Port Botany Industrial Estate, Stage 1

Section 75W Application - Civil Infrastructure Report

Author: Andrew Tweedie

Approver: Anthony McLandsborough

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Suite 702, 154 Pacific Highway, St Leonards, NSW 2065

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01	Issue for Section 75W Application	29/09/2014
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Finalisation signatures

The design described in this report is considered to have been finalised.

Signature	Date
Andrew Tweedie Civil Engineer (Author)	10/10/14
Graham Brechney Lead Designer	10/10/14
Anthony McLandsborough Director	10/10/14

Notes: The finalisation signatures shown above do not provide evidence of approval to the design. Approval signatures are shown on the title sheet of the design plans.

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APPENDIX

1 PROJECT DESCRIPTION

The Port Botany Industrial Estate site on McPherson Street in Banksmeadow is part of a 19 Hectare Southlands site to be developed as a high quality industrial site.

The Southlands site is an approximate 19 ha site fronting onto McPherson Street in Banksmeadow and lies entirely within the Botany Bay Local Government Area. The site is bounded by McPherson Street on its southern boundary, the port railway line on the east, industrial development to the north and Coal Pier Road to the west. Refer to Figures 1 and 2 for Site Location Plan.

Figure 1 Site Location Plan

Stage 1 of the Southlands site which is the subject site for this Section 75W application involves the western portion of the site between Coal Pier Road to the west and Nant Road to the east. Refer to Figure2 for Site Layout

Figure 2 – Site Layout Plan

Stage 1 of the site has a total area of approximately 9.38 Ha including the Riparian Corridor to the north and east.

2 INTRODUCTION

AT&L have been engaged by Goodman to undertake the Civil Design for the Section 75W Application for Stage 1 of the Port Botany Industrial Estate development.

This report should be read in conjunction with the following AT&L Section 75W Application 14-213 drawings dated August 2014:

DAC001	COVER SHEET AND LOCALITY PLAN
DAC002	NOTES AND LEGENDS
DAC003	GENERAL ARRANGEMENT PLAN
DAC005	SITE SECTIONS
DAC007	TYPICAL CROSS SECTIONS SHEET 1
DAC008	TYPICAL CROSS SECTIONS SHEET 2
DAC010	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 1
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DAC020	SITEWORKS DETAILS
DAC 025	STORMWATER DRAINAGE DETAILS
DAC030	PAVEMENT, SIGNAGE AND LINEMARKING PLAN SHEET 1
DAC031	PAVEMENT, SIGNAGE AND LINEMARKING PLAN SHEET 2
DAC040	SEDIMENTATION AND EROSION CONTROL PLAN SHEET 1
DAC041	SEDIMENTATION AND EROSION CONTROL PLAN SHEET 2
DAC042	SEDIMENTATION AND EROSION CONTROL DETAILS
DAC050	STORMWATER CATCHMENT

Refer to the Civil Drawings within Appendix A for the proposed siteworks drawings.

Summary

This report generally covers the following items:

- Stormwater Management
  - Piped and Overland Flows
  - Water Sensitive Urban Design (WSUD)
  - Sedimentation and Erosion Control
- Review of Flooding
- Services Infrastructure
- Road / Car Park and Pavement

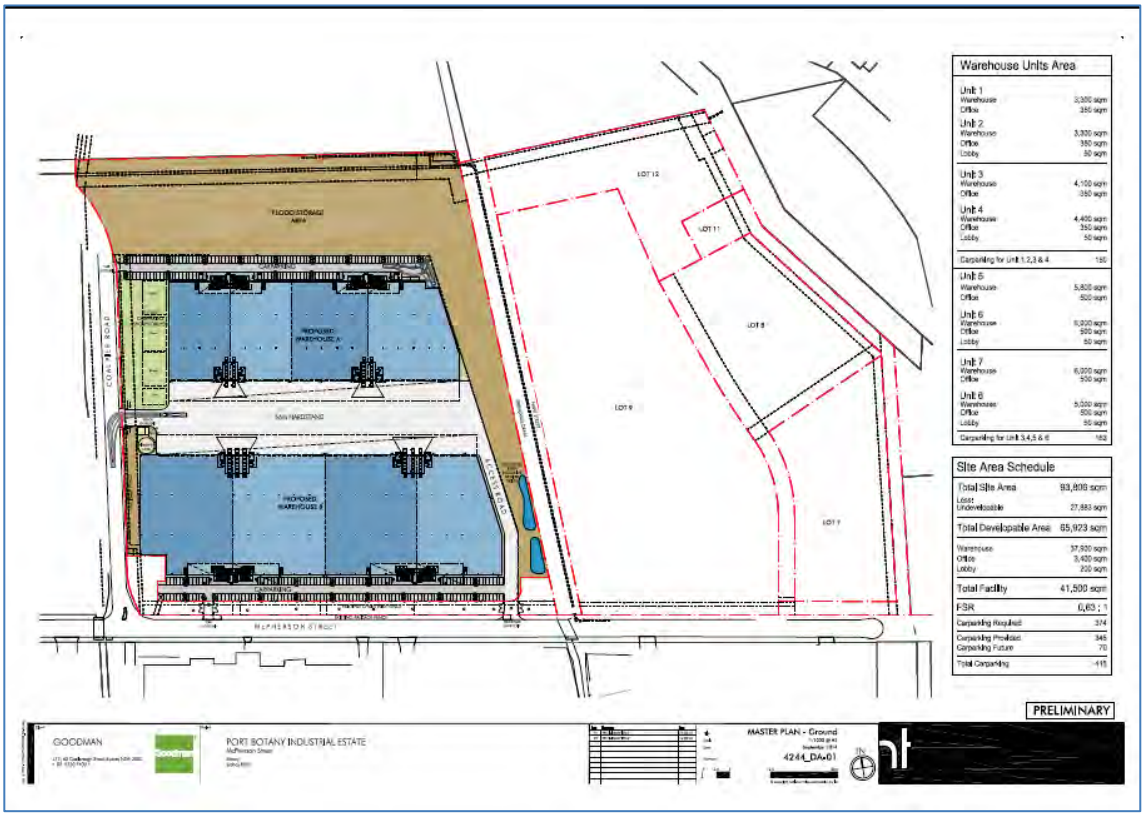

Figure 3 - Site Plan

3 STORMWATER MANAGEMENT

3.1 The Site

The subject site is legally described as Lot 1 in D.P 254392. The developed site is approximately 9.38 Ha in area and is located within the Botany Bay Council Local Government area (LGA).

The site is currently undeveloped and classified as a "Greenfield" site.

3.1.1 Previous Site Studies

In August 2009 a Development Application was submitted by Orica and Goodman under Part 3A of the EP&A Act for Stages 1 and 2 of an industrial estate on the Southlands site at Banksmeadow. As part of the DA a Hydrology and Flooding Report was carried out by URS. This report is tilted:

"Southland Remediation and Development Project: Environmental Assessment Project Application (MP06_0191): Appendix G: Hydrology and Flooding – August 2009"

This report was carried out to determine the stormwater flooding impacts resulting from the proposed development of the Southlands site into an industrial estate and is included in Appendix D of this report.

In September 2009 the Department of Planning engaged WMAWater to provide a review of this report. WMAWater provided a review report which recommended changes and additions to the hydraulic modelling approach carried out in the August 2009 report.

In November 2010 Aurecon took over the flood modelling from URS and submitted two reports to the Department of Planning.

1. *Review of Orica Southlands Remediation and Development Hydraulic Modelling Report* and

2. Response to Exhibition Submissions/Comments – 29 November 2010.

The first report provided a re-assessment of the hydraulic modelling approach and revised results taking into account the comments made in the WMAWater review report dated September 2009. The second report provided a response to all comments from the exhibition of the August 2009 submission.

In August 2011 WMAWater carried out another review on the two reports submitted by Aurecon. Overall WMAWater contended the reports were approved and development could proceed provided the following conditions were met:

- *A detention basin is to be constructed to the east of Springvale Drain and immediately upstream of McPherson Street to provide additional*

flood storage to compensate for the amount lost due to filling within the floodplain of Springvale and Floodvale Drains

- *Construction of a control structure on the Springvale Drain is required to control flows into the detention basin to ensure that the detention basin will compensate for the amount lost due to filling within the floodplain of Springvale and Floodvale Drains*
- *Construction of a low flow pipe is required to allow draining of the detention basin*
- *The Proponent shall obtain written confirmation from the City of Botany Bay Council that all issues relating to public safety of the detention basin (overtopping of basin, access to basin and drowning) have been adequately accommodated in the design. The written confirmation shall be provided to the Director-General prior to the construction of the detention basin.*
- *The Proponent shall obtain written confirmation from the City of Botany Bay Council that details on the dimensions and legal status of the easement on the northern part of the site between the Springvale and Floodvale Drains have been addresses to the satisfaction of Council. The written confirmation shall be provided to the Director-General prior to the construction of the easement*
- *The Proponent shall obtain written confirmation from the NSW Dams Safety Committee that the as constructed detention basin complies with current standards (refer Guidance DSC3E). The written confirmation shall be provided to the Director-General within 6 weeks of completion of the construction of the detention basin.*
- *The Stage 1 design relies upon a re-distribution of earthworks within the site and construction of a control structure to divert floodwaters into the detention basin. The November 2010 report (Report Ref: 204617, 29th November 2010, Revision 3 by Aurecon) acknowledges (page 25) that any change in the design may require re-modeling. The Proponent shall commission and pay the full cost of the Hydraulic Modeling Flood Validation Assessment Report to confirm that the as constructed Stage 1 works (filling and construction of the detention basin) have been undertaken in accordance with the principles outlined in Figures D9, D10 and D11 of that report. The assessment must:*
    - *Be conducted by a suitably qualified, experienced and independent expert whose appointment has been endorsed by the Director-General;*
    - *Provide details survey from a Registered Surveyor on all key structures*
    - *Provide easy to read figures indicating any difference between the results provided on Figures D9, D10 and D11 of November 2010 report*
    - *Determine whether the as constructed Stage 1 works have been undertaken in accordance with the design principles outlined in the November 20120 report and comply with the requirements in this approval and if necessary:*

        - *Recommend and prioritise measures to be undertaken in the event that the assessment shows that the flood impact exceeds that shown on Figures D9, D10 and D11 of the November 2010 report and that the works as executed are not in accordance with this approval*
    - *Should the Hydraulic Modeling Flood Validation Assessment report identify an exceedance or non-compliance, then the Proponent shall undertake/ employ additional mitigation to the satisfaction of the Director-General within the timeframe specified by the Director-General*
    - *Within 6 weeks of the completion of the Stage 1 works, the Proponent shall submit a copy of the Hydraulic Modeling Flood Validation Assessment Report to the Director-General*
- *The Proponent shall engage a Registered Surveyor to certify that all new building Finished Floor Levels for Stage 1 are constructed a minimum of 500mm freeboard above the 100 year ARI flood level with Climate Change impacts. This written confirmation shall be provided to the Director-General within 6 weeks of completion of construction of the buildings.*

In this August 2011 report WMAWater also provided conditions for Stage 2 of the proposed development however as this S75W only deals with Stage 1 this will not be discussed in this report.

Refer to Appendix D for all relevant reports.

Based on these Condition of Approval Cardno produced a set of Civil Works drawings for the bulk earthworks and stormwater design of the entire Southlands development. These drawings have been approved by the City of Botany Bay Council and were issued for Construction in April 2014. At the time of writing this report (September 2014) Orica have commenced civil works on site with expected completion due in March 2015. Refer to drawings within Appendix B for Cardno drawings.

3.1.2 Cardno Civil Works Package

When Stage 1 is developed it is assumed the site will bulk earthworked to the levels in Cardno Civil Works Package drawings of May 2014. Refer to Appendix B for Cardno drawings. Finished levels and stormwater pit invert levels will need to be confirmed with as constructed survey upon completion of the works.

For the basis of the civil works design of Stage 1 in this S75W application all existing levels have been assumed to be the design levels as per Cardno's bulk earthwork levels.

When the bulk earthworks are completed the site will have two building platforms. One in the north and another in the south of the site. Refer to drawing 2100094-1-006 and 007 in Appendix B.

The northern platform will have a high level in the middle of RL 5.0 tapering down to RL 4.6 along the sides.

The southern platform will have a high level of RL4.70 in the middle tapering down to RL 4.40 along the sides.

To the south of the southern platform immediately north of McPherson Street is an access track which Orica still own. This land as shown on the Cardno drawing 210094-1-002 is dedicated to a Ground Treatment Plant (GPT) due to the contaminated nature of the groundwater. There will be no development within this land.

Levels between the two platforms fall into low spots at RL 4.2 with stormwater pits at the sag locations to drain surface water runoff. Overall there are four stormwater outlet pits discharging the Stage 1 development.

The first pit is the western sag pit between the northern and southern platform. This pit discharges via pipework into the Floodvale Drain to the west of the site.

The second pit is the eastern sag pit between the northern and southern platform. This pit discharges via pipework into the Springvale Drain to the east of the site.

The third pit is in the south west corner of the site which discharges into the existing stormwater network within McPherson Street.

The fourth pit is in the south east corner of the site which discharges into Springvale Drain to the east.

Refer to the Civil Drawings within Appendix B for the proposed siteworks drawings for this S75W Application.

3.1.3 Existing Earthworks

Due to the contaminated nature of the existing soil across the site, clean fill (VENM) has been imported onto the Stage 1 site. Generally across the site a minimum of 500mm clean fill will be placed on top of the existing contaminated soil. This contaminated soil is sealed off with a marker layer with the clean fill placed on top. Refer to Cardno's drawing 210094-1-113 for details.

Ideally works for this S75W application will ensure this marker layer is never breached however due to recessed loading docks and the internal stormwater drainage laid at falls, breaches into this layer will occur. Testing prior to commencing construction works will be carried out on all areas being breached to determine the extent of contaminated soil and rectification measures required.

As discussed previously as at September 2014 the earthworks and installation of this marker layer are currently underway. The bulk earthworks are due to be completed in March 2015. Following completion of these works the surveyed level of this marker layer will be provided to finalise the locations where the contaminated soil is breached. For this S75W application a minimum 500mm depth of VENM material has been assumed under the building platform finished bulked levels to set the marker layer.

3.2 Council Requirements

As the site falls within the City of Botany Bay Council LGA the civil and stormwater design principles have been designed to comply with the City of Botany Bay Stormwater Management Technical Guidelines Development Control Plan.

4 HYDRAULICS & HYDROLOGY

4.1 General Design Principles

DRAINs modeling software has been used to calculate the Hydraulic Grade Line (HGL) of the stormwater system. DRAINs model is attached in Appendix C.

4.1.1 Hydrology

- Pipe drainage shall be designed to accommodate the 20 year ARI storm event in accordance with City of Botany Bay Council requirements for industrial subdivisions
- The combined piped and overland flow paths shall be designed to accommodate the 100-year ARI storm event
- Where trapped low points are unavoidable and potential for flooding private property is a concern, an overland flow path capable of carrying the total 100-year ARI storm event shall be provided. Alternatively, the pipe and inlet system may be upgraded to accommodate the 100 year ARI storm event
- Rainfall intensities shall be as per the Intensity-Frequency-Duration table in accordance with the Australian Rainfall and Runoff volume 2
- Times of concentration for each sub catchment shall be determined using the kinematic wave equation. Minimum time of concentration is 5 mins and the maximum is 20 mins
- Runoff coefficients shall be calculated in accordance with the AR&R. The fraction impervious shall be determined from analysis of the sub catchments
- Flow width in gutter shall not exceed 2m for the minor design storm event.
- Velocity depth rations shall not exceed 0.4 for all storms up to and including the 100 year ARI event
- Blockage factors of 20% and 50% shall be adopted for pits on grade and at sags respectively for all storm events
- The maximum spacing between pits shall be 60m
- The minimum lintel size within a sag shall be 2.4m
- The minimum lintel size for any road drainage pit shall be 0.9m

4.1.2 Hydraulics

- A hydraulic grade line HGL design method shall be adopted for all road pipe drainage design. The HGL shall be shown on all drainage long sections
- The minimum underground pipe size shall be 375mm diameter.
- The minimum pipe grade shall be 0.5%
- All pipes shall be Rubber Ring jointed
- The minimum cover over pipes shall be 450mm in grassed areas and 600mm within carriageways
- Where minimum cover cannot be achieved due to physical constraints the pipe class shall be suitably increased
- All trafficable pipes shall be Class 3 Reinforced Concrete Pipes or Fibre Reinforced Cement equivalent
- The pipe friction coefficients to be adopted shall be:

Materials	Mannings –	Colebrook-White –	Min. Pipe
RCP	0.012	0.3	3
FRC	0.01	0.15	3

Table 1 - Pipe Details

- All pipes shall be designed for the ultimate service loads and where applicable, construction loads will be designed for.
- Pipes discharging to the overland flow path shall adopt a minimum tailwater level equivalent to respective overland flow level.
- Where the tailwater level is unknown 150mm freeboard shall be adopted
- Pit Loss coefficients shall be calculated in accordance with Missouri Charts
- A minimum 150mm freeboard shall be maintained between pit HGL and pit surface levels
- Overland flowpaths shall maintain a minimum of 300mm freeboard to all habitable floor levels
- Pits deeper than 1.2m shall contain step irons at 300mm centres

4.2 On-Site Detention (OSD)

On-Site Detention (OSD) is not required for the development of Stage 1 as additional storage has been provided in the detention basin within the Stage 2 site to compensate. This has been confirmed in the WMAWater report dated November 2010 (Page 22): *OSD has been removed from the site and additional storage volume included in the Stage 1 detention basin. This was agreed with the DOP (Department of Planning) flood modeling peer reviewer.*

The detention basin within Stage 2 which takes into account flood storage lost in Stage 1 due to the earthworks is due to be completed in March 2015.

4.3 Overland Flows

Overland flows within the site have been designed to be safely conveyed within the roads, car parking and loading docks.

Within the WMAWater report dated August 2011 on Page 3 is a note stating: *Aurecon provided further detail on this issue in their letter dated 4th of May 2011 which stated that "All new building finished floor levels (FFLs) for Stage 1 will be constructed a minimum of 500mm freeboard above the 100 year ARI flood level with Climate Change impacts"*

The Aurecon flood report dated November 2010 stated the FFL should be set at a minimum of RL 4.5mAHD to achieve this requirement.

The FFL's of the buildings in this S75W application is set at RL5.0mAHD therefore satisfying this condition.

4.4 Water Sensitive Urban Design (WSUD)

Water Sensitive Urban Design (WSUD) was also discussed in the Aurecon and WMAWater reports.

Within Section 2.1.2 of the WMAWater report of August 2001 the following is stated:

The November 2010 submission omitted discussion on how WSUD related features compatible with best practice have been accommodated in the design (water re-use, infiltration, minimisation of hard stand etc). This above issue was raised in our September 2009 review.

Aurecon provided further detail on this issue in their letter of 4th of May 2011 which indicated that opportunities for water treatment and re-use are limited by the existence of contaminated ground water. This reasoning is accepted and this issue has now been satisfactorily addressed

Following the above advice the only proposed water quality treatment devices proposed for the Stage 1 development is to install Enviropods (by Stormwater 360) on all grated pits and the installation of above ground rainwater tanks for roof runoff re-use purposes.

Further advice was given by Judith Betts, the Environmental Scientist for the City of Botany Bay Council who confirmed in a telephone call on the 2nd of September 2014 that Council would not be keen to have any deep underground tanks or ground water re-use devices due to the contaminated nature of the ground water for this Stage 1 development.

4.5 Sediment and Erosion Control (Construction)

Stormwater runoff generated from within the works area during construction will likely contain sediments and oils from construction machinery. A number of options are available for the removal of these contaminants from stormwater, some of which include:

- Wheel wash down/cattle grid at site access
- Sediment fence at downstream boundary
- Sediment basins
- Diversion banks
- Stabilisation of finished areas
- Cut off drains

Erosion and Sedimentation controls are to be installed and maintained in accordance with Department of Housing (1998), *Managing Urban Stormwater, Soils and Construction*, Fourth Edition. Following are possible levels of control that are to be constructed.

- Silt fences shall be installed along the base of excavated slopes and stockpiles to prevent runoff.
- Kerb inlet sediment traps are to be installed at the completion of the drainage works. Whilst works are underway, geotextile filter fabric fences are to be installed around open pits.

5 FLOODING

As discussed previously flood modeling has been carried out by both URS and Aurecon with the results and conclusions reviewed by WMAWater.

It is assumed for this S75W all recommendations and flood conditions have been taken into account in the Southlands Civil Works Package by Cardno of May 2014. As a result flooding should not be an issue on the Stage 1 site provided the finished floor level is set a minimum 500mm above the projected 100 year flood level. This has been confirmed in Section 4.3 of this report.

6 INFRASTRUCTURE SERVICES

An Infrastructure Services Report has been written by URS in October 2007 which provides a summary of all investigations on the existing and required infrastructure services to develop the site. Refer to the Environmental Assessment Project Application Report (MP 06_0191) in Appendix E for the Infrastructure Report

The report concludes that it is feasible to provide all infrastructure services to the development site including, water, sewerage, electricity, gas and communications. The report also broadly sets out the required upgrades required as notified by the relevant servicing authorities.

7 ROAD / CAR PARK DESIGN

7.1 Horizontal and Vertical Geometry

The loading docks have generally been designed in accordance with AS 2890.1, AS 1428.1 and Council specifications.

All roads have been designed generally in accordance with Australian Standards to accommodate B-Double truck movements.

7.2 Pavement

Pavement will be designed based on the requirements of Austroads Pavement Design Guide – A Guide to the Structural Design of Road Pavements.

8 CONCLUSION

Services including sewer, water, electrical and telecommunications can be made available to the site.

The relevant requirements as set out in Council's Guidelines are demonstrated to be achieved in the Civil Engineering design drawings and supporting reports.

This report has demonstrated that a storm water system consistent with good management practices can be provided for the proposed development.

Appendix A

Civil Drawings for Section 75W Application

PORT BOTANY INDUSTRIAL ESTATE

PROPOSED CIVIL WORKS

STAGE 1

DRAWING LIST

LOCALITY PLAN
N.T.S

Issue	Description	Date
P3	ISSUED FOR SECTION 75W	03-10-14
P2	RE-ISSUED FOR INFORMATION	25-09-14
P1	ISSUED FOR INFORMATION	05-09-14

100mm on Original

Bar Scales

Client: Goodman

Scales	NTS	Drawn	GB
		Designed	GB
Grid	MGA	Checked	AMcL
Height Datum	AHD	Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: COVER SHEET AND LOCALITY PLAN

CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Drawing No.	Project No.	Issue
DAC001	14-213	P3

Date Plotted: 3 Oct 2014 - 04:20PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC001.dwg

SURVEY NOTES

THE EXISTING SITE CONDITIONS SHOWN ON THE FOLLOWING DRAWINGS HAVE BEEN INVESTIGATED BY AAMHATCH Pty Ltd, BEING REGISTERED SURVEYORS. THE INFORMATION IS SHOWN TO PROVIDE A BASIS FOR DESIGN. AT & L DOES NOT GUARANTEE THE ACCURACY OR COMPLETENESS OF THE SURVEY BASE OR ITS SUITABILITY AS A BASIS FOR CONSTRUCTION DRAWINGS.

SHOULD DISCREPANCIES BE ENCOUNTERED DURING CONSTRUCTION BETWEEN THE SURVEY DATA AND ACTUAL FIELD DATA, CONTACT AT & L.

EXISTING UNDERGROUND SERVICES NOTES

THE LOCATIONS OF UNDERGROUND SERVICES SHOWN IN THIS SET OF DRAWINGS HAVE BEEN PLOTTED FROM SURVEY INFORMATION AND SERVICE AUTHORITY INFORMATION. THE SERVICE INFORMATION HAS BEEN PREPARED ONLY TO SHOW THE APPROXIMATE POSITIONS OF ANY KNOWN SERVICES AND MAY NOT BE AS CONSTRUCTED OR ACCURATE.
AT & L CAN NOT GUARANTEE THAT THE SERVICES INFORMATION SHOWN ON THESE DRAWINGS ACCURATELY INDICATES THE PRESENCE OR ABSENCE OF SERVICES OR THEIR LOCATION AND WILL ACCEPT NO LIABILITY FOR INACCURACIES IN THE SERVICES INFORMATION SHOWN FROM ANY CAUSE WHATSOEVER.

CONTRACTORS SHALL TAKE DUE CARE WHEN EXCAVATING ONSITE INCLUDING HAND EXCAVATION WHERE NECESSARY.

CONTRACTORS ARE TO CONTACT THE RELEVANT SERVICE AUTHORITY PRIOR TO COMMENCEMENT OF EXCAVATION WORKS.

CONTRACTORS ARE TO UNDERTAKE A SERVICES SEARCH, PRIOR TO COMMENCEMENT OF WORKS ON SITE. SEARCH RESULTS ARE TO BE KEPT ON SITE AT ALL TIMES.

BULK EARTHWORKS NOTES

1. ORIGIN OF LEVELS: REFER SURVEY NOTES
2. STRIP ALL TOPSOIL/ORGANIC MATERIAL FROM CONSTRUCTION AREA AND REMOVE FROM SITE OR STOCK PILE AS DIRECTED BY SUPERINTENDENT.
3. EXCAVATED MATERIAL TO BE USED AS STRUCTURAL FILL PROVIDED THE PLACEMENT MOISTURE CONTENT OF THE MATERIAL IS +/- 2% OF THE OPTIMUM MOISTURE CONTENT.
4. COMPACT FILL AREAS AND SUBGRADE TO NOT LESS THAN:

LOCATION	STANDARD DRY DENSITY (AS 1289 E 5.1.1)
UNDER BUILDING SLABS ON GROUND	98%
UNDER ROADS AND CARPARKS	98%
LANDSCAPED AREAS UNLESS NOTED OTHERWISE	98%

5. FOR NON COHESIVE MATERIAL, COMPACT TO 75% DENSITY INDEX.
6. BEFORE PLACING FILL, PROOF ROLL EXPOSED SUBGRADE WITH AN 8 TONNE (MIN) DEADWEIGHT SMOOTH DRUM VIBRATORY ROLLER TO DETECT THEN REMOVE SOFT SPOTS (AREAS WITH MORE THAN 2mm MOVEMENT UNDER ROLLER).
7. FREQUENCY OF COMPACTION TESTING SHALL BE NOT LESS THAN :-
   (A) 1 TEST PER 200m^2 OF FILL PLACED PER 300 LAYER OF FILL.
   (B) 3 TESTS PER VISIT
   (C) 1 TEST PER 1000m^2 OF EXPOSED SUBGRADE
   TESTING SHALL BE "LEVEL 1" TESTING IN ACCORDANCE WITH AS 3798 (1996).
8. FILLING TO BE PLACED AND COMPACTED IN MAXIMUM 150mm LAYERS
9. NO FILLING SHALL TAKE PLACE TO EXPOSE SUBGRADE UNTIL THE AREA HAS BEEN PROOF ROLLED IN THE PRESENCE OF AT & L AND APPROVAL GIVEN IN WRITING THAT FILLING CAN PROCEED.

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SITEWORKS NOTES

1. ORIGIN OF LEVELS:- REFER SURVEY NOTES.
2. CONTRACTOR MUST VERIFY ALL DIMENSIONS AND EXISTING LEVELS ON SITE PRIOR TO COMMENCEMENT OF WORK. ANY DISCREPANCIES TO BE REPORTED TO AT & L.
3. MAKE SMOOTH CONNECTION WITH EXISTING WORKS.
4. ALL TRENCH BACKFILL MATERIAL SHALL BE COMPACTED TO THE SAME DENSITY AS THE ADJACENT MATERIAL.
5. ALL SERVICE TRENCHES UNDER VEHICULAR PAVEMENTS SHALL BE BACKFILLED WITH SAND TO 300mm ABOVE PIPE. WHERE PIPE IS UNDER PAVEMENTS BACKFILL REMAINDER OF TRENCH TO UNDERSIDE OF PAVEMENT WITH SAND OR APPROVED GRANULAR MATERIAL COMPACTED IN 150mm LAYERS TO MINIMUM 98% MODIFIED MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS 1289 5.2.1. (OR A DENSITY INDEX OF NOT LESS THAN 75)
6. PROVIDE 10mm WIDE EXPANSION JOINTS BETWEEN BUILDINGS AND ALL CONCRETE OR UNIT PAVEMENTS.
7. ASPHALTIC CONCRETE SHALL CONFORM TO RMS. SPECIFICATION R116.
8. ALL BASECOURSE MATERIAL SHALL BE IGNEOUS ROCK QUARRIED MATERIAL TO COMPLY WITH RMS. FORM 3051 (UNBOUND), RMS. FORM 3052 (BOUND) COMPACTED TO MINIMUM 98% MODIFIED DENSITY IN ACCORDANCE WITH AS 1289 5.2.1
   FREQUENCY OF COMPACTION TESTING SHALL NOT BE LESS THAN 1 TEST PER 50m^2 OF BASECOURSE MATERIAL PLACED.
9. ALL SUB-BASE COURSE MATERIAL SHALL BE IGNEOUS ROCK QUARRIED MATERIAL TO COMPLY WITH RMS. FORM 3051, 3051.1 AND COMPACTED TO MINIMUM 95% MODIFIED DENSITY IN ACCORDANCE WITH A.S 1289 5.2.1
   FREQUENCY OF COMPACTION TESTING SHALL NOT BE LESS THAN 1 TEST PER 50m^2 OF SUB-BASE COURSE MATERIAL PLACED.
10. AS AN ALTERNATIVE TO THE USE OF IGNEOUS ROCK AS A SUB-BASE MATERIAL IN (9) A CERTIFIED RECYCLED CONCRETE MATERIAL COMPLYING WITH RMS. FORM 3051 AND 3051.1 WILL BE CONSIDERED, SUBJECT TO MATERIAL SAMPLES AND APPROPRIATE CERTIFICATIONS BEING PROVIDED TO THE SATISFACTION OF AT & L.
11. SHOULD THE CONTRACTOR WISH TO USE A RECYCLED PRODUCT THIS SHALL BE CLEARLY INDICATED IN THEIR TENDER AND THE PRICE DIFFERENCE BETWEEN AN IGNEOUS PRODUCT AND A RECYCLED PRODUCT SHALL BE CLEARLY INDICATED.
12. WHERE NOTED ON THE DRAWINGS THAT WORKS ARE TO BE CARRIED BY OTHERS, (eg. ADJUSTMENT OF SERVICES), THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CO-ORDINATION OF THESE WORKS.

KERBING NOTES

1. ALL CONCRETE TO HAVE A MINIMUM COMPRESSIVE STRENGTH OF25 MPa U.N.O IN REINFORCED CONCRETE NOTES.
2. ALL KERBS, GUTTERS, DISH DRAINS AND CROSSINGS TO BE CONSTRUCTED ON 100mm GRANULAR BASECOURSE COMPACTED TO MINIMUM 95% MODIFIED DRY DENSITY (AS 1289 5.2.1).
3. EXPANSION JOINTS (E.J) TO BE FORMED FROM 10mm COMPRESSIBLE CORK FILLER BOARD FOR THE FULL DEPTH OF THE SECTION AND CUT TO PROFILE. EXPANSION JOINTS TO BE LOCATED AT DRAINAGE PITS, ON TANGENT POINTS OF CURVES AND ELSEWHERE AT MAX 12m CENTRES EXCEPT FOR INTEGRAL KERBS WHERE THE EXPANSION JOINTS ARE TO MATCH THE JOINT LOCATIONS IN THE SLABS.
4. WEAKENED PLANE JOINTS TO BE MIN 3mm WIDE AND LOCATED AT 3m CENTRES EXCEPT FOR INTEGRAL KERBS WHERE THE WEAKENED PLANE JOINTS ARE TO MATCH THE JOINT LOCATIONS IN THE SLABS.
5. BROOMED FINISH TO ALL RAMPED AND VEHICULAR CROSSINGS. ALL OTHER KERBING OR DISH DRAINS TO BE STEEL FLOAT FINISHED.
6. IN THE REPLACEMENT OF KERB AND GUTTER :-
   EXISTING ROAD PAVEMENT IS TO BE SAWCUT 900mm U.N.O FROM THE LIP OF GUTTER. UPON COMPLETION OF THE NEW KERB AND GUTTER NEW BASECOURSE AND SURFACE TO BE LAID 600mm WIDE U.N.O.

   EXISTING ALLOTMENT DRAINAGE PIPES ARE TO BE BUILT INTO THE NEW KERB AND GUTTER WITH 100mm DIA HOLE.

   EXISTING KERB AND GUTTER IS TO BE COMPLETELY REMOVED WHERE NEW KERB AND GUTTER IS SHOWN.

CONCRETE NOTES

1. ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS 3600 CURRENT EDITION WITH AMENDMENTS, EXCEPT WHERE VARIED BY THE CONTRACT DOCUMENTS.
2. CONCRETE QUALITY
   ALL REQUIREMENTS OF THE CURRENT ACSE CONCRETE SPECIFICATION DOCUMENT 1 SHALL APPLY TO THE FORMWORK, REINFORCEMENT AND CONCRETE UNLESS NOTED OTHERWISE.

ELEMENT	AS 3600 F'c MPa AT 28 DAYS	SPECIFIED SLUMP	NOMINAL AGG. SIZE
VEHICULAR BASE	32	60	20
KERBS, PATHS, AND PITS	25	80	20

   - CEMENT TYPE SHALL BE (ACSE SPECIFICATION) TYPE SL
   - PROJECT CONTROL TESTING SHALL BE CARRIED OUT IN ACCORDANCE WITH AS 1379.
3. NO ADMIXTURES SHALL BE USED IN CONCRETE UNLESS APPROVED IN WRITING BY AT & L.
4. CLEAR CONCRETE COVER TO ALL REINFORCEMENT FOR DURABILITY SHALL BE 40mm TOP AND 70mm FOR EXTERNAL EDGES UNLESS NOTED OTHERWISE.
5. ALL REINFORCEMENT SHALL BE FIRMLY SUPPORTED ON MILD STEEL PLASTIC TIPPED CHAIRS, PLASTIC CHAIRS OR CONCRETE CHAIRS AT NOT GREATER THAN 1m CENTRES BOTH WAYS. BARS SHALL BE TIED AT ALTERNATE INTERSECTIONS.
6. THE FINISHED CONCRETE SHALL BE A DENSE HOMOGENEOUS MASS, COMPLETELY FILLING THE FORMWORK, THOROUGHLY EMBEDDING THE REINFORCEMENT AND FREE OF STONE POCKETS. ALL CONCRETE INCLUDING SLABS ON GROUND AND FOOTINGS SHALL BE COMPACTED AND CURED IN ACCORDANCE WITH R.T.A. SPECIFICATION R83.
7. REINFORCEMENT SYMBOLS:
   N DENOTES GRADE 450 N BARS TO AS 1302 GRADE N
   R DENOTES 230 R HOT ROLLED PLAIN BARS TO AS 1302
   SL DENOTES HARD-DRAWN WIRE REINFORCING FABRIC TO AS 1304

   NUMBER OF BARS IN GROUP — BAR GRADE AND TYPE
   17 N 20 250
   NOMINAL BAR SIZE IN mm — SPACING IN mm

   THE FIGURE FOLLOWING THE FABRIC SYMBOL SL IS THE REFERENCE NUMBER FOR FABRIC TO AS 1304.
8. FABRIC SHALL BE LAPPED IN ACCORDANCE WITH THE FOLLOWING DETAIL:

SERVICES LEGEND

EXISTING SERVICES

- EXISTING GAS
- EXISTING TELSTRA
- EXISTING WATER
- EXISTING ELECTICAL
- EXISTING STORMWATER DRAINAGE PIPE
- EXISTING STORMWATER DRAINAGE PIT

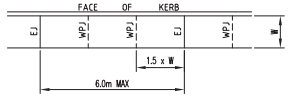
STORMWATER DRAINAGE NOTES

1. STORMWATER DESIGN CRITERIA:
   (A) AVERAGE RECURRENCE INTERVAL:
   1:100 YEARS ROOFED AREAS TO SURCHARGE PIT
   1:20 YEARS EXTERNAL PAVEMENTS
   (B) RAINFALL INTENSITIES:
   TIME OF CONCENTRATION: 5 MINUTES
   1:100 YEARS= 269 mm/hr
   1:20 YEARS= 210 mm/hr
   (C) RUNOFF COEFFICIENTS:
   ROOF AREAS: C_{100} =1.0
   EXTERNAL PAVEMENTS: C_{20} =1.0
2. PIPES 300 DIA. AND LARGER TO BE REINFORCED CONCRETE CLASS '2' APPROVED SPIGOT AND SOCKET WITH RUBBER RING JOINTS. U.N.O.
3. PIPES UP TO 300 DIA SHALL BE SEWER GRADE uPVC WITH SOLVENT WELDED JOINTS.
4. EQUIVALENT STRENGTH VCP OR FRC PIPES MAY BE USED.
5. ALL STORMWATER DRAINAGE LINES UNDER PROPOSED BUILDING SLABS TO BE uPVC PRESSURE PIPE GRADE 6. ENSURE ALL VERTICALS AND DOWNPIPES ARE uPVC PRESSURE PIPE, GRADE 6 FOR A MIN OF 3.0m IN HEIGHT.
6. PIPES TO BE INSTALLED TO TYPE HS3 (ROAD) HS2 (LOTS) SUPPORT IN ACCORDANCE WITH AS 3725 (2007) IN ALL CASES BACKFILL TRENCH WITH SAND TO 300mm ABOVE PIPE. WHERE PIPE IS UNDER PAVEMENTS BACKFILL REMAINDER OF TRENCH TO UNDERSIDE OF PAVEMENT WITH SAND OR APPROVED GRANULAR MATERIAL COMPACTED IN 150mm LAYERS TO MINIMUM 98% STANDARD MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS 1289 5.2.1. (OR A DENSITY INDEX OF NOT LESS THAN 75)
7. ALL INTERNAL WORKS WITHIN PROPERTY BOUNDARIES ARE TO COMPLY WITH THE REQUIREMENTS OF AS 3500 3.1 (1998) AND AS/NZS 3500 3.2 (1998).
8. PRECAST PITS MAY BE USED EXTERNAL TO THE BUILDING SUBJECT TO APPROVAL BY AT & L.
9. ENLARGERS, CONNECTIONS AND JUNCTIONS TO BE PREFABRICATED FITTINGS WHERE PIPES ARE LESS THAN 300 DIA.
10. WHERE SUBSOIL DRAINS PASS UNDER FLOOR SLABS AND VEHICULAR PAVEMENTS, UNSLOTTED uPVC SEWER GRADE PIPE IS TO BE USED.
11. CARE IS TO BE TAKEN WITH LEVELS OF STORMWATER LINES. GRADES SHOWN ARE NOT TO BE REDUCED WITHOUT APPROVAL.
12. GRATES AND COVERS SHALL CONFORM TO AS 3996.
13. ALL INTERNAL PIT DIMENSIONS TO CONFORM TO AS3500.3 TABLE 8.2.
14. AT ALL TIMES DURING CONSTRUCTION OF STORMWATER PITS, ADEQUATE SAFETY PROCEDURES SHALL BE TAKEN TO ENSURE AGAINST THE POSSIBILITY OF PERSONNEL FALLING DOWN PITS.
15. ALL EXISTING STORMWATER DRAINAGE LINES AND PITS THAT ARE TO REMAIN ARE TO BE INSPECTED AND CLEANED. DURING THIS PROCESS ANY PART OF THE STORMWATER DRAINAGE SYSTEM THAT WARRANTS REPAIR SHALL BE REPORTED TO THE SUPERINTENDENT/ENGINEER FOR FURTHER DIRECTIONS.

JOINTING NOTES

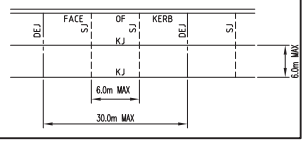
PEDESTRIAN PAVEMENT JOINTS

1. ALL PEDESTRIAN PAVEMENTS ARE TO BE JOINTED AS FOLLOWS. (U.N.O)
2. EXPANSION JOINTS ARE TO BE LOCATED WHERE POSSIBLE AT TANGENT POINTS OF CURVES AND ELSEWHERE AT MAX. 6.0m CENTRES.
3. WEAKENED PLANE JOINTS ARE TO BE LOCATED AT A MAX. SPACING OF 1.5 x WIDTH OF THE PAVEMENT.
4. WHERE POSSIBLE JOINTS SHOULD BE LOCATED TO MATCH KERBING AND OR ADJACENT PAVEMENT JOINTS.
5. PEDESTRIAN PAVEMENT JOINT DETAIL.



VEHICULAR PAVEMENT JOINTS

6. ALL VEHICULAR PAVEMENTS TO BE JOINTED AS FOLLOWS. (U.N.O)
7. KEYED CONSTRUCTION JOINTS SHOULD GENERALLY BE LOCATED AT A MAX OF 6.0m CENTRES
8. SAWN JOINTS SHOULD GENERALLY BE LOCATED AT A MAX OF 6.0m CENTRES WITH DOWELED EXPANSION JOINTS AT MAX 30.0m CENTRES
9. VEHICULAR PAVEMENT JOINT DETAIL.



EROSION AND SEDIMENT CONTROL NOTES

GENERAL INSTRUCTIONS

1. THE SITE SUPERINTENDENT/ENGINEER WILL ENSURE THAT ALL SOIL AND WATER MANAGEMENT WORKS ARE LOCATED AS DOCUMENTED.
2. ALL WORK SHALL BE GENERALLY CARRIED OUT IN ACCORDANCE WITH
   a. LOCAL AUTHORITY REQUIREMENTS
   b. EPA REQUIREMENTS
   c. NSW DEPARTMENT OF HOUSING MANUAL "MANAGING URBAN STORMWATER, SOILS AND CONSTRUCTION", 4th EDITION, MARCH 2004.
3. MAINTAIN THE EROSION CONTROL DEVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE LOCAL AUTHORITY.
4. WHEN STORMWATER PITS ARE CONSTRUCTED, PREVENT SITE RUNOFF ENTERING UNLESS SEDIMENT FENCES ARE ERECTED AROUND PITS.
5. CONTRACTOR IS TO ENSURE ALL EROSION & SEDIMENT CONTROL DEVICES ARE MAINTAINED IN GOOD WORKING ORDER AND OPERATE EFFECTIVELY. REPAIRS AND OR MAINTENANCE SHALL BE UNDERTAKEN AS REQUIRED, PARTICULARLY FOLLOWING STORM EVENTS.

LAND DISTURBANCE

6. WHERE PRACTICAL, THE SOIL EROSION HAZARD ON THE SITE WILL BE KEPT AS LOW AS POSSIBLE. TO THIS END, WORKS SHOULD BE UNDERTAKEN IN THE FOLLOWING SEQUENCE:
   (A) INSTALL A WIND FENCE ALONG THE BOUNDARIES AS SHOWN ON PLAN. REFER DETAIL.
   (B) INSTALL A SEDIMENT FENCE ALONG THE BOUNDARIES AS SHOWN ON PLAN. REFER DETAIL.
   (C) CONSTRUCT STABILISED CONSTRUCTION ENTRANCE TO LOCATION AS DETERMINED BY SUPERINTENDENT/ENGINEER. REFER DETAIL.
   (D) INSTALL SEDIMENT BASIN AS SHOWN ON PLAN
   (E) INSTALL SEDIMENT TRAPS AS SHOWN ON PLAN.
   (F) UNDERTAKE SITE DEVELOPMENT WORKS IN ACCORDANCE WITH THE ENGINEERING PLANS. WHERE POSSIBLE, PHASE DEVELOPMENT SO THAT LAND DISTURBANCE IS CONFINED TO AREAS OF WORKABLE SIZE.

EROSION CONTROL

7. DURING WINDY WEATHER, LARGE, UNPROTECTED AREAS WILL BE KEPT MOIST (NOT WET) BY SPRINKLING WITH WATER TO KEEP DUST UNDER CONTROL.
8. FINAL SITE LANDSCAPING WILL BE UNDERTAKEN AS SOON AS POSSIBLE AND WITHIN 20 WORKING DAYS FROM COMPLETION OF CONSTRUCTION ACTIVITIES.

SEDIMENT CONTROL

9. STOCKPILES WILL NOT BE LOCATED WITHIN 2 METRES OF HAZARD AREAS, INCLUDING LIKELY AREAS OF CONCENTRATED OR HIGH VELOCITY FLOWS SUCH AS WATERWAYS. WHERE THEY ARE BETWEEN 2 AND 5 METRES FROM SUCH AREAS, SPECIAL SEDIMENT CONTROL MEASURES SHOULD BE TAKEN TO MINIMISE POSSIBLE POLLUTION TO DOWNSLOPE WATERS, E.G. THROUGH INSTALLATION OF SEDIMENT FENCING.
10. ANY SAND USED IN THE CONCRETE CURING PROCESS (SPREAD OVER THE SURFACE) WILL BE REMOVED AS SOON AS POSSIBLE AND WITHIN 10 WORKING DAYS FROM PLACEMENT.
11. WATER WILL BE PREVENTED FROM ENTERING THE PERMANENT DRAINAGE SYSTEM UNLESS IT IS RELATIVELY SEDIMENT FREE, I.E. THE CATCHMENT AREA HAS BEEN PERMANENTLY LANDSCAPED AND/OR ANY LIKELY SEDIMENT HAS BEEN FILTERED THROUGH AN APPROVED STRUCTURE.
12. TEMPORARY SOIL AND WATER MANAGEMENT STRUCTURES WILL BE REMOVED ONLY AFTER THE LANDS THEY ARE PROTECTING ARE REHABILITATED.

OTHER MATTERS

13. ACCEPTABLE RECEPTORS WILL BE PROVIDED FOR CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHINGS, LIGHT-WEIGHT WASTE MATERIALS AND LITTER.
14. ANY EXISTING TREES WHICH FORM PART OF THE FINAL LANDSCAPING PLAN WILL BE PROTECTED FROM CONSTRUCTION ACTIVITIES BY:
   (A) PROTECTING THEM WITH BARRIER FENCING OR SIMILAR MATERIALS INSTALLED OUTSIDE THE DRIP LINE
   (B) ENSURING THAT NOTHING IS NAILED TO THEM
   (C) PROHIBITING PAVING, GRADING, SEDIMENT WASH OR PLACING OF STOCKPILES WITHIN THE DRIP LINE EXCEPT UNDER THE FOLLOWING CONDITIONS.
   (I) ENCROACHMENT ONLY OCCURS ON ONE SIDE AND NO CLOSER TO THE TRUNK THAN EITHER 1.5 METRES OR HALF THE DISTANCE BETWEEN THE OUTER EDGE OF THE DRIP LINE AND THE TRUNK, WHICH EVER IS THE GREATER
   (II) A DRAINAGE SYSTEM THAT ALLOWS AIR AND WATER TO CIRCULATE THROUGH THE ROOT ZONE (E.G. A GRAVEL BED) IS PLACED UNDER ALL FILL LAYERS OF MORE THAN 300 MILLIMETRES DEPTH
   (III) CARE IS TAKEN NOT TO CUT ROOTS UNNECESSARILY NOR TO COMPACT THE SOIL AROUND THEM.

SITEWORKS LEGEND

- EXISTING BOUNDARY
- FINISHED PAVEMENT LEVEL (FP5.00)
- PROPOSED CONTOUR (4.0)
- EXISTING CONTOUR (4.0)
- KERB AND GUTTER (K&G). REFER DRAWING C020 FOR DETAILS.
- KERB ONLY (KO). REFER DRAWING C020 FOR DETAILS.
- INTEGRAL KERB (IK). REFER DRAWING C020 FOR DETAILS.
- CHAINWIRE FENCE. REFER LANDSCAPE ARCHITECTS DRAWINGS FOR DETAILS.
- PALISADE FENCE. REFER LANDSCAPE ARCHITECTS DRAWINGS FOR DETAILS.
- HANDRAIL. REFER LANDSCAPE ARCHITECTS DRAWINGS FOR DETAILS.
- PRAM RAMP. REFER DRAWING C020 FOR DETAILS.
- VEHICULAR CROSSING (VC). REFER DRAWING C020 FOR DETAILS.
- RCP STORMWATER PIPE (U.N.O)
- uPVC STORMWATER PIPE (U.N.O)
- STORMWATER PIT REFERENCE NUMBER (A1)
- KERB INLET PIT. REFER DRAWING C025 FOR DETAILS.
- SURFACE INLET PIT. REFER DRAWING C025 FOR DETAILS.
- JUNCTION PIT. REFER DRAWING C025 FOR DETAILS.
- STORMWATER DOWNPIPE (DP)
- GRATED DRAIN (GD). REFER DRAWING C025 FOR DETAILS.
- SUBSOIL DRAINAGE LINE. REFER DRAWING C025 FOR DETAILS.
- FLUSHING POINT (FP). REFER DRAWING C025 FOR DETAILS.
- INTERMEDIATE RISER (IR). REFER DRAWING C025 FOR DETAILS.
- PROPOSED TREE. REFER LANDSCAPE ARCHITECTS DRAWINGS FOR DETAILS.

Issue	Description	Date
P2	ISSUED FOR SECTION 75W	03-10-14
P1	ISSUED FOR INFORMATION	25-09-14

100mm on Original

Bar Scales

Client: Goodman

Scales	NTS	Drawn	GB
		Designed	GB
Grid	MGA	Checked	AMcL
Height Datum	AHD	Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: NOTES AND LEGENDS

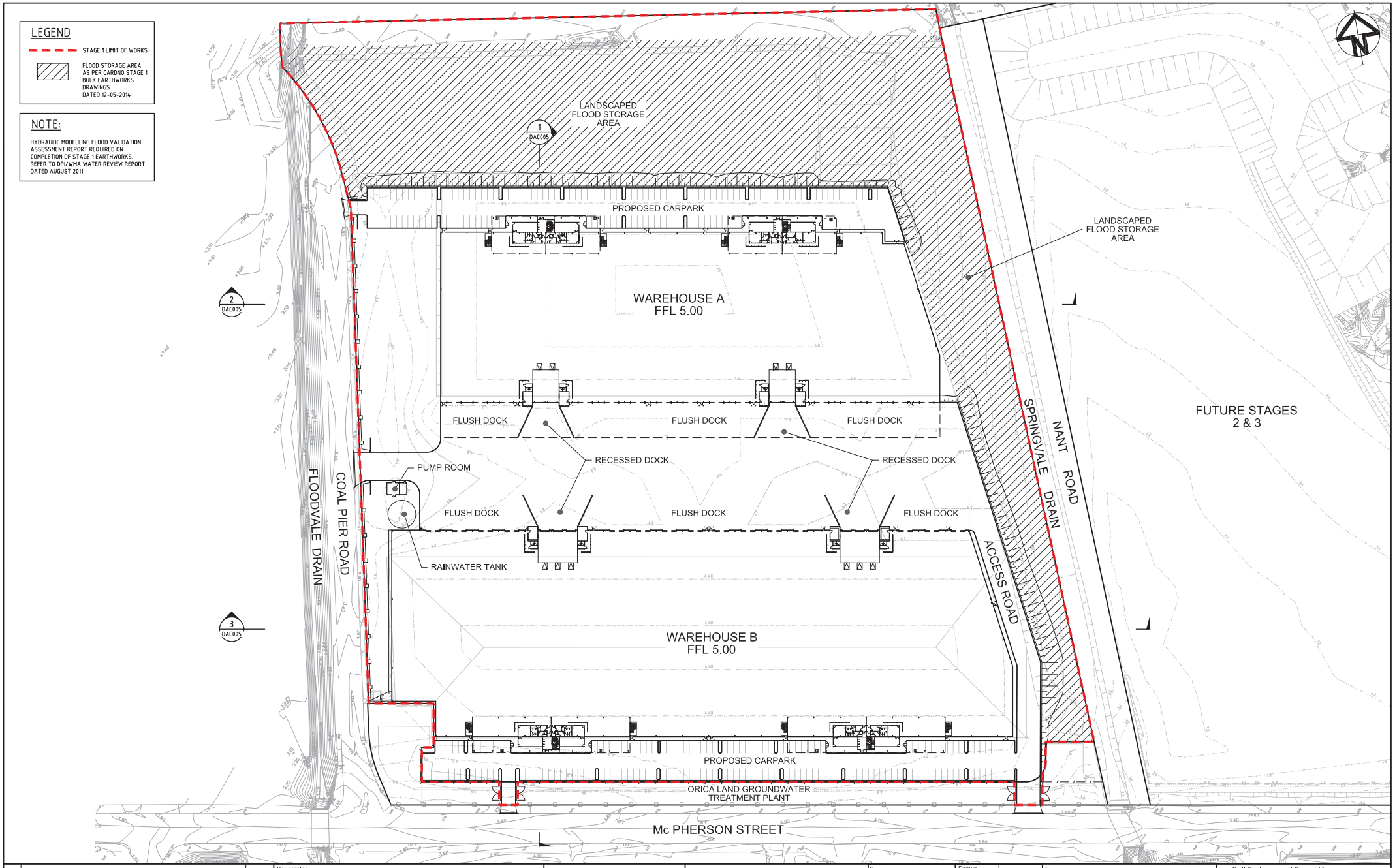
Civil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Drawing No.	Project No.	Issue
DAC002	14-213	P2

Date Plotted: 3 Oct 2014 - 04:20PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC002.dwg



Issue	Description	Date
P3	ISSUED FOR SECTION 75W	03-10-14
P2	RE-ISSUED FOR INFORMATION	25-09-14
P1	ISSUED FOR INFORMATION	05-09-14

100mm on Original

Bar Scales

0 15 30 45 60 75m

1 : 750 @ A1 1 : 1500 @ A3

Client: Goodman

Scales	1 : 750 @ A1	Drawn	GB
		Designed	GB
Grid	MGA	Checked	AMcL
Height Datum	AHD	Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: GENERAL ARRANGEMENT PLAN

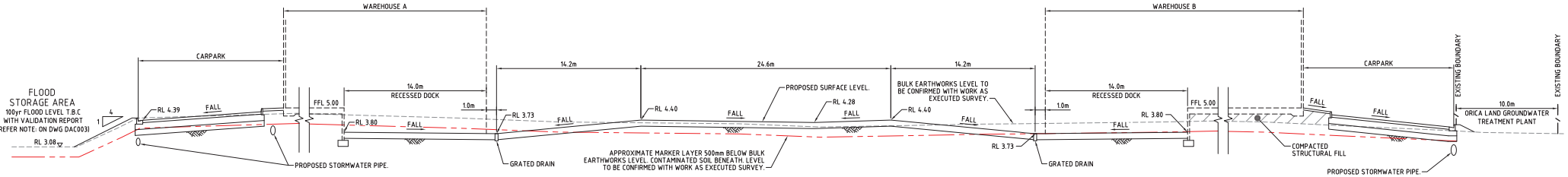
CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
Info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

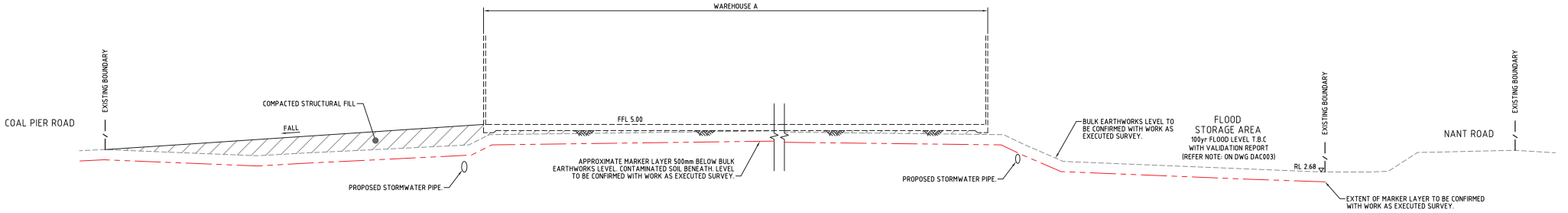
A1

Drawing No.	Project No.	Issue
DAC003	14-213	P3

Date Plotted: 3 Oct 2014 - 04:20PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC003.dwg



SECTION 1 (DAC003)
1 : 200 (H)
1 : 100 (V)



SECTION 2 (DAC003)
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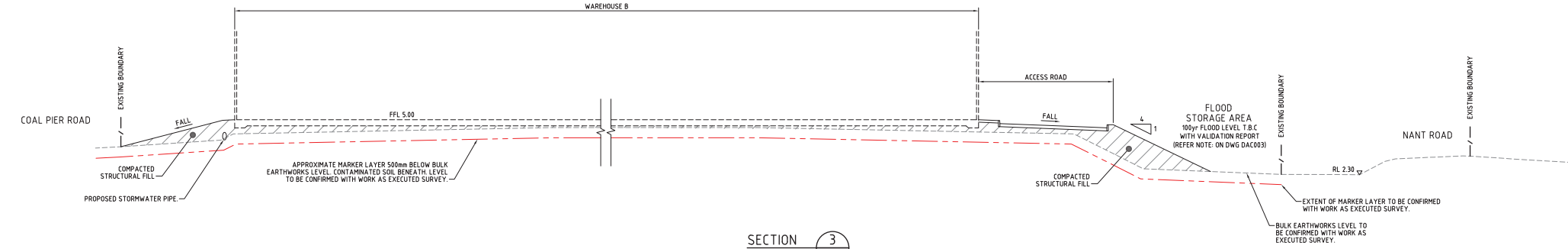
1 : 100 (V)



SECTION 3 (DAC003)
1 : 200 (H)
1 : 100 (V)

Issue	Description	Date
P3	ISSUED FOR SECTION 75W	03-10-14
P2	RE-ISSUED FOR INFORMATION	25-09-14
P1	ISSUED FOR INFORMATION	05-09-14

100mm on Original

Bar Scales

0 2 4 6 8 10m
1 : 100 @ A1 1 : 200 @ A3

0 5 10 15 20m
1 : 200 @ A1 1 : 400 @ A3

Client: Goodman

Scales	1 : 200 (H) 1 : 100 (V)
Grid	MGA
Height Datum	AHD
Drawn	GB
Designed	GB
Checked	AMcL
Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: SITE SECTIONS

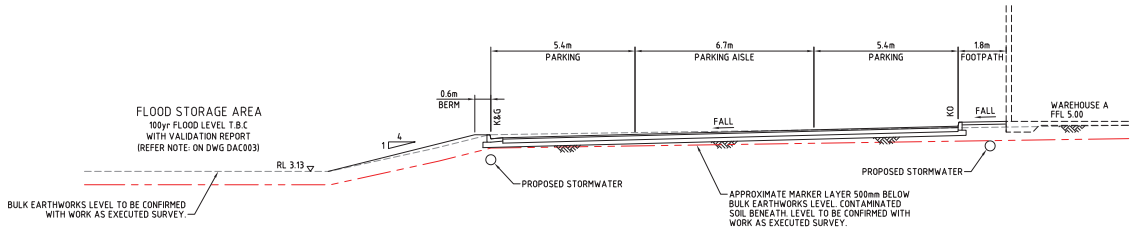
CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
Info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

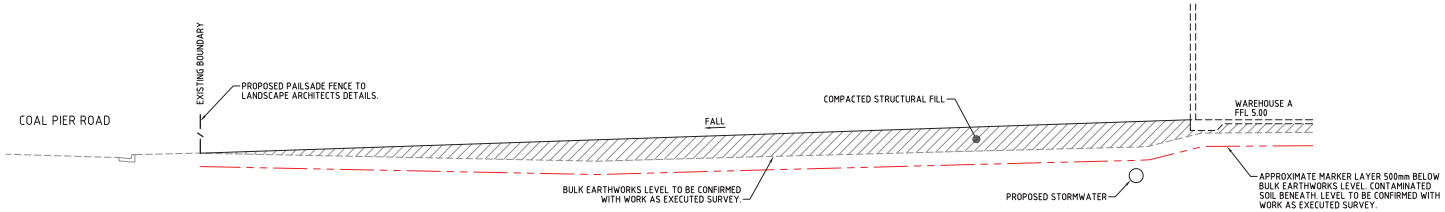
A1

Drawing No.	Project No.	Issue
DAC005	14-213	P3

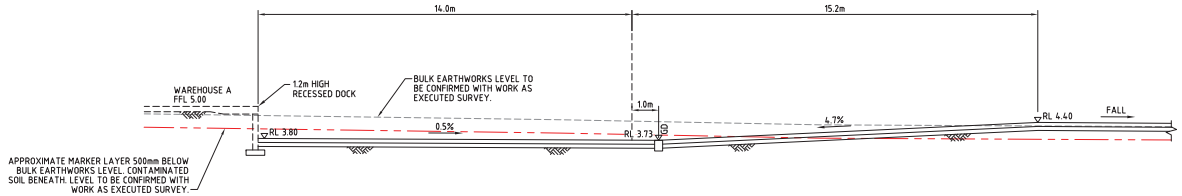
Date Plotted: 3 Oct 2014 - 04:20PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC005.dwg



SECTION 4 (DAC010)
1 : 100



SECTION 5 (DAC012)
1 : 100



SECTION 6 (DAC012)
1 : 100

Issue	Description	Date
P2	ISSUED FOR SECTION 75W	03-10-14
P1	ISSUED FOR INFORMATION	25-09-14

100mm on Original

Bar Scales

0 2 4 6 8 10m

1 : 100 @ A1 1 : 200 @ A3

Client: Goodman

Scales	1 : 100 @ A1
Grid	MGA
Height Datum	AHD
Drawn	GB
Designed	GB
Checked	AMcL
Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: TYPICAL CROSS SECTIONS SHEET 1

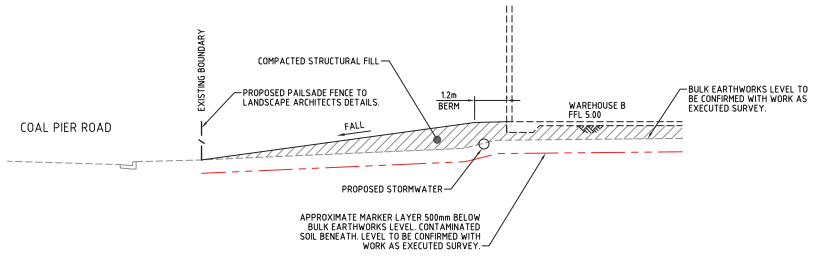
CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Drawing No.	Project No.	Issue
DAC007	14-213	P2

Date Plotted: 3 Oct 2014 - 04:20PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC007.dwg



SECTION 7 (DAC014)
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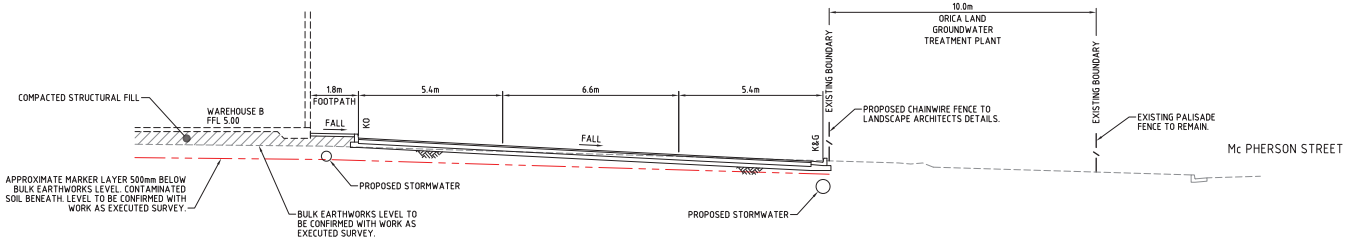
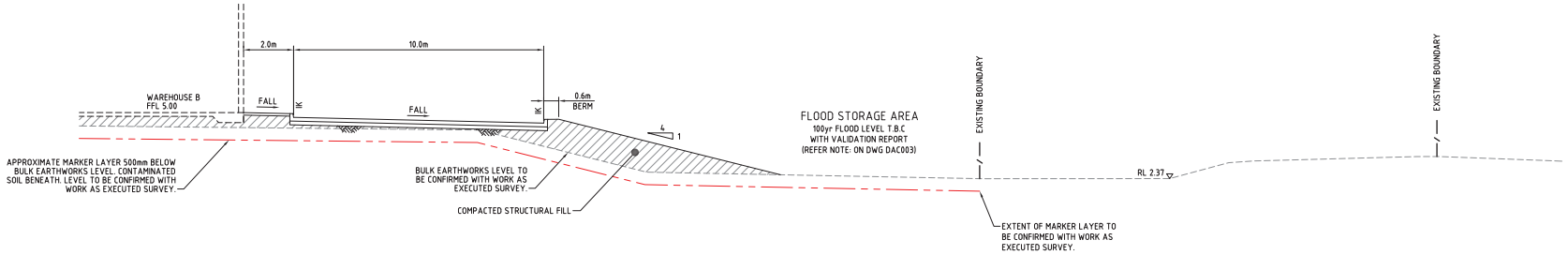


SECTION 8 (DAC014)
1 : 100



SECTION 9 (DAC015)
1 : 100

Issue	Description	Date
P2	ISSUED FOR SECTION 75W	03-10-14
P1	ISSUED FOR INFORMATION	25-09-14

Bar Scales
0 2 4 6 8 10m
1 : 100 @ A1 1 : 200 @ A3

Client: Goodman

Scales	1 : 100 @ A1
Grid	MGA
Height Datum	AHD
Drawn	GB
Designed	GB
Checked	AMcL
Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: TYPICAL CROSS SECTIONS SHEET 2

CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

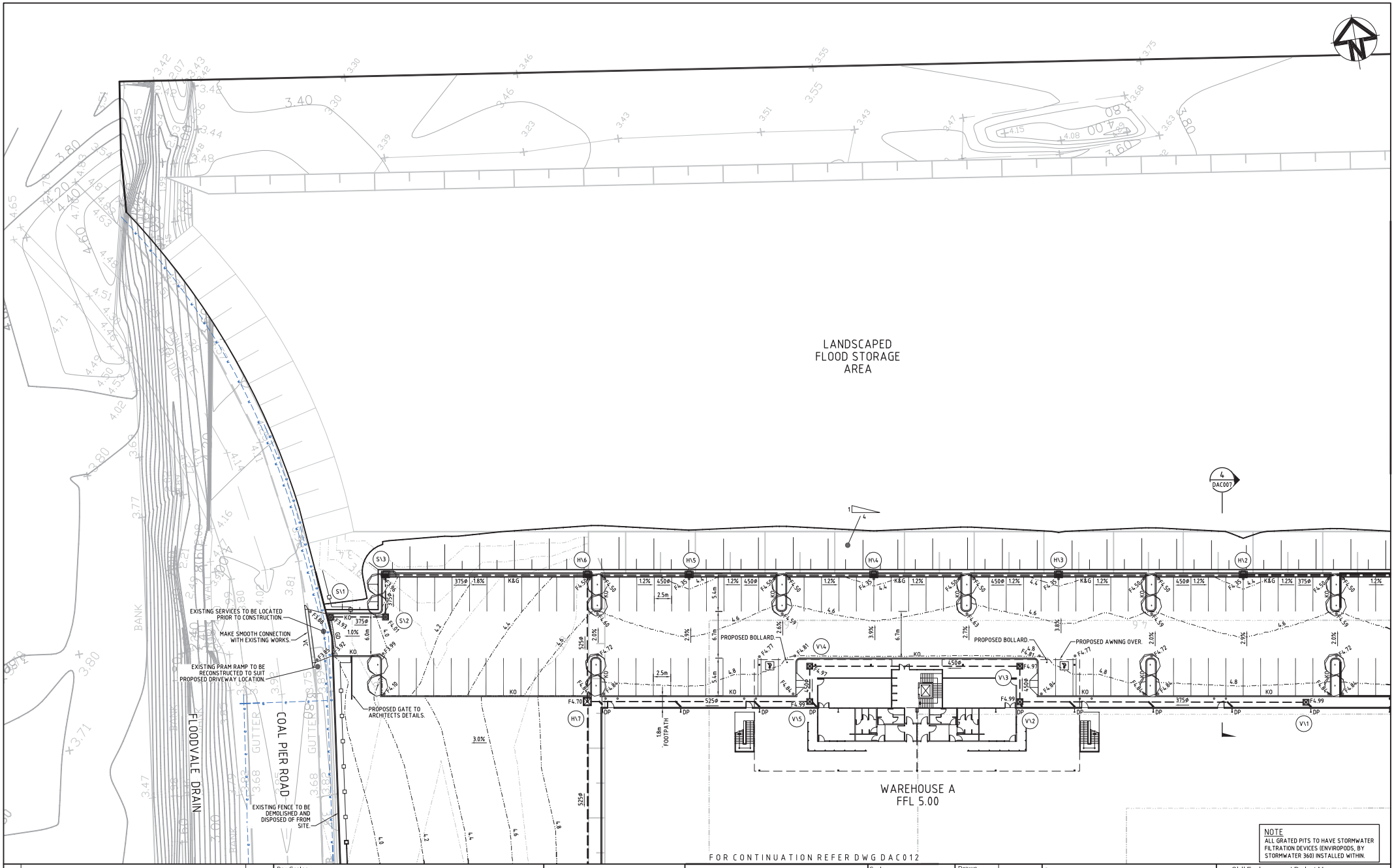
Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Drawing No.	Project No.	Issue
DAC008	14-213	P2

100mm on Original

Date Plotted: 3 Oct 2014 - 04:21PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC008.dwg



NOTE
ALL GRATED PITS TO HAVE STORMWATER FILTRATION DEVICES (ENVIROPODS, BY STORMWATER 360) INSTALLED WITHIN.

Issue	Description	Date
P3	ISSUED FOR SECTION 75W	03-10-14
P2	RE-ISSUED FOR INFORMATION	25-09-14
P1	ISSUED FOR INFORMATION	05-09-14

Bar Scales
0 5 10 15 20 25m
1 : 250 @ A1 1 : 500 @ A3

Client: Goodman

Scales	1 : 250 @ A1
Grid	MGA
Height Datum	AHD
Drawn	GB
Designed	GB
Checked	AMcL
Approved	AT

Project
PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title
SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 1

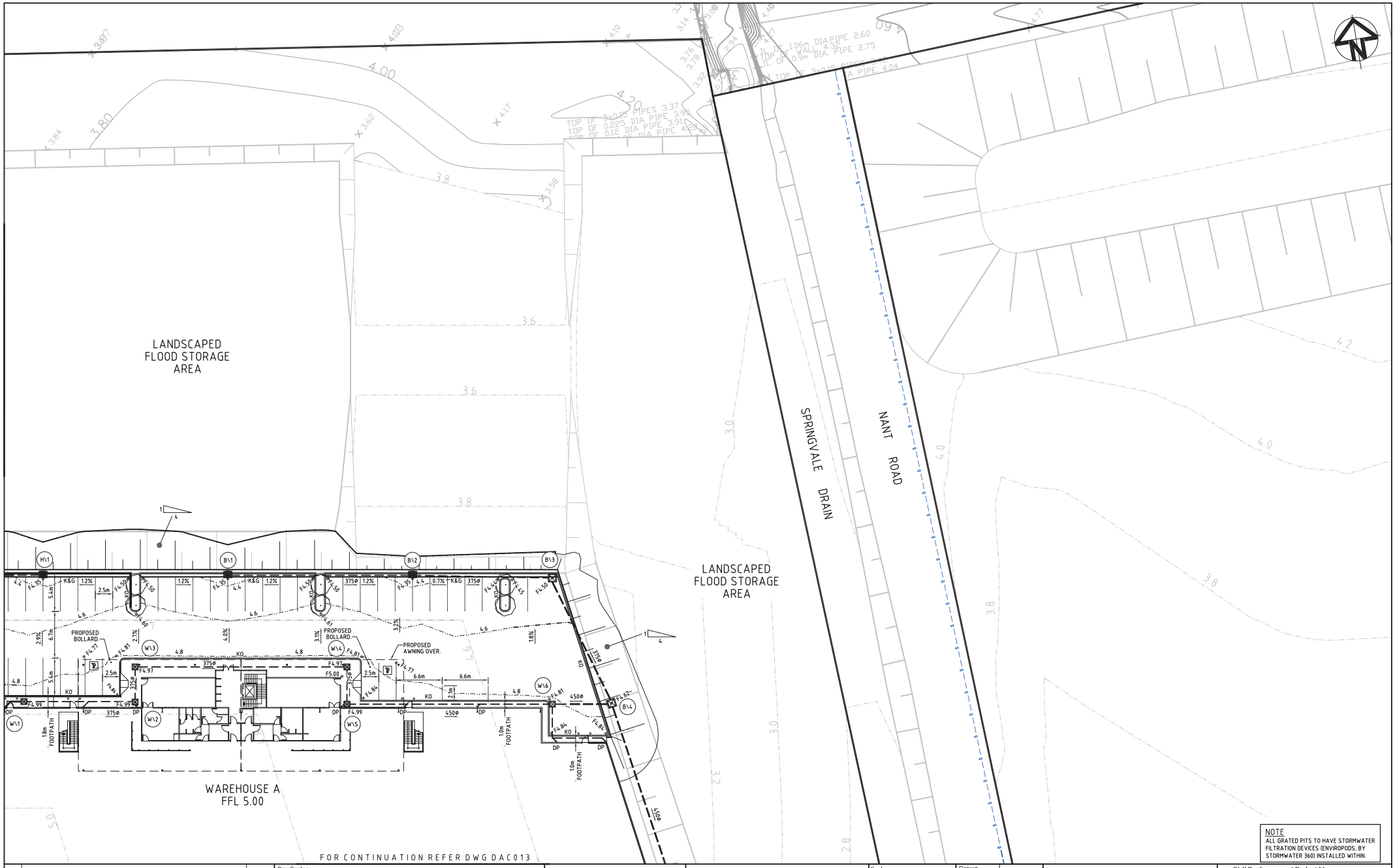
Civil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION
A1

Drawing No.	Project No.	Issue
DAC010	14-213	P3

100mm on Original

Date Plotted: 3 Oct 2014 - 04:21PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC010.dwg



NOTE
ALL GRATED PITS TO HAVE STORMWATER FILTRATION DEVICES (ENVIROPODS, BY STORMWATER 360) INSTALLED WITHIN.

Issue	Description	Date
P3	ISSUED FOR SECTION 75W	03-10-14
P2	RE-ISSUED FOR INFORMATION	25-09-14
P1	ISSUED FOR INFORMATION	05-09-14

100mm on Original

Bar Scales
0 5 10 15 20 25m
1 : 250 @ A1 1 : 500 @ A3

Client
Goodman

Scales	1 : 250 @ A1
Grid	MGA
Height Datum	AHD
Drawn	GB
Designed	GB
Checked	AMcL
Approved	AT

Project
PORT BOTANY
INDUSTRIAL ESTATE
STAGE 1

Title
SITEWORKS AND
STORMWATER DRAINAGE
PLAN
SHEET 2

Civil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

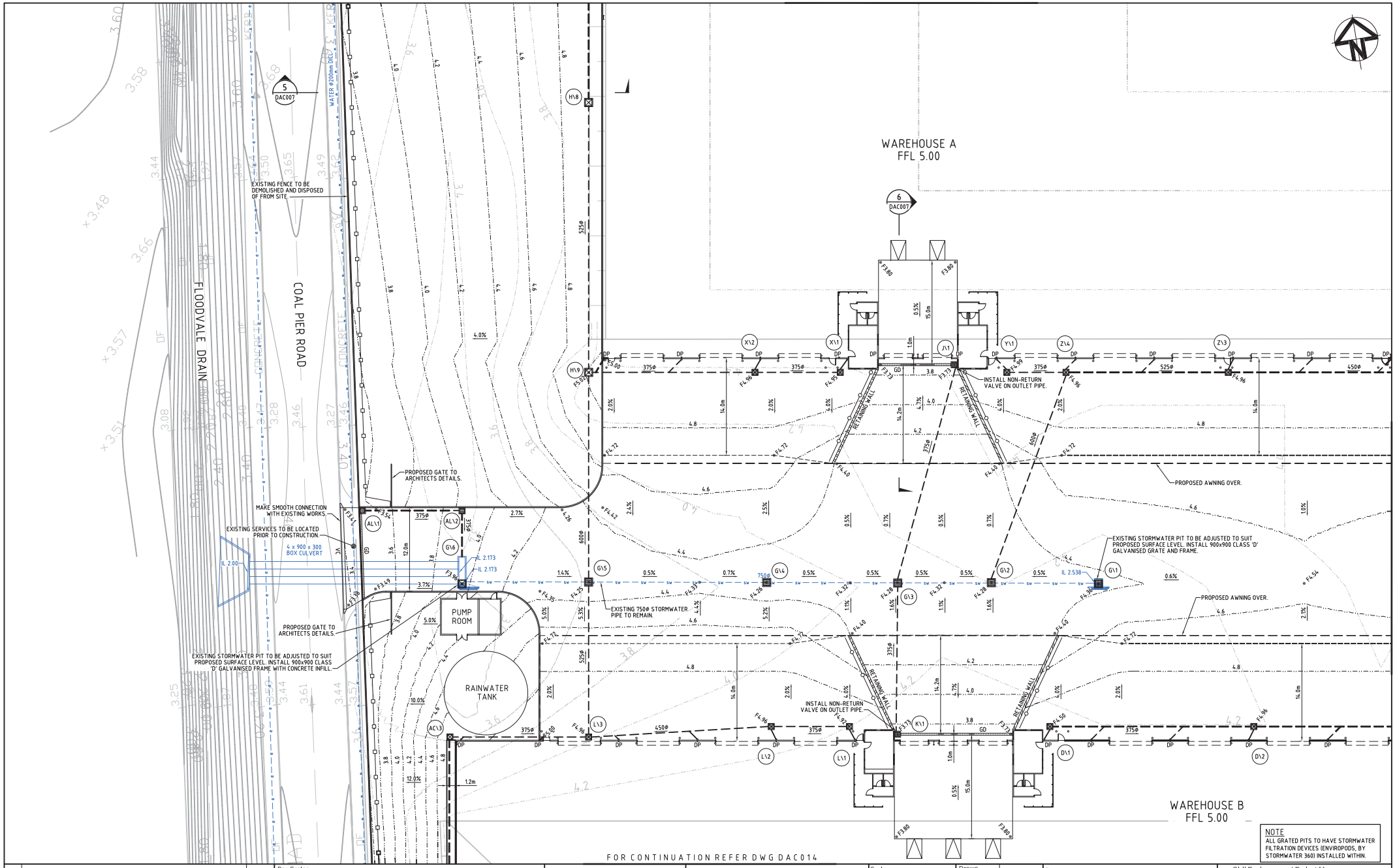
Status
FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Drawing No.	Project No.	Issue
DAC011	14-213	P3

Date Plotted: 3 Oct 2014 - 04:21PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC011.dwg

FOR CONTINUATION REFER DWG DAC010



FOR CONTINUATION REFER DWG DAC013

FOR CONTINUATION REFER DWG DAC014

NOTE
ALL GRATED PITS TO HAVE STORMWATER FILTRATION DEVICES (ENVIROPODS, BY STORMWATER 360) INSTALLED WITHIN.

Issue	Description	Date
P3	ISSUED FOR SECTION 75W	03-10-14
P2	RE-ISSUED FOR INFORMATION	25-09-14
P1	ISSUED FOR INFORMATION	05-09-14

Bar Scales
0 5 10 15 20 25m
1 : 250 @ A1 1 : 500 @ A3

Client: Goodman

Scales	1 : 250 @ A1
Drawn	GB
Designed	GB
Grid	MGA
Checked	AMcL
Height Datum	AHD
Approved	AT

Project
PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title
SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 3

CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION
A1

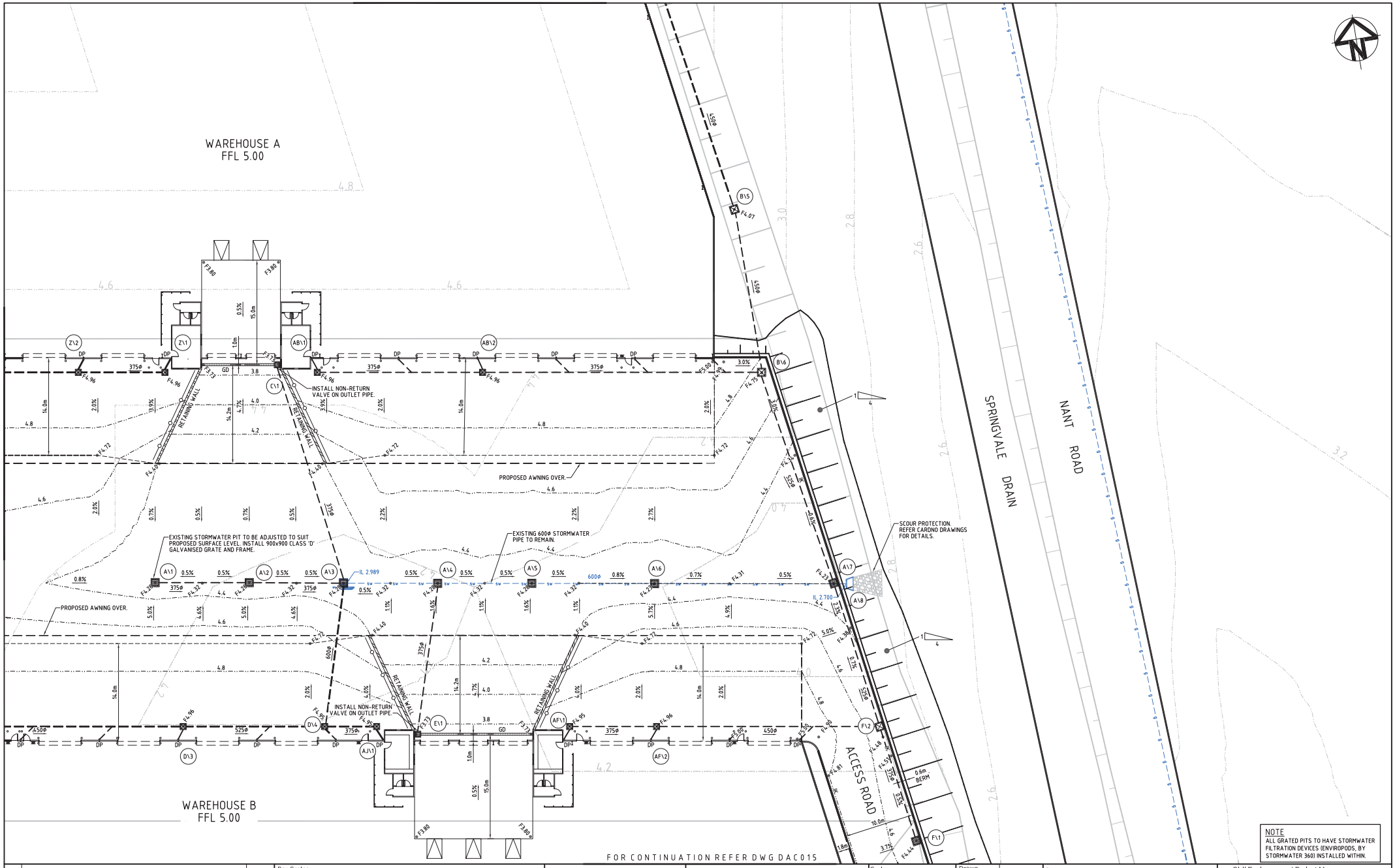
Drawing No.	Project No.	Issue
DAC012	14-213	P3

100mm on Original

Date Plotted: 3 Oct 2014 - 04:28PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC012.dwg

FOR CONTINUATION REFER DWG DAC011

FOR CONTINUATION REFER DWG DAC012



FOR CONTINUATION REFER DWG DAC015

NOTE
ALL GRATED PITS TO HAVE STORMWATER FILTRATION DEVICES (ENVIROPODS, BY STORMWATER 360) INSTALLED WITHIN.

Issue	Description	Date
P3	ISSUED FOR SECTION 75W	03-10-14
P2	RE-ISSUED FOR INFORMATION	25-09-14
P1	ISSUED FOR INFORMATION	05-09-14

100mm on Original

Bar Scales

0 5 10 15 20 25m

1 : 250 @ A1 1 : 500 @ A3

Client: Goodman

Scales	1 : 250 @ A1
Grid	MGA
Height Datum	AHD
Drawn	GB
Designed	GB
Checked	AMcL
Approved	AT

Project
PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title
SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 4

CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
Info@atl.net.au

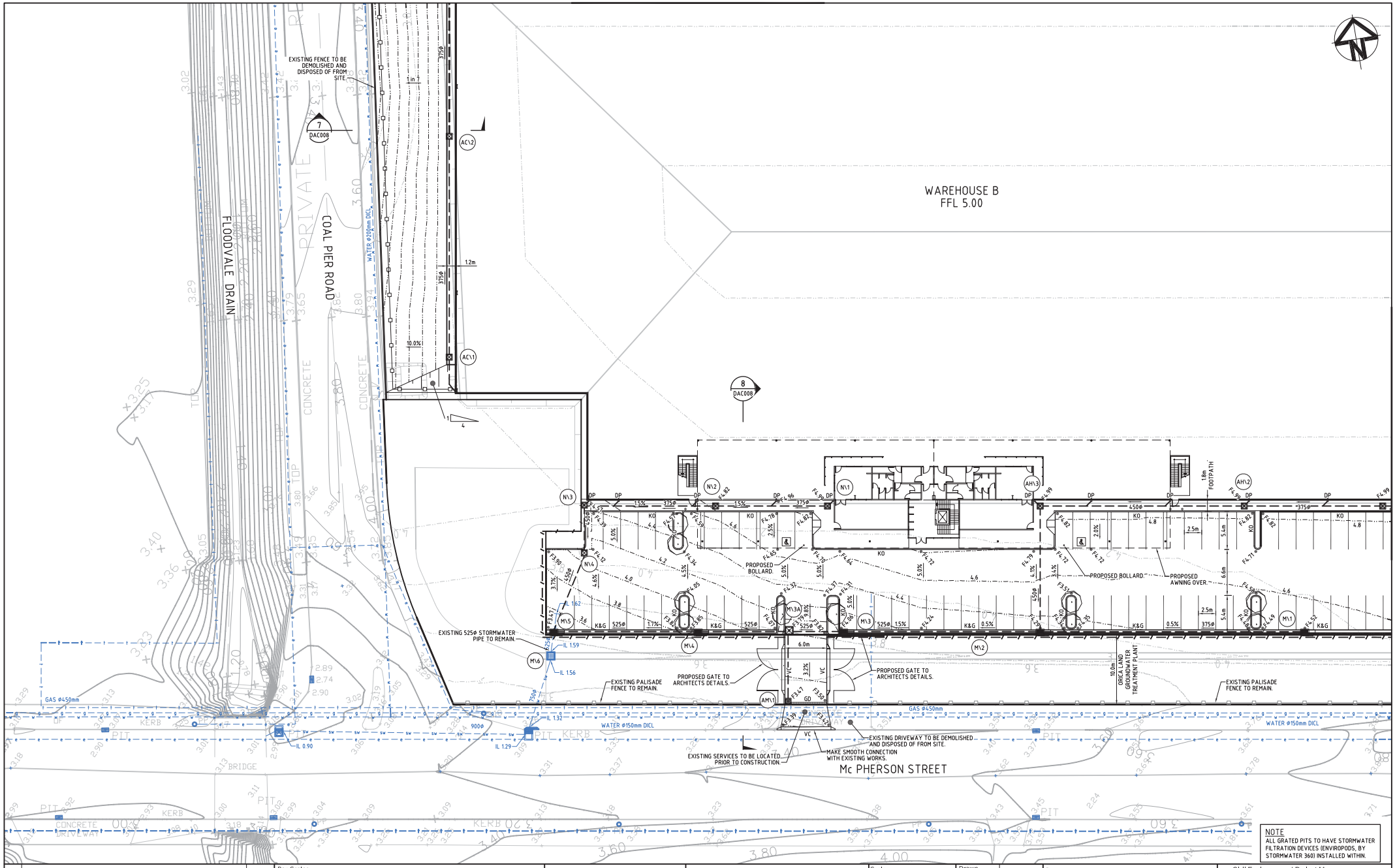
Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Drawing No.	Project No.	Issue
DAC013	14-213	P3

Date Plotted: 3 Oct 2014 - 04:22PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC013.dwg

FOR CONTINUATION REFER DWG DAC012



NOTE
ALL GRATED PITS TO HAVE STORMWATER FILTRATION DEVICES (ENVIROPODS, BY STORMWATER 360) INSTALLED WITHIN.

Issue	Description	Date
P3	ISSUED FOR SECTION 75W	03-10-14
P2	RE-ISSUED FOR INFORMATION	25-09-14
P1	ISSUED FOR INFORMATION	05-09-14

100mm on Original

Bar Scales
0 5 10 15 20 25m
1 : 250 @ A1 1 : 500 @ A3

Client: Goodman

Scales	1 : 250 @ A1
Drawn	GB
Designed	GB
Grid	MGA
Checked	AMcL
Height Datum	AHD
Approved	AT

Project
PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title
SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 5

CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION
A1

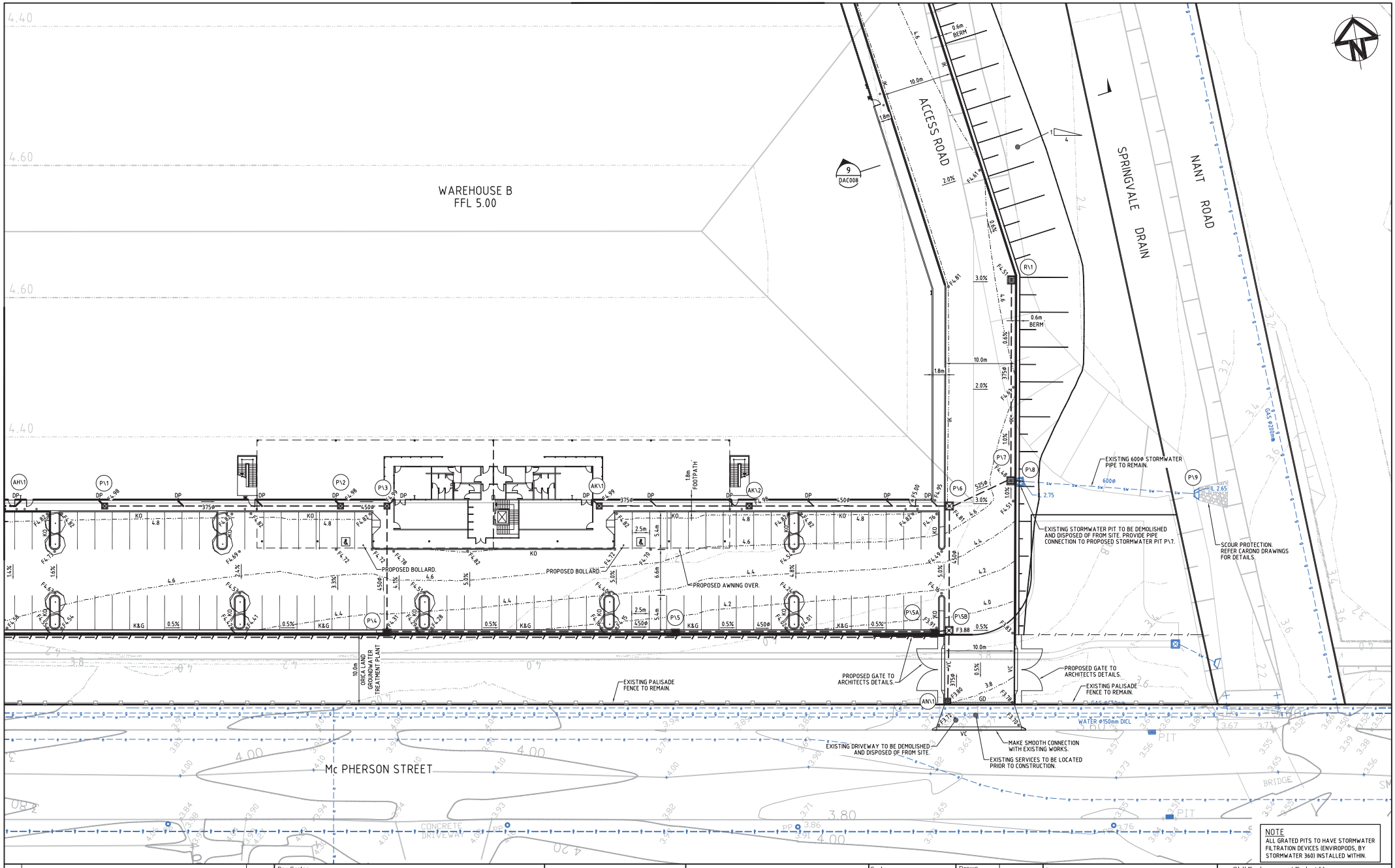
Drawing No.	Project No.	Issue
DAC014	14-213	P3

Date Plotted: 3 Oct 2014 - 04:22PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC014.dwg

FOR CONTINUATION REFER DWG DAC015

FOR CONTINUATION REFER DWG DAC013

FOR CONTINUATION REFER DWG DAC014



NOTE
ALL GRATED PITS TO HAVE STORMWATER FILTRATION DEVICES (ENVIROPODS, BY STORMWATER 360) INSTALLED WITHIN.

Issue	Description	Date
P3	ISSUED FOR SECTION 75W	03-10-14
P2	RE-ISSUED FOR INFORMATION	25-09-14
P1	ISSUED FOR INFORMATION	05-09-14

100mm on Original

Bar Scales

0 5 10 15 20 25m

1 : 250 @ A1 1 : 500 @ A3

Client: Goodman

Scales	1 : 250 @ A1	Drawn	GB
		Designed	GB
Grid	MGA	Checked	AMcL
Height Datum	AHD	Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 6

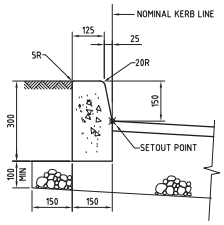
CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

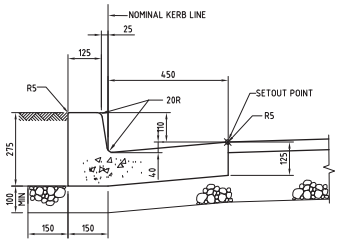
A1

Drawing No.	Project No.	Issue
DAC015	14-213	P3

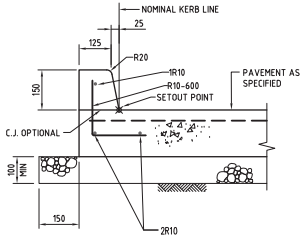
Date Plotted: 3 Oct 2014 - 04:23PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC015.dwg



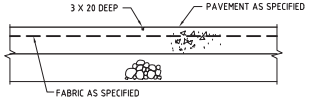
KERB ONLY (KO)
SCALE 1:10



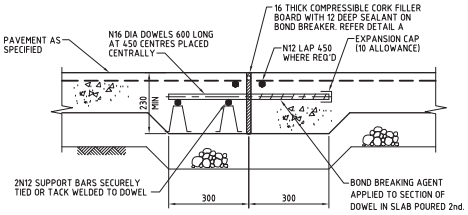
KERB AND GUTTER (K&G)
SCALE 1:10



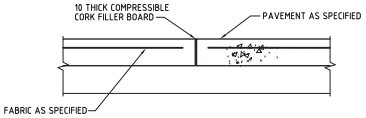
INTEGRAL KERB (IK)
SCALE 1:10



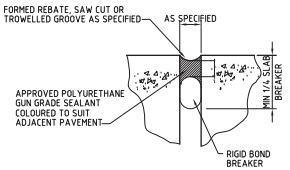
FOOTPATH WEAKENED PLANE JOINT (WPJ)
SCALE 1:10



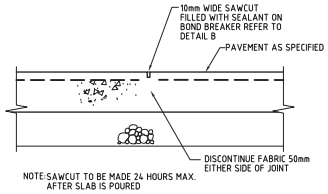
DOWELLED EXPANSION JOINT (DEJ)
SCALE 1:10



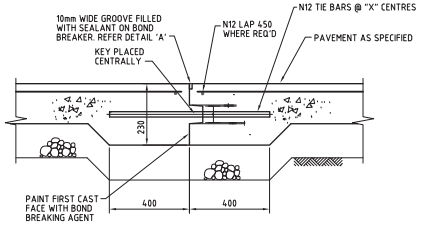
FOOTPATH EXPANSION JOINT (EJ)
SCALE 1:10



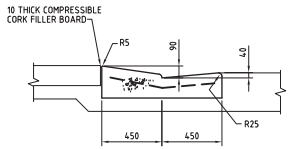
DETAIL A
N.T.S.



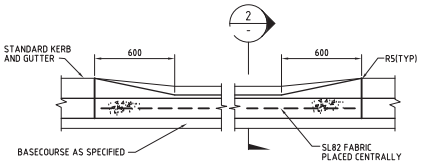
SAWN JOINT (SJ)
SCALE 1:10



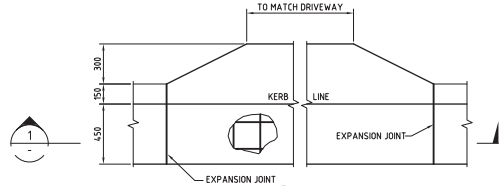
KEYED CONSTRUCTION JOINT (KJ)
SCALE 1:10
(X = 650,000/(BASE THICKNESS (mm) x JOINT SPACING (m)))



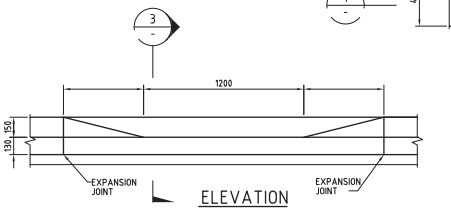
SECTION 2
1 : 20



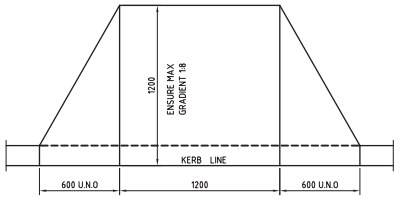
SECTION 1
1 : 20



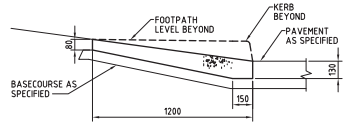
PLAN
VEHICULAR CROSSING
SCALE 1:20



ELEVATION



PLAN
RAMPED CROSSING
SCALE 1:20



SECTION 3
1 : 20

Issue	Description	Date
P2	ISSUED FOR SECTION 75W	03-10-14
P1	ISSUED FOR INFORMATION	25-09-14

100mm on Original

Bar Scales

0 100 200 400 600 800 1000mm
1 : 10 @ A1 1 : 20 @ A3

0 500 1000 1500 2000mm
1 : 20 @ A1 1 : 40 @ A3

Client: Goodman

Scales	AS SHOWN	Drawn	GB
		Designed	GB
Grid	MGA	Checked	AMcL
Height Datum	AHD	Approved	AT

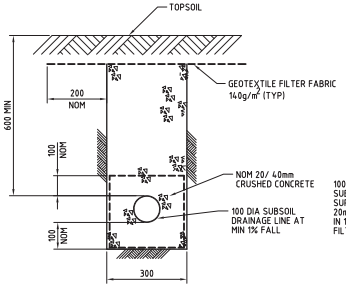
Project
PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title
SITEWORKS DETAILS

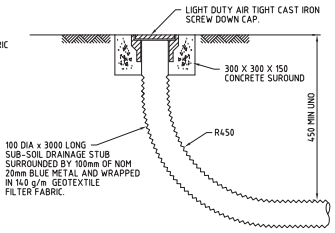
CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
Info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION
A1

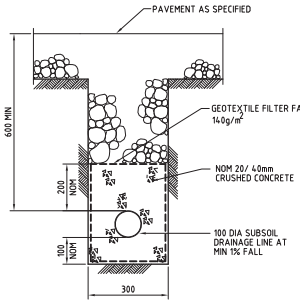
Drawing No.	Project No.	Issue
DAC020	14-213	P2



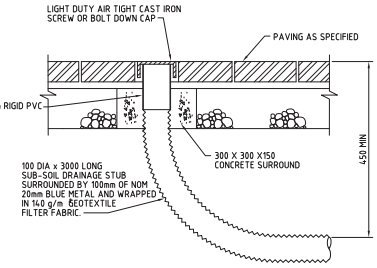
SUBSOIL IN LANDSCAPED AREAS
SCALE 1:10



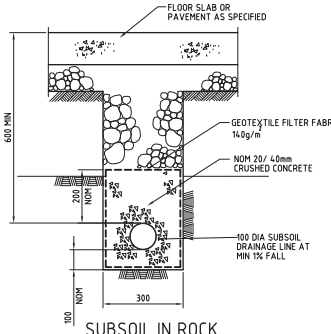
FLUSHING POINT
SCALE 1:10
NOTE: SLOTTED RIGID PVC PIPE AND FITTINGS MAY BE USED



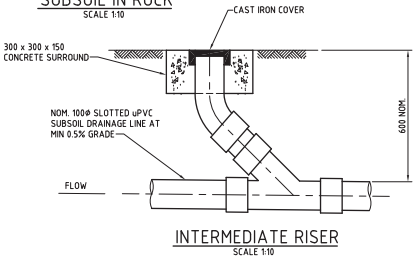
SUBSOIL IN PAVED AREAS
SCALE 1:10



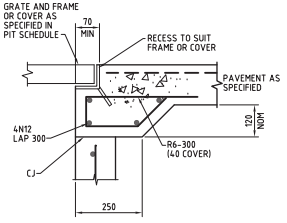
FLUSHING POINT IN PAVING
SCALE 1:10
NOTE: SLOTTED RIGID PVC PIPE AND FITTINGS MAY BE USED



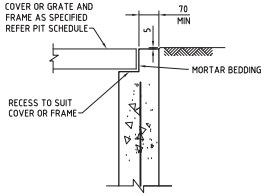
SUBSOIL IN ROCK
SCALE 1:10



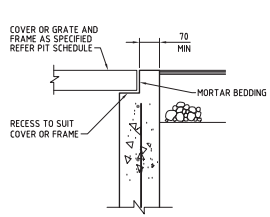
INTERMEDIATE RISER
SCALE 1:10



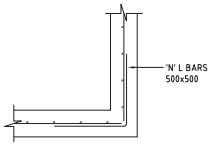
DETAIL "C"
SCALE 1:10



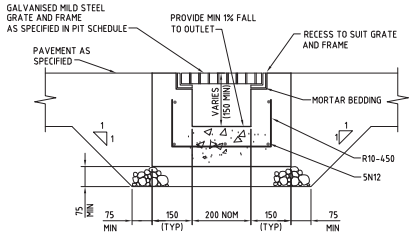
DETAIL "E"
SCALE 1:10



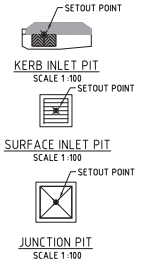
DETAIL "D"
SCALE 1:10



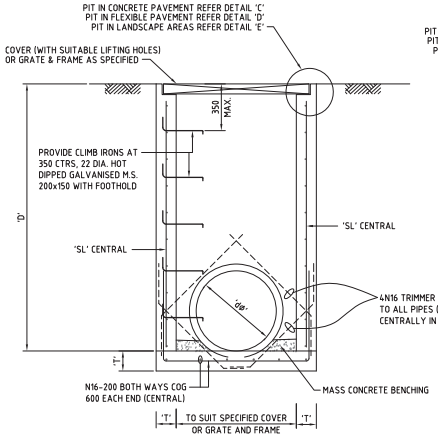
TYPICAL CORNER DETAIL
SCALE 1:20



GRATED DRAIN (GD)
SCALE 1:10

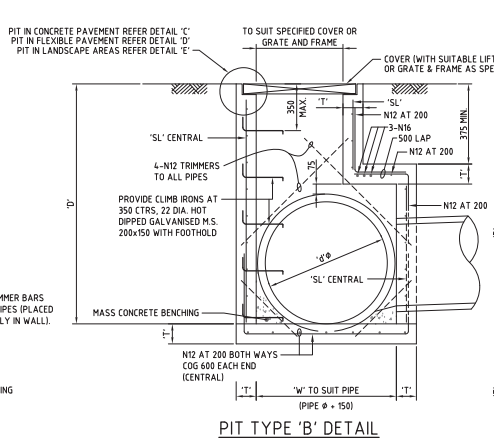


STORMWATER PIT SETOUT POINTS



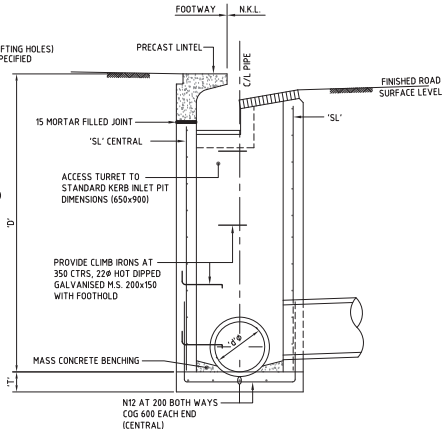
PIT TYPE 'A' DETAIL
SURFACE INLET PIT
FOR PIPES UP TO 525ø
SCALE: 1:20

PIPE DIA. 'øø'	WIDTH 'W'	DEPTH 'D'	WALL 'T'	FABRIC/COV 'SL'
375	650	800	150	SL72
	650	1200	150	SL72
	650	1600	150	SL72
	650	2000	150	SL72
	650	2400	150	SL72
450	650	800	150	SL72
	650	1200	150	SL72
	650	1600	150	SL72
	650	2000	150	SL72
	650	2400	150	SL72
525	650	800	150	SL72
	650	1200	150	SL72
	650	1600	150	SL72
	650	2000	150	SL72
	650	2400	150	SL72



PIT TYPE 'B' DETAIL
SURFACE INLET PIT
FOR PIPES FROM 600ø TO 1200ø
(ENLARGED CHAMBER)
SCALE: 1:20

PIPE DIA. 'øø'	WIDTH 'W'	DEPTH 'D'	WALL 'T'	FABRIC/COV 'SL'
600	850	1200	150	SL72
	850	1600	150	SL72
	850	2000	150	SL72
	850	2400	150	SL72
675	940	1200	150	SL72
	940	1600	150	SL72
	940	2000	150	SL72
	940	2400	150	SL72
750	1020	1200	150	SL72
	1020	1600	150	SL72
	1020	2000	150	SL72
	1020	2400	150	SL72
825	1100	1600	150	SL72
	1100	2000	150	SL72
	1100	2400	150	SL72
900	1180	1600	150	SL72
	1180	2000	150	SL72
	1180	2400	150	SL72
1050	1345	1600	150	SL92
	1345	2000	150	SL92
	1345	2400	150	SL92
1200	1510	2000	150	SL102
	1510	2400	150	SL102
	1510	2800	150	SL102



PIT TYPE 'D' DETAIL
STANDARD GRATED KERB INLET PIT
FOR PIPES UPTO 525ø
SCALE: 1:20

PIPE DIA. 'øø'	WIDTH 'W'	DEPTH 'D'	WALL 'T'	FABRIC/COV 'SL'
375	650	800	150	SL72
	650	1200	150	SL72
	650	1600	150	SL72
	650	2000	150	SL72
	650	2400	150	SL72
450	650	800	150	SL72
	650	1200	150	SL72
	650	1600	150	SL72
	650	2000	150	SL72
	650	2400	150	SL72
525	650	800	150	SL72
	650	1200	150	SL72
	650	1600	150	SL72
	650	2000	150	SL72
	650	2400	150	SL72

NOTE

1. FOR PIT SIZE REFER TO TABLE (900 MIN LONG).
2. REINFORCING MESH IS TO BE BENT TO LAP 300 AROUND ALL CORNERS. VERTICAL BARS ARE NOT TO BE CUT. ALTERNATLY PROVIDE N12 "L" BARS (500x500) AT 400 VERTICAL CTS.
3. COMPRESSIVE STRENGTH (F'c) FOR CAST IN SITU CONCRETE SHALL BE A MINIMUM 32 MPa AT 28 DAYS.
4. TOP OF BENCHING SHALL BE ½ OF OUTLET PIPE DIAMETER.
5. 100mm SUBSOIL DRAINAGE PIPE 3000 LONG WRAPPED IN FABRIC SOCK TO BE PROVIDE ADJACENT TO INLET PIPES.
6. ALL PITS SHALL BE PROVIDED WITH A LOCKING CLIP.
7. PIT GRATE TO BE 'WELDLOK' GULLY GRATE GG 78-50 OR APPROVED EQUIVALENT.
8. DURING INSTALLATION OF GRATE AND FRAME CONTRACTOR IS TO ENSURE CLEARANCE BETWEEN LINTEL AND OPENED GRATE (REFER TO INSTALLATION TOLERANCE).
9. PROVIDE STEP IRONS AS INDICATED FOR PITS DEEPER THAN 1200.
10. N12 AT 200 CENTRAL MAY BE USED IN LEIU OF MESH. LAP 500 AT CORNERS
11. CONCRETE STRENGTH – UNLESS NOTED OTHERWISE

ELEMENT	f'c MPa (28 DAYS)	SLUMP	MAX AGG SIZE	CEMENT TYPE
PITS	32	80mm	20mm	GP

12. COVER – UNLESS NOTED OTHERWISE

ELEMENT	INTERIOR	EXTERIOR
PITS		45mm
SLAB TOP	45mm	45mm
SLAB BOTTOM	45mm	45mm
BEAM TOP		
BEAM BOTTOM		
BEAM SIDE		
COLUMNS		

Issue	Description	Date
P2	ISSUED FOR SECTION 75W	03-10-14
P1	ISSUED FOR INFORMATION	25-09-14

100mm on Original

Bar Scales
0 100 200 400 600 800 1000mm
1 : 10 @ A1 1 : 20 @ A3
0 500 1000 1500 2000mm
1 : 20 @ A1 1 : 40 @ A3
0 2 4 6 8 10m
1 : 100 @ A1 1 : 200 @ A3

Client: Goodman

Scales	AS SHOWN	Drawn	GB
		Designed	GB
Grid	MGA	Checked	AMcL
Height Datum	AHD	Approved	AT

Project
PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title
STORMWATER DRAINAGE DETAILS

CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION
A1

Drawing No.	Project No.	Issue
DAC025	14-213	P2

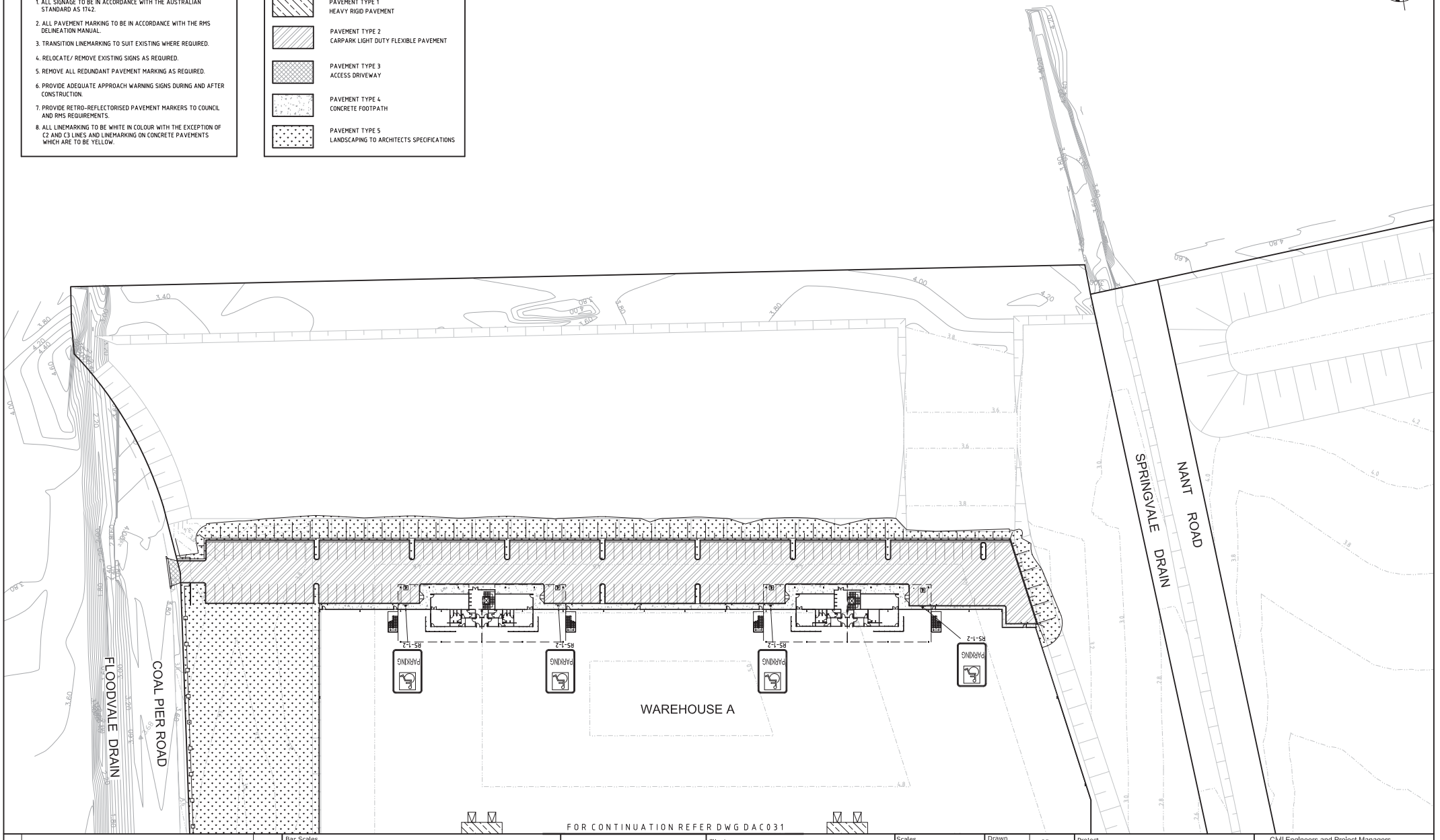
Date Plotted: 3 Oct 2014 - 04:23PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC025.dwg

PAVEMENT MARKING NOTES

1. ALL SIGNAGE TO BE IN ACCORDANCE WITH THE AUSTRALIAN STANDARD AS 1742.
2. ALL PAVEMENT MARKING TO BE IN ACCORDANCE WITH THE RMS DELINEATION MANUAL.
3. TRANSITION LINEMARKING TO SUIT EXISTING WHERE REQUIRED.
4. RELOCATE/ REMOVE EXISTING SIGNS AS REQUIRED.
5. REMOVE ALL REDUNDANT PAVEMENT MARKING AS REQUIRED.
6. PROVIDE ADEQUATE APPROACH WARNING SIGNS DURING AND AFTER CONSTRUCTION.
7. PROVIDE RETRO-REFLECTORISED PAVEMENT MARKERS TO COUNCIL AND RMS REQUIREMENTS.
8. ALL LINEMARKING TO BE WHITE IN COLOUR WITH THE EXCEPTION OF C2 AND C3 LINES AND LINEMARKING ON CONCRETE PAVEMENTS WHICH ARE TO BE YELLOW.

PAVEMENT LEGEND

- PAVEMENT TYPE 1 — HEAVY RIGID PAVEMENT
- PAVEMENT TYPE 2 — CARPARK LIGHT DUTY FLEXIBLE PAVEMENT
- PAVEMENT TYPE 3 — ACCESS DRIVEWAY
- PAVEMENT TYPE 4 — CONCRETE FOOTPATH
- PAVEMENT TYPE 5 — LANDSCAPING TO ARCHITECTS SPECIFICATIONS



Issue	Description	Date
P2	ISSUED FOR SECTION 75W	03-10-14
P1	ISSUED FOR INFORMATION	25-09-14

100mm on Original

Bar Scales

0 10 20 30 40 50m

1 : 500 @ A1 1 : 1000 @ A3

Client: Goodman

Scales	1 : 500 @ A1
Grid	MGA
Height Datum	AHD
Drawn	GB
Designed	GB
Checked	AMcL
Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: PAVEMENT, SIGNAGE AND LINEMARKING PLAN SHEET 1

CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
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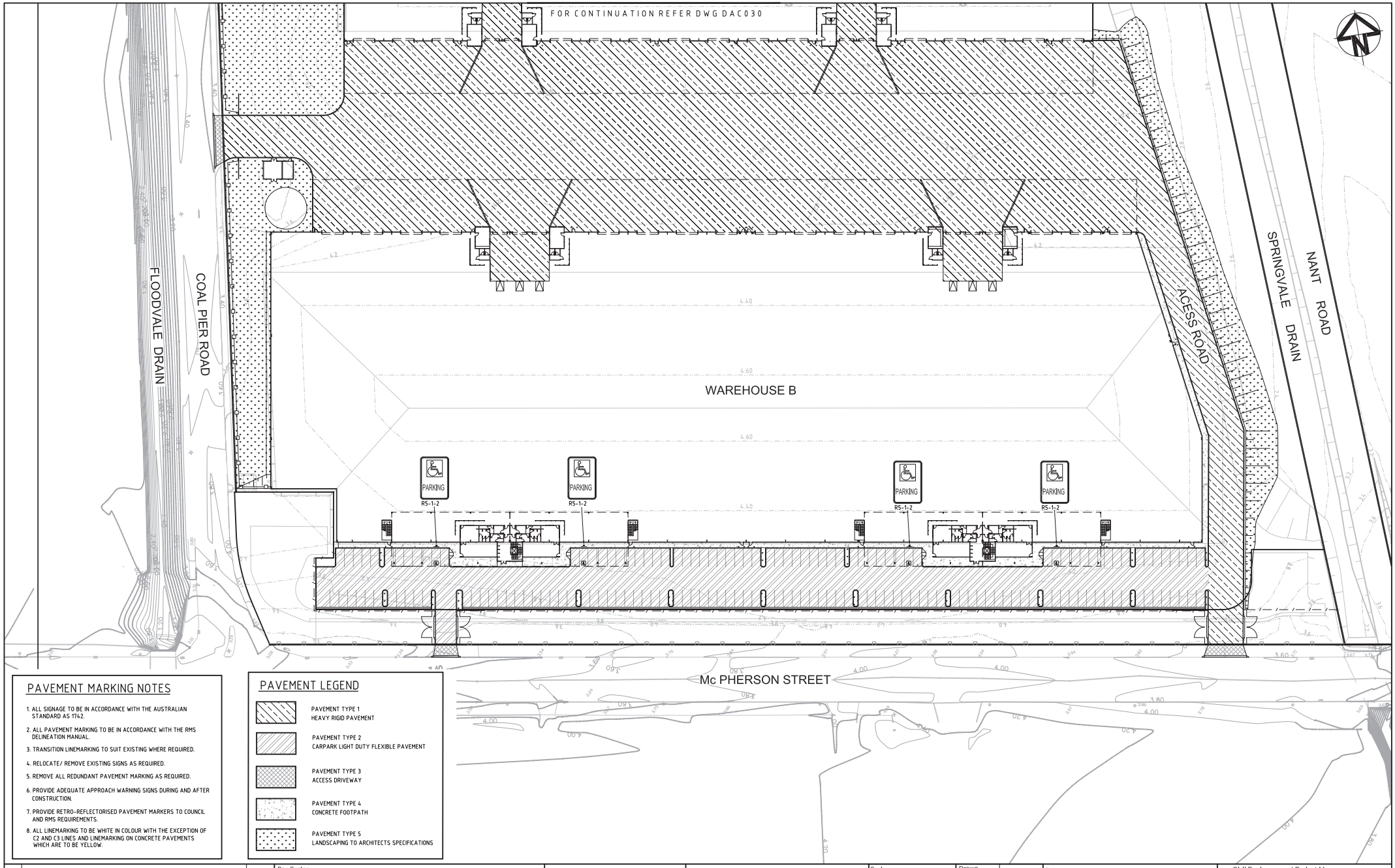
A1

Drawing No.	Project No.	Issue
DAC030	14-213	P2

Date Plotted: 3 Oct 2014 - 04:23PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC030.dwg



PAVEMENT MARKING NOTES

1. ALL SIGNAGE TO BE IN ACCORDANCE WITH THE AUSTRALIAN STANDARD AS 1742.
2. ALL PAVEMENT MARKING TO BE IN ACCORDANCE WITH THE RMS DELINEATION MANUAL.
3. TRANSITION LINEMARKING TO SUIT EXISTING WHERE REQUIRED.
4. RELOCATE/ REMOVE EXISTING SIGNS AS REQUIRED.
5. REMOVE ALL REDUNDANT PAVEMENT MARKING AS REQUIRED.
6. PROVIDE ADEQUATE APPROACH WARNING SIGNS DURING AND AFTER CONSTRUCTION.
7. PROVIDE RETRO-REFLECTORISED PAVEMENT MARKERS TO COUNCIL AND RMS REQUIREMENTS.
8. ALL LINEMARKING TO BE WHITE IN COLOUR WITH THE EXCEPTION OF C2 AND C3 LINES AND LINEMARKING ON CONCRETE PAVEMENTS WHICH ARE TO BE YELLOW.

PAVEMENT LEGEND

- PAVEMENT TYPE 1 — HEAVY RIGID PAVEMENT
- PAVEMENT TYPE 2 — CARPARK LIGHT DUTY FLEXIBLE PAVEMENT
- PAVEMENT TYPE 3 — ACCESS DRIVEWAY
- PAVEMENT TYPE 4 — CONCRETE FOOTPATH
- PAVEMENT TYPE 5 — LANDSCAPING TO ARCHITECTS SPECIFICATIONS

Issue	Description	Date
P2	ISSUED FOR SECTION 75W	03-10-14
P1	ISSUED FOR INFORMATION	25-09-14

100mm on Original

Bar Scales

0 10 20 30 40 50m

1 : 500 @ A1 1 : 1000 @ A3

Client: Goodman

Scales	1 : 500 @ A1	Drawn	GB
		Designed	GB
Grid	MGA	Checked	AMcL
Height Datum	AHD	Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: PAVEMENT, SIGNAGE AND LINEMARKING PLAN SHEET 2

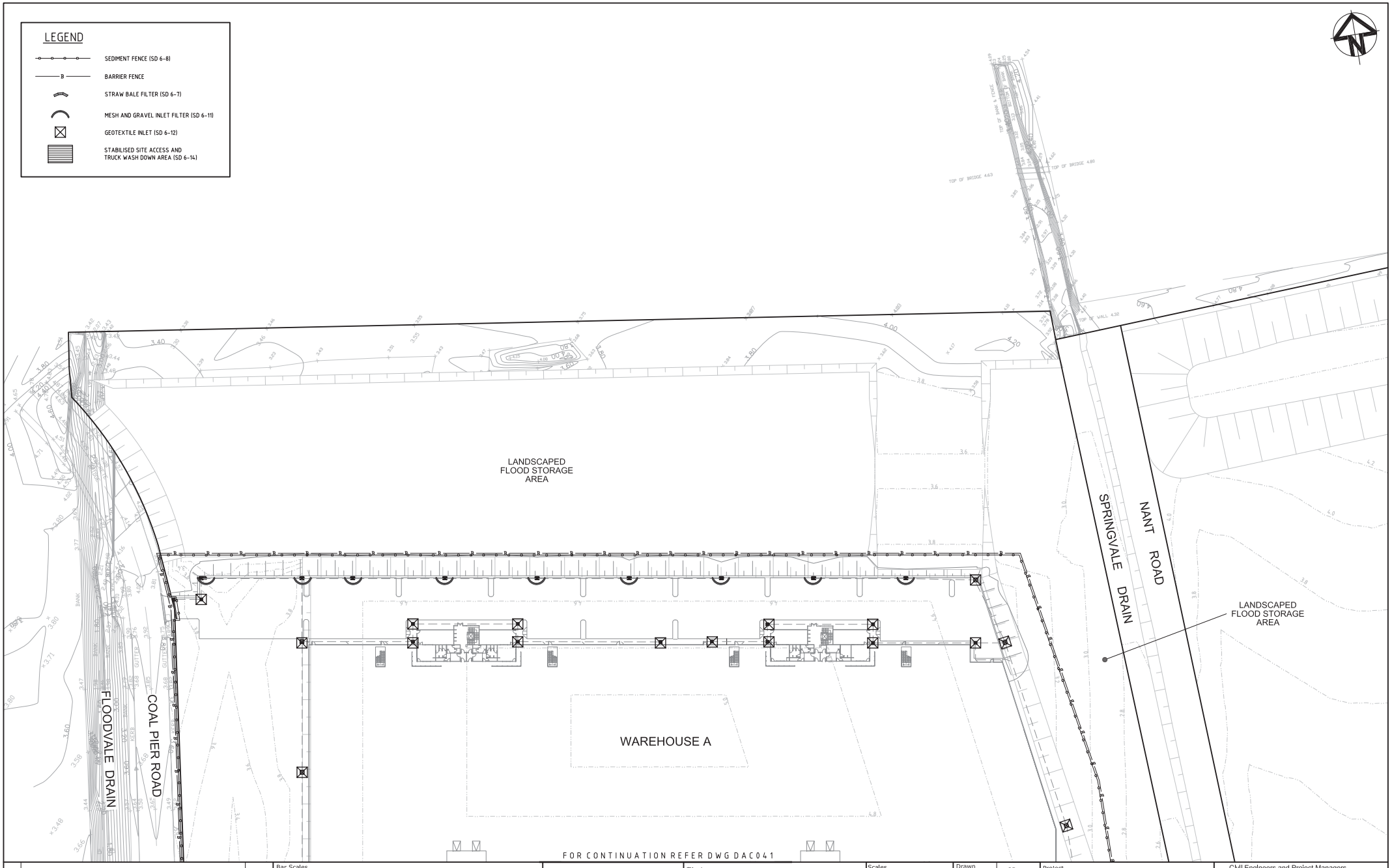
CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Drawing No.	Project No.	Issue
DAC031	14-213	P2

Date Plotted: 3 Oct 2014 - 04:23PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC031.dwg



Issue	Description	Date
P2	ISSUED FOR SECTION 75W	03-10-14
P1	ISSUED FOR INFORMATION	25-09-14

100mm on Original

Bar Scales

0 10 20 30 40 50m

1 : 500 @ A1 1 : 1000 @ A3

Client: Goodman

Scales	1 : 500 @ A1
Grid	MGA
Height Datum	AHD
Drawn	GB
Designed	GB
Checked	AMcL
Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: SEDIMENTATION AND EROSION CONTROL PLAN SHEET 1

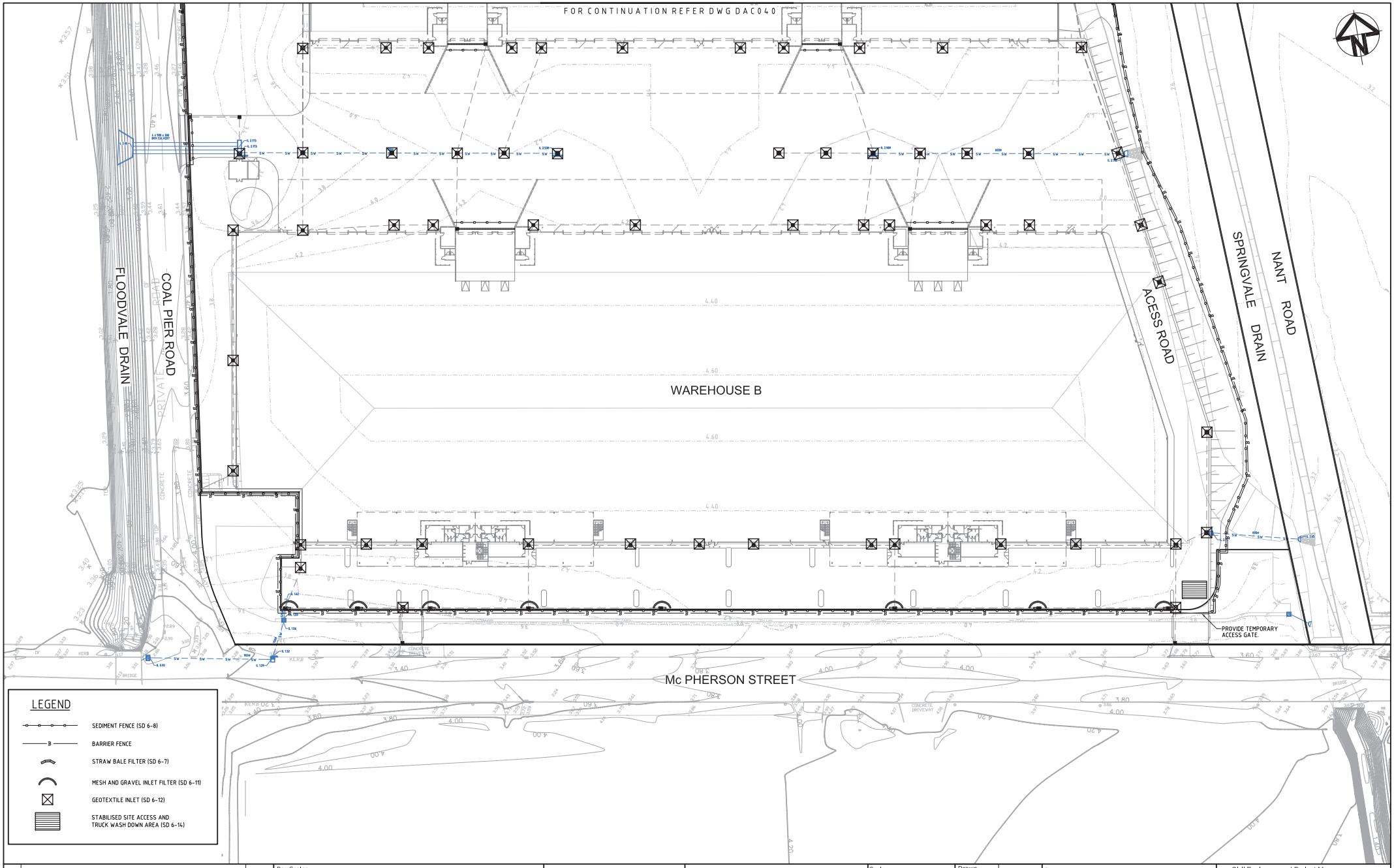
Civil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Drawing No.	Project No.	Issue
DAC040	14-213	P2

Date Plotted: 3 Oct 2014 - 04:24PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC040.dwg



Issue	Description	Date
P2	ISSUED FOR SECTION 75W	03-10-14
P1	ISSUED FOR INFORMATION	25-09-14

100mm on Original

Bar Scales

0 10 20 30 40 50m

1 : 500 @ A1 1 : 1000 @ A3

Client: Goodman

Scales	1 : 500 @ A1
Grid	MGA
Height Datum	AHD
Drawn	GB
Designed	GB
Checked	AMcL
Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: SEDIMENTATION AND EROSION CONTROL PLAN SHEET 2

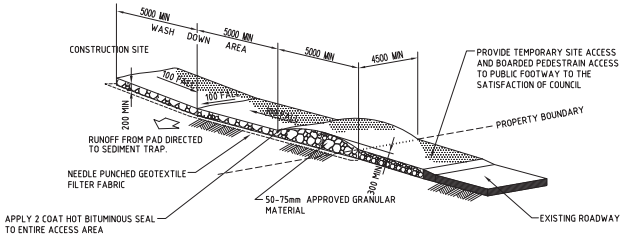
Civil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

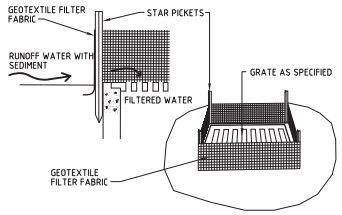
A1

Drawing No.	Project No.	Issue
DAC041	14-213	P2

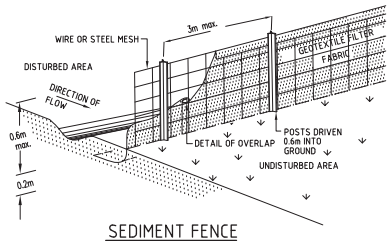
Date Plotted: 3 Oct 2014 - 04:24PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC041.dwg



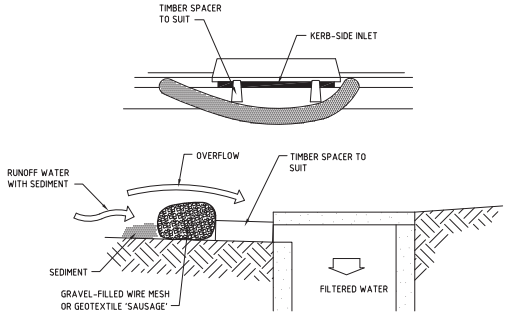
STABILISED SITE ACCESS AND TRUCK WASH DOWN AREA
NTS



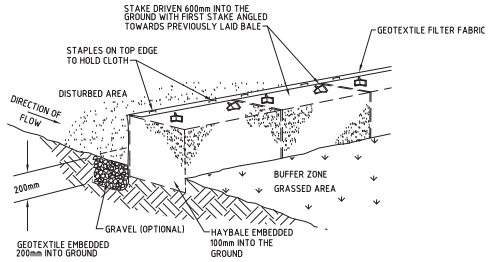
GEOTEXTILE FILTER PIT SURROUND
NTS



SEDIMENT FENCE
NTS



MESH AND GRAVEL INLET FILTER
NTS



HAYBALE AND GEOTEXTILE SEDIMENT FILTER
NTS

Issue	Description	Date
P2	ISSUED FOR SECTION 75W	03-10-14
P1	ISSUED FOR INFORMATION	25-09-14

100mm on Original

Bar Scales

Client: Goodman

Scales	AS SHOWN
Grid	MGA
Height Datum	AHD
Drawn	GB
Designed	GB
Checked	AMcL
Approved	AT

Project: PORT BOTANY INDUSTRIAL ESTATE STAGE 1

Title: SEDIMENTATION AND EROSION CONTROL DETAILS

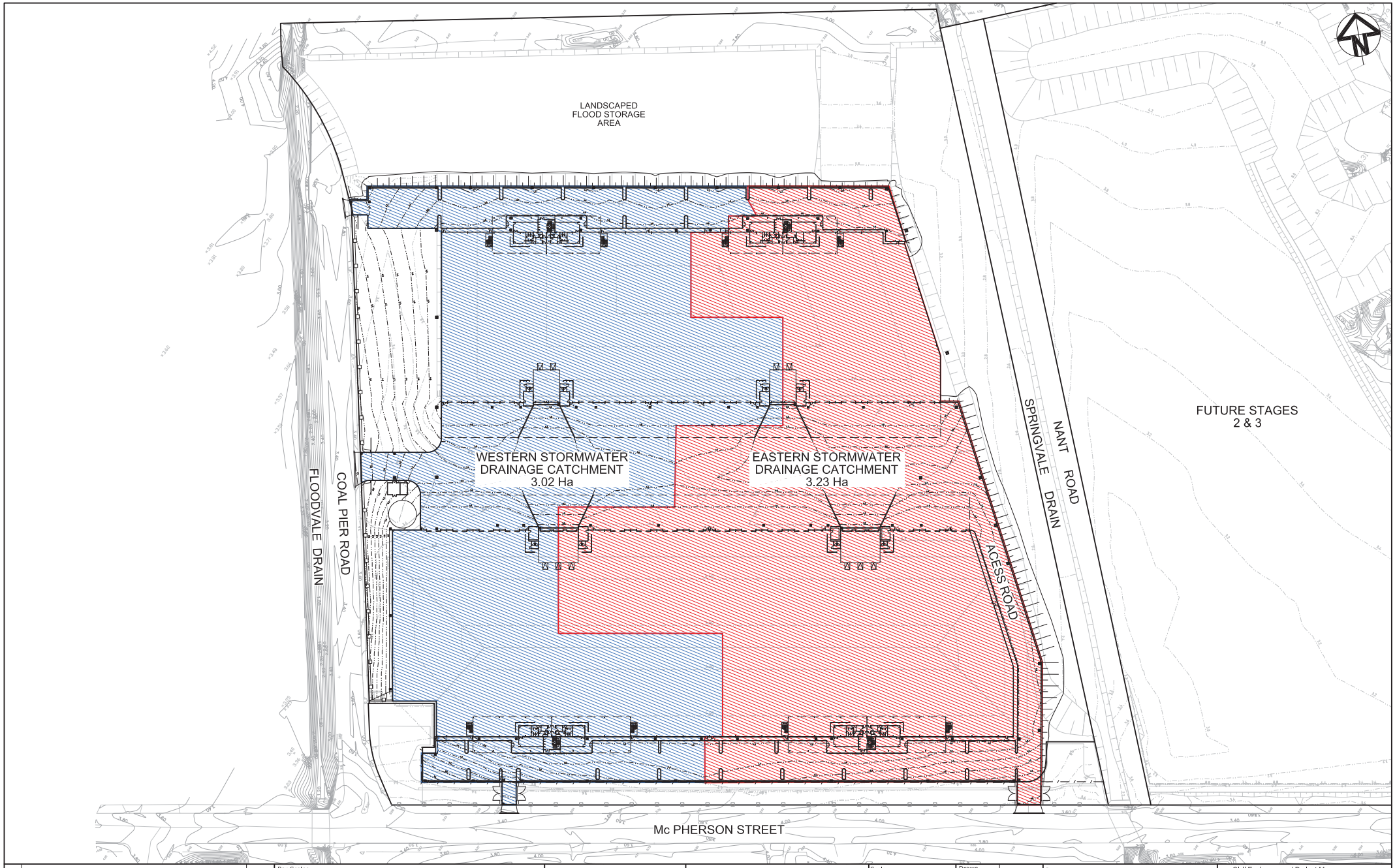
CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Drawing No.	Project No.	Issue
DAC042	14-213	P2

Date Plotted: 3 Oct 2014 - 04:24PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC042.dwg



Issue	Description	Date
P2	ISSUED FOR SECTION 75W	03-10-14
P1	ISSUED FOR INFORMATION	25-09-14

100mm on Original

Bar Scales

0 15 30 45 60 75m

1 : 750 @ A1 1 : 1500 @ A3

Client

Goodman

Scales	1 : 750 @ A1	Drawn	GB
		Designed	GB
Grid	MGA	Checked	AMcL
Height Datum	AHD	Approved	AT

Project

PORT BOTANY
INDUSTRIAL ESTATE
STAGE 1

Title

STORMWATER CATCHMENT PLAN

CIVil Engineers and Project Managers
at&l
Suite 702, 154 Pacific Hwy
St Leonards NSW 2065
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9460 8413
www.atl.net.au
Info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Drawing No.	Project No.	Issue
DAC050	14-213	P2

Date Plotted: 3 Oct 2014 - 04:24PM File Name: F:\14-213 Orica Site Southlands\Drgs\Civil\DA-Drawings\DAC050.dwg

Appendix B

Cardno Southlands Civil Works drawings

SOUTHLANDS
CIVIL WORKS PACKAGE

LOCALITY PLAN
N.T.S.

DRAWING LIST

210094-1-000	COVER SHEET & DRAWING LIST
210094-1-001	NOTES AND LEGENDS
210094-1-002	GENERAL ARRANGEMENT PLAN
210094-1-003	SITE POSSESSION PLAN
210094-1-005	EXISTING SERVICES PLAN
210094-1-006	BULK EARTHWORKS SITEWORKS SEDIMENT AND EROSION CONTROL PLAN SHEET 1
210094-1-007	BULK EARTHWORKS SITEWORKS SEDIMENT AND EROSION CONTROL PLAN SHEET 2
210094-1-008	BULK EARTHWORKS SITEWORKS SEDIMENT AND EROSION CONTROL PLAN SHEET 3
210094-1-009	BULK EARTHWORKS SITEWORKS SEDIMENT AND EROSION CONTROL PLAN SHEET 4
210094-1-010	SITEWORKS DETAILS - SHEET 1
210094-1-011	SITEWORKS DETAILS - SHEET 2
210094-1-012	RETAINING WALL ELEVATIONS
210094-1-013	RETAINING WALL AND ACCESS ROAD DETAILS
210094-1-014	FLOW CONTROL STRUCTURE
210094-1-015	LONGITUDINAL SECTIONS AND SETOUT - ACCESS TRACK
210094-1-113	BULK EARTHWORKS EDGE TREATMENT DETAILS - SHEET 1
210094-1-114	BULK EARTHWORKS EDGE TREATMENT DETAILS - SHEET 2
210094-1-115	BULK EARTHWORKS EDGE TREATMENT DETAILS - SHEET 3
210094-1-120	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 1
210094-1-121	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 2
210094-1-122	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 3
210094-1-123	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 4
210094-1-124	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 5
210094-1-125	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 6
210094-1-126	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 7
210094-1-127	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 8
210094-1-128	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 9
210094-1-129	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 10
210094-1-130	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 11
210094-1-131	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 12
210094-1-132	BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 13
210094-1-140	STORMWATER DRAINAGE LONGITUDINAL SECTIONS
210094-1-150	FENCING SETOUT
210094-1-200	STORMWATER CATCHMENT PLAN - SHEET 1
210094-1-300	BOTANY ROAD ROADWORKS PLAN
210094-1-301	BOTANY ROAD TURNING PATHS
210094-1-310	NANT STREET AND SPRINGVALE DRAIN - SITEWORKS
210094-1-320	LONGITUDINAL SECTIONS - NANT STREET & SPRINGVALE DRAIN
210094-1-332	CROSS SECTIONS - NANT STREET

NOT IN CONTRACT - FOR INFORMATION ONLY

210094-1-350	HOT SPOT PLAN
210094-1-400	HEIC TRIAL AREA PLAN
210094-1-405	EROSION AND SEDIMENT HEIC TRIAL AREA CONTROL PLAN
210094-1-410	HEIC TRIAL AREA LONGITUDINAL SECTION
210094-1-420	HEIC TRIAL AREA CROSS SECTIONS
210094-1-430	MONITORING TRENCH PLAN
210094-1-440	EXPANDED BASIN INVESTIGATION - PHASE 1 WORKS

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	03.12.13	ISSUED FOR REVIEW	NVH	RL
E	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
D	21.01.13	ISSUED FOR REPRICING	DJB	RL
C	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
B	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
A	07.08.12	PRELIMINARY ISSUE	RDM	RL

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date	AUG'12
Checked	RL	Date	AUG'12
Designed	RH	Date	AUG'12
Verified	RH	Date	AUG'12
Approved	RL	Date	AUG'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
COVER SHEET & DRAWING LIST

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
AUG'12	AHD	NTS	A1

Drawing Number: 210094-1-000
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

DATE PLOTTED: 12 May 2014 11:42 AM BY: DAVID BALL (SYDNEY)

XREFs: X-BHL-A1-SHT, SURVEY, CONCNOT, EROS_B, ESERVICE, GEN, JOINTS, KERB, SITE, SITE_LEG, STORM, FOUNDATION

CAD FILE: G:\210094 - Southlands\Norwest Civil\Drawings\CC\210094-1-001 (2) NOTES AND LEGENDS.dwg

EROSION AND SEDIMENT CONTROL NOTES

GENERAL INSTRUCTIONS

1. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE CONTROL OF EROSION AND SEDIMENTATION TO THE SATISFACTION OF COUNCIL, OFFICE OF WATER, SYDNEY WATER, OFFICE OF ENVIRONMENT AND HERITAGE (OEH) AND ORICA'S REPRESENTATIVE. TO THIS END, THE EROSION AND SEDIMENTATION CONTROLS SHOWN ON THE DRAWINGS SHALL ONLY BE USED AS A GUIDE BY THE CONTRACTOR, AND SHALL REPRESENT THE MINIMUM REQUIREMENT ONLY.

2. THE CONTRACTOR SHALL ENSURE THAT ALL SOIL AND WATER MANAGEMENT WORKS ARE LOCATED AS DOCUMENTED OR AS OTHERWISE DIRECTED BY THE SUPERINTENDENT.

3. ALL WORK SHALL BE GENERALLY CARRIED OUT IN ACCORDANCE WITH
a. LOCAL AUTHORITY REQUIREMENTS
b. EPA REQUIREMENTS
c. LANDCOM "MANAGING URBAN STORMWATER, SOILS AND CONSTRUCTION", 4th EDITION, MARCH 2004.

4. MAINTAIN THE EROSION CONTROL DEVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE LOCAL AUTHORITY.

5. WHEN STORMWATER PITS ARE CONSTRUCTED, PREVENT SITE RUNOFF ENTERING UNLESS SEDIMENT FENCES ARE ERECTED AROUND PITS.

6. CONTRACTOR IS TO ENSURE ALL EROSION & SEDIMENT CONTROL DEVICES ARE MAINTAINED IN GOOD WORKING ORDER AND OPERATE EFFECTIVELY. REPAIRS AND OR MAINTENANCE SHALL BE UNDERTAKEN AS REQUIRED, PARTICULARLY FOLLOWING STORM EVENTS.

7. THE PLACEMENT OF ROCKS AND BOULDERS IS TO ALLOW FOR DIVERSITY IN SHAPE AND EDGE OUTLINE, ACHIEVING AN IRREGULAR SHAPED CHANNEL WHILST RETAINING THE HYDRAULIC FUNCTIONALITY. THE PLAN SHOWN IS FOR GENERAL ALIGNMENT ONLY. THE ALIGNMENT SHALL BE AGREED TO ON SITE WITH THE SUPERINTENDENT PRIOR TO COMMENCEMENT.

8. ALL ROCKWORK SHALL CONSIST OF SANDSTONE.

LAND DISTURBANCE

9. WHERE PRACTICAL, THE SOIL EROSION HAZARD ON THE SITE WILL BE KEPT AS LOW AS POSSIBLE. TO THIS END, WORKS SHOULD BE UNDERTAKEN IN THE FOLLOWING SEQUENCE:

(A) INSTALL A SEDIMENT FENCE AS SHOWN ON PLAN. REFER DETAIL.

(B) CONSTRUCT STABILISED CONSTRUCTION ENTRANCE TO LOCATION AS DETERMINED BY SUPERINTENDENT/ENGINEER. REFER DETAIL.

(C) INSTALL SEDIMENT BASINS AS SHOWN ON PLAN

(D) UNDERTAKE SITE DEVELOPMENT WORKS IN ACCORDANCE WITH THE ENGINEERING PLANS. WHERE POSSIBLE, PHASE DEVELOPMENT SO THAT LAND DISTURBANCE IS CONFINED TO AREAS OF WORKABLE SIZE.

EROSION CONTROL

10. DURING WINDY WEATHER, LARGE, UNPROTECTED AREAS WILL BE KEPT MOIST (NOT WET) BY SPRINKLING WITH WATER TO KEEP DUST UNDER CONTROL.

11. FINAL SITE STABILISATION WILL BE UNDERTAKEN AS SOON AS POSSIBLE AND WITHIN 20 WORKING DAYS FROM COMPLETION OF CONSTRUCTION ACTIVITIES.

SEDIMENT CONTROL

12. STOCKPILES WILL NOT BE LOCATED WITHIN 2 METRES OF HAZARD AREAS, INCLUDING LIKELY AREAS OF CONCENTRATED OR HIGH VELOCITY FLOWS SUCH AS WATERWAYS. WHERE THEY ARE BETWEEN 2 AND 5 METRES FROM SUCH AREAS, SPECIAL SEDIMENT CONTROL MEASURES SHOULD BE TAKEN TO MINIMISE POSSIBLE POLLUTION TO DOWNSLOPE WATERS, E.G. THROUGH INSTALLATION OF SEDIMENT FENCING.

13. ANY SAND USED IN THE CONCRETE CURING PROCESS (SPREAD OVER THE SURFACE) WILL BE REMOVED AS SOON AS POSSIBLE AND WITHIN 10 WORKING DAYS FROM PLACEMENT.

14. WATER WILL BE PREVENTED FROM ENTERING THE PERMANENT DRAINAGE SYSTEM UNLESS IT IS RELATIVELY SEDIMENT FREE, I.E. THE CATCHMENT AREA HAS BEEN PERMANENTLY LANDSCAPED AND/OR ANY LIKELY SEDIMENT HAS BEEN FILTERED THROUGH AN APPROVED STRUCTURE.

15. TEMPORARY SOIL AND WATER MANAGEMENT STRUCTURES WILL BE REMOVED ONLY AFTER THE LANDS THEY ARE PROTECTING ARE REHABILITATED.

OTHER MATTERS

16. ACCEPTABLE RECEPTORS WILL BE PROVIDED FOR CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHINGS, LIGHT-WEIGHT WASTE MATERIALS AND LITTER.

17. ANY EXISTING TREES WHICH FORM PART OF THE CONSERVATION AREAS PLAN WILL BE PROTECTED FROM CONSTRUCTION ACTIVITIES BY:
(A) PROTECTING THEM WITH BARRIER FENCING OR SIMILAR MATERIALS INSTALLED OUTSIDE THE DRIP LINE
(B) ENSURING THAT NOTHING IS NAILED TO THEM
(C) PROHIBITING PAVING, GRADING, SEDIMENT WASH OR PLACING OF STOCKPILES WITHIN THE DRIP LINE.

STORMWATER DRAINAGE NOTES

1. STORMWATER DESIGN CRITERIA:
(A) AVERAGE RECURRENCE INTERVAL:
20 YEAR ARI MINOR STORM EVENT.
100 YEAR ARI MAJOR STORM EVENT.

(B) THE DRAINAGE NETWORK HAS BEEN DESIGNED USING "DRAINS" SOFTWARE.

2. PIPES 300 DIA. AND LARGER TO BE REINFORCED CONCRETE CLASS '2' APPROVED SPIGOT AND SOCKET WITH RUBBER RING JOINTS. U.N.O.

3. PIPES UP TO AND INCLUDING 225 DIA SHALL BE SEWER GRADE uPVC WITH SOLVENT WELDED JOINTS.

4. EQUIVALENT STRENGTH FRC PIPES MAY BE USED.

5. PIPES TO BE INSTALLED TO TYPE HS1 SUPPORT IN ACCORDANCE WITH AS 3725 (1989) IN ALL CASES BACKFILL TRENCH WITH SAND TO 300mm ABOVE PIPE. WHERE PIPE IS UNDER PAVEMENTS BACKFILL REMAINDER OF TRENCH TO UNDERSIDE OF PAVEMENT WITH SAND OR APPROVED GRANULAR MATERIAL COMPACTED IN 150mm LAYERS TO MINIMUM 98% STANDARD MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS 1289 5.2.1. (OR A DENSITY INDEX OF NOT LESS THAN 75)

6. ALL INTERNAL WORKS WITHIN PROPERTY BOUNDARIES ARE TO COMPLY WITH THE REQUIREMENTS OF AS 3500 3.1 (1998) AND AS/NZS 3500 3.2 (1998).

7. PRECAST PITS MAY NOT BE USED.

8. ENLARGERS, CONNECTIONS AND JUNCTIONS TO BE PREFABRICATED FITTINGS WHERE PIPES ARE LESS THAN 300 DIA.

9.CARE IS TO BE TAKEN WITH LEVELS OF STORMWATER LINES. GRADES SHOWN ARE NOT TO BE REDUCED WITHOUT APPROVAL.

10. GRATES AND COVERS SHALL CONFORM TO AS 3996.

11. AT ALL TIMES DURING CONSTRUCTION OF STORMWATER PITS, ADEQUATE SAFETY PROCEDURES SHALL BE TAKEN TO ENSURE AGAINST THE POSSIBILITY OF PERSONNEL FALLING DOWN PITS.

12. ALL EXISTING STORMWATER DRAINAGE LINES AND PITS THAT ARE TO REMAIN ARE TO BE INSPECTED AND CLEANED. DURING THIS PROCESS ANY PART OF THE STORMWATER DRAINAGE SYSTEM THAT WARRANTS REPAIR SHALL BE REPORTED TO THE SUPERINTENDENT/ENGINEER FOR FURTHER DIRECTIONS.

SITEWORKS NOTES

1. ORIGIN OF LEVELS:- REFER SURVEY NOTES.

2. CONTRACTOR MUST VERIFY ALL DIMENSIONS AND EXISTING LEVELS ON SITE PRIOR TO COMMENCEMENT OF WORK. ANY DISCREPANCIES TO BE REPORTED TO CARDNO.

3. MAKE SMOOTH CONNECTION WITH EXISTING WORKS.

4. ALL TRENCH BACKFILL MATERIAL SHALL BE COMPACTED TO THE SAME DENSITY AS THE ADJACENT MATERIAL.

5. ALL SERVICE TRENCHES UNDER VEHICULAR PAVEMENTS SHALL BE BACKFILLED WITH SAND TO 300mm ABOVE PIPE. WHERE PIPE IS UNDER PAVEMENTS BACKFILL REMAINDER OF TRENCH TO UNDERSIDE OF PAVEMENT WITH SAND OR APPROVED GRANULAR MATERIAL COMPACTED IN 150mm LAYERS TO MINIMUM 98% MODIFIED MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS 1289 5.2.1. (OR A DENSITY INDEX OF NOT LESS THAN 75)

6. ASPHALTIC CONCRETE SHALL CONFORM TO R.T.A. SPECIFICATION R116. SPRAY BITUMINOUS SEALING WORKS SHALL CONFORM TO RTA SPECIFICATIONS R106 AND R111.

7. ALL BASECOURSE MATERIAL SHALL BE IGNEOUS ROCK QUARRIED MATERIAL TO COMPLY WITH R.T.A. FORM 3051 (UNBOUND), COMPACTED TO MINIMUM 98% MODIFIED DENSITY IN ACCORDANCE WITH AS 1289 5.2.1 FREQUENCY OF COMPACTION TESTING SHALL NOT BE LESS THAN 1 TEST PER 50m³ OF BASECOURSE MATERIAL PLACED.

8. ALL SUB-BASE COURSE MATERIAL SHALL BE IGNEOUS ROCK QUARRIED MATERIAL TO COMPLY WITH R.T.A. FORM 3051, 3051.1 AND COMPACTED TO MINIMUM 100% MODIFIED DENSITY IN ACCORDANCE WITH A.S 1289 5.2.1 FREQUENCY OF COMPACTION TESTING SHALL NOT BE LESS THAN 1 TEST PER 50m³ OF SUB-BASE COURSE MATERIAL PLACED.

9. AS AN ALTERNATIVE TO THE USE OF IGNEOUS ROCK AS A SUB-BASE MATERIAL IN (8) A CERTIFIED RECYCLED CONCRETE MATERIAL COMPLYING WITH R.T.A. FORM 3051 AND 3051.1 WILL BE CONSIDERED. SUBJECT TO MATERIAL SAMPLES AND APPROPRIATE CERTIFICATIONS BEING PROVIDED TO THE SATISFACTION OF CARDNO.

10. WHERE NOTED ON THE DRAWINGS THAT WORKS ARE TO BE CARRIED BY OTHERS, (eg. ADJUSTMENT OF SERVICES), THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CO-ORDINATION OF THESE WORKS.

CONCRETE NOTES

1. ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS 3600 CURRENT EDITION WITH AMENDMENTS, EXCEPT WHERE VARIED BY THE CONTRACT DOCUMENTS.

2. CONCRETE QUALITY
ALL REQUIREMENTS OF THE CURRENT ACSE CONCRETE SPECIFICATION DOCUMENT 1 SHALL APPLY TO THE FORMWORK, REINFORCEMENT AND CONCRETE UNLESS NOTED OTHERWISE.

ELEMENT	AS 3600 F'c MPa AT 28 DAYS	SPECIFIED SLUMP	NOMINAL AGG. SIZE
VEHICULAR BASE AND PATHS	32	60	20
KERBS AND PITS	25	80	20

- CEMENT TYPE SHALL BE (ACSE SPECIFICATION) TYPE SL
- PROJECT CONTROL TESTING SHALL BE CARRIED OUT IN ACCORDANCE WITH AS 1379.

3. NO ADMIXTURES SHALL BE USED IN CONCRETE UNLESS APPROVED IN WRITING BY CARDNO.

4. CLEAR CONCRETE COVER TO ALL REINFORCEMENT FOR DURABILITY SHALL BE 40mm TOP AND 70mm FOR EXTERNAL EDGES UNLESS NOTED OTHERWISE.

5. ALL REINFORCEMENT SHALL BE FIRMLY SUPPORTED ON MILD STEEL PLASTIC TIPPED CHAIRS, PLASTIC CHAIRS OR CONCRETE CHAIRS AT NOT GREATER THAN 1m CENTRES BOTH WAYS. BARS SHALL BE TIED AT ALTERNATE INTERSECTIONS.

6. THE FINISHED CONCRETE SHALL BE A DENSE HOMOGENEOUS MASS, COMPLETELY FILLING THE FORMWORK, THOROUGHLY EMBEDDING THE REINFORCEMENT AND FREE OF STONE POCKETS. ALL CONCRETE INCLUDING SLABS ON GROUND AND FOOTINGS SHALL BE COMPACTED AND CURED IN ACCORDANCE WITH R.T.A. SPECIFICATION R83.

7. REINFORCEMENT SYMBOLS:
N DENOTES GRADE 450 N BARS TO AS 1302 GRADE N
R DENOTES 230 R HOT ROLLED PLAIN BARS TO AS 1302
SL DENOTES HARD-DRAWN WIRE REINFORCING FABRIC TO AS 1304
NUMBER OF BARS IN GROUP — BAR GRADE AND TYPE
17 N 20 250
NOMINAL BAR SIZE IN mm — SPACING IN mm THE FIGURE

FOLLOWING THE FABRIC SYMBOL SL IS THE REFERANCE NUMBER FOR FABRIC TO AS 1304.

8. FABRIC SHALL BE LAPPED IN ACCORDANCE WITH THE FOLLOWING DETAIL:

KERBING NOTES

1. ALL CONCRETE TO HAVE A MINIMUM COMPRESSIVE STRENGTH OF 25 MPa U.N.O IN REINFORCED CONCRETE NOTES.

2. ALL KERBS, GUTTERS, DISH DRAINS AND CROSSINGS TO BE CONSTRUCTED ON 175mm GRANULAR BASECOURSE COMPACTED TO MINIMUM 95% MODIFIED DRY DENSITY (AS 1289 5.2.1).

3. EXPANSION JOINTS (E.J) TO BE FORMED FROM 10mm COMPRESSIBLE CORK FILLER BOARD FOR THE FULL DEPTH OF THE SECTION AND CUT TO PROFILE. EXPANSION JOINTS TO BE LOCATED AT DRAINAGE PITS, ON TANGENT POINTS OF CURVES AND ELSEWHERE AT MAX 12m CENTRES EXCEPT FOR INTEGRAL KERBS WHERE THE EXPANSION JOINTS ARE TO MATCH THE JOINT LOCATIONS IN THE SLABS.

4. WEAKENED PLANE JOINTS TO BE MIN 3mm WIDE AND LOCATED AT 3m CENTRES EXCEPT FOR INTEGRAL KERBS WHERE THE WEAKENED PLANE JOINTS ARE TO MATCH THE JOINT LOCATIONS IN THE SLABS.

5. BROOMED FINISH TO ALL RAMPED AND VEHICULAR CROSSINGS. ALL OTHER KERBING OR DISH DRAINS TO BE STEEL FLOAT FINISHED.

6. IN THE REPLACEMENT OF KERB AND GUTTER :-
EXISTING ROAD PAVEMENT IS TO BE SAWCUT 900mm U.N.O FROM THE LIP OF GUTTER. UPON COMPLETION OF THE NEW KERB AND GUTTER NEW BASECOURSE AND SURFACE TO BE LAID 900mm WIDE U.N.O.

EXISTING KERB AND GUTTER IS TO BE COMPLETELY REMOVED WHERE NEW KERB AND GUTTER IS SHOWN.

GENERAL

1. ALL WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH BOTANY BAY CITY COUNCIL.

2. BOTANY BAY CITY COUNCIL STANDARD DETAILS TO BE USED WHERE POSSIBLE.

3. UTILITY ADJUSTMENTS AT DEVELOPER'S EXPENSE.

4. CONDUITS TO BE PLACED WHERE REQUIRED BY THE RELEVANT AUTHORITIES.

JOINT NOTES

PEDESTRIAN PAVEMENT JOINTS

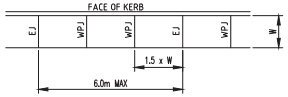
1. ALL PEDESTRIAN PAVEMENTS ARE TO BE JOINTED AS FOLLOWS. (U.N.O)

2. EXPANSION JOINTS ARE TO BE LOCATED WHERE POSSIBLE AT TANGENT POINTS OF CURVES AND ELSEWHERE AT MAX. 6.0m CENTRES.

3. WEAKENED PLANE JOINTS ARE TO BE LOCATED AT A MAX. SPACING OF 1.5 x WIDTH OF THE PAVEMENT.

4. WHERE POSSIBLE JOINTS SHOULD BE LOCATED TO MATCH KERBING AND OR ADJACENT PAVEMENT JOINTS.

5. PEDESTRIAN PAVEMENT JOINT DETAIL.



NB: CHECK RELEVANT COUNCIL REQUIREMENTS IF IN PUBLIC ROAD.

SURVEY NOTES

THE EXISTING SITE CONDITIONS SHOWN ON THE FOLLOWING DRAWINGS HAVE BEEN INVESTIGATED BY AAM HATCH CONSULTANTS, BEING REGISTERED SURVEYORS. THE INFORMATION IS SHOWN TO PROVIDE A BASIS FOR DESIGN. CARDNO DOES NOT GUARANTEE THE ACCURACY OR COMPLETENESS OF THE SURVEY BASE OR ITS SUITABILITY AS A BASIS FOR CONSTRUCTION DRAWINGS.
SHOULD DISCREPANCIES BE ENCOUNTERED DURING CONSTRUCTION BETWEEN THE SURVEY DATA AND ACTUAL FIELD DATA, CONTACT CARDNO.

EXISTING UNDERGROUND SERVICES NOTES

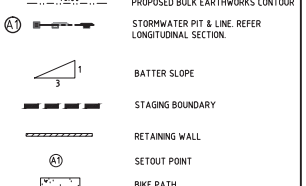
THE LOCATIONS OF UNDERGROUND SERVICES SHOWN IN THIS SET OF DRAWINGS HAVE BEEN PLOTTED FROM SURVEY INFORMATION AND SERVICE AUTHORITY INFORMATION AND POTHOLING IN CRITICAL LOCATIONS. THE SERVICE INFORMATION HAS BEEN PREPARED ONLY TO SHOW THE APPROXIMATE POSITIONS OF ANY KNOWN SERVICES AND MAY NOT BE AS CONSTRUCTED OR ACCURATE.CARDNO CAN NOT GUARANTEE THAT THE SERVICES INFORMATION SHOWN ON THESE DRAWINGS ACCURATELY INDICATES THE PRESENCE OR ABSENCE OF SERVICES OR THEIR LOCATION AND WILL ACCEPT NO LIABILITY FOR INACCURACIES IN THE SERVICES INFORMATION SHOWN FROM ANY CAUSE WHATSOEVER.

CONTRACTORS SHALL TAKE DUE CARE WHEN EXCAVATING ONSITE INCLUDING HAND EXCAVATION WHERE NECESSARY.
CONTRACTORS ARE TO CONTACT THE RELEVANT SERVICE AUTHORITY PRIOR TO COMMENCEMENT OF EXCAVATION WORKS. CONTRACTORS ARE TO UNDERTAKE A SERVICES SEARCH, PRIOR TO COMMENCEMENT OF WORKS ON SITE. SEARCH RESULTS ARE TO BE KEPT ON SITE AT ALL TIMES.

PROPOSED WORKS LEGEND

EXISTING (REFER SURVEY NOTES)

PROPOSED



FOUNDATION NOTES

PILES HAVE BEEN DESIGNED BY DOUGLAS PARTNERS FOR EMBEDMENT IN FILL. THE FOUNDATION MATERIAL AND EMBEDMENT DEPTHS OF THE PILES SHALL BE INSPECTED AND CONFIRMED BY DOUGLAS PARTNERS PRIOR TO POURING OF ANY CONCRETE.

VEGETATION NOTES

THE CONTRACTOR SHALL STRIP AND REMOVE ALL SUPERFLUOUS VEGETATION FROM SITE AND DISPOSE OF VEGETATION IN AN APPROPRIATE MANNER AT THE CONTRACTOR'S COST.

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	22.02.13	STRUCTURAL NOTE ADDED	ASD	RL
D	21.01.13	ISSUED FOR REPRICING	DJB	RL
C	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
B	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
A	07.08.12	PRELIMINARY ISSUE	RDM	RL

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

		Date
Drawn	ASD	AUG'12
Checked	RL	AUG'12
Designed	RH	AUG'12
Verified	RH	AUG'12
Approved	RL	AUG'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
NOTES AND LEGENDS

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
AUG'12	AHD	NTS	A1

Drawing Number: 210094-1-001
Revision: 2

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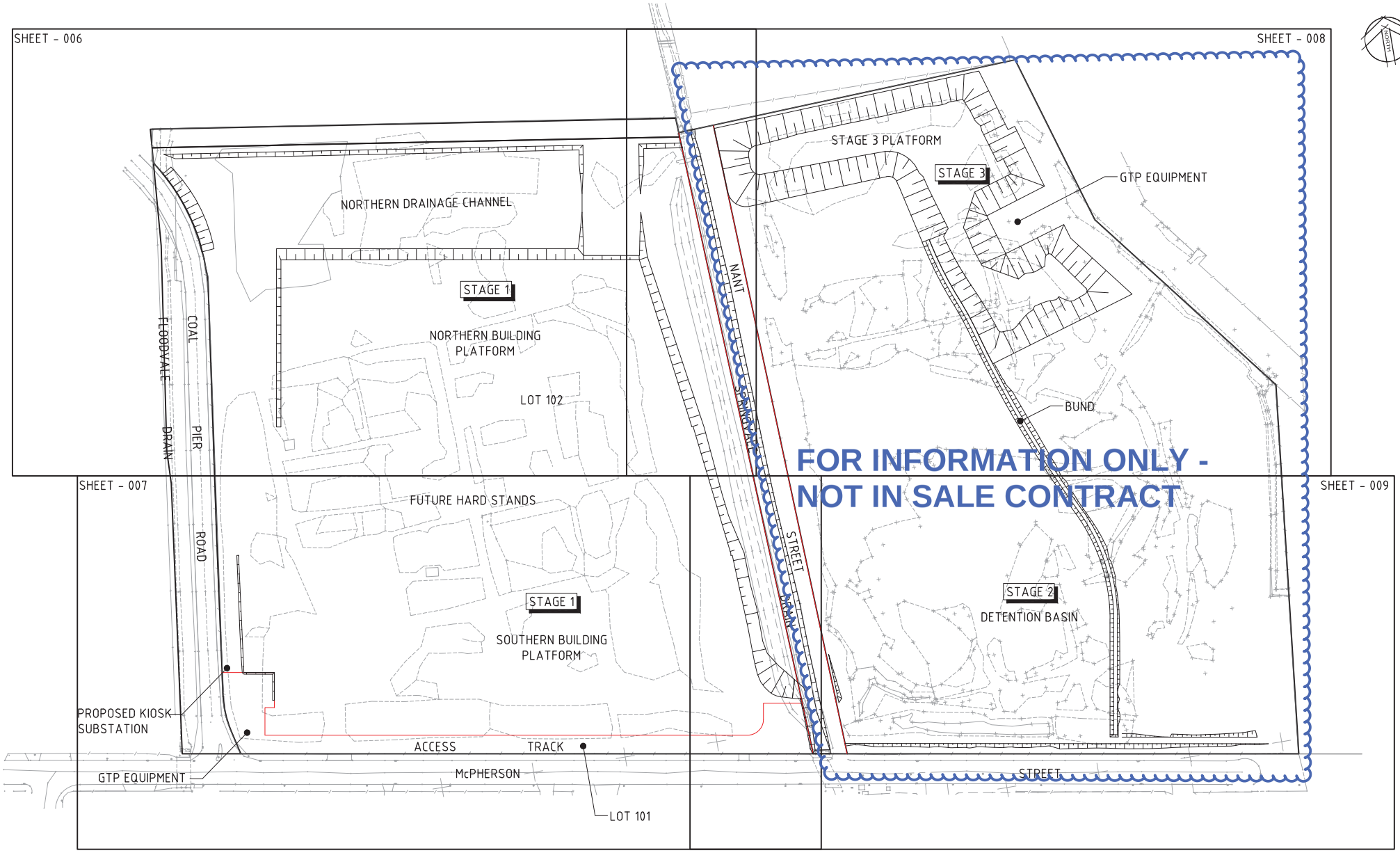

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
G	16.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
C	29.08.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL

0 20 40 60 80 100m
20 15 10 5
SCALE 1:1000

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date MAY'12
Checked	RL	Date MAY'12
Designed	RH	Date MAY'12
Verified	RL	Date MAY'12
Approved	RL	Date MAY'12

Client: ORICA

SOUTHLANDS
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CIVIL WORKS PACKAGE
GENERAL ARRANGEMENT PLAN

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	1:1000	A1

Drawing Number: 210094-1-002
Revision: 2

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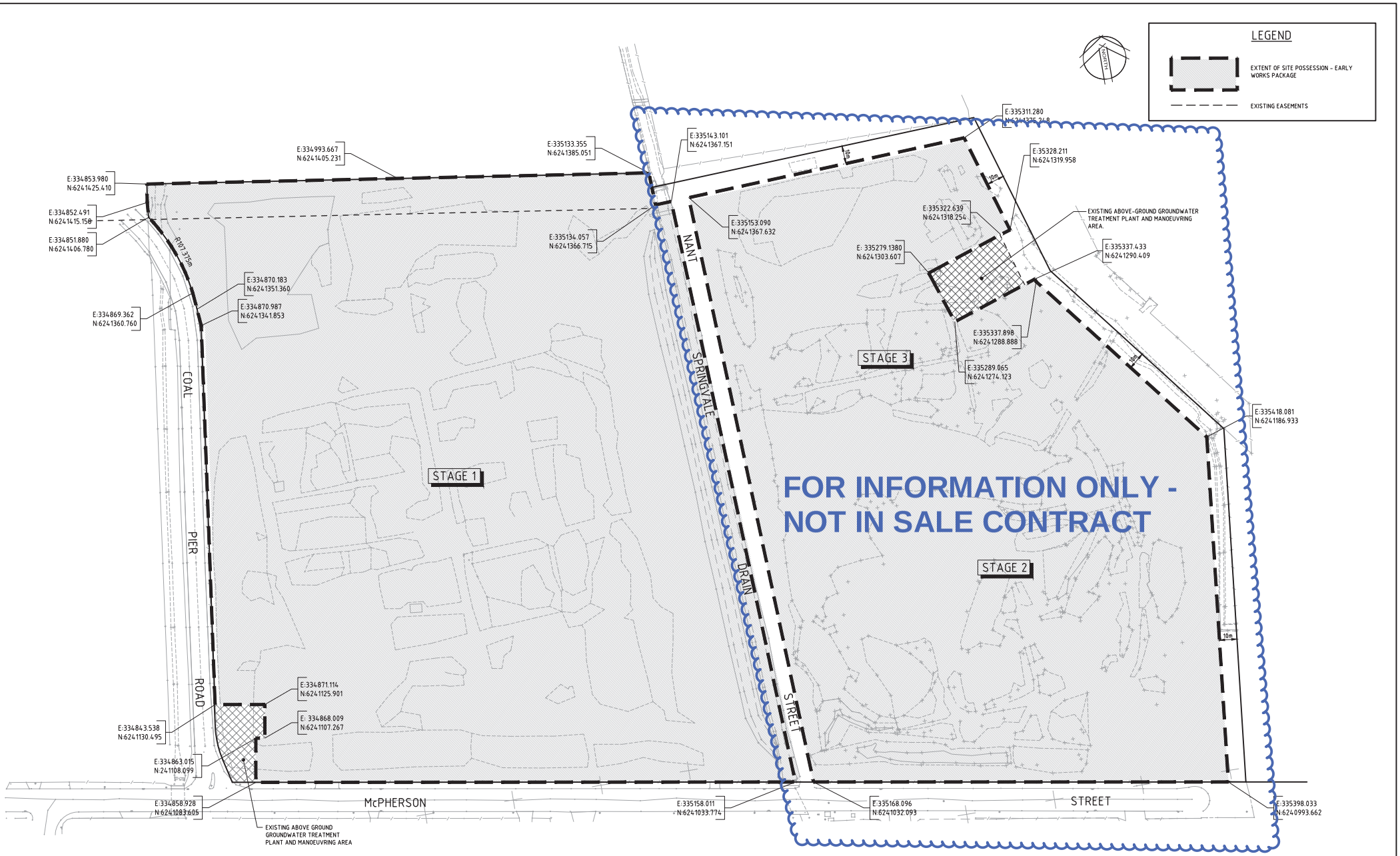

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
I	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
H	15.02.13	SITE POSSESSION AREA AMENDED	JB	RL
G	21.10.13	ISSUED FOR REPRICING	DJB	RL
F	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
E	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE		
D	07.08.12	REVISED BOUNDARIES	SJP	RL
C	20.03.12	TENDER ISSUE	RDM	RL

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20 15 10 5
SCALE 1:1000

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date FEB'12
Checked	RH	Date FEB'12
Designed	RH	Date FEB'12
Verified	RL	Date FEB'12
Approved	RL	Date FEB'12

Client ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
SITE POSSESSION PLAN

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
FEB'12	AHD	1:1000	A1

Drawing Number: 210094-1-003
Revision: 2

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DATE PLOTTED: 12 May 2014 11:42 AM BY: DAVID BALL (SYDNEY)
XREFs: X-BNL-A1-SHT; 003-LEGEND; 123ITA_DAQ1_REVQ_m; X-Extent of Site Possession MATCH; X-Extent of Site Possession; X-Base Layout
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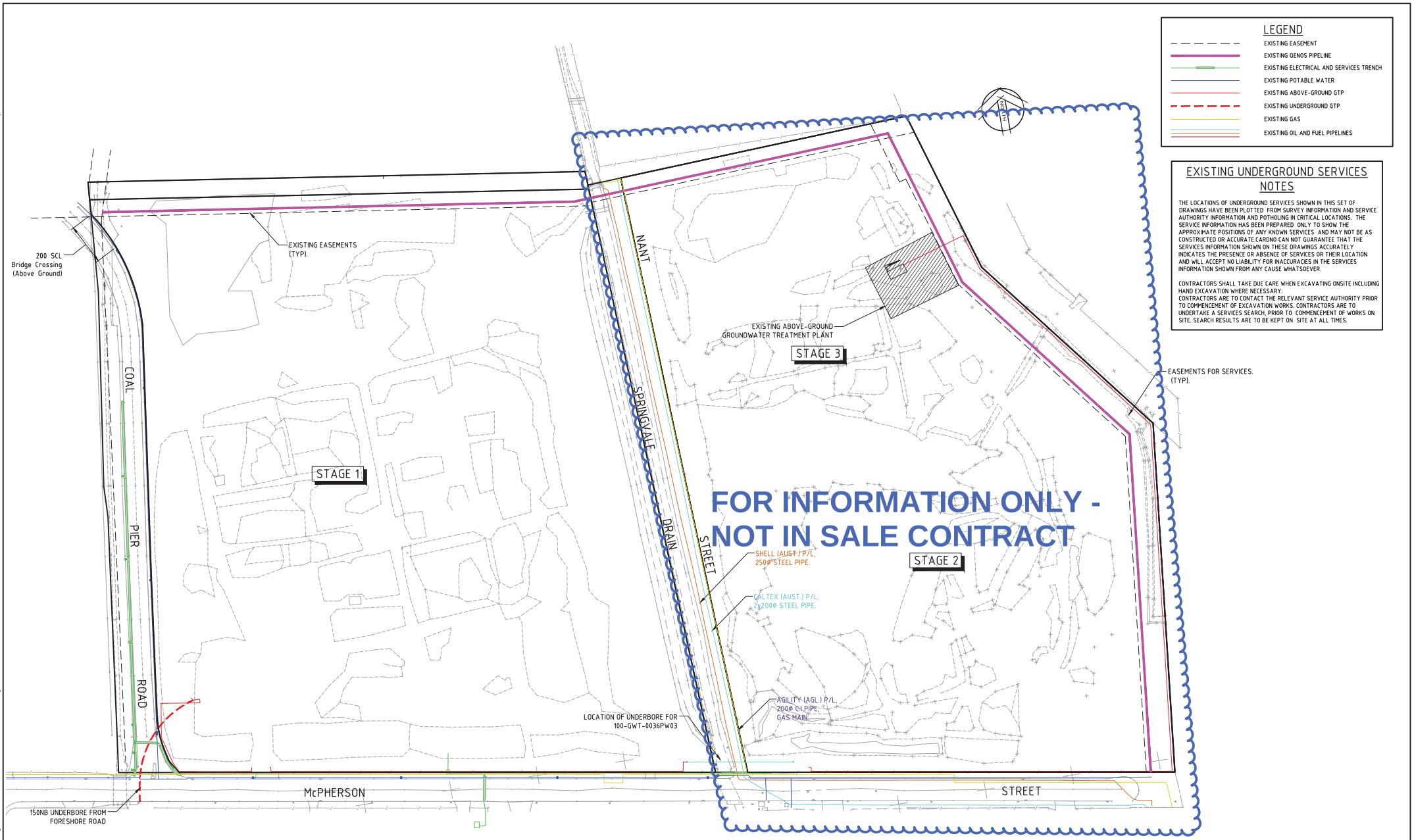

DATE PLOTTED: 12 May 2014 11:42 AM BY: DAVID BALL (SYDNEY)

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Rev	Date	Description	Drawn	Appr.
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8	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
7	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
6	21.01.13	ISSUED FOR RIPRICING	DJB	RL
5	03.01.13	UPDATED SERVICE LOCATIONS	DJB	RL
4	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
3	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
2	07.08.12	TRACK MONITORING TRENCH REMOVED	SJP	RL

0 20 40 60 80 100m
20 15 10 5
SCALE 1:1000

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date FEB'12
Checked	RH	Date FEB'12
Designed	RH	Date FEB'12
Verified	RL	Date FEB'12
Approved	RL	Date FEB'12

Client: ORICA

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CIVIL WORKS PACKAGE
EXISTING SERVICES PLAN

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
FEB'12	AHD	1:1000	A1

Drawing Number: 210094-1-005
Revision: 9

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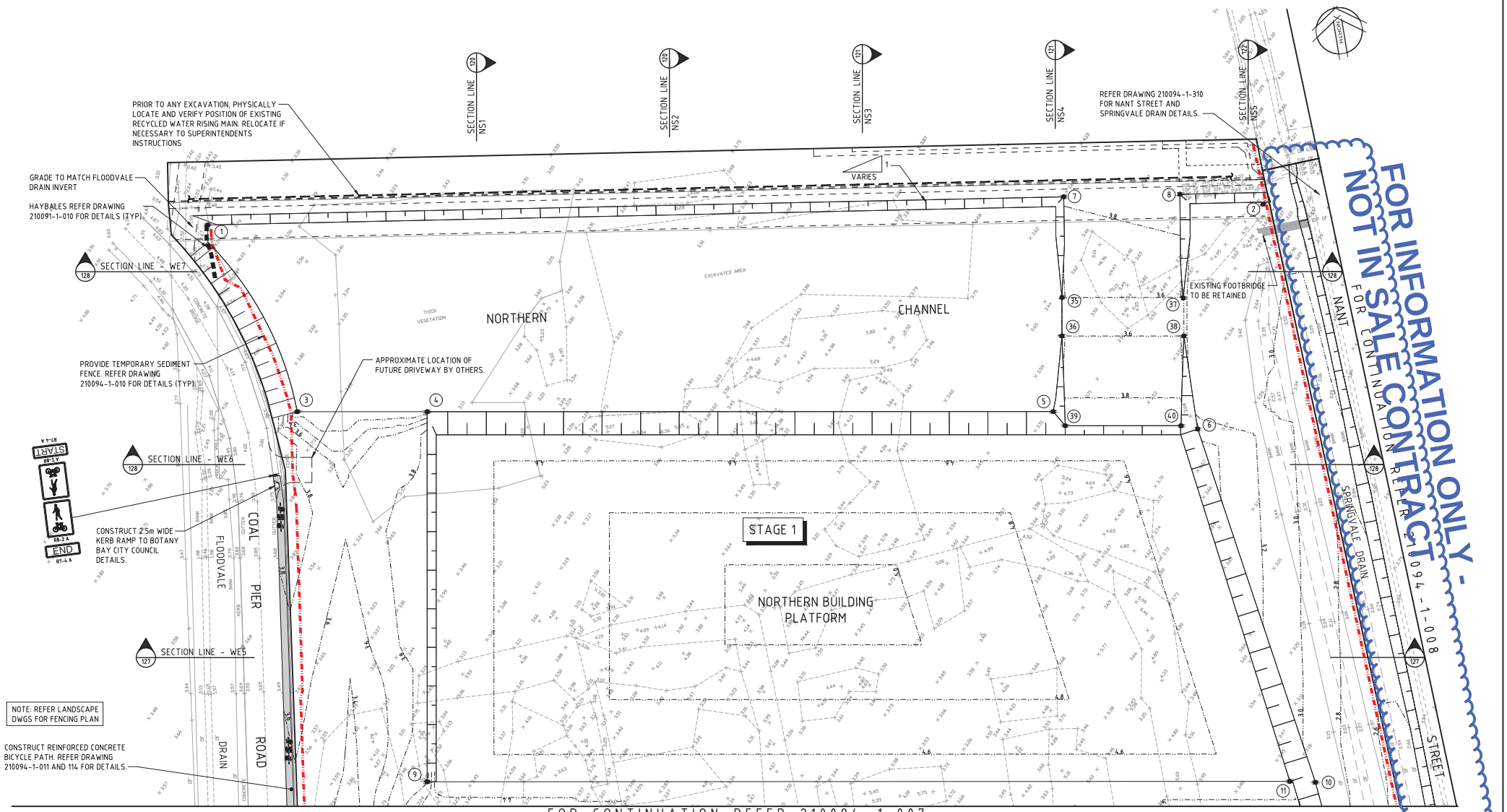

NOTE:
NO FILLING (INCLUDING TEMPORARY STOCKPILES) SHALL BE CARRIED OUT WITHIN SERVICES EASEMENT WITHOUT PRIOR WRITTEN APPROVAL FROM THE SUPERINTENDENT.

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
H	16.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
G	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	21.01.13	ISSUED FOR REPRICING	DJB	RL
E	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
D	11.10.12	RE-ISSUED FOR CONSTRUCTION CERTIFICATE	RH	RL
C	29.08.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL

SCALE 1:500

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date MAY'12
Checked	RL	Date MAY'12
Designed	RH	Date MAY'12
Verified	RL	Date MAY'12
Approved	RL	Date MAY'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITEWORKS SEDIMENT AND EROSION CONTROL PLAN SHEET 1

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	1:500	A1

Drawing Number: 210094-1-006
Revision: 2

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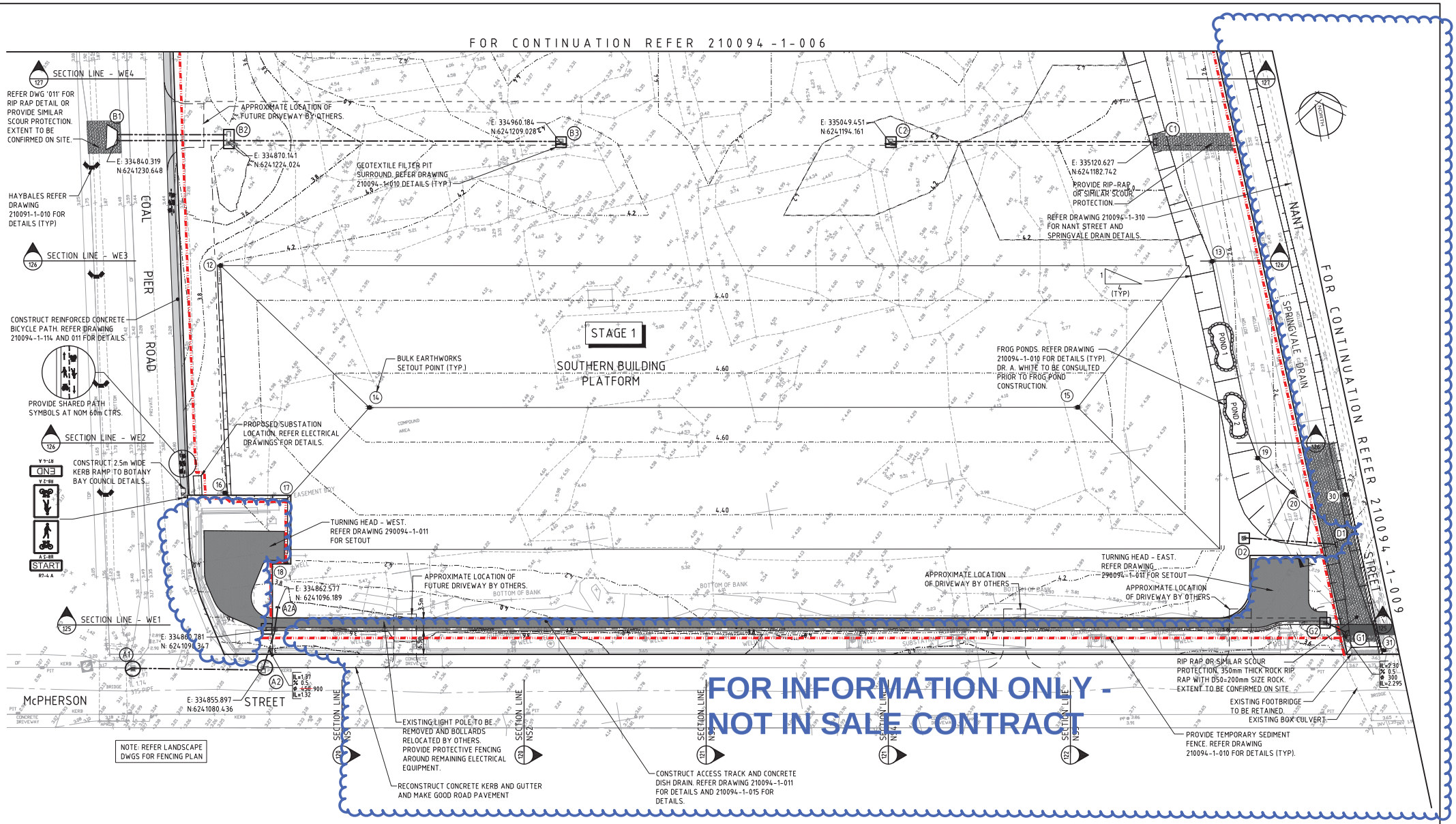
DATE PLOTTED: 12 May 2014 11:42 AM BY: DAVID BALL (SYDNEY)
XREFs: X-BHL-A1-SHT_12317A_DADI_REV0_m; X-Bulk; X-Base Layout; X-Contour Design 200mm; X-100YR ARI AREA; BULK EARTHWORKS NOTES
CAD FILE: G:\210094_ - Southlands\Norwest Civil\Drawings\CC\210094-1-006 (2) BULK EARTHWORKS SITEWORKS SEDIMENT AND EROSION CONTROL PLAN SHEET 1.dwg



NOTE:
THE CONTRACTOR IS REQUIRED TO LOCATE EXISTING BURIED SERVICES IN NANT STREET & McPHERSON STREET, AND VERIFY PROPOSED STORMWATER LONGSECTIONS, PRIOR TO CONSTRUCTION OF ANY STORMWATER DRAINAGE

NOTE:
NO FILLING (INCLUDING TEMPORARY STOCKPILES) SHALL BE CARRIED OUT WITHIN SERVICES EASEMENT WITHOUT PRIOR WRITTEN APPROVAL FROM THE SUPERINTENDENT.

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
J	16.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
H	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
G	21.02.13	SCOUR PROTECTION NOTES ADDED	ASD	RL
F	21.01.13	ISSUED FOR REPRICING	DJB	RL
E	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
D	11.10.12	RE-ISSUED FOR CONSTRUCTION CERTIFICATE	RH	RL
C	29.08.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date MAY'12
Checked	RL	Date MAY'12
Designed	RH	Date MAY'12
Verified	RL	Date MAY'12
Approved	RL	Date MAY'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITEWORKS SEDIMENT AND EROSION CONTROL PLAN SHEET 2

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	1:500	A1

Drawing Number: 210094-1-007
Revision: 2

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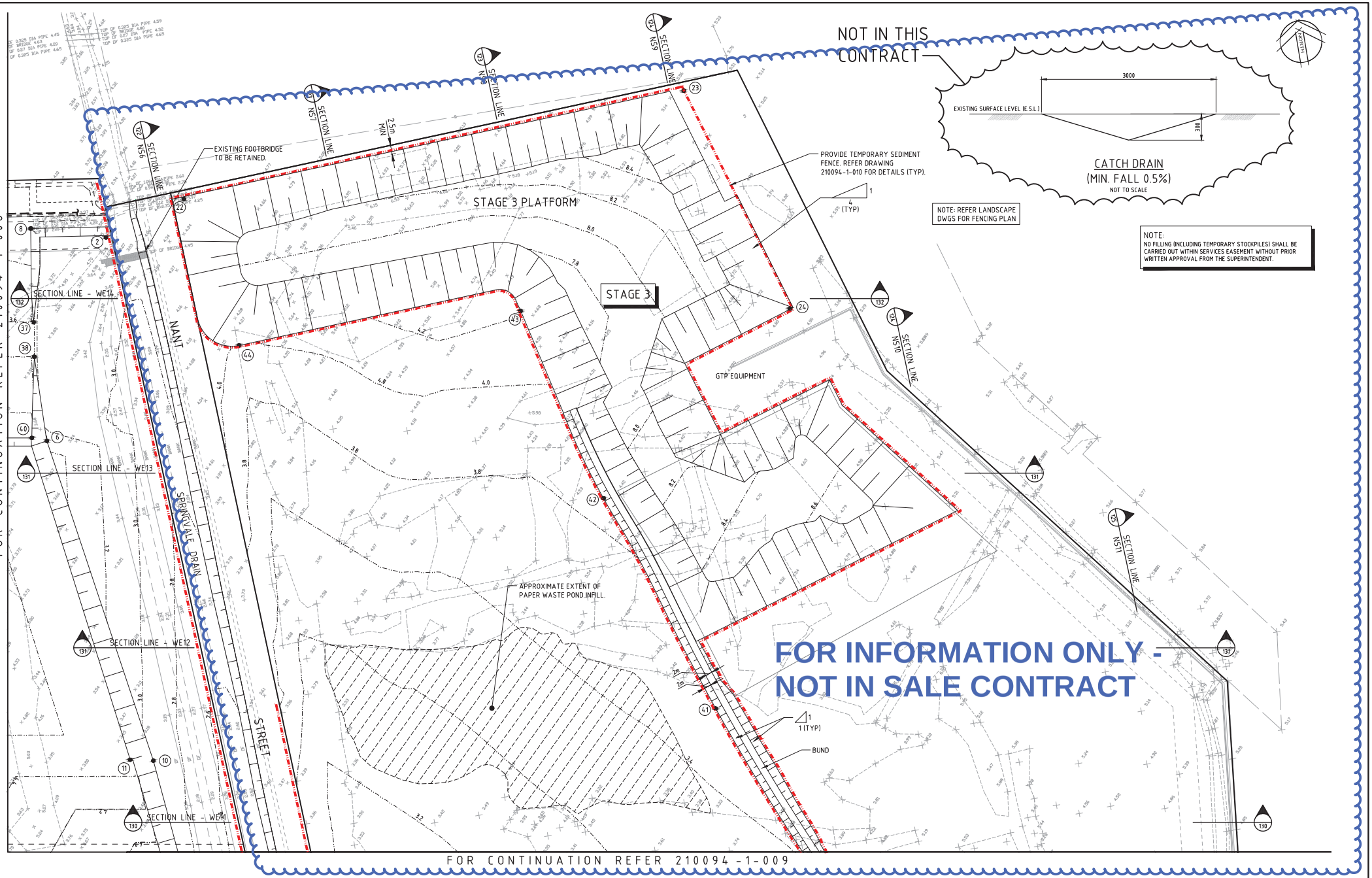

DATE PLOTTED: 12 May 2014 11:42 AM BY: DAVID BALL (SYDNEY)

XREFs: X-BRE-A1-SHT; X-Bulk; X-Base Layout; 12317A_DAAFI_REVQ_m; X-Contour Design 200mm; CATCH_DRAIN; BULK EARTHWORKS NOTES

CAD FILE: G:\210094 - Southlands Norwest Civil\Drawings\CC\210094-1-008 (2) BULK EARTHWORKS SITEWORKS SEDIMENT AND EROSION CONTROL PLAN SHEET 3.dwg

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
H	16.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
G	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	21.01.13	ISSUED FOR REPRICING	DJB	RL
E	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
D	11.10.12	RE-ISSUED FOR CONSTRUCTION CERTIFICATE	RH	RL
C	29.08.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

Cardno Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date MAY'12
Checked	RL	Date MAY'12
Designed	RH	Date MAY'12
Verified	RL	Date MAY'12
Approved	RL	Date MAY'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITEWORKS SEDIMENT AND EROSION CONTROL PLAN SHEET 3

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	1:500	A1

Drawing Number: 210094-1-008
Revision: 2

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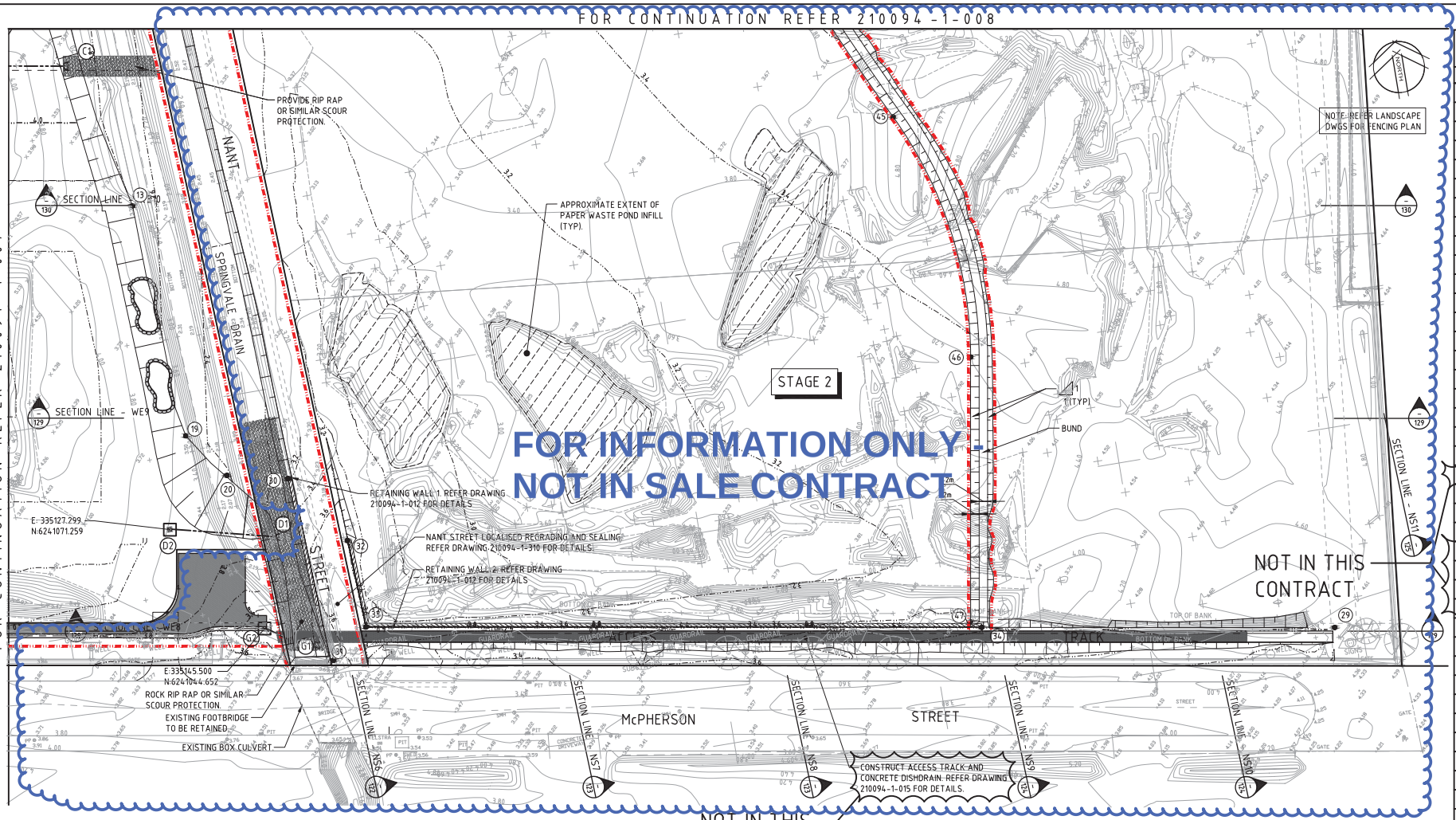
FOR CONTINUATION REFER 210094-1-008

FOR CONTINUATION REFER 210094-1-007



BULK EARTHWORKS SETOUT

POINT No.	EASTING	NORTHING	FSL
1	334861.588	6241407.751	3.20
2	335132.291	6241368.081	3.20
3	334876.521	6241356.209	3.20
4	334909.739	6241350.680	3.20
5	335069.823	6241324.031	3.20
6	335106.022	6241313.406	3.40
7	335081.665	6241378.484	3.60
8	335111.450	6241374.181	4.00
9	334893.983	6241256.073	4.00
10	335121.066	6241218.083	3.00
11	335114.547	6241219.436	4.40
12	334862.435	6241191.281	4.30
13	335131.213	6241147.714	2.80
14	334896.349	6241146.108	4.70
15	335088.210	6241114.216	4.70
16	334853.385	6241129.493	4.00
17	334869.433	6241124.709	4.00
18	334866.671	6241108.028	3.93
19	335134.657	6241092.345	2.60
20	335142.665	6241081.583	2.43
21	~~335121.283~~	~~6241069.457~~	~~4.00~~
22	335156.144	6241375.287	4.26
23	335302.510	6241382.334	5.25
24	335322.231	6241315.753	4.92
25	~~335289.996~~	~~6241305.283~~	~~4.41~~
26	~~335297.100~~	~~6241282.201~~	~~5.00~~
27	~~335329.615~~	~~6241292.208~~	~~5.20~~
28	~~335412.475~~	~~6241185.353~~	~~5.74~~
29	335393.667	6241003.535	4.23
30	335156.714	6241078.496	3.35
31	335160.211	6241034.606	3.60
32	335168.072	6241061.847	3.77
33	335169.004	6241041.068	3.60
34	335311.813	6241017.199	4.40
35	335076.915	6241352.859	3.40
36	335075.270	6241342.979	3.40
37	335107.818	6241347.539	3.40
38	335106.442	6241337.781	3.40
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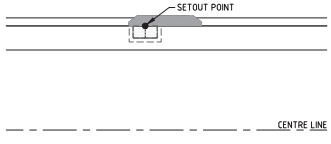
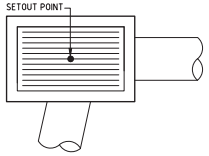
42	335260.632	6241270.978	3.99
43	335245.958	6241327.799	4.20
44	335164.858	6241331.326	4.00
45	335310.961	6241138.937	3.60
46	335319.674	6241080.296	3.40
47	335309.461	6241018.858	3.40
48	~~335010.379~~	~~6241198.186~~	~~4.27~~
49	~~335069.064~~	~~6241190.895~~	~~4.20~~
50	~~334861.426~~	~~6241225.475~~	~~3.50~~
51	~~334860.938~~	~~6241233.817~~	~~3.50~~



KERB INLET PIT



JUNCTION PIT/SURFACE INLET PIT
PIT SETOUT DIAGRAMS

NOTE:
NO FILLING (INCLUDING TEMPORARY STOCKPILES) SHALL BE CARRIED OUT WITHIN SERVICES EASEMENT WITHOUT PRIOR WRITTEN APPROVAL FROM THE SUPERINTENDENT.

NOTE:
ALL STORMWATER DRAINAGE PITS TO BE CONSTRUCTED TO BLACKTOWN CITY COUNCIL STANDARD DETAILS.

NOTE:
REFER DRAWING 210094-1-113 FOR LOCATION OF FSL (FINISHED SURFACE LEVEL)

PIT SCHEDULE

TYPE	COVER	PIT NUMBER
A	KERB INLET PIT CLASS "D" GALVANISED MILD STEEL GRATE HINGED TO FRAME. (2.4m LINTEL) ON GRADE	A2, ~~A3~~, A4, ~~A5~~
B	PITS TO BE PLATED TO BULK LEVEL TO ALLOW FOR FUTURE CONSTRUCTION OF GRATES / LINTEL PROVIDE CLASS 'D' COVER X= 900 Y= 1100	B2, B3, ~~C3~~, C2, D2
C	PIT IN DISH DRAIN CLASS "D" GALVANISED MILD STEEL GRATE HINGED TO FRAME.	A1, A2A, ~~F2~~, G2
D	PRECAST CONCRETE HEADWALL	B1, C1, D1, ~~E1, E2~~, G1, ~~F1, H1, J1, K1~~

PIT SCHEDULE

TYPE	COVER	PIT NUMBER
E	CONNECT TO EXISTING PIT	A1
F	PITS STUB FOR FUTURE CONNECTION WITH SURFACE MARKER AT CAPPING POSITION	A2A, ~~A3A~~, ~~A5A~~
G	SURFACE INLET PIT CLASS "D" GALVANISED MILD STEEL GRATE ONLY ON GRADE X=900 Y=600	~~B2A, B2B, B3A, B3B, C2A, C2B, H2, J2, K2~~

NOT IN THIS CONTRACT

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E	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
D	11.10.12	RE-ISSUED FOR CONSTRUCTION CERTIFICATE	RH	RL
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0 10 20 30 40 50m
10 8 6 4 2
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Approved	RL	Date MAY'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITEWORKS SEDIMENT AND EROSION CONTROL PLAN SHEET 4

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	1:500	A1

Drawing Number: 210094-1-009
Revision: 2

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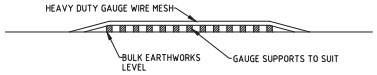
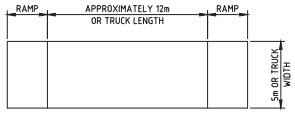


ELEVATION

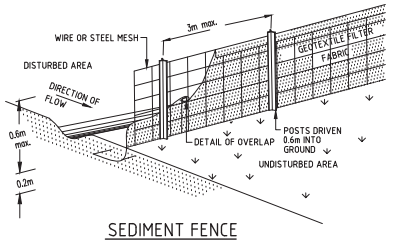


PLAN

TEMPORARY CONSTRUCTION EXIT (WASH DOWN DETAIL)

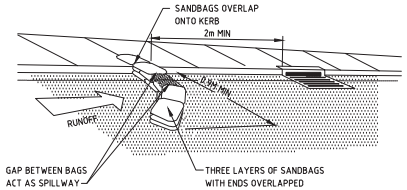
SCALE 1:200

THE EXIT SHALL BE MAINTAINED IN A CONDITION WHICH PREVENTS TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS OF WAY. THIS MAY REQUIRE REPAIR AND OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS OF WAY MUST BE REMOVED IMMEDIATELY.



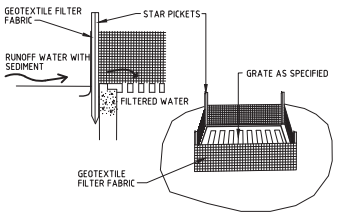
SEDIMENT FENCE

NTS



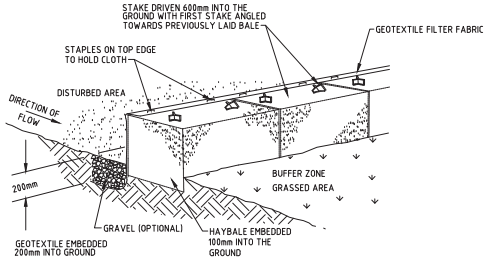
SANDBAG SEDIMENT TRAP FOR KERB INLET ON GRADE

NTS



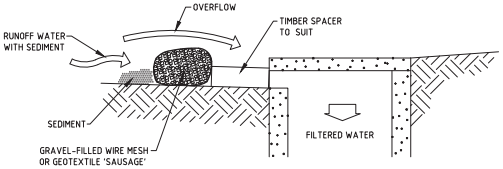
GEOTEXTILE FILTER PIT SURROUND

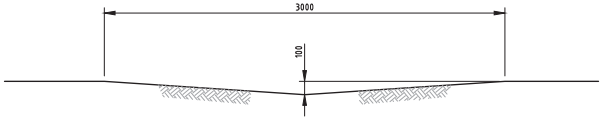
NTS



HAYBALE AND GEOTEXTILE SEDIMENT FILTER

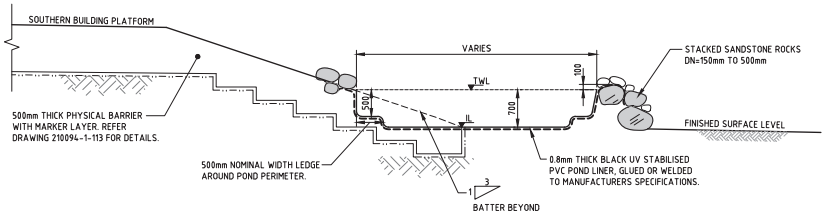
NTS



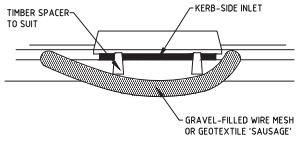


DIVERSION CHANNEL DETAIL

SCALE 1:20

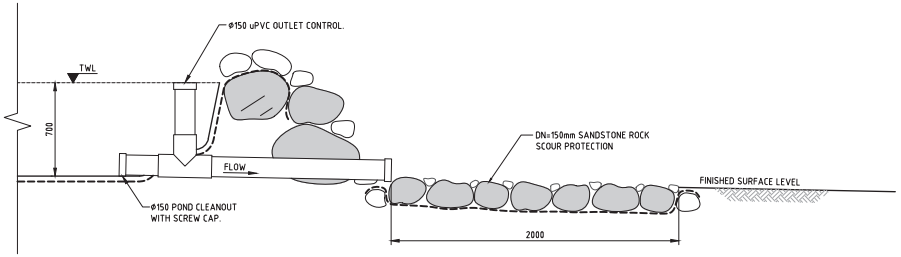


SECTION A
SCALE 1:25



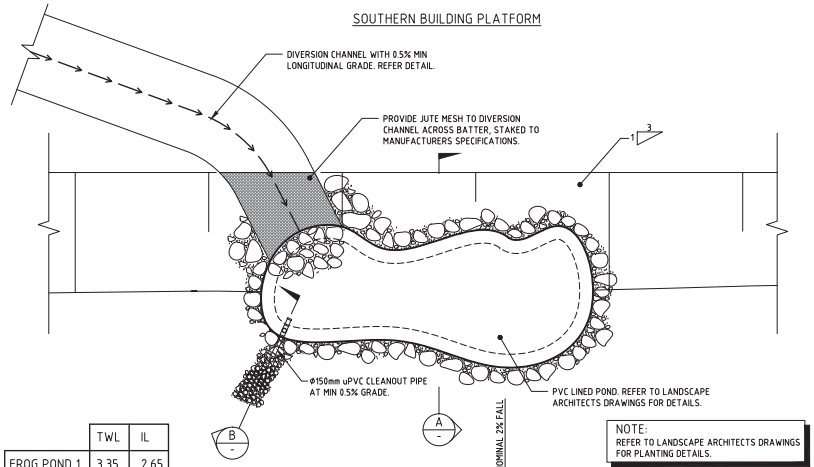
MESH AND GRAVEL INLET FILTER

N.T.S.



SECTION B
SCALE 1:20

SOUTHERN BUILDING PLATFORM



	TWL	IL
FROG POND 1	3.35	2.65
FROG POND 2	3.30	2.60

NOTE:
REFER TO LANDSCAPE ARCHITECTS DRAWINGS FOR PLANTING DETAILS.

SPRINGVALE DRAIN

FROG POND DETAIL PLAN

SCALE 1:100

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2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	07.08.12	PRELIMINARY ISSUE	RDM	RL

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Designed	RH	Date AUG'12
Verified	RH	Date AUG'12
Approved	RL	Date AUG'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
SITEWORKS DETAILS - SHEET 1

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
AUG'12	AHD	NTS	A1

Drawing Number: 210094-1-010
Revision: 2

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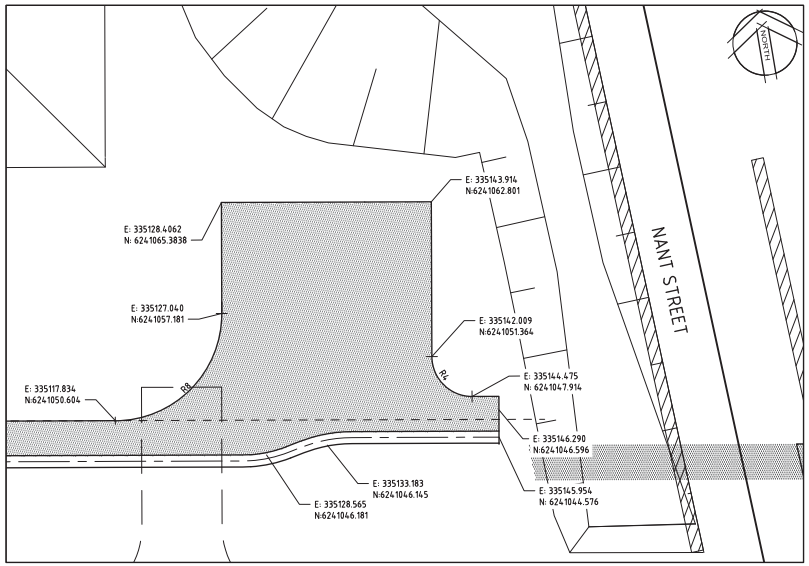
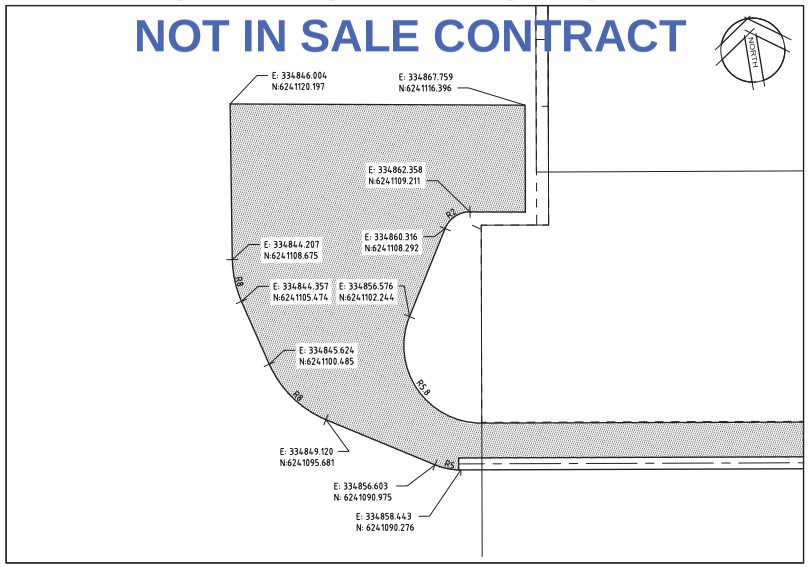


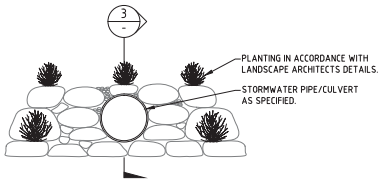
TURNING HEAD - EAST SETOUT PLAN

SCALE 1:200



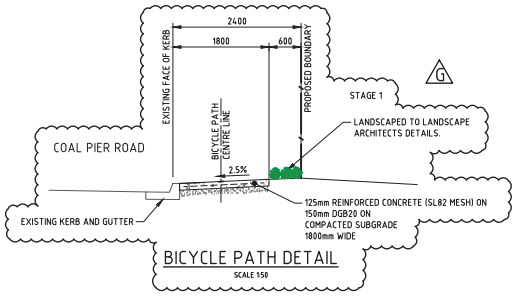
TURNING HEAD - WEST SETOUT PLAN

SCALE 1:200



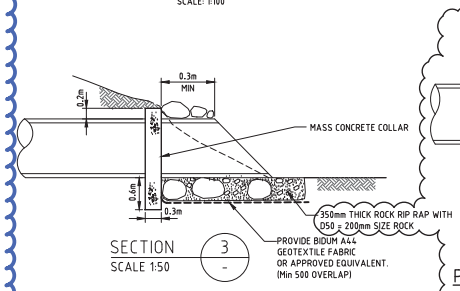
ROCK HEADWALL - TYPICAL ARRANGEMENT

SCALE: 1:100



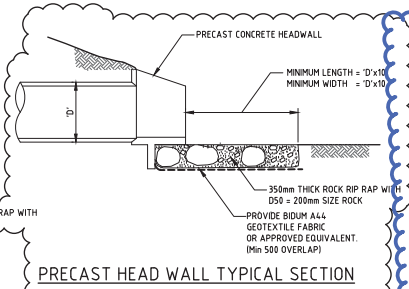
BICYCLE PATH DETAIL

SCALE 1:50



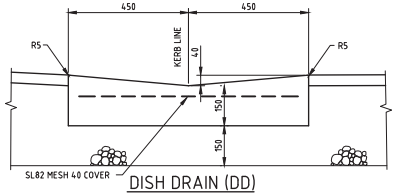
SECTION 3

SCALE 1:50



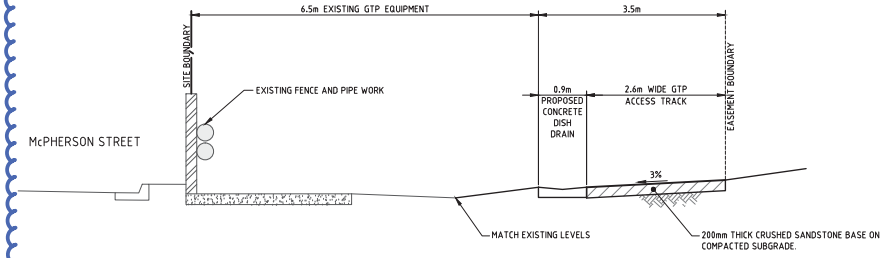
PRECAST HEAD WALL TYPICAL SECTION

SCALE 1:50



DISH DRAIN (DD)

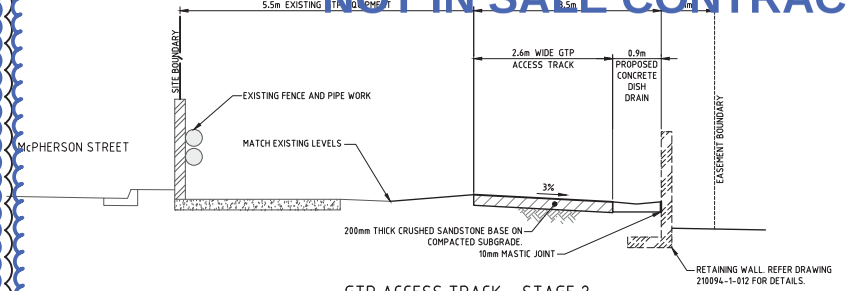
SCALE 1:10



GTP ACCESS TRACK - STAGE 1

SCALE 1:50

NOT IN THIS CONTRACT



GTP ACCESS TRACK - STAGE 2

SCALE 1:50

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
G	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	21.02.13	PRECAST HEADWALL DETAIL ADDED	ASD	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	07.08.12	PRELIMINARY ISSUE	RDM	RL

0 200 400 600 800 1000mm

SCALE 1:10

0 1000 2000 3000 4000 5000mm

SCALE 1:50

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ABN: 95 001 145 035
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Verified	RH	Date AUG'12
Approved	RL	Date AUG'12

Client ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
SITEWORKS DETAILS - SHEET 2

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
AUG'12	AHD	1:100	A1

Drawing Number: 210094-1-011

Revision: 2

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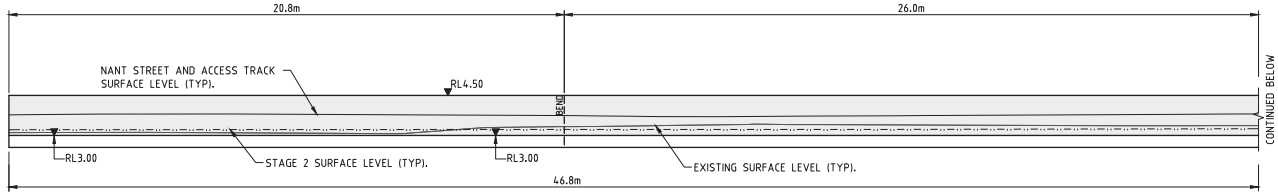
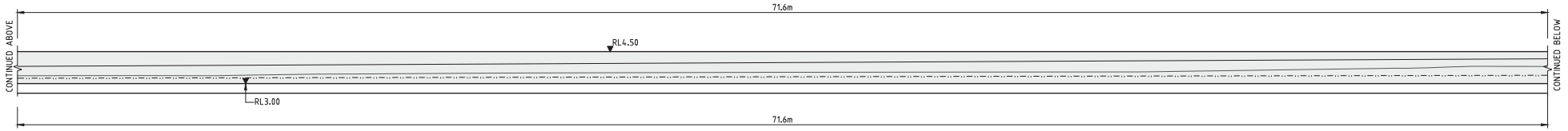
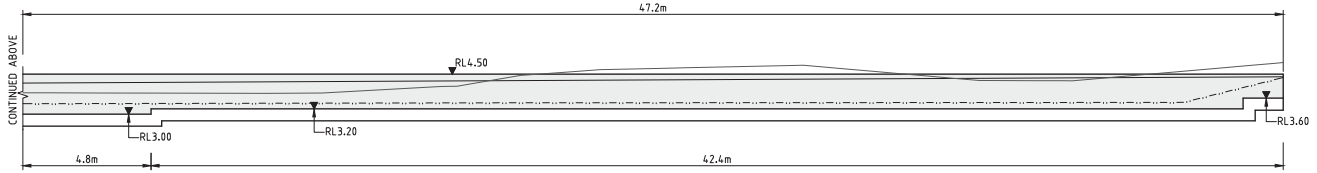


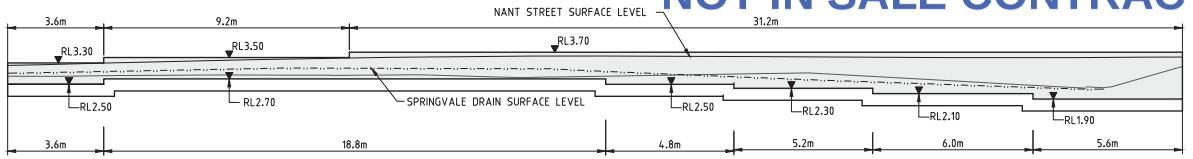
RETAINING WALL 2
SCALE 1:100 (NAT)



RETAINING WALL 2
SCALE 1:100 (NAT)



RETAINING WALL 2
SCALE 1:100 (NAT)



RETAINING WALL 1
SCALE 1:100 (NAT)

NOTE:
REFER TO DRAWING 210094-1-009 FOR RETAINING WALL SETOUT

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	NVH	RL
E	21.02.13	RETAINING WALL STEPS AMENDED	ASD	RL
D	21.01.13	ISSUED FOR REPRICING	DJB	RL
C	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
B	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
A	07.08.12	PRELIMINARY ISSUE	RDM	RL

0 2 4 6 8 10m
2 1
SCALE 1:100

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ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date AUG'12
Checked	RL	Date AUG'12
Designed	RH	Date AUG'12
Verified	RH	Date AUG'12
Approved	RL	Date AUG'12

Client: ORICA

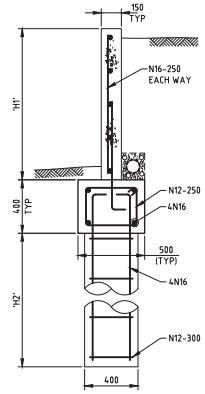
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
RETAINING WALL ELEVATIONS

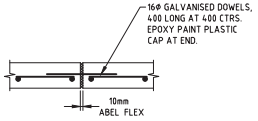
Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
AUG'12	AHD	1:100	A1

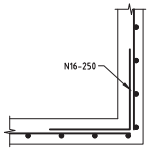
Drawing Number: 210094-1-012
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

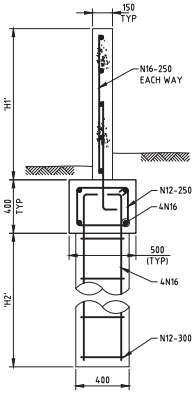




WALL EXPANSION JOINT
SCALE 1:20
(PROVIDE JOINTS AT 10m MAX CTRS)

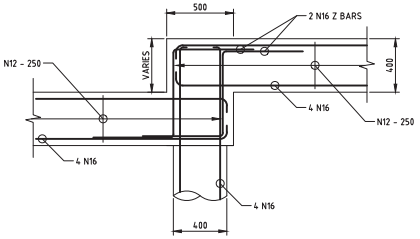


CORNER DETAIL
SCALE 1:20

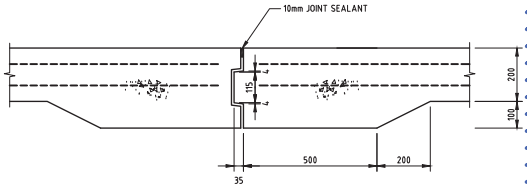


RETAINING WALL RW1					
'H1'	PILE SPACING	PILE ACTIONS			'H2' (mm)
		M (kNm)	N (kN)	V (kN)	
H1≤600	3000	2	21	9	1200
600<H1≤1000	3000	8	26	23	1800
1000<H1≤1300	2500	14	24	32	2100
1300<H1≤1600	2500	26	27	48	2600

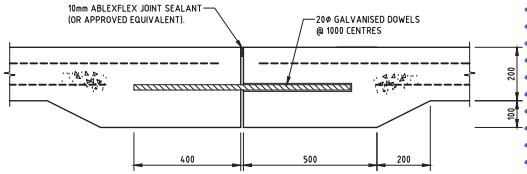
RETAINING WALL RW2					
'H1'	PILE SPACING	PILE ACTIONS			'H2' (mm)
		M (kNm)	N (kN)	V (kN)	
H1≤600	3000	5	21	17	1000
600<H1≤1000	3000	15	26	35	1500
1000<H1≤1300	2500	23	24	43	2000
1300<H1≤1600	2000	30	27	47	2200



RETAINING WALL STEP DETAIL
SCALE 1:20



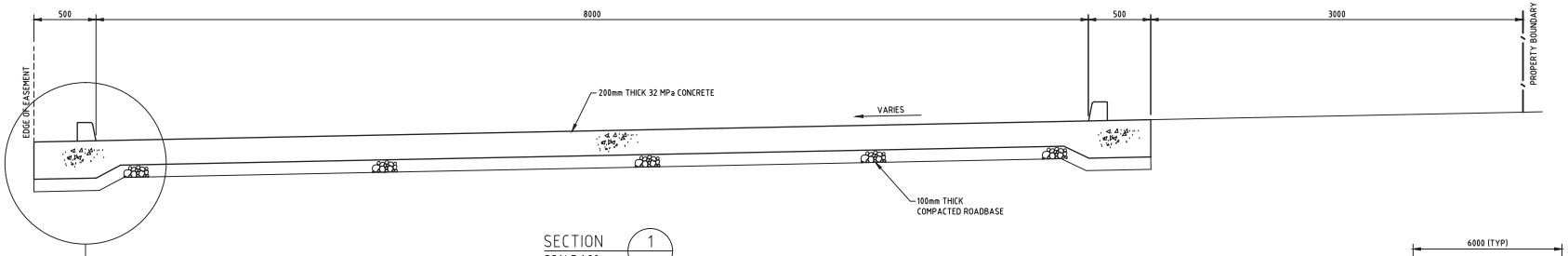
KJ DETAIL
SCALE 1:10



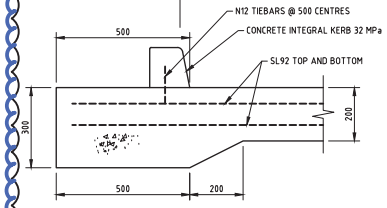
DEJ DETAIL
SCALE 1:10

NOT IN THIS CONTRACT

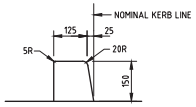
FOR INFORMATION ONLY - NOT IN SALE CONTRACT



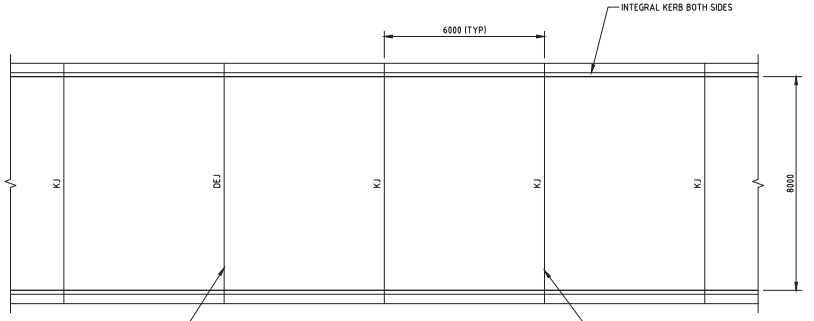
SECTION 1/007
SCALE 1:20



EDGE THICKENING DETAIL
SCALE 1:10



CONCRETE INTEGRAL KERB
SCALE 1:10



JOINTING PLAN
SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
C	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
B	22.02.13	RETAINING WALL STEP DETAIL ADDED	ASD	RL
A	21.01.13	ISSUED FOR REPRICING	MDH	RL

0 200 400 600 800 1000mm
SCALE 1:10
0 500 1000 1500 2000mm
SCALE 1:20
0 2000 4000 6000 8000 10000mm
SCALE 1:100

Cardno Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	MDH	Date DEC'12
Checked	RL	Date DEC'12
Designed	RL	Date DEC'12
Verified	RL	Date DEC'12
Approved	RL	Date DEC'12

Client: ORICA

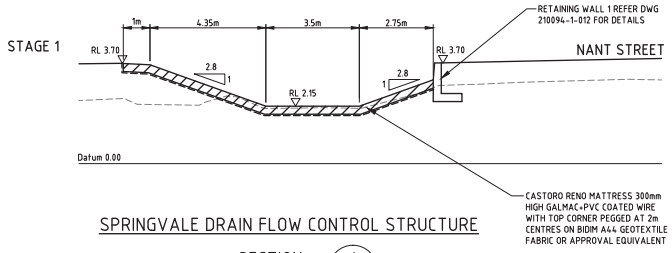
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
RETAINING WALL AND ACCESS ROAD DETAILS

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
DEC'12	AHD	AS SHOWN	A1

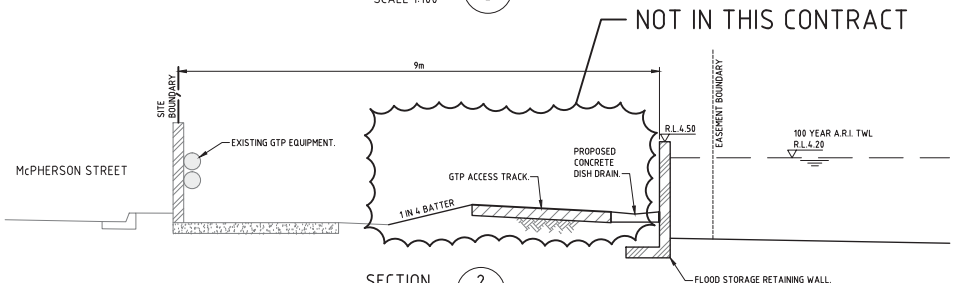
Drawing Number: 210094-1-013
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

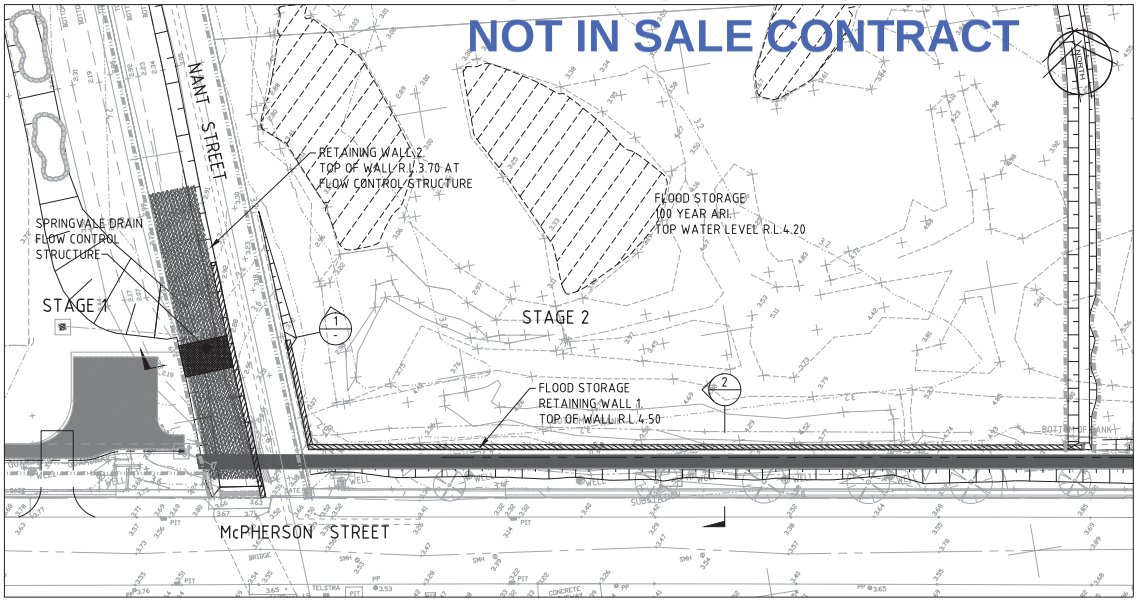


SPRINGVALE DRAIN FLOW CONTROL STRUCTURE

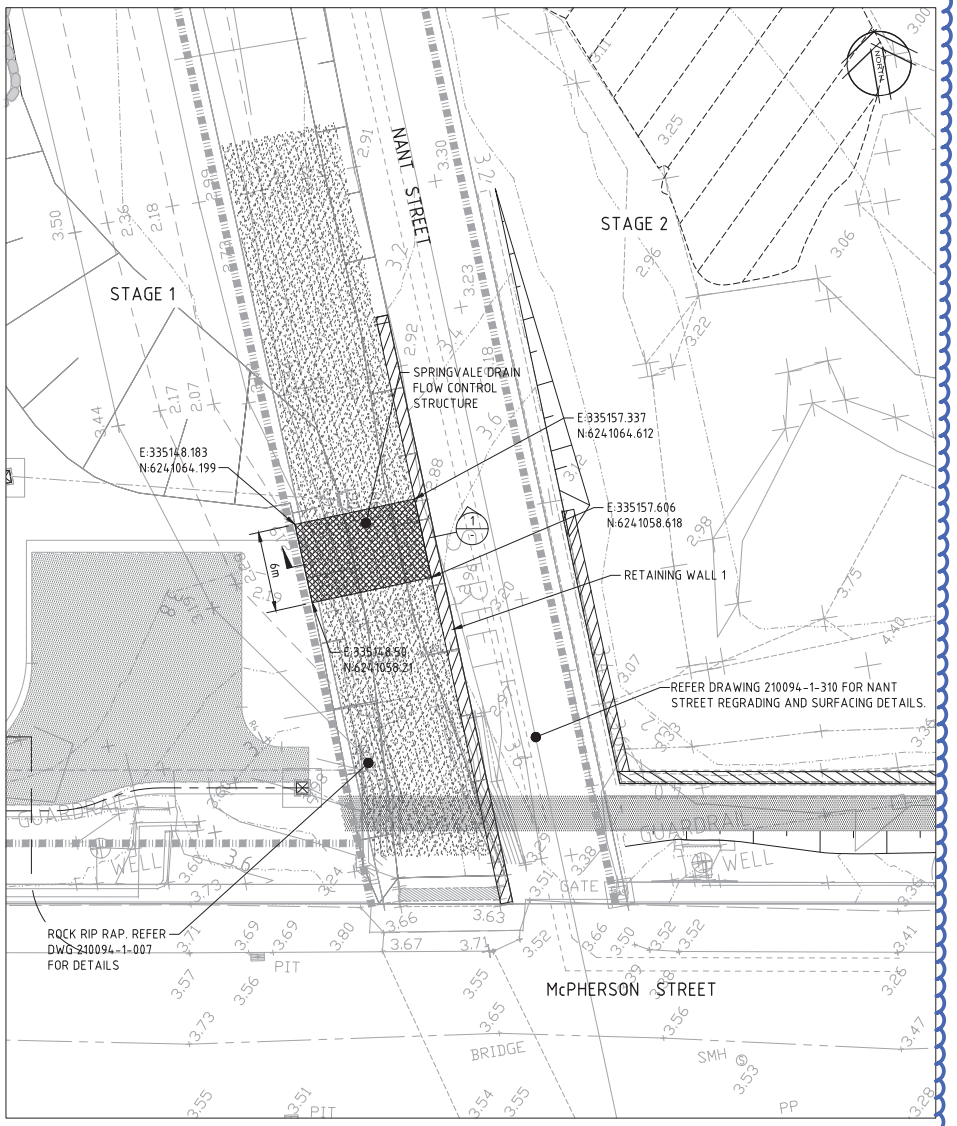
SECTION 1
SCALE 1:100



SECTION 2
SCALE 1:50



SOUTHLANDS FLOODPLAIN MANAGEMENT STRUCTURES
SCALE: 1:500



PLAN
SCALE: 1:200

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
D	16.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
C	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
B	14.06.13	REISSUED FOR APPROVAL	DB	RL
A	13.06.13	FOR APPROVAL	JY	RL

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

0 4 8 12 16 20m
4 3 2 1
SCALE 1:200

0 2 4 6 8 10m
2 1
SCALE 1:100

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	JY	Date JUN'13
Checked	RL	Date JUN'13
Designed	RH	Date JUN'13
Verified	RL	Date JUN'13
Approved	RL	Date JUN'13

Client ORICA

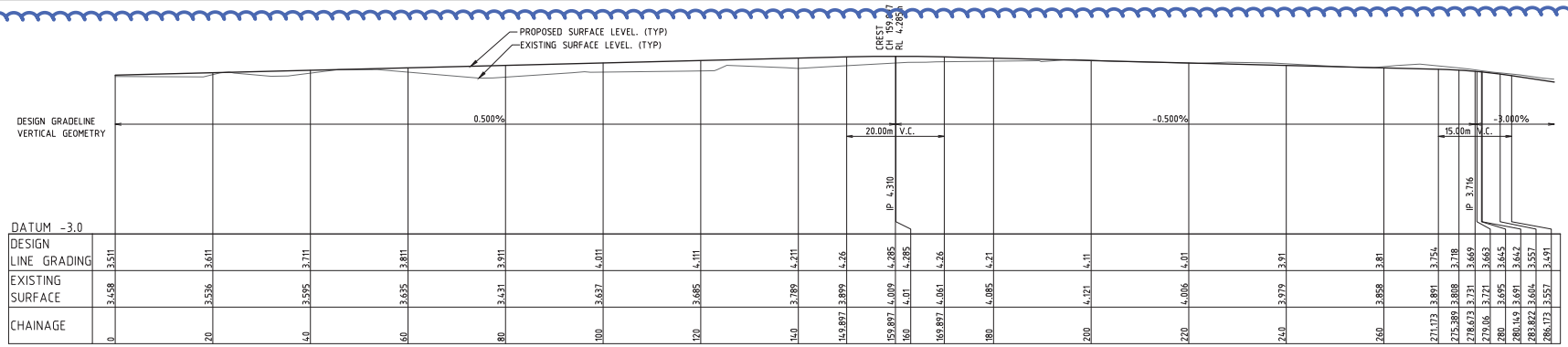
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
FLOW CONTROL STRUCTURE

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
JUN'13	AHD	AS SHOWN	A1

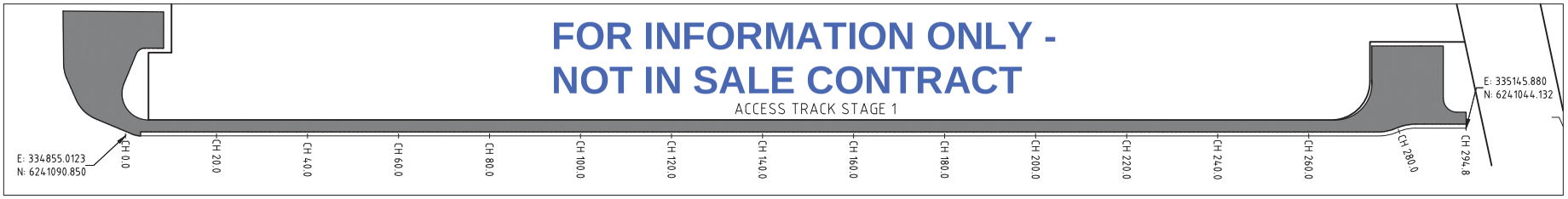
Drawing Number: 210094-1-014
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL



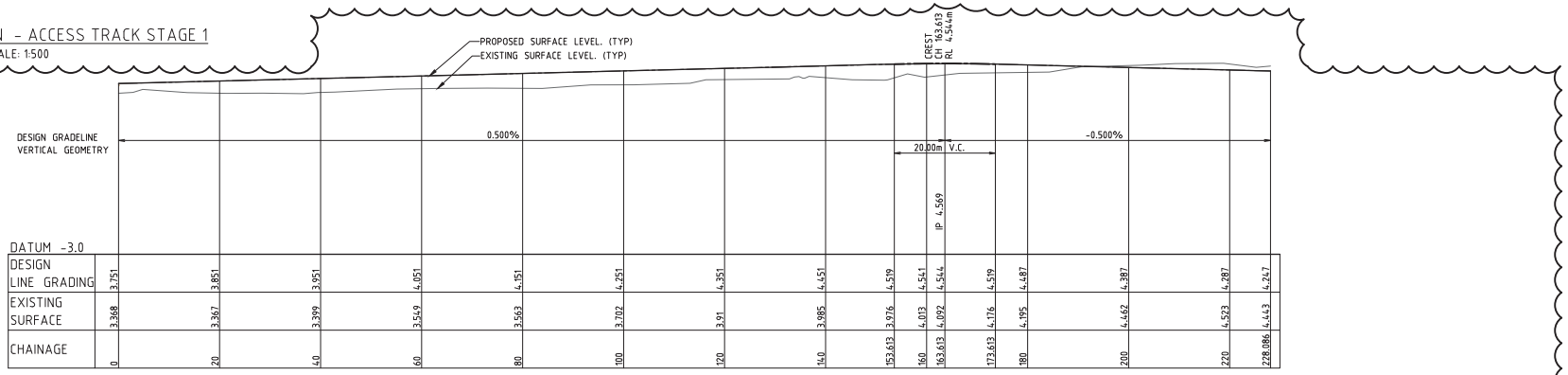
LONGITUDINAL SECTION - ACCESS TRACK STAGE 1

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100



CONTROL SETOUT PLAN - ACCESS TRACK STAGE 1

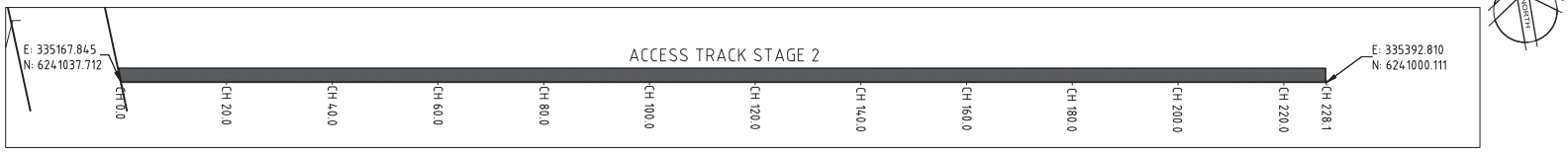
SCALE: 1:500



NOT IN THIS CONTRACT

LONGITUDINAL SECTION - ACCESS TRACK STAGE 2

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100



CONTROL SETOUT PLAN - ACCESS TRACK STAGE 2

SCALE: 1:500

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
A	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL

SCALE 1:500

SCALE 1:100

Cardno Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

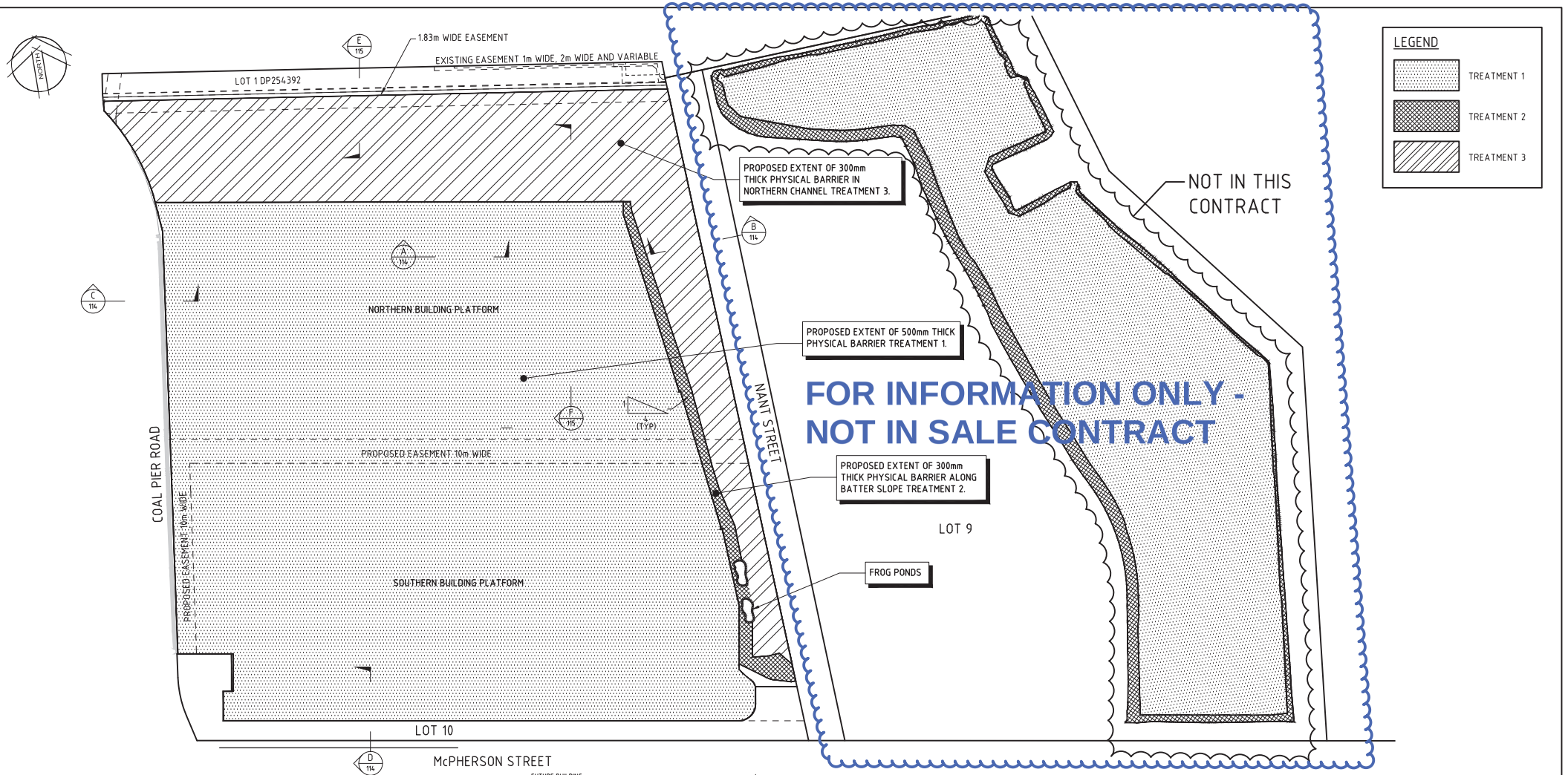
		Date
Drawn	RT	SEP'13
Checked	RL	SEP'13
Designed	RH	SEP'13
Verified	RL	SEP'13
Approved	RL	SEP'13

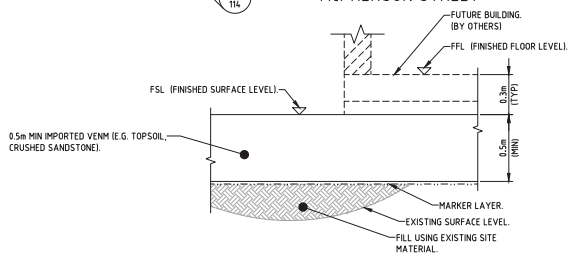
Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
LONGITUDINAL SECTIONS AND SETOUT - ACCESS TRACK

Status: ISSUED FOR CONSTRUCTION			
Date: SEP'13	Datum: AHD	Scale: 1:100	Size: A2
Drawing Number: 210094-1-015			Revision: 2

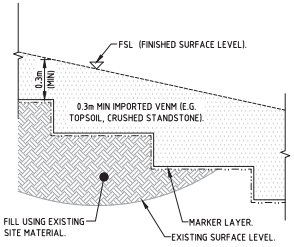
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL





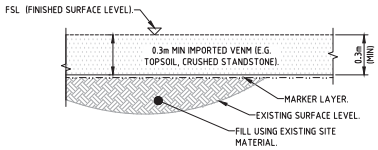
TYPICAL SECTION - 500mm THICK PHYSICAL BARRIER TREATMENT 1

SCALE 1:20



TYPICAL SECTION - 300mm THICK PHYSICAL BARRIER TREATMENT 2

SCALE 1:20



TYPICAL SECTION - 300mm THICK PHYSICAL BARRIER TREATMENT 3

SCALE 1:20

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
J	16.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
H	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
G	08.02.13	CAPPING EXTENDED	ASD	RL
F	21.01.13	ISSUED FOR REPRICING	DJB	RL
E	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
D	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
C	04.07.12	ISSUED FOR APPROVAL	ASD	RL

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

0 500 1000 1500 2000mm
SCALE 1:20

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	RDM	Date FEB'12
Checked	RH	Date FEB'12
Designed	RH	Date FEB'12
Verified	RL	Date FEB'12
Approved	RL	Date FEB'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS EDGE TREATMENT DETAILS
- SHEET 1

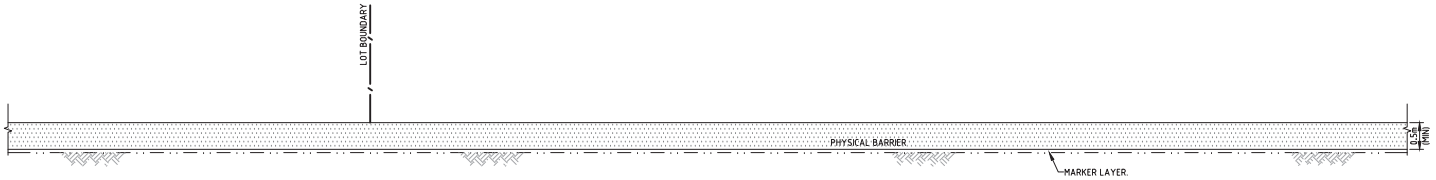
Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAR'11	AHD	1:500	A1

Drawing Number: 210094-1-113
Revision: 2

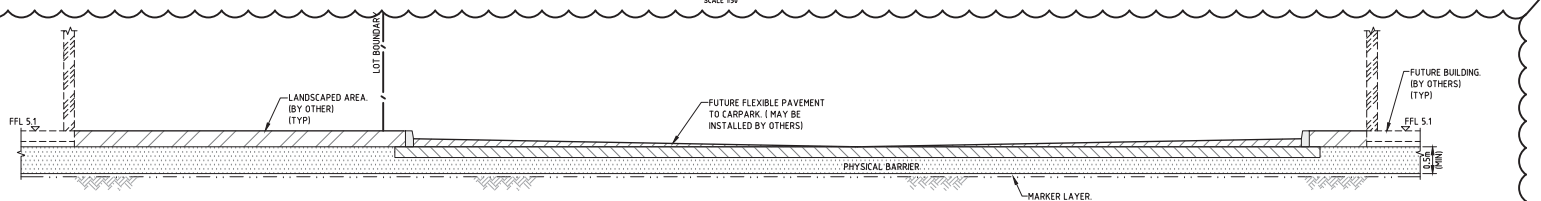
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

NOTE:
REFER TO LANDSCAPE ARCHITECTS FENCING PLAN FOR FENCE LOCATIONS.

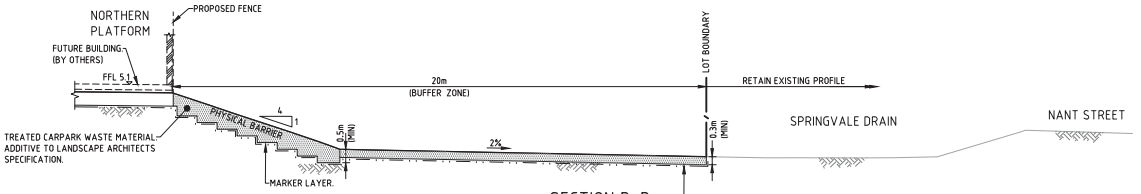


SECTION A-A INTERIM CONFIGURATION
SCALE 1:50

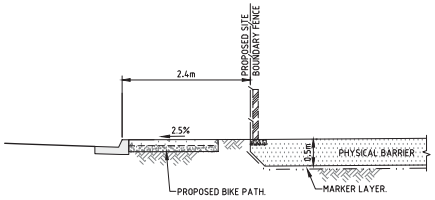
NOT IN THIS CONTRACT



SECTION A-A POTENTIAL FUTURE DEVELOPMENT
SCALE 1:50

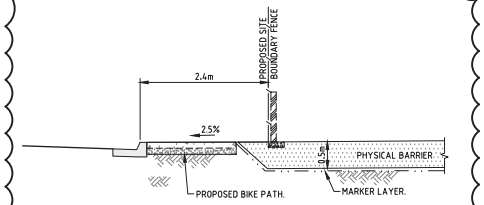


SECTION B-B
SCALE 1:100

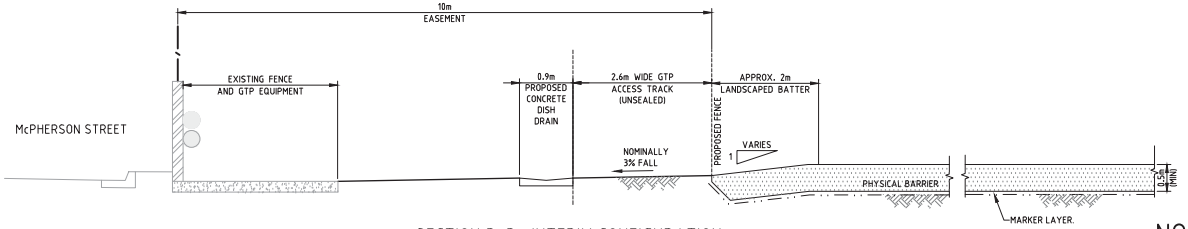


SECTION C-C
SCALE 1:50

ALTERNATIVE TREATMENT ONLY IF REQUIRED

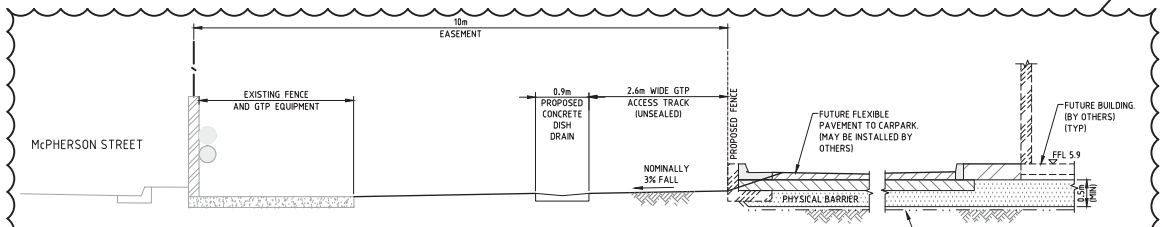


SECTION C-C - ALTERNATIVE TREATMENT SUBJECT TO RESULTS OF VALIDATION
SCALE 1:50



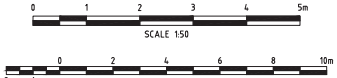
SECTION D-D -INTERIM CONFIGURATION
SCALE 1:50

NOT IN THIS CONTRACT



SECTION D-D - POTENTIAL FUTURE DEVELOPMENT
SCALE 1:50

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
G	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	08.02.13	SECTION B-B CAPPING ADDED	ASD	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	04.07.12	ISSUED FOR APPROVAL	ASD	RL
A	02.02.12	PRELIMINARY ISSUE	RDM	RL



Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	RDM	Date	FEB'12
Checked	RH	Date	FEB'12
Designed	RH	Date	FEB'12
Verified	RL	Date	FEB'12
Approved	RL	Date	FEB'12

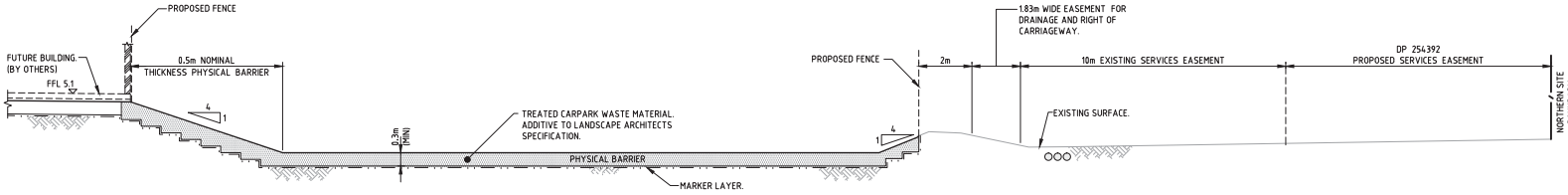
Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS EDGE TREATMENT DETAILS
- SHEET 2

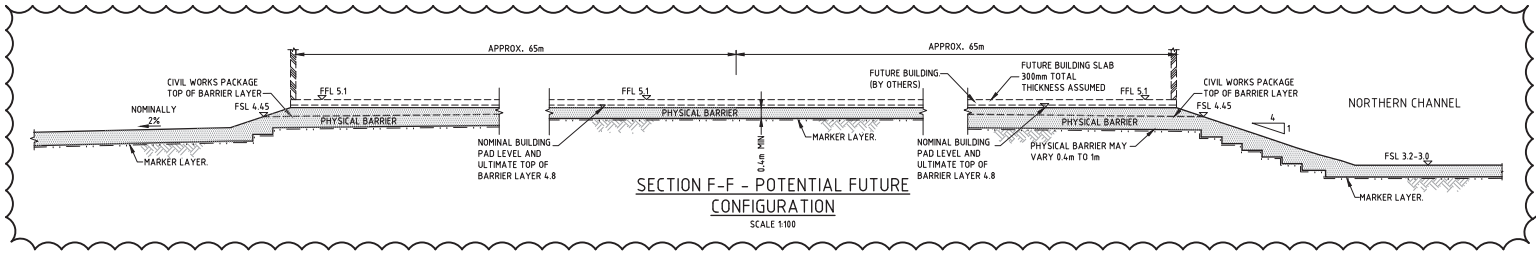
Status: ISSUED FOR CONSTRUCTION			
Date: MAR'11	Datum: AHD	Scale: AS SHOWN	Size: A1
Drawing Number: 210094-1-114			Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

NOTE:
REFER TO LANDSCAPE ARCHITECTS FENCING PLAN FOR FENCE LOCATIONS.

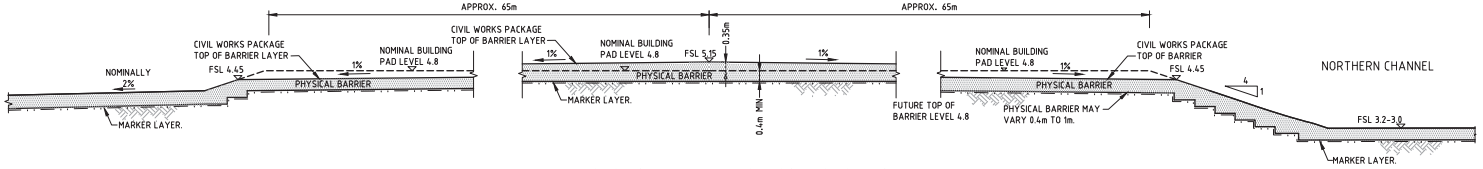


SECTION E-E NORTHERN CHANNEL
SCALE 1:100



SECTION F-F - POTENTIAL FUTURE CONFIGURATION
SCALE 1:100

NOT IN THIS CONTRACT



SECTION F-F - INTERIM CONFIGURATION
SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
G	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	21.01.13	ISSUED FOR REPRICING	DJB	RL
E	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
D	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
C	04.07.12	ISSUED FOR APPROVAL	ASD	RL
B	28.05.12	ISSUED FOR APPROVAL	AG	RL
A	02.02.12	PRELIMINARY ISSUE	RDM	RL

0 2 4 6 8 10m
2 1
SCALE 1:100

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	RDM	Date FEB'12
Checked	RH	Date FEB'12
Designed	RH	Date FEB'12
Verified	RL	Date FEB'12
Approved	RL	Date FEB'12

Client: ORICA

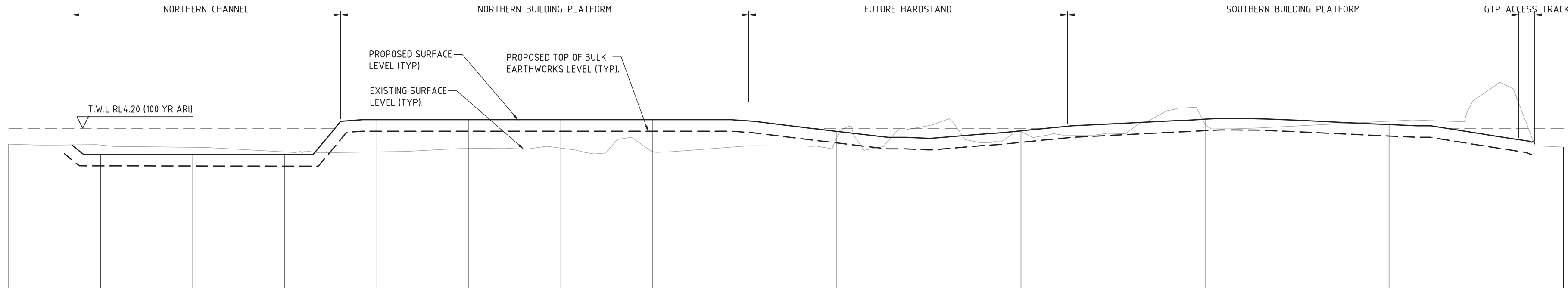
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS EDGE TREATMENT DETAILS
- SHEET 3

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAR'11	AHD	1:100	A1

Drawing Number: 210094-1-115
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

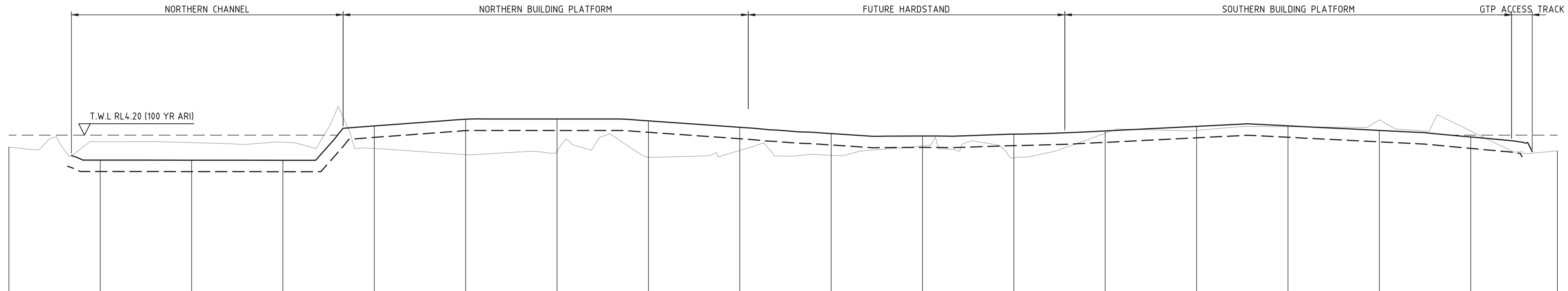


DATUM -3.0

DESIGN BE STAGE 1		3.062	3.056	3.049	4.57	4.57	4.57	4.57	4.531	4.066	3.761	4.083	4.392	4.592	4.547	4.362	3.962	
EXISTING SURFACE		3.47	3.371	3.171	3.17	3.319	3.341	3.188	3.421	3.722	4.308	4.072	3.974	4.447	4.297	4.505	5.61	3.377
CHAINAGE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	338.077

SECTION - NS1

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100



DATUM -3.0

DESIGN BE STAGE 1		3.108	3.104	3.1	4.599	4.896	4.904	4.828	4.546	4.272	4.16	4.24	4.381	4.581	4.608	4.408	4.124	
EXISTING SURFACE		3.91	3.873	3.891	3.616	3.345	3.455	3.236	3.516	3.319	3.727	3.204	4.267	4.404	4.566	4.844	4.399	3.508
CHAINAGE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	339.158

SECTION - NS2

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL

SCALE 1:100
SCALE 1:500

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Shaping the Future

ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Role	Name	Date
Drawn	ASD	MAY'12
Checked	RL	MAY'12
Designed	RH	MAY'12
Verified	RL	MAY'12
Approved	RL	MAY'12

Client: ORICA

SOUTHLANDS INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 1

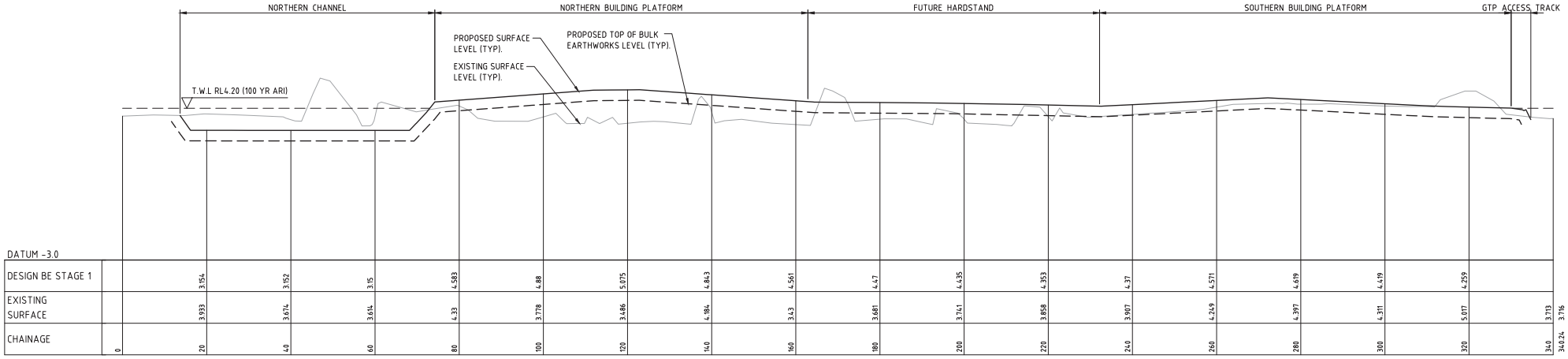
Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	AS SHOWN	A1

Drawing Number: 210094-1-120 Revision: 2

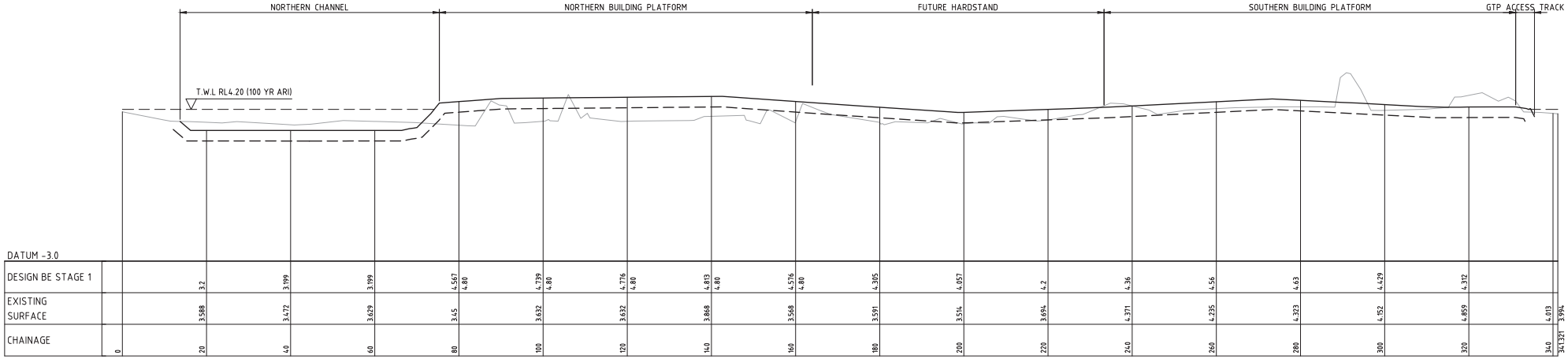
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

DATE PLOTTED: 12 May 2014 11:43 AM BY : DAVID BALL (SYDNEY)
XREF's: X-BHL-A1-SHT; RD-LP-JUL23SECTION-MARKERS---WESTERN-NS21; RD-LP-JUL23SECTION-MARKERS---WESTERN-NS11
CAD FILE: G:\210094 - Southlands\Norwest Civil\Drawings\CC\210094-1-120 (2) BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 1.dwg



SECTION - NS3

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100



SECTION - NS4

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL

SCALE 1:100 (0 2 4 6 8 10m; 2 1)

SCALE 1:500 (0 10 20 30 40 50m; 10 8 6 4 2)

Cardno Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

		Date
Drawn	ASD	MAY'12
Checked	RL	MAY'12
Designed	RH	MAY'12
Verified	RL	MAY'12
Approved	RL	MAY'12

Client: ORICA

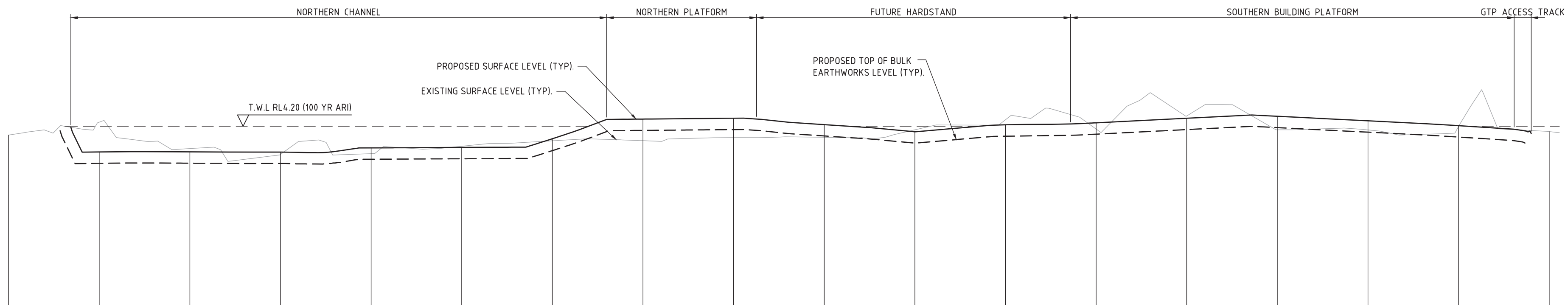
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 2

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	AS SHOWN	A1

Drawing Number: 210094-1-121
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL



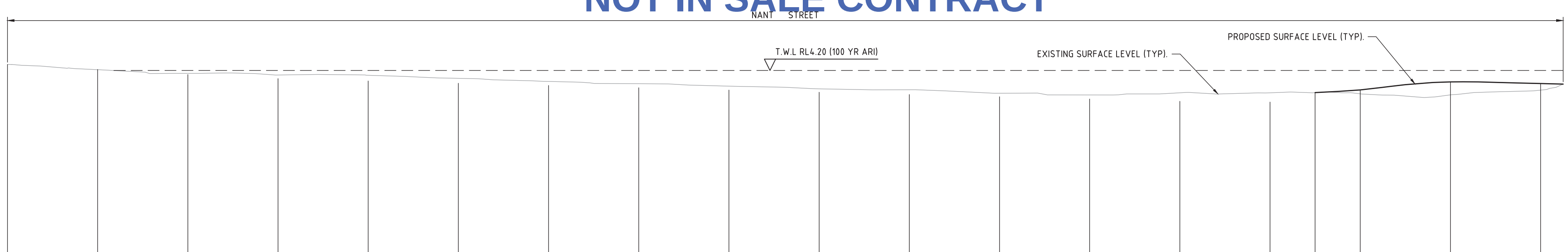
DATUM -4.0

DESIGN BE STAGE 1		3.064	3.069	3.063	3.244	3.265	3.638	4.515	4.552	4.273	3.959	4.259	4.349	4.549	4.64	4.44	4.225		
EXISTING SURFACE		4.366	3.212	2.935	2.99	3.314	3.555	3.563	3.696	3.711	4.034	4.459	4.096	4.635	4.045	4.04	4.138	3.966	3.915
CHAINAGE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	342.403

SECTION - NS5

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

FOR INFORMATION ONLY - NOT IN SALE CONTRACT



DATUM -4.0

DESIGN LINE GRADING													2.932	2.832	2.795	3.336	3.69	3.619
EXISTING SURFACE	4.464	4.233	4.07	3.997	3.983	3.85	3.712	3.61	3.502	3.38	3.342	3.188	3.111	3.206	3.208	3.162	3.114	3.325
CHAINAGE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340

SECTION - NS6

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL

SCALE 1:100 (0 2 4 6 8 10m)
SCALE 1:500 (0 10 20 30 40 50m)

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Role	Name	Date
Drawn	ASD	MAY'12
Checked	RL	MAY'12
Designed	RH	MAY'12
Verified	RL	MAY'12
Approved	RL	MAY'12

Client: ORICA

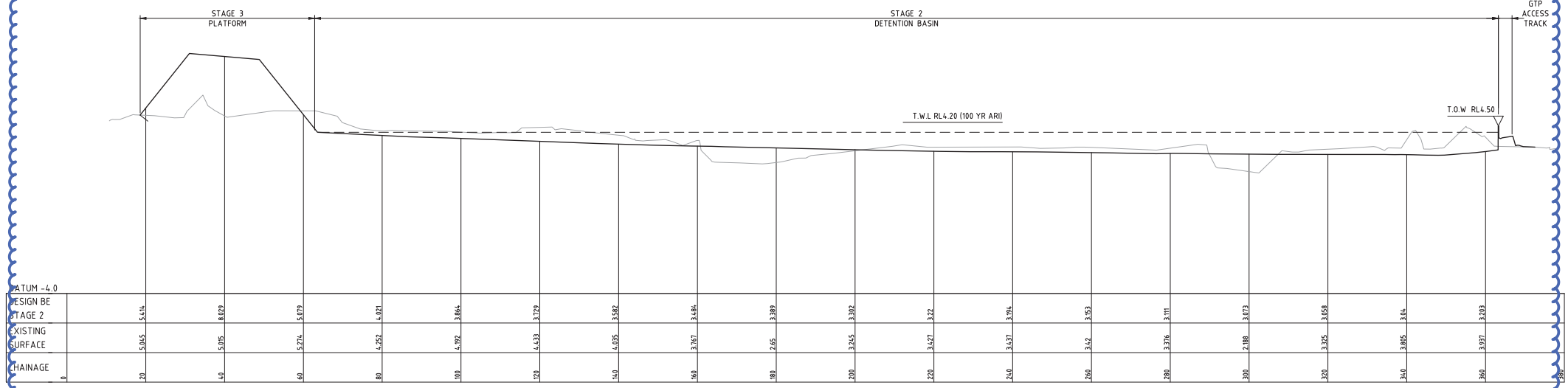
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 3

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	AS SHOWN	A1

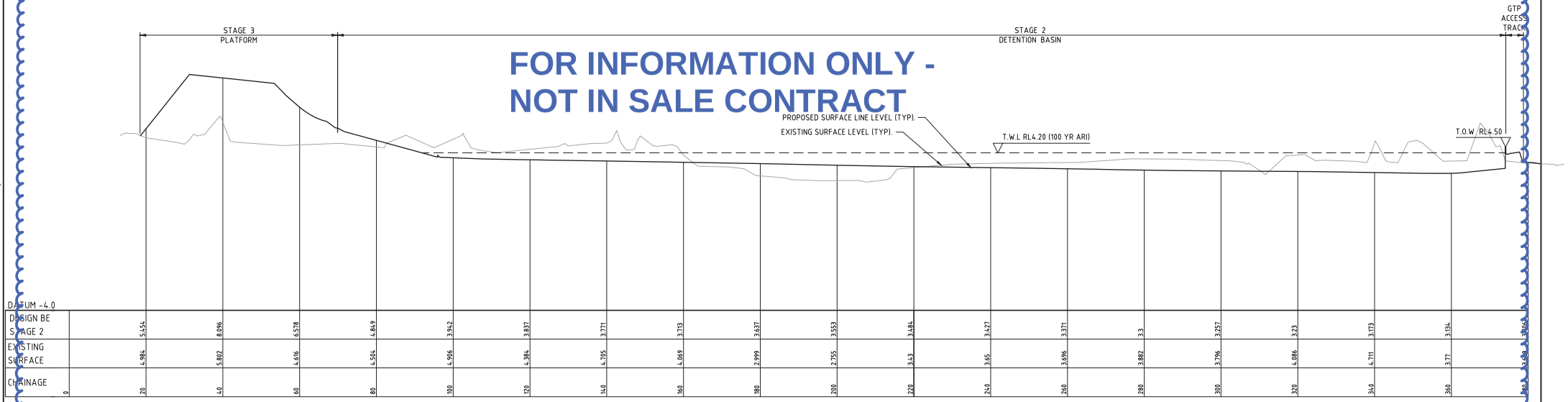
Drawing Number: 210094-1-122
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL



SECTION - NS7

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100



SECTION - NS8

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
G	16.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL

0 2 4 6 8 10m
2 1
SCALE 1:100

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date	MAY'12
Checked	RL	Date	MAY'12
Designed	RH	Date	MAY'12
Verified	RL	Date	MAY'12
Approved	RL	Date	MAY'12

Client: ORICA

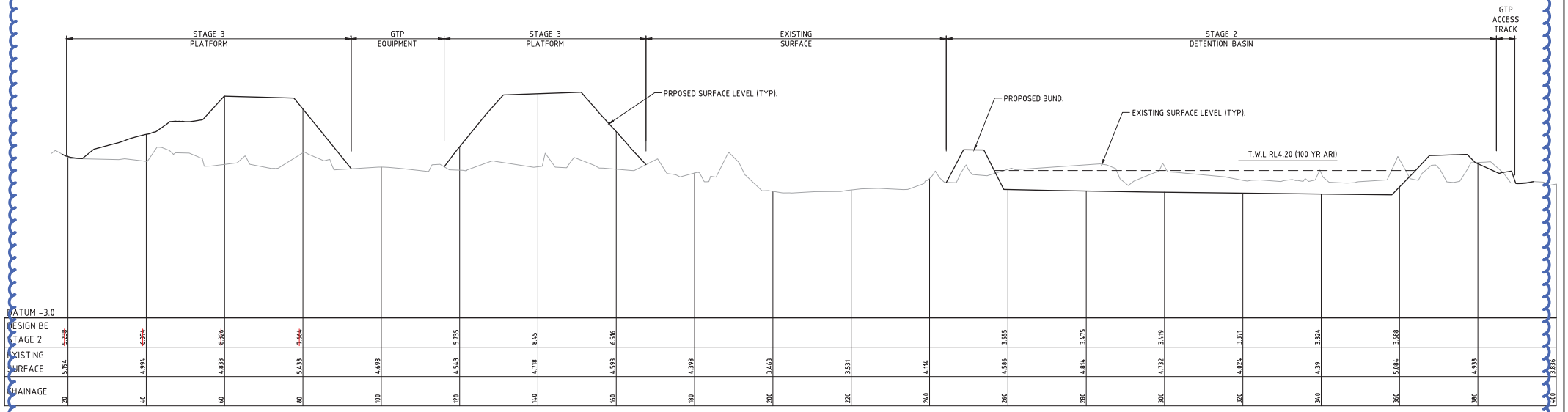
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 4

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	AS SHOWN	A1

Drawing Number: 210094-1-123
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

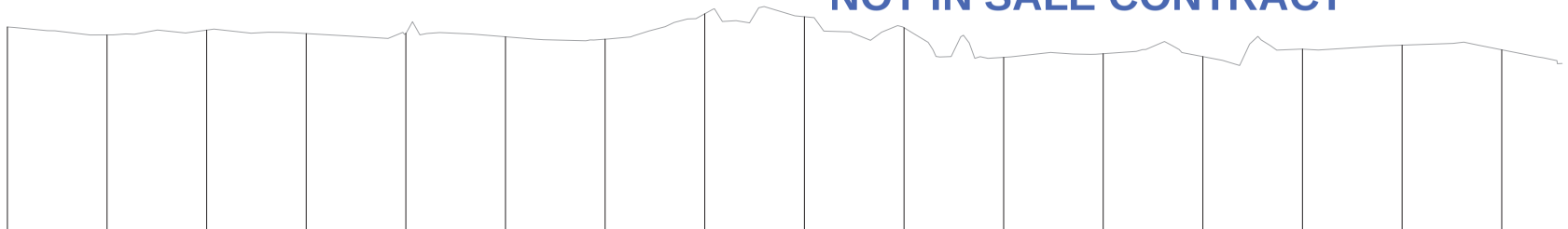


DATUM -3.0																									
DESIGN BE TAGE 2	5.238	6.274	8.326	7.664	5.735	8.45	6.516					3.555	3.475	3.419	3.371	3.324	3.688								
EXISTING SURFACE	5.194	4.994	4.838	5.433	4.698	4.543	4.788	4.593	4.398	3.463	3.531	4.114	4.586	4.814	4.732	4.024	4.39	5.084	4.938	5.836					
CHAINAGE	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400					

SECTION - NS9
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

NOT IN THIS CONTRACT

FOR INFORMATION ONLY - NOT IN SALE CONTRACT



DATUM -3.0																									
DESIGN LINE GRADING				5.491	5.491	5.491	5.491	5.491	5.491	5.491	5.491	5.491	5.491	5.491	5.491	5.491	5.491	5.491	5.491						
EXISTING SURFACE	5.446	5.126	5.32	5.182	5.193	5.051	4.955	5.977	5.858	5.438	4.224	4.371	4.255	4.556	4.714	4.528									
CHAINAGE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300									

SECTION - NS10
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL

0 2 4 6 8 10m
SCALE 1:100

0 10 20 30 40 50m
SCALE 1:500

Cardno Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

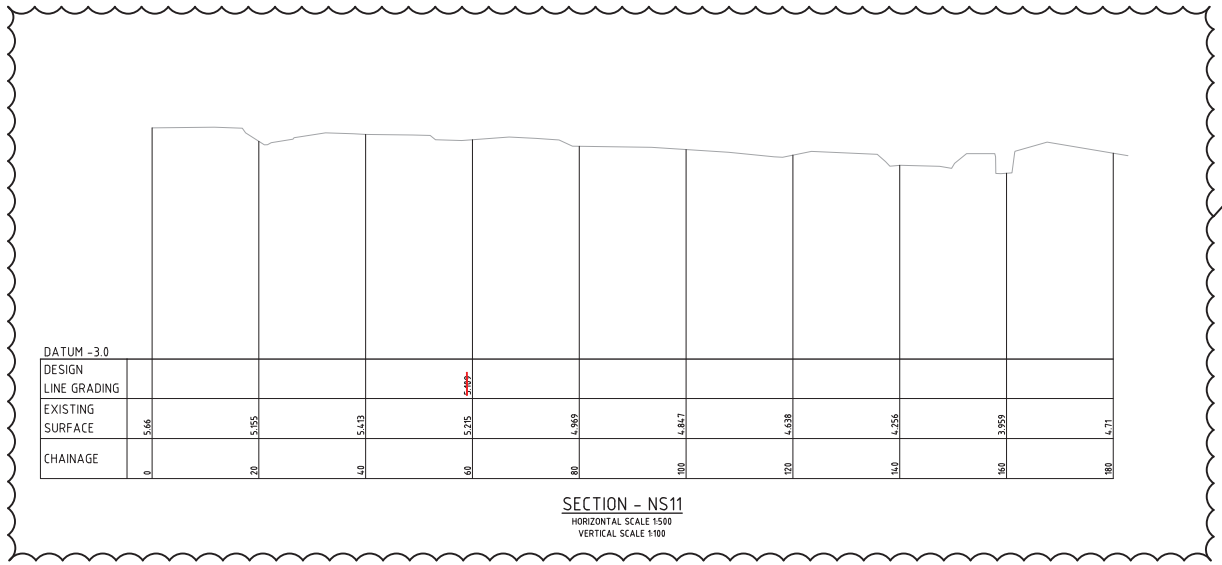
		Date
Drawn	ASD	MAY'12
Checked	RL	MAY'12
Designed	RH	MAY'12
Verified	RL	MAY'12
Approved	RL	MAY'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 5

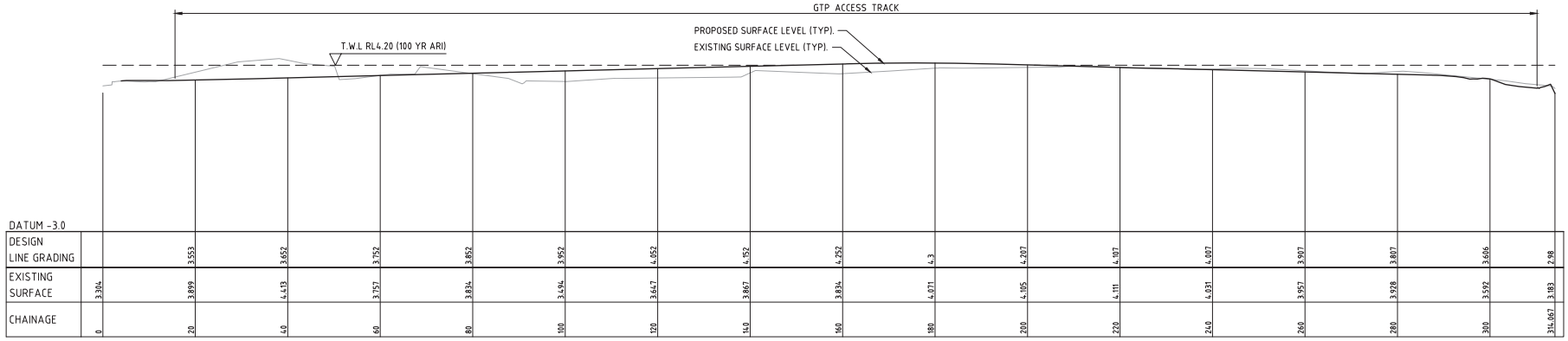
Status			
ISSUED FOR CONSTRUCTION			
Date: MAY'12	Datum: AHD	Scale: AS SHOWN	Size: A1
Drawing Number: 210094-1-124			Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL



SECTION – NS11
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

FOR INFORMATION ONLY - NOT IN SALE CONTRACT



SECTION – WE1
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL

0 2 4 6 8 10m
2 1
SCALE 1:100

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

Cardno Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

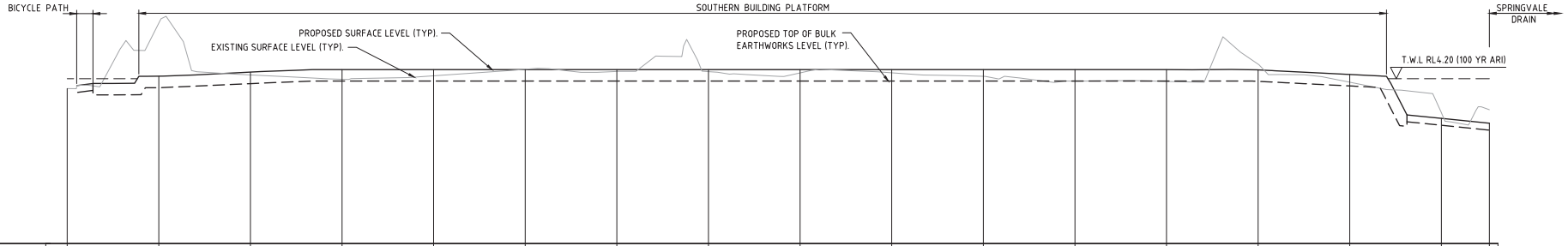
		Date
Drawn	ASD	MAY'12
Checked	RL	MAY'12
Designed	RH	MAY'12
Verified	RL	MAY'12
Approved	RL	MAY'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 6

Status			
ISSUED FOR CONSTRUCTION			
Date: MAY'12	Datum: AHD	Scale: AS SHOWN	Size: A1
Drawing Number: 210094-1-125			Revision: 2

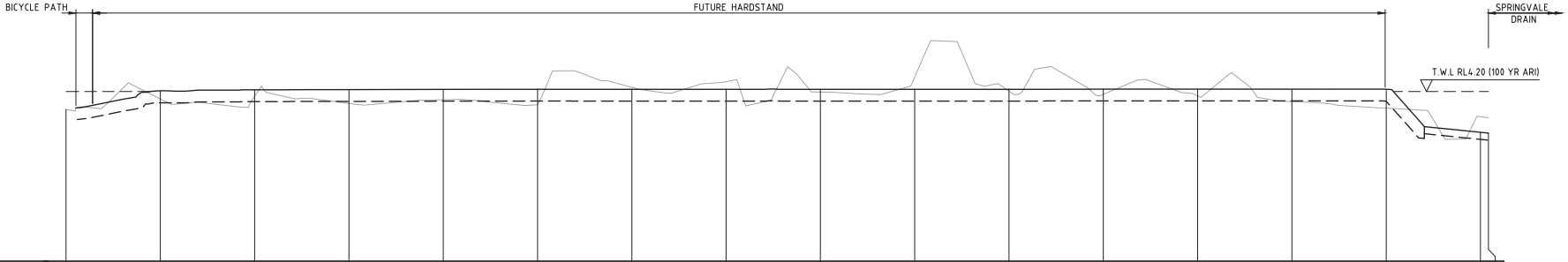
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL



DATUM -3.0

DESIGN LINE GRADING		4.307		4.485		4.598		4.597		4.597		4.597		4.597		4.597		4.597		4.585		4.365		4.468		2.255
EXISTING SURFACE	3.769		6.629		4.367		4.176		4.328		4.612		4.519		4.511		4.455		4.458		4.394		4.096		4.083		4.835		4.046		2.714		2.847
CHAINAGE	0		20		40		60		80		100		120		140		160		180		200		220		240		260		280		300		310.482

SECTION - WE2
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

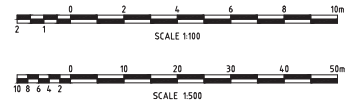


DATUM -3.0

DESIGN LINE GRADING		4.221		4.275		4.284		4.295		4.297		4.296		4.296		4.296		4.296		4.301		4.301		4.301		4.296		2.47		2.436
EXISTING SURFACE	3.439		3.889		4.005		3.697		3.853		3.637		4.379		4.622		4.177		4.812		4.218		4.879		4.017		3.774		3.699		3.134		3.083
CHAINAGE	0		20		40		60		80		100		120		140		160		180		200		220		240		260		280		300		301.677

SECTION - WE3
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
G	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	08.02.13	CAPPING EXTENDED	ASD	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL



Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date	MAY'12
Checked	RL	Date	MAY'12
Designed	RH	Date	MAY'12
Verified	RL	Date	MAY'12
Approved	RL	Date	MAY'12

Client: ORICA

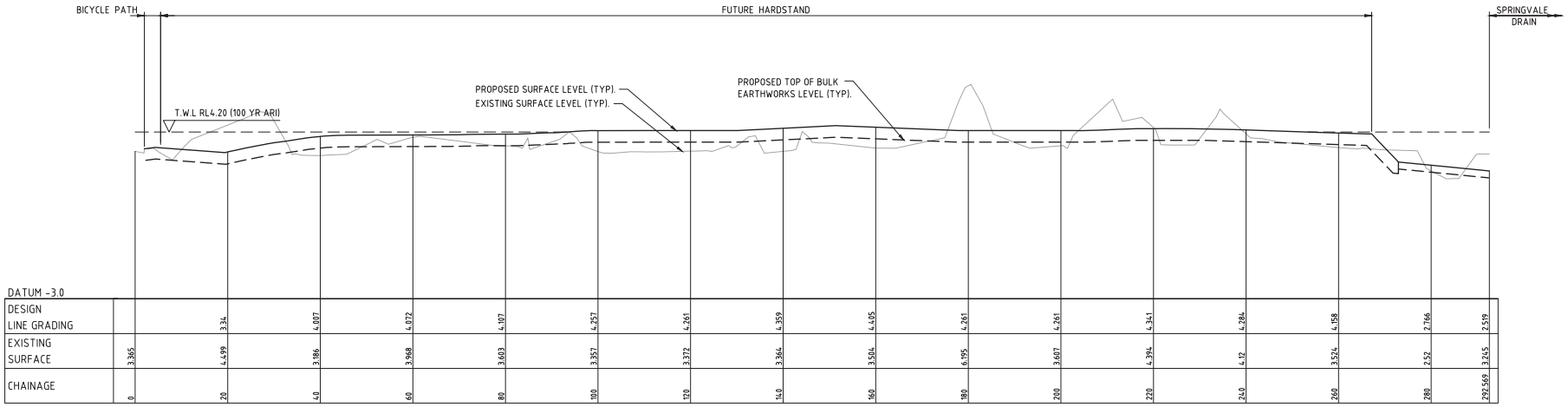
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 7

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	AS SHOWN	A1

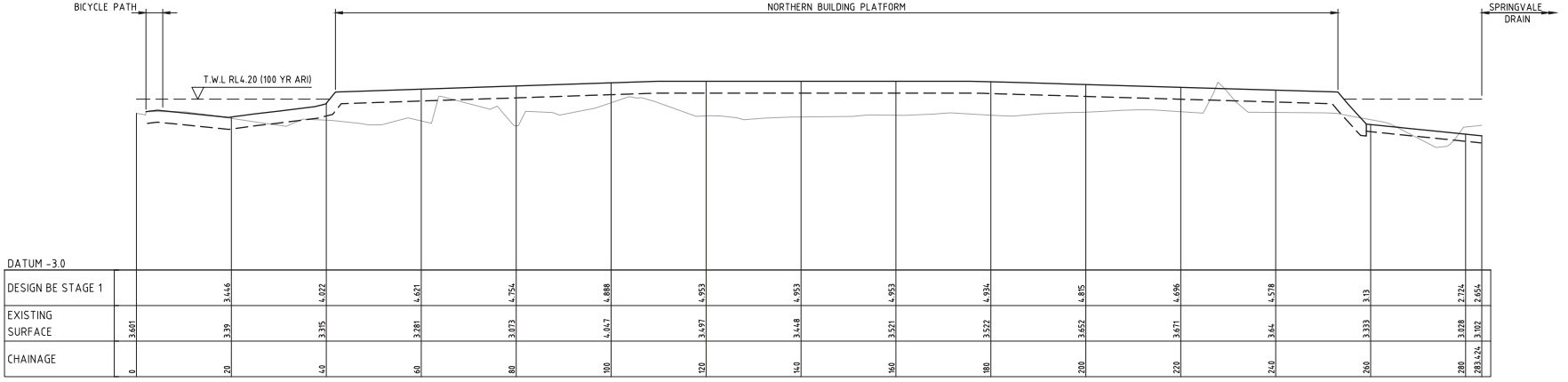
Drawing Number: 210094-1-126
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL



SECTION - WE4

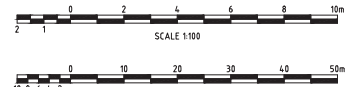
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100



SECTION - WE5

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
G	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	08.02.13	CAPPING EXTENDED	ASD	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL



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Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date MAY'12
Checked	RL	Date MAY'12
Designed	RH	Date MAY'12
Verified	RL	Date MAY'12
Approved	RL	Date MAY'12

Client: ORICA

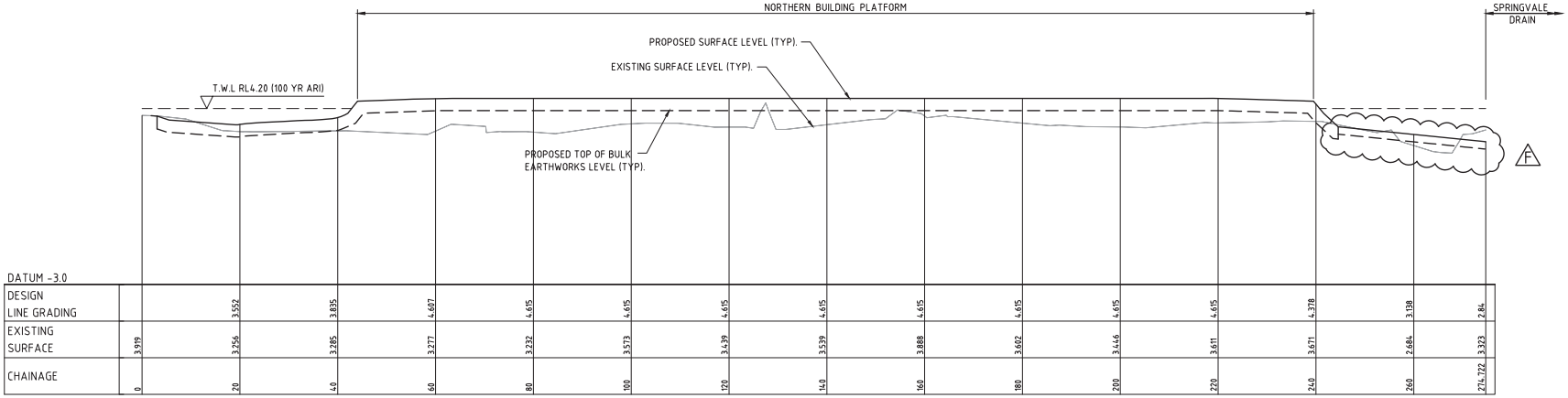
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 8

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	AS SHOWN	A1

Drawing Number: 210094-1-127
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

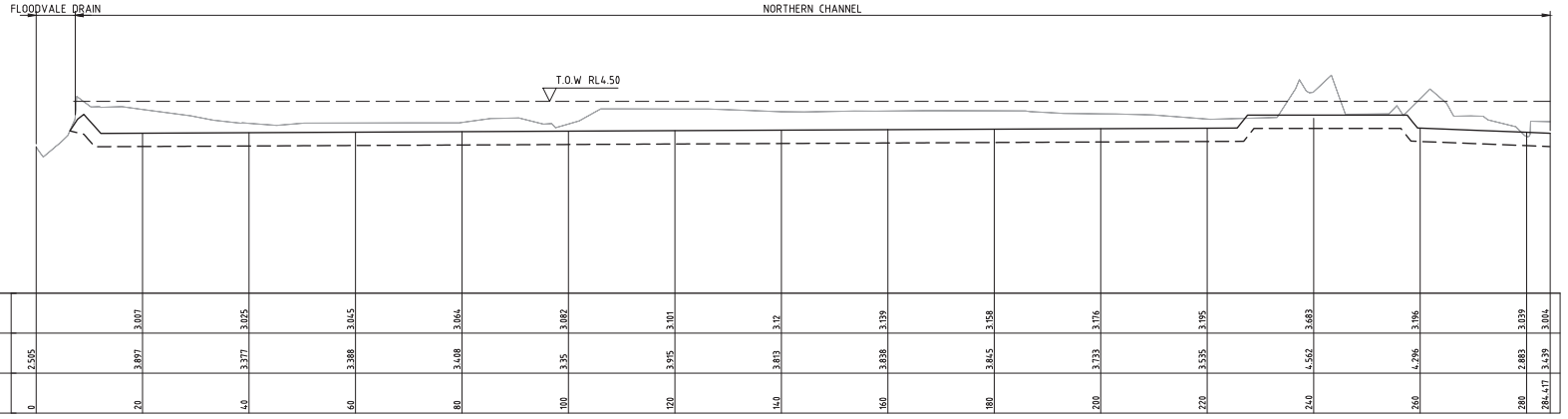


DATUM -3.0

DESIGN LINE GRADING		3.552	3.835	4.607	4.615	4.615	4.615	4.615	4.615	4.615	4.615	4.318	3.138	2.84
EXISTING SURFACE	3.919	3.256	3.285	3.277	3.232	3.573	3.439	3.539	3.888	3.602	3.446	3.611	3.671	2.684	3.323
CHAINAGE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	271.722

SECTION - WE6

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100



DATUM -6.0

DESIGN LINE GRADING		3.007	3.025	3.045	3.064	3.082	3.101	3.12	3.139	3.158	3.176	3.195	3.683	3.196	3.039	3.034
EXISTING SURFACE	2.595	3.897	3.377	3.388	3.408	3.35	3.975	3.813	3.838	3.845	3.733	3.535	4.562	4.296	2.883	3.439
CHAINAGE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	284.417

SECTION - WE7

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
G	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	08.02.13	CAPPING EXTENDED	ASD	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL

0 2 4 6 8 10m
SCALE 1:100

0 10 20 30 40 50m
SCALE 1:500

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date	MAY'12
Checked	RL	Date	MAY'12
Designed	RH	Date	MAY'12
Verified	RL	Date	MAY'12
Approved	RL	Date	MAY'12

Client: ORICA

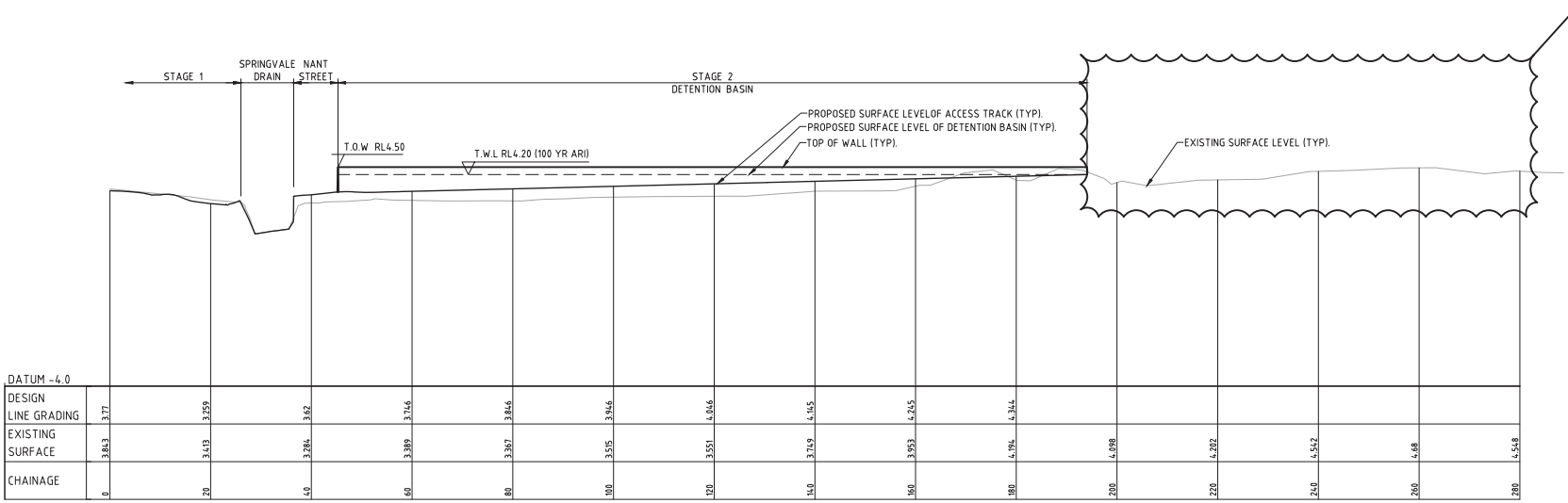
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 9

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	AS SHOWN	A1

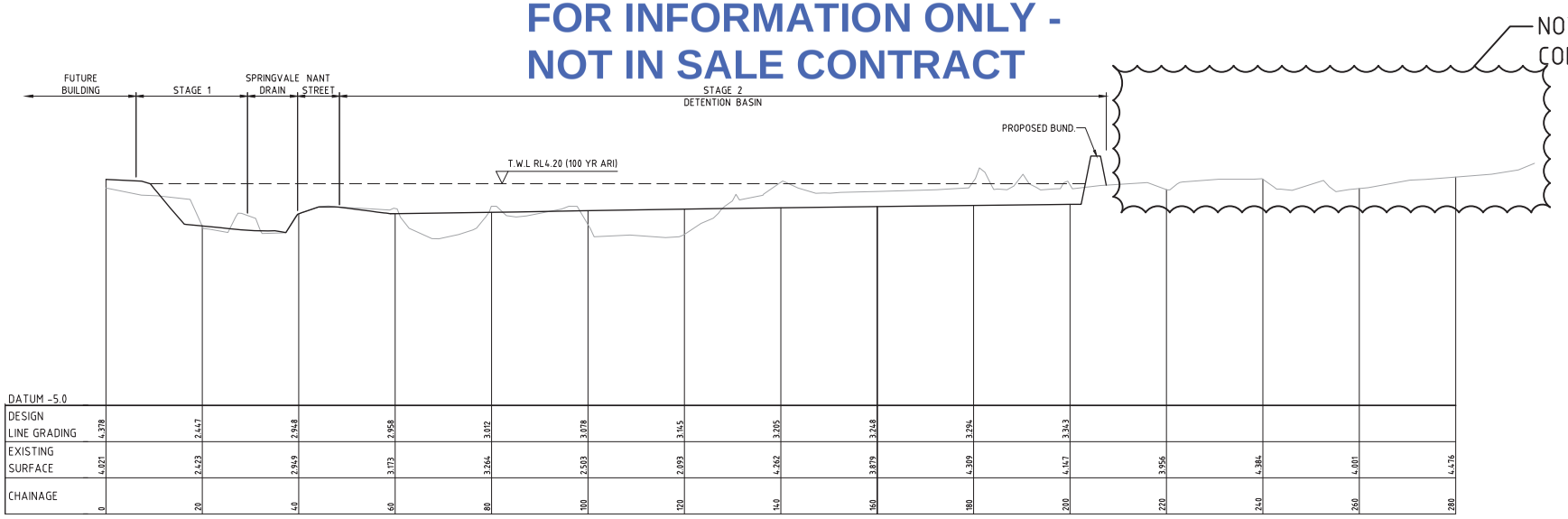
Drawing Number: 210094-1-128
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL



SECTION - WE8
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

FOR INFORMATION ONLY - NOT IN SALE CONTRACT



SECTION - WE9
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL

SCALE 1:100

SCALE 1:500

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ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date MAY'12
Checked	RL	Date MAY'12
Designed	RH	Date MAY'12
Verified	RL	Date MAY'12
Approved	RL	Date MAY'12

Client: ORICA

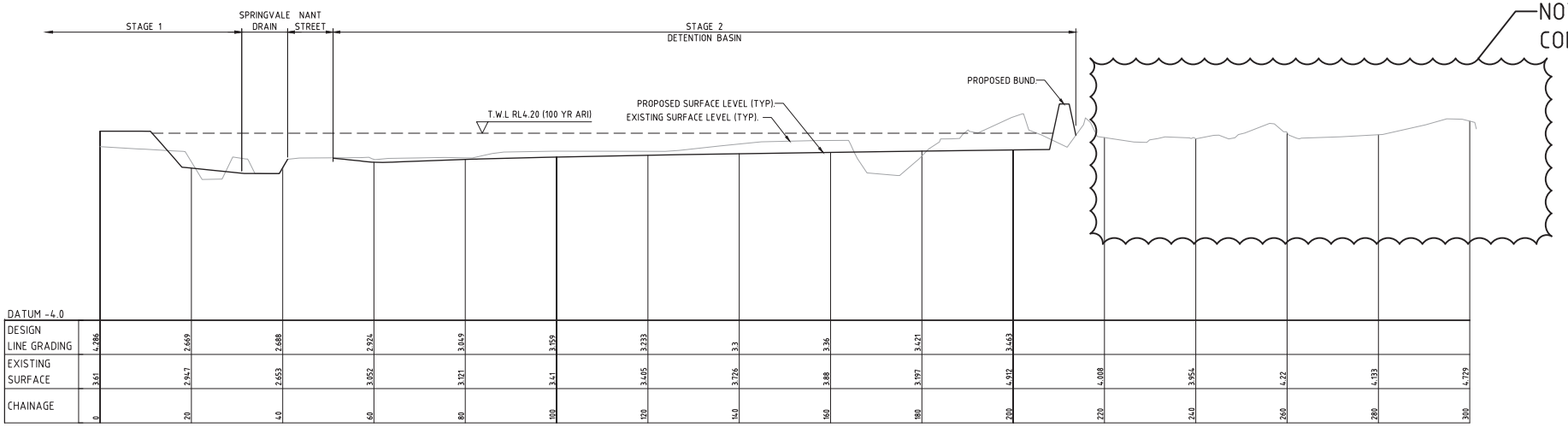
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 10

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	AS SHOWN	A1

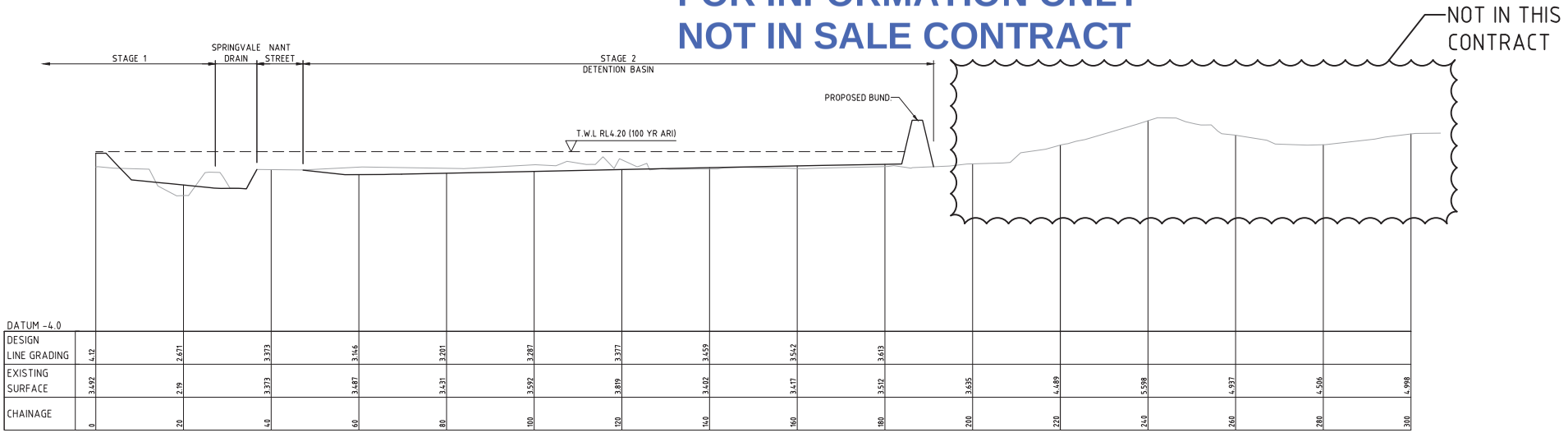
Drawing Number: 210094-1-129
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL



SECTION - WE10
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

FOR INFORMATION ONLY - NOT IN SALE CONTRACT



SECTION - WE11
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL

0 2 4 6 8 10m
2 1
SCALE 1:100

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

Cardno Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date MAY'12
Checked	RL	Date MAY'12
Designed	RH	Date MAY'12
Verified	RL	Date MAY'12
Approved	RL	Date MAY'12

Client: ORICA

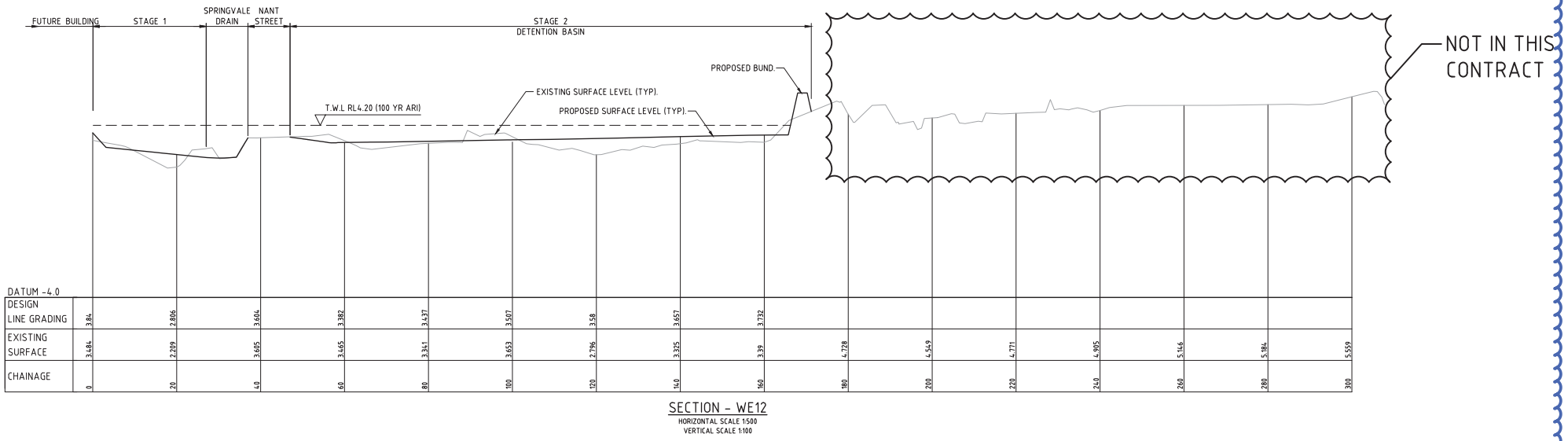
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 11

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	AS SHOWN	A1

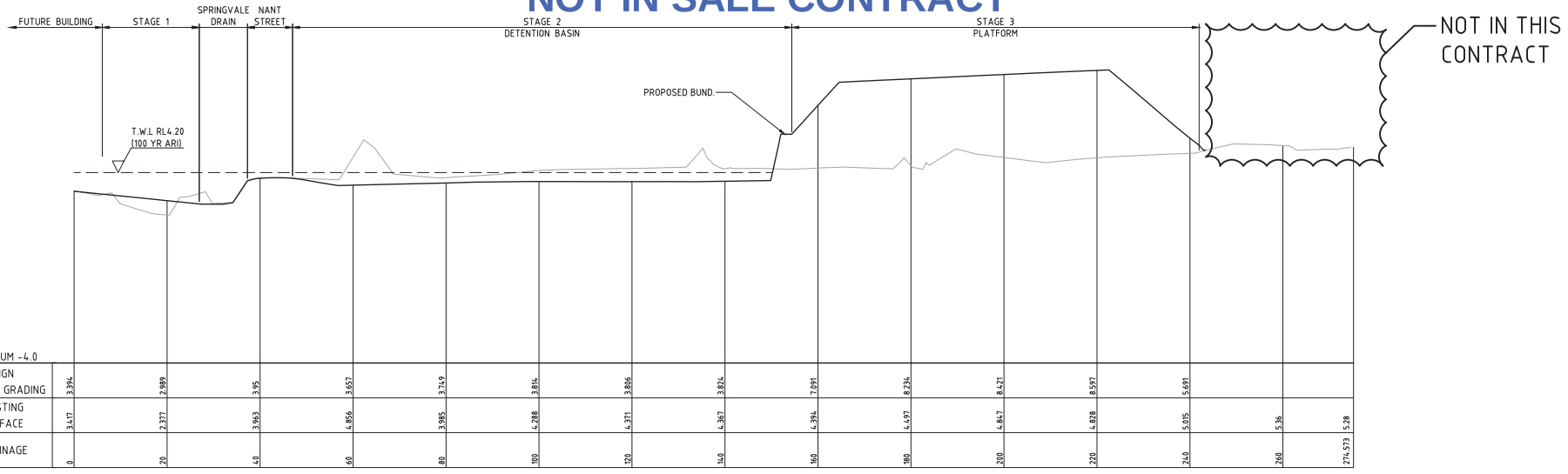
Drawing Number: 210094-1-130
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL



SECTION - WE12
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

FOR INFORMATION ONLY - NOT IN SALE CONTRACT



SECTION - WE13
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL

0 2 4 6 8 10m
2 1
SCALE 1:100

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

Cardno Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date MAY'12
Checked	RL	Date MAY'12
Designed	RH	Date MAY'12
Verified	RL	Date MAY'12
Approved	RL	Date MAY'12

Client: ORICA

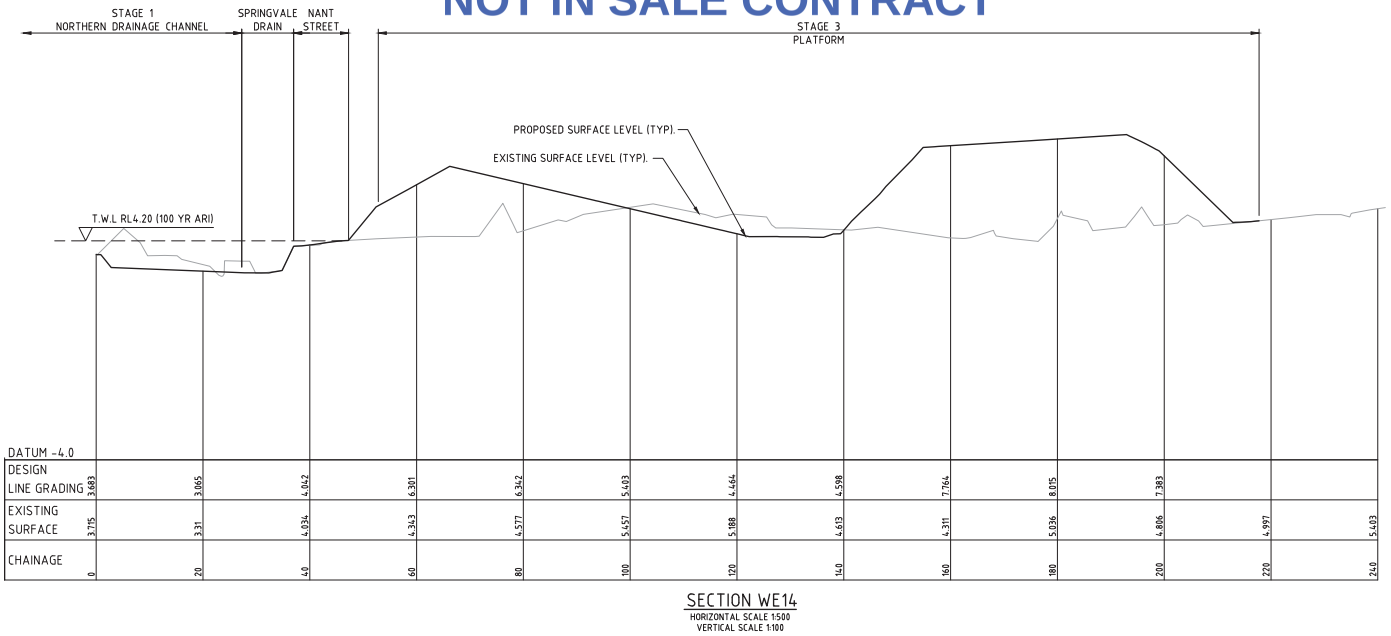
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 12

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	AS SHOWN	A1

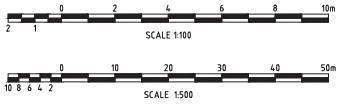
Drawing Number: 210094-1-131
Revision: 2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL



SECTION WE14
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
G	16.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	21.01.13	ISSUED FOR REPRICING	DJB	RL
D	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RL
C	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
B	07.08.12	REVISED PRELIMINARY ISSUE	SJP	RL
A	17.05.12	PRELIMINARY ISSUE	ASD	RL



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Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	ASD	Date	MAY'12
Checked	RL	Date	MAY'12
Designed	RH	Date	MAY'12
Verified	RL	Date	MAY'12
Approved	RL	Date	MAY'12

Client ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BULK EARTHWORKS SITE CROSS SECTIONS - SHEET 13

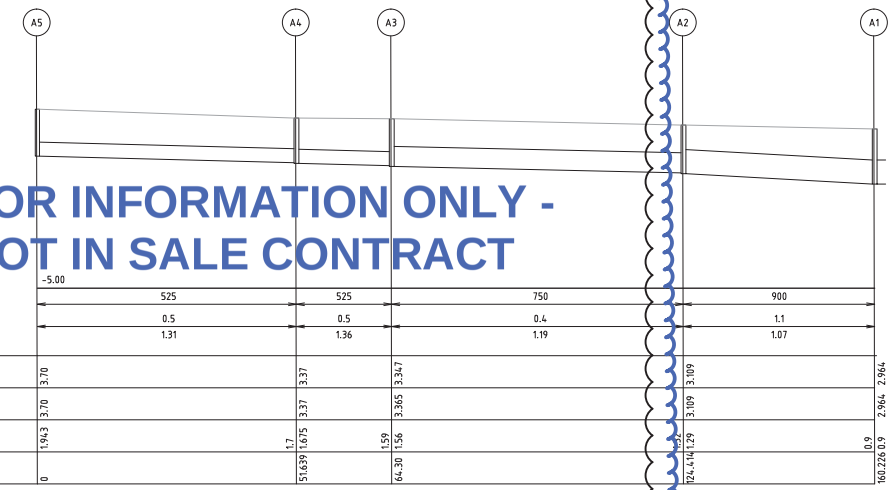
Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
MAY'12	AHD	AS SHOWN	A1

Drawing Number: 210094-1-132
Revision: 2

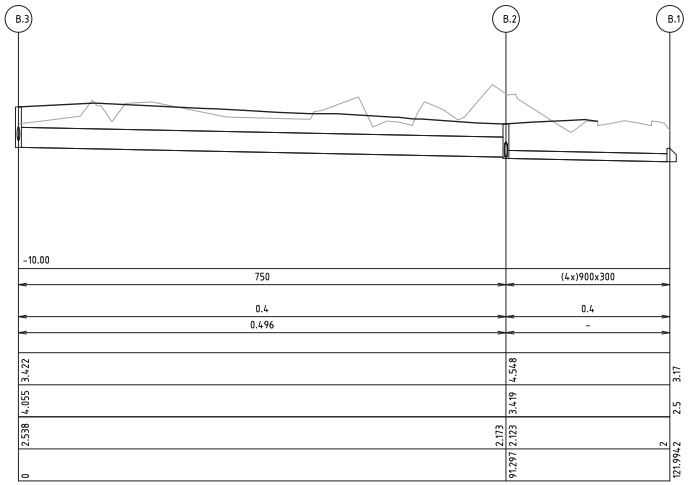
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

NOT IN THIS CONTRACT



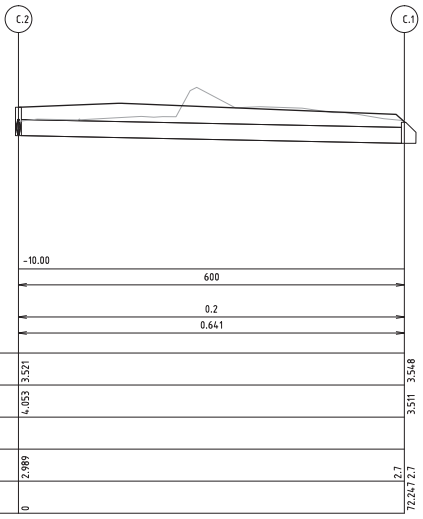
DATUM (m)	-5.00			
PIPE SIZE (mm)	525	525	750	900
PIPE GRADE (%)	0.5	0.5	0.4	1.1
PIPE COVER MINIMUM	1.31	1.36	1.19	1.07
EXISTING SURFACE LEVEL	3.70	3.37	3.347	3.109 2.964
PROPOSED SURFACE LEVEL	3.70	3.37	3.365	3.109 2.964
INVERT LEVEL	1.943	1.675 1.7	1.56 1.59	1.29 0.9
PIPE CHAINAGE	0	51.639	64.30	124.414 160.226 0.9

LINE A
SCALE 1:500 (H)
1:100 (V)



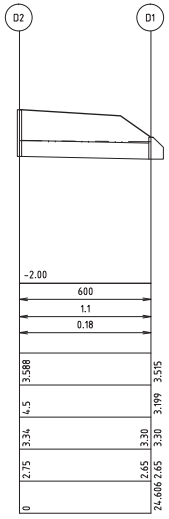
-10.00			
750		(4x)900x300	
0.4		0.4	
0.496		-	
3.422		4.548	3.17
4.055		3.419	2.5
2.538		2.173	2
0		91.297	2.123 121.994 2

LINE B
SCALE 1:500 (H)
1:100 (V)



DATUM (m)	-10.00	
PIPE SIZE (mm)	600	
PIPE ROUGHNESS		
PIPE GRADE (%)	0.2	
PIPE COVER MINIMUM	0.641	
FULL PIPE VELOCITY (m/s)		
PEAK FLOW (L/s)		
EXISTING SURFACE LEVEL	3.521	3.548
PROPOSED SURFACE LEVEL	4.053	3.511
HYDRAULIC GRADE LINE (20 YEAR ARI)		
INVERT LEVEL	2.989	2.7 2.7
PIPE CHAINAGE	0	72.247

LINE C
SCALE 1:500 (H)
1:100 (V)



-2.00		
600		
1.1		
0.18		
3.588		3.515
4.5		3.199
3.34		3.30 3.30
2.75		2.65 2.65
0		24.606

LINE D
SCALE 1:500 (H)
1:100 (V)

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
E	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
D	21.01.13	ISSUED FOR REPRICING	DJB	RL
C	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
B	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
A	07.08.12	PRELIMINARY ISSUE	SJP	RL

SCALE 1:100

SCALE 1:500

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

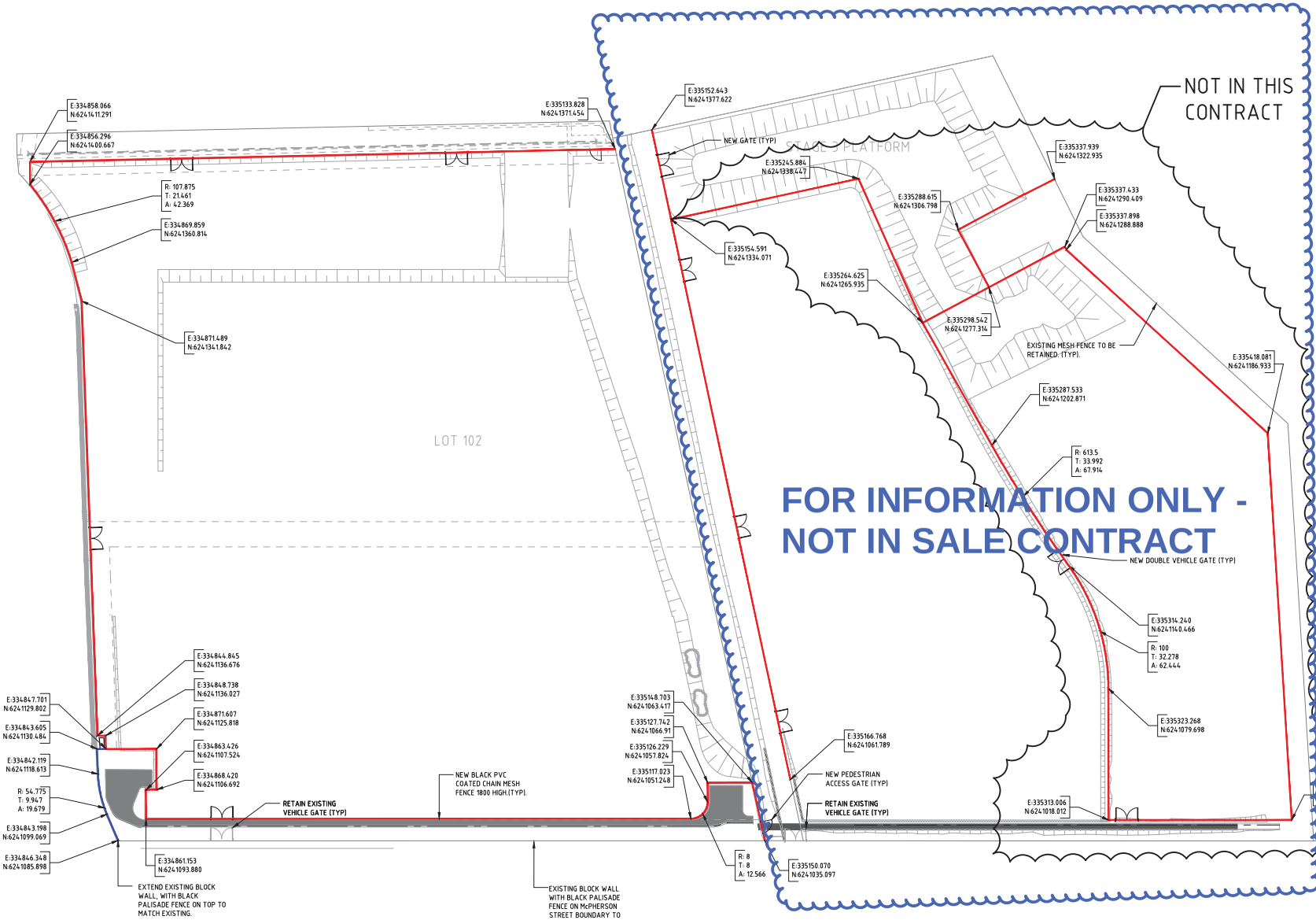
Drawn	SJP	Date	JUL'12
Checked	RL	Date	JUL'12
Designed	RH	Date	JUL'12
Verified	RL	Date	JUL'12
Approved	RL	Date	JUL'12

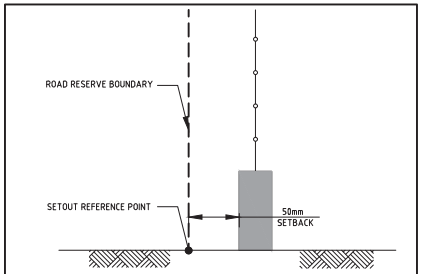
Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
STORMWATER DRAINAGE LONGITUDINAL SECTIONS

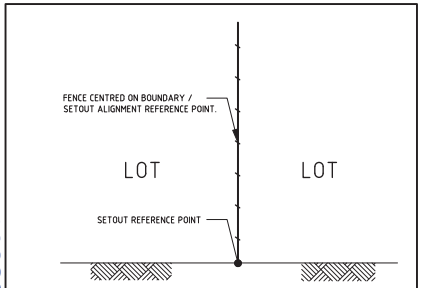
Status	ISSUED FOR CONSTRUCTION		
Date	JUL'12	Datum	AHD
Scale	AS SHOWN	Size	A1
Drawing Number	210094-1-140	Revision	2

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL





FENCES AT ROAD RESERVE BOUNDARIES
NTS



INTERNAL FENCES
NTS

NOTE:
REFER TO LANDSCAPE ARCHITECTS DRAWINGS FOR FENCING DETAILS.

NOTE:
SETOUT REFERENCES BOUNDARY LINES. ALL FENCES ALONG COAL PIER ROAD AND NANT STREET ROAD RESERVE BOUNDARIES SHALL BE SETBACK 50mm FROM FACE OF WALL TO BOUNDARY. ALL INTERNAL FENCES TO BE CENTRED ON THE SETOUT LINES.

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
A	03.12.13	ISSUED FOR REVIEW	NVH	RL

0 20 40 60 80 100m
20 15 10 5
SCALE 1:1000

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ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
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Drawn	NVH	Date DEC'13
Checked	RL	Date DEC'13
Designed	XX	Date DEC'13
Verified	XX	Date DEC'13
Approved	RL	Date DEC'13

Client ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
FENCING SETOUT

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
DEC'13	AHD	AS SHOWN	A1

Drawing Number: 210094-1-150
Revision: 2

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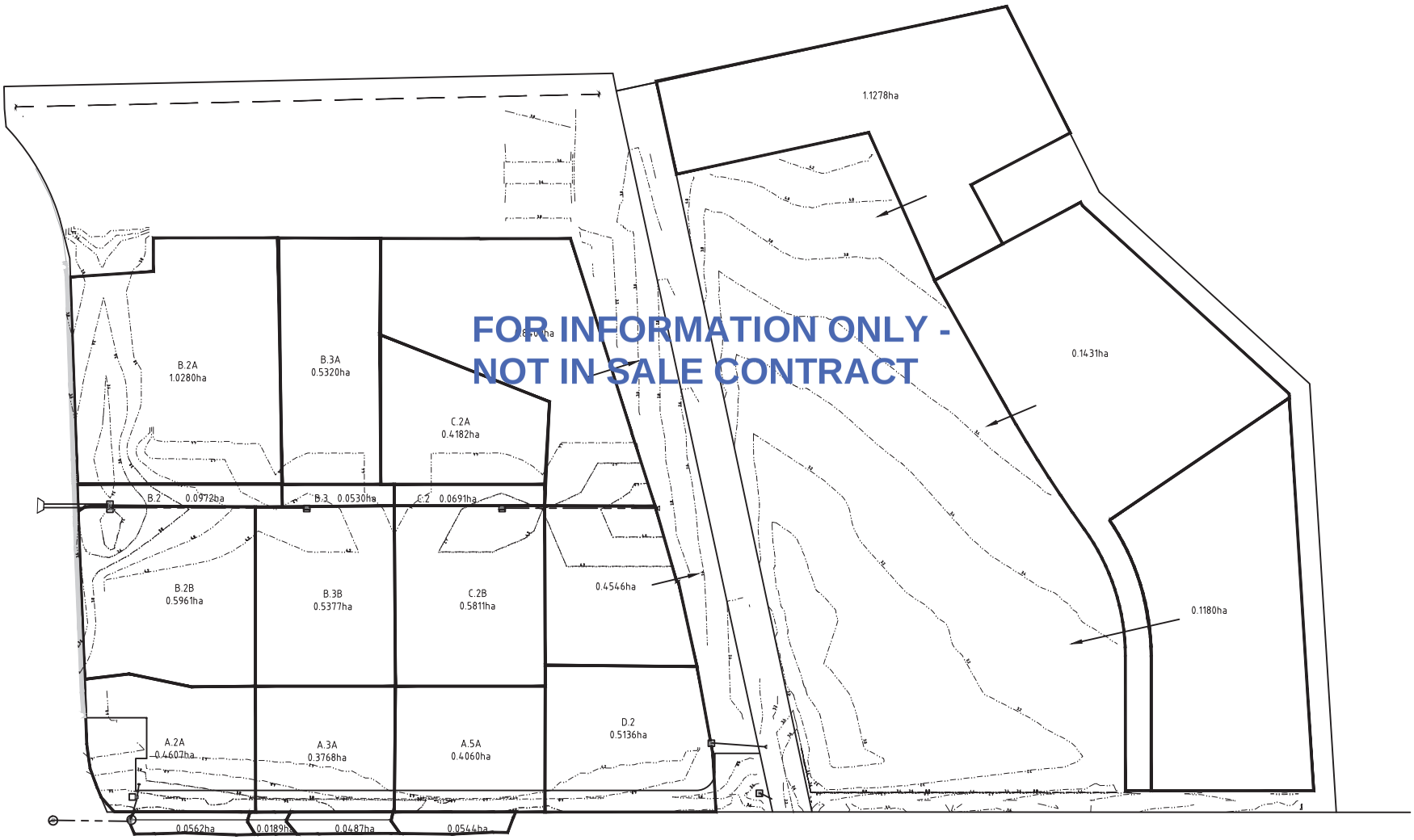

NOT IN THIS CONTRACT

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	26.06.13	BOUNDARIES AMENDED	NVH	RL
D	21.01.13	ISSUED FOR REPRICING	DJB	RL
C	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
B	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
A	27.08.12	PRELIMINARY ISSUE	SJP	RL

0 20 40 60 80 100m
20 15 10 5
SCALE 1:1000

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Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	SJP	Date AUG'12
Checked	RL	Date AUG'12
Designed	RH	Date AUG'12
Verified	RL	Date AUG'12
Approved	RL	Date AUG'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
STORMWATER CATCHMENT PLAN

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
AUG'12	AHD	1:1000	A1

Drawing Number: 210094-1-200
Revision: 2

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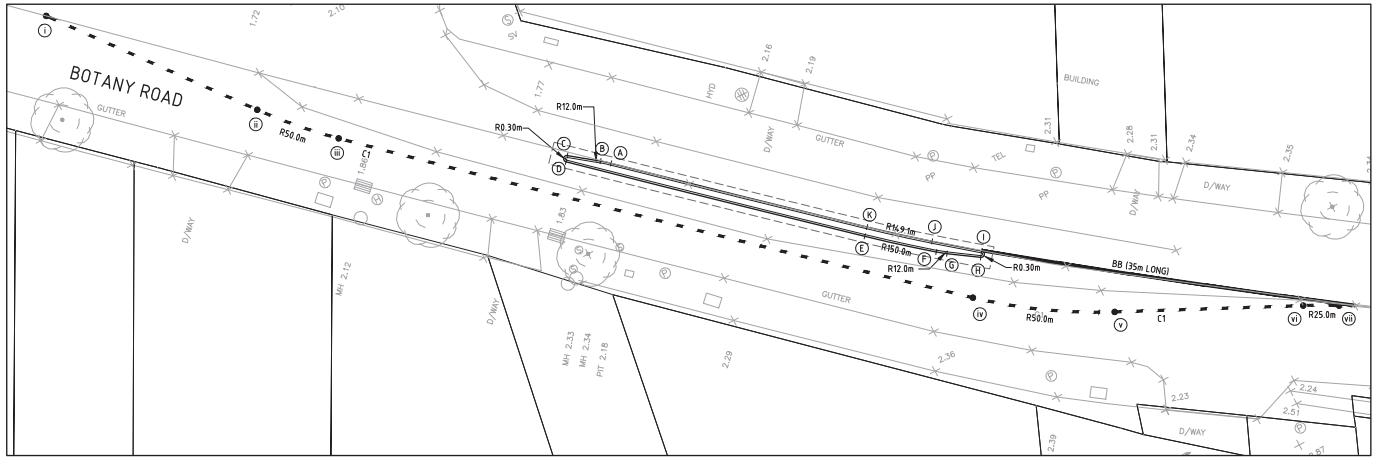
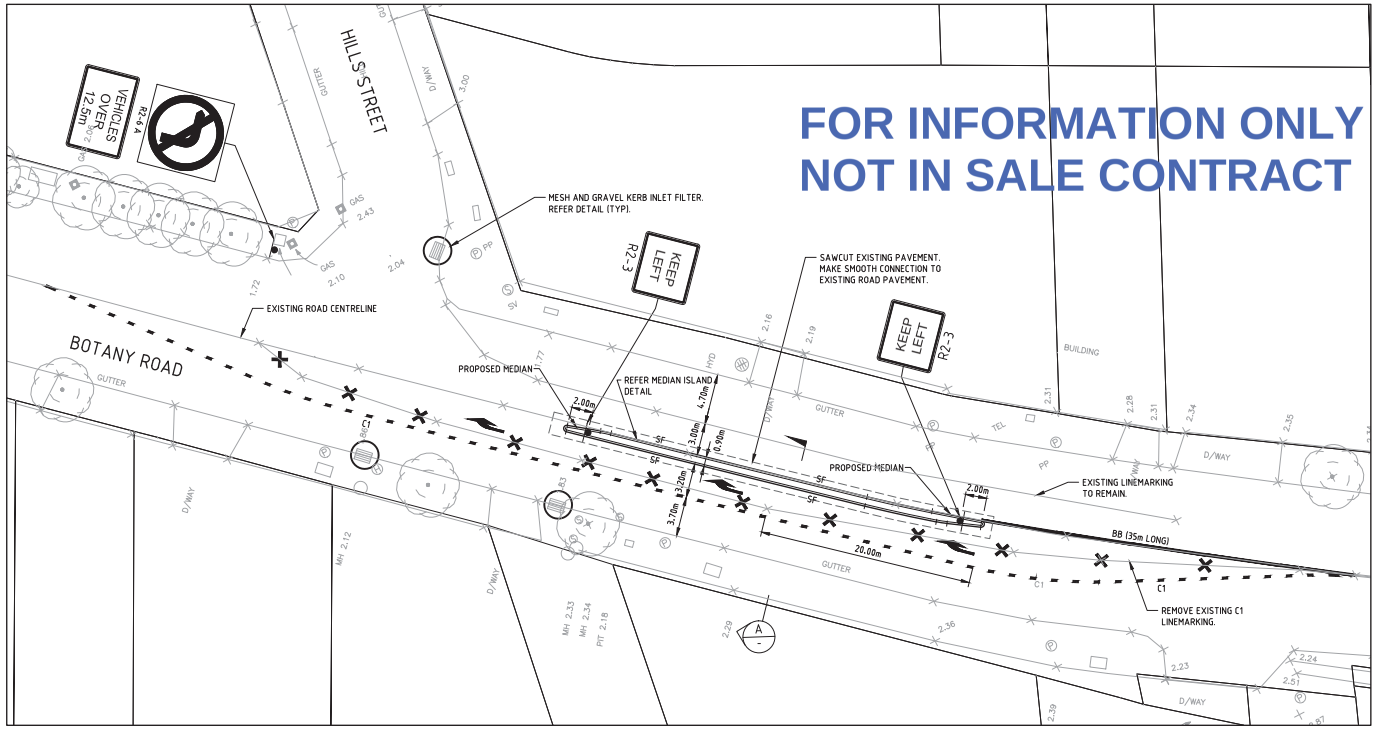


SETOUT PLAN

POINT	EASTING	NORTHING
A	334429.2044	6240985.3452
B	334428.4272	6240985.9935
C	334425.9220	6240987.8989
D	334425.5378	6240987.4376
E	334447.0366	6240968.2339
F	334452.2746	6240963.8115
G	334453.0875	6240963.2111
H	334455.7241	6240961.4301
I	334456.0786	6240961.9136
J	334452.3921	6240964.8741
K	334447.6327	6240968.9082
i	334388.8470	6241022.2028
ii	334402.2325	6241005.2216
iii	334407.7299	6240999.3018
iv	334453.3184	6240958.4371
v	334464.4382	6240951.0726
vi	334480.3311	6240943.3718
vii	334483.2995	6240941.8005

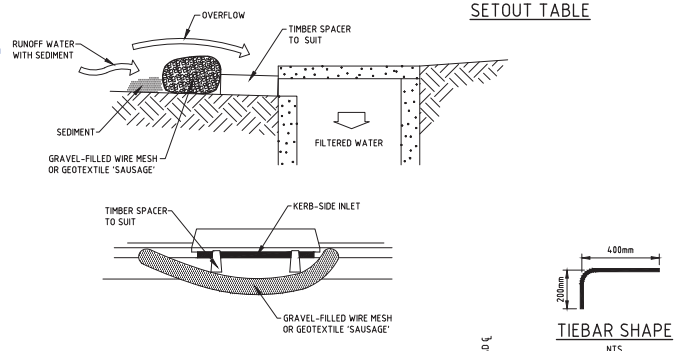
SETOUT TABLE

NOTE:
IF NO CONCRETE PAVEMENT EXISTS BENEATH THE PROPOSED MEDIAN THE CONTRACTOR SHALL SEEK INSTRUCTION FROM THE SUPERINTENDENT



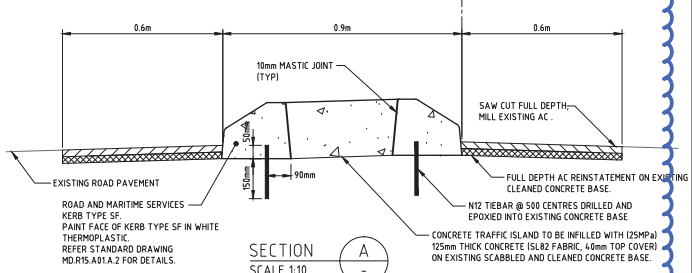
FOR INFORMATION ONLY - NOT IN SALE CONTRACT

ROADWORKS PLAN
SCALE 1:250



MESH AND GRAVEL INLET FILTER
N.T.S.

TIEBAR SHAPE
NTS



SECTION A
SCALE 1:10

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
I	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
H	24.01.13	ISSUED FOR REPRICING	DJB	RL
G	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
F	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
E	19.07.12	RE-ISSUE FOR RMS APPROVAL	AD	RL
D	28.06.12	RE-ISSUE FOR RMS APPROVAL	RT	RL
C	25.02.12	RE-ISSUE FOR RMS APPROVAL	AG	RL

0 5 10 15 20 25m
5 4 3 2 1
SCALE 1:250

0 200 400 600 800 1000mm
SCALE 1:10

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Shaping the Future
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Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	AG	Date DEC'11
Checked	AG	Date DEC'11
Designed	RL	Date DEC'11
Verified	RL	Date DEC'11
Approved	RL	Date DEC'11

Client: ORICA
SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BOTANY ROAD ROADWORKS PLAN

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
NOV'11	AHD	AS SHOWN	A1

Drawing Number: 210094-1-300
Revision: 2

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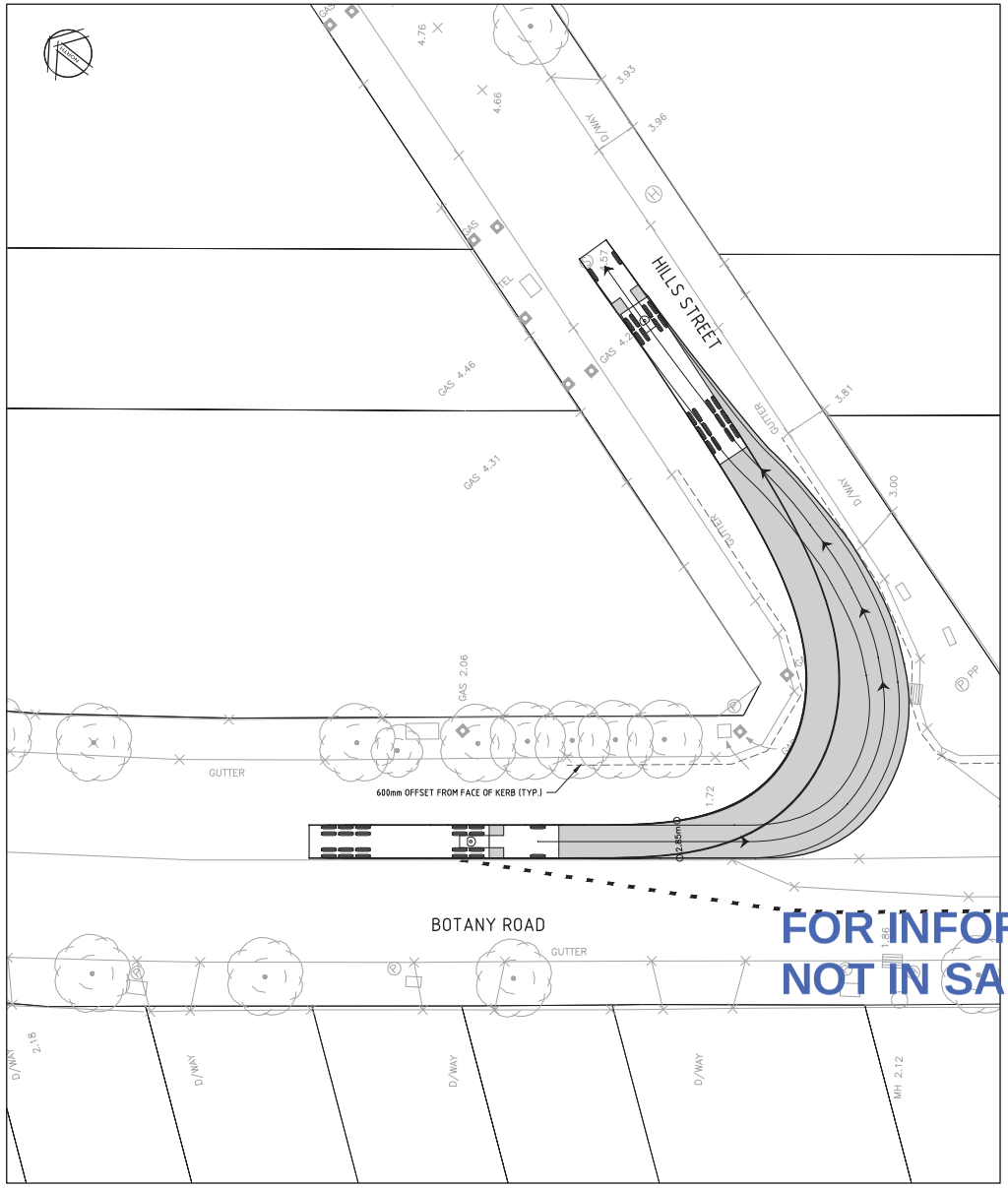
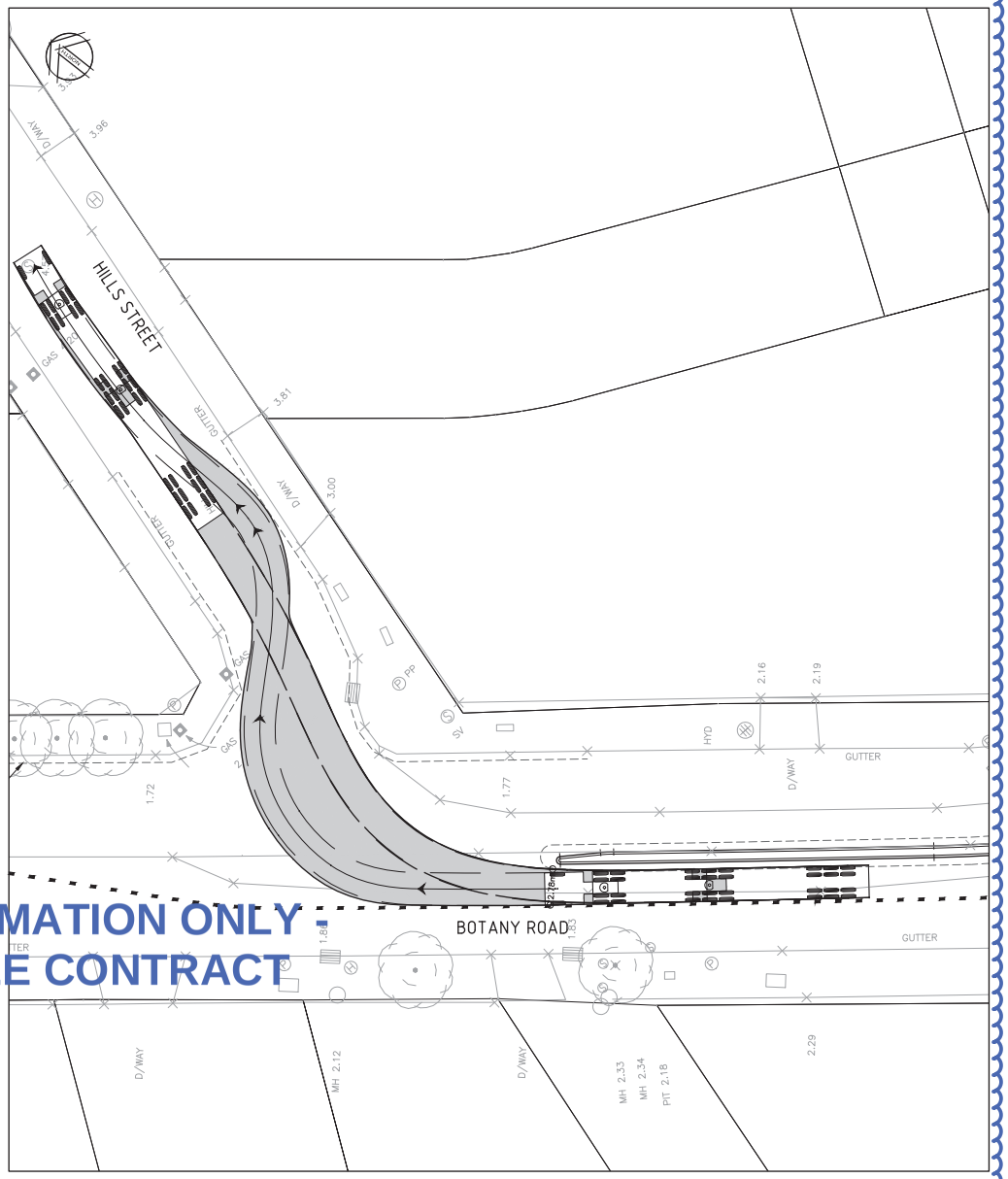


BOTANY ROAD & HILLS STREET INTERSECTION
AUSTROADS 19.0m SEMI-TRAILER LEFT TURN SWEPT PATH

SCALE 1:200



BOTANY ROAD & HILLS STREET INTERSECTION
AUSTROADS 19.0m SEMI-TRAILER RIGHT TURN SWEPT PATH

SCALE 1:200

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
E	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
D	21.01.13	ISSUED FOR REPRICING	DJB	RL
C	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
B	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
A	02.03.12	PRELIMINARY ISSUE	BC	RL

0 4 8 12 16 20m
4 3 2 1
SCALE 1:200

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Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
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		Date
Drawn	BC	FEB'12
Checked	RH	FEB'12
Designed	RH	FEB'12
Verified	RL	FEB'12
Approved	RL	FEB'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
BOTANY ROAD TURNING PATHS

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
FEB'12	AHD	AS SHOWN	A1

Drawing Number: 210094-1-301
Revision: 2

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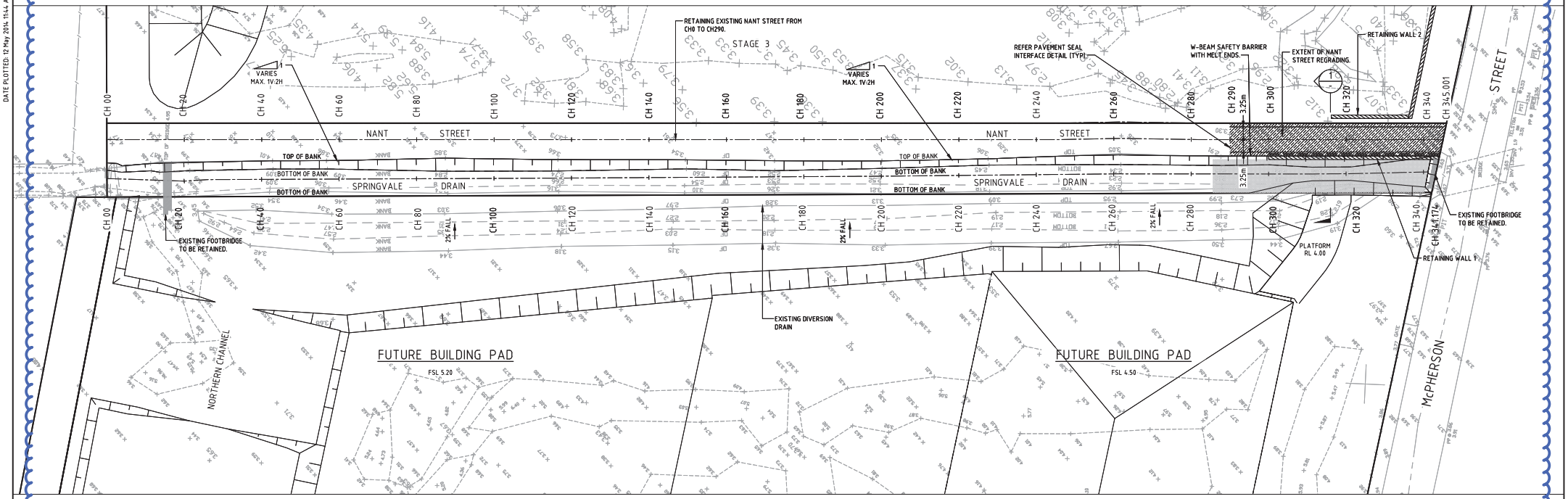
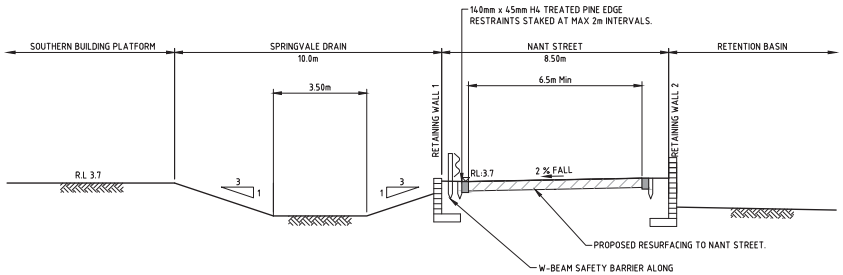
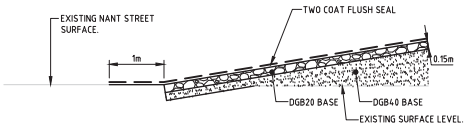


PLAN
SCALE 1:500

FOR INFORMATION ONLY - NOT IN SALE CONTRACT



SPRINGVALE DRAIN WEIR
SECTION 1 / SCALE 1:100



PAVEMENT SEAL INTERFACE
SECTION 1 / SCALE 1:50

PAVEMENT LEGEND

TWO COAT 7/14 FLUSH SEAL ON 150mm DGB20 BASE ON 150mm NOMINAL DGS40 SUBBASE OR EQUIVALENT RECYCLED MATERIAL TO SUPERINTENDENTS APPROVAL (REFER SITEWORKS NOTES ON DRAWING 210094-1-001) .

NOTE:
ASSUMED DESIGN TRAFFIC = 3 x 10^5 ESA
ASSUMED SUBGRADE CBR = 6%

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
G	16.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	17.07.13	ISSUED FOR APPROVAL	RT	RL
D	21.01.13	ISSUED FOR REPRICING	DJB	RL
C	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
B	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
A	02.03.12	PRELIMINARY ISSUE	BC	RL

SCALE 1:100
SCALE 1:500

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Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	BC	Date FEB'12
Checked	RH	Date FEB'12
Designed	RH	Date FEB'12
Verified	RL	Date FEB'12
Approved	RL	Date FEB'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
NANT STREET AND SPRINGVALE DRAIN - SITEWORKS

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
FEB'12	AHD	AS SHOWN	A1

Drawing Number: 210094-1-310
Revision: 2

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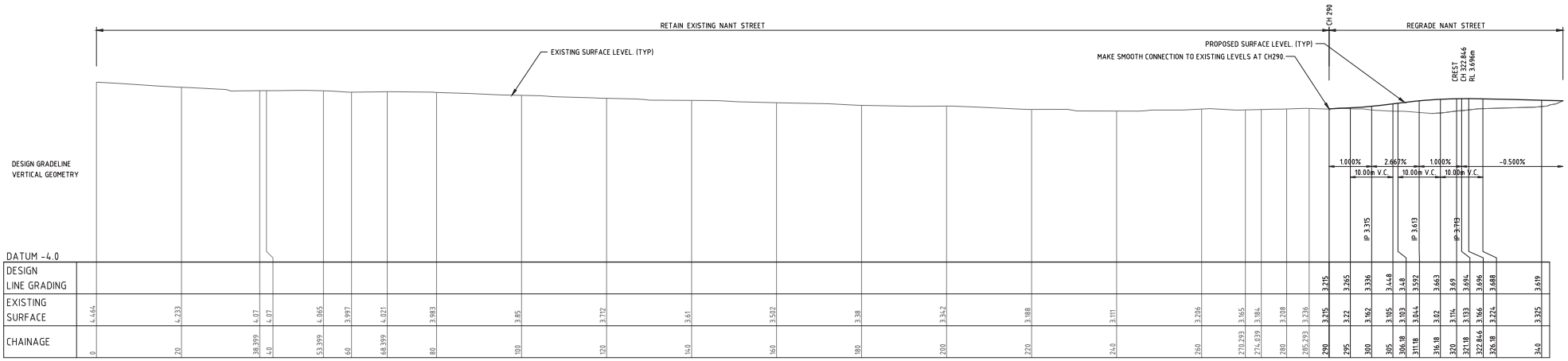
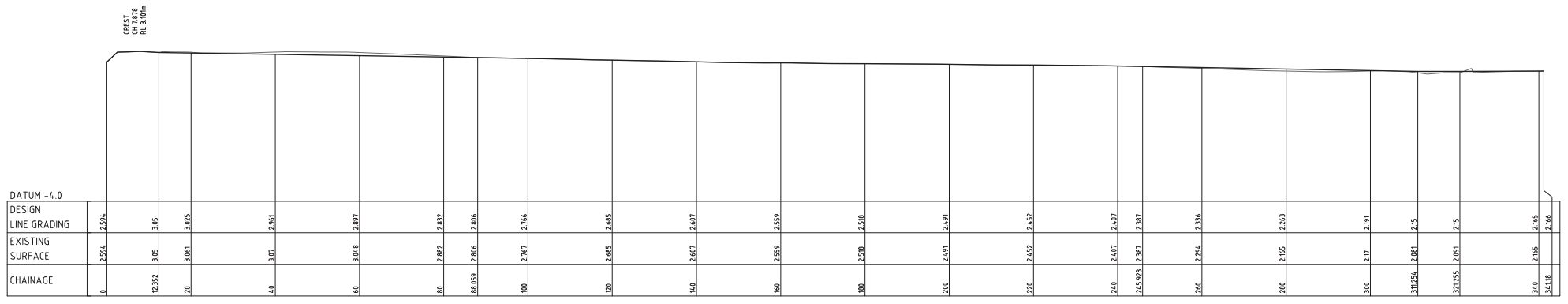


LONGITUDINAL SECTION - NANT STREET

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

FOR INFORMATION ONLY - NOT IN SALE CONTRACT



LONGITUDINAL SECTION - SPRINGVALE DRAIN

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

Rev	Date	Description	Drawn	Appr.
2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
F	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
E	17.07.13	ISSUED FOR APPROVAL	RT	RL
D	21.01.13	ISSUED FOR REPRICING	DJB	RL
C	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
B	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
A	02.03.12	PRELIMINARY ISSUE	BC	RL

SCALE 1:100

SCALE 1:500

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Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
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Drawn	BC	Date FEB'12
Checked	RH	Date FEB'12
Designed	RH	Date FEB'12
Verified	RL	Date FEB'12
Approved	RL	Date FEB'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
LONGITUDINAL SECTIONS - NANT STREET & SPRINGVALE DRAIN

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
FEB'12	AHD	AS SHOWN	A1

Drawing Number: 210094-1-320
Revision: 2

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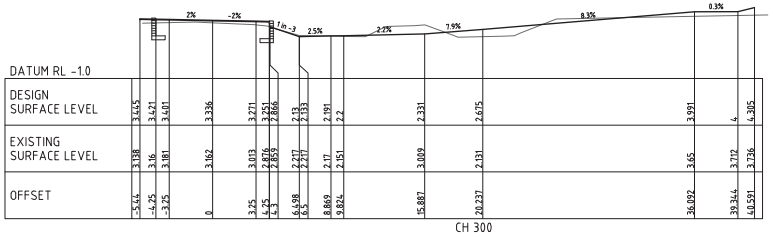
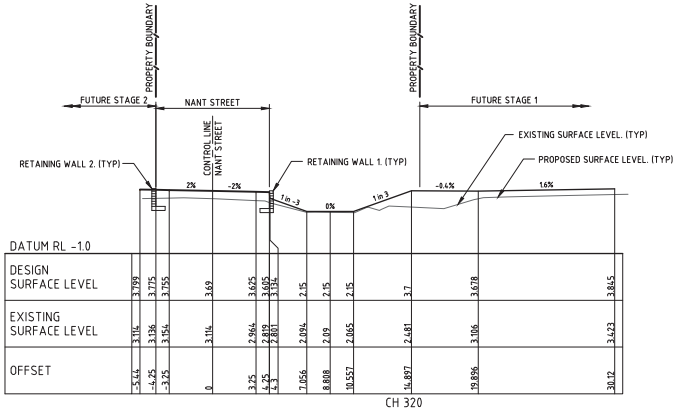
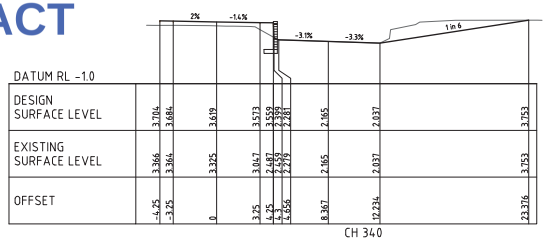




FOR INFORMATION ONLY - NOT IN SALE CONTRACT



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2	12.05.14	REISSUED FOR CONSTRUCTION	RT	RL
1	16.04.14	ISSUED FOR CONSTRUCTION	DB	RL
G	02.10.13	REISSUED FOR CONSTRUCTION CERTIFICATE	RT	RL
F	17.07.13	ISSUED FOR APPROVAL	RT	RL
E	21.02.13	BATTER SLOPE AMENDED	ASD	RL
D	21.01.13	ISSUED FOR REPRICING	DJB	RL
C	25.10.12	ISSUED FOR TENDER/CONSTRUCTION CERTIFICATE	MDH	RH
B	29.08.12	ISSUED FOR CONSTRUCTION CERTIFICATE	MDH	RL
A	02.03.12	PRELIMINARY ISSUE	BC	RL

SCALE 1:100

SCALE 1:200

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Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

Drawn	BC	Date	FEB'12
Checked	RH	Date	FEB'12
Designed	RH	Date	FEB'12
Verified	RL	Date	FEB'12
Approved	RL	Date	FEB'12

Client: ORICA

SOUTHLANDS
INDUSTRIAL ESTATE
CIVIL WORKS PACKAGE
CROSS SECTIONS - NANT STREET

Status: ISSUED FOR CONSTRUCTION

Date	Datum	Scale	Size
FEB'12	AHD	AS SHOWN	A1

Drawing Number: 210094-1-332
Revision: 2

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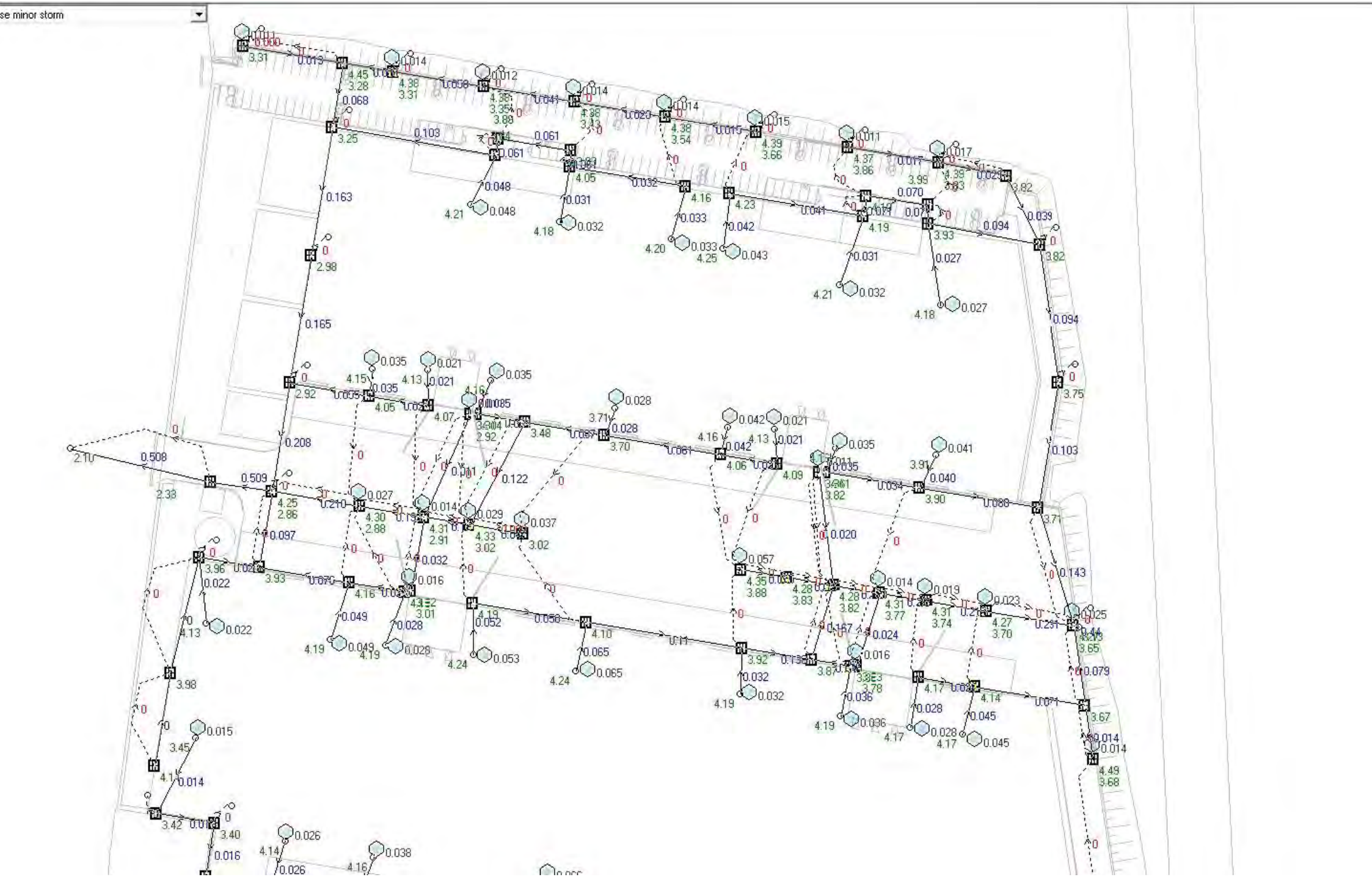
Appendix C

DRAINs Model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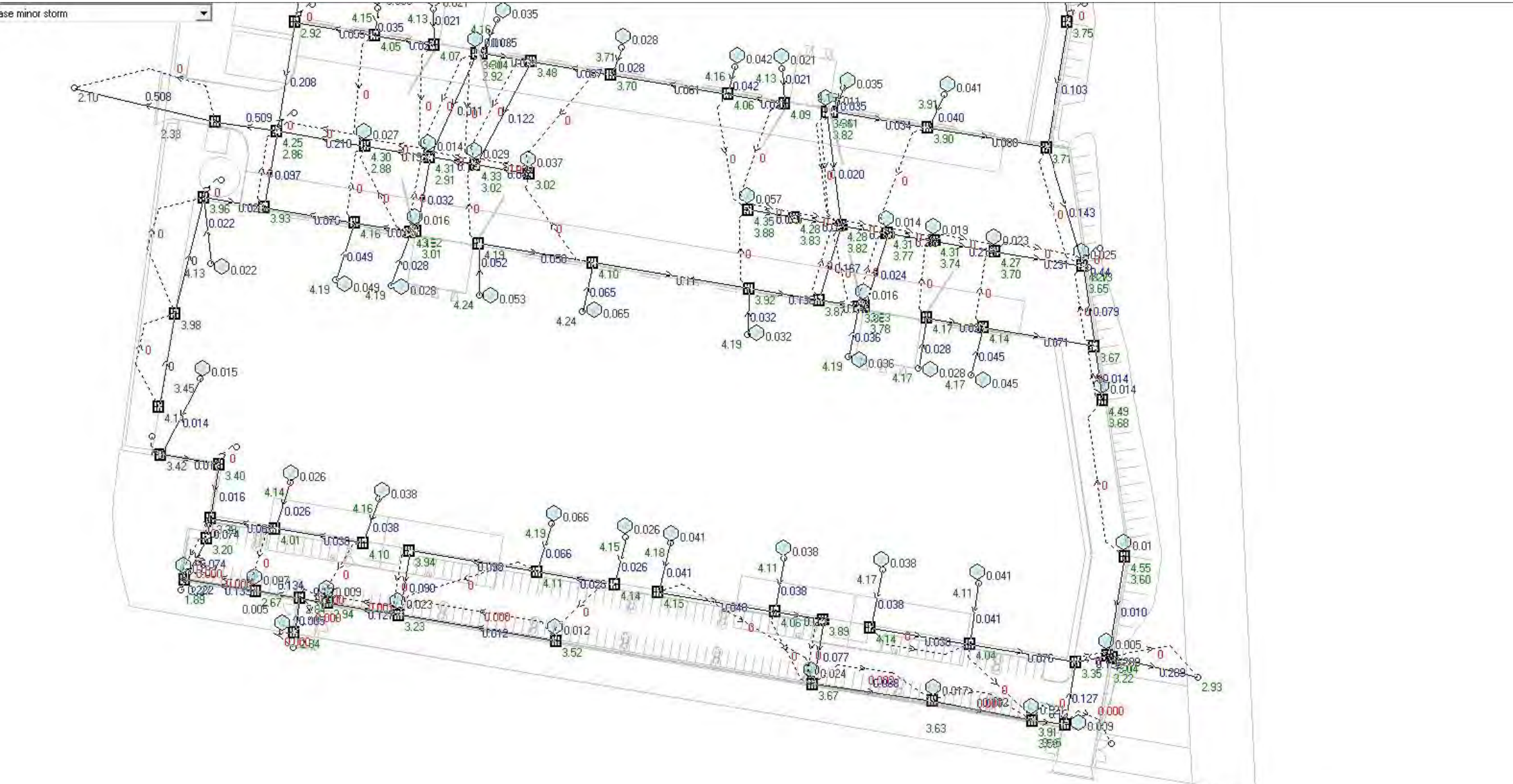
ase minor storm

Appendix D

Historical Site Flood Reports

ORICA Southlands Remediation and Development Project Hydraulic Modelling Report and Response to Exhibition Submissions/Comments ORICA

Report ref:
204617
29 November 2010
Revision 3

aurecon

Document prepared by:

Aurecon Australia Limited
Level 2,116 Military Road
Neutral Bay NSW 2089 Australia

T: +61 2 9465 5599
F: +61 2 9465 5598
E: sydney@ap.aurecongroup.com
W: aurecongroup.com

Document control

aurecon

Document ID: 204617-GEN-W-001[03].doc

Rev No	Date	Revision details	Typist	Author	Verifier	Approver
1	05.11.2010	Draft Issue	MS/DW	MS/DW	NW/LT	NW
2	12.11.2010	Final Draft Issue including Client Comments	MS/DW	MS/DW	NW/LT	NW
3	29.11.2010	Final issue including Client Comments	DW	DW	NW	NW

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Contents

1. Introduction

1.1 Background

Orica propose to develop a high quality industrial estate land known as “Southlands” at Banksmeadow near Botany Bay. The land is located in the lower part of the water catchment of Springvale and Floodvale Drains (**Figure 1** in **Appendix A**). The proposal involves a 3 stage development of the Southlands site (**Figure 2** in **Appendix A**) and includes in Stage 2 delivery of a new site access road from Botany Road to McPherson Street along with enhanced drainage infrastructure to alleviate long term flooding issues within the general area.

In 2007, Aurecon undertook a flood investigation of the proposed Orica Southlands site and surrounding areas using a MIKE 11 1D hydraulic model. The investigation involved survey, hydrologic modelling using RAFTS and hydraulic modelling which considered flooding under both the existing scenario and the proposed Stage 1 works. A preliminary analysis of the Stage 2 concept design was also undertaken, although no extensive hydraulic modelling was carried out for the Stage 2 works. Aurecon submitted the report *ORICA/Goodman Southlands Remediation/Development Project* in March 2009 describing the modelling and interpretation of results.

The NSW Department of Planning (DoP) undertook a review of the previous modelling works using independent consultants (Webb McKeown & Associates). Comment on the development was also accepted from surrounding landholders. A meeting with DoP to discuss comments from the review suggested a number of additional tasks, primarily that 2D hydraulic modelling be undertaken to address most of these comments. Responses to comments received are provided in Section 5.

A detailed description of the existing catchment, proposed Stage 1 and Stage 2 development scenarios and previous studies are included in the previous Aurecon study (2009).

The present study was undertaken to address comments received from the DoP following exhibition of the Application. It involved extending the modelling exercise by utilising a two-dimensional hydraulic model, updating the model to include changes in the surrounding area and new developments that have occurred since the original model. The study also included alterations to the development plans to incorporate further flood mitigation measures to ensure no adverse flood impacts thus satisfying the planning criteria.

1.2 Scope of works

Aurecon has undertaken linked 1D/2D hydraulic modelling of the Orica Southlands proposed development and surrounding area to address the DoP and adjoining landowner comments, and to further the modelling to investigate the proposed Stage 2 works.

The scope of works for this portion of the project is:

- Examine issues raised by DoP and adjoining landowners, namely Hynlong Pty Ltd, Solvay Interox Pty Ltd and Sydney Ports Corporation
- Review hydrology to include Climate Change impacts and determine the Probable Maximum Precipitation (PMP) event flows
- Review the terrain model and collect additional survey data
- Develop a linked 1D/2D hydraulic model for the Existing (2009) and proposed Stage 1 development scenario
- Run hydraulic model for the Existing and Stage 1 scenarios
- Develop a linked 1D/2D model for the proposed Stage 2 development scenario
- Run model for the Stage 2 scenario
- Analyse and present the results and reporting
- Liaise with DoP peer reviewer (Webb McKeown & Associates) to ensure DoP comments are addressed within the study

1.3 Structure

The report is presented in the following sections:

Section 1: Introduction – provides a background to the current study, the scope of works and the structure of this report.

Section 2: Description of the Development – Describes the Southlands site and the proposed development which is the subject of the Application.

Section3: Hydrological Analysis – Describes the hydrology of the catchment, the hydrological modelling and the hydrographs developed for use in the hydraulic modelling.

Section 4: Hydraulic Model Setup – Describes the model setup and parameters used for each model scenario to investigate the flood impacts of each stage of the proposed Southlands development.

Section 5: Hydraulic Model Results – provides the results of the hydraulics modelling and defines the flood impacts of each of the model scenarios. Discussion of the results and responses to comments received following exhibition of the Application.

Section 6: Conclusion and Recommendations – provides conclusions drawn from the present study and presents recommendations for approval and future actions.

All figures are presented in **Appendix A** to **Appendix D**.

2. Description of the Development

2.1 Southlands Site

The 19 hectare Southlands site is bounded by McPherson Street on its southern boundary, the port railway line on the east and Floodvale Drain on the west. Springvale Drain runs through the site (**Figure 1**). These "drains" are likely to have been the remnants of previous water courses that have been enlarged over time to assist in draining this previously swampy area.

The Southlands property is the last remaining significant development site on McPherson Street and is the last major development site within its catchment. As a consequence of this, development of the Southlands property is burdened with addressing a flood regime that is a result of all previous development. The result of this is that the Southlands site, to some extent, currently operates as a de-facto flood storage area during major flood events, providing flood storage for other developed sites in the catchment. Contours for the existing site are shown in **Figure 3**.

2.2 Proposed Development

The proposed development envisaged for the Southlands site has been determined in association with a team of consultants and the proponents. The review of flood issues at the site has been a significant part of this process. The final proposal includes construction of a number of warehouses, ancillary office space, access roads and detention basins as set out in the development plans contained in the Environmental Assessment prepared by URS consultants. The area of the proposed development will occupy flood prone areas of the present site and hence the flood study is required to demonstrate that the design does not have an adverse flooding impact on properties upstream or downstream of the site. In addition, capping of the topsoil will provide additional assurances with respect to encountering residual soil contaminants such as asbestos. Further details are provided in the Remedial Action Plan (RAP) (URS, 2007). The high water table and contaminated groundwater also constrain regrading of the site.

The proposed development is to be advanced to the Minister for Planning to seek Project Approval under Part 3A of the Environmental Planning and Assessment Act, 1979. The Part 3A Application proposes a redevelopment of the site on a Staged basis as follows:

- Stage 1 – generally involving the western portion of the site between Floodvale and Springvale Drains and interim flood detention in the Stage 2 area
- Stage 2 – generally involving the south eastern portion of the site, Link Road and drainage downstream
- Stage 3 – generally involving the north eastern portion of the site.

The current Project Application will seek Approval for Stages 1 and 2 of the Project whilst Stage 3 will be the subject of a later approval. Details of the proposed works associated with flood mitigation at the site are given in Section 2.2.1 to Section 2.2.3 below.

As part of the Application process, Director General's Requirements (DGR's) have been sought on issues to be covered in the Environmental Assessment. The DGR's did not note any specific hydrology and flooding issues but it has been determined by the Proponent that this issue needs to be fully reviewed in respect of the new development. Therefore this report provides an overview of flood issues for the entire site (Stages 1 – 3) and more detailed analysis of flooding issues and mitigation measures to be undertaken in Stages 1 and 2 (the subject of the current application).

Furthermore, detailed investigations and design will be required on the Stage 2 works prior to a Construction Certificate for that stage of works, however a workable drainage solution is demonstrated in this report.

Future development of the Stage 3 area will be the subject of a future Project Application based on the flooding parameters set out in this report.

This report thus focuses on the flood mitigation issues for the Stages 1 and 2 of the Development.

2.2.1 Stage 1

The proposed development incorporates filling of areas to the west of Springvale drain that currently provide flood storage. In order to compensate for this loss of flood storage the drainage design required careful consideration of the site geometry. The stage 1 floodplain storage area has been designed to accommodate the flood requirements for the development.

The south-eastern region of the site was identified as potential interim compensatory storage for the Stage 1 development pending development of Stage 2 when the enhancements to Springvale Drain downstream of the site are designed to accommodate reduced flood levels. A potential storage volume curve for the basin east of Nant St was developed from the digital terrain model. Sufficient storage is available in the south eastern section of the site with the proposed earthworks.

Bulk earthworks drawings for the Stage 1 detention area have been reviewed by Golders and Associates and compared to historic groundwater levels. The final detention basin arrangement will be determined in coordination with the onsite environmental management and agreed with the site auditor to optimise the flood storage and groundwater treatment requirements.

The hydraulic model was restructured to utilise this area and thereby offset the existing floodplain storage lost to the proposed Stage 1 development area. This includes regrading the easement along the north of the Southlands site to RL 3.0 m AHD to provide a flood flow path from Floodvale to Springvale Drain. In addition, a set-back of 18 m from Floodvale Drain in the north-western portion of the site has been provided to ensure no development within this area.

The existing Stage 2 area comprises a number of mounds, ridges and holes that would be graded to produce a surface with finished ground levels. A 1.0 m high visual screening embankment is proposed along the McPherson Street boundary. Within the Stage 2 area this embankment also serves as the detention basin embankment (or bund) and as such is designed to a minimum level of RL 4.5 m AHD. This bund will continue at RL 4.5 m AHD along Springvale Drain to the north for approximately 40 m.

A level control structure has been incorporated within Springvale Drain approximately 25 m upstream of McPherson Street to raise water levels upstream of the structure during large events to divert flood waters to the detention area. The structure is effectively a compound weir with crest at RL 3.2 m AHD and a 3 m wide low flow cut-out. This reduces the channel width to 3 m from the bed to RL 3.2 m, above which flow is allowed to pass over the wing walls. A different weir or other control structure design that has an equivalent rating curve could be used as an alternative to this design. To facilitate the effectiveness of the structure localised regrading of the existing Nant St access track and the Springvale Drain western bank will be needed to create high points at RL4.0 m AHD adjacent to the level control structure.

The basin has a minimum longitudinal slope of 0.33% to allow free drainage. The basin extents do not impact on the easements to the east of Stage 2 area. The basin interface with existing levels has been achieved using a batter slope of 1 in 6 for safety reasons. Given the relatively large basin surface area, batter slopes do not have a significant influence on the stage-storage curve of the basin.

The Stage 3 area would largely remain undeveloped as part of the Stage 1 works, with the exception of earthworks in the south-eastern portion of this area to provide additional storage. The existing levels provide an overflow path between Springvale Drain and the interim Stage 2 flood detention area.

The proposed earthworks design was consequently developed to utilise the south-eastern quadrant of the site as an interim floodplain storage area thus, the design incorporates the developed Stage 1 area in the western half, a large detention basin in the south-eastern area (Stage 2) with the north-eastern area (Stage 3) remaining largely in its existing state.

The impact of the proposed Stage 1 development was then assessed by running the MIKE FLOOD model with the revised terrain model and structures and comparing results with the existing terrain results for the same inflow events.

The modelled earthworks plan for Stage 1 is shown in **Figure 4**.

2.2.2 Stage 2

Stage 2 of the development involves the introduction of new drainage infrastructure in tandem with the new link road (from Botany Road to McPherson Street) allowing a significant improvement for the drainage of Springvale and Floodvale catchments. However as the new road is not proposed until Stage 2 of the Project, detailed consideration has been given to the options and alternatives for developing the Stage 1 area of the site that will not cause any significant impact on surrounding properties.

The proposed Stage 2 development aims to alleviate flooding by enlarging the culverts and channel dimensions to contain 1% AEP flood flows within the banks of the refurbished Springvale Drain within and downstream of the Southlands site. A plan view of the proposed Stage 2 Springvale Drain enhancement activities is shown in **Figure 5**.

The works would include the following:

- Enlarging the Stage 1 culverts under the new Stage 1 access road crossing of Springvale Drain
- New culverts under McPherson Street and the new roundabout
- Additional culverts running in tandem with the new link road between McPherson Street and the Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS)
- Improved siphon under the SWSOOS
- New open channel in tandem with the new link road through Discovery Cove to the new intersection at Botany Road
- A new road crossing for new culverts under Botany Road to connect with the existing open channel at the Caltex property that forms the effective entry to the Penrhyn Estuary (Botany Bay).

As discussed previously (SKM, 1992) the design of these upgrades would allow for detention, trash racks and gross pollutant traps.

2.2.3 Stage 3

Stage 3 of the development would involve further filling of the Stage 3 area to house more warehouses and would include internal access roads and detention basins. As discussed above, future development of the Stage 3 area will be the subject of a future Project Application.

3. Hydrological Analysis

3.1 Introduction

The peer review undertaken for the previous study (Aurecon, 2009) requested that the 2D hydraulic model be run for the Probable Maximum Flood (PMF) and 1% Annual Exceedance Probability (AEP) event with the predicted impacts of Climate Change included.

Where possible the inflow hydrographs from the previous study (Aurecon, 2009) have been used as input into the hydraulic model. The existing RAFTS model was used to simulate the Probable Maximum Precipitation (PMP) event and 1% AEP event with predicted climate change impacts included. The development of these additional runs is discussed in the Section 3.3. Inflow Hydrographs used in the hydraulic modelling are shown in **Appendix B**.

3.2 Existing RAFTS hydrological model

The hydrological analysis undertaken in the previous study (Aurecon, 2009) utilised the RAFTS hydrological modelling software package. The model for the Southlands site was adopted from the existing RAFTS model of Springvale and Floodvale drains (**Figure 6**), prepared previously by Lawson and Treloar (May, 2003) and detailed in Appendix I of the Port Botany Expansion Environmental Impact Statement (Volume 4). The Lawson and Treloar model was modified to incorporate more detail in the proposed Southlands development area to accommodate assessment of the impacts on the drainage. The revised sub-catchments included an increase in the impervious area percentage within the Southlands site from 0% in the existing situation to 80% for the developed situation.

The RAFTS model was run with the same assumptions and input values as used previously by Lawson and Treloar. These values appear appropriate for the catchment and have been tested by various validation methods outlined in Lawson and Treloar. Use of the same values also allows the results from the two studies to be compared. The model assumptions and input parameter values are outlined in **Table 3.1** below.

Table 3.1 RAFTS model assumptions and input parameters

Parameter	Value	Comment
Pervious Surface – Initial Loss	50 mm	This value is higher than many other catchments due to the high hydraulic conductivity of the local botany sands. Using a higher pervious surface loss is conservative in that it will lead to larger detention basins in the proposed development when highly pervious areas are paved.
Pervious Surface – Continuing Loss	15 mm/hr	As above
Pervious Surface – Manning's n	0.025	This is a conservative (with reference to hydrology rather than hydraulics) value, associated with short grass. It is considered appropriate as most pervious areas within the catchments are of an urban nature, being golf courses, gravel roads or grassed areas.
Impervious Surface – Initial Loss	1 mm	Typical of paved areas
Impervious Surface – Continuing Loss	1 mm/hr	Typical of paved areas

Parameter	Value	Comment
Impervious Surface – Manning's n	0.010	This is a conservative (with reference to hydrology rather than hydraulics) value, associated with a piped stormwater system that can convey flows rapidly through the catchment.

The RAFTS model was run for a range of storm events including Average Recurrence Intervals (ARI's) of 1, 2, 10, 20, 50 and 100 years and durations of 15, 20, 45 minutes and 1, 1.5, 2, 3, 6, 9 and 12 hours.

Generally the critical storm for Floodvale drain was found to be a 60 minute event and the critical storm for Springvale drain was found to be a 90 minute event. To simplify the analysis, however, a 90 minute duration storm was adopted for both drains since the volume of water in a 90 minute storm is greater than that of a 60 minute storm. The difference in peak flows resulting from this assumption is outlined in the previous report (Aurecon, 2009) and was considered negligible.

A 90 minute storm duration has been assumed for both the Floodvale and Springvale Drains for this study (see **Appendix B**).

3.3 Hydrology review

The inflow hydrographs from the previous Aurecon study have been used as input into the linked 1D/2D hydraulic model developed for this study.

The existing RAFTS model was not set-up to simulate the PMP storm event or to incorporate the predicted impacts of climate change into individual design ARI storm event simulations. The existing RAFTS hydrologic model has been modified to simulate the PMP and 1% AEP event (with predicted Climate Change impacts). The model development and RAFTS model results from these two additional scenarios are discussed in the Section 3.3.1 and 3.3.2.

3.3.1 Probable Maximum Flood

The Probable Maximum Flood (PMP) has been calculated for the Floodvale/Springvale Drain catchment using "The Estimation of PMP in Australia: Generalised Short-Duration Method" (Bureau of Meteorology, 2003). The PMP was calculated for a range of storm durations to determine the critical duration for the catchment. It is noted that the PMP design temporal pattern from the Generalised Short-Duration Method (GSDM) is different to the AR&R temporal patterns used for the standard ARI design storms and therefore the critical storm duration may be different for the PMP storm event. The PMP has been calculated as 290mm, 340mm, 390mm and 430mm for the 45 minute, 60 minute, 90 minute and 120 minute storm durations respectively.

The RAFTS model has been modified to include Probable Maximum Flood runs for the above storm durations. This simulation uses the PMP rainfall intensity and PMP design temporal distribution from the GSDM.

The catchment initial loss and continuing losses for the PMP storm event have been updated as per recommendations in "Australian Rainfall & Runoff (AR&R) Book VI" (Institution of Engineers Australia, 1998). An initial loss of 0 mm and continuing loss of 1mm/hr has been used for the PMP storm simulated in RAFTS.

The critical storm for Floodvale drain was found to be a 45 minute event and the critical storm for Springvale drain was found to be a 60 minute event. However, to simplify the analysis a 60 minute duration storm was adopted for both drains since the volume of water in a 60 minute storm is greater than that of a 45 minute storm.

The peak PMF discharge for Floodvale Drain and Springvale Drain has been estimated as 87.7m^3/s and 147.0m^3/s, respectively. Inflow hydrographs were extracted from RAFTS to be used as inflows into the linked 1D/2D hydraulic model.

Plot of the hydrographs for the PMF and 1% AEP event (with climate change included) are presented in **Appendix B**. Refer Section 3.3.2 for a discussion of the 1% AEP inflows with climate change impacts included.

3.3.2 Climate change impacts

In addition to the rainfall events modelled previously a simulation of the effects of climate change on the 1% AEP event was also requested.

The predicted increase in rainfall intensity was sourced from the "Floodplain Risk Management Guideline: Practical Consideration of Climate Change", (DECC, 2007). For Sydney Metropolitan catchments the extreme rainfall projected change is +12%.

The 1% AEP event IFD rainfall intensities were increased by 12% in the RAFTS hydrologic model and inflow hydrographs were extracted for use as upstream boundary inflows to the linked 1D/2D hydraulic model.

The peak discharge for both the 1% AEP and future 1% AEP with climate change are presented for Floodvale and Springvale Drains in **Table 3.2** below.

Table 3.2 Comparison of 1% AEP peak discharges from RAFTS analysis

Drain	Peak RAFTS Discharge (m^3/s)	
	1% AEP	1% AEP (with CC)
Floodvale	25.5	28.9
Springvale	39.3	45.3

It is noted that the future 1% AEP with climate change impacts is considered to be of a similar magnitude to the current 0.5% AEP flood event and hence results of this storm may be used to infer the effects of the current 0.5% AEP event.

3.4 Hydraulic model inflow boundary conditions

Inflow hydrographs for the 50% AEP, 10% AEP, 1% AEP, 1% AEP with CC and PMF events were extracted from the RAFTS hydrologic model to be used as inflows into the linked 1D/2D hydraulic model.

Peak discharges for all design events modelled are presented in **Table 3.3** below for Floodvale and Springvale Drains respectively.

Input hydrographs for the developed case were the same as the input hydrographs for the existing case, based on the assumption that additional runoff generated by the developed site will be detained/attenuated on site in the Stage 1 detention basin area.

Table 3.3 Peak flood discharges upstream of the Southlands site

AEP (%)	Peak RAFTS Discharge (m^3/s)	
	Floodvale Drain	Springvale Drain
50	10.8	14.0
10	16.7	23.9
1	25.5	39.3
1 with CC	28.9	45.3
PMF	75.2	142.4

4. Hydraulic Model Setup

4.1 Introduction

As discussed in Section 1, the hydraulic model has been developed to be run with various topography and inflow scenarios. The previous model setups were used as the basis for the current work with recent changes to topography, changed structures and blockage incorporated. Scenarios modelled in this study are listed below:

- **Existing (2009 Topography)** – Based on the existing "2005 topography" survey used for the previous Aurecon study but with the modifications to sites at 15 McPherson Street and at the corner of McPherson Street and Exell Street including earthworks and new buildings that have been developed since the previous Aurecon study. Bridges across Springvale Drain and associated culverts that were removed have been removed from the model. Additional survey was undertaken to obtain more ground levels within the Mobil site including bunds around the tanks. Survey also obtained information about a recently constructed concrete channel along the northern boundary of the Mobil site which connects Springvale drain to Floodvale drain upstream of Mobil and the Southlands site. Coal Pier Road and Bridge and trash racks upstream of the McPherson St culverts on both drains were also surveyed and incorporated in the model. This was done to ensure the present study represents the current topography within the model domain.

- **Stage 1 Development (based on 2009 Topography) –** Develop the Stage 1 area for industrial uses (include building platform) and provide interim floodplain storage in the future Stage 2 area (with minor regrading) and overland flow across the Stage 3 area.

- **Stage 2 Development (based on 2009 Topography) –** Develop the Stage 2 area following construction of the proposed Link Road and enhancements to the Springvale Drain culverts within and downstream of the ORICA Southlands site.

Blockage factors have been applied to all hydraulic structures (refer to Section 4.3.1).

A detailed description of the Existing, Stage 1 development and Stage 2 development scenarios are included in Section 2. Figures showing the model setup are presented in **Appendix C**.

4.2 Modelling approach

As discussed in Section 1.1, the NSW Department of Planning (DoP) undertook a review of the previous modelling works using an independent consultant Webb McKeown & Associates. Comment on the proposed development was also accepted from surrounding landholders. During a meeting with DoP to discuss comments from the reviewers it was suggested to undertake a number of additional tasks, primarily that 2D modelling be undertaken to address issues raised and improve the level of confidence in the predicted flooding characteristics.

Hydraulic modelling for this study was undertaken using the MIKE FLOOD Software Package developed by DHI. MIKE FLOOD integrates the two-dimensional MIKE 21 and one-dimensional MIKE 11 hydraulic modelling packages into a single, dynamically coupled hydraulic modelling system. Using this 1D/2D coupled approach enables the best features of both one-dimensional and two-dimensional models to be utilised, whilst at the same time avoiding many of the limitations of resolution and accuracy encountered when using MIKE 11 or MIKE 21 separately (DHI, 2008).

Complex overland flow paths are best represented by a two-dimensional hydraulic model. MIKE 21 is a comprehensive modelling system for two-dimensional free surface flows where stratification can be neglected. MIKE 21 simulates the water level variations and flows in response to a variety of forcing functions in floodplains, lakes, estuaries, bays and coastal areas. The water levels and flows are

resolved on a rectangular grid covering the area of interest when provided with the bathymetry (topography), bed resistance coefficients and hydrographical boundary conditions.

The following hydraulic models have been developed for this study:

- 1D MIKE 11 hydraulic model of the Floodvale and Springvale Drains only and all structures included within the drains such as culverts, inverted syphons, weirs and trash racks.
- 2D MIKE 21 hydraulic model of the floodplain between the Floodvale and Springvale Drains as well as the greater catchment.
- 1D/2D coupled MIKE FLOOD hydraulic model to link the MIKE 11 and MIKE 21 models into a single, dynamically coupled hydraulic modelling system. The lateral links allow floodwater that overflows a 1D channel onto a floodplain or vice versa by allowing MIKE 21 cells to be laterally linked to a given 1D reach in MIKE 11.

It is noted that due to the narrow/deep nature of the Floodvale and Springvale Drains it is not possible to adequately resolve the topography of the drains onto a 2D MIKE 21 model topography within the limitations of the 2D MIKE 21 governing equations. The Floodvale and Springvale Drains are considered to be sub grid scale structures and must therefore be included in a 1D MIKE 11 model which is dynamically coupled to the 2D hydraulic model.

The hydraulic model development is discussed in the following sections.

4.3 Model development

The development of the 1D MIKE 11 model, 2D MIKE 21 model and 1D/2D coupled MIKE FLOOD model are discussed in the following sections.

4.3.1 MIKE 11 – 1D model development

Floodvale and Springvale Drains have been modelled using DHI's 1D MIKE 11 hydraulic modelling software. This approach ensures that the drain conveyance is accurately resolved and allows structures within the drains to be accurately modelled. It is important that hydraulic control structures such as culverts and inverted syphons are accurately modelled as these structures control the proportion of flood water that overflows onto the floodplain within the ORICA site.

Individual elements of the MIKE 11 model development are discussed below.

Existing Scenario

- **Model extent** – The 1D MIKE 11 network includes the Floodvale Drain, Springvale Drain and the concrete channel that connects Springvale Drain to Floodvale Drain just upstream of the Mobil site. The two drains extend downstream to Botany Bay.
- **Cross-sections** – Cross-sections at various chainages along the drains have been extracted from the previous study catchment ground survey. The existing ground survey was carried out by AAMHatch Pty Ltd (2005). Additional survey was carried out by Aurecon as part of this study. The model cross sections only represent the main drains between the left and right banks. When the flood level exceeds the bank elevations, floodwater can spill out of the MIKE 11 channel into MIKE 21 via the MIKE FLOOD lateral links and vice versa.
- **Upstream Inflows** – Design inflows to the upstream boundaries of Floodvale and Springvale Drain have been taken from the RAFTS hydrologic model (Refer Section 3).
- **Boundary Conditions** – The downstream boundary condition has been set to a constant water level of 1m AHD. This value was used in the previous Aurecon study (2007) and is approximately equal to the High Water tide level in Botany Bay. It is noted that flooding within

the ORICA site is governed mainly by the hydraulic controls at the inverted syphons under the SWSOOS and downstream ocean tide levels have negligible effect on the Orica site flood levels. As such, the 1% AEP (with CC impacts) scenario was run with a downstream boundary condition of 1m AHD and did not account for predicted sea level rise.

- **Roughness –** The roughness values for Floodvale and Springvale Drains have been selected based on a visual inspection and aerial photography. Manning's n value of 0.07 and 0.06 has been selected for the Floodvale and Springvale Drains, respectively due to significant vegetation growth within the channels.

- **Structures –** Culverts, inverted syphons, piped sections and trash racks on Floodvale and Springvale Drains have been included in the MIKE 11 model. A list of structures and modelled blockage factor is presented in **Table 4.1** below.

Table 4.1 Structure blockage factors

Structure	Description	Blockage Factor (%)
Floodvale Drain		
Culvert	Pipeline under Mobil site	50
Bridge	Coal Pier Rd Bridge (just downstream of Mobil site)	50
Trash Rack	Trash rack upstream of McPherson St Bridge	100
Culvert	McPherson St.	50
Inverted syphon	Inverted syphon under the SWSOOS	70
Culvert	Pipeline beneath Botany Golf Course. Discharges into Botany Bay	50
Springvale Drain		
Trash Rack	Trash rack upstream of McPherson St Bridge	100
Culvert	McPherson St.	50
Inverted syphon/ Culvert	Inverted syphon under the SWSOOS and then pipeline though the Discovery Cove Site.	70
Culvert	Culverts beneath Penrhyn Rd. Discharges into Botany Bay.	50

Stage 1 Development Scenario

All variables have been maintained other than the introduction of a level control structure approximately 25m upstream of McPherson Street on Springvale Drain. The weir is effectively a constriction to reduce the channel width to 3m between the bed and an elevation of 3.2m AHD (approximate bank level by the construction of wing walls that extend into the bank). This allows low flows to be maintained with relatively little impact while larger flows are diverted into the detention basin through raising the water level.

Stage 2 Development Scenario

The Springvale Drain has been altered to introduce the planned structures described in Section 2 and shown in **Figure 5**. The new structures have had a 50% blockage factor applied assuming reasonable maintenance of the structures with the introduction of a Gross Pollutant Trap device upstream of the

inverted siphon under the SWSOOS. The significant number and width of the culvert set under McPherson Street allows the assumption that a significant blockage of these structures is unlikely and hence a 25% blockage factor has been applied. The bed roughness values have been reduced to 0.04 to represent the channel improvement and the less likely overgrowth/vegetation that can occur in future.

4.3.2 MIKE 21 – 2D model development

Given the wide unconfined nature of the existing catchment topography, overland flow is better represented by a two-dimensional hydraulic model. MIKE 21 is a comprehensive modelling system for dynamic two-dimensional free surface flows. The water levels and flows are resolved on a rectangular grid covering the area of interest when provided with the topography, bed resistance coefficients and hydrographical boundary conditions.

An overview of the MIKE 21 model development, key assumptions and model parameters are presented below:

Existing Scenario

- **Topography** – The model topography has been derived from detailed survey of the Southlands site carried out by AAMHatch Pty Ltd (2005) and Airborne Laser Survey (ALS) data of the catchment. Additional detailed ground survey undertaken for this study has also been incorporated in the model topography in areas where new buildings (including the Toll Warehouse) or changes to structures have been made. The site topography has been represented on a rectangular grid with a cell size of six (6) metres. Floodvale and Springvale Drains below bank level have been blocked out of the MIKE 21 topography to prevent the MIKE FLOOD model duplicating conveyance and storage in both MIKE 11 and MIKE 21. The storage tanks on the Mobil and Qenos sites have been blocked out of the topography since it is not possible for floodwaters to flow through the tanks. Major buildings around the area have been blocked out and smaller buildings are incorporated through increased roughness. The existing levees around the Mobil storage tanks have been included into the MIKE 21 topography. The existing levees have been represented as two cells wide. This is required because MIKE 21 requires two cells to calculate the transition between sub and super-critical flow and this is also required to reduce numeric instabilities in the model. The Stage 1 development topography includes the proposed building platform and interim floodplain storage in the future Stage 2 area (with minor regrading). The Stage 2 development topography includes construction of the proposed Link Road and enhancements to the Springvale Drain culverts within and downstream of the ORICA Southlands site. Maps of model topography for the Existing (2009 Topography), Stage 1 development and Stage 2 development are presented in **Appendix C**.

- **Boundary Conditions** - The downstream boundary condition has been set to 1m AHD. This value was used in the previous Aurecon study and is approximately equal to the High Water in Botany Bay. Inflow hydrographs from RAFTS have been entered into the MIKE 11 hydraulic model at the upstream extent of Floodvale and Springvale Drains. This includes an additional flow to incorporate the contribution from the post-development Southlands site runoff.

- **Bed Resistance** – The bed resistance (roughness) of the site was represented using roughness coefficients over the rectangular grid. Manning's roughness coefficients used for this study are presented in **Table 4.2**.

Table 4.2 Manning's Roughness Coefficients for 2D Hydraulic Model

Surface Type	Value	Comment
Roads (concrete)	0.015	Concrete roads and surfaces
Roads (asphalt/gravel)	0.02	Asphalt and gravel surfaces
Floodplain	0.05	Vegetation between Floodvale and Springvale Drains
Grass	0.03	Short grass regularly mown such as the Botany Golf Course (water depth > grass height)
Thick vegetation	0.1	Some areas on the floodplain include very thick vegetation with closely spaced trees, regular shrubs and difficult to walk through
Buildings (which have not been blocked out)	0.4	The increased energy dissipation of water flowing through and around buildings has been represented by increasing the bed resistance parameter. This approach is favoured over blocking out the building as it includes the storage effects of the building being inundated.

Bed resistance maps used in the MIKE 21 model topographies as presented in **Appendix C**.

Stage 1 Development Scenario

- **Topography** – Differences in the topography for this scenario include the proposed Stage 1 Southlands development site, the earthworks to create the detention basin in the Stage 2 area, setbacks and minor regrading surrounding the site to provide flood flow paths and high points adjacent to the level control weir structure in Springvale Drain approximately 25 metres upstream of McPherson St. Terrain models of the proposed Stage 1 area were created and a flood model grid for the proposed system extracted to represent the developed ground surface. The new terrain model for the Stage 1 development is presented in **Appendix C**.

- **Boundary Conditions** - The same downstream boundary condition and inflow hydrographs have been used as for the Existing scenario.

- **Bed Resistance** – Bed resistance remains unchanged for undeveloped areas and in the detention basin area. Bed resistance on the Southlands site has been set to 0.015 and 0.02 for paved areas, although this is largely inconsequential as the site is predominantly raised above the 100 year flood level.

Stage 2 Development Scenario

- **Topography** – Differences in the topography for this scenario include the filling of the proposed Stage 2 Southlands development site to raise it to proposed levels. The new Link road has been introduced and all associated Stage 2 development buildings have been appropriately adjusted and blocked out such that water cannot flow through them. In addition the topography has been modified where minor earthworks are required in the vicinity of channel improvements in the Springvale Drain downstream of the Southlands site such as at the drain widening to incorporate new larger structures.

- **Boundary Conditions** - The same downstream boundary condition and inflow hydrographs have been used as for the Existing scenario.

- **Bed Resistance** – Bed resistance remains unchanged for undeveloped areas and in the detention basin area. Bed resistance on the Southlands site has been set to 0.015 and 0.02 for paved areas, although this is largely inconsequential as the site is predominantly raised above the 100 year flood level.

4.3.3 MIKE FLOOD – Linked 1D/2D model development

MIKE FLOOD integrates the two-dimensional MIKE 21 and one-dimensional MIKE 11 hydraulic modelling packages into a single, dynamically coupled hydraulic modelling system.

Lateral links located along both banks of the two drains allow floodwaters to overflow from the 1D drain onto a floodplain or vice versa by allowing MIKE 21 cells to be laterally linked to a given 1D reach in MIKE 11.

All model simulations were undertaken using the linked 1D/2D MIKE FLOOD model.

Table 4.3 presents a list of all the lateral links included within the Existing (2000 Topography) and Existing (2009 Topography) MIKE FLOOD models. **Table 4.3** presents a schematic of the 2D MIKE 21 topography, 1D MIKE 11 network (Floodvale and Springvale Drains) and location of the 1D/2D MIKE FLOOD lateral links.

Table 4.3 Existing Scenario MIKE FLOOD lateral link locations

Link Id left / right side of drain	Upstream extent of lateral link	Downstream extent of lateral link
Floodvale Drain		
1/2*	Upstream end of Floodvale Drain	Upstream of Mobil site
3/4*	Downstream of Mobil site	Upstream of Coal Pier Road Bridge
5/6*	Downstream of Coal Pier Road Bridge	Upstream of McPherson Street Bridge
7/8*	Downstream of McPherson Street Bridge	Upstream of SWSOOS No.2
9/10*	Downstream of SWSOOS No.2	Foreshore Road
Springvale Drain		
11/12*	Upstream end of Springvale Drain	Upstream of McPherson Street Bridge
13/14*	Downstream of McPherson Street Bridge	Upstream of SWSOOS No.2
Link Channel (from Springvale Drain to upstream end of Floodvale Drain)		
15/16*	Springvale Drain	Upstream end of Floodvale Drain

NOTE: (*) Lateral link provided on the true left and true right bank of the drain.

Stage 1 Development Scenario

The MIKE FLOOD links have been updated for the Stage 1 development scenario. Lateral links 11 and 12 (refer **Table 4.3** above) have been modified to accommodate the proposed level control structure by including lateral links upstream and downstream of the structure. An explicit link has been included to allow floodwater in the interim detention basin to flow back into Springvale Drain (when the flood level drops) via the proposed low flow culvert.

Stage 2 Development Scenario

The MIKE FLOOD links have been further updated for the Stage 2 development scenario to accommodate the proposed changes to the Springvale Drain.

4.4 Model Scenarios

The MIKE FLOOD scenarios simulated for this study are presented in **Table 4.4** below.

Table 4.4 Model scenarios

Topography Scenario	Flood Event Scenario (AEP)				
	50%	10%	1%	1% with Climate Change	PMF
Existing (2009)	X	X	X		
Stage 1 (2009)	X	X	X	X	X
Stage 2 (2009)	X	X	X	X	

Hydraulic model results are discussed in Section 5 below.

5. Model results

Flooding in the Springvale and Floodvale Drains catchment is a result of the complex interaction of runoff from key storm events coupled with flat terrain, significant development for industrial purposes in the catchment and undersized, poorly maintained drainage infrastructure. The recent construction of a concrete channel north of the Mobil site connected Springvale Drain to Floodvale Drain along with new developments since the previous hydraulic model study have further altered the flood behaviour.

Development of the Southlands site is further complicated by the relatively high groundwater table and groundwater contamination under the site, reducing opportunities for extensive site grading works to increase storage capacity and thereby accommodate major flood events. Importantly though, the key objective of the revised modelling and development is to deliver 'no impact' on any adjacent property. Consequently, numerous development options were reviewed but only the preferred hydraulic options are presented as part of this Project Application.

It is assumed that the existing drains and other structures are partially blocked as observed on site and as per guidelines in the NSW Floodplain Development Manual (2005).

Model results for all scenarios are presented as a maximum flood level map showing the extent of flooding. The Stage 1 and Stage 2 development scenarios also present a flood level difference map to show the comparison with the existing scenario. These are presented in **Appendix D**.

The hydraulic modelling assumes the water flow characteristics are well resolved by the representation of the actual drainage channels on site and the model equations that represent the hydraulics. Given the ALS accuracy, assumptions about the hydraulics and a range of contributing factors the absolute accuracy of the model results is difficult to define. This is typical of flood models where limited data for calibration is available. However, relative accuracy is likely to be in the order of ±10 millimetres. As such, in presentation of the results, a flood difference of 10 millimetres or less is considered 'no impact' as agreed with the peer reviewer.

5.1 Existing

The results for the existing flooding situation during the 1% AEP event (**Figure 8**) show that the Southlands site currently acts as a flood storage area for the wider catchment receiving overbank flows from both drains. Flooding occurs over the northwest and southeast areas of the Southlands site as well as adjacent areas both upstream and downstream of the site. A major reason for this is the inadequacy of the capacity of the drainage infrastructure as well as the high propensity for blockage of these structures, further reducing their capacity.

Maximum flood level results for the 50%, 10% and 1% AEP events under existing conditions are shown in **Appendix D**. The results show that with the applied roughness and blockage factors described above, flood waters will overtop the banks of both the Floodvale and Springvale Drains. The small capacity of the drains causes flooding of the Southlands site and adjacent properties for the 50% AEP event and larger events. The following findings can be made:

- The flows enter the Southlands site from the Mobil site and Floodvale Drain and flow across towards the Springvale Drain where flows also overtop the banks spilling into the site.
- There are a number of hydraulic controls along both drains which influence flood behaviour, particularly when partially blocked.
- Flood levels at the Southlands site are predominantly controlled by the top level of the Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS). The SWSOOS runs from west to east, approximately halfway between Botany Road and McPherson Street. It consists of an approximately 3m wide x 2m high rectangular concrete structure that crosses above both Springvale and Floodvale drains.
- The SWSOOS crossing of Floodvale drain creates a short siphon (approximately 10m along the direction of flow), where the drain flows under the concrete sewer. This appears to operate

effectively during low flows, however in a 1% AEP event the siphon cannot accommodate the peak flows. The SWSOOS begins to act as a dam wall that is overtopped in the peak event, particularly in its current partially blocked state. This results in a backwater effect, with the upstream water surface elevation determined by the depth of flow over the top of the SWSOOS.

- The trash racks upstream of the culverts under McPherson St in both Floodvale and Springvale Drains are significantly blocked with vegetative debris and general gross pollutants such that the trash racks effectively act as weirs, raising the upstream water levels.
- The two drains are hydraulically linked, with overbank flow moving between Floodvale and Springvale Drains at a number of locations: upstream of the Mobil site, through the Mobile site, through the Southlands site, at the SWSOOS and again downstream through the Discovery Cove industrial complex area.
- The newly constructed concrete channel north of the Mobil site appears to encourage additional flow from Springvale Drain towards Floodvale Drain during flood events.

5.2 Stage 1

Model runs for the existing system indicated a maximum flood level in Springvale drain of around RL 4.15 m AHD and that approximately 20,000 m^3 of water flooded over the proposed Stage 1 development area. The south-eastern region of the site was identified as potential interim compensatory storage for the Stage 1 development pending development of Stage 2 when the enhancements to Springvale Drain downstream of the site are designed to accommodate reduced flood levels.

A potential storage volume curve for the basin east of Nant St was developed from the digital terrain model. At an elevation of RL 4.2 m AHD some 50,000 m^3 of storage is available in the south eastern section of the site with the proposed earthworks, which is sufficient to offset the filling of the Stage 1 development area.

The Stage 1 development scenario 1% AEP flood extents (**Figure 9**) show similar extents to those for the existing flood extents. Due to the filling of the site, flood waters no longer enter the northern portion of the Southlands site, but are diverted along the northern boundary of the site from Floodvale Drain towards Springvale Drain. Within the site itself the distribution of flood depths shifts from the proposed Stage 1 development area west of Springvale Drain to the Stage 2 area east of the drain. The flood level difference map (**Figure 10**) indicates that there is no off-site increase in flood levels.

Maximum flood level results for the 50% AEP, 10% AEP and 1% AEP events with the proposed Stage 1 development scenario are shown in **Appendix D**. Flood level difference maps for all design events indicate that the proposed development has no adverse flood impacts to any surrounding properties and the flood waters are successfully diverted and detained within the Southlands site. The following findings can be made:

- The flows are diverted from Floodvale Drain to Springvale Drain through the easement along the northern boundary of the Southlands site
- The proposed level control structure upstream of Springvale Drain raises water levels within Springvale Drain on the Southlands site, which allows flood waters to enter the Stage 1 detention basin.
- As flows recede, stored flood waters are able to flow back into Springvale Drain from the detention basin either back over the banks or through a low flow outlet to be constructed at the low point in the basin.
- Flood levels remain the same or are in many circumstances lower on adjoining properties following the Stage 1 development. This is particularly the case for properties downstream of the site adjacent to Springvale Drain.

To demonstrate the effectiveness of the detention basin, the following **Table 5.1** shows the flood storage volumes within the Stage 1 and Stage 2 and 3 areas of the site for the existing case and the

Stage 1 development scenario. Volumes are shown at RL 4.1 m AHD and RL 4.2 m AHD, which encompasses the 1% AEP flood levels for both scenarios in both Drains.

Table 5.1 Flood storage volumes - Existing and Stage 1 development scenarios

Scenario	Flood Storage Volume (m^3)		
	Stage 1	**Stage 2 and 3**	**Total**
At RL 4.1 m AHD			
Existing	34,700	20,000	54,700
Stage 1 Development	14,300	44,100	58,400
At RL 4.2 m AHD			
Existing	41, 400	23,400	64,800
Stage 1 Development	16,200	49,600	65,800

The Stage 1 modelling assumes existing Nant Street access track levels, which flood waters can pass over to enter the detention basin. If the elevation of this track is raised, additional works will be required to provide culverts or similar under the road to allow flows to enter the detention basin.

Results for the PMF event are also shown to indicate the maximum extent of flooding expected (**Figure D13**).

5.2.1 Factors affecting Stage 1 and 2 floor and road levels

Building finished floor levels within the Stage 1 and 2 area are required to be set above the 1 in 1% AEP flood event including Climate Change impacts (**Figure11**).

The design floor levels for the warehouse areas of the proposed development are subject to a number of criteria including:

- 1% AEP Flood (including Climate Change) level plus 300 mm freeboard.
- The ability to drain stormwater from the site.
- Site remediation levels as defined in the preferred remediation strategy documented in URS (2007)

The design floor level needs to be set at the highest of these constraints, which may vary for different locations on the Southlands property and may be reduced as a result of the Stage 2 works, however initial Stage 1 filling works will need to meet current flood conditions as proposed in Stage 1.

The 1% AEP event with Climate Change results indicate maximum flood levels along the northern boundary of the Southlands site are RL 4.2m AHD near Floodvale Drain. Incorporating 300mm freeboard results in a minimum finished floor level to satisfy flood criteria of 4.5 m AHD at this point.

Maximum flood levels along the southern boundary of the Southlands site are RL 4.1m AHD near Springvale Drain. Incorporating 300mm freeboard results in a minimum finished floor level to satisfy flood criteria of 4.4 m AHD at this point.

5.3 Stage 2

The Stage 2 development aims to confine the flood flows within the refurbished Springvale Drain. Downstream of the Southlands site the new Link road will be tied into McPherson St and Botany Road

and most likely will include a bridge over the SWSOOS. This component of the project will require negotiations with a number of stakeholders including property owners, council and asset managers to formulate a detailed plan.

The proposed Stage 2 development scenario maximum flood level results for the 1% AEP event along with a flood level difference map is shown in **Figure 12** and **Figure 13** as well as **Appendix D**. Maximum flood level results for the 50% AEP, 10% AEP and 1% AEP events with the proposed Stage 2 development scenario are shown in **Appendix D**.

These results demonstrate that the improvements to Springvale Drain as part of the Stage 2 development works will largely contain the 1% AEP event such that there are no adverse impacts off-site as a result of Stage 2 and Stage 3 developments.

The proposed improvements to the hydraulic capacity of Springvale Drain would lead to a reduction in the duration of the flood hydrograph and an associated increase in the peak flow rate passing to Botany Bay. An increase in peak flow rate has potential to affect the outlet to Botany Bay and the surrounding Penrhyn Estuary wetlands. Possible issues including scour near the outlet channel and wetland degradation may result without sufficient mitigation measures. Detailed design of the new infrastructure will therefore need to incorporate mitigating design features, prior to construction. These measures will be designed and modelled prior to any Stage 2 works being undertaken, and will ensure an optimal design solution resulting in negligible impact on the wetlands and Botany Bay.

Detailed design measures to be investigated will therefore include:

- Scour prevention by increased vegetation of the banks immediately downstream of the outlet
- Upstream detention by the incorporation of additional in-ground detention areas on the Southlands site, where possible
- Upstream detention in the land adjacent to the section of drain between Foreshore Drive and Penrhyn Road. This could be achieved through excavation of a wider channel, a secondary channel or a detention basin in this area. Approval would need to be sought from the landowner.
- Pollutant removal through measures such as a detention basin or rock weirs in the channel upstream of Penrhyn Road to reduce sediment loading and a trash rack at the inlet to the culvert under Penrhyn Road.

Initial modelling and design resolution confirms that these measures are possible and will reduce flow and scour impacts in the Penrhyn estuary, but detailed design and incorporation of these mitigating items will be required prior to the issuance of a Construction Certificate for the Stage 2 works.

These upgrade works are to a large extent as noted in the SKM (1992) report to Council, as improvements for the local catchment and should be recognised as an issue for all landowners in the area. These works could therefore reasonably be seen as an appropriate S.94 Plan for the area, rather than delivering the burden onto a single land owner. Nevertheless, the upgrade works as proposed in Stage 2 on lands downstream of the Southlands site are proposed as part of the current Project Application.

5.4 Discussion

The existing flooding situation shows flooding over the northwest and southeast areas of the Southlands site as well as adjacent areas both upstream and downstream of the site for all events greater than the 50% AEP. A major reason for this is the inadequacy of the capacity of the drainage infrastructure as well as the high propensity for blockage of these structures, further reducing their capacity. The Southlands site currently acts as a flood storage area for the surrounding industrial area receiving overbank flows from both drains.

The area exhibits complex hydraulics and careful consideration was required to develop appropriate flood mitigation options within each stage of the development. Adjustments to the proposed Stage 1 development have been made to introduce flood mitigation measures including the lowering of the

easement to the north of the site to provide a flow path between Floodvale and Springvale drains along with additional storage provisions in the Stage 2 and Stage 3 areas. The results presented in this report are for those configurations modelled and any variation to the scenarios modelled would need to be carefully considered and possibly re-modelled if necessary.

The flood levels and discharges for the 1% AEP event for each scenario at key locations are summarised in **Table 5.1** and **Table 5.2**.

Table 5.1 Summary of 1% AEP event peak flood levels at key locations

Location	Peak Flood Level (m AHD)		
	Existing	**Stage 1**	**Stage 2**
Upstream end of Southlands site			
Floodvale Drain	4.14	4.15	4.14
Springvale Drain	4.20	4.12	4.08
Upstream of McPherson St			
Floodvale Drain	4.13	4.03	4.02
Springvale Drain	4.03	4.03	3.85
Upstream of SWSOOS			
Floodvale Drain	3.95	3.94	3.93
Springvale Drain	4.03	3.97	3.66

Table 5.2 Summary of 1% AEP event peak flood discharges at key locations

Location	Peak Discharge (m^3/s)		
	Existing	**Stage 1**	**Stage 2**
Downstream of McPherson Street			
Floodvale Drain	20.00	20.48	20.87
Springvale Drain	7.62	6.69	20.56

Modelling shows that the proposed Stage 1 development has no adverse impact on flood levels within either Floodvale or Springvale drains and will lower flood levels in many areas. Similarly, construction of proposed improvements to Springvale drain as part of Stage 2 works would allow filling of the Stage 2 and Stage 3 areas to above the 1% AEP event flood levels without adversely impacting any surrounding properties. The above table shows similar peak flows in Floodvale Drain for all scenarios, while the peak discharge in Springvale Drain is increased for the Stage 2 development which is adequately conveyed with the increased capacity of the proposed channel improvements.

While the Stage 3 area is undeveloped, storage will still occur on this area of the site resulting in lower flood levels than those determined as part of the Stage 2 modelling. It may be possible to maintain some portion of this storage volume in detention basins in the Stage 3 development, the details of which are not the subject of this Application.

5.5 Responses to Comments

The following section is a summary response to comments raised by each respondent to the public exhibition of the Development Application.

5.5.1 Department of Planning (DoP)

The following specific responses are made in relation to comments from DoP.

Climate Change

Climate Change impacts have been added to the 1% AEP discharges for the Stage 1 development scenario and results presented in relation to setting Flood Planning Levels

On-site Stormwater Detention (OSD)

OSD has been removed from the site and additional storage volume included in the Stage 1 detention basin. This was agreed with the DoP flood modelling peer reviewer.

Stage 1 Detention Basin

Floodplain storage volumes are provided in Section 5.

Hydraulic Modelling

The MIKE FLOOD 1D/2D coupled model has been utilised for the revised modelling detailed in Section 4 of this report.

Peak flood levels and peak flows at key locations have been provided along with peak flood maps and flood level difference maps.

70% blockage factors have been applied to the inverted syphons under the SWSOOS in both Floodvale and Springvale Drains.

Stage 2

Proposed Stage 2 improvement works on Springvale Drain have been simulated with the 1D/2D coupled model and results and discussion presented in Section 5 this report.

5.5.2 Hynlong Pty Ltd

The following general responses are made to comments from Hynlong Pty Ltd:

Previous Studies

Modelling has been completely revised to utilise a 1D/2D coupled model with Airborne Laser Survey (ALS) data supplemented with ground survey. The area has undergone significant development since the SKM (1992) study and the resolution of the model data is significantly different. As such it is inappropriate to draw comparisons between the absolute flood level results of the previous study and the current study.

Present Day Circumstances

As discussed above, modelling has been updated to utilise 1D/2D coupled model to provide more confidence in model results for all stakeholders. Additional survey was also undertaken as part of the present study to obtain information to reflect the present day conditions including:

- new developments at 15 McPherson Street and at the corner of McPherson St and Exell Street
- Coal Pier Road and Bridge
- bridges across Springvale Drain and associated culverts that were removed have been removed from the model.
- a newly developed concrete channel north of the Mobil site
- tank bunds within the Mobil site
- trash racks in both drains upstream of McPherson Street

- revised roughness and structure blockage factors to reflect current conditions.

Development at 15 McPherson Street

This development was undertaken by a separate developer and it is not the responsibility of Orica to investigate the impacts of this development. The development has been included in the present study to reflect current conditions and is included in all model scenarios to allow a relative comparison of the impacts of the Southlands development.

Presentation of Flood Model Results and Flood Impacts

In accordance with the comments, the following flood model results have been provided in this report to further define the flood extents and impacts of the proposed Southlands Stage 1 and Stage 2 development scenarios:

- Flood extents and flood difference maps
- Tabulation of peak flood levels and peak discharges at key locations
- Flood storage volumes for the Stage 1 detention basin

The above results demonstrate 'no impact' for either the Stage 1 or Stage 2 development and importantly, indicate lower flood levels on the Hynlong property.

The present flood modelling has been undertaken in consultation with the DoP independent flood modelling peer reviewer to ensure to robustness of the results.

Responsibility for Flood Improvement Works

As discussed within this report, the Southlands site in its existing condition acts as a de facto flood storage area for the wider catchment. This is the result of a long history of development with insufficient infrastructure and flood planning in the area. This has lead to the current situation where the potential for Orica to develop their site is being hindered by this legacy.

This report demonstrates that the proposed development is viable without adversely affecting properties when compared with the current situation, however, inundation of properties remains an issue. The flood problem in the area is a concern for all surrounding property holders and it is in the interest of all involved to improve the flooding situation. It is therefore prudent that the potential shared responsibility for any improvement works be considered, including a Section 94 Plan.

5.5.3 Solvay Interox Pty Ltd

Orica have not contributed to the existing flood problem on the Solvay Interox property and the stated raising of building floor levels on the Solvay Interox site to prevent flooding are likely to have adversely impacted on flood storage and levels in the wider area.

As discussed above, the additional survey has been undertaken and modelling updated to represent prevailing conditions. This includes revised roughness coefficients and blockage factors in both drains and associated infrastructure to reflect the vegetative cover and debris that is present.

The Stage 1 detention basin has been regraded to obtain the additional storage required to offset the filling of the Stage 1 area. The Stage 1 detention basin ensures that flood levels within Floodvale drain are not increased and whether Stage 2 proceeds or not, the flood situation in Floodvale drain would be no worse than presently exists. Stage 2 works are not required as part of Stage 1 and the Stage 2 channel improvement works would have a greater benefit for Springvale Drain than Floodvale Drain. Additional works on Floodvale Drain would be required to improve the flood situation within Floodvale Drain and is not a requirement of this Application.

5.5.4 Sydney Ports Corporation

Development Stage 1

The Stage 1 detention basin surface will be re-vegetated following any earthworks to regrade the area, providing a stable surface to prevent suspension of sediments during flood events. Further, due to the low velocities present in the storage area it is unlikely that sediments will be transported into Springvale Drain and will settle in the basin itself.

With regards to contaminated groundwater, a substantial groundwater treatment plant has already been in operation for some time and the management of environmental issues on the site is monitored and proven. Any changes to these requirements as a result of the Stage 1 works will be determined and appropriately managed as part of the environmental management plan and with agreement from the Site Auditor.

Development Stage 2

The present modelling has included a more detailed assessment of the proposed Stage 2 Springvale Drain improvement works to establish the potential for this solution to achieve the desired outcomes.

Modelling for the Stage 2 development indicates that peak discharge velocities from Springvale Drain into Penrhyn Estuary are approximately 3.05 m/s through the 50% blocked Penrhyn Road culverts and 1.95 m/s into the estuary with the high tide boundary of 1.0 m AHD. Lower velocities would prevail with fewer blockages of the culverts. Erosion protection measures have been suggested, and measures to mitigate these impacts will be incorporated into the detailed design for Stage 2 works.

For the main part, the total volume of freshwater flows will not be increased, but rather the shape of the flood hydrograph changed such that the peak flow is increased while the duration is decreased. The flows will be re-distributed from Floodvale Drain to Springvale Drain, both of which discharge to the estuary. As such there will be no net increase in freshwater flows to the estuary from the wider catchment.

Any net increases in runoff occurring from the Stage 1 development area will be catered for in the Stage 1 detention basin. Both Stage 2 and Stage 3 plans include areas for detention basins to manage site stormwater runoff. WSUD measures will seek to further minimise these post-development flows. While the Stage 3 area is undeveloped, storage will still occur on this site. Some portion of this storage may be able to be maintained in detention basins in the Stage 3 development, the details of which are not the subject of this Application.

Flooding

Modelling of the Stage 2 Springvale Drain improvement works indicates that the SWSOOS syphon and Botany Road culverts will remain as control points in relation to flooding upstream. Downstream of the SWSOOS, there is sufficient gradient in the channel and the capacity of the channel adjacent to the Caltex carpark is sufficient to convey the increased flows with flood waters remaining in-bank. As such, flooding of Penrhyn Road or the Port Botany rail line will not occur.

6. Conclusions and Recommendations

The NSW Department of Planning (DoP) undertook a review of the previous 2007 flood modelling works (Aurecon, 2009) using independent consultants (Webb McKeown & Associates). Comment on the development was also accepted from surrounding landholders. A meeting with DoP to discuss comments from the review suggested a number of additional tasks, primarily that 2D hydraulic modelling be undertaken to address most of these comments. In response to these comments, Aurecon has undertaken linked 1D/2D hydraulic modelling of the Orica Southlands proposed development and the surrounding area for a range of inflow scenarios.

The revised modelling has incorporated a number of changes and additional survey which was undertaken to better define certain areas. This includes:

- new developments at 15 McPherson Street and at the corner of McPherson St and Exell Street
- Coal Pier Road and Bridge
- bridges across Springvale Drain and associated culverts that were removed have been removed from the model.
- a newly developed concrete channel north of the Mobil site
- tank bunds within the Mobil site
- trash racks in both drains upstream of McPherson Street
- revised roughness and structure blockage factors to reflect current conditions.

The existing flooding situation shows flooding over the northwest and southeast areas of the Southlands site as well as adjacent areas both upstream and downstream of the site for all events greater than the 50% AEP event. A major reason for this is the inadequacy of the capacity of the drainage infrastructure as well as the high propensity for blockage of these structures, further reducing their capacity. The Southlands site currently acts as a flood storage area for the wider catchment and surrounding industrial area receiving overbank flows from both Floodvale and Springvale Drains.

The area exhibits complex hydraulics and careful consideration was required to develop appropriate flood mitigation options within each stage of the development. Adjustments to the proposed Stage 1 development have been made to introduce flood mitigation measures including the lowering of the easement to the north of the site to provide a flow path between Floodvale and Springvale Drains along with additional storage provisions in the Stage 2 and Stage 3 areas. The results presented in this report are for those configurations modelled and any variation to the scenarios modelled would need to be carefully considered and possibly re-modelled if necessary.

Modelling shows that with the recommended storage and ancillary works, the proposed Stage 1 development has no adverse impact on flood levels on adjacent properties within either Floodvale or Springvale Drains and will lower flood levels in many areas.

Importantly, the modelling work predicts no significant adverse impacts on flood levels either upstream or downstream of the Southlands development site as a result of the Stage 1 works and contains all major flood events within the eastern (Stage 2 and Stage 3) portion of the site. The eastern half of the Southlands site operates effectively as an interim compensatory flood storage area for the Stage 1 development and this flow will be transferred downstream through the increased capacity of Springvale Drain and the culverts following the Stage 2 development. This report has focused on surface water drainage and further mitigation measures may be required in order to manage groundwater interaction with surface flows in the interim stage compensatory flood storage area.

Stage 2 works will serve to significantly increase hydraulic capacity of Springvale Drain through to Botany Bay. The result of adding this new infrastructure will see a significant positive impact on flood levels in the area allowing the subsequent filling of Stages 2 and 3 without any impact on any adjoining properties. Likely changes in flow characteristics of the proposed Stage 2 channel system have been considered and various mitigating measures designed to reduce impacts from increased

flows are noted in Section 5 of this report. Further detailed design of these measures will be required during the detailed design phase and prior to the issuance of a Construction Certificate for Stage 2 works, with more detailed hydraulic model investigation to ensure the incorporation of appropriate mitigative measures, as required.

Improvements to Floodvale Drain as identified by SKM (1992) would further seek to improve the flooding situation, however are not the subject of this investigation.

Development of Stage 3 will be the subject of future Project Application. Stage 3 will benefit from the major new infrastructure works undertaken in Stage 2 which will essentially allow both Stages 2 and 3 to be filled as required to above 1% AEP flood levels.

Filling of the site generally in accordance with the levels proposed in the Stage 1 and 2 of this Application and as included in this report would be acceptable and will not result in any off site flood impacts on surrounding properties.

The works required for Stage 1 and Stage 2 are indicated on **Figure 4** and **Figure 5** in **Appendix A**, respectively. Storage volumes are presented in Section 5 of this report.

The Springvale and Floodvale Drain culverts under the SWSOOS should be cleared and maintained to allow maximum flow in Stage 1.

It is recommended that Council consider the preparation of an appropriate Section 94 Plan to deal with the catchment wide flooding issues as outlined in the SKM Report to Botany Bay City Council (1992). This wider approach would facilitate ownership of flooding issues by all affected stakeholders rather than relying on individual landowners to solve catchment wide issues.

7. References

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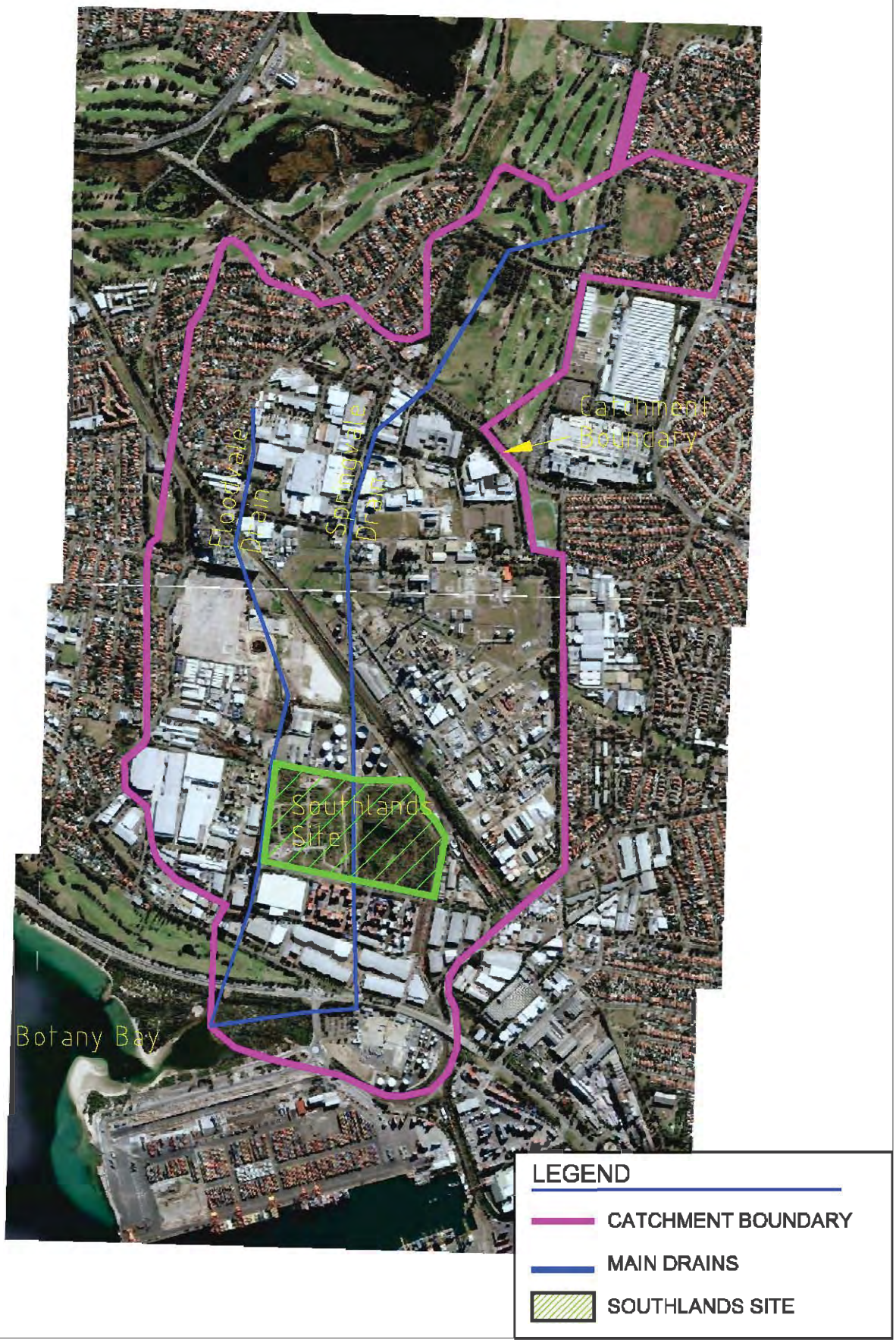
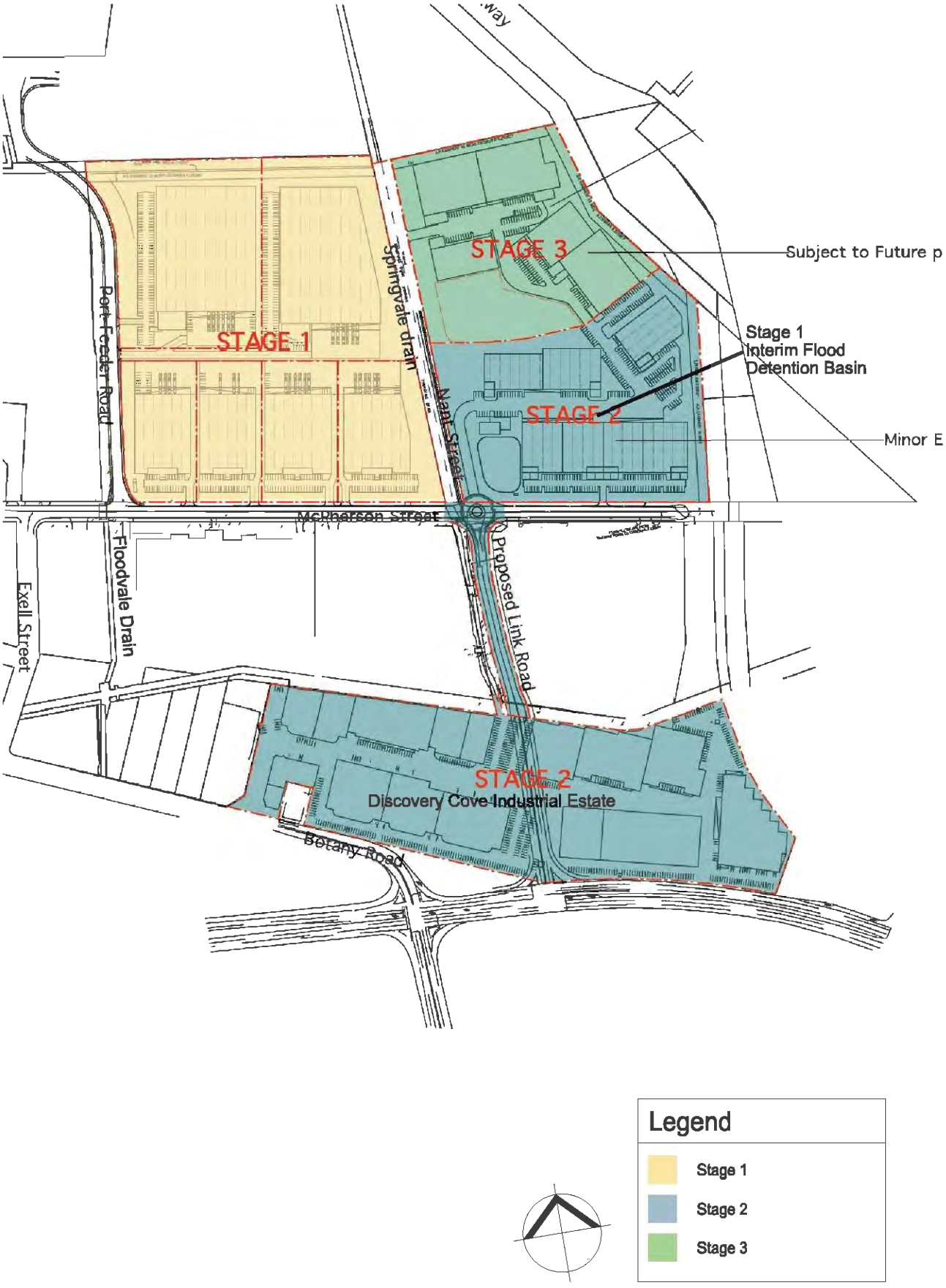
Appendix A
Figures



Southlands Flood Modelling **Figure 1**

Aerial photo showing Springvale and Floodvale Drains and the catchment boundary



Southlands Flood Modelling **Figure 2**

Proposed Development Masterplan - Stages 1 to 3

SCALE

0 80 160m

Southlands Flood Modelling

Figure 3

Existing Site Elevation Contours and October 2004 Groundwater Contours

aurecon

SCALE
0 40 80 m

Southlands Flood Modelling

Figure 4

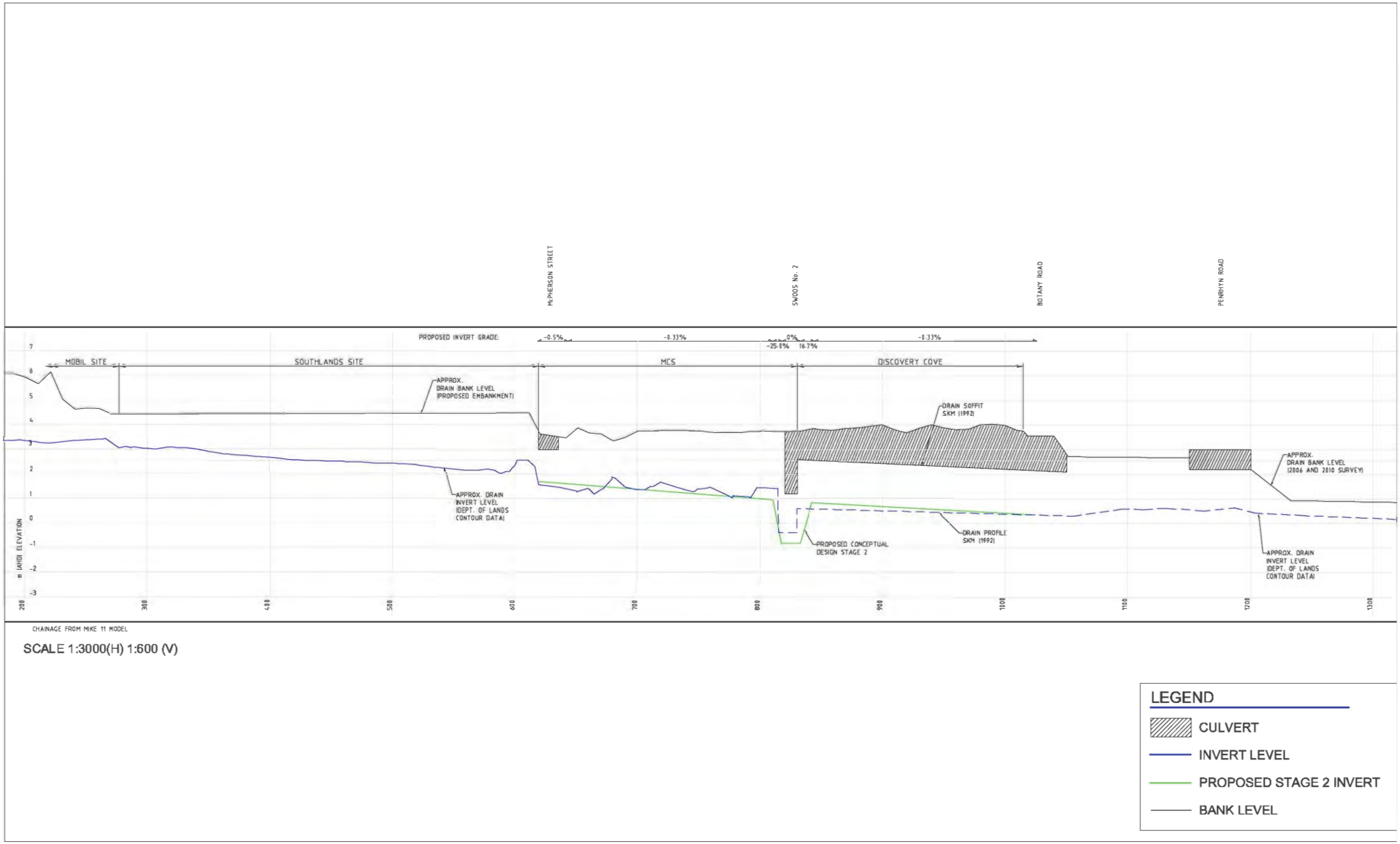
Proposed Stage 1 Interim Flood Flow Paths

SCALE

0 50 100m

Southlands Flood Modelling **Figure 5**

Stage 2 Conceptual Hydraulic Design



SCALE 1:3000(H) 1:600 (V)

LEGEND

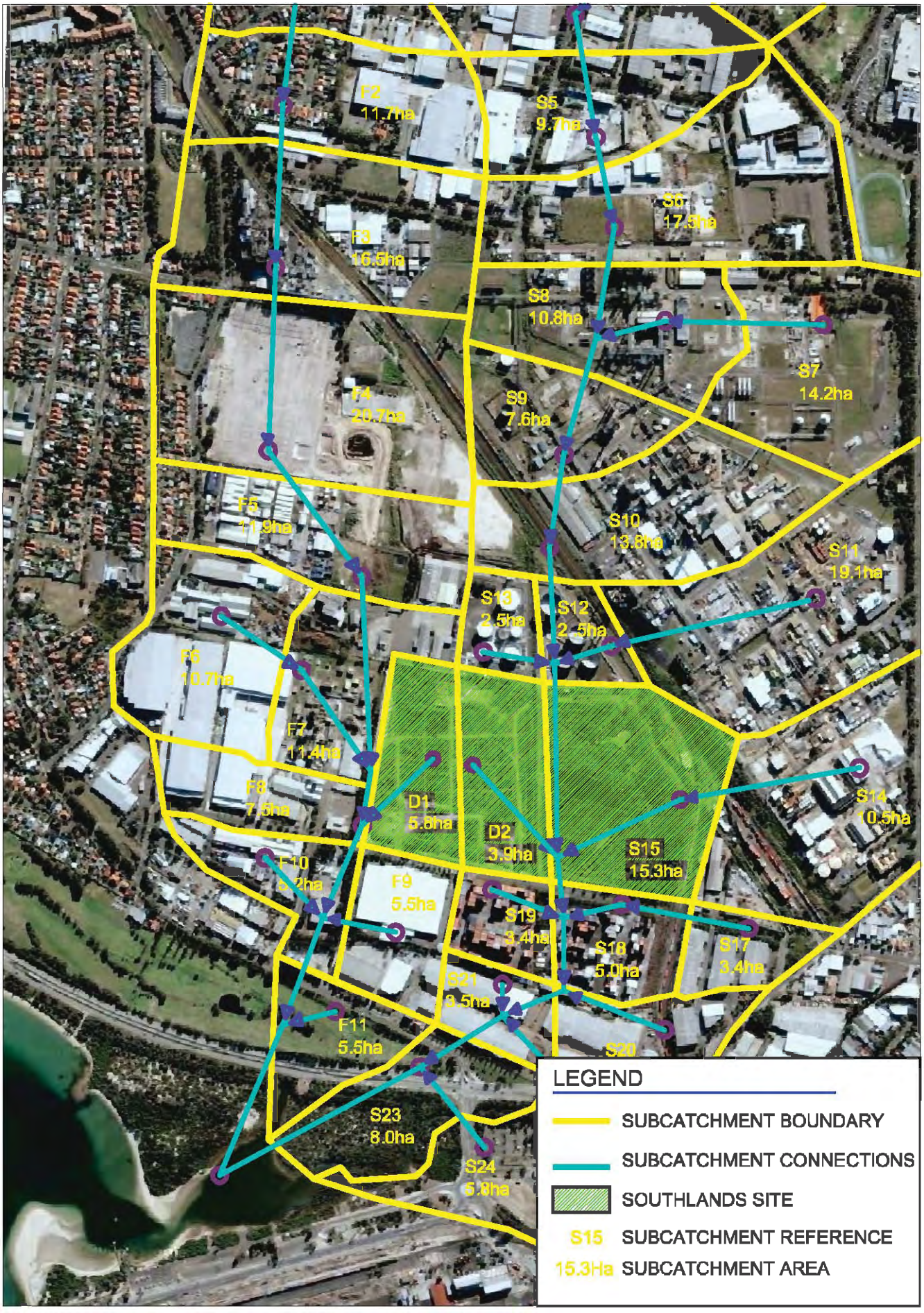
- CULVERT
- INVERT LEVEL
- PROPOSED STAGE 2 INVERT
- BANK LEVEL

SCALE

0 50 100m

Southlands Flood Modelling **Figure 6**

Proposed Stage 2 Springvale Drain longitudinal section



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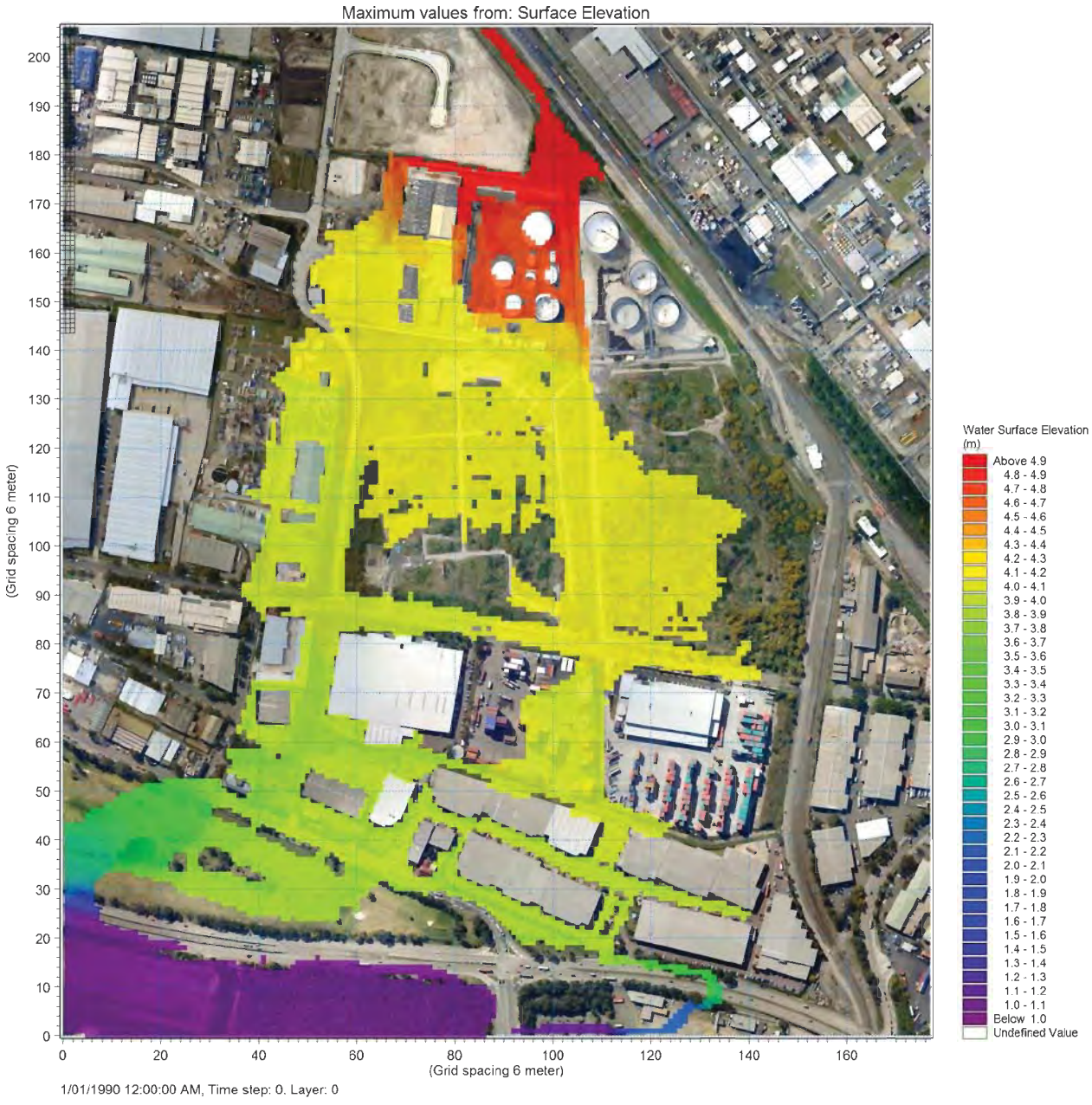
Southlands Flood Modelling **Figure 7**

RAFTS Rainfall-Runoff Model Catchments Plan



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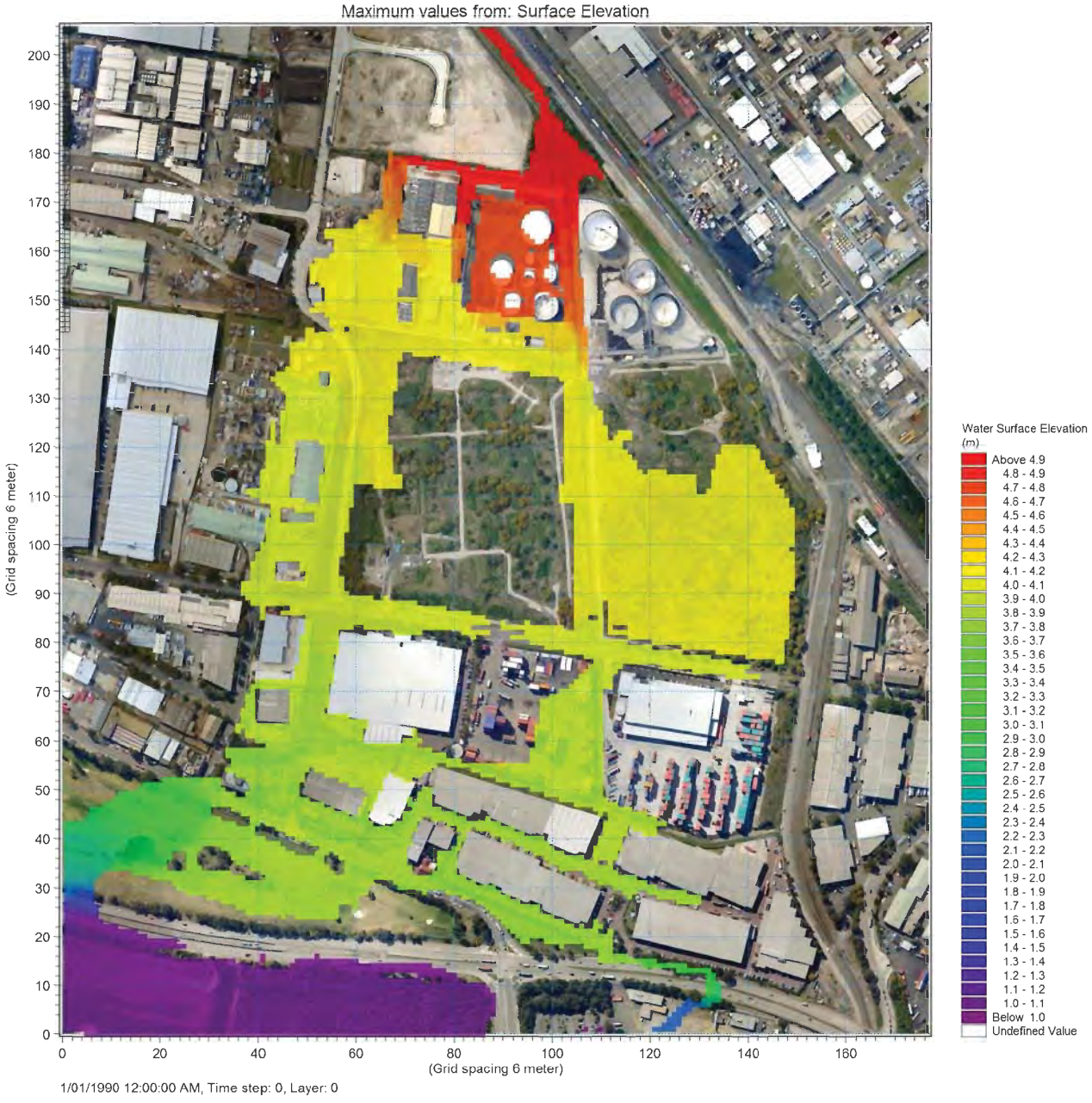
Southlands Flood Modelling **Figure 8**

Existing Scenario 1% AEP flood extents



SCALE
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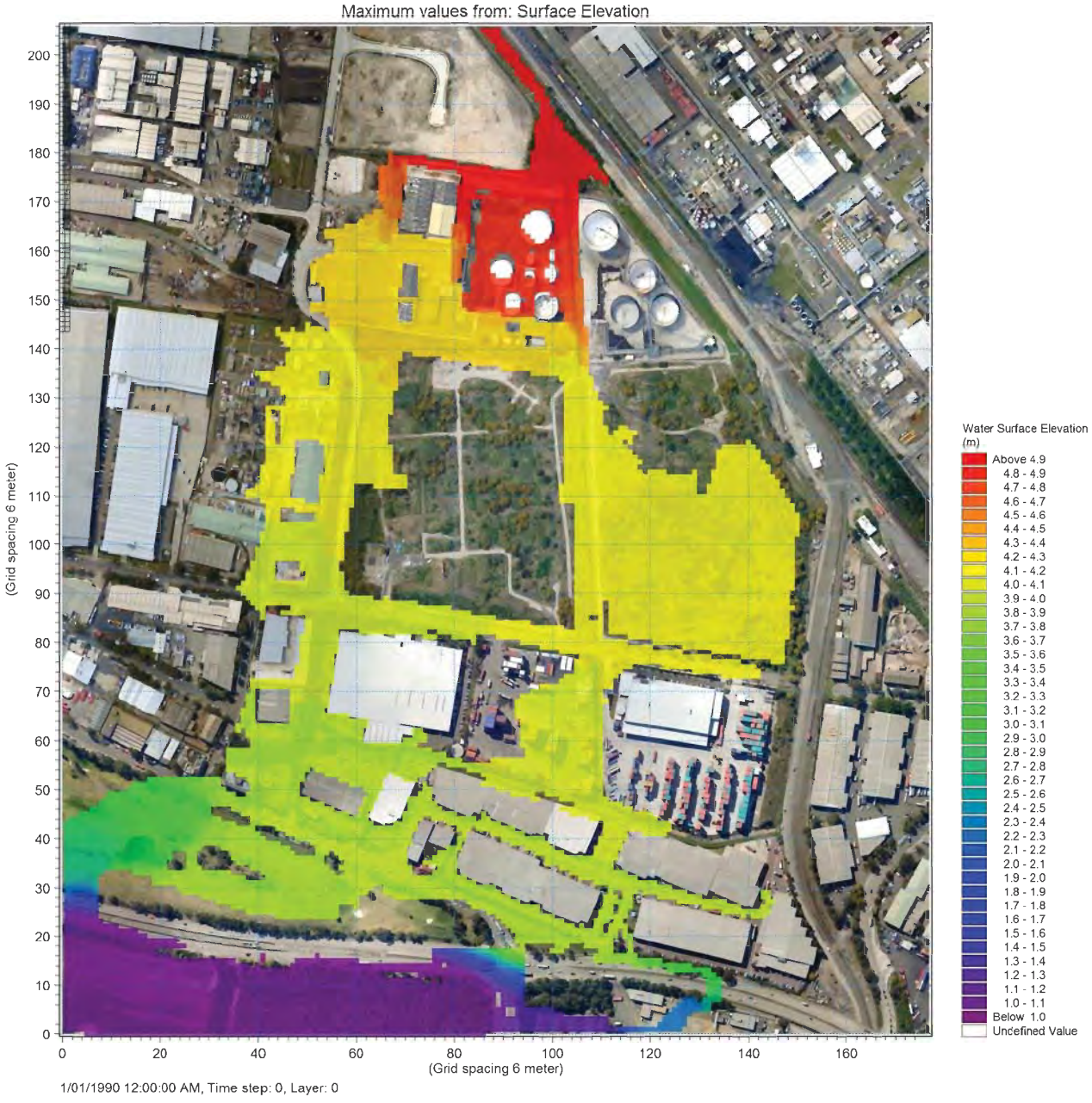
Southlands Flood Modelling **Figure 9**

Stage 1 Development Scenario 1% AEP flood extents



SCALE
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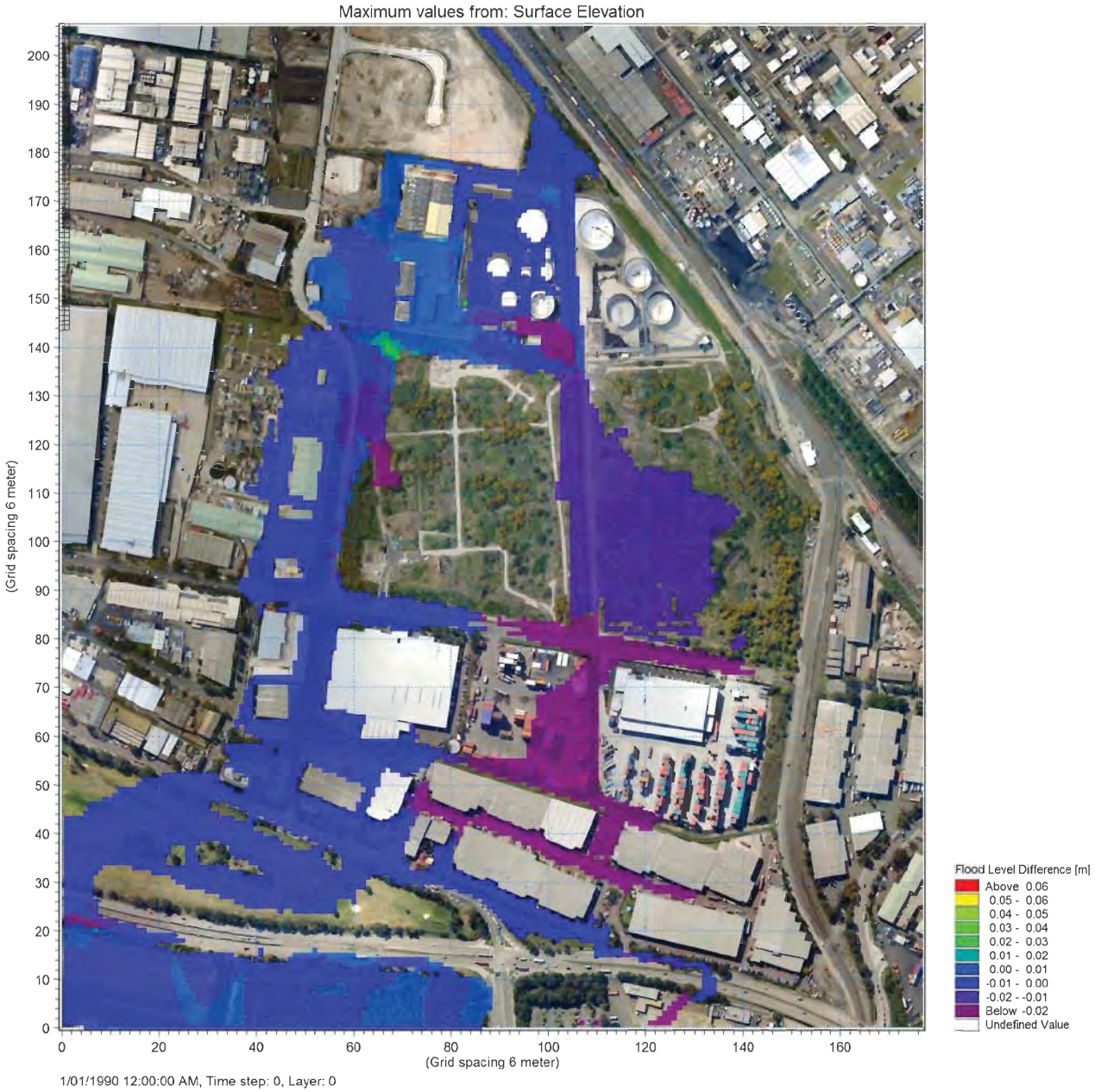
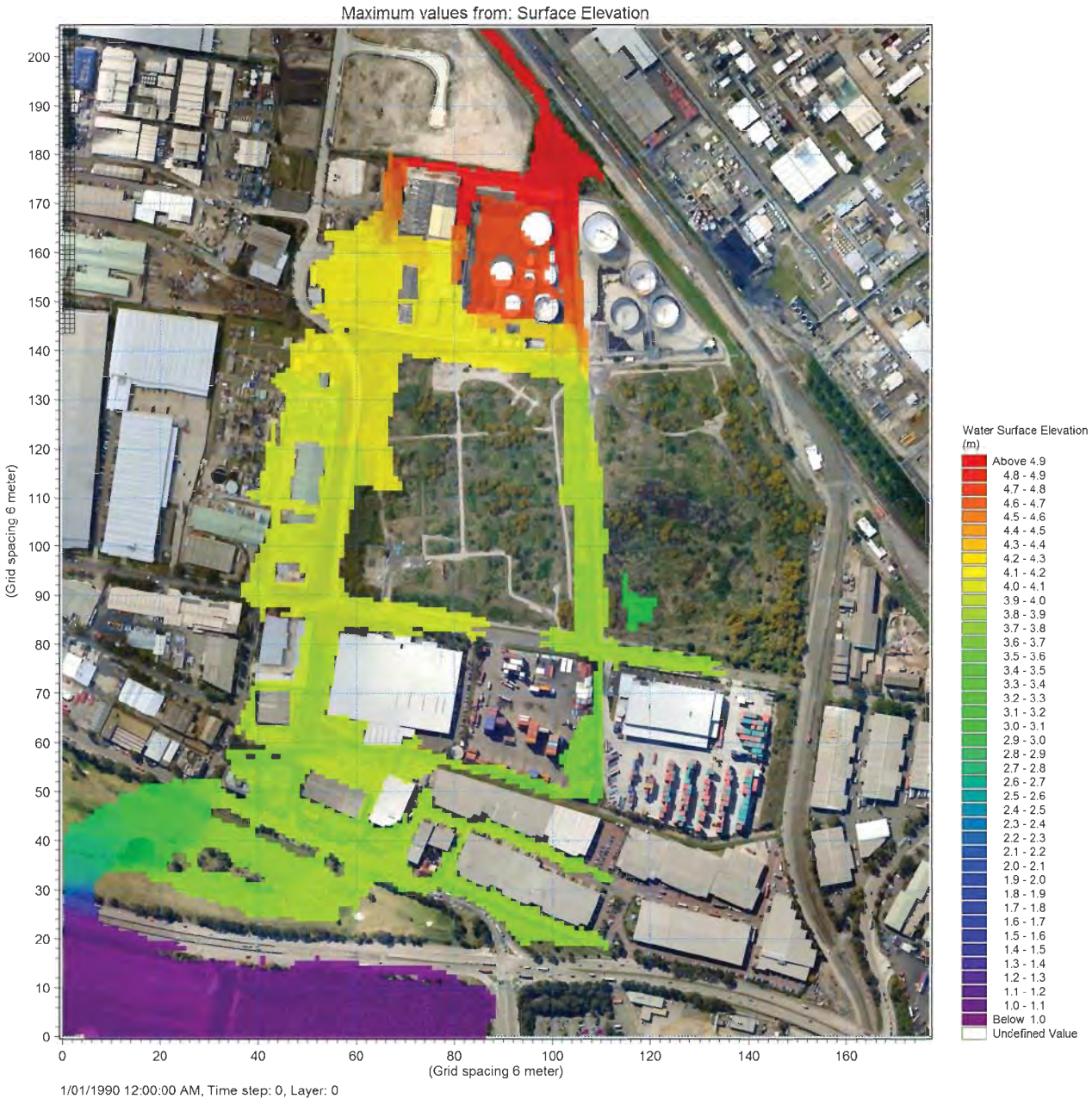
Southlands Flood Modelling **Figure 10**

Stage 1 Development Scenario 1% AEP with Climate Change flood extent



Southlands Flood Modelling **Figure 11**

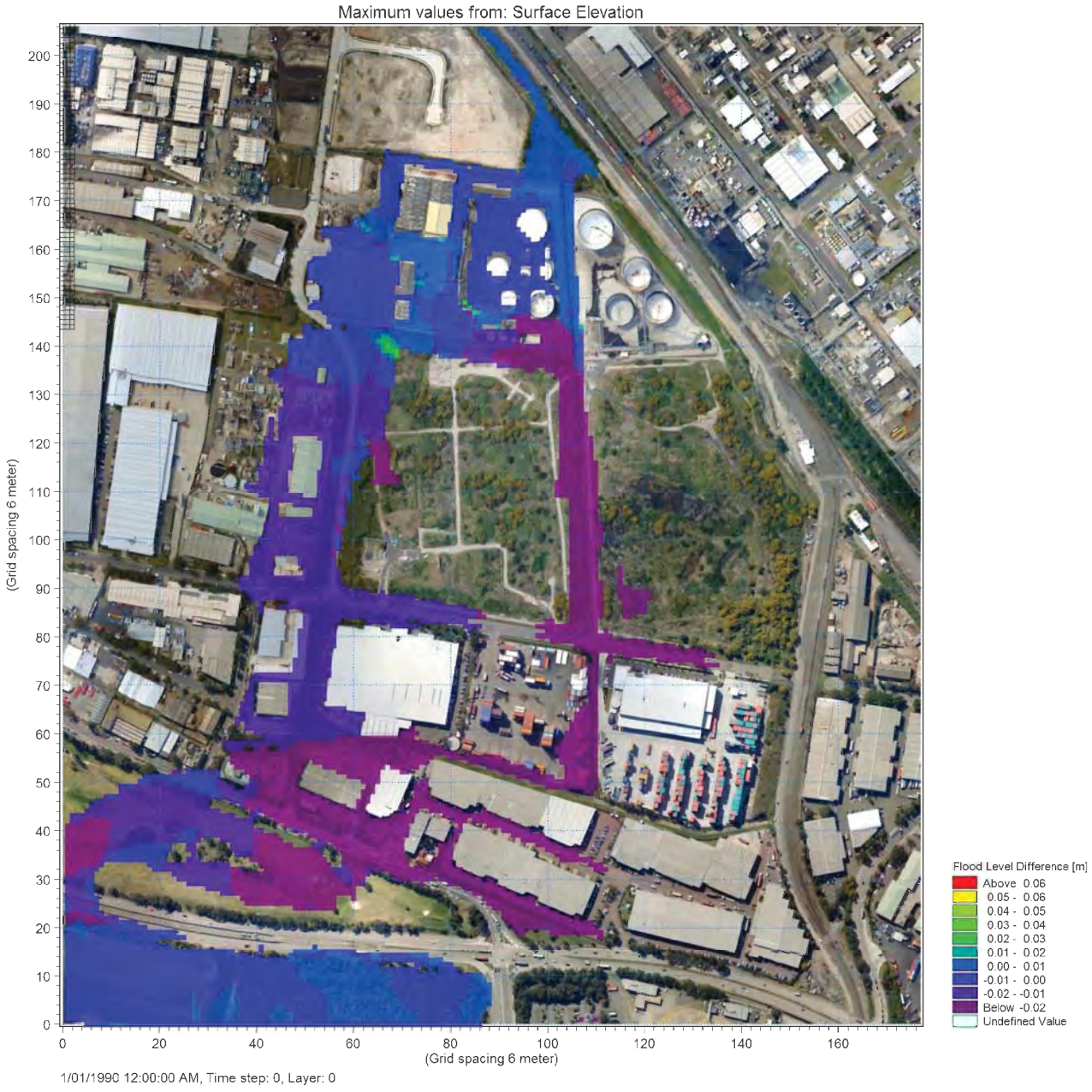
Stage 1 Development Scenario 1% AEP flood level difference map



SCALE
0 160 320m

Southlands Flood Modelling **Figure 12**

Stage 2 Development Scenario 1% AEP flood extents

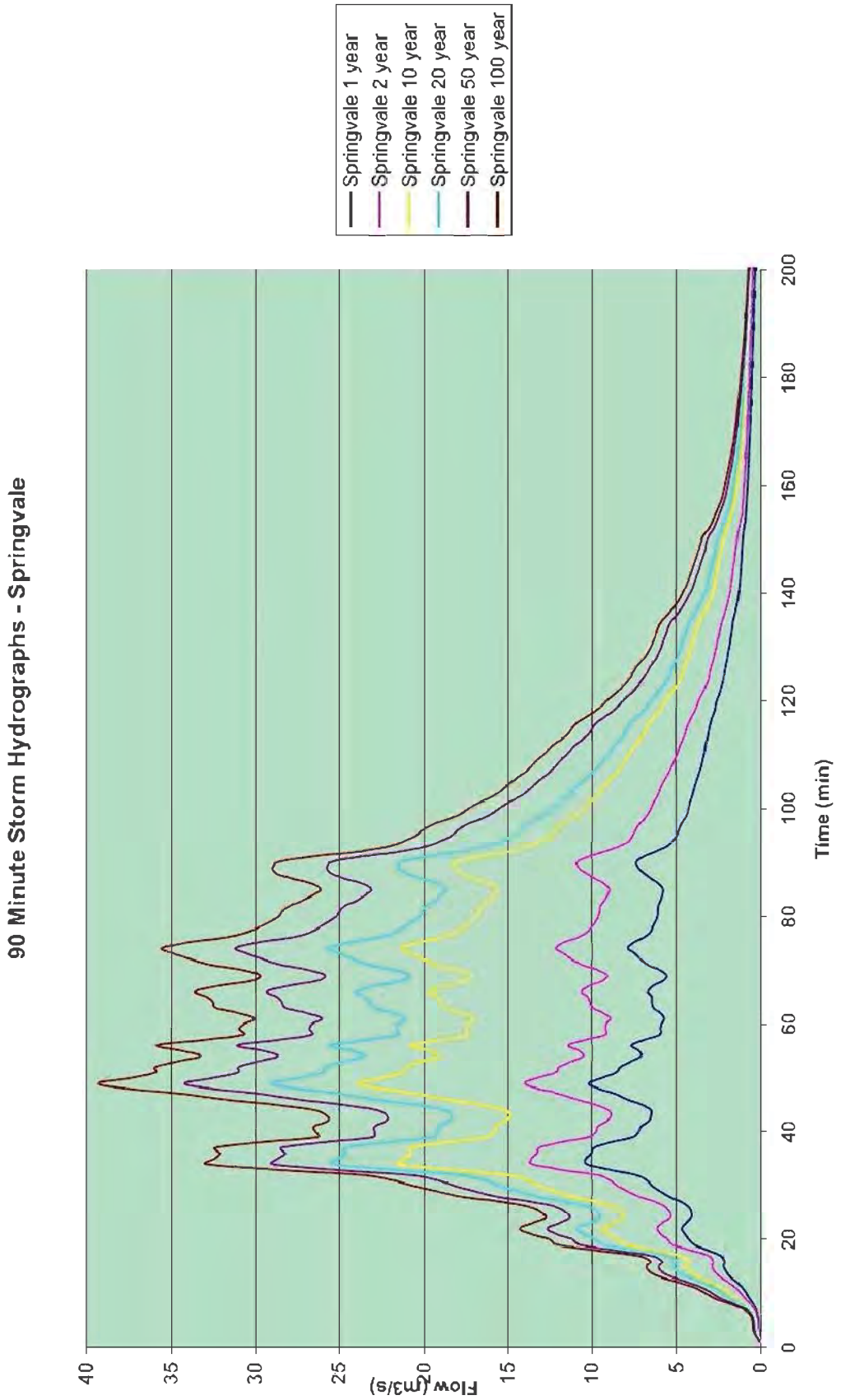


Southlands Flood Modelling

Figure 13

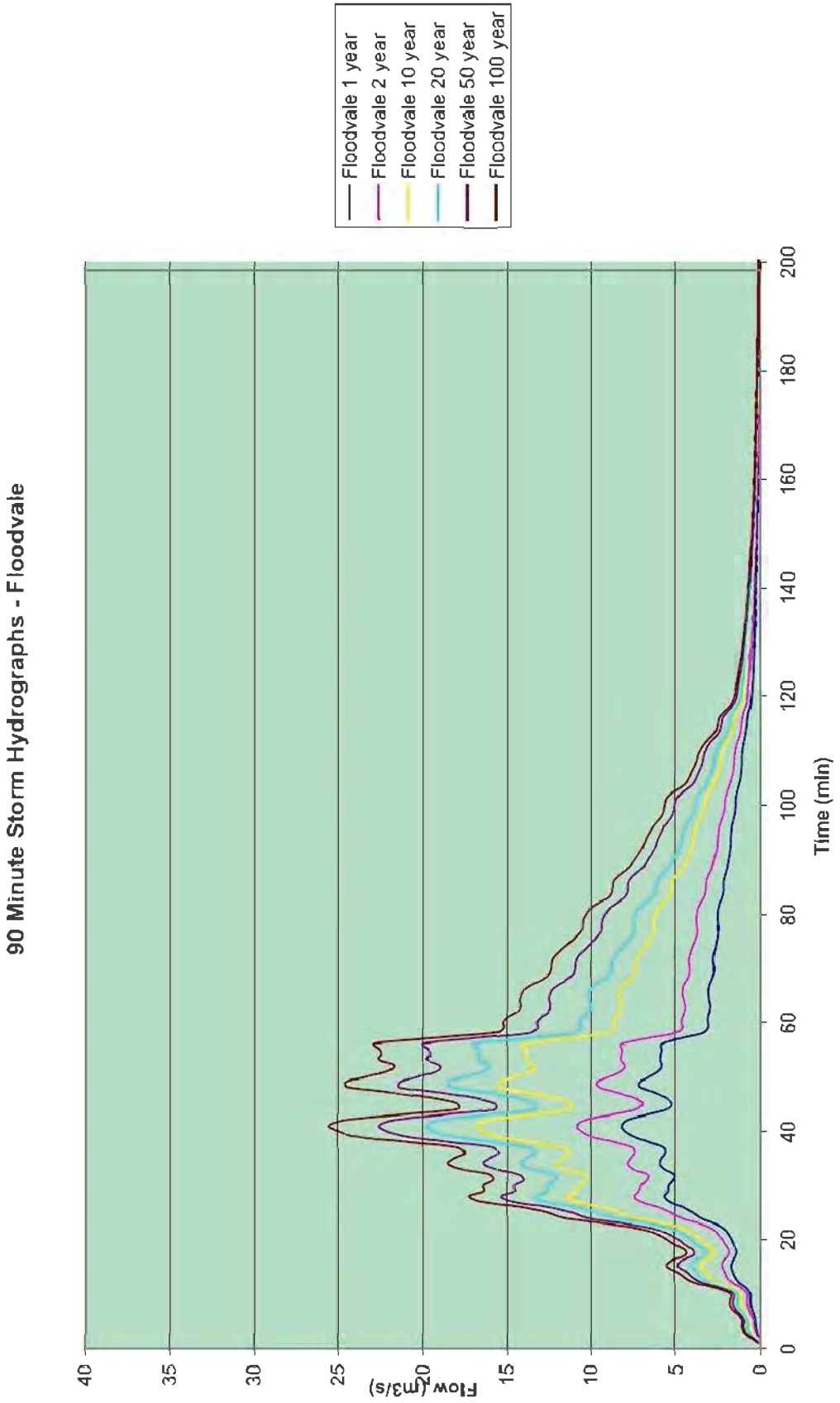
Stage 2 Development Scenario 1% AEP flood level difference map

Appendix B
RAFTS Hydrological Model Results



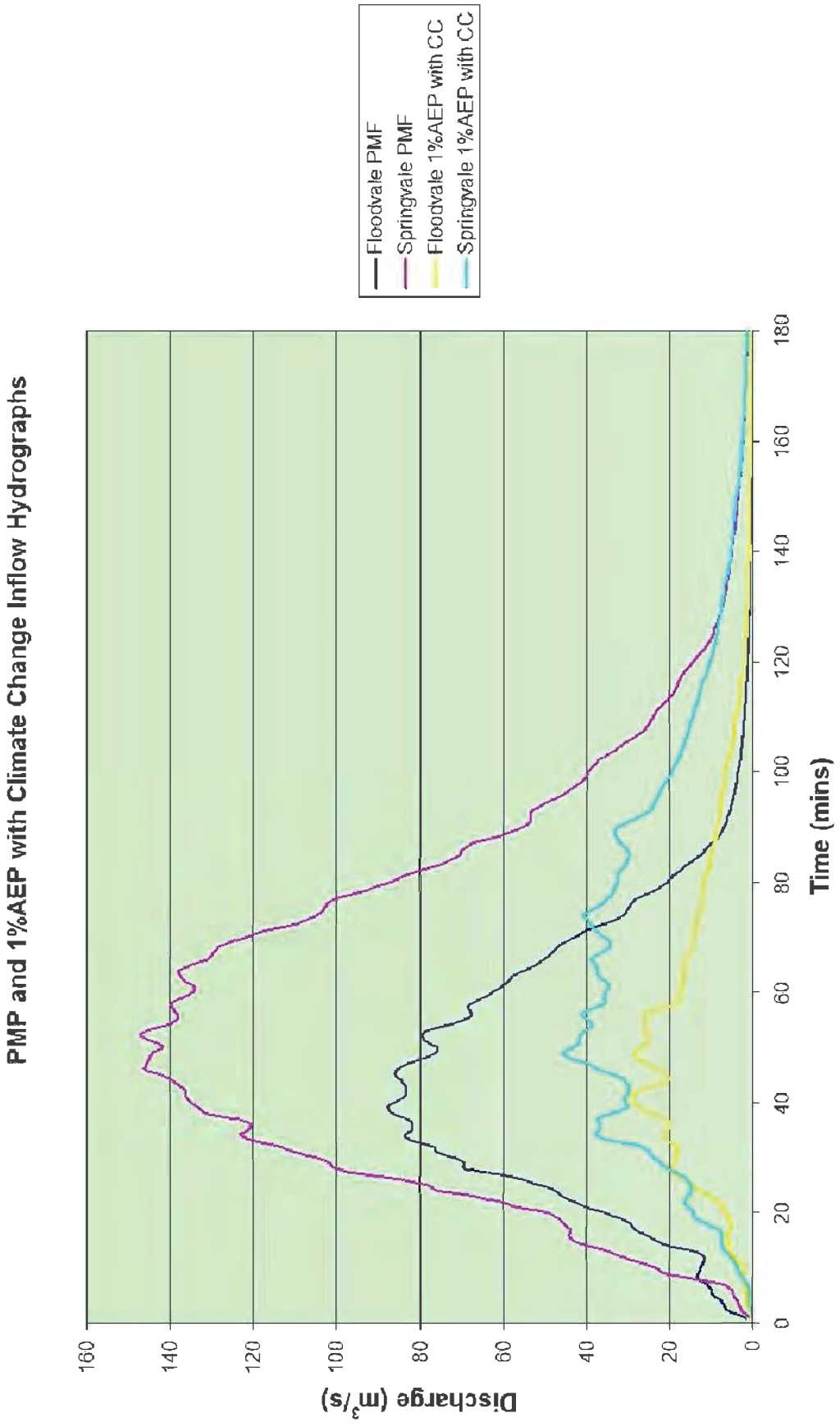
Southlands Flood Modelling **Figure B1**

Springvale Drain discharge hydrographs at different recurrence intervals for 90 minute rainfall event

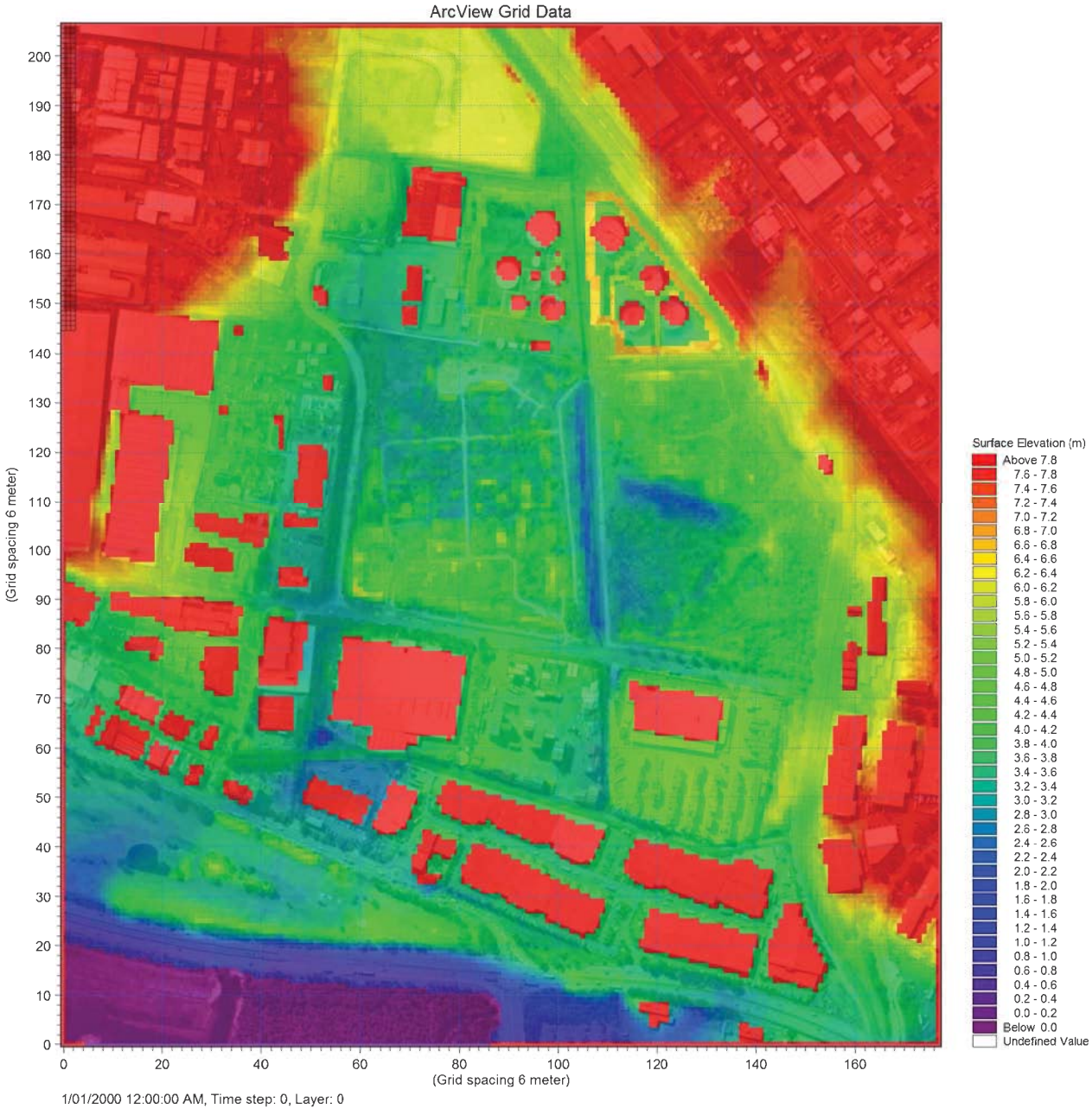


Southlands Flood Modelling **Figure B2**

Floodvale Drain discharge hydrographs at different recurrence intervals for 90 minute rainfall event


PMP and 1%AEP with Climate Change Inflow Hydrographs
Floodvale PMF
Springvale PMF
Floodvale 1%AEP with CC
Springvale 1%AEP with CC
Discharge (m³/s)
Time (mins)
0
20
40
60
80
100
120
140
160
180

Appendix C
Flood Model Setup



SCALE
0 160 320m

Southlands Flood Modelling **Figure C1**

Existing Scenario MIKE 21 terrain model

SCALE
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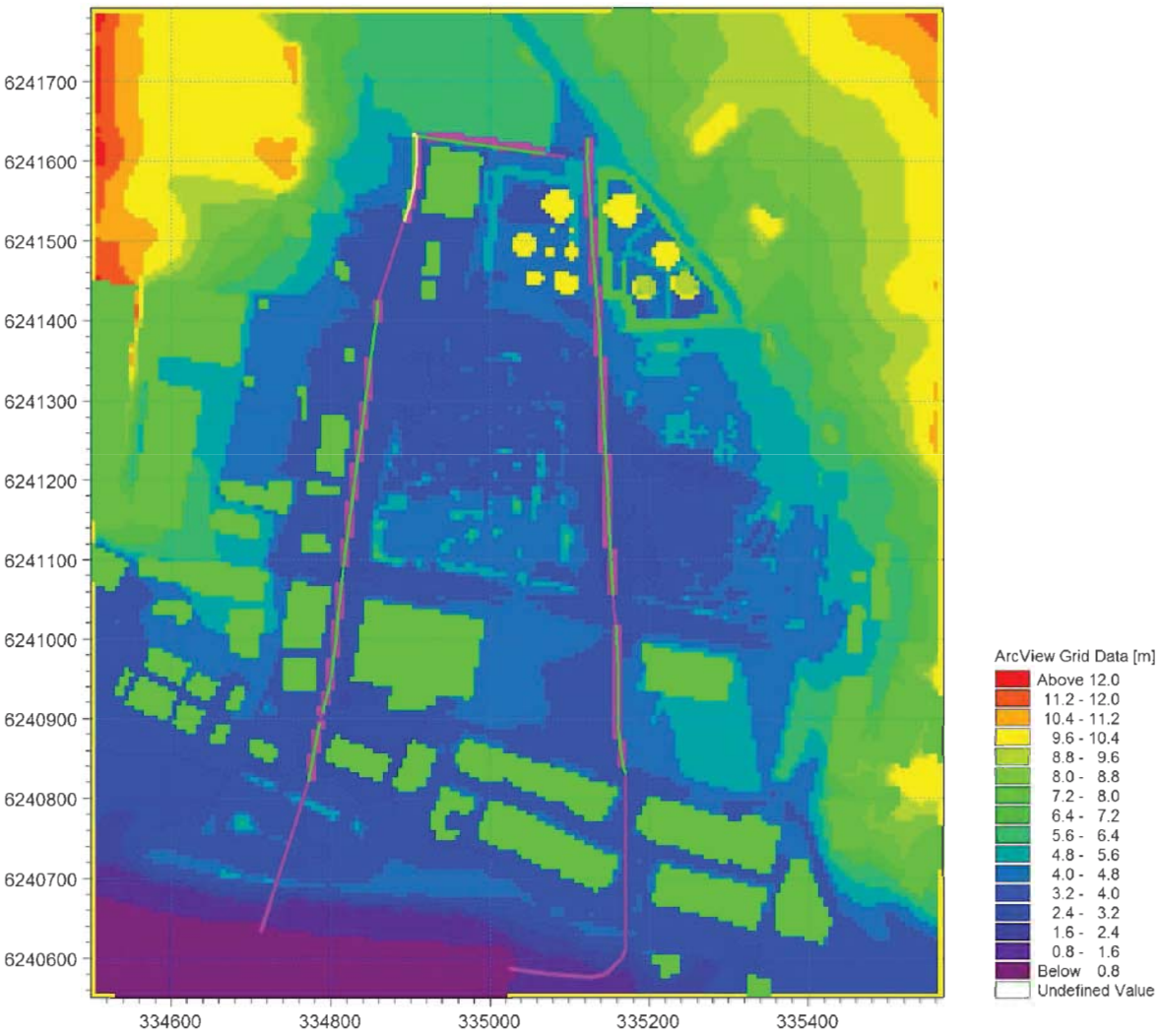
Southlands Flood Modelling **Figure C2**

Existing Scenario MIKE 21 Manning M (1/n) roughness parameters



SCALE

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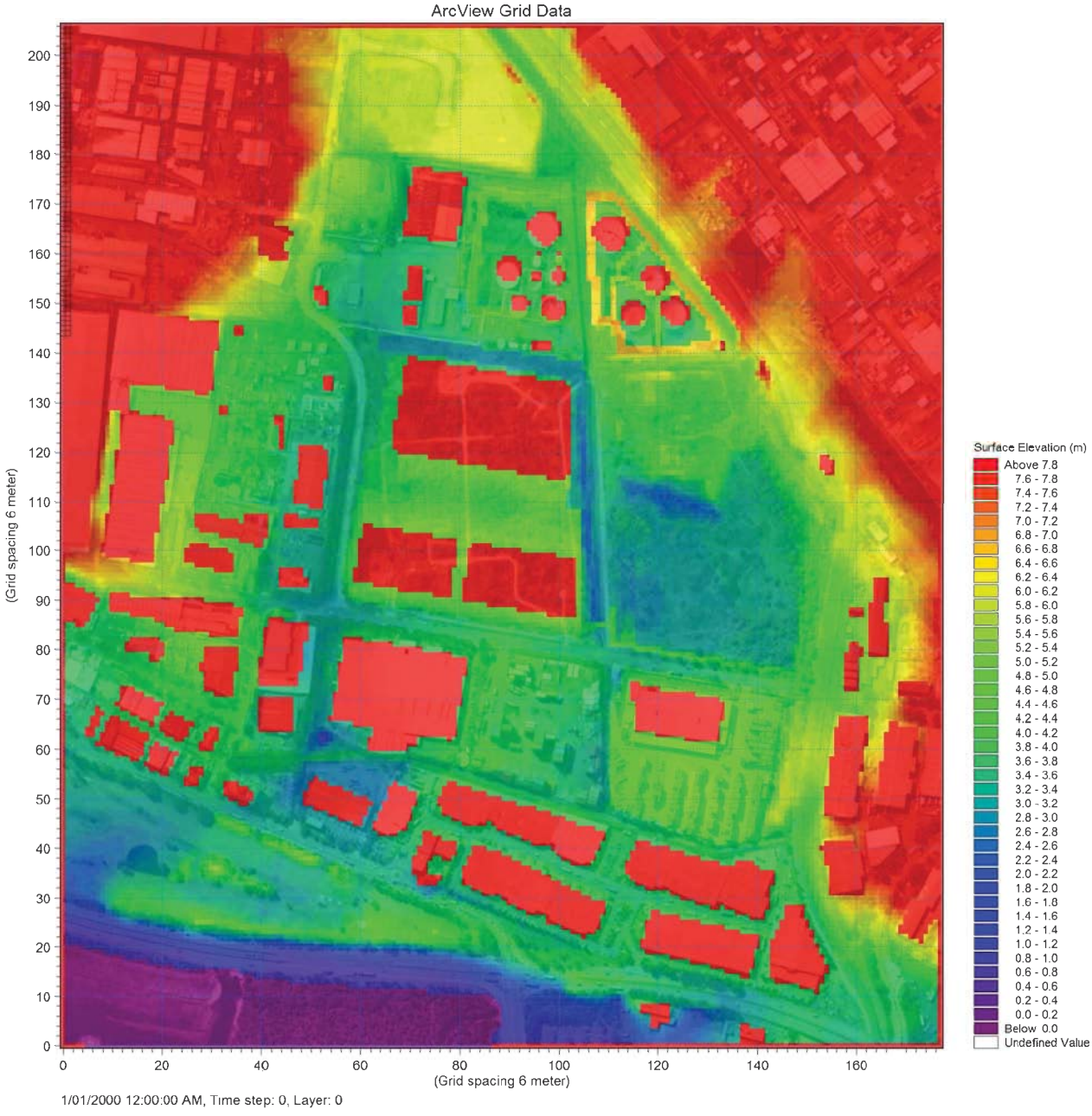
Southlands Flood Modelling **Figure C3**

Existing Scenario MIKE FLOOD model setup schematic showing lateral links



SCALE
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Southlands Flood Modelling **Figure C4**

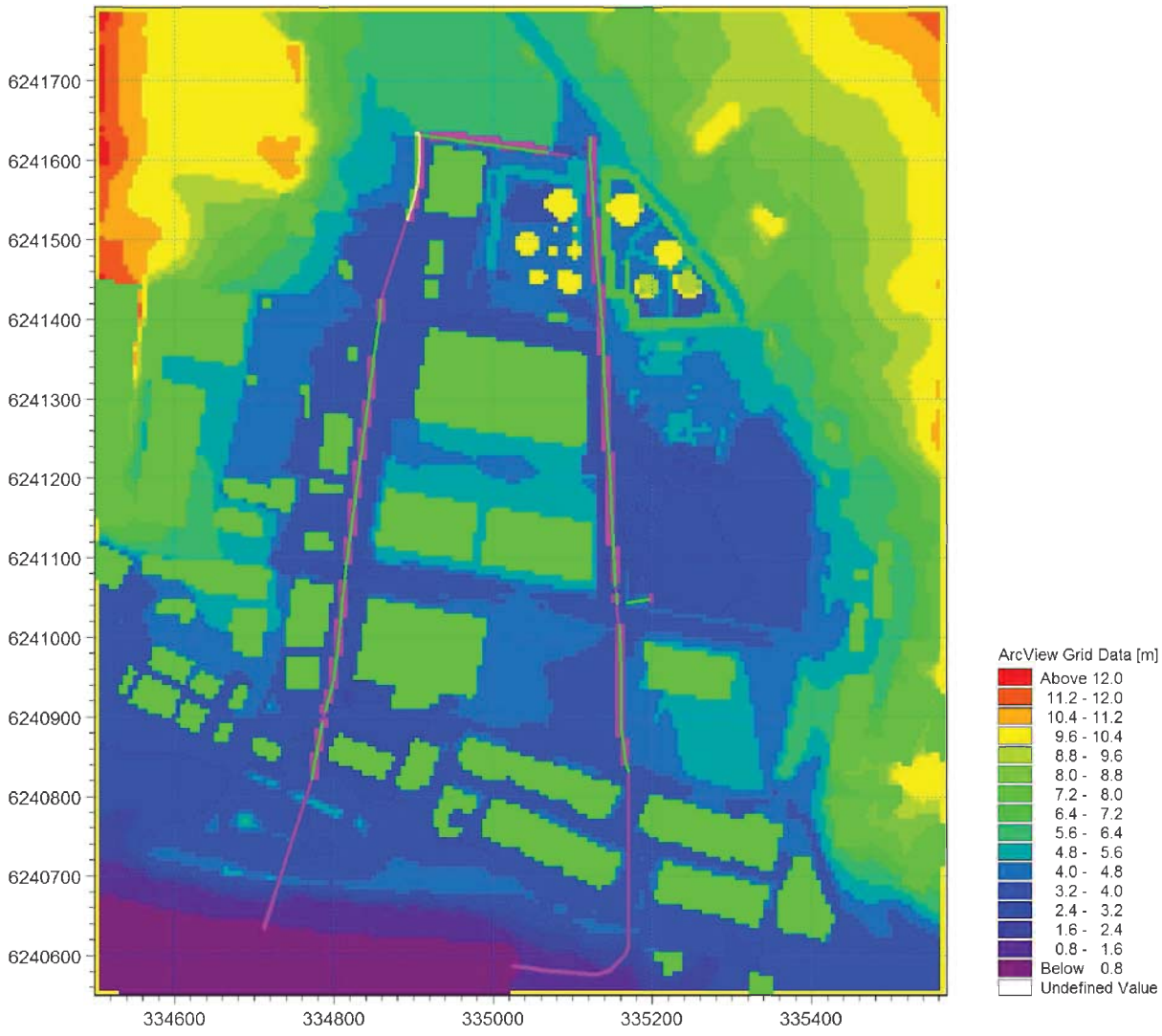
Stage 1 development scenario MIKE 21 terrain model

SCALE

0 160 320m

Southlands Flood Modelling **Figure C5**

Stage 1 development scenario MIKE 21 Manning M (1/n) roughness parameters



SCALE

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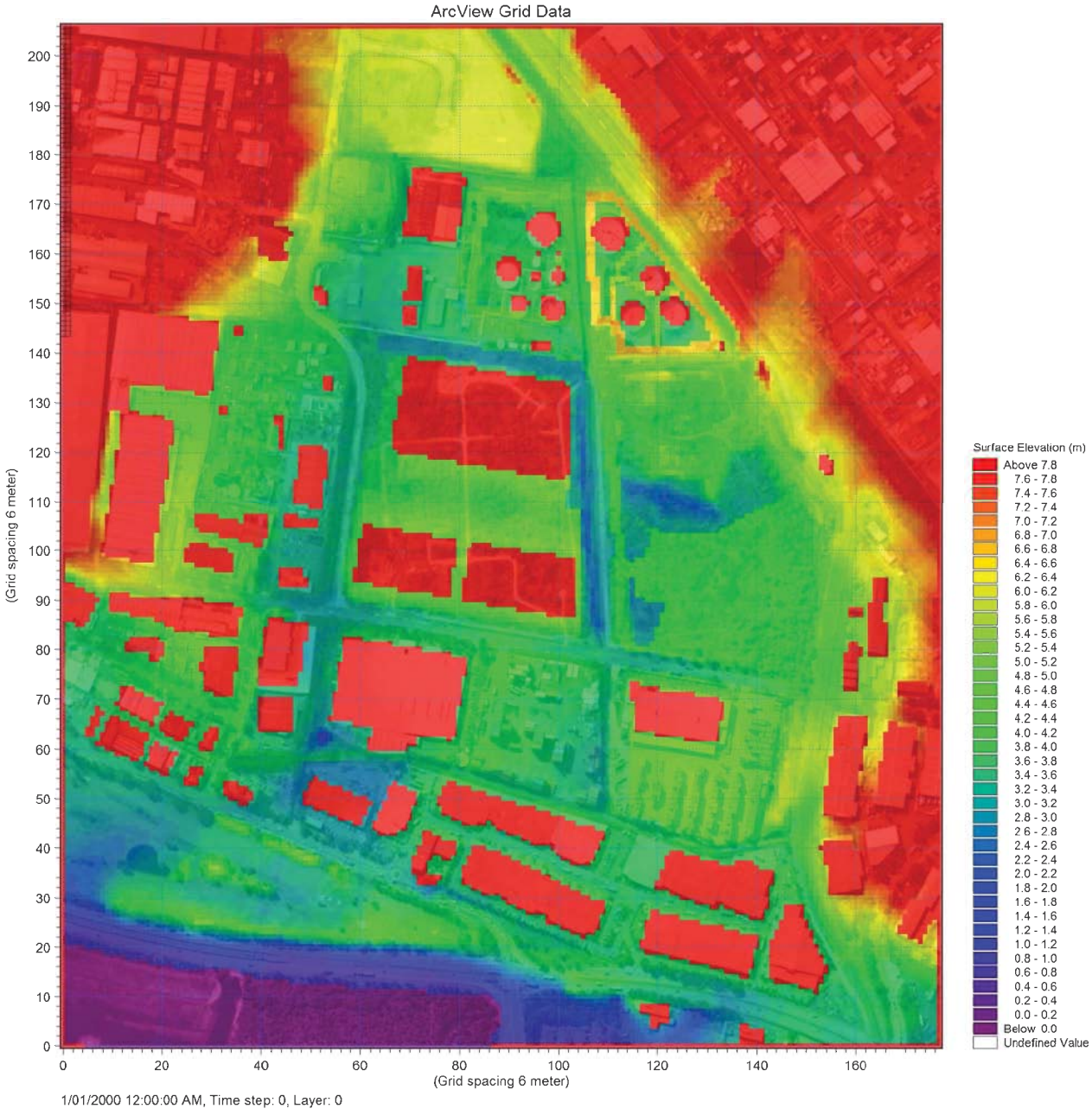
Southlands Flood Modelling **Figure C6**

Stage1 development scenario MIKE FLOOD model setup schematic showing lateral links



SCALE
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Southlands Flood Modelling **Figure C7**

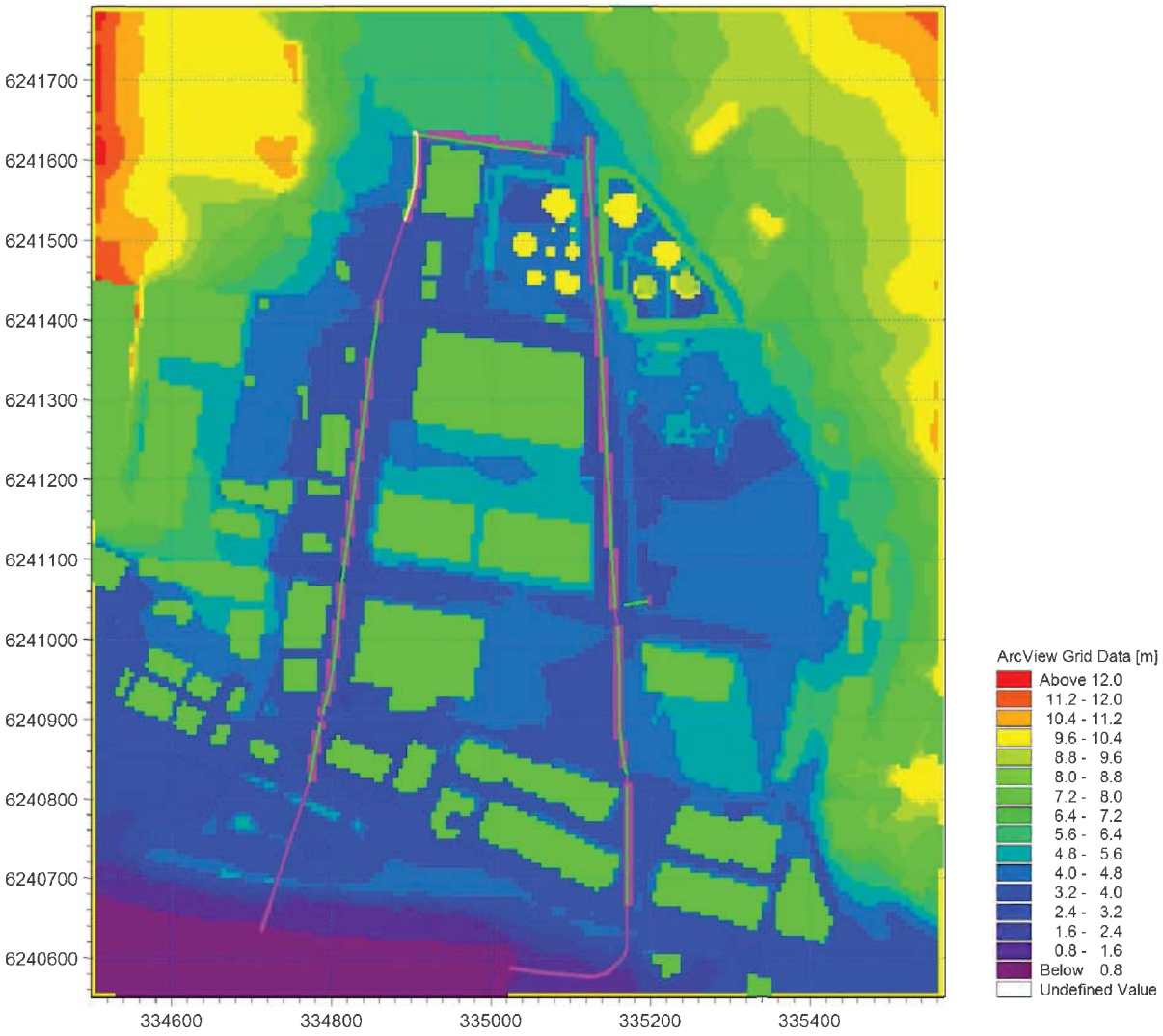
Stage 2 development scenario MIKE 21 terrain model

SCALE

0 160 320m

Southlands Flood Modelling **Figure C8**

Stage 2 development scenario MIKE 21 Manning M (1/n) roughness parameters



SCALE

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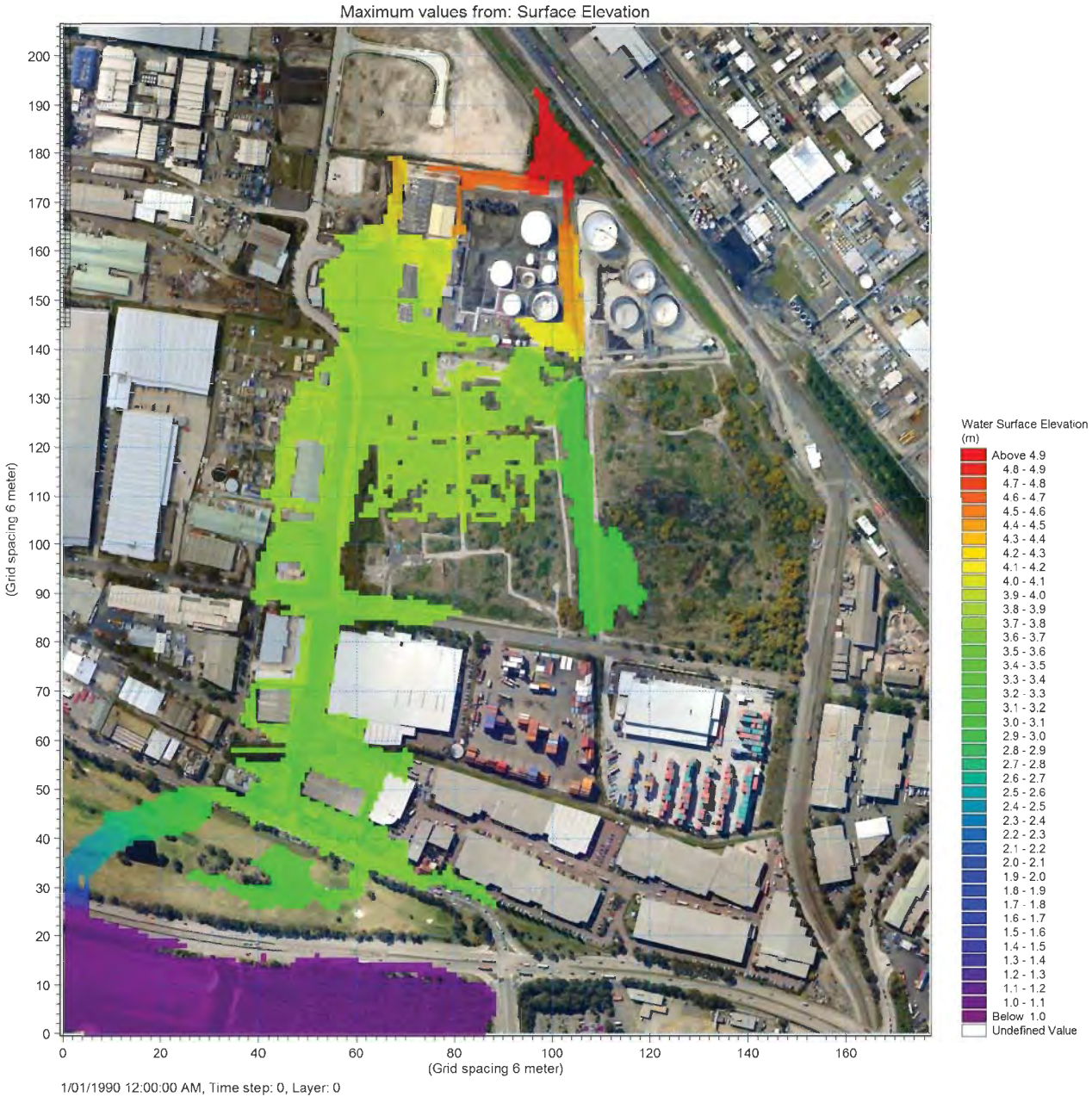
Southlands Flood Modelling **Figure C9**

Stage 2 development scenario MIKE FLOOD model setup schematic showing lateral links

Appendix D
Flood Model Results



SCALE
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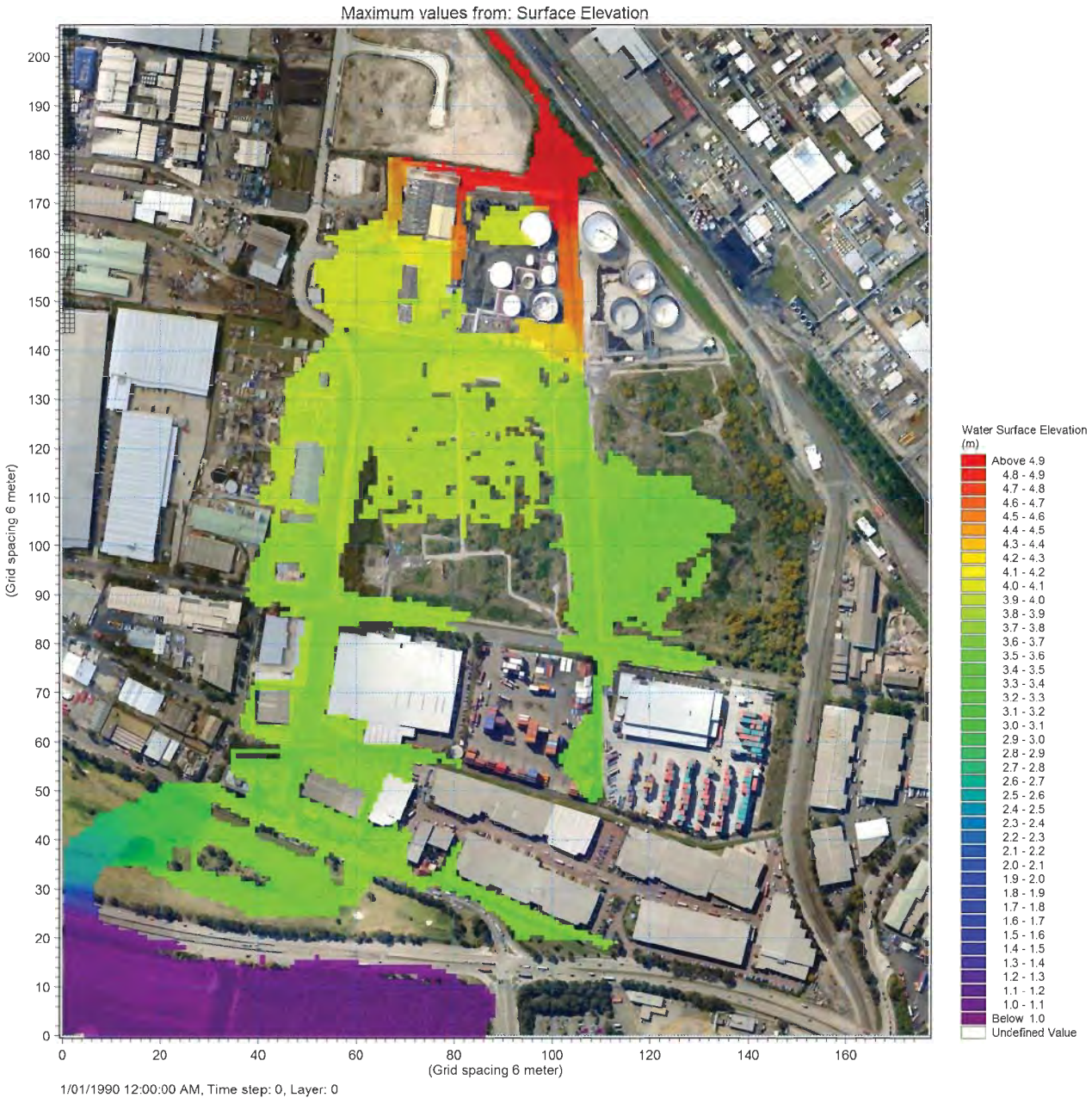
Southlands Flood Modelling **Figure D1**

Existing Scenario 50% AEP flood extents



SCALE
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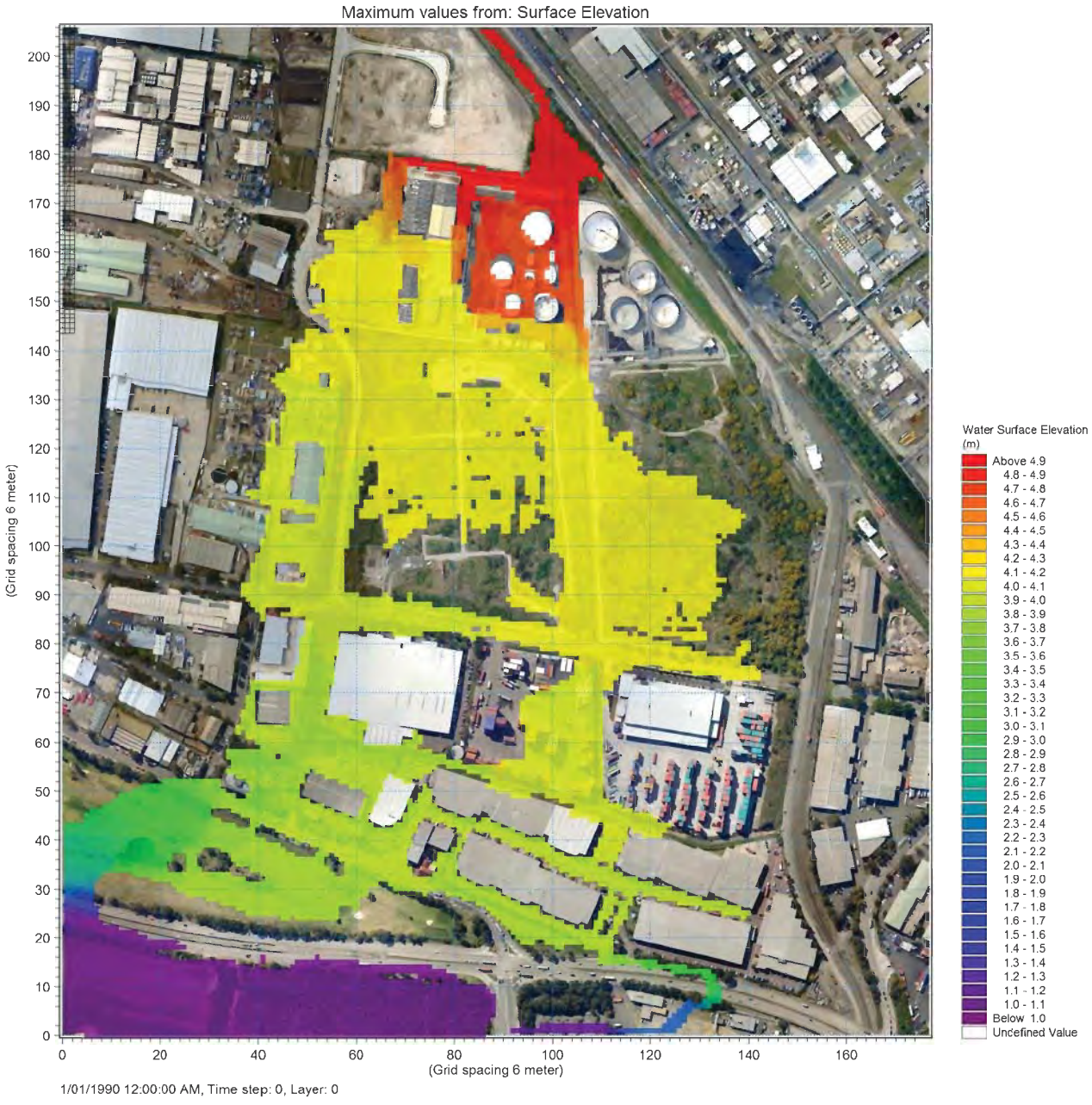
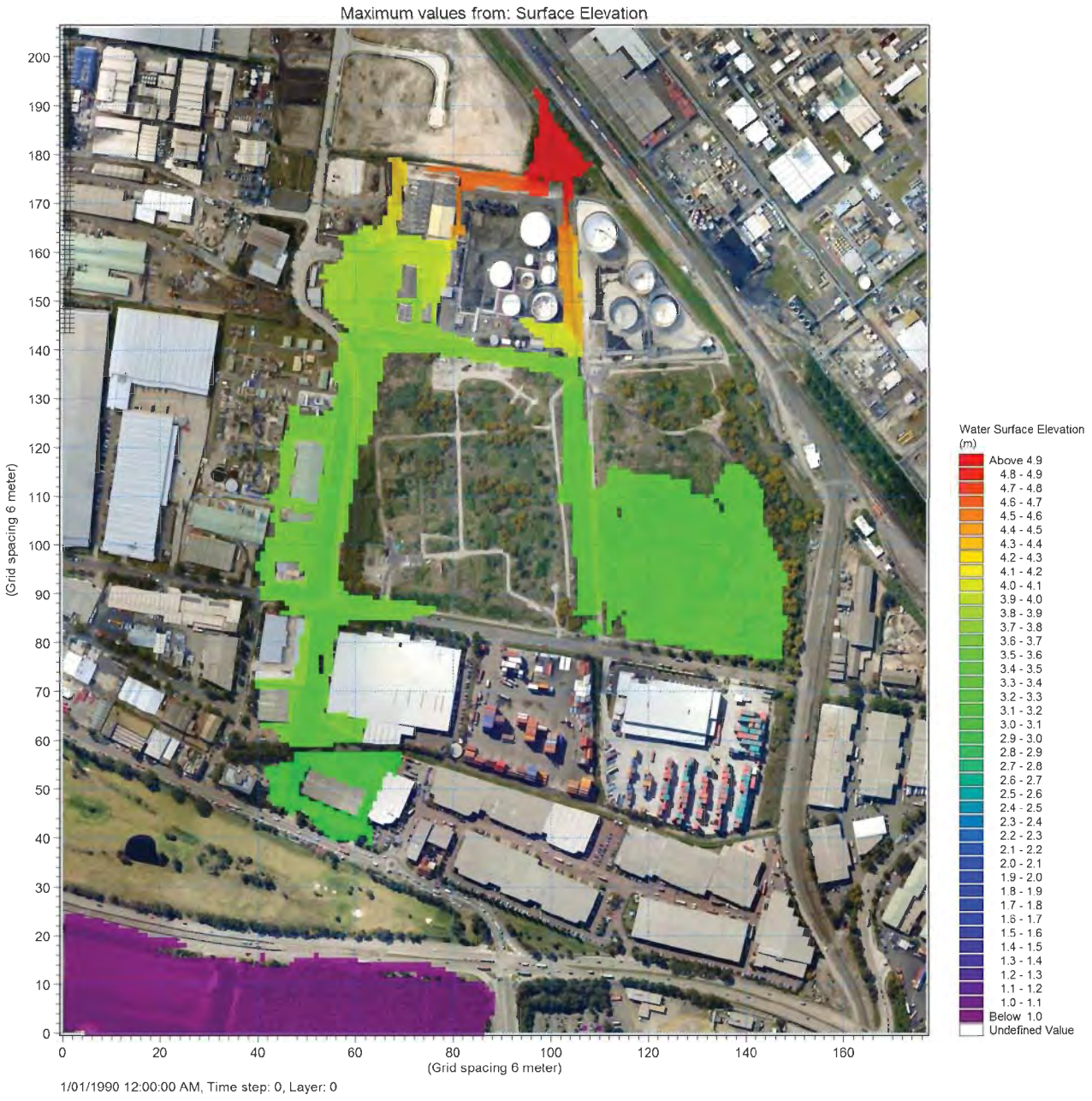
Southlands Flood Modelling **Figure D2**

Existing Scenario 10% AEP flood extents



Southlands Flood Modelling **Figure D3**

Existing Scenario 1% AEP flood extents



SCALE
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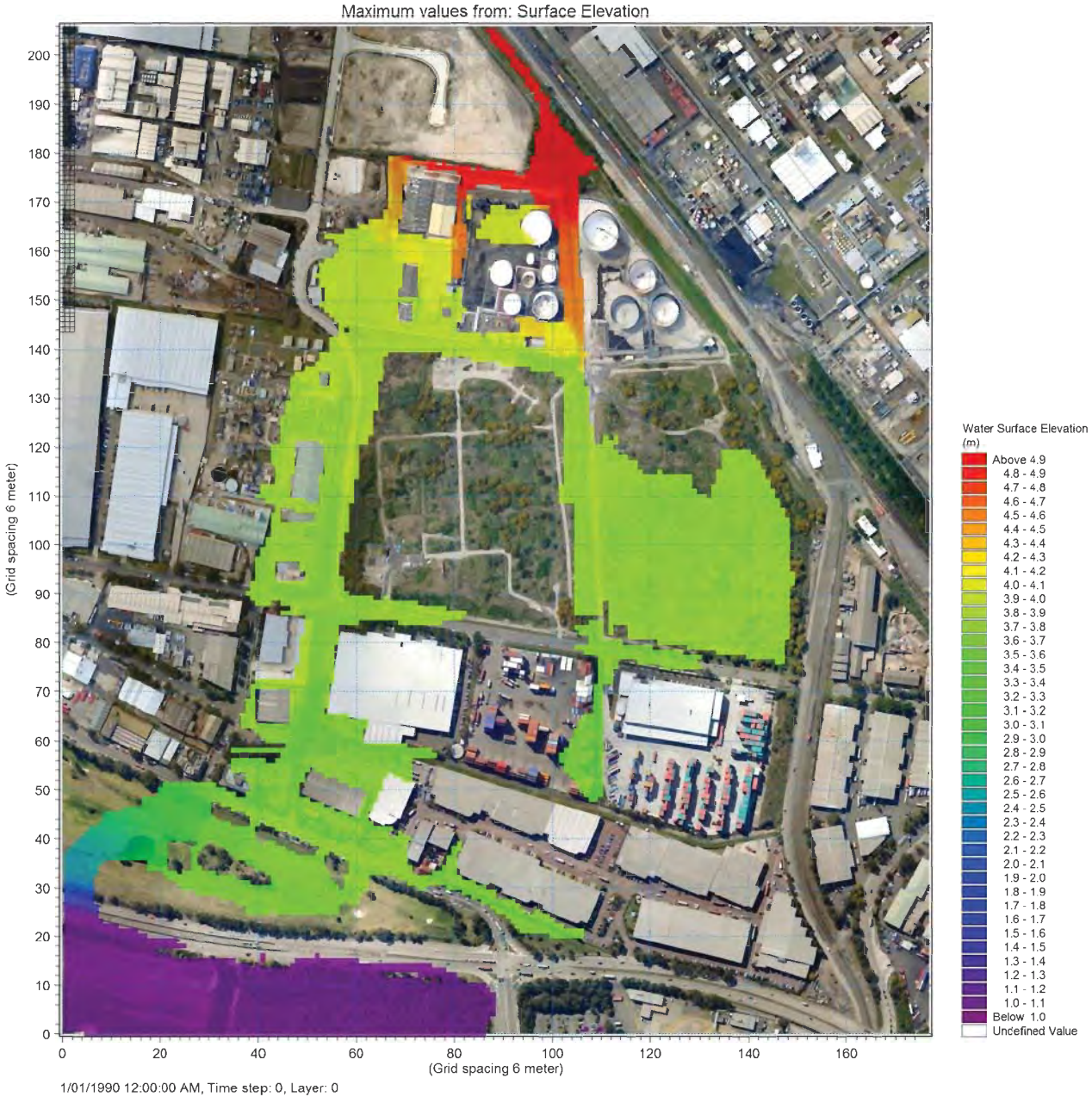
Southlands Flood Modelling **Figure D4**

Stage 1 Development Scenario 50% AEP flood extents



SCALE
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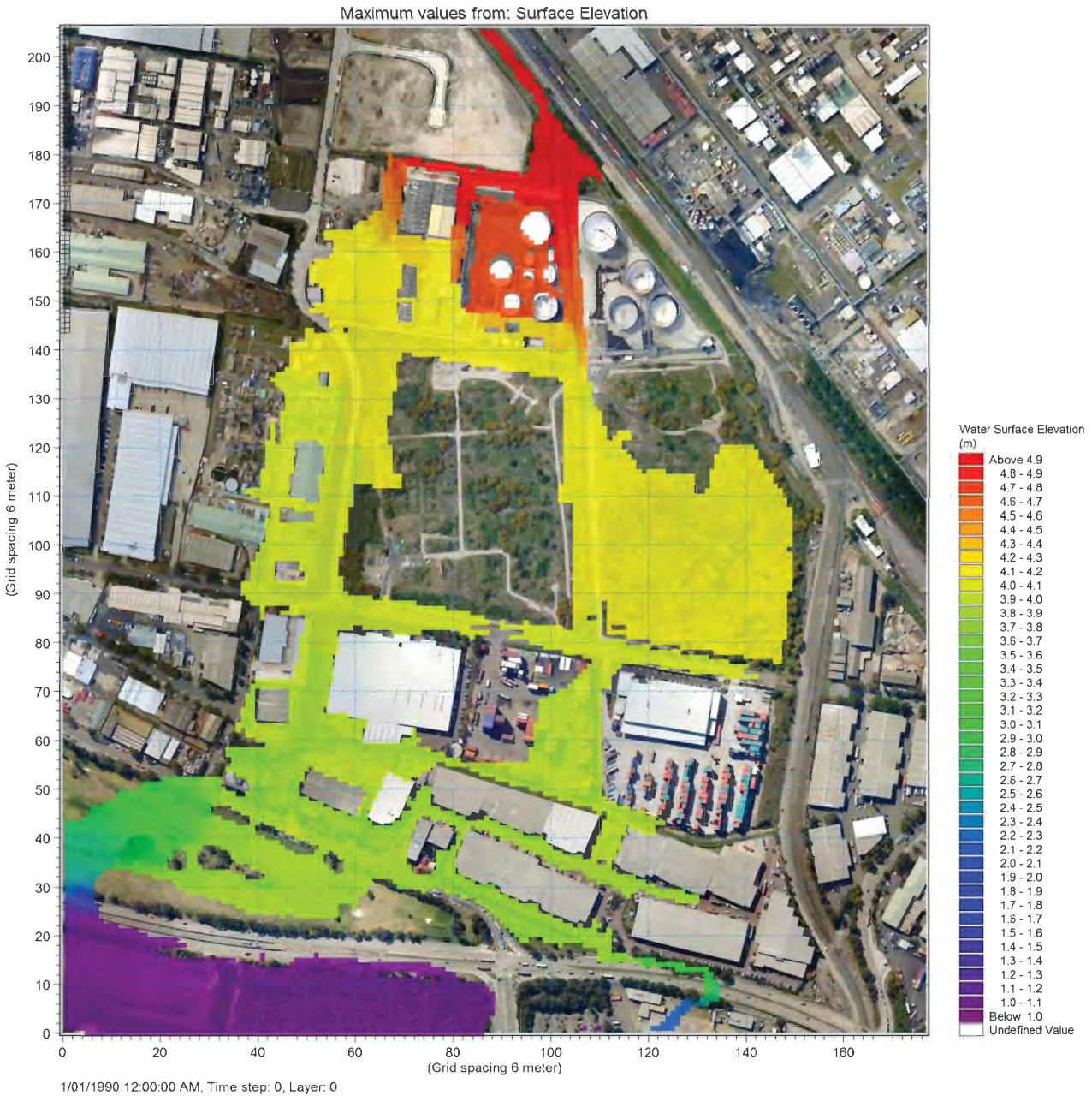
Southlands Flood Modelling **Figure D5**

Stage 1 Development Scenario 10% AEP flood extents



SCALE
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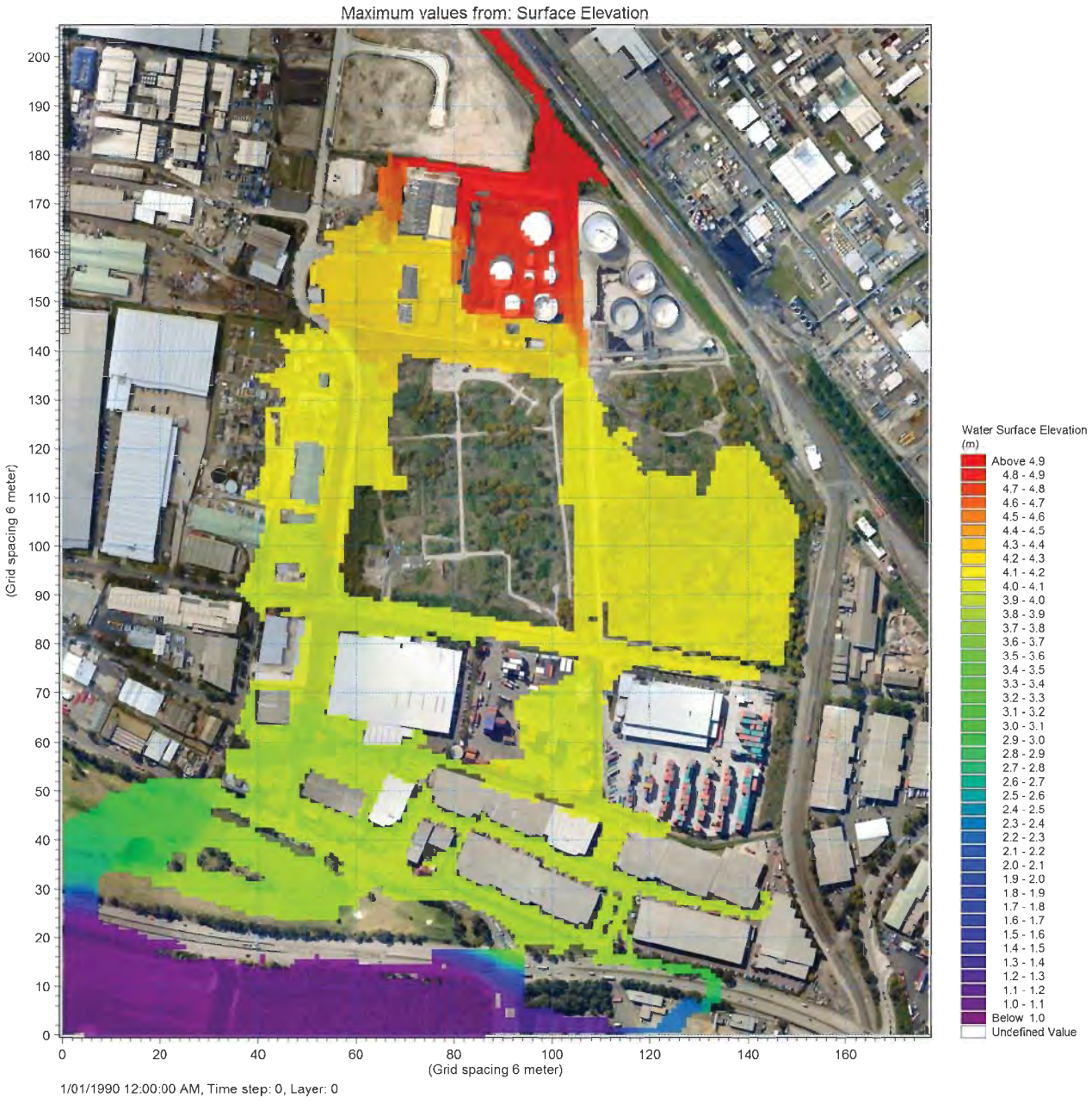
Southlands Flood Modelling **Figure D6**

Stage 1 Development Scenario 1% AEP flood extents



SCALE
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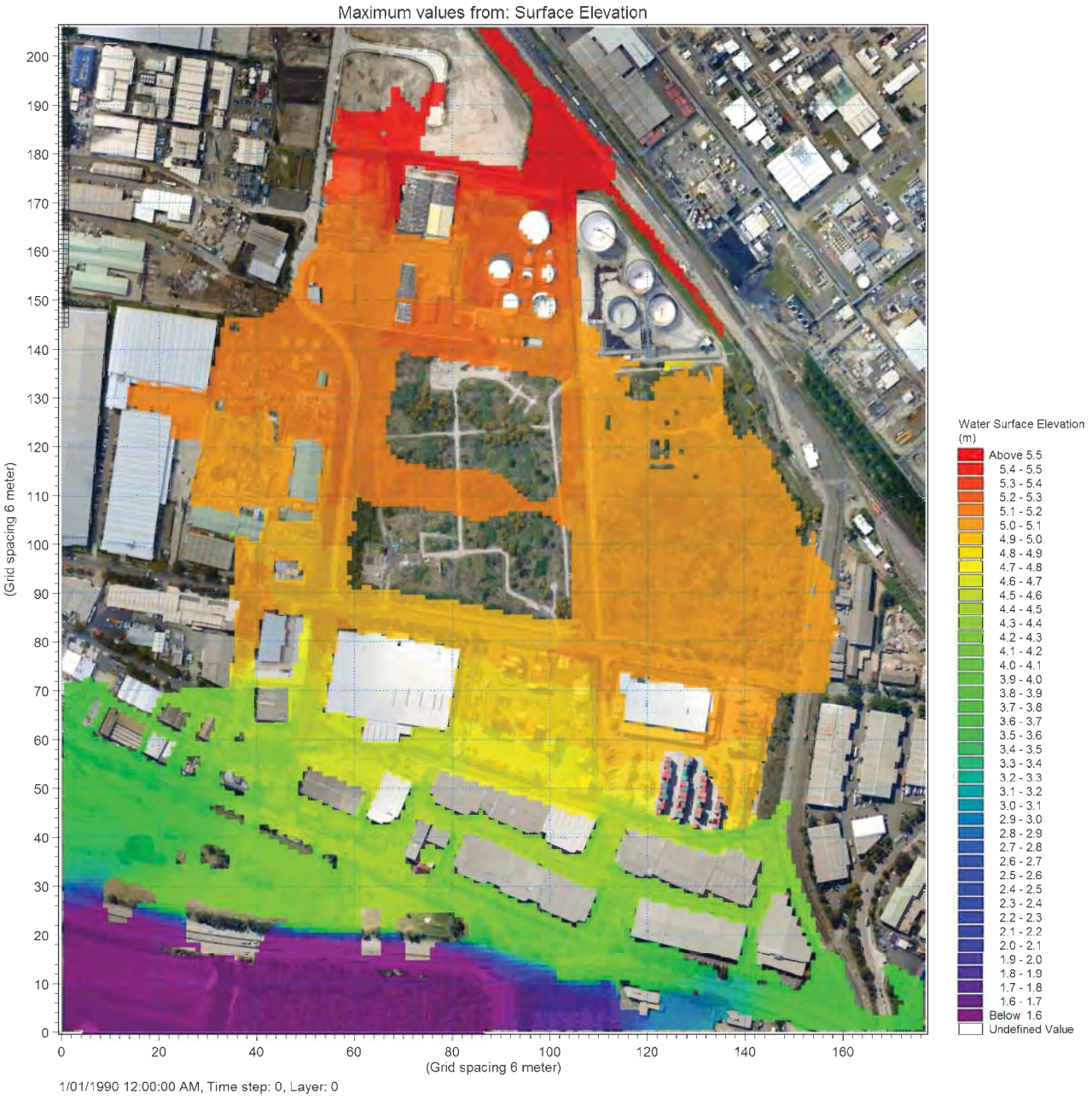
Southlands Flood Modelling **Figure D7**

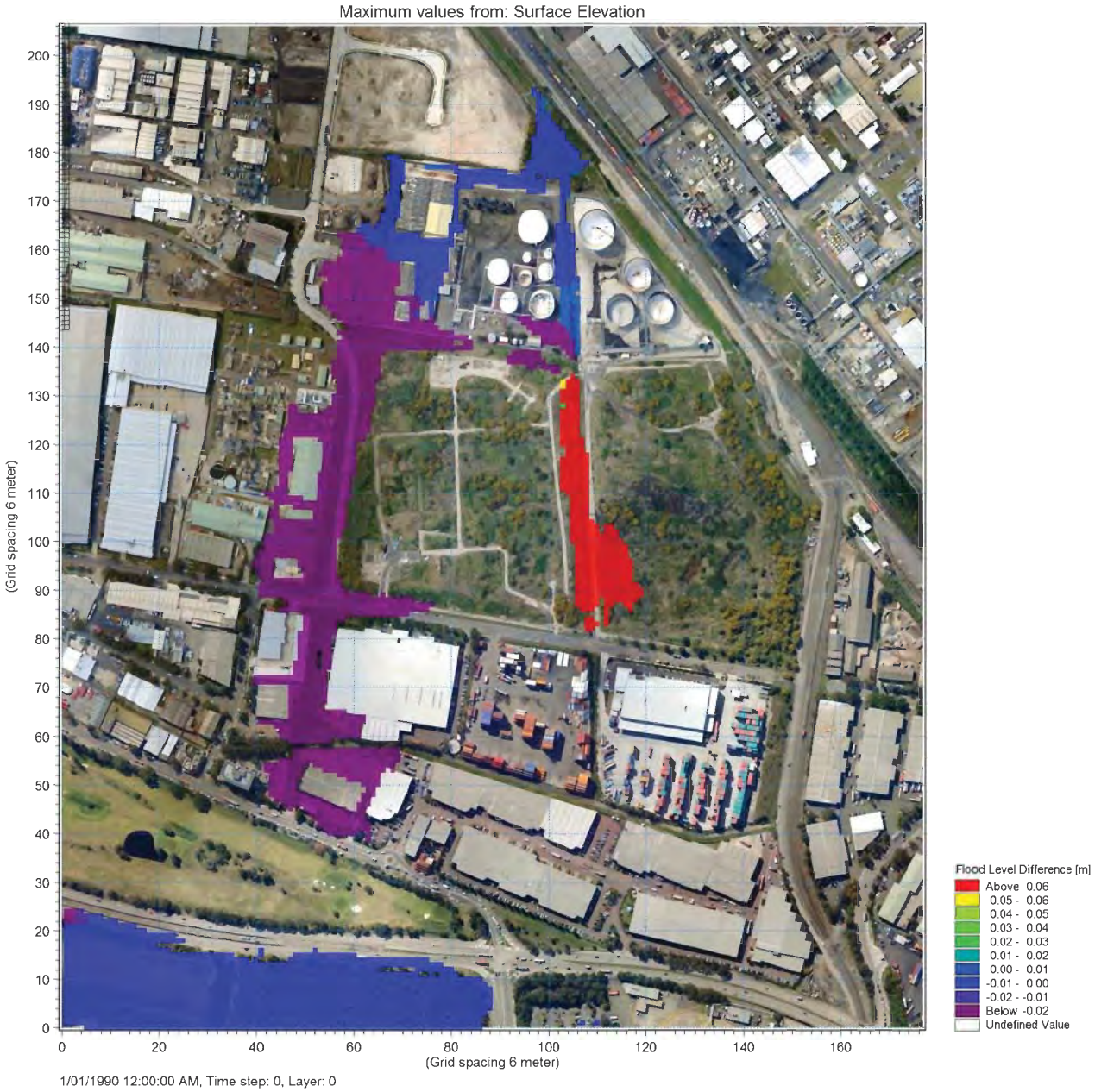
Stage 1 Development Scenario 1% AEP with Climate Change flood extents



SCALE
0 160 320m

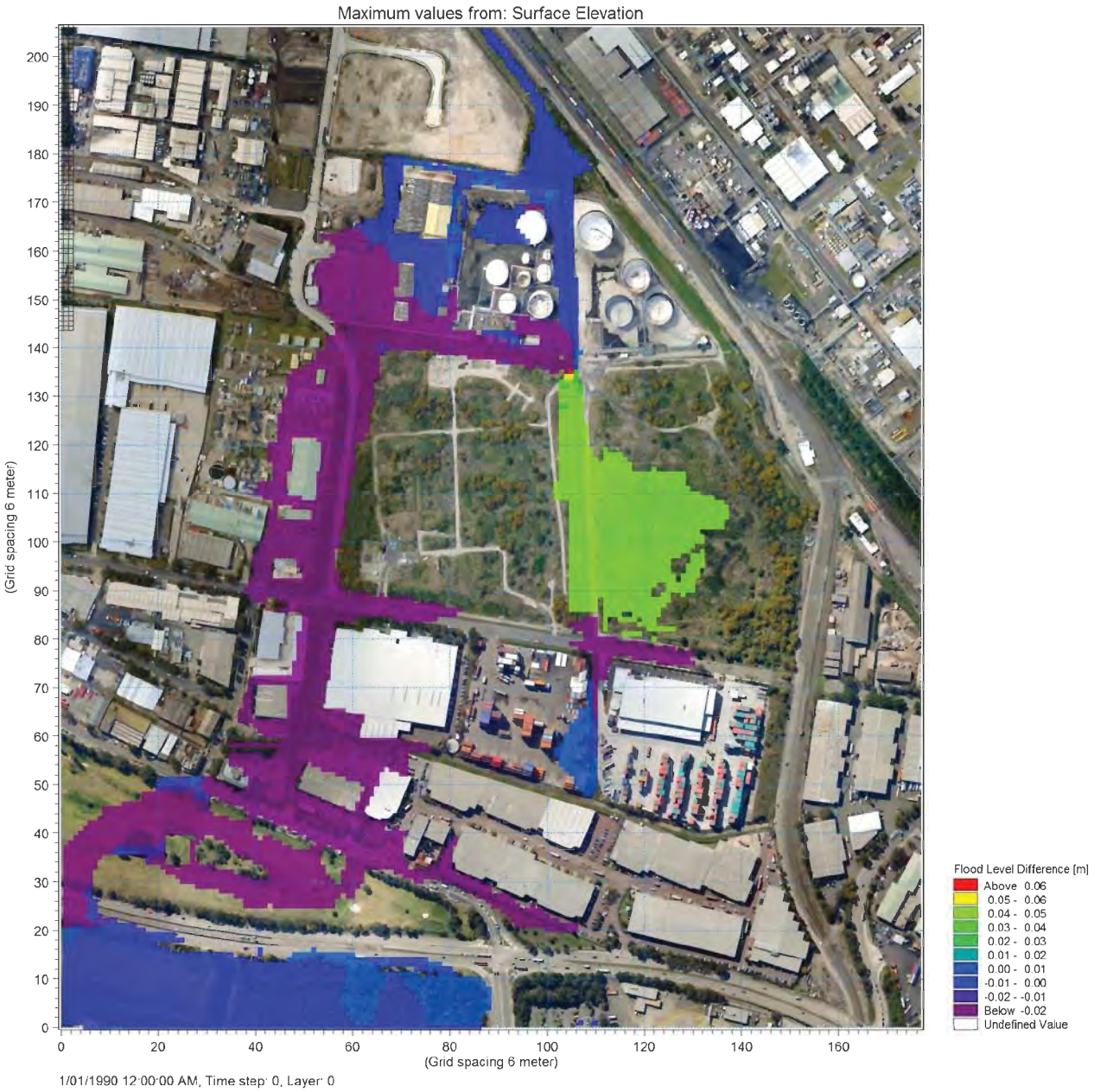
Southlands Flood Modelling **Figure D8**

Stage 1 Development Scenario PMF flood extents



Southlands Flood Modelling **Figure D9**

Stage 1 Development Scenario 50% AEP flood level difference map



SCALE
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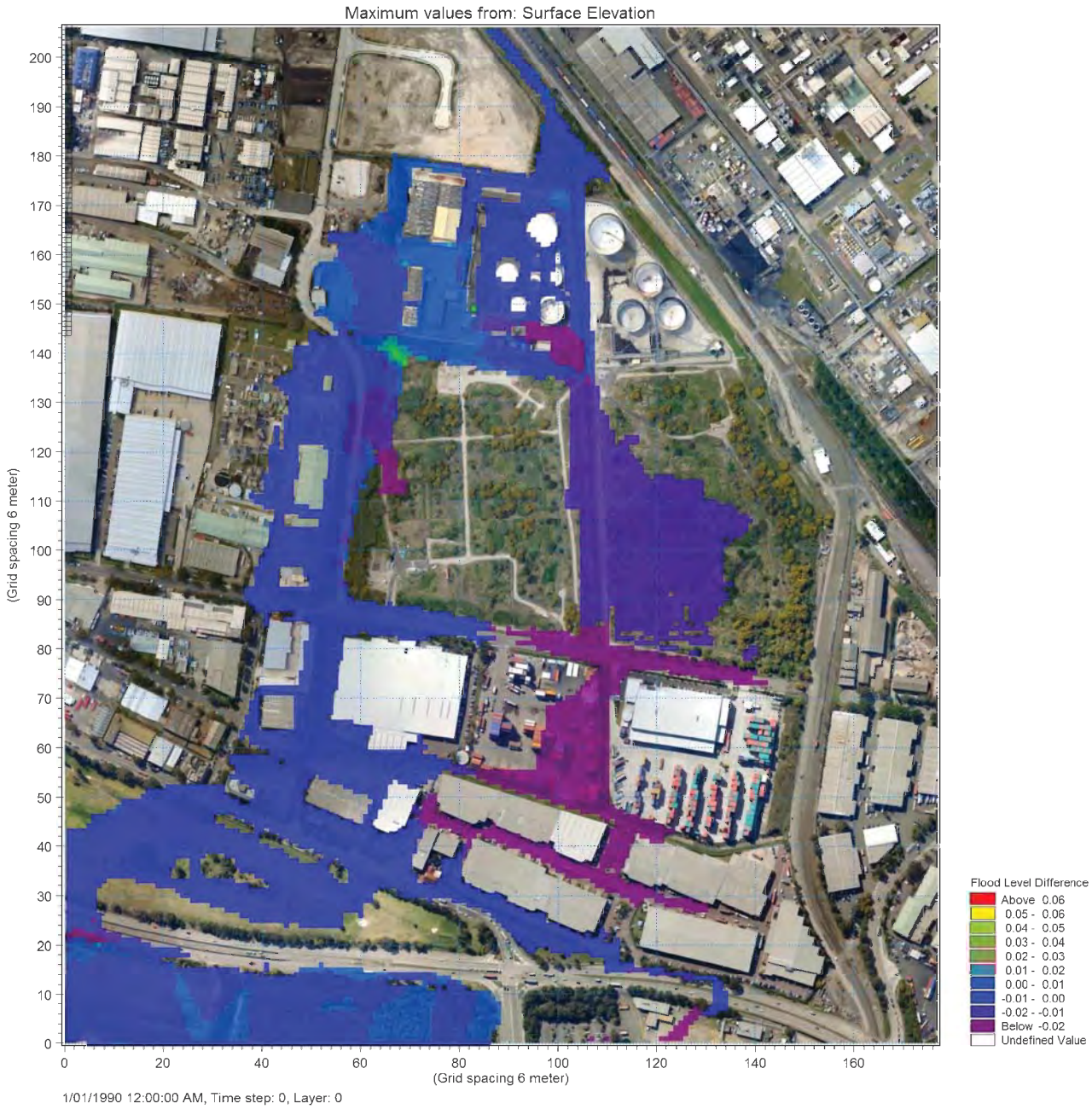
Southlands Flood Modelling **Figure D10**

Stage 1 Development Scenario 10% AEP flood level difference map



SCALE

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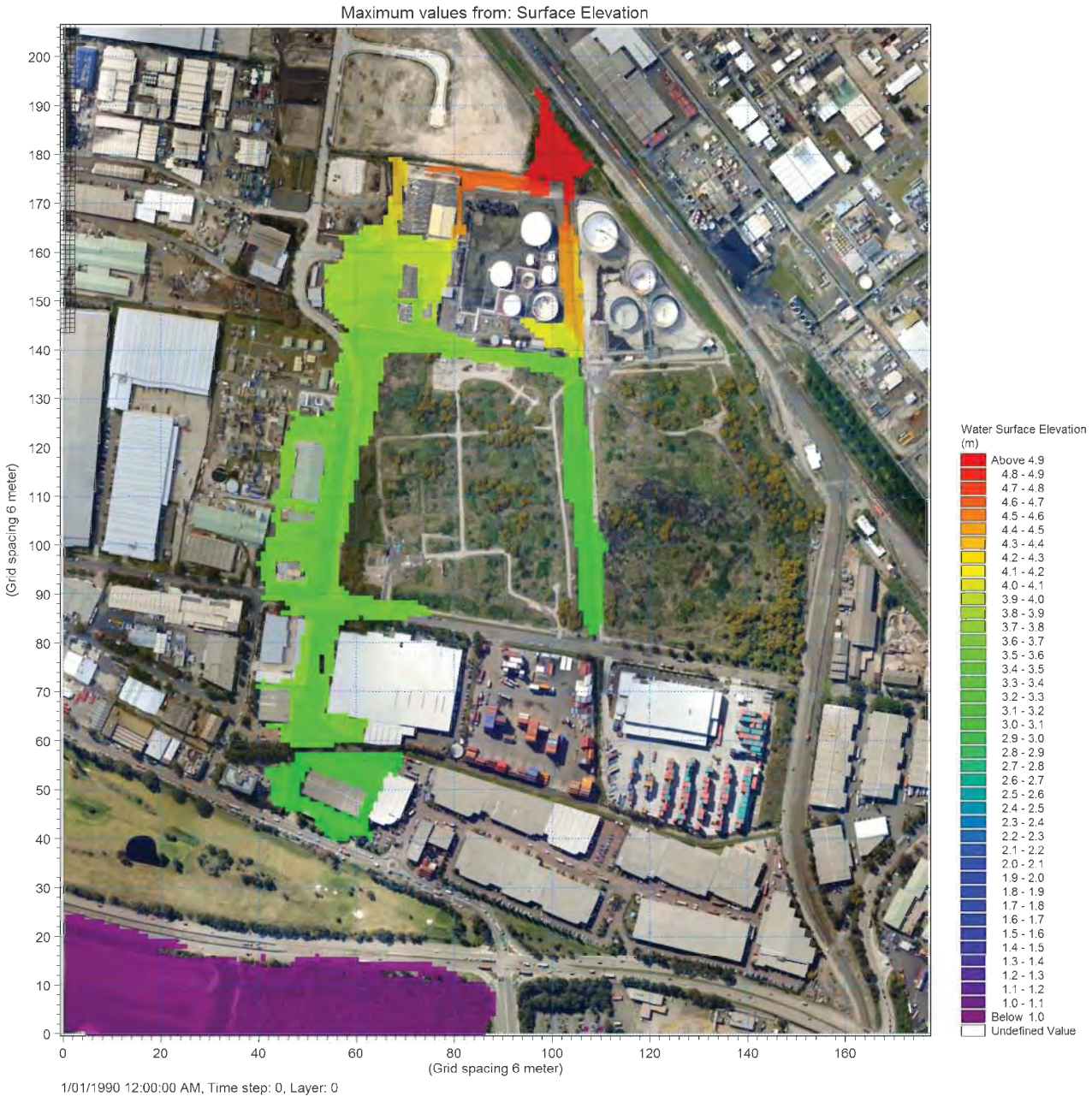
Southlands Flood Modelling **Figure D11**

Stage 1 Development Scenario 1% AEP flood level difference map



SCALE
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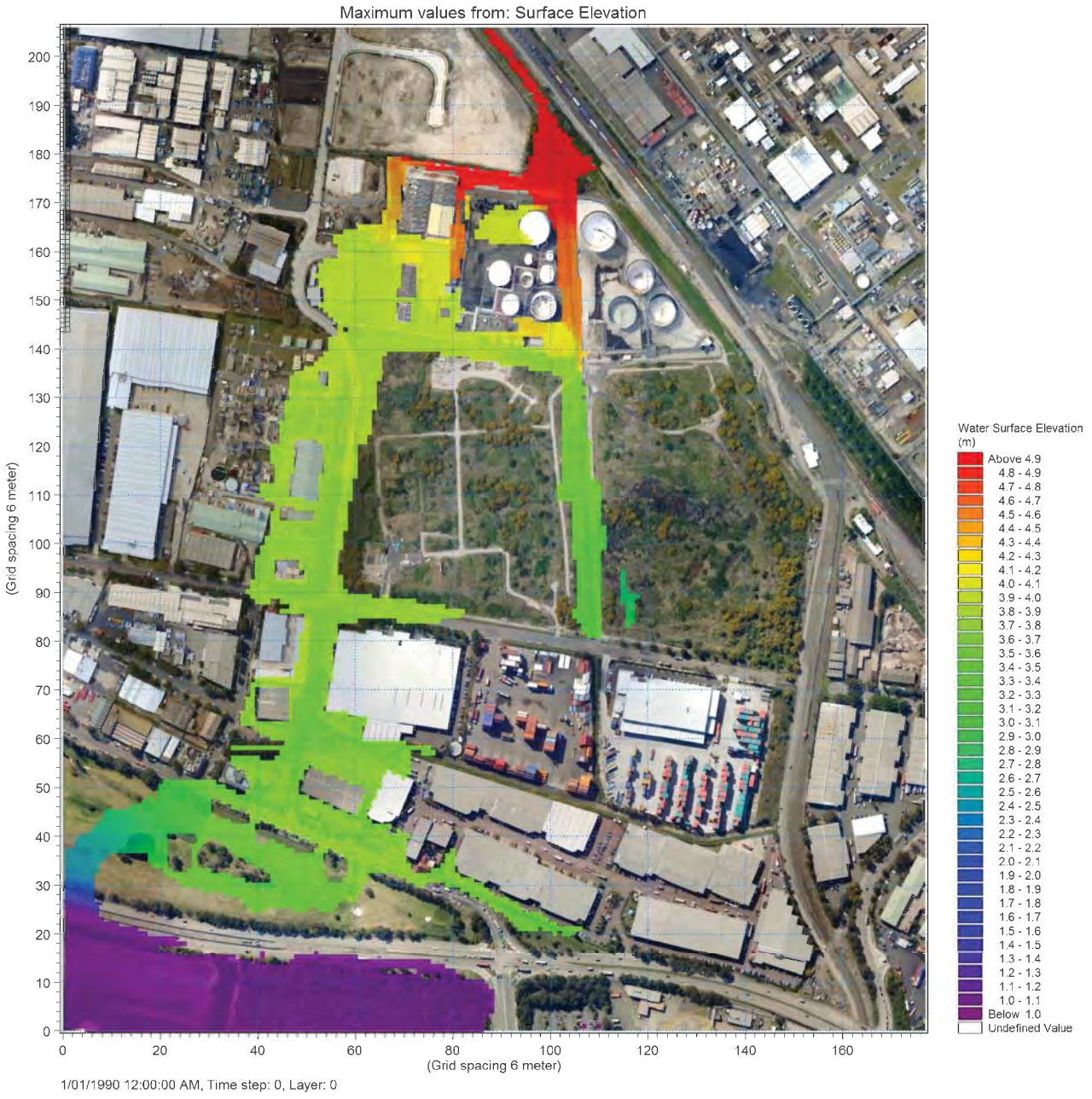
Southlands Flood Modelling **Figure D12**

Stage 2 Development Scenario 50% AEP flood extents



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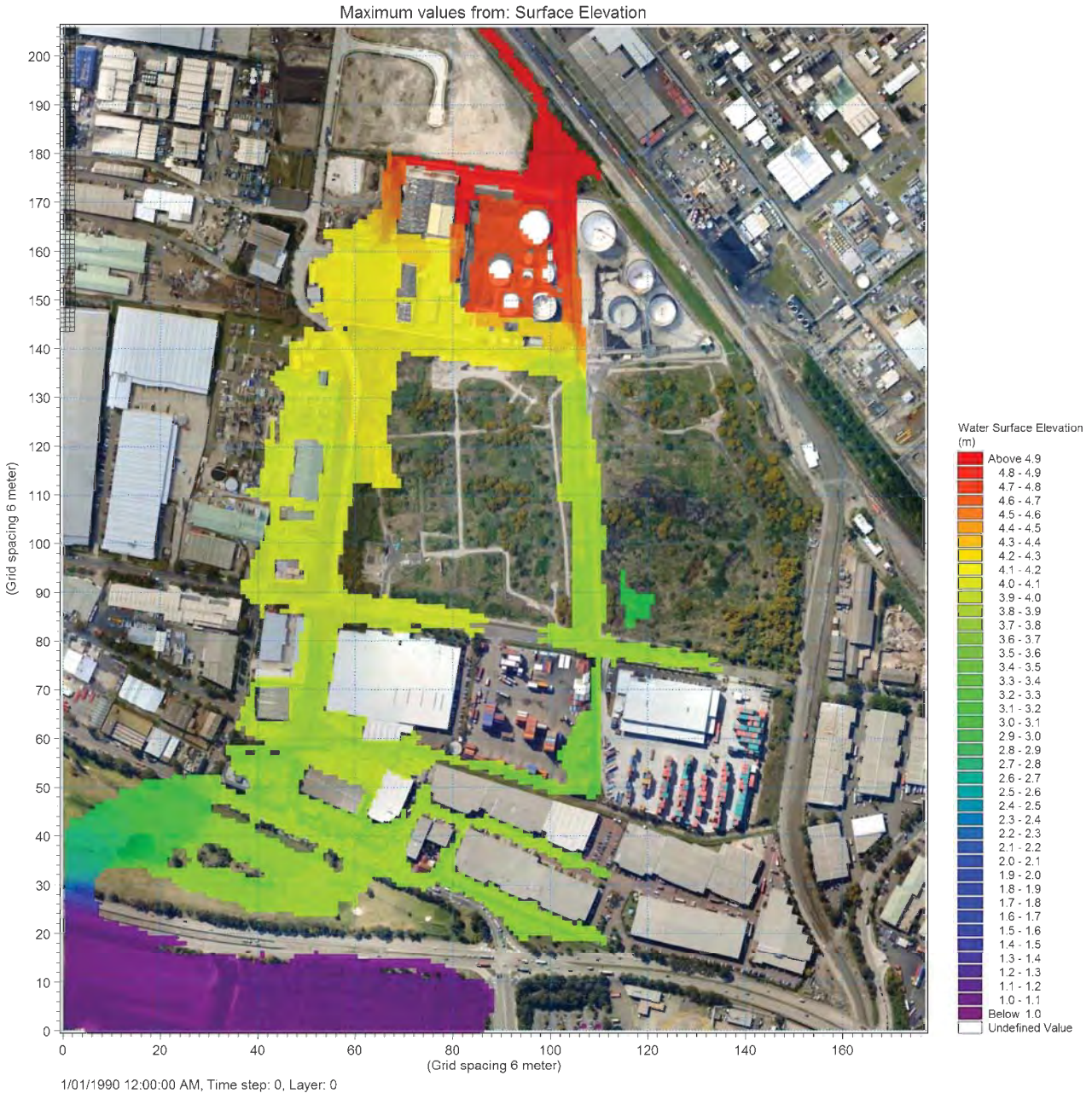
Southlands Flood Modelling **Figure D13**

Stage 2 Development Scenario 10% AEP flood extents



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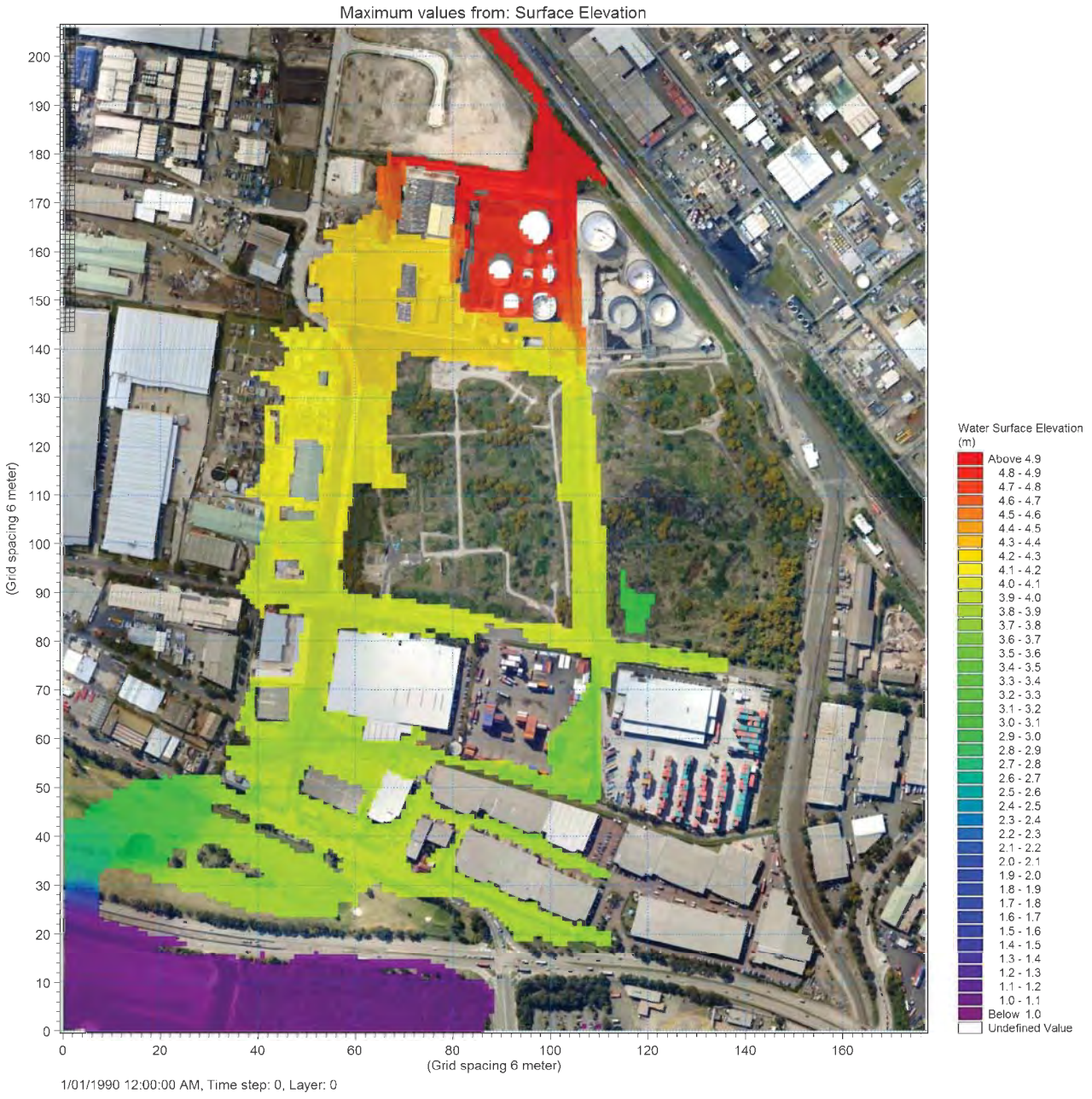
Southlands Flood Modelling **Figure D14**

Stage 2 Development Scenario 1% AEP flood extents



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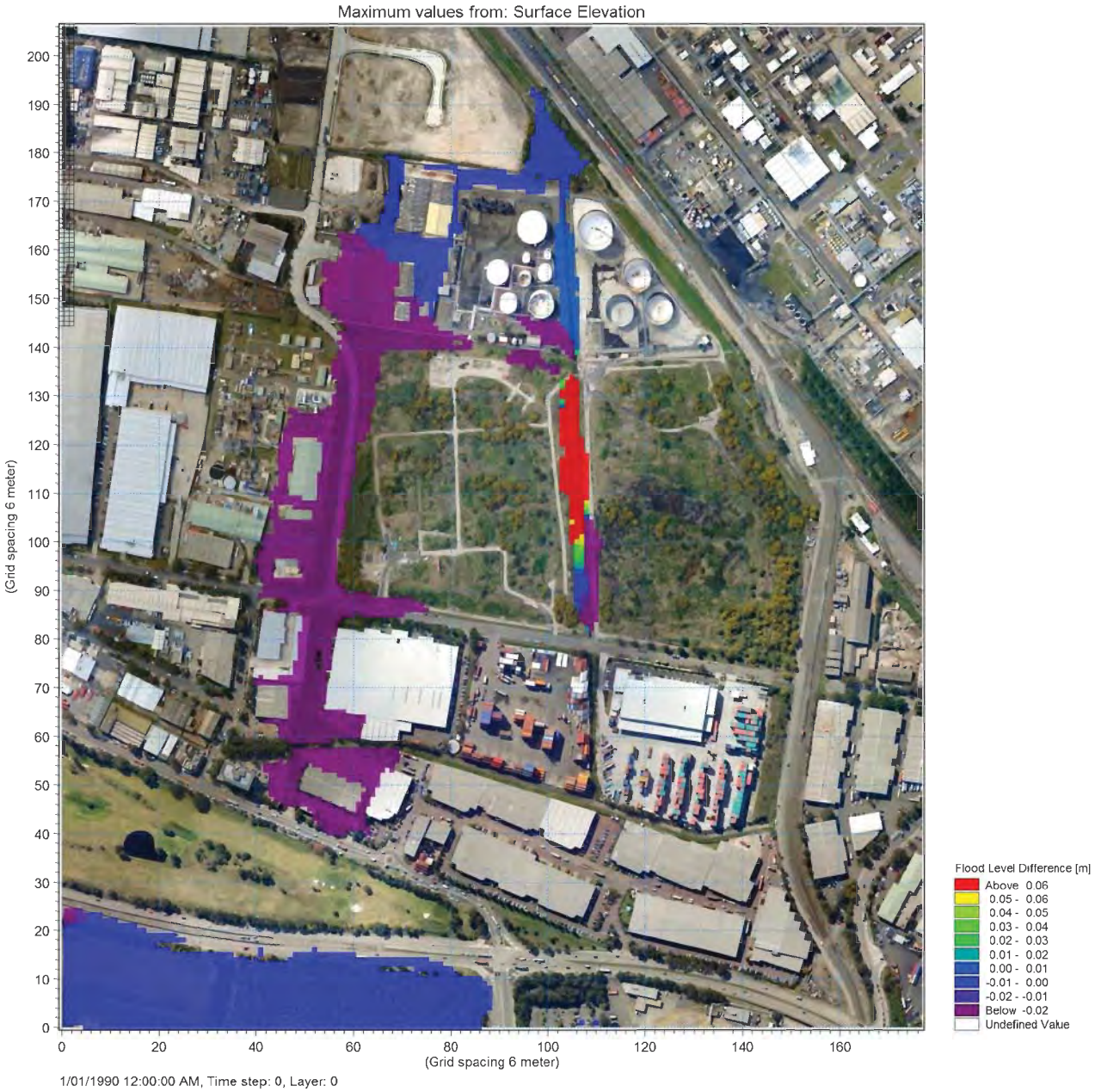
Southlands Flood Modelling **Figure D15**

Stage 2 Development Scenario 1% AEP with Climate Change flood extents

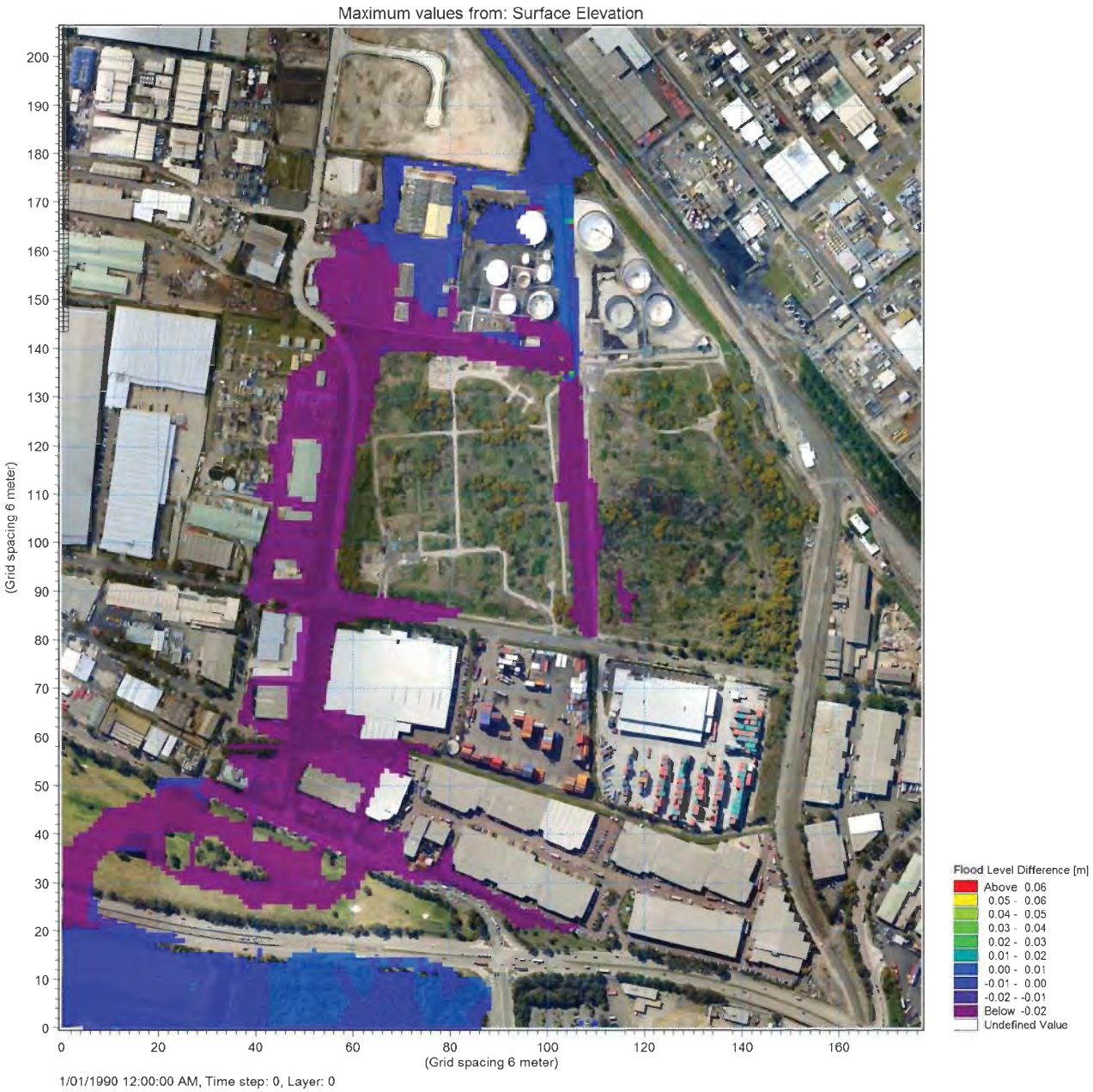


SCALE

0 160 320m

Southlands Flood Modelling **Figure D16**

Stage 2 Development Scenario 50% AEP flood level difference map

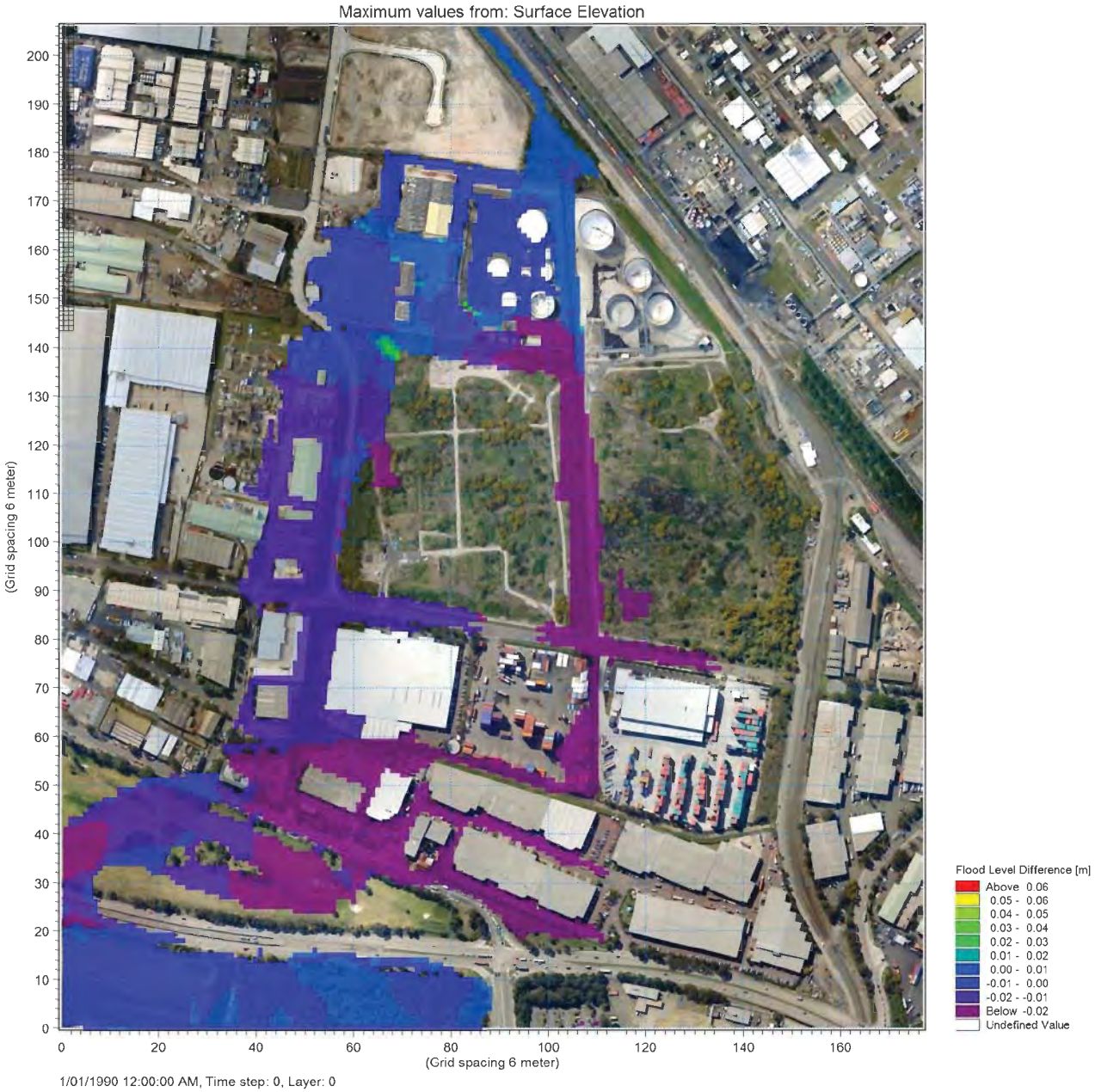


SCALE

0 160 320m

Southlands Flood Modelling **Figure D17**

Stage 2 Development Scenario 10% AEP flood level difference map



SCALE

0 160 320m

Southlands Flood Modelling **Figure D18**

Stage 2 Development Scenario 1% AEP flood level difference map

NSW GOVERNMENT Planning & Infrastructure

DEPARTMENT OF PLANNING and INFRASTRUCTURE

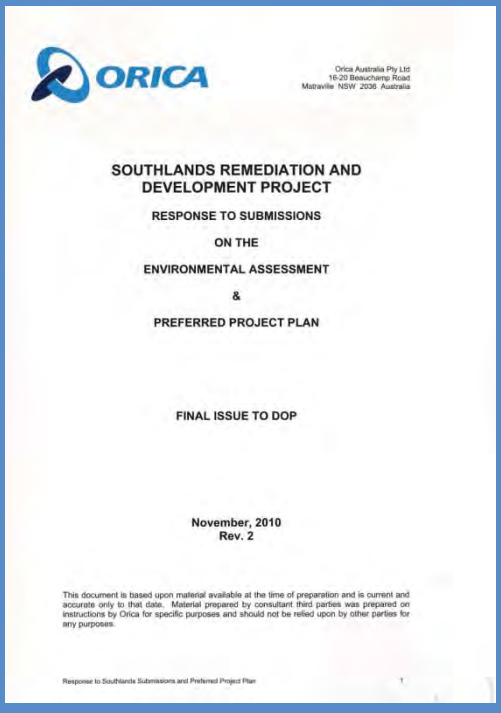
REVIEW OF ORICA SOUTHLANDS REMEDIATION and DEVELOPMENT

HYDRAULIC MODELLING REPORT and RESPONSE to EXHIBITION SUBMISSIONS/COMMENTS


ORICA Southlands Remediation and Development Project
Hydraulic Modelling Report and Response to Exhibition Submissions/Comments
ORICA

Report ref: 204617
29 November 2010
Revision 3

aurecon


ORICA

Orica Australia Pty Ltd
16-20 Beauchamp Road
Matraville NSW 2036 Australia

SOUTHLANDS REMEDIATION AND DEVELOPMENT PROJECT

RESPONSE TO SUBMISSIONS

ON THE

ENVIRONMENTAL ASSESSMENT

&

PREFERRED PROJECT PLAN

FINAL ISSUE TO DOP

November, 2010
Rev. 2

This document is based upon material available at the time of preparation and is current and accurate only to that date. Material prepared by consultant third parties was prepared on instructions by Orica for specific purposes and should not be relied upon by other parties for any purposes.

Response to Southlands Submissions and Preferred Project Plan 1

wma water

AUGUST 2011

Level 2, 160 Clarence Street
Sydney, NSW, 2000

Tel: 9299 2855
Fax: 9262 6208
Email: wma@wmawater.com.au
Web: www.wmawater.com.au

REVIEW OF ORICA SOUTHLANDS REMEDIATION and DEVELOPMENT HYDRAULIC MODELLING REPORT and RESPONSE to EXHIBITION SUBMISSIONS/COMMENTS

AUGUST, 2011

Project **REVIEW OF ORICA SOUTHLANDS REMEDIATION and DEVELOPMENT HYDRAULIC MODELLING REPORT and RESPONSE to EXHIBITION SUBMISSIONS/COMMENTS**	**Project Number** **111014**
Client **Department of Planning and Infrastructure**	**Client's Representative** Christine Chapman
Authors **Richard Dewar**	**Prepared by**
Date **2 August 2011**	**Verified by**

Revision	Description	Date
1	Draft Report	2 August 2011

REVIEW OF ORICA SOUTHLANDS REMEDIATION AND DEVELOPMENT HYDRAULIC MODELLING REPORT AND RESPONSE TO EXHIBITION SUBMISSIONS/COMMENTS

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APPENDICEES

1. INTRODUCTION

1.1. Review of August 2009 Submission

WMAwater (Mr R Dewar – Director) was engaged by the Department of Planning in September 2009 to provide a review of the report:

> *"Review of Southlands Remediation and Development Project: Environmental Assessment Project Application (MP 06_0191): Appendix G: Hydrology and Flooding" – August 2009.*

The report was prepared to support a Development Application under Part 3a of the EP&A Act for an industrial estate on land that is commonly known as Southlands at Banksmeadow. The land is owned by ORICA. The land is currently (2011) open space but is used as part of the remediation works being undertaken by ORICA to remove groundwater contamination.

WMAwater prepared a review in September 2009 of the Appendix G:Hydrology and Flooding (this report was prepared by Connell Wagner and is dated 2 November 2007) as well as Chapter 8 of the main report which summarised this Appendix G. The WMAwater review report is provided as Appendix A of this present report. In summary, the WMAwater review report of September 2009 report detailed many changes and additions to the hydraulic modelling approach provided in the applicant's August 2009 submission.

1.2. Review of November 2010 Submission

Aurecon (Connell Wagner has now been taken over and included as part of Aurecon) submitted the following two reports in November 2010 to the Department of Planning.

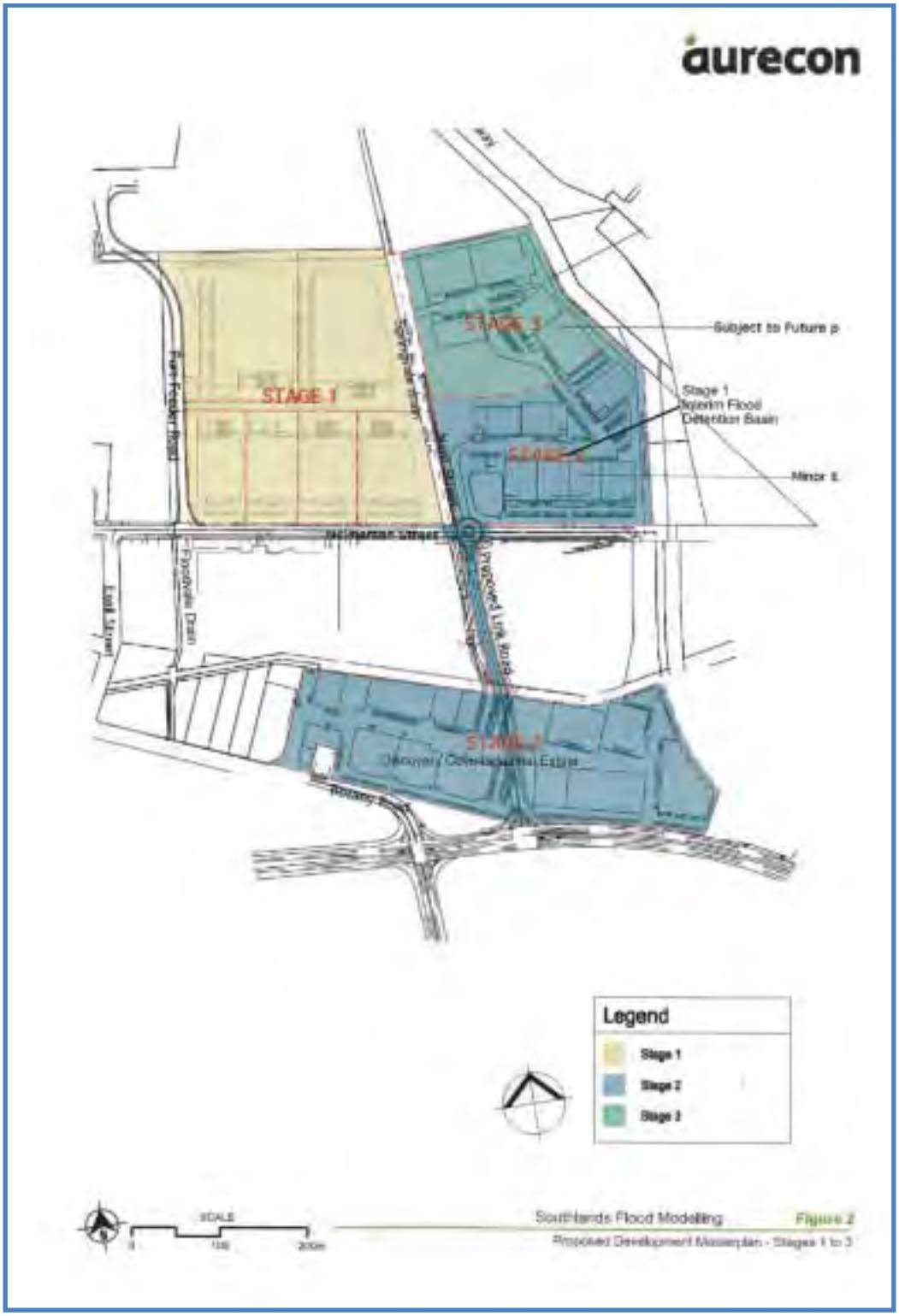
1. *Review of Orica Southlands Remediation and Development Hydraulic Modelling Report and*
2. *Response to Exhibition Submissions/Comments" – 29 November 2010.*

The first report (Hydraulic Modelling report) provides a re-assessment of the hydraulic modelling approach and revised results taking into account the comments made in the WMAwater review report of September 2009 report as well as comments from other parties. The second report (Response to Submissions) provides a response to all comments from the exhibition of the August 2009 submission.

WMAwater (formerly Webb, McKeown & Associates Pty Ltd) have over 25 years of experience in the field of hydrology and hydraulic modelling in NSW and are familiar with the local area and the associated flood problems. Our review includes all flood related issues contained in the two reports on behalf of Orica. From September 2009 until November 2010 Aurecon were in regular contact with WMAwater to agree upon aspects of the hydraulic modelling approach.

1.3. Extent of Proposed Development

The proposed development is to be undertaken in three stages (see diagram below) but the application (and our review of the assessment) is only for Stages 1 and 2.



Our comments have been summarised under Stage 1 and Stage 2.

2. STAGE 1 Proposal

2.1. Outline of Stage 1 Works

The Stage 1 proposal involves the following:

- Filling and development of the majority of the land between the Springvale and Floodplain Drains,
- Construction of a detention basin to the east of the Springvale Drain and immediately upstream of McPherson Street that provides additional floodplain storage to compensate for the amount lost due to the proposed filling above. At RL 4.2 mAHD the temporary floodplain storage capacity of the site is similar for the existing and Stage 1 development (i.e no loss of storage within the site),
- An easement (existing or to be created) at the northern part of the proposed development site between the Springvale and Floodplain Drains allows the exchange of floodwaters between the two drains,
- A control structure is to be formed on the Springvale Drain to control inflows to the proposed detention basin (design details to be confirmed) as well as a low flow pipe to drain the basin,
- A wall (to RL 4.5 mAHD) and fence are to be constructed around the perimeter of the proposed detention basin. The exact dimensions of the basin are to be confirmed at the detail design stage.

The report indicates that as a result of construction of the proposed works there will be no significant increase in flood levels (taken as > 0.01m) on surrounding properties or change in peak flows or velocities.

2.1.1. Flood Planning Levels

Flood Planning Levels (FPLs) are stated as the 1% AEP +0.3m freeboard for building floors in the November 2010 submission (rather than the more commonly used 0.5m freeboard). This issue was raised in our September 2009 review.

Aurecon provided further detail on this issue in their letter of 4th May 2011 which stated that "*All new building Finished Floor Levels (FFLs) for Stage 1 will be constructed a minimum of 500mm freeboard above the 100 year ARI flood level with Climate Change impacts*". This now satisfactorily addresses this issue.

2.1.2. Water Sensitive Urban Design (WSUD)

The November 2010 submission omitted discussion on how WSUD related features compatible with best practice have been accommodated in the design (water re-use, infiltration, minimisation of hard stand etc.). This above issue was raised in our September 2009 review.

Aurecon provided further detail on this issue in their letter of 4th May 2011 which indicated that opportunities for water treatment and re-use are limited by the existence of contaminated ground

water. This reasoning is accepted and this issue has now been satisfactorily addressed.

2.1.3. Summary

The hydrologic and hydraulic modelling approaches are compatible with currents standards in this field. The approach to permit the Stage 1 development is to undertake cut/fill earthworks such that the temporary floodplain storage capacity within the site is retained and peak flows are not increased. The results for Stage 1 indicate no significant impacts on adjoining land owners.

2.2. Stage 1 - Conditions of Approval

The following conditions of approval should be applied for the Stage 1 works:

1. A detention basin is to be construction to the east of Springvale Drain and immediately upstream of McPherson Street to provide additional flood storage to compensate for the amount lost due to filling within the floodplain of Springvale and Floodvale Drains.
2. Construction of a control structure on the Springvale Drain is required to control flows into the detention basin to ensure that the detention basin will compensate for the amount lost due to filling within the floodplain of Springvale and Floodvale Drains.
3. Construction of a low flow pipe is required to allow draining of the detention basin.
4. The Proponent shall obtain written confirmation from the City of Botany Bay Council that all issues relating to public safety of the detention basin (overtopping of basin, access to basin and drowning) have been adequately accommodated in the design. The written confirmation shall be provided to the Director-General prior to the construction of the detention basin.
5. The Proponent shall obtain written confirmation from the City of Botany Bay Council that details on the dimensions and legal status of the easement on the northern part of the site between the Springvale and Floodvale Drains have been addressed to the satisfaction of Council. The written confirmation shall be provided to the Director-General prior to the construction of the easement.
6. The Proponent shall obtain written confirmation from the NSW Dams Safety Committee that the as constructed detention basin complies with current standards (refer Guidance DSC3E). The written confirmation shall be provided to the Director General within 6 weeks of completion of the construction of the detention basin.
7. The Stage 1 design relies upon a re-distribution of earthworks within the site and construction of a control structure to divert floodwaters into the detention basin. The November 2010 report (*Report Ref: 204617, 29th November 2010, Revision 3 by Aurecon*) acknowledges (page 25) that any change in the design may require re-modelling. The Proponent shall commission and pay the full cost of a Hydraulic Modelling Flood Validation Assessment Report to confirm that the as constructed Stage 1 works (filling and construction of the detention basin) have been undertaken in accordance with the principles outlined in the November 2010 report, and that the flood impact is no greater than indicated in Figures D9, D10 and D11 of that report. The assessment must:
    1. be conducted by a suitably qualified, experienced and independent expert whose appointment has been endorsed by the Director-General;

2. provide detail survey from a Registered Surveyor on all key structures;
3. provide easy to read figures indicating any differences between the results provided on Figures D9, D10 and D11 of the November 2010 report;
4. determine whether the as constructed Stage 1 works have been undertaken in accordance with the design principles outlined in the November 2010 report and comply with the requirements in this approval; and if necessary;
    - recommend and prioritise measures to be undertaken in the event that the assessment shows that the flood impact exceeds that shown on Figures D9, D10 and D11 of the November 2010 report and that the works as executed are not in accordance with this approval;
5. should the Hydraulic Modelling Flood Validation Assessment report identify an exceedence or non-compliance, then the Proponent shall undertake/employ additional mitigation to the satisfaction of the Director-General within the timeframe specified by the Director-General;
6. within 6 weeks of the completion of the Stage 1 works, the Proponent shall submit a copy of the Hydraulic Modelling Flood Validation Assessment Report to the Director-General.

8. The Proponent shall engage a Registered Surveyor to certify that all new building Finished Floor Levels for Stage 1 are constructed a minimum of 500mm freeboard above the 100 year ARI flood level with Climate Change impacts. This written confirmation shall be provided to the Director General within 6 weeks of completion of construction of the buildings.

3. STAGE 2 Proposal

3.1. Outline of Stage 2 Works

The Stage 2 proposal involves the following:

- Filling and development of approximately 95%+ of the site. The only areas not proposed to be developed are areas adjacent to the two drains and the easement to the north of the Stage 1 development proposal,
- The proposed works that are required to ensure that there is no adverse flood impact to adjoining properties are:
    - enlarging culverts along the Springvale Drain within the site,
    - additional culverts under McPherson Street,
    - enlarging the channel between McPherson Street and the SWSOOS,
    - providing additional openings under the SWSOOS,
    - providing additional culverts under the Discovery Park development,
    - providing additional culverts under Botany Road and to Botany Bay (no channel upgrading is shown through the land downstream of Botany Road or for the culverts under Penrhyn Road).
- Construction of a link road from McPherson Street, over the SWSOOS and to Botany Road

The report indicates that as a result of construction of the proposed works there will be no significant increase in flood levels (taken as > 0.01m) on surrounding properties or change in peak flows or velocities.

3.2. Summary

It is noted that the report acknowledges that further detailed investigations will be required prior to the issuing of the Stage 2 Construction Certificate and the Stage 2 design only demonstrates that a workable drainage solution is possible.

Construction of the Stage 2 works cannot be approved at this time as it is considered that the following issues may not be able to be satisfactorily resolved.

3.2.1. Financial Viability of Stage 2

Stage 2 involves significant costs to construct:

- Additional culverts under McPherson Street,
- Enlarging the channel between McPherson Street and the SWSOOS,
- Providing additional openings under the SWSOOS,
- Providing additional culverts under the Discovery Park development,
- Providing additional culverts under Botany Road and to Botany Bay,
- Construction of a link road from McPherson Street, over the SWSOOS and to Botany Road.

No costings are provided for these works though it is suggested that they could be paid for out of a Section 94 contribution Plan. The applicant should provide the following additional details:

- An indicative itemised cost to construct the required drainage works for Stage 2,
- The viability of a Section 94 contribution Plan when it would appear from the results (Figure D18) that the only beneficiary of the Stage 2 drainage works, apart from ORICA, is 9-13 McPherson Street. The owners of 9-13 McPherson Street should be contacted to determine if they consider the reduction in flood levels as a result of the Stage 2 works of value. It is suggested that their flood levels could be reduced by a similar amount to those shown on Figure D18 by introducing the same blockage minimisation measures proposed in the Stage 2 works for the existing openings under the SWSOOS. These measures would cost a fraction of the cost of the Stage 2 drainage works and provide a similar benefit to 9-13 McPherson Street.

If it cannot be demonstrated that a Section 94 contribution Plan is viable then ORICA need to confirm that their development is still viable if they contribute the entire costs for the Stage 2 works.

3.2.2. Loss of Pervious Area and Temporary Floodplain Storage

Stage 2 involves the loss of a significant amount of pervious area and replacement with impervious cover as well as the loss of a significant amount of temporary floodplain storage. This approach is contrary to generally accepted WSUD and floodplain management practice and comments are required to justify why this approach should be approved.

3.2.3. Approval from Sydney Water for SWSOOS Waterway Crossing

The SWSOOS presents a significant obstacle to flood flows and for Stage 2 it is assumed that additional siphons (to take 3* the existing capacity) or other structures to increase flow capacity are required on the Springvale Drain crossing of the SWSOOS. In addition there is construction of the link road over the top of the SWSOOS.

The SWSOOS is a major asset of Sydney Water and written confirmation needs to be obtained from Sydney Water that they will agree in principle to these works and the conditions on the proponent they may impose. ORICA needs to confirm that it will accept in principle the Sydney Water conditions of approval and include any costs in the above project costings.

3.2.4. Increase in Peak Flow

Table 5.2 indicates that for the Stage 2 development the 1% AEP peak flow in the Springvale Drain will increase from approximately $8m^3/s$ to $21m^3/s$ (160% increase). Page 24 also indicates that "*flows will be redistributed from Floodvale Drain to Springvale Drain*". It is unclear if this redistribution is occurring as Table 5.2 indicates that there is minimal change in the peak flow in the Floodvale Drain under Stage 2 conditions.

In general there should be minimal increase in peak flow as a result of any development on the

floodplain. The magnitude of this flow increase is extreme and insufficient information is provided to ensure that the possible increases in flood damages, the risk to life and environmental impacts to downstream floodplain users are adequately addressed.

3.2.5. Flow under the SWSOOS

The Stage 2 proposal relies upon enlarging the siphons under the SWSOOS to cater for a 160% increase in peak flow. Hydraulic modelling of the existing siphons using a computer model relies upon a number of assumptions that are not well understood (hydraulic losses as the floodwaters enter the structure). For the Stage 1 proposal this is not critical as there is no proposed change to the structure. However under Stage 2 conditions the design relies on the success of enlarging the siphons and a more critical investigation, possibly using a physical model or sensitivity of the model parameters, is required to confirm this approach.

3.2.6. Percentage of Land Flood Free in 1% AEP event

Stage 2 results in approximately 95%+ of the Orica site becoming flood free in the 1% AEP event and thus development on it will not be burdened by flooding. In theory it is possible to construct works that will largely make the majority of flood affected sites in urban areas flood free, however the magnitude and cost of such works as well as the environmental consequences makes this impractical. It is noted that all the surrounding properties (except 15 McPherson Street which has been filled) are flood affected and the Stage 2 works results in an inequitable distribution of land that will not be burdened by flooding amongst the adjoining property owners. This approach is not in accordance with accepted and equitable floodplain management practice.

4. REVIEW of SUBMISSIONS

4.1. Summary

The DoP provided copies of the November 2010 submission by Orica to various private and public authorities for further comment. The following provides a summary of the comments received in regard to flooding and are in no particular order.

4.2. Sydney Water

Sydney Water advised that it would need detailed design plans before it could provide a specific comment. However the response indicated that a major works deed would need to be entered into and Sydney Water would need to be satisfied that the structural integrity of the SWSOOS was not compromised.
Comment by WMAwater: This issue has been included in the Stage 2 Proposal (Section 3).

4.3. NSW Transport

No comment were made on flooding matters.

4.4. Sydney Ports

Sydney Ports indicates that the Stage 2 proposal lacks detail and the potential for significant impacts means that approval for Stage 2 would be premature. Also Sydney Ports is concerned about the change in velocity of the discharge into Penrhyn Bay and the proposed mitigation measures (feasibility, who pays and whether they are possible).
Comment by WMAwater: This issue is only of relevance if approval for Stage 2 is given.

4.5. Randwick City Council

Council notes that the report refers to the DECC 2007 Guideline on Climate Change impacts but this has now been superseded by the August 2010 Guideline and use of the latter may change results.
Comment by WMAwater: At the time of undertaking the study the DECC 2007 Guideline was the most current version and the August 2010 Guideline does not provide any advice regarding the possible climate change increase in rainfall intensity (the only climate change issue that was considered in the assessment) only sea level rise.

Council raises the issues that on going pipe clearance and beach nourishment may alter the results.
Comment by WMAwater: These two matters will have no significant impact on the relative impacts of the pre versus post works assessment.

4.6. Roads and Traffic Authority

No comment on flooding matters.

4.7. Hynlong Pty Ltd Owners of 9-13 McPherson Street

Hynlong indicate that insufficient detail is provided to assess/certify the design, namely:

- lack of detail in text and on drawings of the proposed levee and flood control structure,
- no detailed design is provided,
- existing surface contours are unreadable in Figure 3,
- indistinguishable flood extents contours provided in report,
- earthworks drawings indicate that final levels may change by +/- 300mm and finalised levels should be provided,
- insufficient detail on application plans and civil works drawings.

However if approval is granted Hynlong request:

- works as executed (WAE) drawings to be re-modelled and confirmation by the certifier prior to the issue of any construction certificates that there is no adverse flood impact,
- provision of adequate floodplain storage during the construction phase,
- the floodplain storage should not be adversely affected by any other remediation or associated works.

Comment by WMAwater: The Orica report is based on a Stage 1 concept design and it is acknowledged that this will be modified as detailed design is undertaken. The issue of WAE compliance has been included in the Stage 1 Proposal (Section 2). The issues of adequate floodplain storage during construction will need to be addressed by Orica as part of their detailed design. The issue of affectation by any other works on the site would need to be addressed by Orica if and when that occurs.

4.8. Gazal Corporation

Gazal indicated that they are concerned about flooding but provided no specific details.

4.9. Department of Environment, Climate Change and Water (DECCW)

DECCW indicated that a long term monitoring program to assess the impacts of increased flows in the Penrhyn Bay estuary should be undertaken for Stage 2.
Comment by WMAwater: This issue is only of relevance if approval for Stage 2 is given.

4.10. City of Botany Bay Council

The following comments were made in Council's letter of 18th February 2011:

i. the relocation of the flood storage area will prolong the duration of flooding across Nant Street and increase the hazard during floods. Comment by WMAwater: This issue has been addressed in Aurecon's letter of 4th May 2011,
ii. there is concern about the loss of flood storage between Stage 1 and the subsequent

stages. Comment by WMAwater: This issue is only of relevance if approval for Stage 2 is given.

iii. additional details are required for the flow path easement between the two drains. Comment by WMAwater: The hydraulic modelling has demonstrated the capacity of the flow path and the requirement for an "official easement" has been included in Section 2.2.3 – Conditions of Approval,

iv. there are safety concerns with the proposed basin. Comment by WMAwater: This issue has been included in Section 2.2.3 – Conditions of Approval,

v. there are no details of whether the flood control structure in the Springvale Drain proposed for Stage 1 will be retained for Stage 2 and whether a higher blockage factor is required. Comment by WMAwater: This issue is only of relevance if approval for Stage 2 is given,

vi. no velocity-depth products have been provided in the flood flow paths, especially along Nant Street and the new link road. Comment by WMAwater: This issue along Nant Street (not the new link road) has been addressed in Aurecon's letter of 4th May 2011.

The following comments were made in Council's letter of 30th June 2011 following review of Aurecon's letter of 4th May 2011:

- no details are provided of the flow path north of the Southland site (point iii above). Comment by WMAwater: whilst there is no exact dimensions of these works the hydraulic modelling undertaken by Aurecon has included these Stage 1 works and concluded that there is no significant adverse impact to other floodplain users. At the detailed design stage, drawings will be provided indicating the exact details and the outcomes of Section 2.2.3 – Conditions of Approval (hydraulic modelling of works as executed) will demonstrate that what is built has been included in the hydraulic modelling and will produce increases in flood level no greater than those indicated in the November 2010 report,
- a repeat of point iv above. Comment by WMAwater: This issue has been included in Section 2.2.3 – Conditions of Approval,
- a repeat of point v above. Comment by WMAwater: This issue is only of relevance if approval for Stage 2 is given,
- no velocity-depth products have been provided for the new link road. Comment by WMAwater: This is an issue for the designers of the new link road regarding whether the road can be constructed in accordance with acceptable flood inundation standards.

Appendix A

NSW GOVERNMENT
Department of Planning

DEPARTMENT OF PLANNING

REVIEW OF SOUTHLANDS REMEDIATION AND DEVELOPMENT

PROJECT APPLICATION MP 06_0191

Appendix G: Hydrology and Flooding

wma water

SEPTEMBER 2009

Level 2, 160 Clarence Street
Sydney, NSW, 2000

Tel: 9299 2855
Fax: 9262 6208
Email: wma@wmawater.com.au
Web: www.wmawater.com.au

REVIEW OF SOUTHLANDS REMEDIATION AND DEVELOPMENT PROJECT: ENVIRONMENTAL ASSESSMENT PROJECT APPLICATION (MP 06_0191): APPENDIX G: HYDROLOGY AND FLOODING

SEPTEMBER, 2009

Project REVIEW OF SOUTHLANDS REMEDIATION AND DEVELOPMENT PROJECT: ENVIRONMENTAL ASSESSMENT PROJECT APPLICATION (MP 06_0191): APPENDIX G: HYDROLOGY AND FLOODING	**Project Number** 29055
Client Department of Planning	**Client's Representative** Anne Maree Carruthers
Authors Richard Dewar	**Prepared by**
Date 17 September 2009	**Verified by**

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REVIEW OF SOUTHLANDS REMEDIATION AND DEVELOPMENT PROJECT: ENVIRONMENTAL ASSESSMENT PROJECT APPLICATION (MP 06_0191): APPENDIX G: HYDROLOGY AND FLOODING

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1. INTRODUCTION

WMAwater (Mr R Dewar – Director) was engaged by the Department of Planning in September 2009 to provide a review of the report:

> *"Review of Southlands Remediation and Development Project: Environmental Assessment Project Application (MP 06_0191): Appendix G: Hydrology and Flooding".*

The report was prepared to support a Development Application under Part 3a of the EP&A Act for an industrial estate.

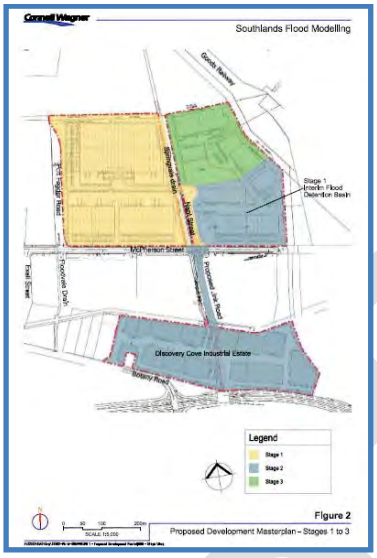
WMAwater (formerly Webb, McKeown & Associates Pty Ltd) have over 25 years of experience in the field of hydrology and hydraulic modelling in NSW and are familiar with the local area and the associated flood problems. Our review is primarily of Appendix G:Hydrology and Flooding as well as Chapter 8 of the main report which summarises this appendix.

Section 2 of this report provides a summary of the key floodplain management issues that need to be resolved regarding this Development Application.

No site inspection of the site has been undertaken.

2. KEY ISSUES

The proposed development is to be undertaken in three stages (see diagram below) but the application (and our review of the assessment) is only for Stages 1 and 2.



Our comments have been summarised under these two stages and are within no particular order within each section.

2.1. Comments on Stage 1 Proposal

2.1.1. Climate Change

Climate change has the potential to raise flood levels due to sea level rise and rainfall increase. These two phenomenon need to be addressed in the context of the level of flood immunity of the proposed development throughout its lifespan. The Department of Environment and Climate Change has recently (November 2007) issued guidelines regarding the possible impacts of climate change on flood levels and these should be evaluated for the 1% AEP event.

Climate change does NOT need to be taken into consideration as part of the existing v design flood assessment but needs to be considered in the setting of Flood Planning Levels.

2.1.2. Blockage

The report states "*it is assumed that the existing drains and other structures are clean and function as they were originally designed*" (Page 10). This assumption is clearly not valid as the following photographs (taken from the report) illustrate that the existing drainage system is already partially blocked (the report also states that both drains are "*heavily blocked with silt and debris"* and *"the culverts are currently severely blocked*") and includes structures (small openings, vegetative debris, pipes and railings crossing the channel) conducive to a high level of blockage during a flood.

Existing conditions MUST relate to what is there at present (i.e considerable blockage) and for design it cannot be assumed that this blockage will be removed unless some form of blockage minimisation device or maintenance is included. These devices will only be accepted if it can be demonstrated that they will work as designed and be properly maintained for the life of the project. It cannot be assumed that Council or any other authority will undertake this task.

An assessment of blockage of ALL culverts and waterway openings therefore needs to be considered in the existing v design flood assessment as well as for the setting of Flood Planning Levels.


Photo 5: Floodvale drain at SWOOS crossing looking south.


Photo 3: Floodvale drain at McPherson Street culvert looking south.


Photo 14: Springvale drain SWOOS crossing looking south.


Photo 3b: Springvale drain at McPherson street culvert V notch weir looking south.

A suggestion is to assign a % blockage to each structure based on a review of the structure as they exist today and use this same value for all subsequent hydraulic analysis (identical values for existing and design). The SWOOS and McPherson Street crossings are likely to have >70% blockage.

2.1.3. Flood Planning Levels

Flood Planning Levels (FPLs) are stated as the 1% AEP +0.3m freeboard for building floors. It must be demonstrated why a 0.3m freeboard is considered appropriate rather than the more commonly used 0.5m freeboard (particularly as the report states that the absolute accuracy of the design flood levels is likely to be only +/- 0.5m).

FPLs are also required for all structures in the floodplain such as:

- Car parking,
- Services ducts and equipment,
- Access roads during a flood.

2.1.4. On-Site Stormwater Detention (OSD)

OSD is proposed for Stage 1 (Figure 6) as underground tanks. These tanks are costly to build, are underground and possibly may affect the groundwater table, are likely to require pumps to discharge the collected runoff and must be maintained to be effective. Justification is required as to why OSD is proposed rather than accommodating the additional storage volume required in the proposed Stage 1 basin. In Stage 2 the channel dimensions can be marginally increased to accommodate any slight increase in peak flow due to the lack of OSD on the site.

2.1.5. Water Sensitive Urban Design (WSUD)

The report needs to include a discussion on how WSUD related features have been accommodated in the design.

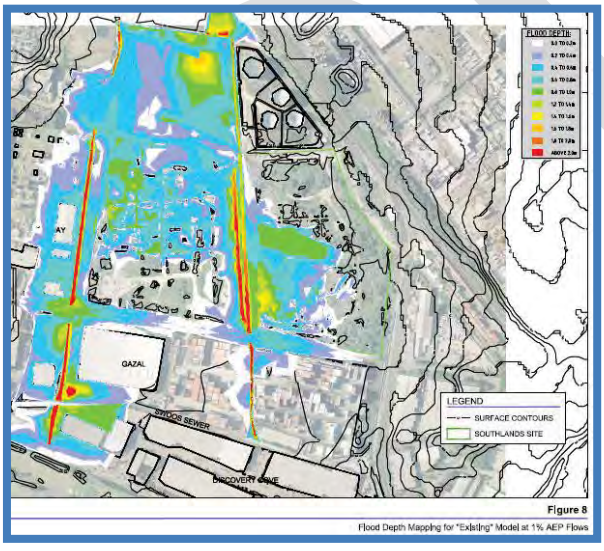
2.1.6. Compensatory Stage 1 Detention Basin

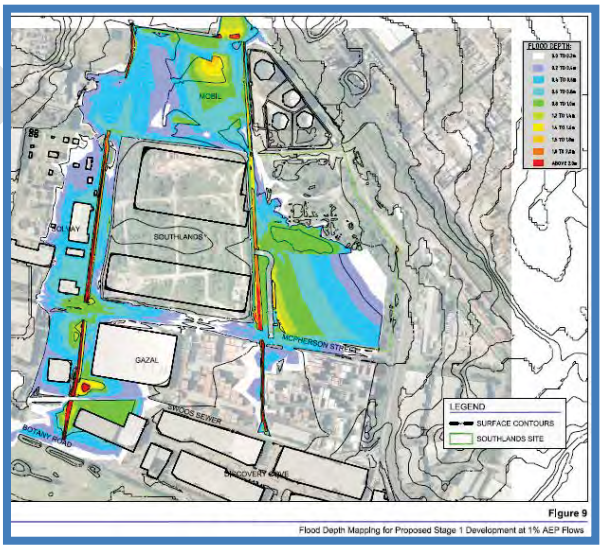
The approach adopted of providing compensatory storage to mitigate the filling of flood liable lands is acceptable in principle. However the following further details are required:

- How has safety to life (overtopping of basin, access to basin and drowning) been addressed in the design?
- A RL(mAHD)/floodplain storage graph should be prepared for both the existing and design scenarios to demonstrate that there is no significant change in temporary floodplain storage capacity within the Southlands site.

2.1.7. Hydraulic Modelling

Under existing conditions the overland flow from the Floodvale and Springvale tributaries merge upstream of Southlands within the Mobil site and enter the site over a 200m wide boundary (see figure below). Under design the combined flow becomes concentrated into two narrow channels on either side (see figure below). The hydraulic modelling needs to conclusively demonstrate that for design the filling of the site will not increase the peak flow in the Floodvale Drain or increase flood levels in the Mobil site. The "connections" shown on Figure 5 do not appear to relate to the topographic conditions.





Mike-11 is a "branched" 1 Dimensional model and it would appear that in order to satisfactorily model the "split" in the flows between the two tributaries within the Mobil lands and elsewhere a 2 Dimensional approach is required. These models (Tuflow, Sobek, Mike-21) are widely used for hydraulic modelling of these systems and would be the preferred approach to address this problem. For example Figure 8 indicates that the flows from the two drains join at McPherson

Street. How has this been adequately simulated in a 1D model?

The report acknowledges the "*complex interaction of catchment runoff coupled with flat terrain*" and the use of a 2 D model will also assist in explaining why there is a relatively steep flood gradient in the Springvale Drain with the Mobil land and upstream but a relatively flat gradient within the Floodvale Drain, this needs to be clarified.

Figure 11 (and for other events) indicates that for the proposed Stage 1 design there is an increase in flood level (up to 0.25m) within the Mobil land. This appears contrary to the many statements in the report which indicate no increase in flood levels upstream or downstream of the site. The report states that at this location the increase would have negligible impact as "*it is contained within the banks of Springvale Drain*" (Page 13). This statement does not appear consistent with the flood extents shown on Figure 9 and requires clarification. An increase in flood level is unacceptable as it will increase the flood damages and risk to life on land beyond that owned by Southlands. No such increase can occur.

The report should provide a tabulation of peak levels and peak flows at key locations for the range of design events for both the existing and design scenarios.

Of interest is the water level upstream of the SWOOS and in what event the SWOOS becomes overtopped. It appears that overtopping in the Floodvale Drain first occurs in a 5% AEP event. In the Springvale Drain the SWOOS is not overtopped in the 1% AEP event (crest at 3.8 m AHD). This result is surprising as the area beneath the SWOOS is only $6m^2$ and the peak flow is of the order of $39m^3/s$ (i.e 6.5m/s). The effect of the SWOOS on flood levels in both drains and including the potential for blockage needs to be clarified. Some clarification is also required to justify why the flood flows from the two drains do not converge immediately upstream of the SWOOS.

The hydraulic analysis for existing and design must be undertaken for an event larger than the 1% AEP (say 0.5% AEP) as well as the Probable Maximum Flood.

2.1.8. Cross Sections

Figure 5 and 7 show different chainages for the Floodvale Drain. A review of the cross sections would seem to indicate that the chainages shown on Figure 5 do not always match with the cross section chainages shown in Appendices E and F. Figure 5 must show exactly the same section chainages as those shown in Appendices E and F (chainages beyond 820 are listed in the Appendices but not shown on Figure 5 and some sections e.g Figure E27 section 510.21 are not shown on Figure 5 and there are others).

The following issues should be addressed in any revision:

- What does TWL relate to?
- It would make it easier to read if the vertical scale was say only to 5m AHD on all figures. Also it would assist if the horizontal extent was limited to show only land up to say 5m

AHD (or even less at the downstream end),

- What Manning's "n" values have been adopted and where do they apply?
- It is presumed that the sections are drawn left to right looking downstream and I note a "spike" at chainage 70 in the Floodvale Drain sections 864.47 to 868.0 (Figure E13). What is this spike and how can water enter the land beyond chainage 70 as the "spike" acts as a barrier?
- In many sections the extremities of the section are not limited by high ground (e.g Floodvale Drain section 866.37 on Figure E14 but there are many others). This requires further explanation as to what decisions have been taken to define the extent of each of these sections.
- Sections 134.06 to 466.88 on the Springvale Drain show that beyond chainage 100+ the flood extent is not limited by high ground. Presumably this is because the floodwaters join up with the Floodvale Drain. It would appear that there is some not documented "split" between the flood extents for the two drains. This requires further explanation and suggests that it may be more appropriate to use a 2D model rather than a 1D model. This is a key issue as it has implications for the distribution of flows between the two drains and the potential impacts of development,
- Floodvale Drain section 866.37 on Figure E14 shows the flood waters extending 400m in width with presumably the same water level (there are other sections showing similar extents as well). Are the flood waters all flowing with some velocity across this width or should some more appropriately be modelled as floodplain storage with nil velocity? This requires further explanation as it may affect the design flood levels,
- In Appendix F could the existing and design sections for each river chainage be provided on the same graph? This would make it easier to see what changes to the section have been made. There is no need to plot sections in Appendix F that have not been altered for design,
- What is the relevance of showing the Detention basin chainages on Figure 7? How do these sections relate to the sections used in the Mike-11 model?
- Comment needs to be made on how the many culverts and other waterway structures have been included in Mike-11 and in particular the siphons beneath the SWOOS. What additional losses etc have been assumed?
- What approach has been taken to include buildings and containers in the sections? For example section 108.2 on the Springvale Drain (Figure E22) does not appear to show the oil storage tank indicated on Figure 5. Also there appears to be a "spike" at chainage negative 10m on Figures E21 to E24, what is this? If this defines a bund around the storage tanks how do flood waters enter the bunded area as shown on the sections? All sections must be checked to make sure that they accurately reflect how floodwaters can flow through the Mobile site (and elsewhere). This task would be much simpler if a 2D hydraulic model was used,
- Further detail is required to explain how the floodwaters are contained to such a small waterway area at Section 711.04 (and 785.31) on Figure E30,
- It is noted that there is a high mound on the downstream side of McPherson Street on the east side of the Springvale Drain. Has this been included in the hydraulic model?

2.2. Comments on Stage 2 Proposal

It is noted that the report acknowledges that further detailed investigations will be required prior to the issuing of the Stage 2 Construction Certificate and the Stage 2 design only demonstrates that a workable drainage solution is possible.

2.2.1. Loss of Temporary Floodplain Storage

Stage 2 involves the loss of a significant amount of temporary floodplain storage. This approach is contrary to generally accepted practice and comments are required to justify this approach.

2.2.2. Loss of Pervious Area

Stage 2 involves the loss of a significant amount of pervious area and replacement with impervious cover. This approach is contrary to generally accepted practice and comments are required to justify this approach.

2.2.3. SWOOS Waterway Crossing

The SWOOS prevents a significant obstacle to flood flows and for Stage 2 it is assumed that an additional siphon or other structure to increase flow capacity is required on the Springvale Drain. As the existing "siphons" do not appear (needs to be clarified for the Stage 1 assessment) to be able to cater for large flows (refer photographs previously and acknowledgement that one sump is blocked - refer Figure B2) further details are required in order to demonstrate that a viable solution can be found at this location.

2.2.4. Interaction between Floodvale and Springvale Drains

Page 14 states that "*this assessment assumes no interaction between the flow in Floodvale Drain and an enhanced Springvale Drain*". The validity of this assumption has been questioned above at several locations (Mobil site, McPherson Street and upstream of SWOOS) and will only be accepted if verified by hydraulic modelling. It is suggested that a 2D modelling approach is required which would eliminate the need for any assumptions.

2.2.5. Hydraulic Modelling

It would appear that no hydraulic modelling (other than an assumed $40m^3/s$ steady flow) for Stage 2 (as given on Figure 12) has been reported. A Stage 2 concept design must be analysed using the hydraulic model for the full range of design events with reporting of results, profiles, flood extents etc.

For approval of Stage 2 the same level of hydraulic detail (blockage, climate change) as provided for Stage 1 must be included.

3. RECOMMENDATIONS

Whilst in principle the Stage 1 construction of an industrial complex and a compensatory floodplain storage basin land is acceptable from a flooding perspective there are a number of design issues which still require resolution. These are summarised below:

- Climate Change,
- Blockage,
- Flood Planning Levels,
- On Site Stormwater Detention,
- Water Sensitive Urban Design,
- Compensatory Stage 1 Detention Basin,
- Hydraulic Modelling,
- Cross Sections.

Significant drainage works are required outside of the Southlands site area for Stage 2 of the development. The report does not provide sufficient detail on the following issues to ascertain whether it will be in accordance with best practice in floodplain management:

- Loss of temporary floodplain storage,
- Loss of pervious area,
- SWOOS waterway crossing,
- Interaction between Floodvale and Springvale Drains,
- Hydraulic Modelling.

Appendix E

URS Infrastructure Services Report