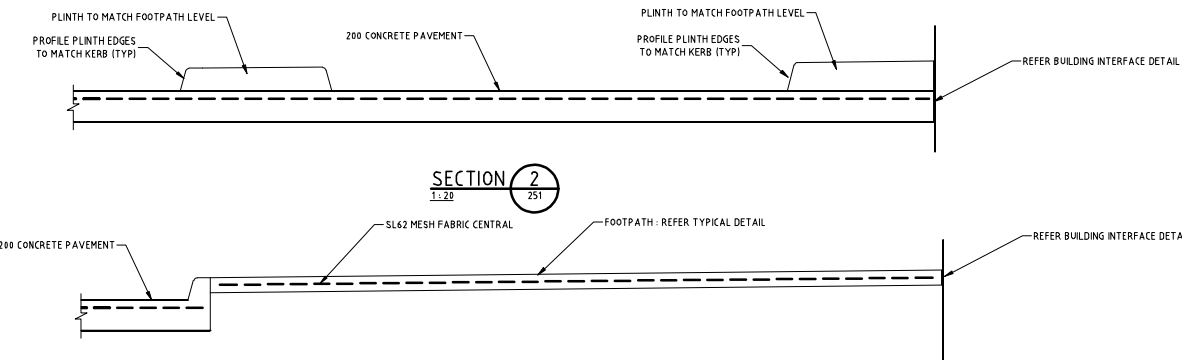


ASPHALT PAVEMENT TYPE 1

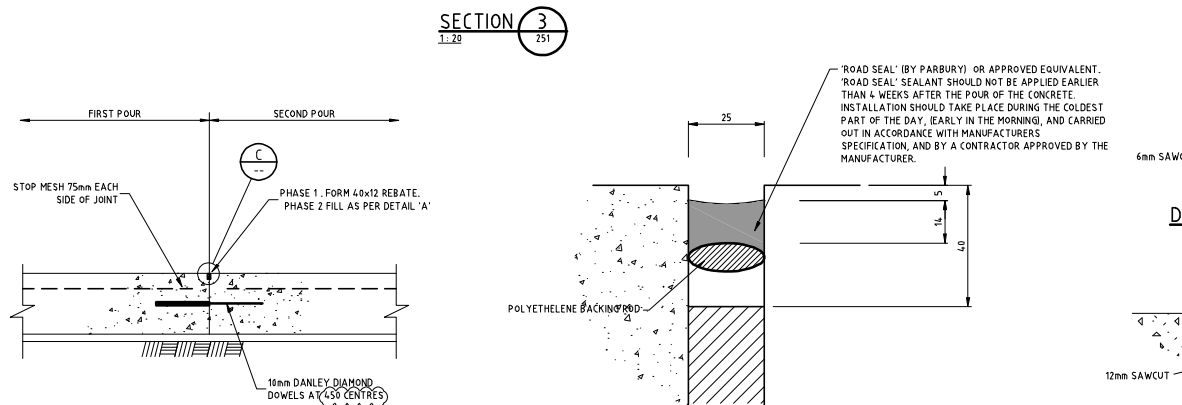


SPRAYED BITUMEN AND CHIP SEAL TYPICAL EDGE DETAIL

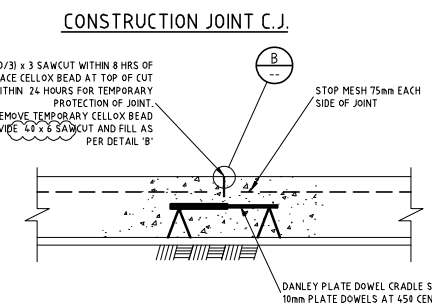
1.0 GENERAL NOTES
2.0 DIMENSIONS
3. REFER BELOW FOR MORE AMENDMENTS



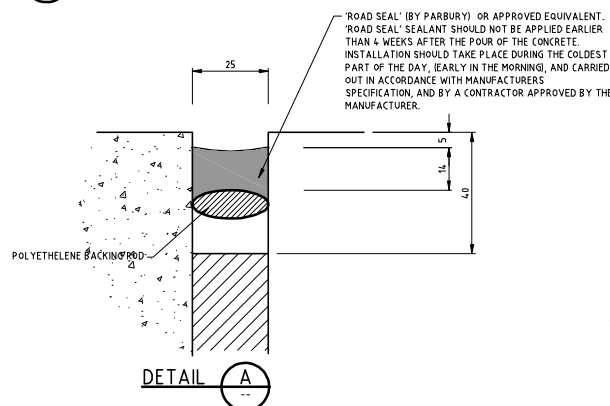
SECTION 2



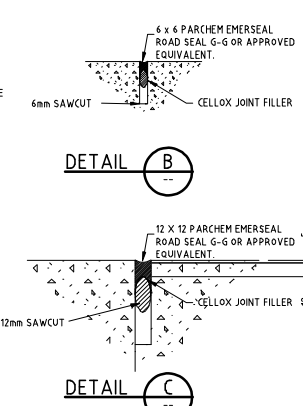
SECTION 3



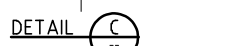
CONSTRUCTION JOINT C.J.



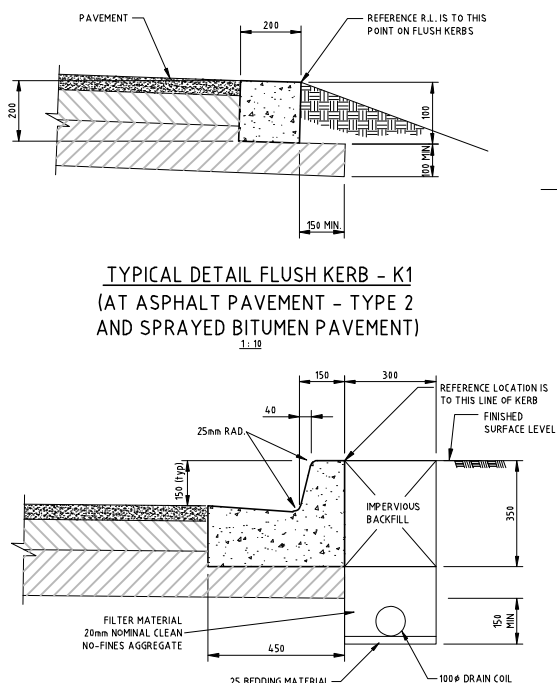
DETAIL A



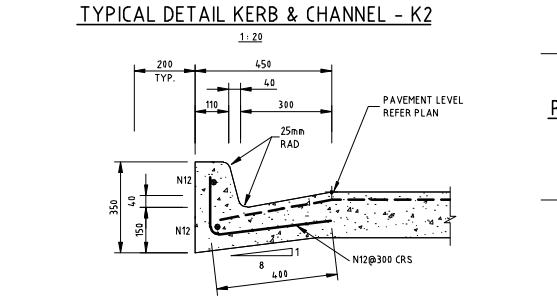
DETAIL B



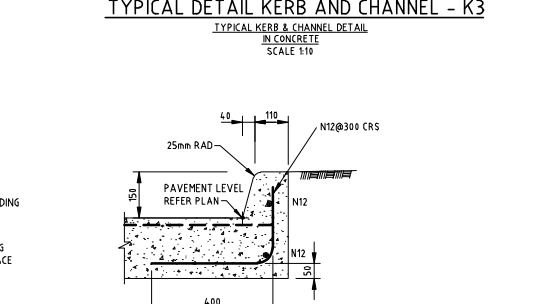
DETAIL C



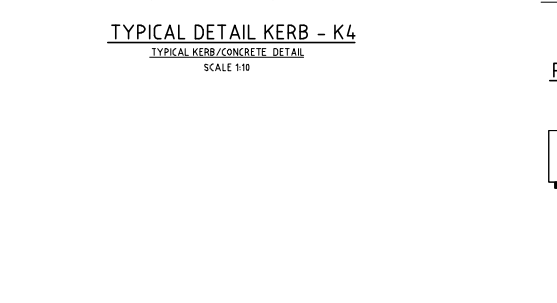
TYPICAL DETAIL FLUSH KERB - K1
(AT ASPHALT PAVEMENT - TYPE 2
AND SPRAYED BITUMEN PAVEMENT)



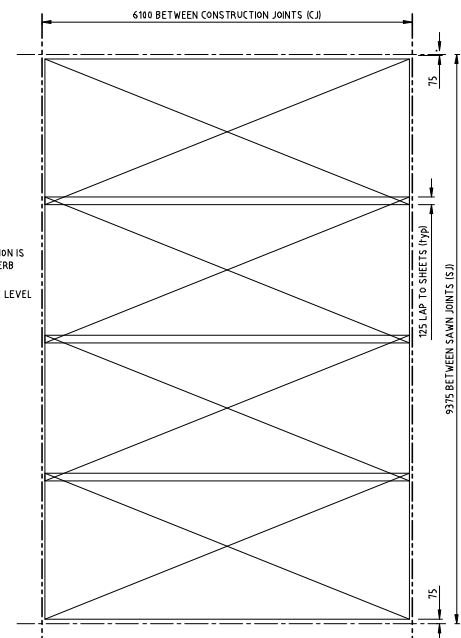
TYPICAL DETAIL KERB & CHANNEL - K2



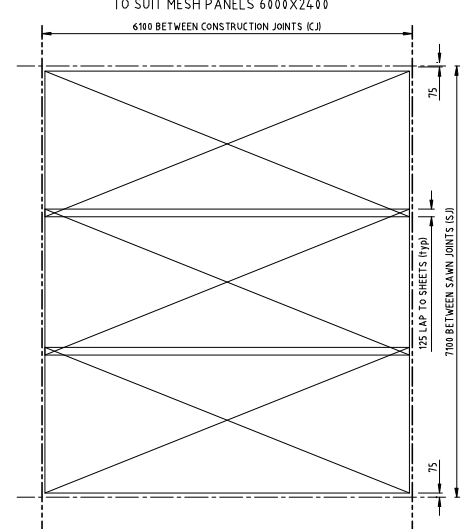
TYPICAL DETAIL KERB AND CHANNEL - K3



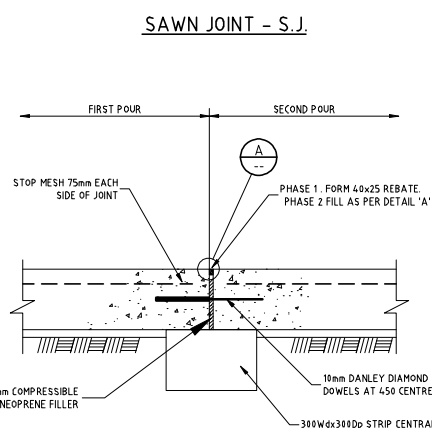
TYPICAL DETAIL KERB - K4



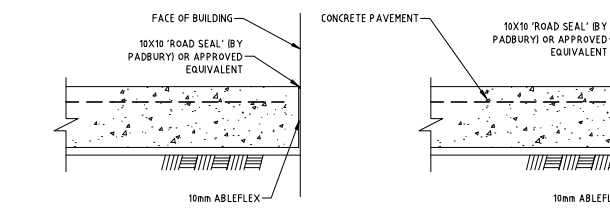
REINFORCEMENT MESH LAYOUT 9375 PANEL



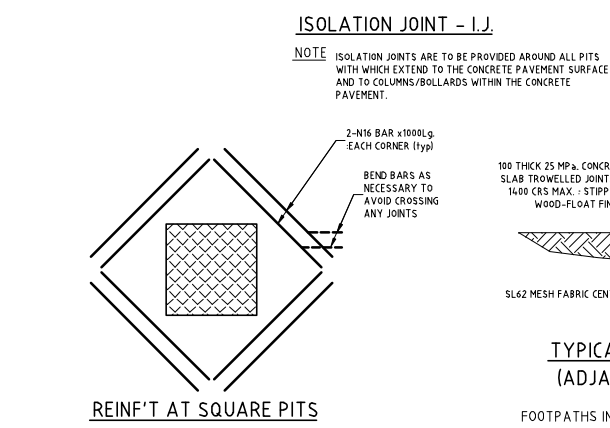
REINFORCEMENT MESH LAYOUT 7100 PANEL



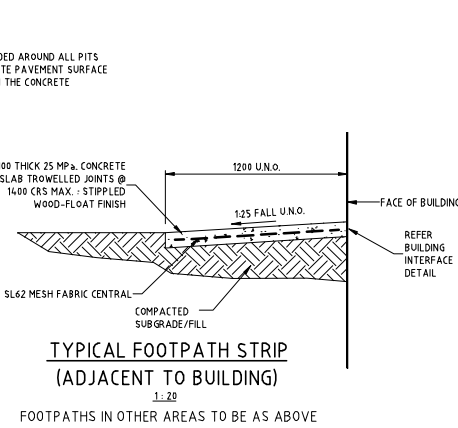
SAWN JOINT - S.J.



ISOLATION JOINT - I.J.



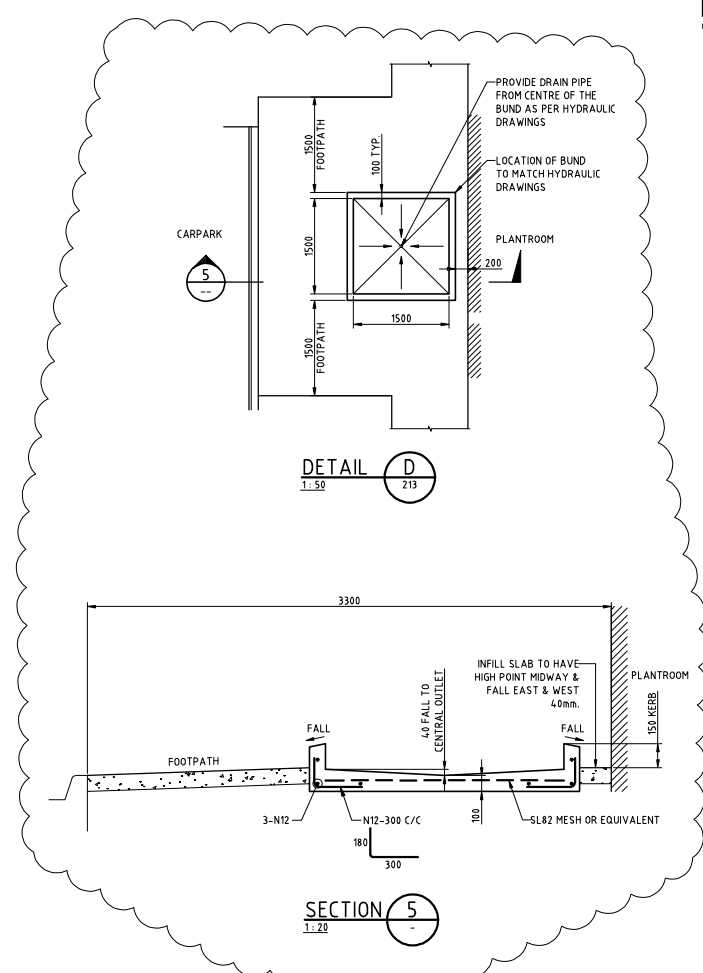
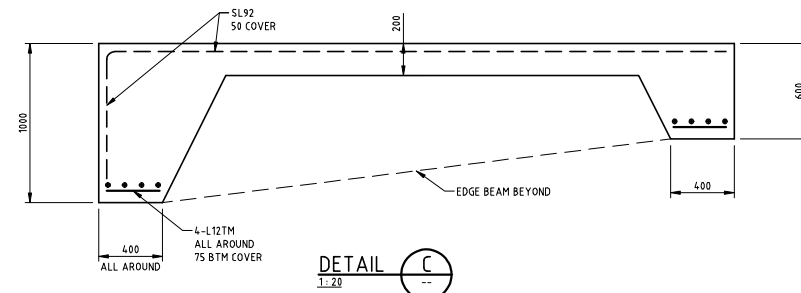
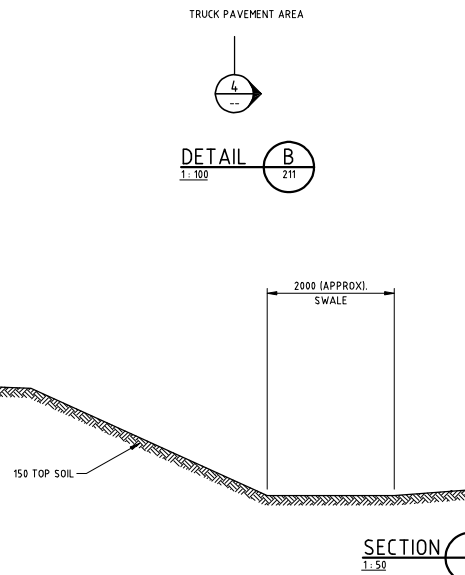
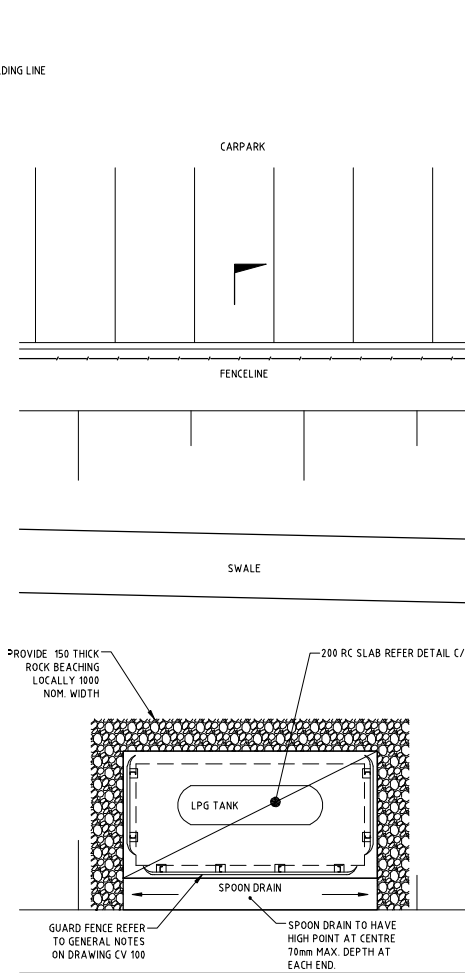
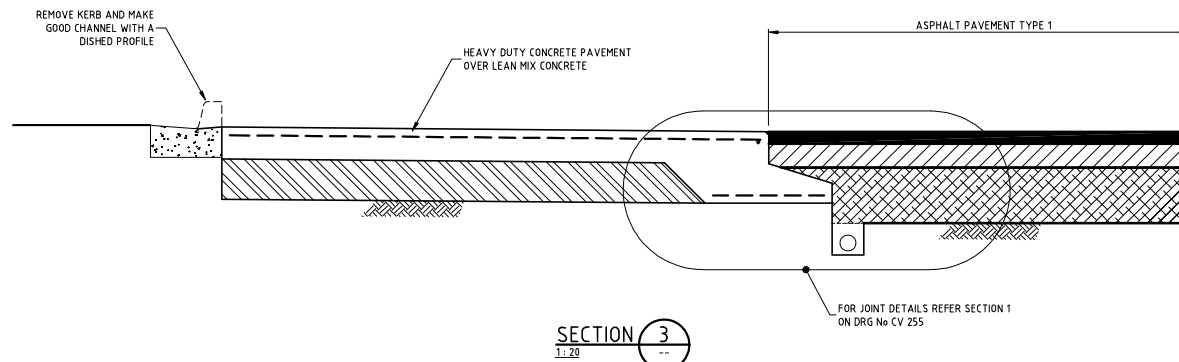
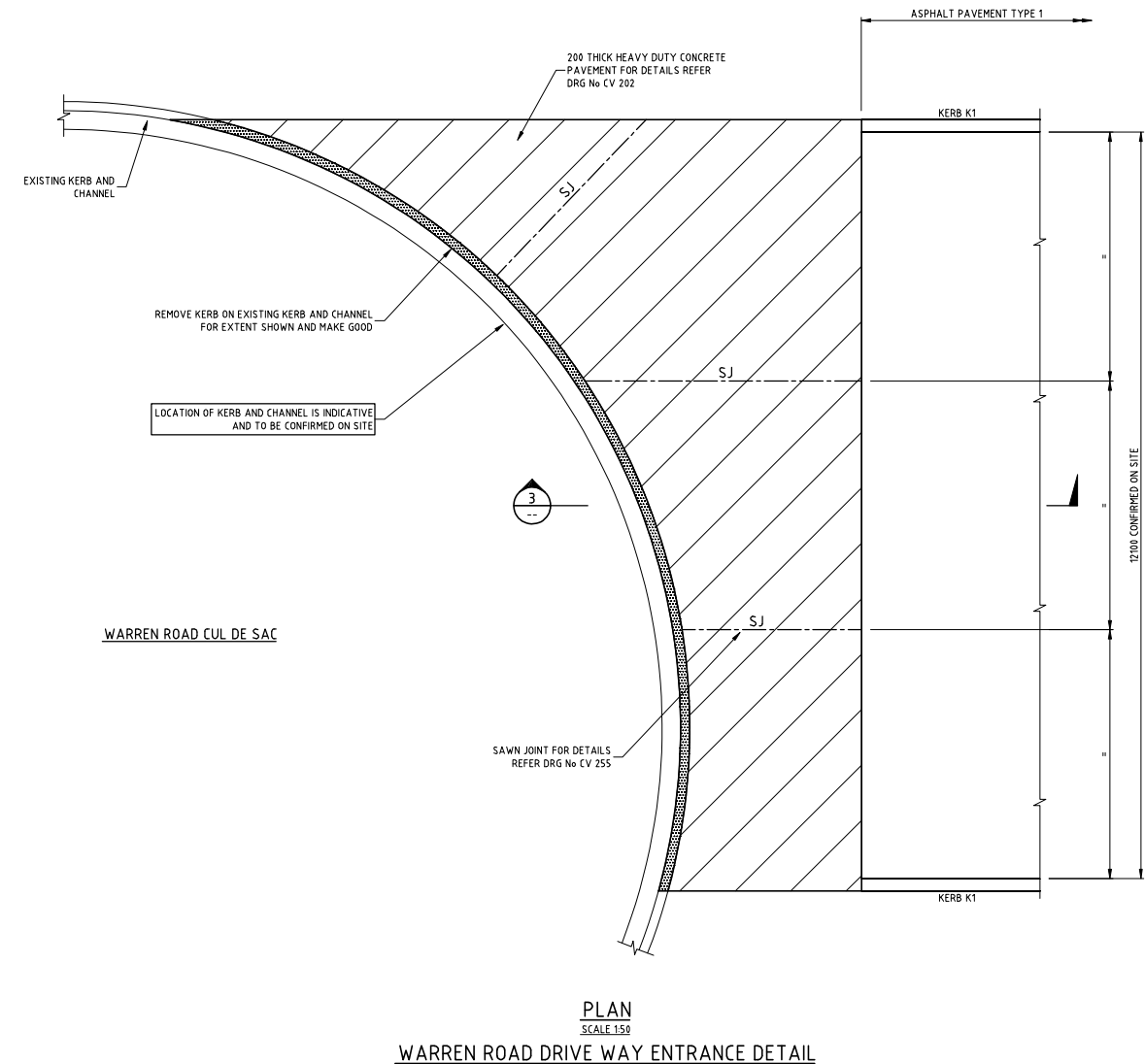
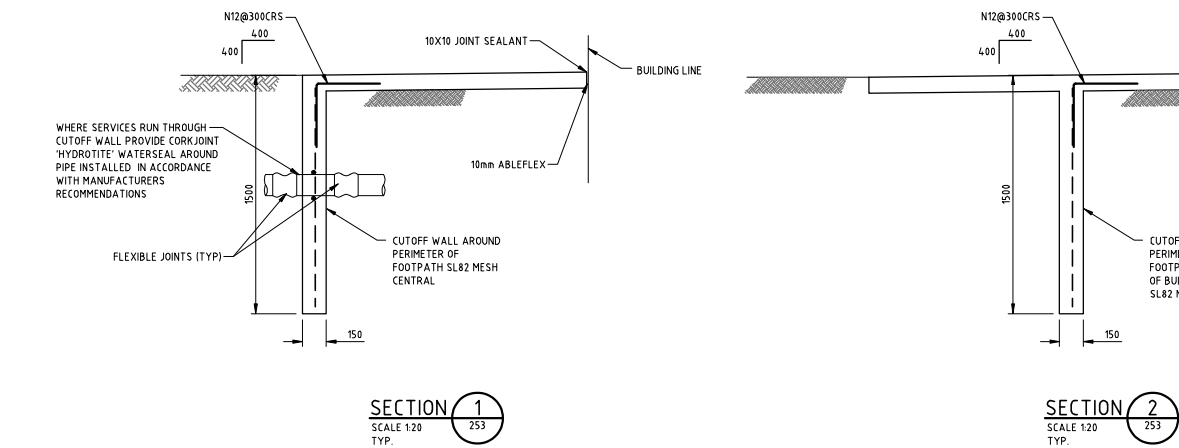
EXPANSION JOINT E.J.



TYPICAL FOOTPATH STRIP
(ADJACENT TO BUILDING)

FOOTPATHS IN OTHER AREAS TO BE AS ABOVE EXCEPT THEY ARE TO BE CONSTRUCTED ON 75mm COMPACTED 20mm CLASS 3 CRUSHED ROCK.

FOR CONSTRUCTION



- 1.0 GENERAL NOTES**
- a) THE CIVIL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND WITH ARCHITECTURAL, SERVICES, STRUCTURAL AND OTHER PROJECT DRAWINGS. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- b) FOR OTHER NOTES REFER TO DRAWING No. CV-100
- 2.0 DIMENSIONS**
- a) VERIFY ALL DIMENSIONS WITH ARCHITECTURAL, SERVICES, CIVIL AND ALL OTHER PROJECT DRAWINGS PRIOR TO CONSTRUCTION COMMENCING. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION.
- b) DO NOT SCALE THE DRAWINGS.

REFER BELOW FOR MORE AMENDMENTS			
4	28.09.05	COALESCING PLATE PLAN & SECTION ADDED	PAS
3	20.09.05	LPG SLAB DETAIL ADDED	PAS
2	20.07.05	WARREN ROAD ENTRY DETAIL ADDED	AGF
1	20.09.04	RE-ISSUED FOR CONSTRUCTION	PAS
0	09.09.04	ISSUED FOR CONSTRUCTION	DAT
REV.	DATE	AMENDMENT	SIGNED

CLIENT

Supply Chain Woolworths

540 George Street, Sydney NSW 2000
PO Box 470, QVB Post Office Sydney NSW 1230
Telephone (02) 9323 1555 Facsimile (02) 9323 1595

PROJECT MANAGER

CliftonConey Group

Level 10, CliftonConey Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 9287 2100 Fax: (02) 9287 2108

PROJECT

WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS

Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel: (02) 9651 6773 Fax: (02) 9633 9477
www.becca.com.au

ARCHITECTS

MINA ARCHITECTS
Level 4, 8 Hely Street, Chiswick 2057
Tel: (02) 9495 6400 Fax: (02) 9495 6444

FIRE SERVICES & MECHANICAL ENGINEERS

BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9657 5577 Fax: (02) 9654 0677

ELECTRICAL ENGINEERS

WOOD & GRIEVE ENGINEERS
933 Ryde Road, Pymble 2073
Tel: (02) 9499 8873 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS

NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1384 Pacific Highway, Tuncurry NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEER SOLUTION CONSULTANTS

ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel: (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT

TRACT CONSULTANTS PTY LTD
Level 1, 106 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9954 3733 Fax: (02) 9954 3825

COST MANAGER

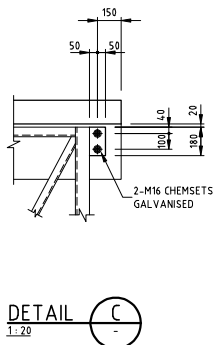
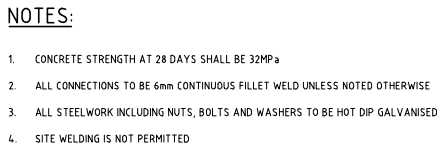
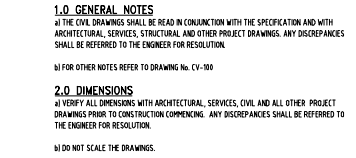
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9622 2277 Fax: (02) 9657 4197

TITLE

EXTERNAL PAVEMENT
DETAILS SHEET 2 OF 2

DATE	JUNE 14	PROJECT No.	610309	STATUS	CV/CN
SCALE	AS NOTED (B1)				
DRAWN	DAT	DWG No.		REV No.	
CHECKED	BTX				
APPROVED	JAW				

FOR CONSTRUCTION



Supply Chain
Woolworths

540 George Street, Sydney NSW 2000
PO Box Q70, QWB Post Office Sydney NSW 1230
Telephone (02) 9323 1555 Facsimile (02) 9323 1595

PROJECT MANAGER


Clifton Coney
Group

Level 18, Citigroup Centre, 2 Park Street, Sydney NSW 2000
Telephone: (02) 8287 2100 Fax: (02) 8287 2188

PROJECT
WOOLWORTHS WYONG RDC
1 WOOLWORTHS WAY
WARNERVALE NSW 2259

STRUCTURAL, CIVIL & REFRIGERATION ENGINEERS



Beca Pty Ltd
CONSULTING ENGINEERS & PROJECT MANAGERS
Level 5, 20 Charles Street,
Parramatta 2150
Tel. (02) 9891 6773 Fax. (02) 9633 9477
www.becca.com.au

MINIA ARCHITECTS
Level 4, 8 Help Street, Chatswood 2067
Tel (02) 9495 6400 Fax: (02) 9495 6444

FIRE SERVICES & MECHANICAL ENGINEERS
BASSETT CONSULTING ENGINEERS
Level 12, 132 Arthur Street, North Sydney 2060
Tel: (02) 9957 5577 Fax: (02) 9954 0677

ELECTRICAL ENGINEERS
WOOD & GRIEVE ENGINEERS
9/33 Ryde Road, Pymble 2073
Tel: (02) 9499 8973 Fax: (02) 9418 4053

HYDRAULIC ENGINEERS
NIVEN DONNELLY & PARTNERS PTY LTD
Suite 2, 1394 Pacific Highway, Turramurra NSW 2074
Tel: (02) 9144 4711 Fax: (02) 9144 4733

FIRE ENGINEERED SOLUTION CONSULTANTS
ARUP
Level 10, 201 Kent Street, Sydney 2000
Tel (02) 9320 9320 Fax: (02) 9320 9321

LANDSCAPE ARCHITECT
TRACT CONSULTANTS PTY LTD
Level 1, 186 Blues Point Rd, McMahons Point, NSW 2060
Tel: (02) 9954 3733 Fax: (02) 9954 3825

COST MANAGER
RIDER HUNT PTY LTD
41 McLaren Street, North Sydney 2060
Tel: (02) 9922 2277 Fax: (02) 9857 4197

PEDESTRIAN BRIDGES PLAN AND DETAILS

DATE	AUGUST '06	PROJECT No.	STATUS
SCALE	AS NOTED (BT)	610309	CV/TD
DRAWN	DAT		
CHECKED		DWG No.	REV No.
APPROVED		CV 257	0

FOR CONSTRUCTION

Appendix F

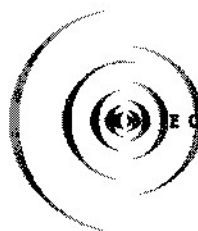
Woolworths RDC Water Cycle Management Strategy – Criteria for Integrated Water Cycle Management

Ecological Engineering Pty Ltd

28 May 2004



WYONG SHIRE
building a better tomorrow!



ECOLOGICAL ENGINEERING

Woolworths RDC Water Cycle Management Strategy

Criteria for Integrated Water Cycle Management Ver 2

28th May 2004

Report by:

Ecological Engineering Pty Ltd

PO A885 Sydney South NSW 1235

Ph 02 9283 1457, Fax 02 9283 1458

Suite 7.011, 249 Pitt Street, Sydney, Australia, 2000

Report for:

Wyong Shire Council

**Document Control Sheet**

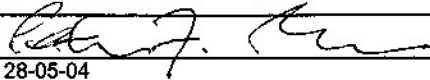
Report title:	Woolworths RDC Water Cycle Management Strategy – Criteria for Integrated Water Cycle Management
Suggested reference:	
Version:	02
Author(s):	Shaun Leinster, Alan Hoban, Dr Peter Breen
Approved by:	Dr Peter Breen, Tony Wong
Signed:	
Date:	28-05-04
Distribution:	Wyong Shire Council



Table of Contents

1. Introduction	1
1.1 This Document	2
2 Council Environmental Protection Objectives	4
2.1 Introduction	4
2.2 General Objectives	4
2.3 Specific Objectives	5
3 Appraisal of 'Pre-Development' and 'Existing' Catchments, Waterways and Habitats	7
3.1 Catchment	7
3.2 Waterways	9
3.3 Adjacent Aquatic Ecosystems	13
3.3 Porter's Creek	16
4. 'Pre-Development' and 'Existing' Site Hydrology and Water Balance	20
4.1 Modelling Procedure	20
4.2 MUSIC Modelling Parameters (Best Practice)	24
4.3 'Pre Development' Results	24
4.4 Existing Development Results	29
4.5 Comparison of 'Pre-Development' and 'Existing'	33
5. Establishment of a preferred 'Post Development' WCMS	39
5.1 Car Park Centre Medians Swale Bioretention	41
5.2 Truck Turning 'Rain Garden' Bioretention	42
5.3 Vegetated Swales	42
5.4 Eastern Vegetated Swale	43
5.5 High Water Use landscape	43
5.6 South Eastern Constructed Wetland	43
5.7 Western Constructed Wetland & Central Channel	44



5.8 Rainwater Tanks	45
5.9 Flow Diversion to Eastern Waterway	45
6. Assessment of 'Post Development' WCMS	51
7. Discussion and Conclusion.....	61
7.1 Pre Development Hydrology & Water Balance	61
7.2 Existing Development Hydrology & Water Balance	61
7.3 Post Development Hydrology, Water Balance & Pollutant Removal ..	62
7.4 Conclusion.....	63
Appendix A – 'Pre-developed' MUSIC Modelling	
Appendix B – 'Existing' Case MUSIC Modelling	
Appendix C – 'Post Development' MUSIC Modelling	



1. Introduction

Wyong Shire Council (WSC) is currently in the process of assessing a Section 96 application from Woolworths to develop a Regional Distribution Centre (RDC) within the Warnervale Business Park. The subject land lies within the drainage catchment of the Porters Creek Wetland (one of the largest freshwater wetlands on the NSW coast) and other sensitive terrestrial and aquatic ecosystems (including sensitive Wallum Froglet habitat). As such, the sustainable management of the hydrology and water quality entering these ecosystems from the subject land is critical to ensure the ongoing sustainability and integrity of these systems. Council acknowledges the importance of ecosystems adjacent to the Business Park in its DCP which states the following environmental protection objectives:

"To ensure that development of the proposed Warnervale Business Park is sensitive to the environmental conditions of the locality, particularly Porters Creek Wetland, threatened fauna species and adjacent areas of environmental value".

"To ensure the ecological values of the wetlands are maintained and to protect water quality for the region it is imperative, that adjoining developments do not interfere with the hydrological regime of the area."

The proximity of the subject land to sensitive aquatic ecosystems coupled with the likely significant increase in imperviousness and associated water borne contaminants requires a carefully considered drainage and Water Cycle Management Strategy (WCMS) aimed at supporting the intended industrial land uses on the site whilst also affording adequate protection to the sensitive receiving aquatic ecosystems. Council have been working with Woolworths to develop this WCMS to deliver on the objectives listed above.

A key step in the development of WCMS's and one that underpins the final management strategy is a fundamental understanding of the ecology of the adjacent ecosystems (Wallum Froglet Habitat and Porter's Creek) and their response to hydrologic and water quality change.



Ecological Engineering has been appointed by WSC to:

- further develop an understanding of the ecosystems adjacent to subject site and define the pre-development hydrology which has sustained the ecosystems to date;
- improve the definition of the existing hydrology of the Woolworths RDC site, particularly for the central channel; and
- refine the post development WCMS for the proposed development in consultation with Beca Pty Ltd.

The outcomes of the assessment are to:

- i. ensure the environmental protection objectives developed by Council are appropriate;
- ii. define predevelopment and existing hydrology associated with the site and surrounds; and
- iii. ensure a suitable WCMS can be developed to achieve the environmental protection objectives, particularly to the east of the proposed RDC.

1.1 This Document

The report briefly presents the environmental objectives for water management for the Woolworths RDC (as provided by WSC); describes the existing waterways and receiving environments of the Woolworths RDC site and surrounds; outlines a methodology for establishing pre-development and existing hydrology and water balance; and demonstrates how the preferred WCMS concept can be developed to achieve the environmental protection objectives.

The results of the investigations are then used to further refine Council's preliminary environmental objectives to form a set of criteria and objectives for Water Cycle Management (WCM) and environmental (including habitat) protection for the proposed development site. The report provides a basis for assessment of the proposed Woolworths RDC WCMS and is presented in the following sections:

2. Council Environmental Protection Objectives



3. Appraisal of pre -development & existing catchment, waterways and habitats
4. 'Pre-Development' and 'Existing' hydrology/water balance
5. Establishment of a preferred 'Post Development' WCMS
6. Assessment of 'Post Development' WCMS
7. Discussion and Conclusion



2 Council Environmental Protection Objectives

2.1 Introduction

Council recently received a S96 Application for the Woolworths RDC development that contained a number of changes to the original concept. Review of the application revealed a number of concerns relating to stormwater collection, treatment and disposal and the potential impact on the adjacent ecosystems and Porter's Creek Wetland. Given the changes to the proposed development Council require that the proposed water management strategy be improved.

2.2 General Objectives

Preliminary review of the Woolworth's RDC development proposal indicates a substantial change to the 'Existing' and Pre-Development" hydrology. The proximity of the site to sensitive aquatic ecosystems coupled with the likely significant increase in imperviousness and associated water borne contaminants requires a carefully considered drainage and water cycle management strategy aimed at supporting the intended land uses on the site whilst also affording adequate protection to the sensitive receiving aquatic ecosystems. The Water Cycle Management Strategy needs to be developed with the aim of achieving the following general objectives (as provided by Council on 7th April 2004):

- Maintain existing flow paths along the lower eastern boundary as identified by Stephen Bell's 'Vegetation and Terrestrial Orchid Survey of the Warnervale Industrial Lands' (May 2003).
- Limit total annual flow volumes entering the sensitive habitat to pre-development conditions.
- Limit the frequency of individual flows (as shown in a flow duration curve) to that of pre-development conditions (including cease to flow conditions, low flows and high flows).
- Provide attenuation of flow to account for reduced time of concentration under 'developed' conditions.



- Maintain cease-to-flow conditions including median cease to flow period and number of cease to flow days to pre-development.
- Reduce stormwater pollutants to acceptable levels as indicated in Council's Stormwater Management Plan.
- Maintain pre-development pH of stormwater runoff in the range 4.5 to 7.0.

2.3 Specific Objectives

(i) Eastern & South Eastern Boundaries

The large increase in impervious surfaces that accompanies industrial/commercial land uses will undoubtedly result in a marked increase/change in runoff volumes, peak flows, flow duration characteristics, and stormwater contaminants.

In order to preserve the function of the key local ecosystems, those along the eastern and south eastern boundaries, and to minimise the impact on the ecosystems to the south (ie. Porter's Creek and southern ecosystem), the following hydrologic, water balance and water quality objectives have been established:

- Maintain existing flow paths along the eastern boundary and ensure delivery of water is across a width of 100-150m.
- Limit the frequency of individual flows (as shown in a flow duration curve) to that of pre-development conditions (including cease to flow conditions, low flows and high flows).
- Limit total annual flow volumes entering the sensitive habitat to pre-development conditions.
- Provide attenuation of flow to account for reduced time of concentration under 'developed' conditions.
- Maintain cease-to-flow conditions including median cease to flow period and number of cease to flow days to pre-development.



- Reduce stormwater pollutants to acceptable levels as indicated in Council's Stormwater Management Plan (90% reduction in TSS and 50% reduction in TN and TP).

(ii) Southern Boundary (central channel)

It is accepted that the large increase in impervious surfaces on the Woolworths site will undoubtedly result in a marked change in hydrology that will be difficult to manage entirely onsite. To this extent, stormwater harvesting for local re-use opportunities (toilet flushing, irrigation) should form an integral component of the water cycle management strategy for the site. Ultimately reuse regionally will be considered for the water generated on the site, however, the regional opportunities for reuse have not been established at this stage. Therefore an adaptive approach to managing the water cycle and delivery of water to the south is required. Positions adopted now should allow for future initiatives such as regional stormwater harvesting and reuse:

- Provide for a water storage within the southern eastern corner of the site to allow for reuse on-site and regionally OR provide for water storage of runoff for delivery to a high water use landscape zone (ie. a water disposal system).
- Adjust the method delivery to spread water across a width of 200–250m under most flow conditions (it is accepted that diversion of low flows may not be possible).
- Limit the increase in frequency of individual flows.
- Limit the increase in total annual flow volume existing the southern boundary 'Post Development' (as much as possible).
- Provide attenuation of flow to account for reduced time of concentration under 'developed' conditions.
- Reduce stormwater pollutants to acceptable levels as indicated in Council's Stormwater Management Plan (90% reduction in TSS and 50% reduction in TN and TP).



3 Appraisal of 'Pre-Development' and 'Existing' Catchments, Waterways and Habitats

The proposed Woolworths RDC site is located within Warnervale Business Park which is situated approximately six kilometres north-west of Wyong. The Park is bounded by Sparks Road to the north, Warnervale Airport to the east and the F3 Freeway to the west. The subject land lies within a relatively small drainage catchment of Porters Creek Wetland and contains a number of sensitive terrestrial and aquatic ecosystems.

The following sections define the site and adjacent habitat characteristics relevant to the water cycle management. We have based our appraisal on a GIS, aerial photography, topographical survey, previous reporting provided by WSC and a site inspection undertaken on Wednesday 12th May to review specific elements of the Woolworths RDC site, adjacent habitat and identify potential flow paths.

3.1 Catchment

The subject site (23.2 hectares) sits within a wider catchment (83.3 hectares) which drains via a number of waterways into Porter's Creek Wetland. As indicated in Figure 1, the catchment upstream of the Woolworths RDC site (60.1 hectares) drains via preferred drainage pathway through the site to the receiving environments. A description of the catchment and site characteristics are provided below. Note that as part of the appraisal it was considered important to develop an understanding of conditions through the site BOTH as it currently exists ('Existing') and also prior to any development on the site ('Pre-Development').

Pre-Development

- The regional 83.3 hectare catchment contains a mixture of flat to undulating topography with the general aspect being towards the south east. Elevations within the catchment range from 34m AHD to 8m AHD along the southern boundary of the site.
- The site is located at the base of the catchment across mostly flat alluvial plain zones. Most of the land sits between 8–9.5m AHD with the moderate elevations (up to 18m AHD) present in the north eastern and south western corners of the site.



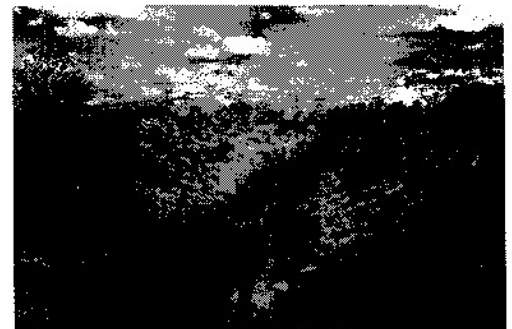
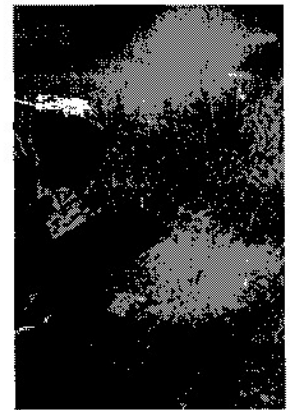
- Upstream of the existing F3 Freeway the catchment is dominated by rural residential landuse.
- Prior to construction of the F3 Freeway and subsequently the Warnervale Business Park catchment runoff and discharge downstream was via flat wide heathland-sedgeland-wetland waterways rather than defined creek or drainage lines. Inspections of these heathland waterways zones indicates a variable pock marked microtopography comprising mosaics of alternate rises and depressions (~0.2–0.3m in depth and up to 1 metre in wetland zones). The nature of these heathland zones means a large proportion of rainfall runoff will be retained following events. Further discussion of these waterway zones is provided in Section 2.2.
- Inspection of the 1941 aerial photo and discussion with Council personnel indicate heathland waterway extended right through the subject site up to the current Freeway location. The heathland waterways drained south east across the subject site.
- In addition an ephemeral wetland of approximately 1–1.5 hectares was sited on the eastern side of Burnett Rd along/adjacent to the line of the current Woolworths Road. The nature of this wetland system is further discussed in Section 2.2.

Existing

- The first adjustment to hydrology through the subject site occurred in 1982–83 with the construction of the F3 Freeway and Sparks Rd. The clearing of heathland waterway, introduction of substantial impervious area (>2 hectares) to the catchment and concentration of flows to a number of large culverts has drastically changed water movement through this zone of the waterway. This has resulted in gradual die back of trees upstream, within the retardation basin, and through the Business Park and subject site.
- Development of the Warnervale Business Park in 2000–2003 has resulted in substantial change to landform and hydrology.



- The topography of the land on the subject site and throughout the wider Business Park has been altered significantly as a result of development and filling.
- The former natural wetland depression has been filled to create industrial allotments, the site was cleared of vegetation and much of the heathland levelled. This has substantially changed the local and regional hydrology through the site as outlined in Section 2.2.
- A number of roadways have been created within the Business Park north west of the subject site thus introducing impervious surfaces resulting in marked increases/changes in runoff volumes, peak flows, flow duration characteristics and stormwater quality.
- A retardation basin was constructed at the upstream boundary of the Business Park to manage peak storm event/flood flows entering the subject site.
- A large stormwater channel (central channel) was constructed through the central south eastern corner of the site to efficiently drain local runoff and upstream flows through the site. This has resulted in a pronounced changed in hydrology through the site and within the receiving environments (Wallum Froglet Habitat and Porter's Creek). Further discussion is provided in Section 2.2-2.3.



3.2 Waterways

As outlined above, drainage of the catchment flows has changed markedly in recent years. Prior to construction of the F3 Freeway and subsequently the Warnervale Business Park catchment runoff and discharge downstream was via flat wide heathland-sedgeland-wetland waterways rather than defined creek or drainage lines. As development of the Freeway and Business Park occurred drainage has become channelised and more efficient therefore greatly influencing the nature of flows through the subject site and into adjacent ecosystems. Description of the waterways



prior to development and those that currently existing within the catchment is provided below.

Pre Development

Ephemeral Wetland

- Inspection of aerial photos (1941 and 1990s) and site inspections by Council staff confirms that a wetland basin existed on the eastern side of Burnett Rd along/adjacent to the line of the current Woolworths Road.
- The developer of the site, who oversaw the drainage, removal and filling of this wetland, estimates a wetland depression of approximately 1–1.5 hectare and between 0.5 and 0.8m depth during wetter periods (rain in 2002 caused lengthy delays to works in this area due to bogging of excavation machinery). The wetland originally had the typical pock marked surface of this catchment.
- Council's subdivision supervisor described the wetland as following: "It was like a little basin in there (the central wetland). It was dry when we began and you could move through there but once it rained it filled up and you couldn't move.... It was a marsh, like peat, and once it rained you couldn't move and it sat there for ages, they couldn't drain it. It was not until they got the big drain in that it began to drain and then very slowly and it took them a long while to get the drain down far enough to fully drain it – and even then it took a while for it to dry out."
- It seems the wetland filled during runoff events and then was slowly drawn down via a combination of evapotranspiration and seepage. Overflow from the wetland entered the major heathland flow paths to flow to the south and east into receiving environments.
- The accumulation of organic material in the base of the wetland had formed a thick peat layer which was excavated as part of road construction.



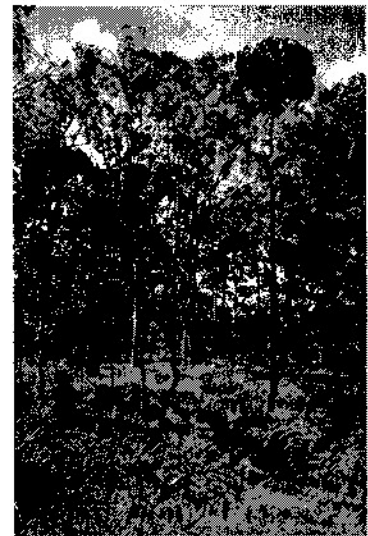
Heathland-Sedgeland Waterways

- Prior to construction of the F3 Freeway and subsequently the Warnervale Business Park catchment runoff and discharge downstream was via flat broad heathland-sedgeland-wetland waterways rather than defined creek or drainage lines.
- Inspections of the heathland waterways zones, which still exist downstream of the subject site and within the upstream retarding basin indicates, a variable pock marked microtopography comprising mosaics of alternate rises and depressions (~0.2-0.3m in depth). The nature of these heathland zones means a large proportion of rainfall runoff will be retained following events therefore reducing the volume of water delivered to downstream and adjacent environments.
- When floods did occur through the subject site, they were usually wide, shallow, slow moving sheet flows.
- Inspection of the 1941 aerial photo and discussion with Council personnel indicate the heathland waterway extended right through the subject site up to the current Freeway location. The heathland waterways drained south east across the Woolworths RDC site, along the line of the recently constructed earth drain and also eastwards across the subject. Both the 1941 and more recent photos show the lines of sedge woodland that branched out from the central ephemeral wetland (see above). The 1990s and 2000 aerials show an apparent sedge-lined flow path branching to the south and east across the RDC (sedge lines appear as olive or grey-green colouring on the colour photos).
- The preferred flow path seems to be along the waterway heading south across the boundary of the subject site. The south eastern and eastern waterways seem to have been engaged under moderate flows which occur approximately 2-3 times per.
- In terms of hydrological function, the heathland-sedgeland areas can be divided two key zones being 'Local Heath' and 'Regional Heath'.



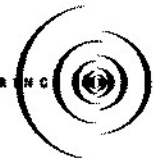


- The 'Local Heath' accepts rainfall directly and runoff from the local catchment and provides retention and storage within the variable microtopography (pock marked). Following rainfall, waters within these heathland zones would recede via evapotranspiration and soil seepage. Once the storage capacity of the 'Local Heath' is reached water begins to overflow into the 'Regional Heath' where waters are stored and slowly conveyed downstream.
- The 'Regional Heath' not only accepts rainfall directly and from the local catchments but also from upstream catchments. This zone is where conveyance of flows occurs and this system retains water/moisture for the longest period. Therefore this zones provide suitable conditions for establishment of aquatic plant species which exists under mostly moist to wet conditions (eg *Baumea nuda*, *Lepidosperma quadrangulatum*, *Leptocarpus tenax*).



Existing

- The form and function of the heathland waterways was first modified in 1982-83 with the construction of the F3 Freeway and Sparks Rd. The far upstream end of the waterways was totally cleared of vegetation and all stormwater runoff piped/channelled to 2-3 discharge points. This has resulted in removal of waterway storage (pock marked depressions), increase in total runoff and delivering of flows in a concentrated manner and seems to have resulted in gradual die back of trees in the heathland directly downstream of the Freeway.
- Development of the Warnervale Business Park in 2000-2003 has totally changed the way water moves across the subject site.
- All of the heathland-sedgeland zones (both 'Local Heathland' and 'Regional Heathland') have been cleared with much of the area levelled and filled in.



Also the 'Ephemeral Wetland' was filled to create Woolworths Way and industrial allotments. This has effectively removed a large portion of the storage function within the waterways through the subject site meaning most catchment flows pass to the receiving environments with seemingly small percentages of water being retained. This has effectively increased the total volume of water and the frequency of water entering the receiving environments. This has a significant impact on the vegetation of the receiving dry swamp forests. These areas have become water logged resulting in the death of trees and a change in the understory species.

- A retardation basin was constructed at the upstream boundary of Warnervale Business Park to manage peak storm event/flood flows entering the subject site. The function of this system plus the additional runoff from the Freeway has resulted in more regular waterlogging of the heathlands within the retarding basin causing gradual die back of certain trees and a change in the understorey vegetation.
- A large stormwater channel (central channel) was constructed through the central south eastern corner of the site, generally along the alignment of the waterway heading to the south. This channel seems to have been constructed to efficiently convey local runoff and upstream flows through the site. The channel ensures local and upstream flows are passed through the site without any permanent (and minimal) temporary storage. This is a substantial variation from the pre-development heathland hydrology particularly for low to moderate flow events which would have been detained and retained within the large surface volume of the pock marked microtopography. This has both increased the efficiency of conveyance through the site and reduced storage within the site.

3.3 Adjacent Aquatic Ecosystems

As indicated in Figure 4, there are a number of key ecosystems that the Woolworths RDC site is located adjacent to and which receive runoff from the site:

- Eastern Boundary – the eastern edge of the site is bounded by a series of adjoining woodland communities which become indicative of wetter conditions toward the south (Spotted Gum–Ironbark Forest, Snappy Gum



Forest, Snappy Gum–Sedge Woodland (dry swamp forest) (East Coast Flora 2003).

- Southern (east) Boundary – The southern eastern edge of the site is bounded by Snappy Gum–Sedge Woodland (dry swamp forest) which grades into a wetter Alluvial Drainage Line Complex which grades (drains) into the Wet Heath communities of Porters Creek Wetland (East Coast Flora 2003).
- Porter's Creek – Porters Creek Wetland is a large mosaic of wetland communities ranging from sedgeland marshes through wet heath and wet swamp forest to ephemeral and dry swamp forests.

The woodland and wetland areas of the Woolworths RDC site and adjacent properties are known as long term habitat for the listed endangered Wallum froglet, *Crinia tinnula*. Ecotone Ecological Consultants report: "A population of at least 100 (Wallum froglet) individuals appear to occur on or near the Woolworths site in the Warnervale Business Park." (Ecotone, 2003). Woolworths Development Consent 187/03A contains three conditions (23, 33, 34) that address the protection of the Wallum froglet habitat downstream of the RDC site. This protection requires the maintenance of the pre-development hydrology, topography and vegetation in these areas and a monitoring program is required to assist compliance with these conditions. By mimicking the pre-development hydrology of the Business Park, the stormwater design for the Woolworths RDC s96 application, will help maintain this habitat.

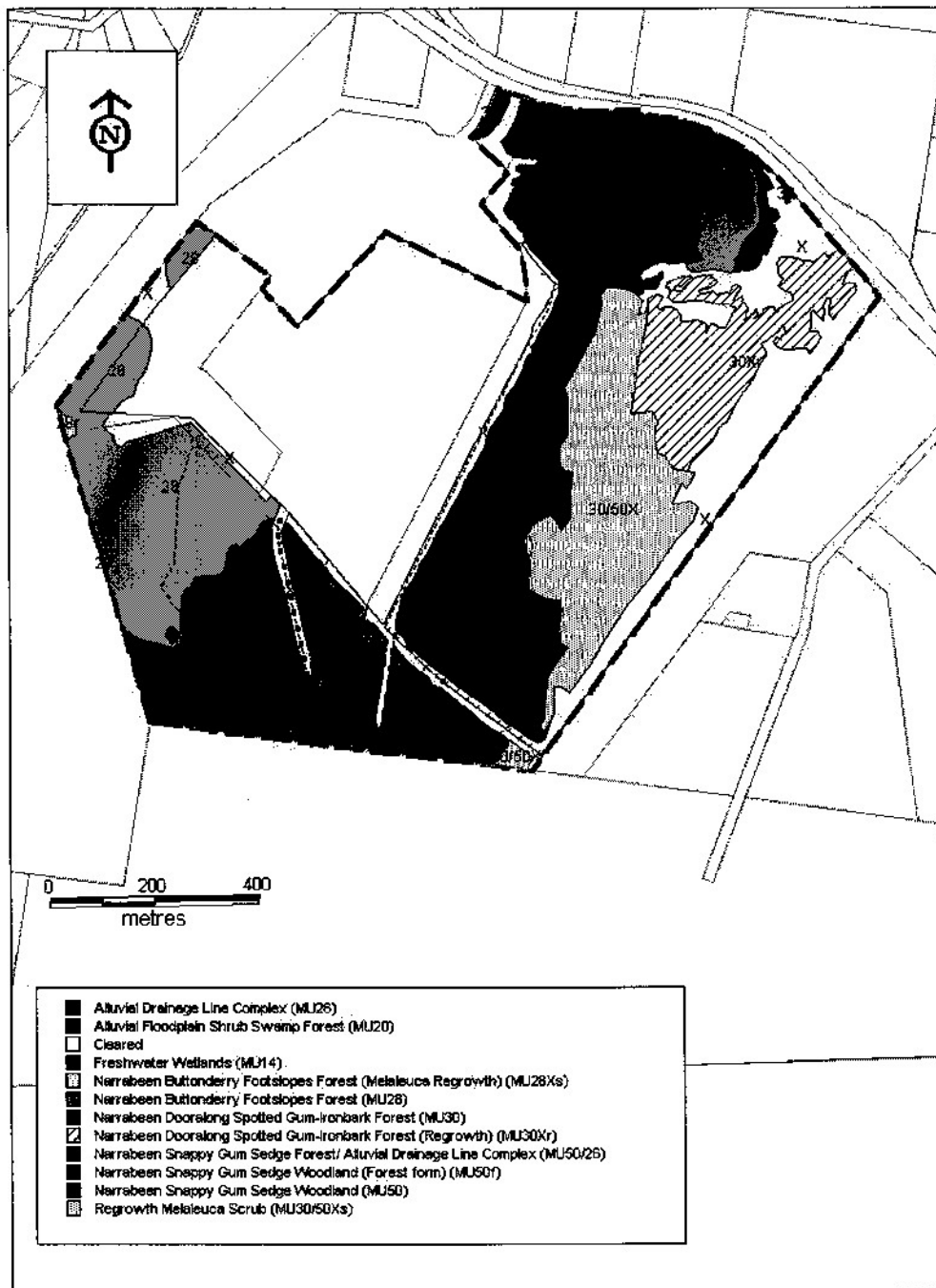


Figure 4 – Vegetation communities surrounding the Warnervale Business Park (East Coast Flora 2003).



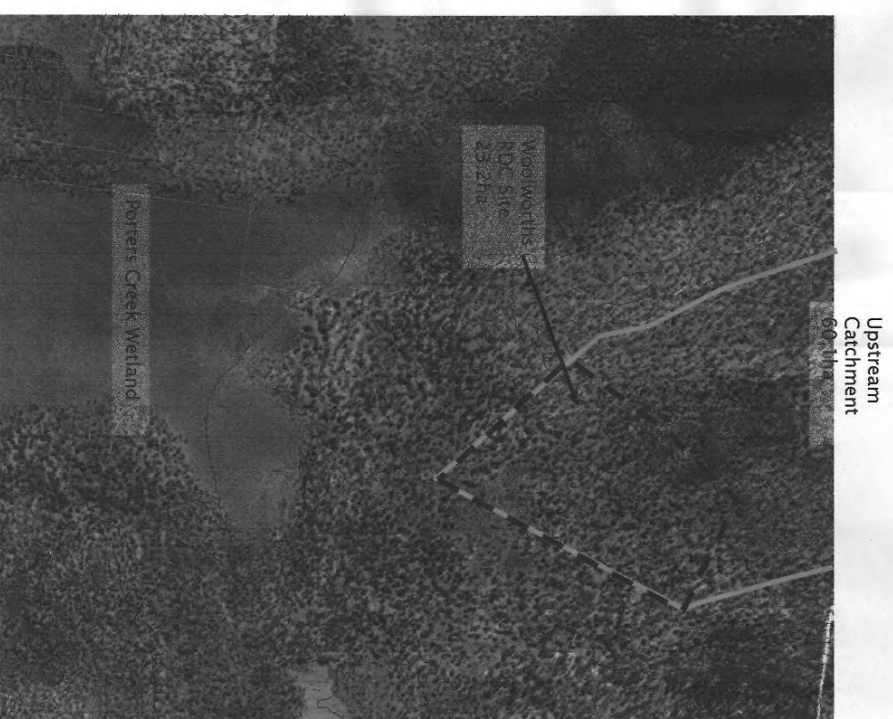
3.3 Porter's Creek

Porters Creek wetland is a large regionally significant floodplain forest wetland located approximately 100–150 south of the subject site. The wetland is largely swamp forest dominated by several *Melaleuca* communities adapted to different hydrologic or flooding regimes. The Porters Creek wetland is habitat to four significant plant species (Aquatic Ecological Investigations 1999). *Angophora inopina* and *Melaleuca biconvexa* are listed as vulnerable species on Schedule 2 of the Threatened Species Conservation Act (1995). *Eucalyptus robusta* is regarded as a keystone species in the broader area because of its importance as a winter flowering and seasonal food source. *Xanthorrhoea fulva* is thought to be significant as Porters Creek wetland seems to represent the southern limit of this species distribution. In general the Porters Creek wetland represents a regionally significant wetland and provides important habitat for both flora and fauna. The wetland also provides natural water quality and quantity regulation for the catchment draining through the wetlands to the Wyong River and subsequently Tuggerah Lakes.

The ecological health of Porters Creek wetland seems to be threatened by urban development in the upstream catchments. This is the subject of a current study (WSUD Solutions for Catchments above Wetlands), but a major threat appears to be the increased runoff generated from developed catchments and the nature of the delivery of this urban stormwater to or into the wetland. Increased runoff volume is potentially disadvantaging the drier forest communities, whereas local point source discharges into the fringing driest swamp forest communities is having a severe local impact with tree death and weed invasion. Clearly any future upstream or adjacent development is going to need to consider the impact of drainage design on Porters Creek wetland if the system is to be protected and rehabilitated in the future.



1998-2000 Air Photo



1941 Air Photo

Figure 1
Pre-Development Catchment and Site Location

Flows from catchment enter upstream section of heathland



Preferred southern drainage waterway to Porter's Creek Wetland

Ephemeral Wetland which existed prior to development of industrial sub-division. Historical records and recollection indicate the wetland was approximately 1-1.5 hectare in size and 0.5-0.8m deep.

Preferred Southern Drainage Path which existed prior to development of industrial sub-division. Historical records and recollection indicate the wetland was approximately 1-1.5 hectare in size and 0.5-0.8m deep.

Minor Ridgeline appears to existing parallel to the eastern boundary that is approximate 0.2m higher than the preferred southern drainage path and the eastern boundary.

Eastern and South Eastern waterways which accept local catchment flows and overland/overflows from upstream catchment. Inspection and modelling indicates overflows from upstream catchment occur approx 2 times per year on average.

Local Heath - Accepts rainfall directly and runoff from the local catchment and provides retention and storage within the variable microtopography (Typified by dense ground cover with pock marked and pitted depressions). Following rainfall, waters within these heathland zones via evapotranspiration and soil seepage. Once the storage capacity of the 'Local Heath' is reach water begin to overflow into the 'Regional Heath' where waters are stored and slowly conveyed downstream.



Regional Heath - Not only accepts rainfall directly and from the local catchments but also from upstream catchments. This zone is where conveyance of flows occurs and which retains wet/moist for the longest period. Therefore this zones provide suitable conditions for establishment of aquatic plant species which exists under moist to wet conditions as well as dry conditions.

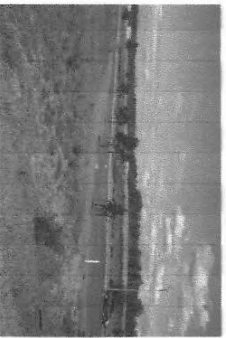
Figure 2
'Pre-Development' Hydrologic Flowpaths

E3 Freeway which resulted in clearing of heathland waterway, introduction of substantial impervious area (>2 hectares) to the catchment and concentration of flows to a number of large culverts. Result is a drastic change in local hydrology which has result in gradual die back of trees.



Retardation Basin to managed peak storm event/flood flows entering the subject site.

Filling and construction of roadways as part of business park has resulted in clearing of essentially all vegetation, leveling/filling of heathland and introduction of impervious surfaces.



Constructed Drain to efficiently drain local runoff and upstream flows through the site. The drain ensures local and upstream flows as passed through the site, without any permanent or temporary storage, delivering increased volumes of water to receiving environment.



Minor Ridgeline appears to existing parallel to the eastern boundary that is approximate 0.2m higher than the preferred southern drainage path and the eastern boundary.

Regrowth of Vegetation is occurring across the cleared Woolworths RDC site. Vegetation is typical of heathland habitat which existed prior to clearing.



Slight depression exists along eastern boundary which accepts overflow from preferred drainage path.



Figure 3
Existing Site Hydrologic Characteristics



4. 'Pre-Development' and 'Existing' Site Hydrology and Water Balance

The following section outlines the modelling procedure for establishing pre-development hydrology and water balance through Woolworths RDC site. A detailed hydrologic assessment using this procedure would require calibration of hydrologic models using data from nearby gauging stations. The calibration process was considered beyond the scope of this investigation, therefore, a general understanding of pre-development hydrology was developed through modelling using best practice knowledge and assumptions.

Note that Ecological Engineering is currently in the process of refining MUSIC model parameters for catchments above Porter's Creek wetland as part of the WSUD Solutions for Catchments Above Wetland project. A MUSIC model which has been established for the entire catchment feeding to Porter's Creek Wetland is currently being calibrated to long term stream flow records. The outcomes of this modelling assessment may be used to better inform the pre-development hydrology through the Woolworths RDC site.

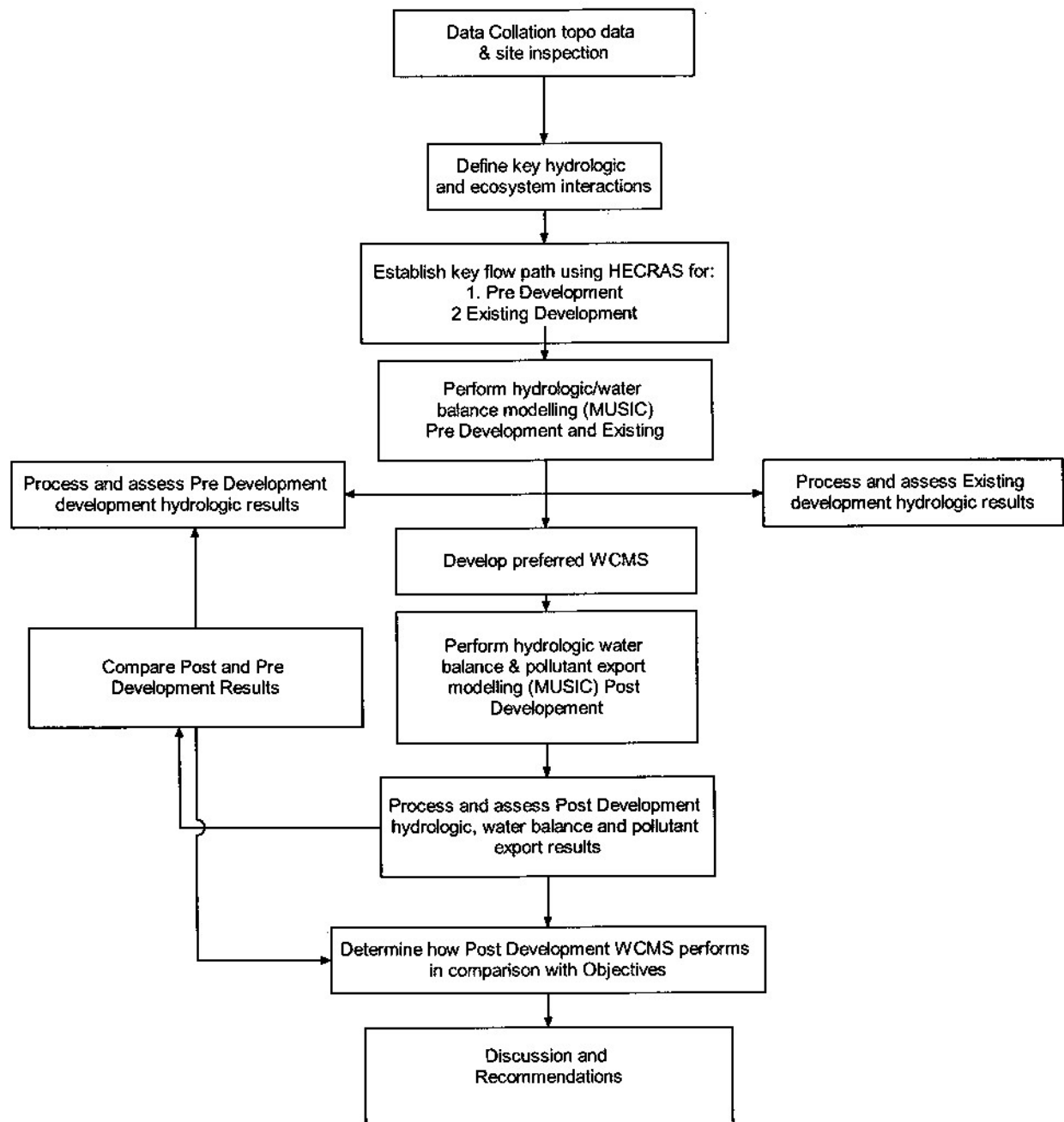
4.1 Modelling Procedure

Ideally when establishing the hydrological characteristics of a particular ecosystem system a comprehensive data collection exercise would be scoped and undertaken. This would allow accurate definition of catchment runoff, flow/storage characteristics within the heathland storage zones and overland flow paths. However, in this case a data collection exercise has not been undertaken by the Council and Woolworths .

In the absence of this locally specific data, computer modelling methods can be used to gain a general understanding of hydrologic characteristics. Ecological Engineering were asked by WSC to establish a robust modelling procedure that could be used to provide a realistic assessment of baseline or Pre-Development hydrological and water balance characteristics of the subject site. The procedure could then be used again at a later date to refine understanding of the local hydrology once suitable data is available for calibration.



This section presents a summary of the modelling procedure established to assess the Pre-Development hydrology through the Woolworths RDC site. A flowchart presenting the overall modelling methodology is presented below:





In MUSIC this landscape was represented as a series of storage systems (ie. wetlands) with a large surface area and small extended detention depth. Based on site inspections and documented evidence from other reports the depressions were assumed to be 0.2m deep and covering half of the heathland zone. Note that Council are currently in the process of determining detailed survey scope of work for typical heathland areas in order to quantify the storage characteristics. When this survey information is available it can be used to further refine the modelling of heathland zones.

The overflow point within the subject site (point at which overflow to the east occurs under moderate flows) was modelled using generic nodes to represent the inflow-outflow relationship (branching relationship) as determined from HECRAS.

The MUSIC model was run on a six minute time step for ten years of data to establish an understanding of the mean annual flow and number of no-flow days into the eastern channel. MUSIC was then run for ten years on an hourly timestep and the generic node inflow-outflow properties were adjusted to preserve the mean annual flow and number of no-flow days. This adjustment was necessary due to the flow-attenuating affect of longer time steps.

An 80 year simulation using Sydney rainfall data was then run on a 1 hour timestep.

Post Processing of Data

There are three main statistical analysis techniques that have been adopted to compare pre and post development hydrology for the site. Council has termed these techniques as (1) flow duration curves (or exceedance curves); (2) descriptive statistics; and (3) histogram with each of these methods of analysis outlined below.

(i) Flow Duration Curve

A 'duration curve' (or exceedance curve) is a graphical representation of a set of statistics. This flow duration curve is a convenient way to get an overall view of flow data and to visually compare two curves that represent pre and post development scenarios. They are particularly relevant for wetting-drying cycles and low flows rather than peak flow analysis.

In the case of a small ephemeral catchment the flow duration curve would be expected to be at or near zero for a fair portion of the time.



Establish Key Flow Paths – Hydraulic Model (HECRAS)

Key flow paths through the site were identified from a site inspection, aerial photography and topographical survey information (comprising spot heights and 0.25m contours).

Cross sections were obtained from the topographic data at six locations across the main flow path and its branches to the east and south of the Woolworths RDC site. The main sources of topographic data were prepared from detailed survey of Warnervale Business Park by Trehy Ingold Neate (June 1995) and by Craig and Rhodes within the RDC site (January 2003) and outside the eastern boundary of the RDC site (May 2004).

A HECRAS model was then constructed using these cross sections. At the branching node in the hydraulic model the invert of the eastern branch was 0.15–0.2m higher than the invert of the southern branch. The Manning's roughness coefficients were adopted for shallow flow through heathland zones (0.2), and normal water level boundary conditions were adopted. A range of flows were then modelled through the system under steady-state conditions which enabled a branching relationship to be established.

This branching relationship specifies how flows are diverted into the southern and eastern branches for a range of flowrates.

Hydrologic/Water Balance Modelling (MUSIC)

MUSIC was chosen for hydrologic modelling of the catchment due to its ability to run continuous simulations rather than event based simulations. This was important for this catchment due to the long 'hydrologic memory' of the system (heathland storage) which would not have been adequately modelled with an event based model where antecedent conditions are often selected arbitrarily (assumed).

As described in Section 3, the heathland landscape that covered significant areas of the 'pre-development' catchment has many surface depressions and a dense vegetation cover. Rainfall runoff and flow processes in this landscape are thought to be characterised by high amounts of localised detention, with significant losses to evapotranspiration and seepage.



(ii) Descriptive Statistics

Additional descriptive statistics have been derived to examine particular data such as median flow rate; median length of no flow periods, annual volumetric runoff coefficients and mean annual flow volumes.

(iii) Histogram

A histogram of annual flows for 80 years has been prepared which can be used for comparing of post development flows volumes.

4.2 MUSIC Modelling Parameters (Best Practice)

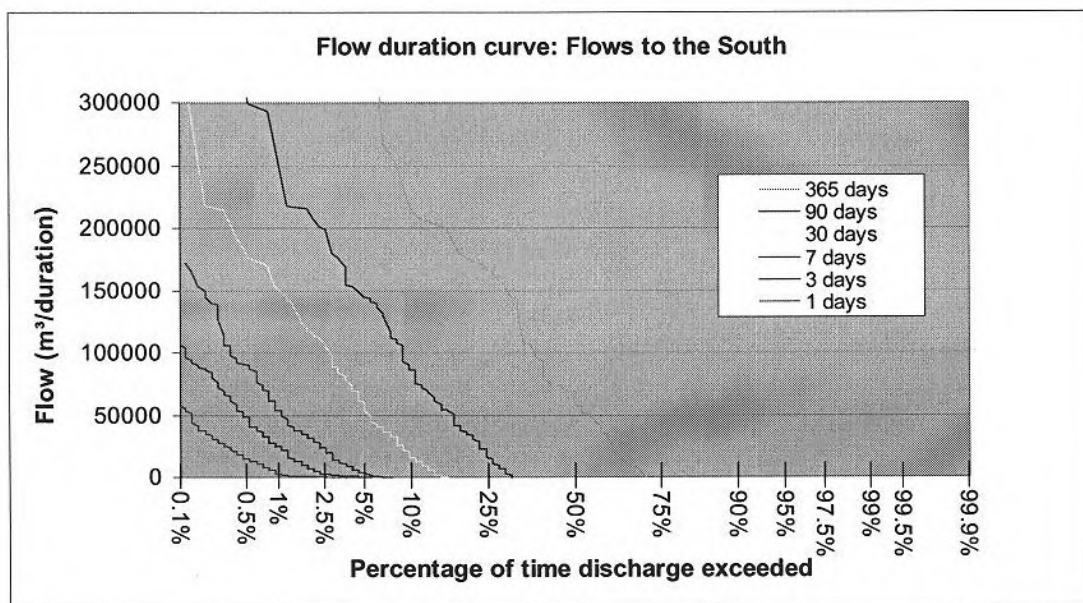
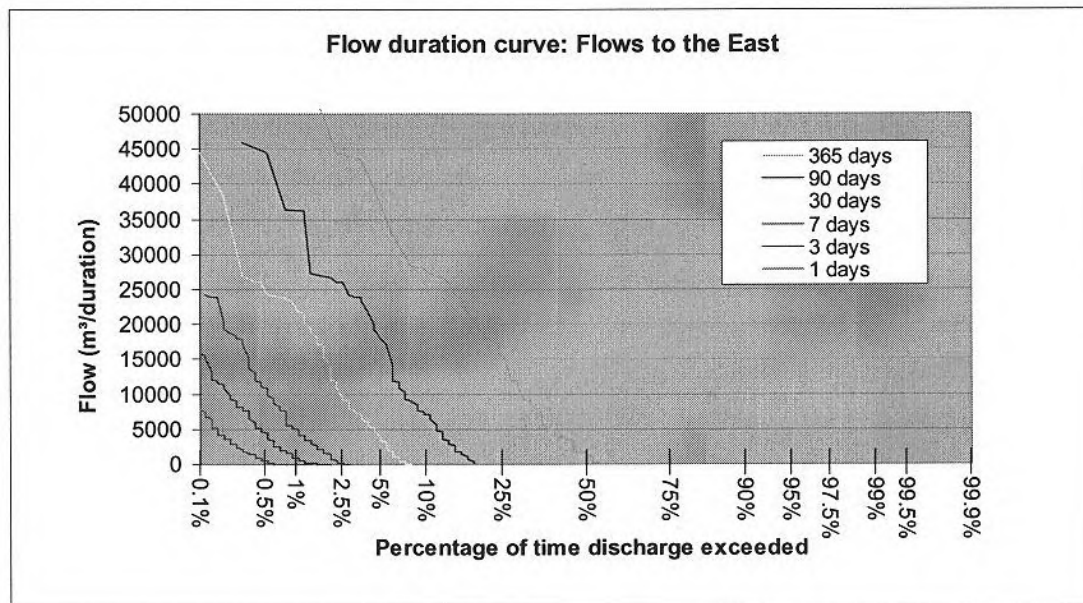
In order to estimate hydrologic behaviour through the site in the absence of this locally specific data, best practise MUSIC parameters adopted and applied with knowledge of how the existing and pre-development ecosystems functioned.

4.3 'Pre Development' Results

Results of the modelling for the 'Pre-Development' conditions are presented below as per procedure outlined in Section 3.1. A summary of the MUSIC model layout and parameter values used in the modelling are provided in Appendix A.



(i) Pre-Development Flow Duration Curves





(ii) Pre Development Descriptive Statistics

Mean annual results (based on daily volumes for 80years of data)

	Mean Annual Volume (ML)		
	Eastern Waterway	Southern Waterway	Total Flow
Pre Development	9.0	98.2	98.2

Daily flow analysis – length of no flow periods (based on daily volumes for 80years of data)

Percentile	Daily Flow (m ³ /day)	
	Eastern Waterway	Southern Waterway
0.01	0	0
0.5 (median)	0	0
0.95	0	0
0.99	30	4420



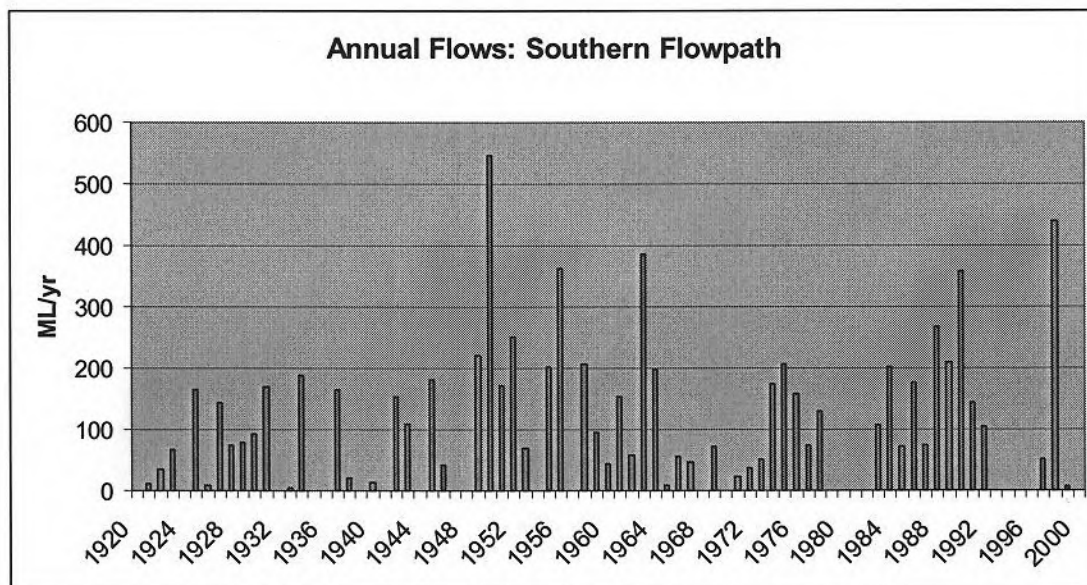
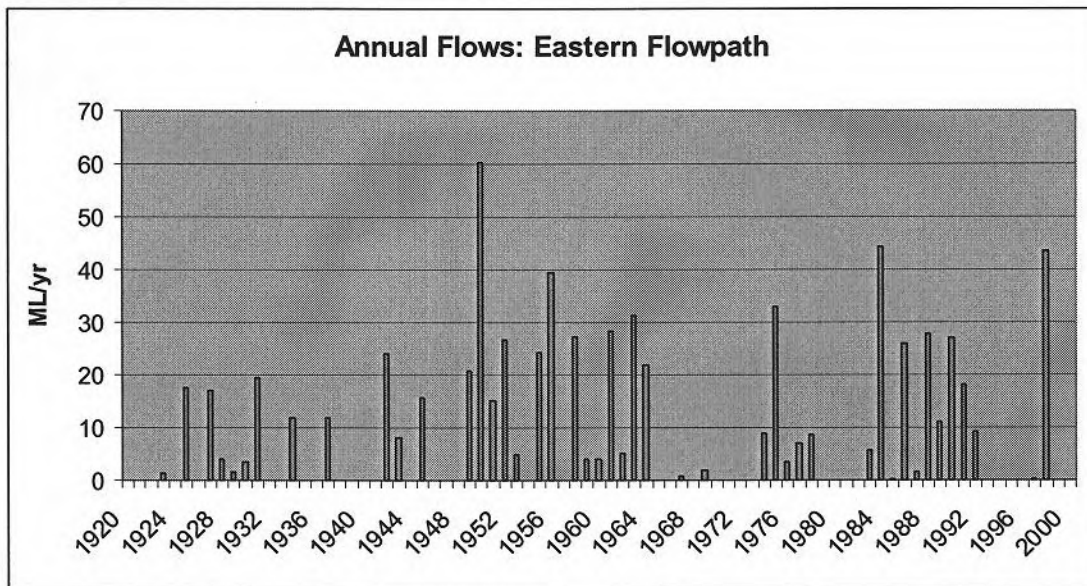
Dry spells analysis (based on daily flow volumes for 80years of data)

Percentile	Length of dry spell (days)	
	Eastern Waterway	Southern Waterway
0.01	1	1
0.05	1	1
0.1	1	2
0.25	5	7
0.5 (median)	89	45
0.75	357	252
0.9	648	419
0.95	1313	603
0.99	1868	1215



(iii) Pre Development Histogram

See below histogram of annual flow volumes.

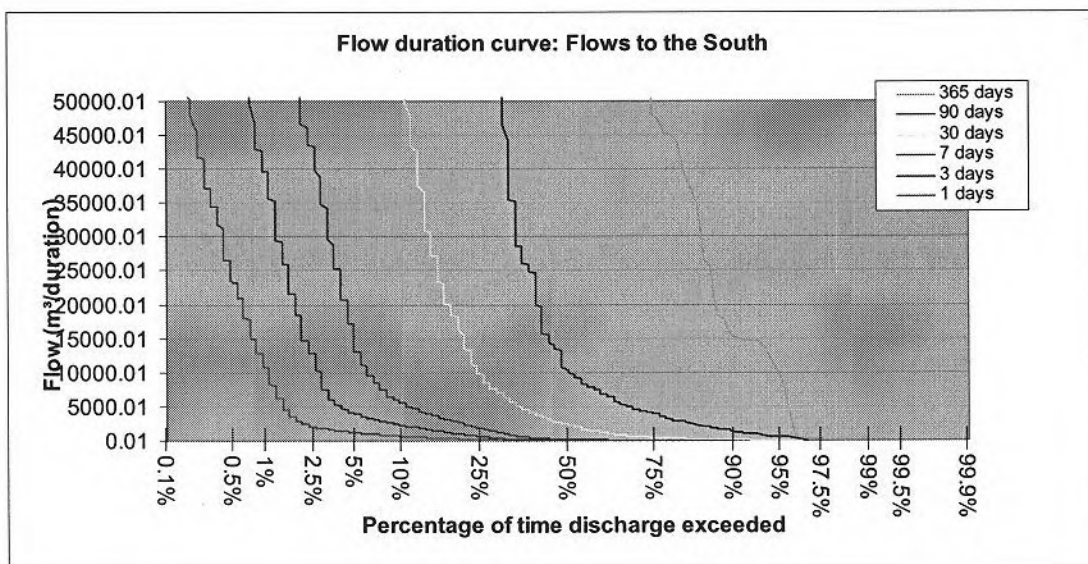
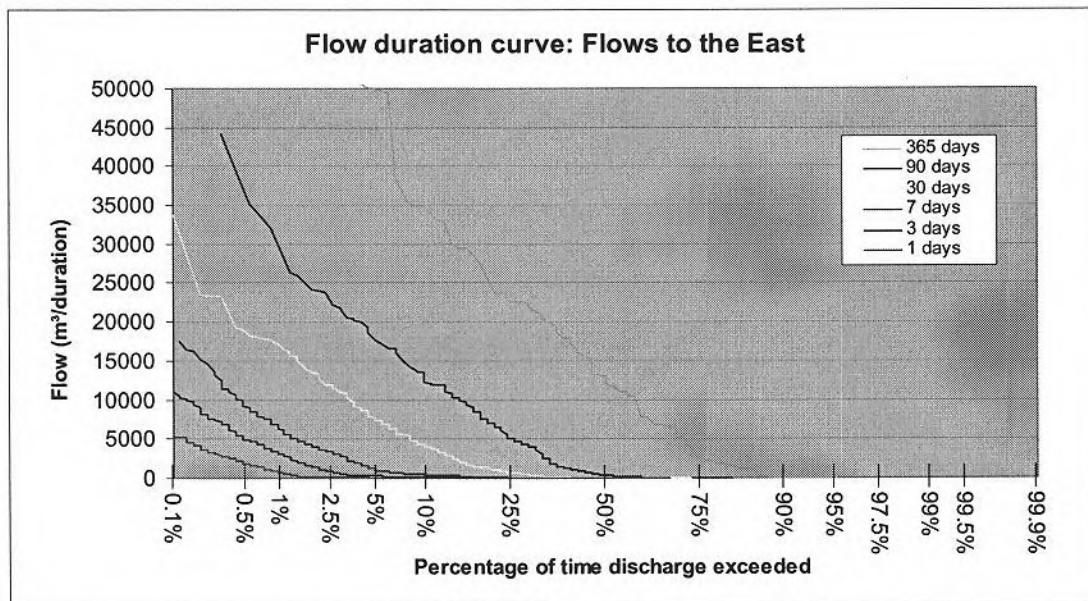




4.4 Existing Development Results

Results of the modelling for the 'existing development' conditions are presented below as per procedure outlined in Section 4.1. A summary of the MUSIC model layout and parameter values used in the existing development modelling are provided in Appendix B.

(i) Existing Development Flow Duration Curves





(ii) Existing Development Descriptive Statistics

Mean annual results (based on daily volumes for 80years of data)

	Mean Annual Volume (ML)		
	Eastern Waterway	Southern Waterway	Total Flow
Existing Flow	16.0	212	228

Daily flow analysis – Percentiles of Daily Flow Volume (based on daily volumes for 80years of data)

Percentile	Daily Flow (m ³ /day)	
	Eastern Waterway	Southern Waterway
0.01	0	0
0.25	0	0
0.5(median)	0	11
0.75	11	175
0.9	54	760
0.95	87	1300
0.99	900	11800
0.995	2000	25200



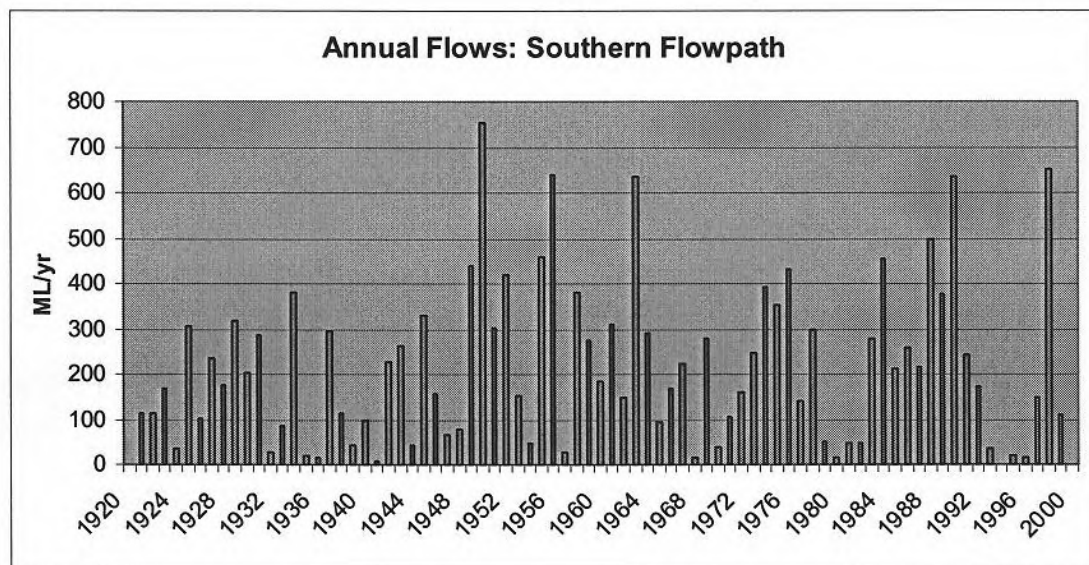
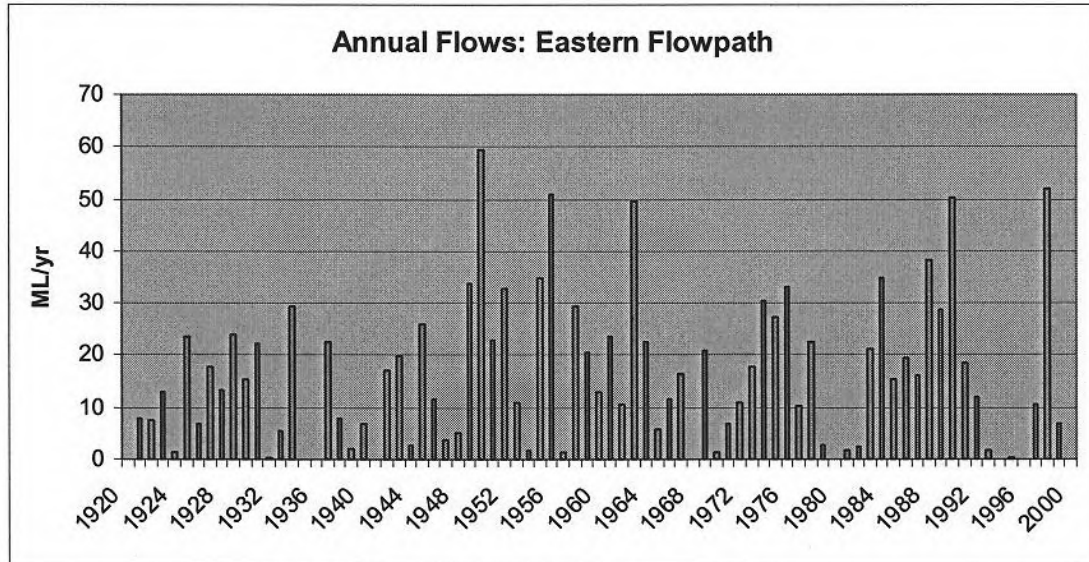
Dry spells analysis (based on daily flow volumes for 80years of data)

Percentile	Length of dry spell (days)	
	Eastern Waterway	Southern Waterway
0.01	4	1
0.05	7	1
0.1	14	1
0.25	45	2
0.5 (median)	100	3
0.75	200	6
0.9	370	9
0.95	480	14
0.99	720	21



(iii) Existing Development Histogram

See below histogram of annual flow volumes.

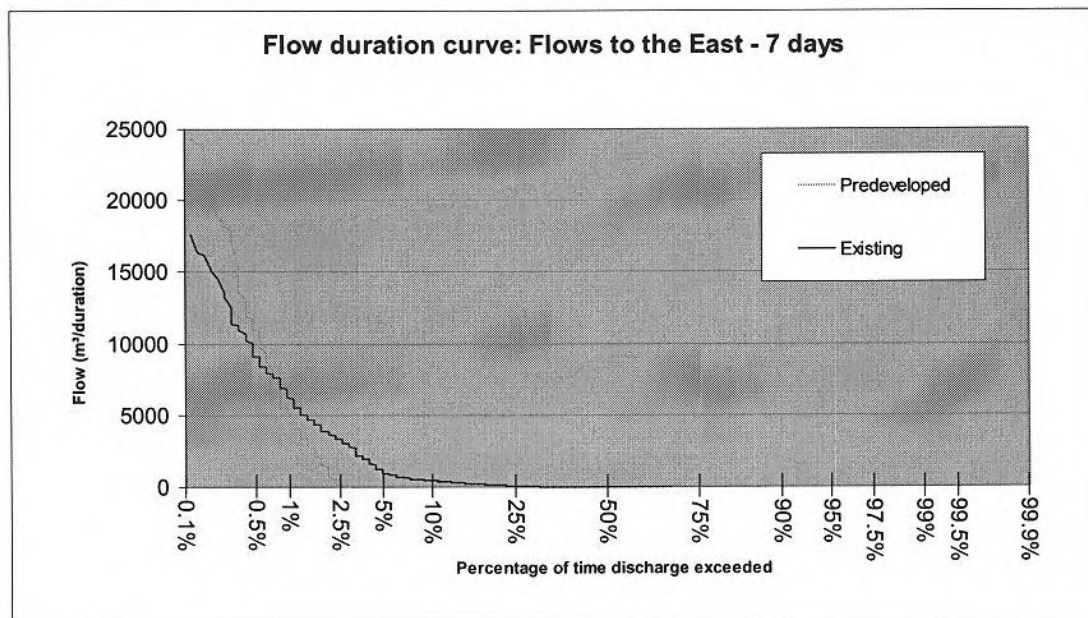
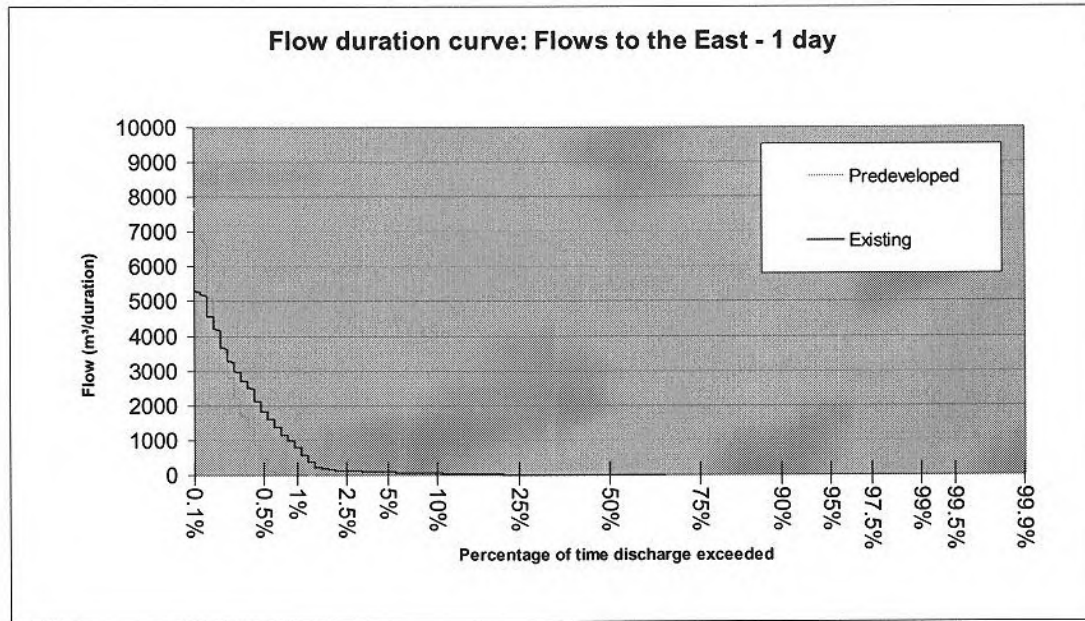


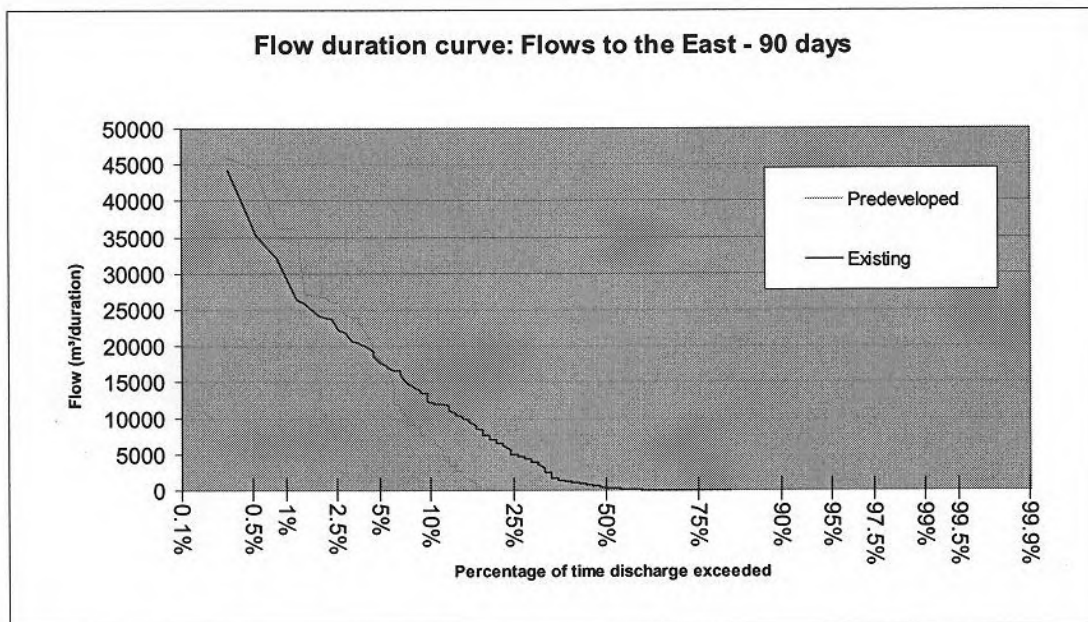


4.5 Comparison of 'Pre-Development' and 'Existing'

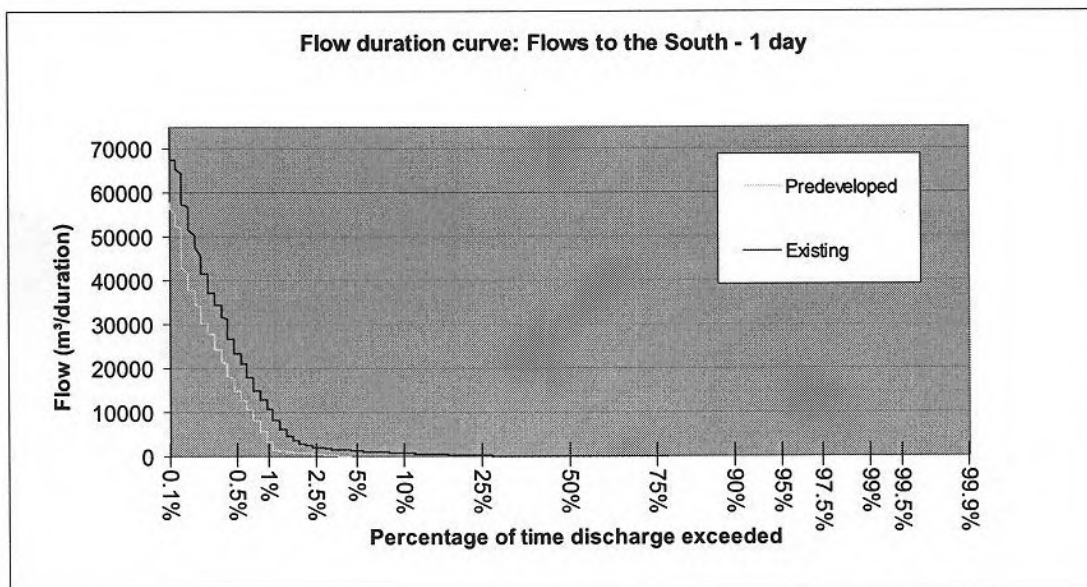
(i) Flow Duration Curves

EASTERN WATERWAY



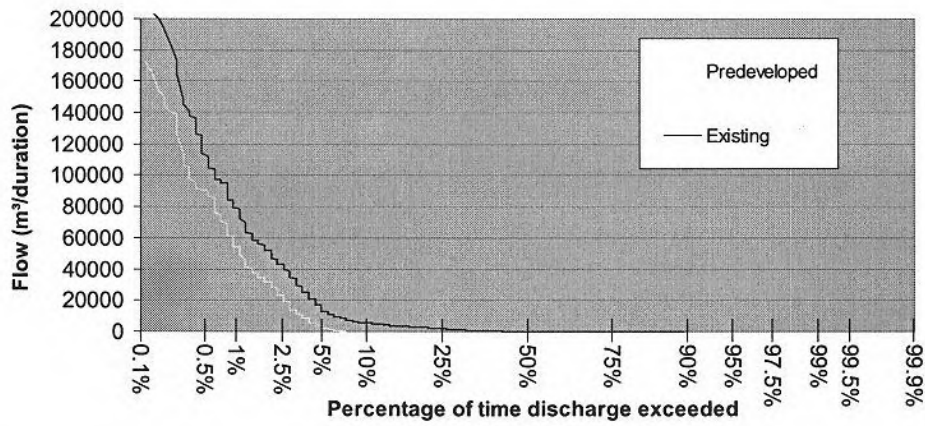


SOUTHERN WATERWAY

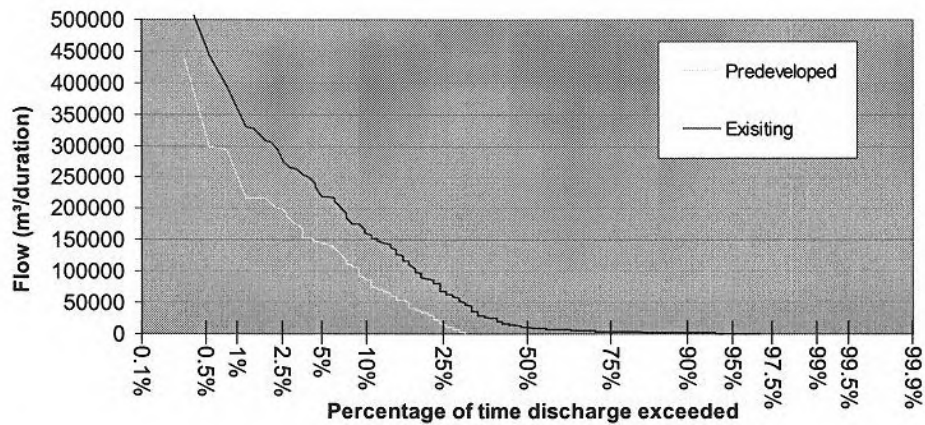




Flow duration curve: Flows to the South - 7 days



Flow duration curve: Flows to the South - 90 days





(ii) Descriptive Statistics

Mean annual results (based on daily volumes for 80years of data)

	Mean Annual Volume (ML)		
	Eastern Waterway	Southern Waterway	Total Flow
Pre Development Flow	9.0	98	107
Existing Flow	16.0	212	228

Daily flow analysis – Percentiles of Daily Flow Volume (based on daily volumes for 80years of data)

Percentile	Daily Flow (m ³ /day)			
	Eastern Waterway Pre-Development	Eastern Existing	Southern Waterway Pre- Development	Southern Existing
0.01	0	0	0	0
0.25	0	0	0	0
0.5 (median)	0	0	0	11
0.75	0	11	0	175
0.9	0	54	0	760
0.95	0	87	0	1300
0.99	30	900	4420	11800
0.995	670	2000	16200	25200

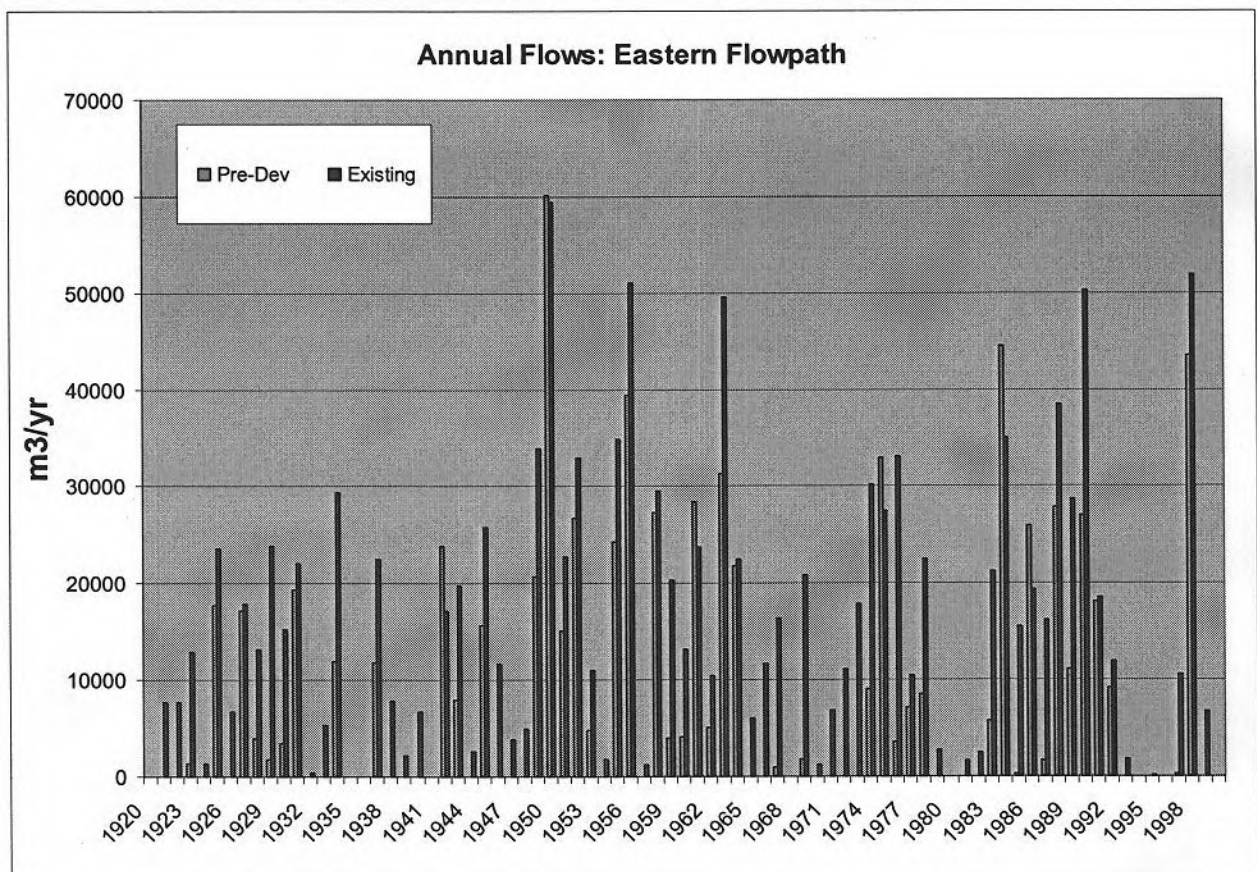
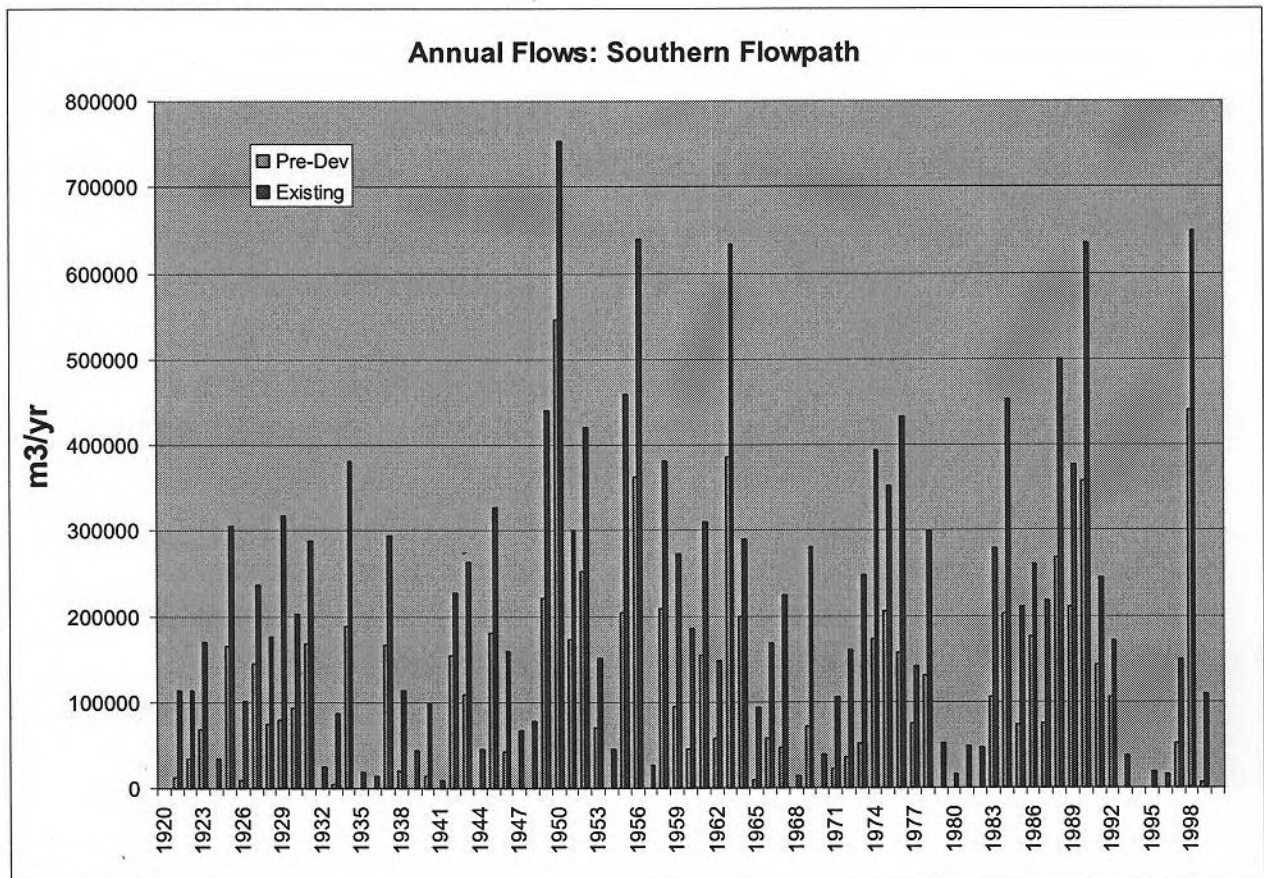


Dry spells analysis (based on daily flow volumes for 80 years of data)

Percentile	Length of dry spell (days)			
	Eastern Waterway Pre-Development	Eastern Existing	Southern Waterway Pre- Development	Southern Existing
0.01	1	4	1	1
0.05	1	7	1	1
0.1	1	14	2	1
0.25	5	45	7	2
0.5 (median)	89	100	45	3
0.75	357	200	252	6
0.9	648	370	419	9
0.95	1313	480	603	14
0.99	1868	720	1215	21



(iii) Histogram





5. Establishment of a preferred 'Post Development' WCMS

Preliminary review of the results presented in the previous sections indicates a substantial change from the 'Pre Development' hydrologic to the 'Existing' hydrology. This change will be further exacerbated by the introduction of the proposed Woolworths RDC development. The large increase in impervious surfaces that accompanies industrial/commercial land uses will undoubtedly result in a marked increase/change in runoff volumes, peak flows, flow duration characteristics, and stormwater quality. The proximity of the site to sensitive aquatic ecosystems coupled with the likely significant increase in imperviousness and associated water borne contaminants requires a carefully considered drainage and water cycle management strategy aimed at supporting the intended land uses on the site whilst also affording adequate protection to the sensitive receiving aquatic ecosystems.

There is a wide range of water cycle and stormwater management technology available to meet the stormwater management objectives outlined above. The selection of the most appropriate technology for the development requires the matching of available technology to the site conditions and management objectives. Table 1 below outlines the range of current best practice structural stormwater management technology and site conditions relevant to their use.



Table 1 Application of Stormwater Management Measures

Stormwater Measure	Potential benefits	Suitable site conditions	Unsuitable site conditions
Gross pollutant traps	Reduces litter and debris Can reduce sediment Pretreatment for other measures	Conventional drainage systems	Sites larger than 100 ha Natural channels
On-site infiltration	Reduced runoff Pollutant removal Passive irrigation	Sandy to sandy-clay soils ($k > 36$ mm/hr) Flat terrain (<5%) Deep groundwater table	Silty clay to clay soils Steep terrain Shallow groundwater table Saline groundwater Highly polluted runoff
Sediment basins	Coarse sediment capture Temporary installations Pretreatment for other measures	Available land area	Proximity to airports, landfill
Rainwater tanks	Storage for reuse Sediment removal in tank Flow retardation Reduce runoff	Proximity to roof Suitable site for gravity feed Incorporate to urban design	Non-roof runoff treatment High air pollution sites
Vegetated swales	Medium and fine particulate removal Streetscape amenity Passive landscape irrigation Flow conveyance Flow retardation Reduce runoff	Mild slopes (<4%)	Steep slopes
Buffer strips	Pretreatment of runoff for sediment removal Streetscape amenity	Flat terrain	Steep terrain
Bioretention systems	Fine and soluble pollutant removal Streetscape amenity Flow retardation Reduce runoff	Flat terrain	Steep terrain High groundwater table
Ponds	Storage for reuse Fine sediment settling Flood retardation Community & wildlife asset	Steep terrain with confined valleys	Proximity to airports, landfill
Wetlands	Community asset Medium to fine particulate and some soluble pollutant removal Flood retardation Storage for reuse Wildlife habitat	Flat terrain	Steep terrain High groundwater table Acid sulphate soils
Retarding basins	Flood retardation Community asset	Available space	Limited available space Very flat terrain



From Table 1 and considering the management objectives outlined in Section 2, the following stormwater management elements (shown schematically on Figure 5) were deemed to be appropriate for use on the site:

5.1 Car Park Centre Medians Swale Bioretention

Median strips within the small vehicle carpark are proposed to include a combined vegetated swale and bioretention systems (Figure 6). The system will be designed as a landscape feature (with dense plantings) and will allow runoff to percolate through a prescribed soil (sandy loam) media. The car park gradients would be designed and constructed to direct surface water runoff into the swale bioretention trench system (see Detail D1 on Figure 6) via the use of flush kerbs or alternatively barrier and lay-back type kerbs with lay backs used to divert gutter flow into the swales.

The swale conveys the minor design storm (typically 2–10 yr ARI) whilst maintaining a trafficable road pavement (as per conventional road drainage systems). When the capacity of the swale is reached a gully pit located at the end of the centre median drains the swale to an underlying stormwater drainage pipe (RCP). The size of the underlying drainage pipe can be smaller than would be required if impervious surfaces were directly connected to the pipe (i.e. as in a conventional pipe stormwater system) due to the swale system's attenuation of the minor storm peak flows.

The bioretention trench allows for infiltration of the ~3month ARI flow with minimal surface ponding (0.1–0.2m) through a sandy loam filter media (hydraulic conductivity of 100–150mm/hr). This design approach results in a low frequency (less than a handful of occurrences each year) of stormwater flows occurring across each driveway cross-over. The vegetated swales are to be planted out with a mixture of rush and reed species.

It is important to note that bioretention systems will not only provide water quality treatment of runoff from the car park but will also act to reduce the volume of flow. Observation and monitoring of the bioretention systems installed in Melbourne has found that the wetting and drying (evapotranspiration) processes that occurring during and following rainfall events result in a net reduction in the volume of flow by between 20–30% particularly for the regular small events. This is considered critical in the context of the Woolworths site and the surrounding ecosystems.



Outflow from the swale bioretention systems are to be collected and conveyed via underground pipe to the swale along the eastern boundary of the car park and then into the swale east of the truck turning zone.

5.2 Truck Turning 'Rain Garden' Bioretention

The centre of the truck queuing area will include a rain garden bioretention system of approximately 200m² (Figure 7). The bioretention systems will accept runoff from the truck turning area, percolated this water through a sandy loam growing (filter) media (hydraulic conductivity of 50–100mm/hr) and recover it the base of the growing media within a coarse sand drainage layer comprising a system of perforated pipes. The systems are to be densely planted out with endemic ground cover, shrubs and plants to promote the feeling of a landscaped form/feature.

Treatment of the stormwater occurs both on the surface of the garden bed and within the filter media. When large storm inflows cause temporary ponding on the surface of the garden, pollutants are removed from the stormwater through sedimentation and particulate adhesion onto the stems and leaves of the vegetation. The agitation of the surface layer of the soil caused by movement of the vegetation and the growth and die of root systems prevents the accreted sediments clogging the growing (filter) media. As stormwater percolates through the growing (filter) media fine particulates and some soluble pollutants are removed through processes such as adhesion on to the surface of the filter media particles, biological transformation of pollutants by biofilms growing on the surface of the filter media particles, and biomass uptake of nutrients and metals through the root systems of the vegetation growing in the garden.

5.3 Vegetated Swales

Vegetated swales will be utilised in lieu of pipes to convey runoff from hardstand areas around the site and discharge runoff into more intensive water treatment syetms (e.g linear and constructed wetlands). These vegetated swales will be densely planted with wetland species to provide water quality treatment.

In addition to vegetated swales the WCMS will include some linear swales that would be less densely planted. Linear swales will provide bypass flowpaths when the larger water treatment systems have reached their capacity.



5.4 Eastern Vegetated Swale

Between the eastern boundary and the truck entry lane will be long vegetated swale/linear wetland system. This component will receive treated runoff from the small vehicle carpark upstream.

A flow diversion structure (series of structures) are to be placed along this swale to divert moderate-high flows into a level spreader which will deliver flows to the eastern waterway. Low-moderate flows will be allowed to continue southward to enter the south-eastern constructed wetland.

5.5 High Water Use landscape

A large landscape area is proposed to be located in the zone between the truck queuing area and truck marshalling area (south of the RDC entry). The landscape will be specifically designed to require moderate to high amounts of irrigation which will be supplied from the constructed wetland in the south eastern corner.

5.6 South Eastern Constructed Wetland

A large constructed wetland system is proposed to be constructed in the south eastern corner of the site and will occupy an area of approximately 0.8-0.9ha under normal water level conditions (~1.3ha under full flow conditions). This wetland would accept treated stormwater runoff from upstream hardstand areas including the small vehicle carpark, truck queuing area, truck marshalling areas and the eastern roof. The wetland is specifically design to provide both water quality treatment and regulation of flows/water balance.

The nature of land use in the catchment, being hardstand industrial, and the position of the wetland within the WSUD stormwater 'treatment train', requires the wetland to remove a principally fine sediment, suspended sediment, particulate nutrients and some soluble nutrients. The wetland will capture and retain the stormwater runoff for a period of approximately 72 hours to provide substantial removal of particulate pollutants and removal of soluble pollutants from the stormwater. The wetland plants (macrophytes) will play an important role in aiding the improvement the quality of water through:

- physical trapping



- chemical adsorptions
- biological absorption
- biological and chemical transformations (see Section 3 for more detail).

The wetland comprises three distinct functional elements (zones) that are important in the successful functioning of the system. These are:

- Inlet zone – removes coarse sediment and controls the delivery of stormwater flows into macrophyte zone, prevents coarse sediments from smothering wetland vegetation in the macrophyte zone and provides the hydraulic control required to manage flows into the macrophyte zone and to ensure flood flows are diverted away from the macrophyte zone (via the bypass system). The inlet zone is sized to settle out particles down to approximately 125 microns in size.
- Macrophyte zone – predominantly wet marsh zone with some ephemeral zones and open water. Uses a combination of physical, chemical and biological processes to intercept and retain/process fine sediment and associated particulate nutrients and heavy metals, soluble nutrients, and pathogens. Requires quiescent flow conditions (velocities generally kept below 0.05m/s) and long detention times (72 hours) to achieve optimal water quality improvement.
- Bypass System – conveys flood flows away from the wetland macrophyte zone providing protection to the wetland plants (macrophytes) and preventing scouring of the bed sediments in the macrophyte zone. The

As indicated in Figure 8 the majority of flows from the wetland will outlet to the central drain while a portion of the high flow will also be directed across the eastern boundary using a flow spreading system.

Waters stored in the wetland will be used as the source of irrigation for the high waster use landscape zone.

5.7 Western Constructed Wetland & Central Channel

The western constructed wetland will be designed to accept water form the western portion of the proposed development (i.e from vegetated swales) and the upstream



parts of the Warnervale Business Park. This constructed wetland will also be designed to be consistent with the south eastern constructed wet land and will include the distinct functional elements discussed above.

Flows from the wetland will be discharged back into the adjacent Central Channel, which will act as a high flow bypass in larger runoff events and will be designed to cater for the 1 in 100 Year ARI event. The central channel will be designed as a natural channel and will discharge into an existing channel downstream of the southern boundary of the RDC site.

5.8 Rainwater Tanks

Rainwater tanks (5 x 20kL) are provided on the western side of the RDC building to collect roof runoff for reuse in toilets (demand 6kL/day). Details provided by Beca Pty Ltd.

5.9 Flow Diversion to Eastern Waterway

A key component of the WSUD scheme is the appropriate delivery of flows to the eastern waterway. This is to occur via a flow diversion strategy and flow spreading system. The flow spreader will deliver flows across a 100m wide zone the location of this area has been identified as between 150, 250m north of the south eastern corner. Further review of the spreader location is to occur with Council as part of detailed design.

In addition to the flow spreader a flow diversion strategy has been established to deliver flows to the eastern waterway in a way that replicates Pre Development behaviour. This involves

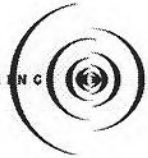
- moderate to high flows along the swale located on the eastern side of the truck turning area will be diverted to the east to mimic aspects of the predevelopment hydrology, specifically the frequency of flow events and volume for smaller flow events.
- collection of waters from the wetland at high water level conditions to deliver the required volume under high flow events.

The design of the flow diversion structure is dictated by a number of Pre Development hydrological factors (flow duration, volume, dry spells, flow



frequency). Due to time constraints the modelling undertaken for this assessment (see results in next section) was restricted to providing close agreement of Pre and Post Development annual/total volumes to the east and median dry spell lengths.

Further refinement of the flow diversion structure must be undertaken during detailed design to achieve suitable agreement to the other hydrological factors which dictate the sustainability of the aquatic habitat to the east.

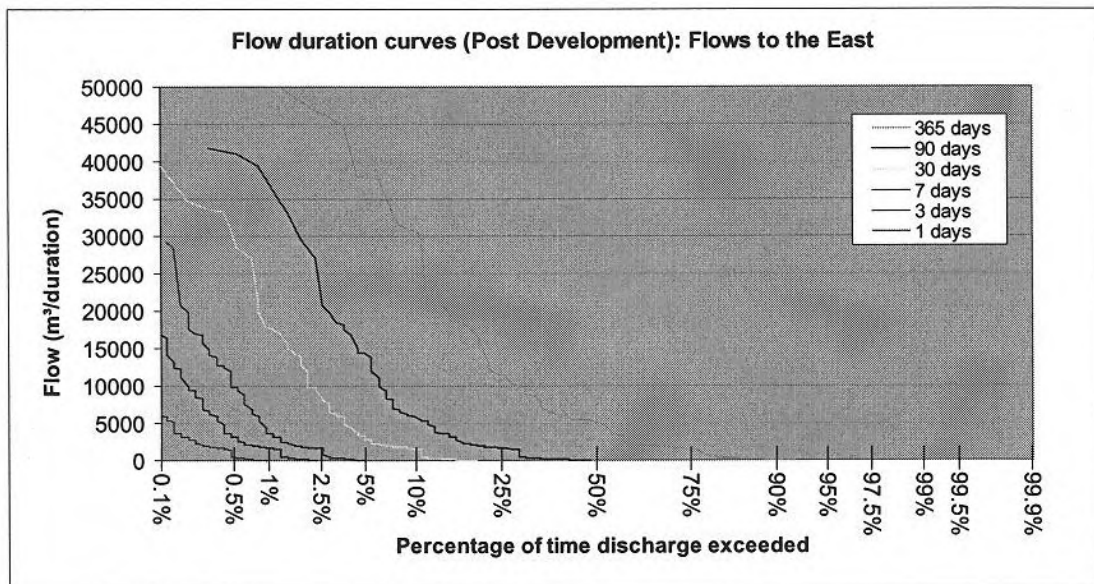


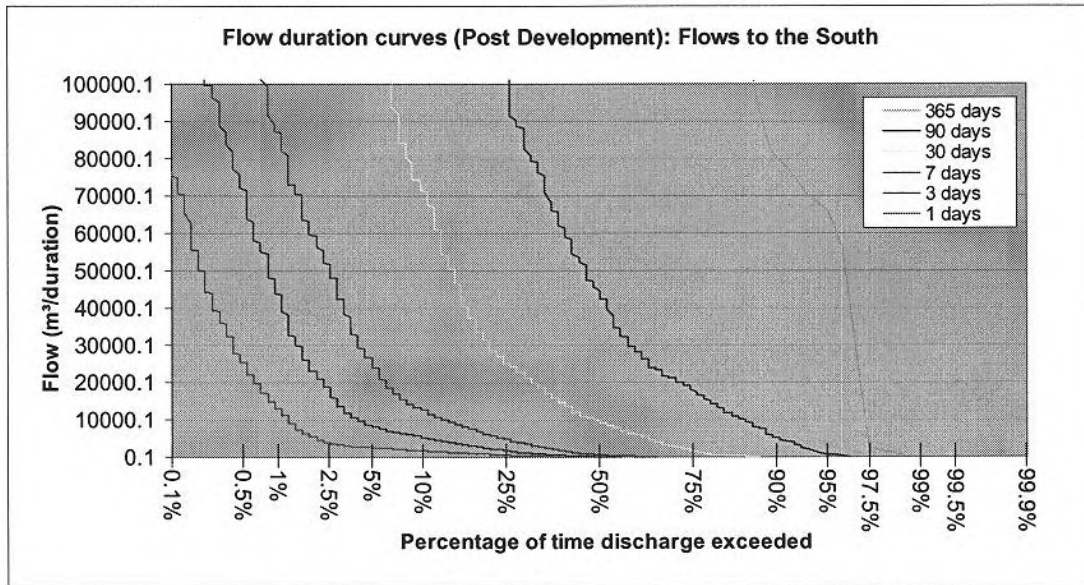
6. Assessment of 'Post Development' WCMS

The performance of the WCMS described above was simulated by adjusting the 'Existing' Development MUSIC model to reflect 'Post Development' conditions on the site and including the WCMS elements.

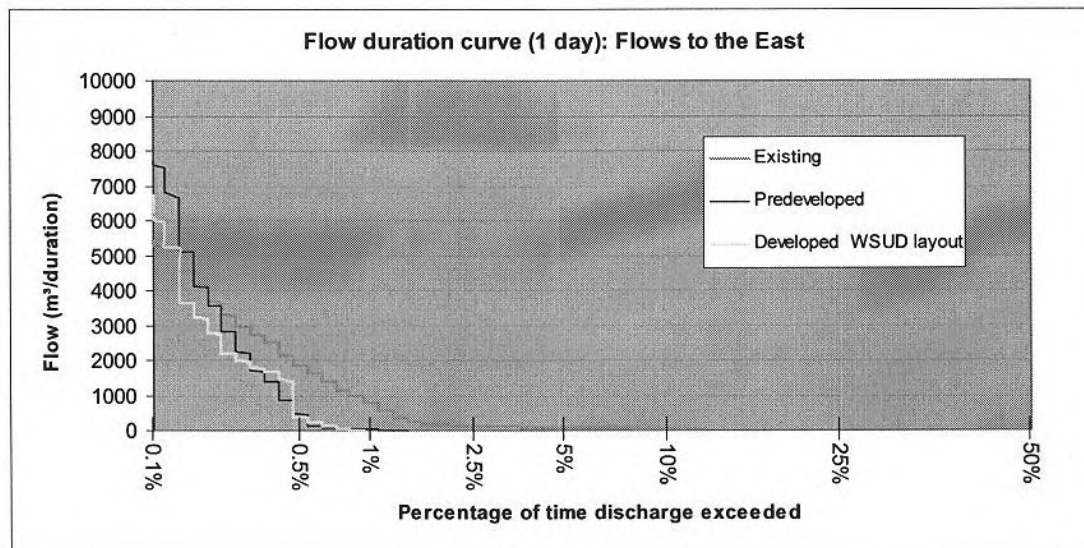
Results of the modelling for the 'Post Development' conditions are presented below as per procedure outlined in Section 4.1. A summary of the MUSIC model layout and parameter values used in the post development modelling are provided in Appendix C.

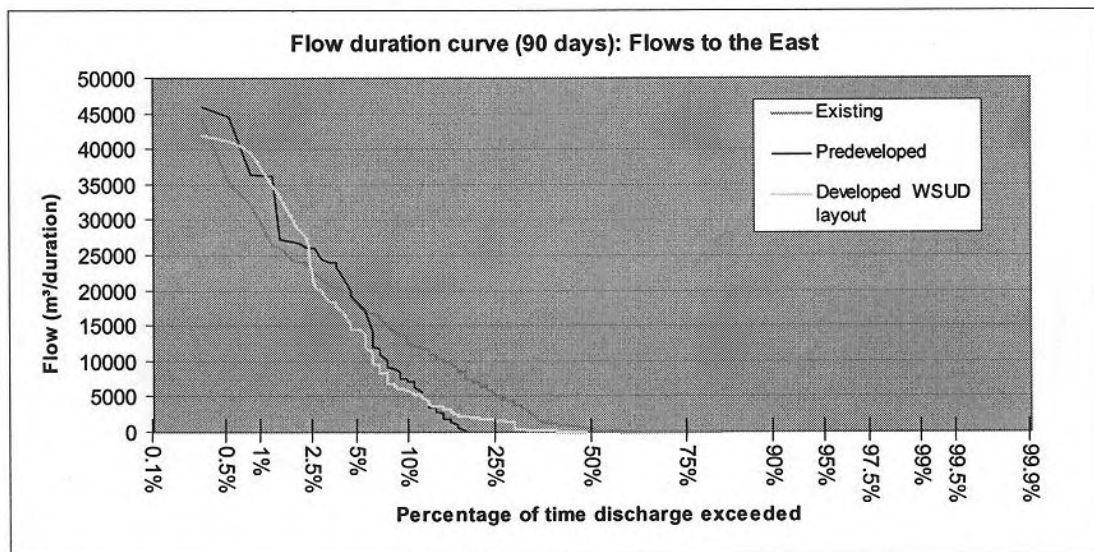
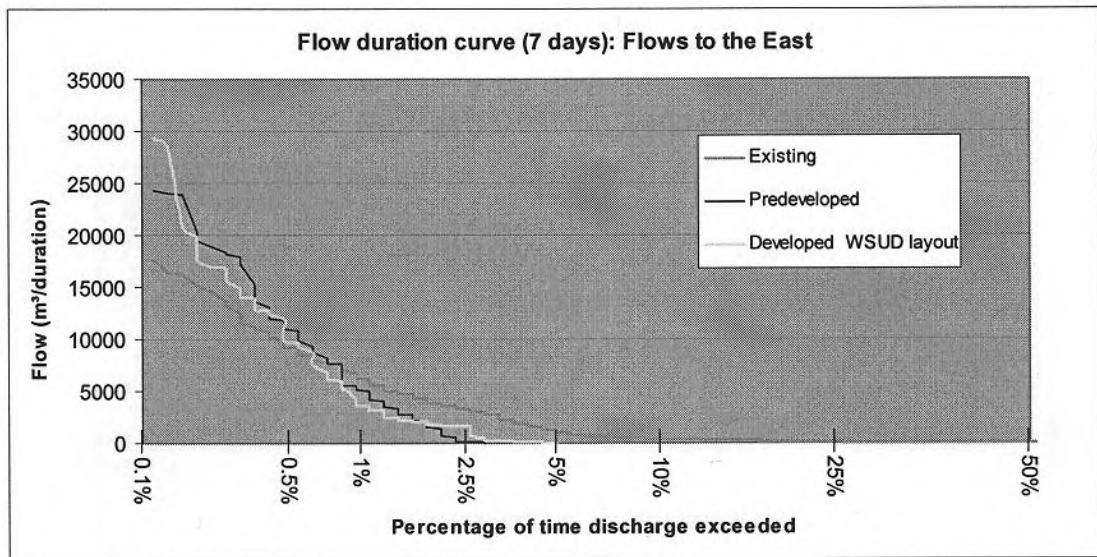
(i) Flow Duration Curves





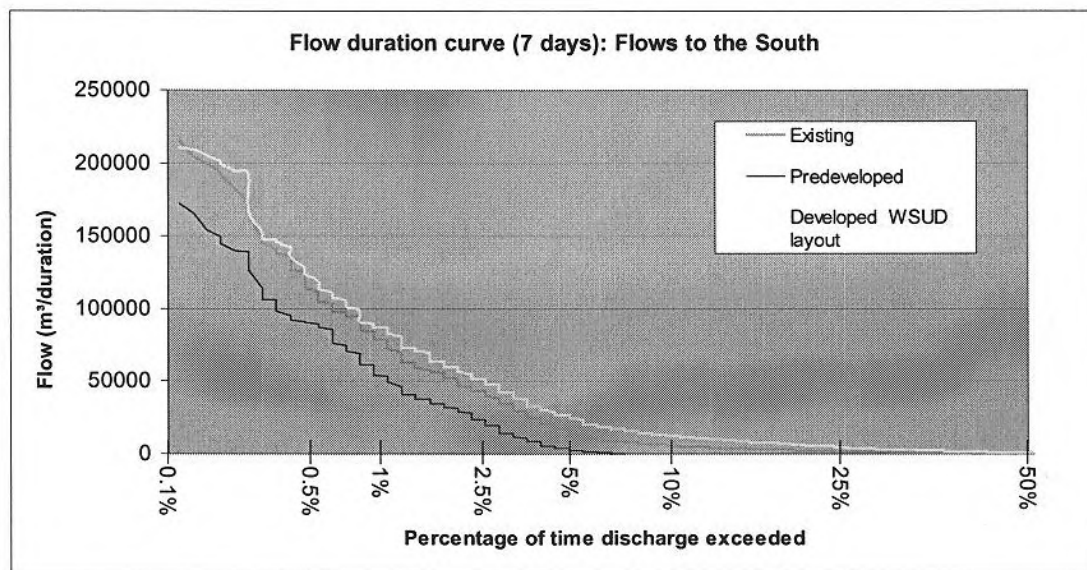
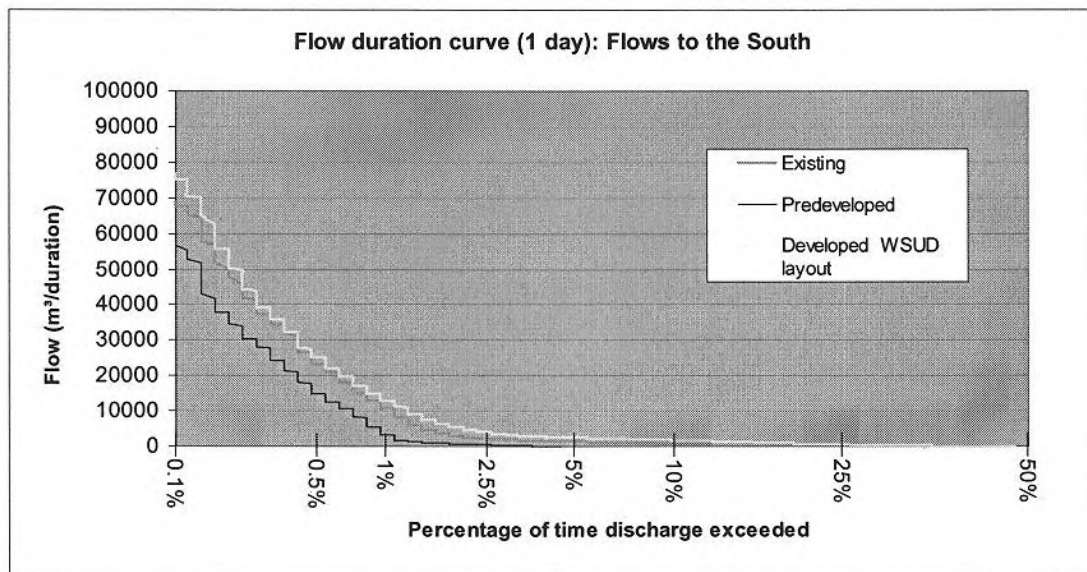
EASTERN WATERWAY COMPARISON

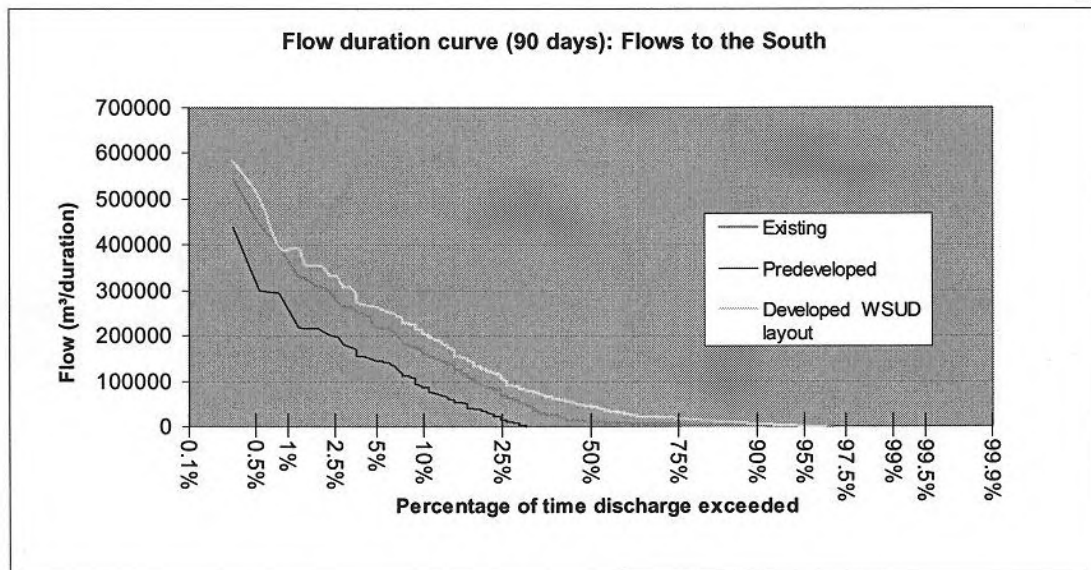






SOUTHERN WATERWAY COMPARISON





(ii) Descriptive Statistics

Mean annual results (based on daily volumes for 80 years of data)

	Mean Annual Volume (ML)		
	Eastern Waterway	Southern Waterway	Total Flow
Pre Development Flow	9.0	98	107
Existing Flow	16.0	212	228
Post Development (NO WSUD)	–	–	424
Post Development with WSUD	9.3	318	327



Daily flow analysis – Percentiles of Daily Flow Volume (based on daily volumes for 80years of data)

Percentile	Daily Flow (m ³ /day)			
	Eastern Waterway Pre-Development	Eastern Post Development with WSUD	Southern Waterway Pre- Development	Southern Post Development with WSUD
0.01	0	0	0	0
0.25	0	0	0	0
0.5 (median)	0	0	0	0
0.75	0	0	0	551
0.9	0	0	0	1811
0.95	0	0	0	2590
0.99	30	0	4420	14029
0.995	670	492	16200	26401

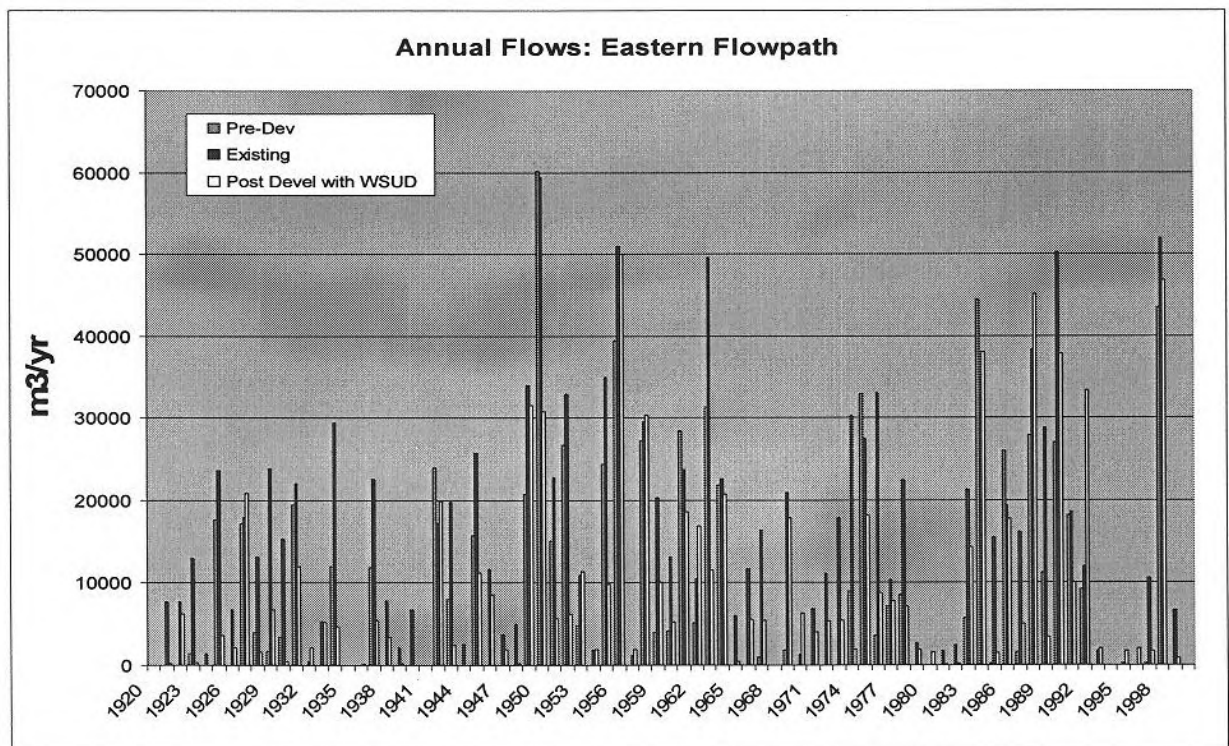
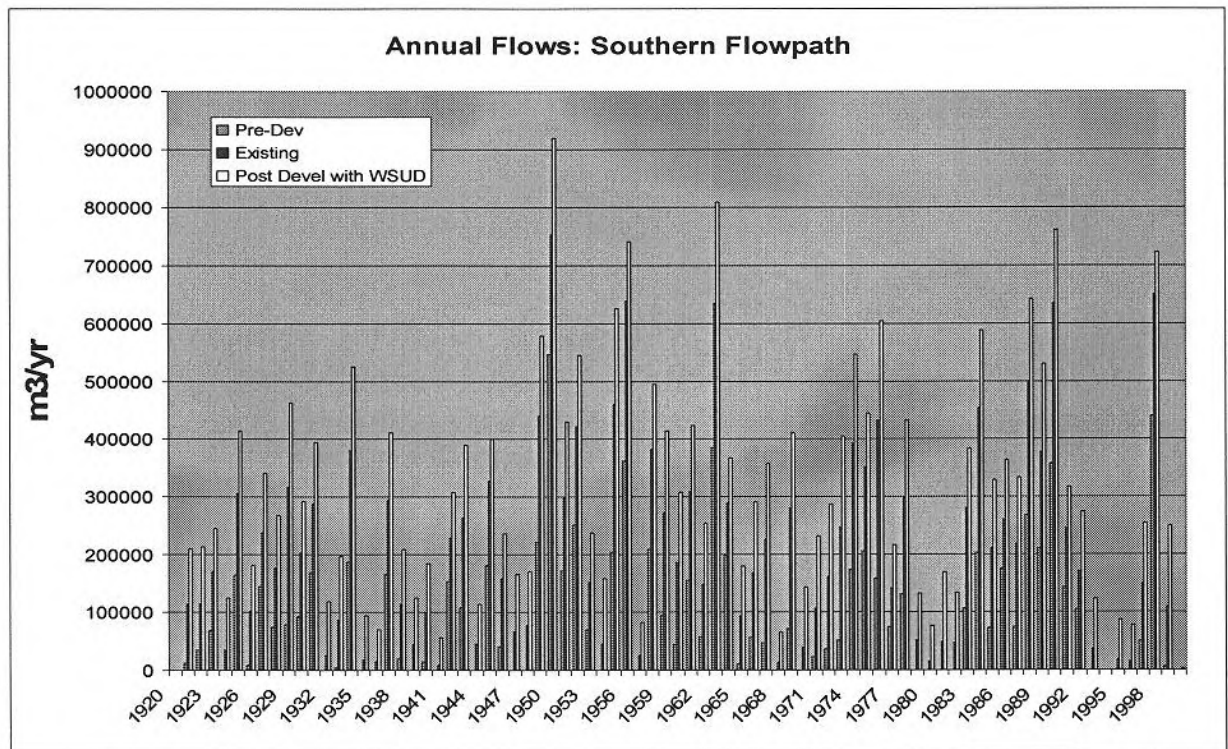


Dry spells analysis (based on daily flow volumes for 80years of data)

Percentile	Length of dry spell (days)			
	Eastern Waterway Pre-Development	Eastern Post Development with WSUD	Southern Waterway Pre- Development	Southern Post Development with WSUD
0.01	1	1	1	0
0.05	1	2	1	1
0.1	1	6	2	1
0.25	5	25	7	2
0.5 (median)	89	76	45	6
0.75	357	172	252	13
0.9	648	276	419	33
0.95	1313	346	603	44.5
0.99	1868	572	1215	84.4



(iii) Histogram





(iv) Water Quality Outcomes

Stormwater quality treatment results as provided by MUSIC for the following locations indicates the WCMS strategy meets Councils Stormwater Management Plan requirements.

1. the from wetland located in the south eastern corner

	Sources	Residual Load	% Reduction
Flow (ML/yr)	154	102	33.8
Total Suspended Solids (kg/yr)	43.1E3	2.27E3	94.7
Total Phosphorus (kg/yr)	57.1	12.3	78.5
Total Nitrogen (kg/yr)	622	180	71.1
Gross Pollutants (kg/yr)	3.70E3	0.00	100.0

2. the wetland located on the western boundary

	Sources	Residual Load	% Reduction
Flow (ML/yr)	265	222	16.4
Total Suspended Solids (kg/yr)	57.1E3	12.7E3	77.8
Total Phosphorus (kg/yr)	87.2	31.1	64.4
Total Nitrogen (kg/yr)	826	428	48.2
Gross Pollutants (kg/yr)	3.40E3	0.00	100.0

NOTE: The treatment effectiveness in this case includes the retardation basin (heathland zone) located upstream of the site within the Business Park.



3. the total site including the upstream flows from 'Existing' catchment.

Treatment Train Effectiveness - Receiving Node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	419	323	22.8
Total Suspended Solids (kg/yr)	100E3	15.0E3	85.1
Total Phosphorus (kg/yr)	144	43.4	70.0
Total Nitrogen (kg/yr)	1.45E3	608	58.0
Gross Pollutants (kg/yr)	7.11E3	0.00	100.0

NOTE: The treatment effectiveness in this case includes the retardation basin (heathland zone) located upstream of the site within the Business Park.



7. Discussion and Conclusion

7.1 Pre Development Hydrology & Water Balance

The key findings of the pre development modelling indicate that:

- overflow out of the preferred southern waterway to the eastern-south eastern waterway occurs on average two (2) times per year.
- the volume of runoff flowing across the eastern boundary is significantly less than that flowing across the southern boundary.
- very little or no flow discharges from the catchment most of the time (98–99%).
- the heathland storage plays and particularly important role in reducing the volume and frequency of flows from the catchment, and in regulating the wetting and drying regime of the receiving environments.
- approximately 10 times the amount of annual runoff (98.2 ML/yr) is discharged from the southern boundary compared to the eastern boundary (9.0 ML/yr) under pre-development conditions. The predevelopment median dry spell in the southern waterway is half of that in the eastern waterway.

7.2 Existing Development Hydrology & Water Balance

The key findings of the existing development modelling indicate that:

- overflow out of the preferred southern waterway to the eastern-south eastern waterway occurs on average nine (9) times per year.
- on average approximately 13 times the amount of annual runoff is discharged from the southern boundary compared to the eastern boundary in the existing condition.
- the heathland storage has been significantly reduced (in comparison to pre development) resulting in a change to the wetting and drying cycles/periods of receiving environments.

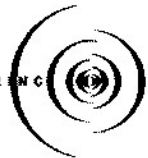


- the existing development has created more regular low flow events with the probability of there being flow on any given day increasing from 5% to 75%. This change to low flows also occurs to the east and it is expected that there will be fewer large flows to the east due to the construction of the central channel which increases conveyance to the south.
- the reduction in the amount of flows from the south to the east is also reflected by the increased length of dry spells that the eastern waterway experiences under existing conditions. In strong contrast the length of the dry spells in the southern waterway (now the central channel) has been dramatically reduced (i.e. median length reduced from 45 to 3 days).

7.3 Post Development Hydrology, Water Balance & Pollutant Removal

The key findings of the existing development modelling indicate that:

- If the Woolworths RDC site were to be developed incorporating WCMS and WSUD management measures the total volume of runoff from the whole catchment would be two times that of the 'Existing' case and four times that of the 'Pre Development'.
- a WSUD stormwater drainage system has been developed for the site that maximises the treatment (quality and quantity) of stormwater runoff as close to its source as possible. The recommended drainage system represents current best practice in urban stormwater management and achieves effective stormwater quantity and quality treatment affording maximum protection to eastern and southern waterways.
- a key component of the WSUD scheme is the appropriate delivery of flows to the eastern waterway. This is to occur via a flow diversion strategy (see below) and flow spreading system. The flow spreader will deliver flows across a 100m wide zone – the location of this area has been identified as between 150–250m north of the south eastern corner and will be refined during detailed design.
- a flow diversion strategy has been established to deliver flows to the eastern waterway in a way that replicates 'Pre Development' behaviour. This involves:



- moderate to high flows along the swale located on the eastern side of the truck turning area will be diverted to the east to mimic aspects of the predevelopment hydrology, specifically the frequency of flow events and volume for smaller flow events.
- collection of waters from the wetland at high water level conditions to deliver the required volume under high flow events.

NOTE: The design of the flow diversion structure is dictated by a number of 'Pre Development' hydrological factors (flow duration, volume, dry spells, flow frequency). Due to time constraints the modelling undertaken for this assessment was restricted to providing close agreement of Pre and Post Development annual/total volumes to the east and median dry spell lengths.

We are confident that further refinement of the flow diversion structure can achieve suitable agreement to the other hydrological factors which dictate the sustainability of the aquatic habitat to the east. This must be undertaken as part of detailed design.

- The WSUD strategy results in a significant reduction in flow volume being delivered to the south when comparing Post Development with and without WSUD. However, there is still an increase in flow volume to the south compared to 'Pre Development' and 'Existing' conditions.
- The WSUD strategy provides best practise stormwater quality treatment of runoff from the site as per Councils SMP requirements (90% removal of TSS, 50% removal of nutrients).

7.4 Conclusion

A WSUD stormwater drainage system has been developed for the site that maximises the treatment (quality and quantity) of stormwater runoff as close to its source as possible. The recommended drainage system represents current best practice in urban stormwater management and achieves effective stormwater quantity and quality treatment affording maximum protection to eastern and southern waterways.

A flow diversion strategy has been developed to ensure the flows to the eastern waterway Post Development are close to those which existed Pre Development. The current design of the diversion strategy has been refined based on reproducing



annual/total volumes to the east and median dry spell lengths. Further refinement of the strategy is to be undertaken as part of detailed design to ensure other hydrological characteristics of the eastern waterway are accommodated for.

The development will result in a significant increase in flow volume and flow frequency to the southern waterway, however, the WSUD strategy developed for the site affords the maximum possible protection to the southern waterway.

Considering the above we recommend:

- that Council consider the S96 proposal with the confidence that the eastern drainage pathway can be adequately protected from runoff quality and quantity changes brought about by the Woolworths development
- that the WCMS and WSUD strategy (in particular the flow diversion) be further refined in detailed design phase
- that a strategy be developed to systematically assess potential future land use change within the estate and wider catchment and how the impact of any changes on the downstream receiving environments can be managed.



Appendix A - 'Pre-developed' MUSIC Modelling

This appendix describes the MUSIC models used for this project and is intended to provide an overview of the adopted modeling approach. A complete list of modeling parameters has not been included, though electronic copies of the model files are available from Ecological Engineering upon request. Such requests should be made through Wyong Shire Council.

Modelling the Pre-developed Catchment

The catchment model used was MUSIC (Model for Urban Stormwater Improvement Conceptualisation) developed by the CRC for Catchment Hydrology. The following text describes the 'Pre-Development' MUSIC model layout and parameters. The set-up of the MUSIC model involved:

- Definition of sub-catchments
- Setting climate conditions (ie. rainfall, evapotranspiration)
- Calibrating rainfall runoff characteristics and MUSIC moisture stores for individual land use categories

Sub-Catchments

Figure A1 shows the discretisation of the MUSIC model for the 'Pre-Development' site and catchment.

'Pre Development' Case MUSIC Catchments

ID	Catchment Area	Landuse
AB Lumped catchments A & B	23.15 ha	Rural residential
CDE	11.74	Forest
FGH	13.99	Forest
IJK	9.53	Forest
LMN	15.12	Forest
OQ	3.40	Forest
P	6.32	Forest



Car Park Centre Median Bioretention as landscape features to collect runoff and percolates through prescribed soil filtration media that is densely vegetated. Research by CRC indicates best practise treatment of runoff using bioretention results in 25-30% reduction in flow volume for all events under Q3mth (through wetting and evapotranspiration)



Heavily Vegetated Swale – Linear Wetland Systems to convey flow in lieu of pipes and provide treatment prior to discharge or entering storage.



Rainwater Tanks (5 x 20kL Tanks) have been provided for in the Woolworths design to capture roof runoff from the western section of the roof for reuse in toilets.



Large Constructed Wetland/Water Storage as landscape features to collect and treat flows from swales, store low flows for reuse and provide attenuation to larger flows. The functional elements of the wetland (storage, hydraulic controls) to be geared to ensure flood flows are stored and bypass is triggered and that appropriate frequency of flow delivered to the east.
NOTE: Most stormwater runoff from the RDC site must reach wetland/storage.



Riser control structure to manage water level in wetland/storage and deliver flows to southern drain



High Water Use Landscape to provide sink for waters stored in wetland.

Steep section – will require scour protection

LEGEND

- ➔ Vegetated Swale (conveyance only)
- Inlet Pits – Swale to Pipe System
- ☞ Stormwater Wetland
- ➔ Conventional Drainage (culverts/pipes)
- Conventional "Inter Allotment" Drainage
- ➔ Vegetated Swale (Linear Wetland) Treatment Systems

SEE DETAIL D1

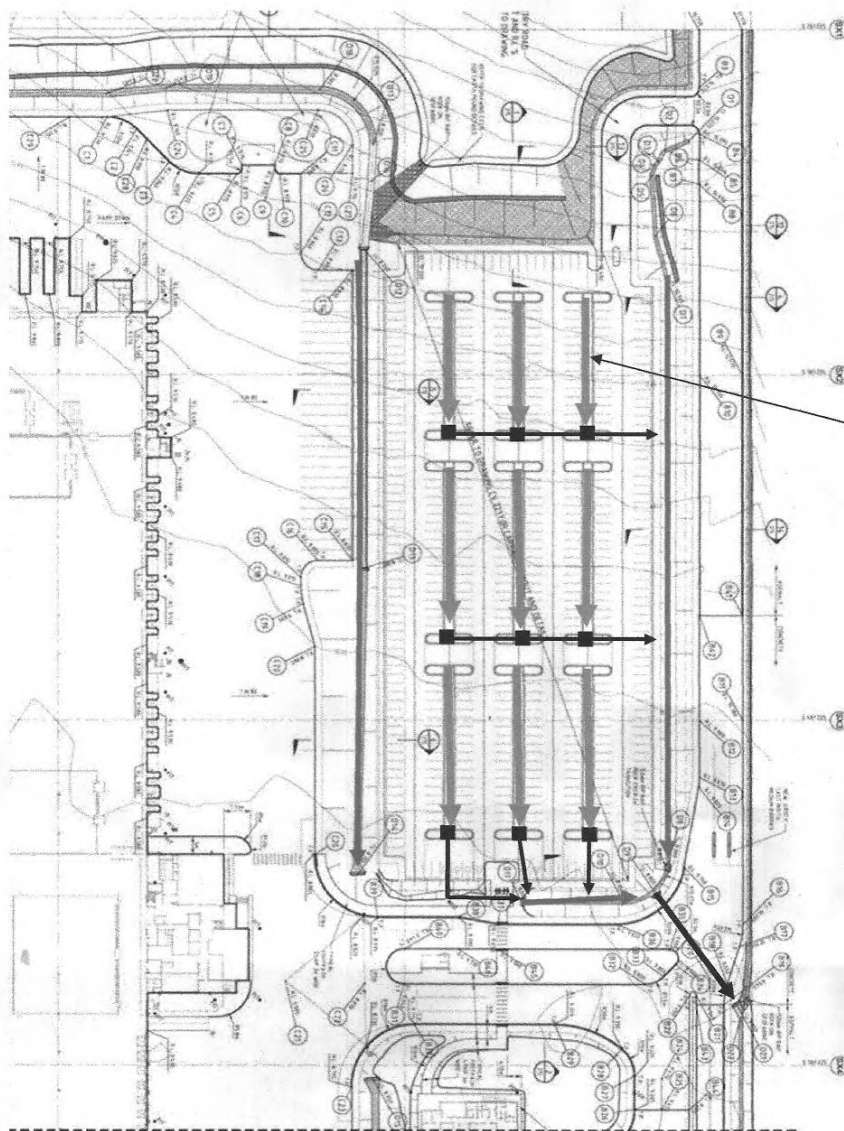


"Rain Garden" Bioretention as landscape features to collect runoff and percolates through prescribed soil filtration media that is densely vegetated. Research by CRC indicates best practise treatment of runoff using bioretention results in 25-30% reduction in flow volume for all events under Q3mth (through wetting and evapotranspiration)

Level spreader – width to be defined (approx 100 wide). Further refinement as part of detailed design.

Hydraulic structure to control volume and frequency of outflow to the east.

Figure 5
Woolworths RDC WSUD Strategy
Drawing: Woolworths RDC Refine D1 Revision: 03 Date: 27/05/04 Design: SL



LEGEND

- ➡ Vegetated Swale (conveyance only)
- Inlet Pits – Swale to Pipe System
- ☁ Stormwater Wetland
- ➡ Conventional Drainage (culverts/pipes)
- Conventional "Inter Allotment" Drainage
- ➡ Vegetated Swale (Linear Wetland) Treatment Systems



Car Park Centre Median Bioretention as landscape features to collect runoff and percolates through prescribed soil filtration media that is densely vegetated.

See typical configuration below.

Research by CRC indicates best practise treatment of runoff using bioretention results in 25-30% reduction in flow volume for all events under Q3mth (through wetting and evapotranspiration)

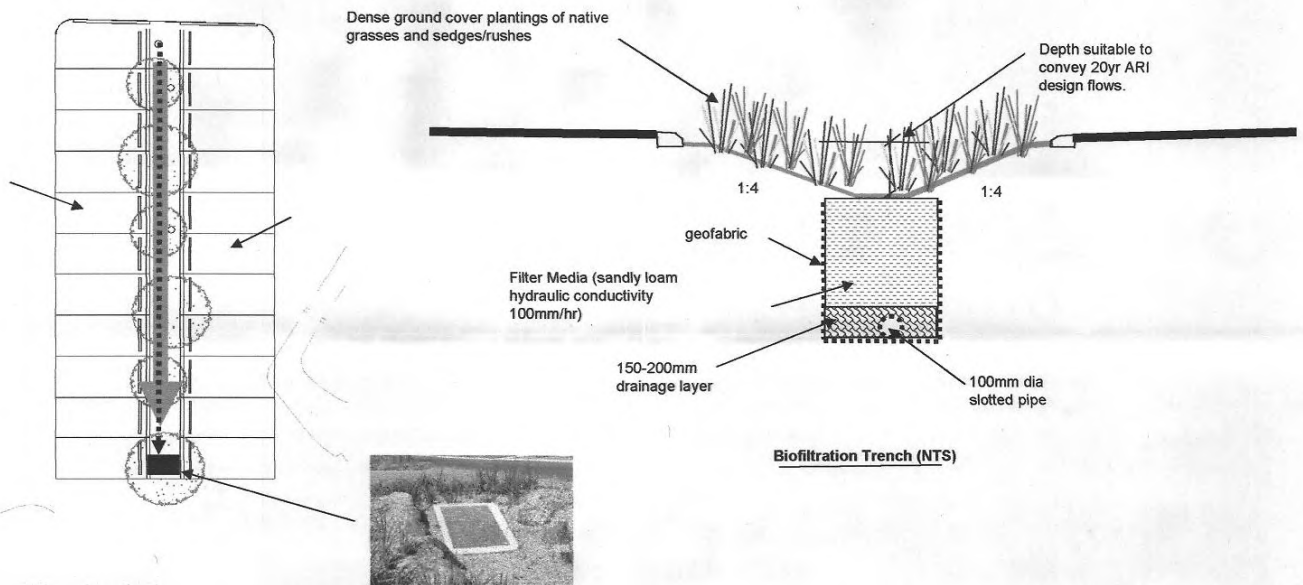


Figure 6
DETAIL D1 – Carp Park Swale Bioretention

Drawing: Woolworths RDC Refine D2

Revision: 01 Date: 27/05/04 Design: SL

'Rain Garden' Bioretention System

- 200m²
- Surface level = 8.3m
- Filter media depth (including drainage layer) = 0.6
- Drainage outlet invert = 7.7m

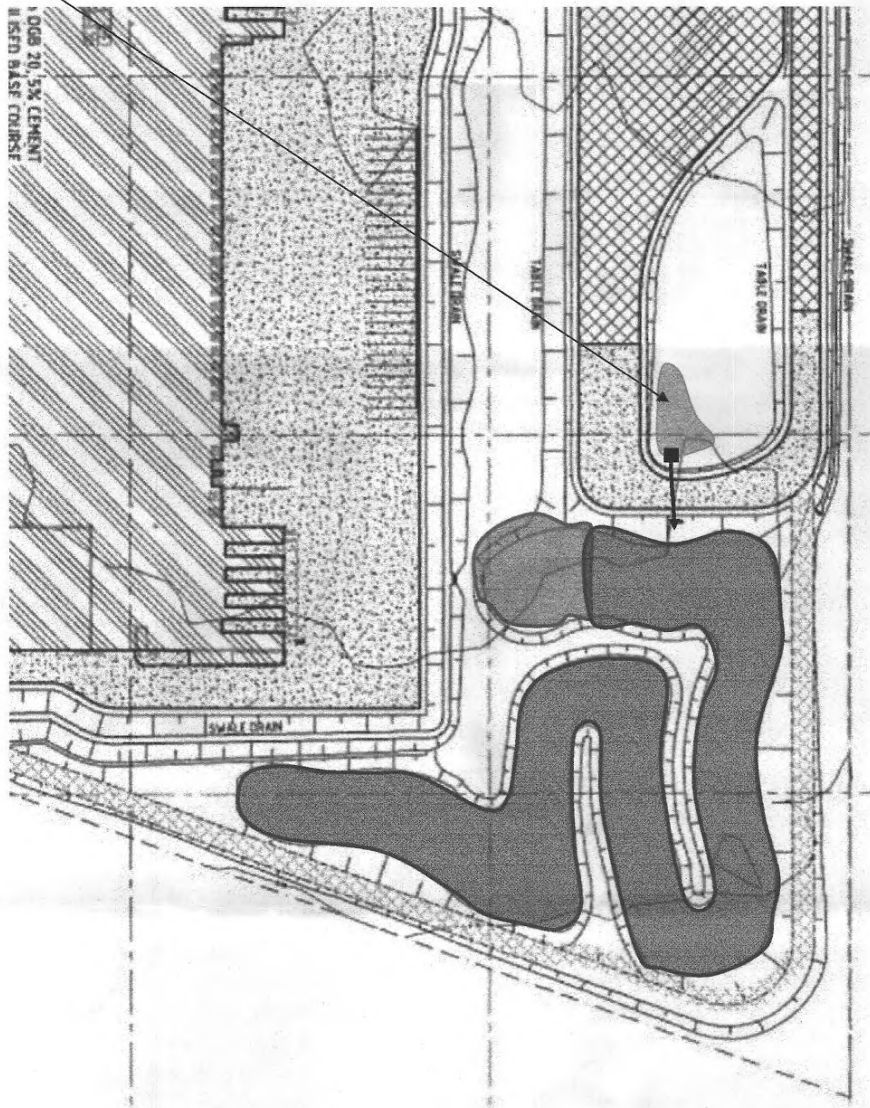
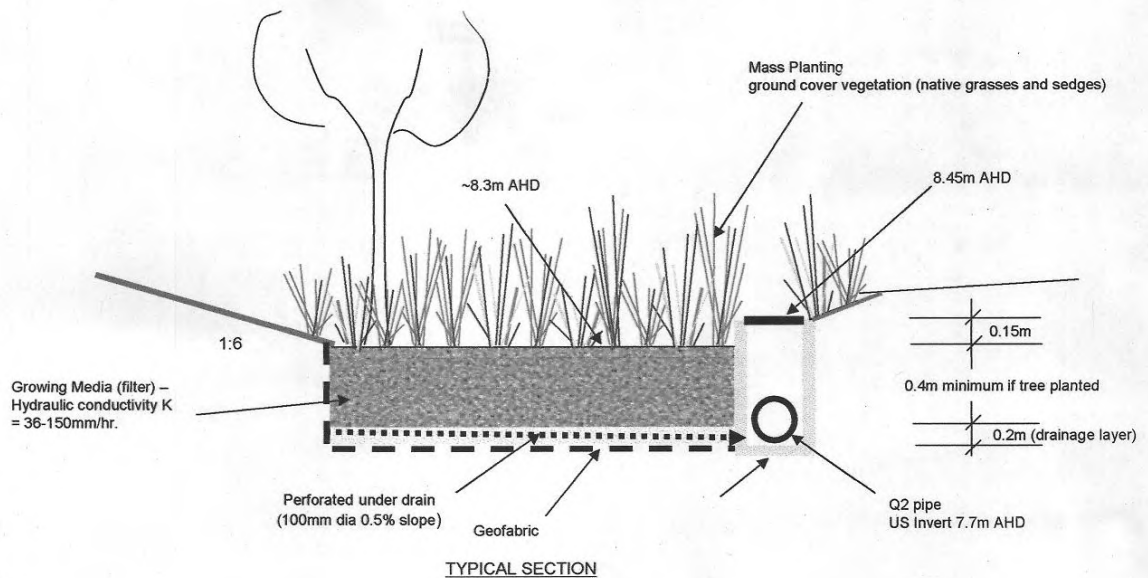
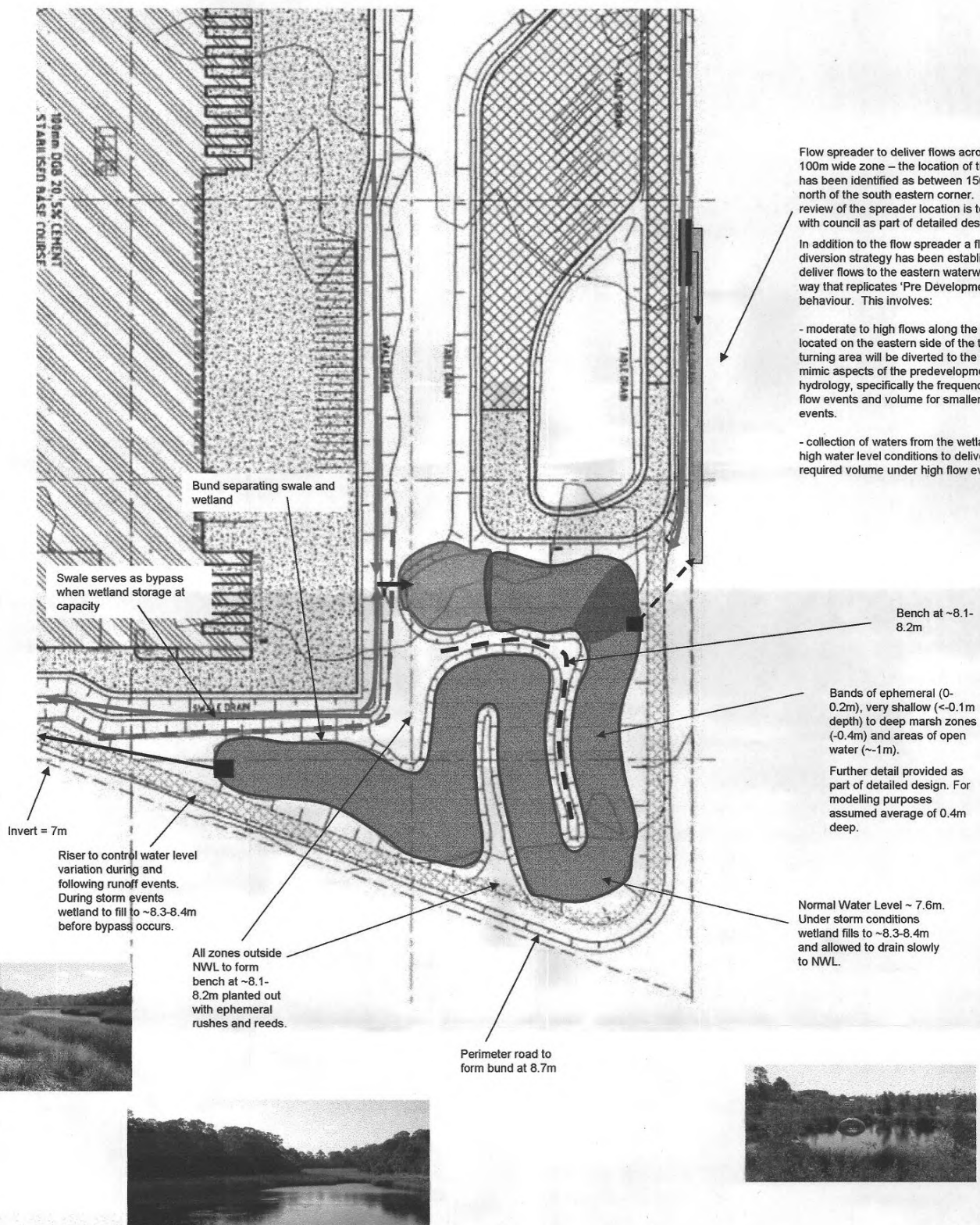


Figure 7
Carp Park 'Rain Garden' Bioretention

Drawing: Woolworths RDC Refine D4

Revision: 02 Date: 28/05/04 Design: SL





Subcatchments

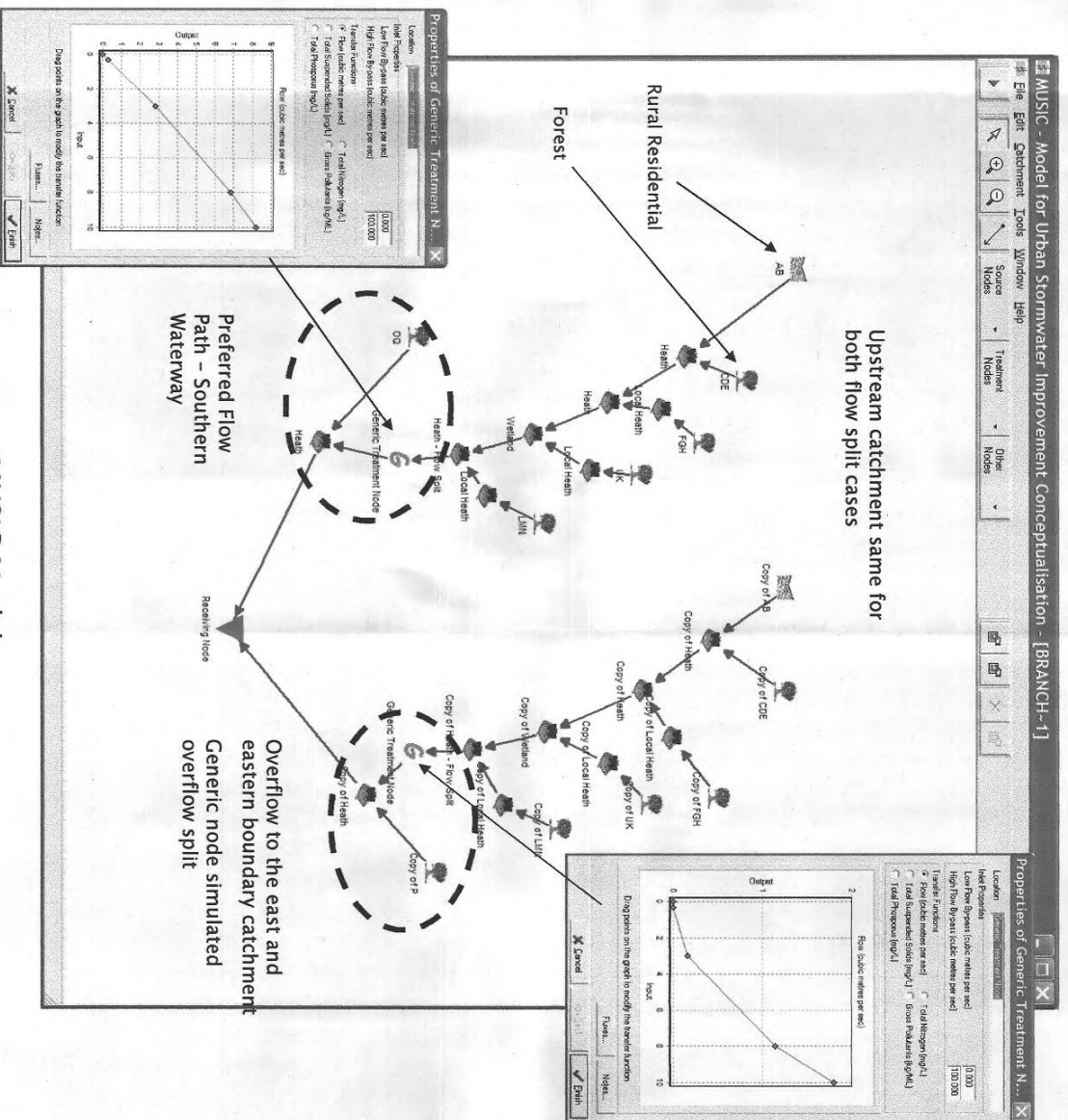


Figure A1
MUSIC Model Discretisation Pre-Development



Climate Information

Details of the relevant climatic information used for the Woolworths RDC assessment are provided below:

- Rainfall information local to Warnervale was preferred for the modelling, however, the pluvio data provided by council was limited to approximately 12 years of data which was considered too shorter period for this assessment. Therefore long term data for Sydney was used. The correlation between rainfall characteristics of Wyong/Warnervale and Sydney are considered appropriate to allow use of the Sydney data for this assessment.
- Sydney Aero 6 minute timestep rainfall data (10years) was initially used to establish an understanding of the mean annual flow and number of no-flows days into the eastern channel.
- Due to very long simulation times and the massive amount of results output a coarser timestep of 1hr was used simulation of the full 80 years of Sydney Aero rainfall–evapotranspiration. To ensure the overflow properties (mean annual flow and number of no-flow days) were preserved comparison of the 6minute and 1hr results was undertaken and inflow–outflow relationship of the generic node adjusted as required.



Model Rainfall Runoff Parameters

In the absence of calibration data for the site the Rainfall Runoff Parameters applied for each land use category were based on the guidelines provided in the MUSIC Manual. The Daily Deep Seepage Rate (%) and Percentage Impervious (%) was adjusted to reproduce the accepted annual volumetric runoff coefficients based on long term stream flow monitoring undertaken by Brisbane City Council. These are:

- Forest Land-use - AVRC = 0.15-0.2

Properties of CDE - Page 1 of 5

Location: **CDE**

Areas

Total Area (ha): **11.74**

Pervious **100 %**

Impervious **0 %**

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%

Fluxes... Notes...

Cancel Back Next

Properties of AB - Page 2 of 5

Rainfall-Runoff Parameters

Impervious Area Properties

Rainfall Threshold (mm/day): **1.00**

Pervious Area Properties

Soil Storage Capacity (mm): **200**

Initial Storage (% of Capacity): **30**

Field Capacity (mm): **170**

Infiltration Capacity Coefficient - a: **200.0**

Infiltration Capacity Exponent - b: **1.00**

Groundwater Properties

Initial Depth (mm): **10**

Daily Recharge Rate (%): **25.00**

Daily Baseflow Rate (%): **5.00**

Daily Deep Seepage Rate (%): **2.50**

Cancel Back Next



- Agriculture/Rural (including rural res) Land-use – AVRC = 0.20–0.25

Properties of AB - Page 1 of 5

Location: **AB**

Areas

Total Area (ha): **23.15**

Pervious **98 %**

Impervious **2 %**

Fluxes... Notes...

Cancel Back Next

Properties of CDE - Page 2 of 5

Rainfall-Runoff Parameters

Impervious Area Properties

Rainfall Threshold (mm/day): **1.00**

Pervious Area Properties

Soil Storage Capacity (mm): **200**

Initial Storage (% of Capacity): **30**

Field Capacity (mm): **170**

Infiltration Capacity Coefficient - a: **200.0**

Infiltration Capacity Exponent - b: **1.00**

Groundwater Properties

Initial Depth (mm): **10**

Daily Recharge Rate (%): **25.00**

Daily Baseflow Rate (%): **5.00**

Daily Deep Seepage Rate (%): **2.50**

Cancel Back Next

Heathland and Ephemeral Wetland Storage

Note that the AVRC's apply to the actual catchment areas. The heathland storage capture some or all of this runoff and retain water for loss via evapotranspiration and seepage. This effectively reduces the overall AVRC's to between 0.05–0.15.

The heathland zones were represented as a series of storage systems (ie. wetlands) with a large surface area and small extended detention depth. Based on site inspections and documented evidence from other reports the depressions were assumed to be 0.2m deep and covering half of the heathland zone (average 0.1 m depth). Note that Council are currently in the process of commissioning detailed survey of typical heathland areas in order to quantify the storage characteristics. When available this information can be used to further refine the modelling of heathland zones.

The 'Local Heathland' and 'Regional Heathland' zones were inserted into the model as separate systems with the 'Local Heathland' storage accepting runoff from local



catchments only and the 'Regional Heathland' storage accepting overflow from the 'Local Heathland' plus flows from upstream.

Properties of Local Heath

Location: **Local Heath**

Inlet Properties	
Low Flow By-Pass (cubic metres per sec)	0.000
High Flow By-pass (cubic metres per sec)	100.000
Inlet Pond Volume (cubic metres)	0.0

Storage Properties	
Surface Area (square metres)	21700.0
Extended Detention Depth (metres)	0.01
Permanent Pool Volume (cubic metres)	2170.0
Vegetation Cover (% of surface area)	50.0
Seepage Loss (mm/hr)	0.10
Evaporative Loss as % of PET	125.00

Outlet Properties	
Equivalent Pipe Diameter (mm)	50000
Overflow Weir Width (metres)	3.0
Notional Detention Time (hrs)	103E-6

Re-use... Fluxes... Notes... More

Properties of Heath

Location: **Heath**

Inlet Properties	
Low Flow By-Pass (cubic metres per sec)	0.000
High Flow By-pass (cubic metres per sec)	100.000
Inlet Pond Volume (cubic metres)	0.0

Storage Properties	
Surface Area (square metres)	27000.0
Extended Detention Depth (metres)	0.01
Permanent Pool Volume (cubic metres)	2700.0
Vegetation Cover (% of surface area)	50.0
Seepage Loss (mm/hr)	0.10
Evaporative Loss as % of PET	125.00

Outlet Properties	
Equivalent Pipe Diameter (mm)	50000
Overflow Weir Width (metres)	3.0
Notional Detention Time (hrs)	129E-6

Re-use... Fluxes... Notes... More

The 'Ephemeral Wetland' was simulated as per the 'Regional Heathland' areas but with a depth of 0.5m.

Properties of Wetland

Location: **Wetland**

Inlet Properties	
Low Flow By-Pass (cubic metres per sec)	0.000
High Flow By-pass (cubic metres per sec)	100.000
Inlet Pond Volume (cubic metres)	0.0

Storage Properties	
Surface Area (square metres)	12500.0
Extended Detention Depth (metres)	0.01
Permanent Pool Volume (cubic metres)	6250.0
Vegetation Cover (% of surface area)	50.0
Seepage Loss (mm/hr)	0.10
Evaporative Loss as % of PET	125.00

Outlet Properties	
Equivalent Pipe Diameter (mm)	50000
Overflow Weir Width (metres)	3.0
Notional Detention Time (hrs)	59.6E-6

Re-use... Fluxes... Notes... More



Pollutant Export Parameters

The pollutant export rates applied to the surface flow (event flow) and baseflow (dry weather flow) components of runoff calculated by the MUSIC model are a mixture of default values and those provided by Duncan (1999) for more specific landuses (car parks, roads etc.). The selected Event Mean Concentration (EMC) and Dry Weather Concentration (DWC) values for each land-use type are shown in the table below.

Landuse	TSS		TP		TN	
	Mean (log mL)	StDev (log mL)	Mean (log mL)	StDev (log mL)	Mean (log mL)	StDev (log mL)
Rural Residential Storm Flow Base Flow	As per MUSIC Defaults (both mean and stdev) for Agricultural landuse					
Forest Storm Flow Base Flow	As per MUSIC Defaults (both mean and stdev) for Forest landuse					
Roof Storm Flow Base Flow	1.553 Urban Default	0.384 Urban Default	-0.89 Urban Default	0.25 Urban Default	Urban Default	Urban Default
Car Park/Roads Storm Flow Base Flow	2.324 Urban Default	0.544 Urban Default	-0.532 Urban Default	0.436 Urban Default	0.491 Urban Default	0.455 Urban Default
Pervious Storm Flow Base Flow	As per MUSIC Defaults (both mean and stdev) for Urban landuse					
Pavements Storm Flow Base Flow	As per MUSIC Defaults (both mean and stdev) for Urban landuse					

Post Processing

Results of the MUSIC modelling were imported to EXCEL for post processing to produce the charts and statistical descriptions presented in Section 4.3.



Appendix B - 'Existing' Development' MUSIC Modelling

This appendix describes the MUSIC models used for this project and is intended to provide an overview of the adopted modelling approach. A complete list of modelling parameters has not been included, though electronic copies of the model files are available from Ecological Engineering upon request. Such requests should be made through Wyong City Council.

This Appendix should be read in conjunction with Appendix A.

The MUSIC model used to simulate the existing catchment conditions was developed from the 'Pre-development' model. The 'Existing' model differed from the predeveloped model in the following ways:

- Based on aerial photographs, the percentage imperviousness of some of the subcatchments was increased.
- The reduced amount of heathland was modelled by the removal of wetland treatment nodes.
- No flows from the upper catchment were able to overflow into the eastern flowpath (due to the presence of the constructed drain). Only the local catchment 'P' contributed flows to the eastern flowpath.

A Schematic of the MUSIC model for the Existing catchment is included as Figure A2 with the table below providing area and landuse details.



'Existing' Case MUSIC Catchments

ID	Catchment Area (ha)	Landuse
AB	19.65 ha	Rural residential
AB Imp - Highway	3.5 ha	Impervious road
CDE	10.94	Forest
CDE Imp	0.8	Impervious road
FGH	13.53	Forest
FGH Impervious	0.46	Impervious road
IJK	8.86	Forest
IJK Imp	0.67	Impervious road
LMN	15.12	Forest
OQ	3.40	Forest
P	6.32	Forest



Figure B1
MUSIC Model Discretisation – Existing Case



Appendix C - 'Post Development' MUSIC Modelling

This appendix describes the MUSIC models used for this project and is intended to provide an overview of the adopted modeling approach. A complete list of modeling parameters has not been included, though electronic copies of the model files are available from Ecological Engineering upon request. Such requests should be made through Wyong City Council.

This Appendix should be read in conjunction with Appendices A & B.

The developed catchment layout was based on the existing catchment model, with the Woolworths RDC site catchments reconfigured to reflect developed site characteristics.

Post development refers to the developed state of the Woolworths RDC site only. The remainder of the catchment is assumed to be in its 'Existing' state. An 'ultimate development' scenario has not been modelled. A schematic of the MUSIC model for the developed catchment is included as Figure A3 with a summary of the catchments listed below.

'Post Development' Case MUSIC Catchments

ID	Catchment Area (ha)	Landuse
AB	19.65	Rural residential
AB Imp - Highway	3.5	Impervious road
CDE	10.94	Forest
CDE Imp	0.8	Impervious road
FGH	13.53	Forest
FGH Impervious	0.46	Impervious road
IJK	8.37	Forest
IJK Imp	0.93	Impervious road
P	1.7	Forest
WW-AB	2.15	Car park
WW-C - Car Park	2.37	Car park
WW-C - Roof	1.3	Roof
WW-D	0.31	Mix of pervious and



		impervious
WW-E	1.2	Car park/road
WW-F - Car Park	3.5	Car park
WW-F - Roof	2.35	Roof
WW-G	2.32	Mix of pervious and impervious
WW-H	1.64	Roof
WW-I	1.2	Road
WW-JK	4.74	Mix of pervious and impervious



WCMS/WSUD Strategy Assessment

A WSUD layout was adapted from the preliminary layout developed by Beca Consulting. The WSUD layout was modified to achieve the site objectives outlined earlier in this report. Details of the proposed WSUD systems are provided in Section 4.

Features of the developed catchment model include:

- Rainwater tanks that collect runoff from part of the roof area were modelled as ponds with no evaporative losses. Water reuse from the tanks was modelled as a constant 6kL/day demand (Beca Consulting).

Properties of Tanks	
Location	Tanks
Inlet Properties	
Low Flow By-pass (cubic metres per sec)	0.000
High Flow By-pass (cubic metres per sec)	100.000
Storage Properties	
Surface Area (square metres)	50.0
Extended Detention Depth (metres)	0.01
Permanent Pool Volume (cubic metres)	100.0
Vegetation Cover (% of surface area)	10.0
Seepage Loss (mm/hr)	0.00
Evaporative Loss as % of PET	0.00
Outlet Properties	
Equivalent Pipe Diameter (mm)	300
Overflow Weir Width (metres)	2.0
Notional Detention Time (hrs)	6.62E-3
Re-use... Fluxes... Notes... More	
Cancel Back Finish	

Stormwater Re-use	
☒ Use stored water for irrigation or other purpose	
Annual Demand (ML/yr) scaled by daily PET	0.0
Daily Demand (kL/day)	6.0
User-defined distribution of Annual Demand (ML/yr)	0.0
OK Cancel	

- Centre Median Swale Bioretention – In absence of detailed concepts the bioretention systems were modelled as being 1m deep. For ease of modelling the bioretention systems were lumped into treatment node assuming a 2m wide bioretention trench along approx 300m length of median.

Recent research has found that bioretention systems produce a 25% reduction in flow volume for flows that pass through the filter media. To reflect this a generic node with a 25% flow reduction follows each



bioretention treatment node. Further refinement of design and assessment of design (water quality and flow volume reduction) to occur as part of detailed design.

Properties of Bio-Retention

Location: Bio-Retention

Inlet Properties

Low Flow By-Pass (cubic metres per sec): 0.000

High Flow By-Pass (cubic metres per sec): 100.000

Storage Properties

Extended Detention Depth (metres): 1.00

Surface Area (square metres): 600.0

Seepage Loss (mm/hr): 0.36

Infiltration Properties

Filter Area (square metres): 600.0

Filter Depth (metres): 1.0

Filter Particle Effective Diameter (mm): 0.50

Saturated Hydraulic Conductivity (mm/hr): 100.0

Outlet Properties

Overflow Weir Width (metres): 2.0

Fluxes... Notes... Less

Advanced Properties

Weir Coefficient: 1.70

Voids Ratio: 0.30

Number of CSTR Cells: 3

	k (m/yr)	C* (mg/L)
Total Suspended Solids	5000	6.000
Total Phosphorus	2800	0.090
Total Nitrogen	500	1.300

Cancel Back Finish

Properties of 25% flow reduction

Location: 25% flow reduction

Inlet Properties

Low Flow By-pass (cubic metres per sec): 0.000

High Flow By-pass (cubic metres per sec): 100.000

Transfer Functions

☒ Flow (cubic metres per sec) ☐ Total Nitrogen (mg/L)

☐ Total Suspended Solids (mg/L) ☐ Gross Pollutants (kg/ML)

☐ Total Phosphorus (mg/L)

Flow (cubic metres per sec)

Drag points on the graph to modify the transfer function

Fluxes... Notes...

Cancel Back Finish

- Truck Turning 'Rain Garden' Bioretention – In absence of detailed concepts the bioretention system was modelled as being 1m deep. Recent research has found that bioretention systems produce a 25% reduction in flow volume for flows that pass through the filter media. To reflect this a generic node with a 25% flow reduction follows each bioretention treatment node. Further refinement of design and assessment of design (water quality and flow volume reduction) to occur as part of detailed design.



Properties of Bio-Retention

Location: Bio-Retention

Inlet Properties

Low Flow By-Pass (cubic metres per sec): 0.000
High Flow By-pass (cubic metres per sec): 100.000

Storage Properties

Extended Detention Depth (metres): 0.20
Surface Area (square metres): 200.0
Seepage Loss (mm/hr): 0.36

Infiltration Properties

Filter Area (square metres): 200.0
Filter Depth (metres): 1.0
Filter Particle Effective Diameter (mm): 0.50
Saturated Hydraulic Conductivity (mm/hr): 100.0

Outlet Properties

Overflow Weir Width (metres): 2.0

Fluxes... Notes... Less

Advanced Properties

Weir Coefficient: 1.70
Voids Ratio: 0.30
Number of CSTR Cells: 3

	k (m/yr)	C* (mg/L)
Total Suspended Solids	1000	12.000
Total Phosphorus	500	0.130
Total Nitrogen	50	1.300

Cancel Back Finish

Properties of 25%flow reduction

Location: 25%flow reduction

Inlet Properties

Low Flow By-pass (cubic metres per sec): 0.000
High Flow By-pass (cubic metres per sec): 100.000

Transfer Functions

Flow (cubic metres per sec) Total Nitrogen (mg/L)
Total Suspended Solids (mg/L) Gross Pollutants (kg/ML)
Total Phosphorus (mg/L)

Flow (cubic metres per sec)

Drag points on the graph to modify the transfer function

Fluxes... Notes...

Cancel Back Finish

- Vegetated Swales that collect flows from some of the roof area and the carparks were modelled with the following parameters using the parameters provided in the original Beca Pty Ltd MUSIC modelling:

Properties of Car Park Swale

Location: Car Park Swale

Inlet Properties

Low Flow By-Pass (cubic metres per sec): 0.000

Storage Properties

Length (metres): 600.0
Bed Slope (%): 0.66
Base Width (metres): 1.0
Top Width (metres): 2.6
Depth (metres): 0.40
Vegetation Height (metres): 0.100
Seepage Loss (mm/hr): 0.36

Fluxes... Notes... Less

Advanced Properties

Number of CSTR Cells: 10

	k (m/yr)	C* (mg/L)	C ^{max} (mg/L)
Total Suspended Solids	15000	30.000	13.600
Total Phosphorus	12000	0.180	0.143
Total Nitrogen	1000	1.700	1.680
Threshold Hydraulic Loading for C ^{max} (m/yr)			3500

Cancel Back Finish



- Constructed Wetland to the western side of the Woolworths RDC site collects runoff from the upper catchment (58.2ha) as well as the western sections of the RDC site (7.6ha). The size of the system was scaled from the site concept as provided by Beca Pty Ltd.

Properties of Wetland

Location: Wetland

Inlet Properties

Low Flow By-Pass (cubic metres per sec)	0.000
High Flow By-pass (cubic metres per sec)	100.000
Inlet Pond Volume (cubic metres)	0.0

Storage Properties

Surface Area (square metres)	3500.0
Extended Detention Depth (metres)	0.70
Permanent Pool Volume (cubic metres)	1050.0
Vegetation Cover (% of surface area)	50.0
Seepage Loss (mm/hr)	0.36
Evaporative Loss as % of PET	125.00

Outlet Properties

Equivalent Pipe Diameter (mm)	100
Overflow Weir Width (metres)	3.0
Notional Detention Time (hrs)	34.9

Re-use... Fluxes... Notes... More

Cancel Back Finish

- Constructed Wetland in the south eastern corner of the Woolworths RDC site collects runoff from 17.2 ha, 15.5ha of which is the Woolworths RDC site. The wetland has the following parameters:

Properties of Wetland

Location: Wetland

Inlet Properties

Low Flow By-Pass (cubic metres per sec)	0.000
High Flow By-pass (cubic metres per sec)	100.000
Inlet Pond Volume (cubic metres)	0.0

Storage Properties

Surface Area (square metres)	10000.0
Extended Detention Depth (metres)	0.80
Permanent Pool Volume (cubic metres)	3000.0
Vegetation Cover (% of surface area)	50.0
Seepage Loss (mm/hr)	0.36
Evaporative Loss as % of PET	125.00

Outlet Properties

Equivalent Pipe Diameter (mm)	100
Overflow Weir Width (metres)	11.0
Notional Detention Time (hrs)	107

Re-use... Fluxes... Notes... More

Cancel Back Finish



- Flow Diversion Strategy to the eastern waterway from the eastern vegetated swale and the south eastern constructed wetland was assessed via an elaborate post processing procedure in EXCEL. The MUSIC output was used along with a series of broad crested weir calculations to abstract appropriate flows for discharge to the east. The weir crest of the abstractions was adjusted to ensure flows to the eastern waterway provided a close agreement with Pre Development annual/total volumes and median dry spells. Further refinement of the flow diversion structure as part of detailed design will be required to achieve suitable agreement to the other hydrological factors which dictate the sustainability of the aquatic habitat to the east.