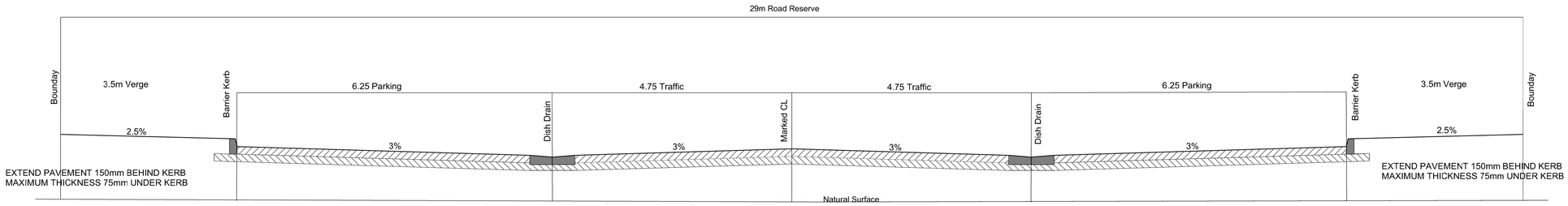
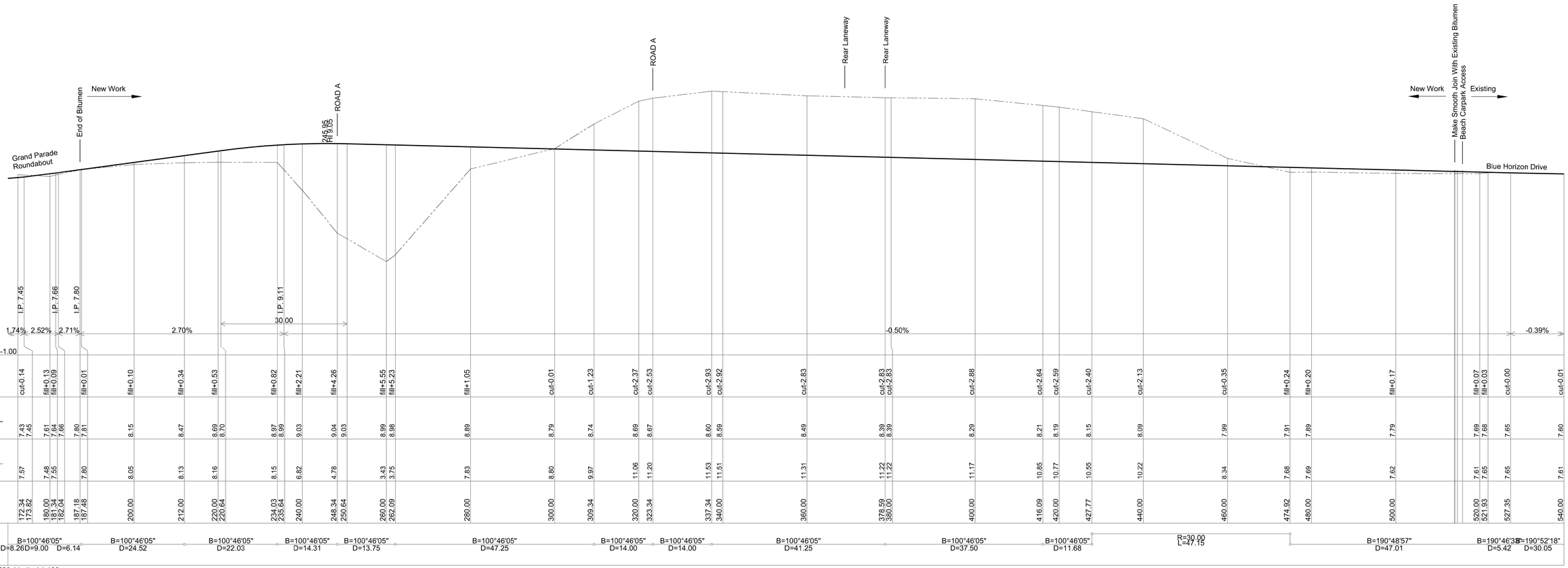


TYPICAL CROSS SECTION GRAND PARADE

NOTES

CONTRACTOR IS TO ENSURE THAT ALL KERB AND GUTTER GRADES SHALL NOT FALL BELOW 0.3% AT ANY POINT IRRESPECTIVE OF ROAD CENTRELINE GRADING SHOWN ON LONGITUDINAL SECTIONS

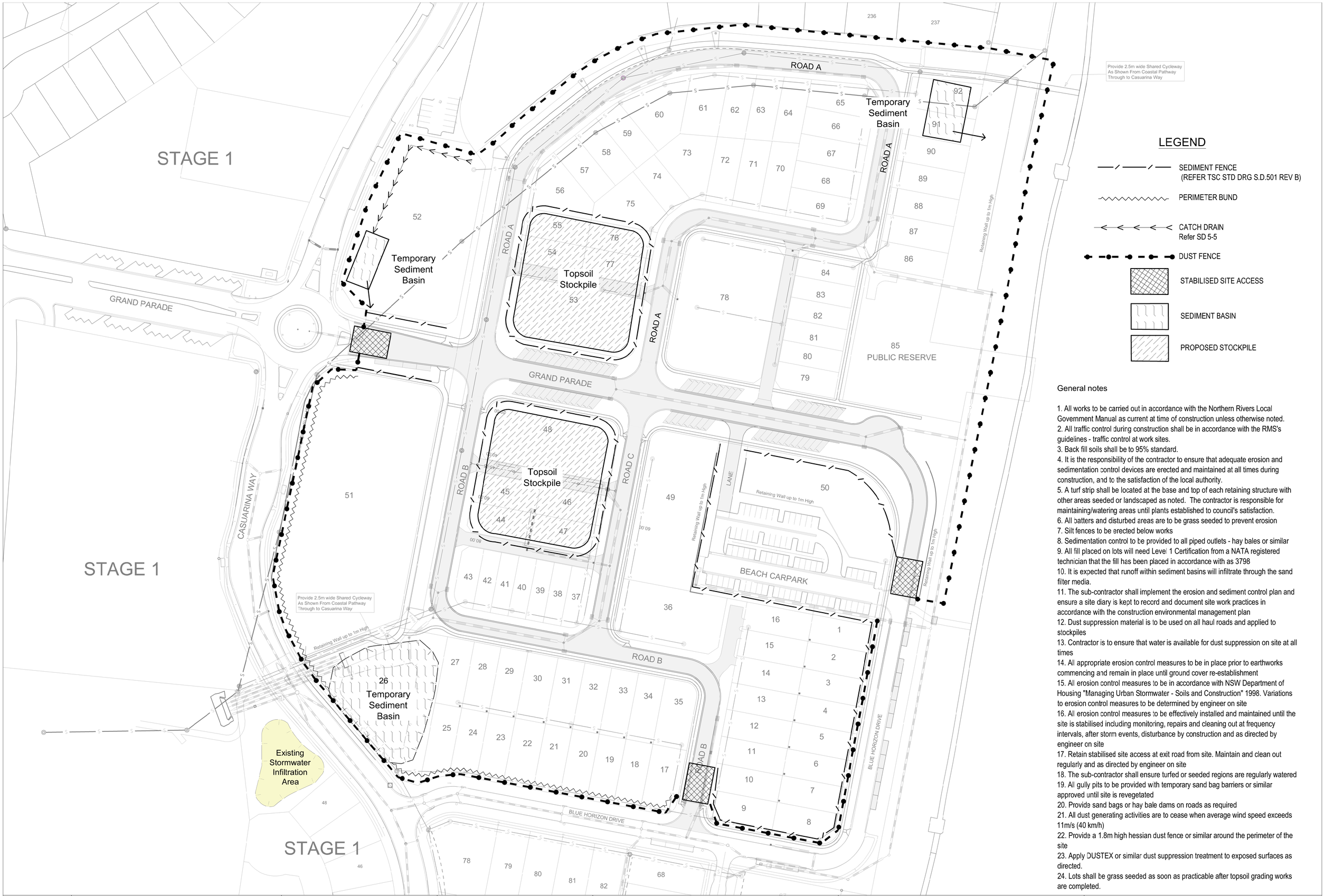
Pavement Design Local Street
Design Subgrade CBR of 9
25mm Asphaltic Concrete (DG10)
5mm 7mm Primer Seal
150mm Top Course (Type 2.1-CBR80)
150mm Base Course (Type 2.3-CBR 45)
330mm Total Box Depth
Subgrade to 70% Density Index AS1289 5.1.1 (Non Cohesive Soils)
Design Subject to TSC Approval



Scale Horizontal 1:500 Vertical 1:100

LONG SECTION OF GRAND PARADE

Amendments	Notes :	Design :	Date: Dec 2015	Newton Denny Chapelle Surveyors Planners Engineers Email: office@newtondennychapelle.com.au	Client: CASUARINA BEACH TOWN CENTRE PROJECT No. 06 0258	Project : LONG SECTION OF GRAND PARADE
		Survey :		Lismore Suite 1 31 Carrington St. Lismore 2480 T: 66 221011 F: 66 224088		Ref No. 13054 Design Rev4 - C4 Long Section of Grande Pde
		Drawn :		Casino 100 Barker St. Casino 2470 T & F : 66 625000		C004 Rev A
		Approved				
		Datum :	Scale $SCALE		K:\Jobs\2013\13054 - Clarence Property\Engineering\Prelim Engineering Plans\C1 Public Carparking Count.dwg	



LEGEND

- SEDIMENT FENCE (REFER TSC STD DRG S.D.501 REV B)
- PERIMETER BUND
- CATCH DRAIN Refer SD 5-5
- DUST FENCE
- STABILISED SITE ACCESS
- SEDIMENT BASIN
- PROPOSED STOCKPILE

General notes

1. All works to be carried out in accordance with the Northern Rivers Local Government Manual as current at time of construction unless otherwise noted.
2. All traffic control during construction shall be in accordance with the RMS's guidelines - traffic control at work sites.
3. Back fill soils shall be to 95% standard.
4. It is the responsibility of the contractor to ensure that adequate erosion and sedimentation control devices are erected and maintained at all times during construction, and to the satisfaction of the local authority.
5. A turf strip shall be located at the base and top of each retaining structure with other areas seeded or landscaped as noted. The contractor is responsible for maintaining/watering areas until plants established to council's satisfaction.
6. All batters and disturbed areas are to be grass seeded to prevent erosion
7. Silt fences to be erected below works
8. Sedimentation control to be provided to all piped outlets - hay bales or similar
9. All fill placed on lots will need Level 1 Certification from a NATA registered technician that the fill has been placed in accordance with as 3798
10. It is expected that runoff within sediment basins will infiltrate through the sand filter media.
11. The sub-contractor shall implement the erosion and sediment control plan and ensure a site diary is kept to record and document site work practices in accordance with the construction environmental management plan
12. Dust suppression material is to be used on all haul roads and applied to stockpiles
13. Contractor is to ensure that water is available for dust suppression on site at all times
14. All appropriate erosion control measures to be in place prior to earthworks commencing and remain in place until ground cover re-establishment
15. All erosion control measures to be in accordance with NSW Department of Housing "Managing Urban Stormwater - Soils and Construction" 1998. Variations to erosion control measures to be determined by engineer on site
16. All erosion control measures to be effectively installed and maintained until the site is stabilised including monitoring, repairs and cleaning out at frequency intervals, after storm events, disturbance by construction and as directed by engineer on site
17. Retain stabilised site access at exit road from site. Maintain and clean out regularly and as directed by engineer on site
18. The sub-contractor shall ensure turfed or seeded regions are regularly watered
19. All gully pits to be provided with temporary sand bag barriers or similar approved until site is revegetated
20. Provide sand bags or hay bale dams on roads as required
21. All dust generating activities are to cease when average wind speed exceeds 11m/s (40 km/h)
22. Provide a 1.8m high hessian dust fence or similar around the perimeter of the site
23. Apply DUSTEX or similar dust suppression treatment to exposed surfaces as directed.
24. Lots shall be grass seeded as soon as practicable after topsoil grading works are completed.

Amendments	Notes :	Design :		Client:	Project :	Ref No. 13054 Design Rev4 - C1 Roads
		Survey :		Stage 2 Casuarina Beach Clarence Property	Erosion & Sediment Control Plan	E001 Rev A
		Drawn :				
		Approved				
		Datum :	Scale 1:750			

Newton Denny Chapelle
Surveyors Planners Engineers
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100 Barker St. Casino 2470
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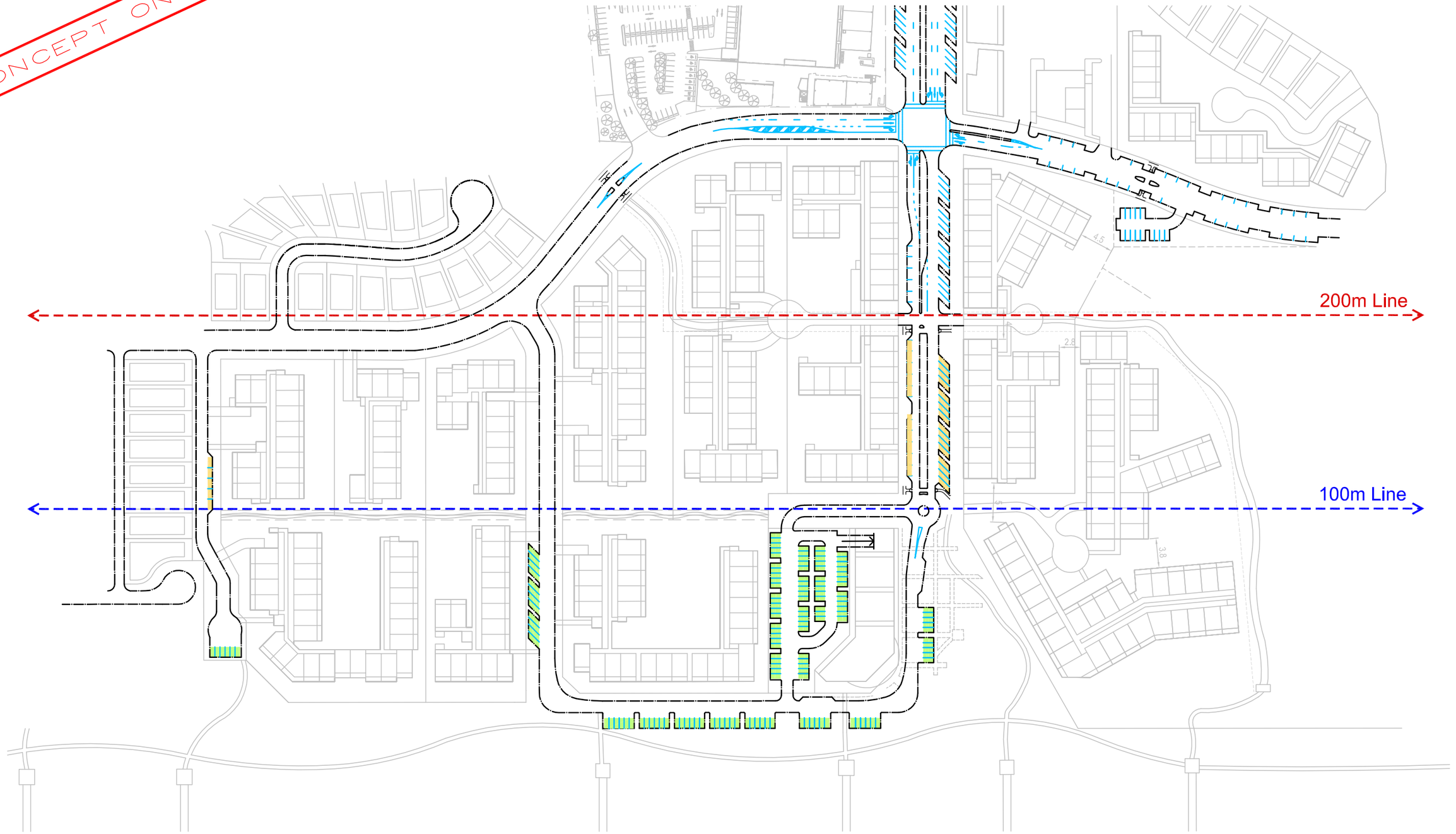
CONCEPT ONLY



LEGEND

- 141 Cars in 100m Zone
- 172 Cars in 200m Zone

Cardno Eppell Olsen

BRISBANE
Level 1, 9 Gardner Close
Milton Qld 4064
P.O. Box 388
Toowong Qld 4066
Tel: (07) 3310 2401
Fax: (07) 3369 9722

GOLD COAST
Suite 2, 20 Nerang Street
Nerang Qld 4211
P.O. Box 391
Nerang Qld 4211
Tel: (07) 5502 1585
Fax: (07) 5502 1586

SYDNEY
910 Pacific Highway
Gordan NSW 2072
Tel: (02) 9496 7700
Fax: (02) 9499 3902

eqp@ec.com.au www.cardno.com.au/eo

Issue	Description	Date	By
A	ISSUE FOR COMMENT	06.01.09	AX
B	SHOPPING CENTRE LAYOUT UPDATED	12.01.09	AX
C	BASE UPDATED	23.01.09	AX

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

20 0 20 40 60 80 100 METRES
SCALE 1 : 1000 @ A1 SCALE 1 : 2000 @ A3

North

Base Information Supplied By: NIL

Design	Drawn	Checked
	AX	BM

Certified .....

RPEQ No. .....

Project Title: CASUARINA TOWN CENTRE

Client: CONSOLIDATED PROPERTIES

Drawing Title: PUBLIC PARKING

Drawing No. 8491-909

Sheet 1 of 1 | Issue C

Scale 1:1000 at A1

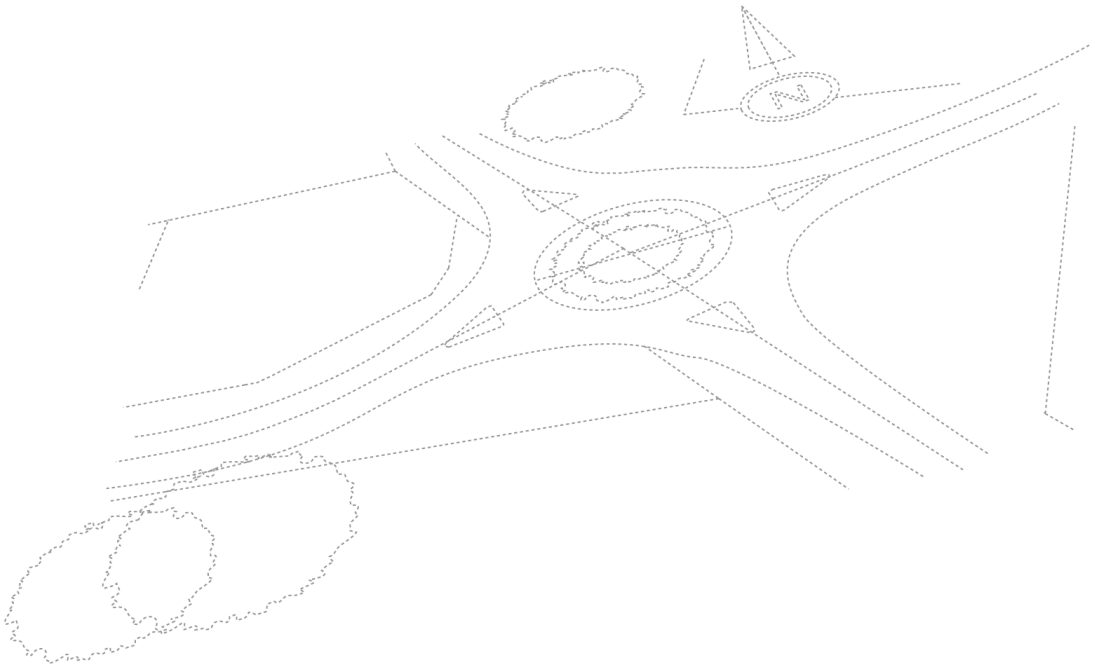
Project CE008491

Xref NIL

ACAD file 8491-Base.dwg

Appendix B Stormwater Management and Piping of Swale

- Casuarina Town Centre, East West Drainage Scheme
- SWINF01 – Infiltration Equivalency Catchment Plan - Rev B



Technical Memorandum 2

Title	**Casuarina Town Centre** **East West Drainage Scheme Options**		
Client	Clarence Property Corporation Ltd	**Project No**	721783
Date	14 July 2015	**Status**	Version 2
Author	Adam Turner	**Discipline**	
Reviewer	Rod Barry	**Office**	Gold Coast

This design summary outlines the drainage strategy prepared as part of the investigation to replace the existing Casuarina Town Centre east-west swale drain with an appropriately sized pipe drainage system.

East West Pipe System Design Criteria

In order to reconfigure the east-west drainage system from an open channel to a pipe culvert system, the following design criteria was considered.

> The pipe culvert system will need to be designed to have sufficient capacity to convey the 100 year ARI flow from the contributing catchment area.
> The grated inlet structure at the upstream end of the pipe system shall be designed for a 50% blockage factor.
> The inlet structure shall have an angled grate with an open area equivalent to three times the area of the total combined pipe areas.
> A review of survey information of the northern precinct provided by Newton Denny Chapelle (NDC), shows the lowest surveyed level for the existing properties fronting the coastal drainage swale is RL5.92mAHD.
> NDC's survey information also indicated that the existing lowest surveyed level along footpath was RL5.56mAHD, and the lowest point in the dune to the east of the footpath is RL5.90mAHD. At this level flow will overtop the swale and discharge towards the beach.
> For open channels that convey major design flows, such as the frontal swale Tweed Shire Council's D5 – Stormwater Drainage Design Development Design Specification outlines that a minimum of 500mm freeboard shall be provided between the 100 year ARI flood level and the floor level of adjacent structures.
> To minimise head losses at the various pit structures, centre lines of the inlet and outlet pipes should be aligned, rather than be aligned with the centre of the pit structure.
> Rock scour protection must be provided at the upstream inlet and downstream outlet of all culverts.

Pipe System Proposed

The previous Technical Memorandum prepared by Cardno (dated 6 September 2013), based on discussions between Cardno and NDC, covered four options which were analysed in the hydraulic modelling package XP-STORM.

Option 4 outlined in the previous memorandum has been selected as the preferred drainage configuration to replace the existing east-west swale drain, which involves the proposed extension of the culvert system along the alignment of the current east-west swale drain up to the existing frontal swale system.

A minor adjustment to the alignment of the pipes was made to ensure that the changes in direction are all less than 45^{o} to reduce the losses through the manhole structures.

Refer to Cardno Sketch No. SK007_B for a schematic layout of the proposed scenario, showing the revised alignment of the pipes, and the locations of the upstream nodes IN/1 (at the inlet to the culvert system), NS50 and NS60 (within the existing northern precinct reach of the frontal swale).

Events Greater than 100 Year ARI

For drainage systems designed to convey the 100year ARI event it is important to consider the impacts of events greater that the 100 year ARI event. Tweed Shire Council's D5.04 Design Rainfall Data requires that the design of major systems a factor of safety of 1.2 shall be applied to design rainfall intensities to properly account for blockages, obstructions, loss of cross section over time, and potential impacts of climate change.

There are two design requirements for the 1.2 x 100 year ARI event. Firstly, to ensure that a freeboard of 500mm to the floor level of adjoining properties. Information provided by NDC stated that the lowest adjoining floor level is at RL6.2mAHD at Lot 237 DP1048494 (being 43 Beech Lane). The second control is to ensure that there is no discharge to the beach in a 1.2 x 100 year ARI event.

The 1.2 x Q100 event was achieved in storm by increasing the 100 year ARI rainfall within the XP storm model by a factor of 1.2, which resulted in increases in required flows from the catchments. A comparison of the flows from the catchments is shown in Table 1 below.

Table 1 1.2 x 100 Year ARI Critical Storm comparison with 100 year ARI Event

Catchment Node ID	Critical Flow Duration	XP Storm 100 Year ARI Peak Flow (m^3/s)	XP Storm 1.2 x 100 Year ARI Peak Flow (m^3/s)
Town Centre Precinct			
NE	60	1.42	1.83
SE	60	0.91	1.11
E	60	1.87	2.30
Northern Precinct			
1	60	1.54	1.95
7	60	1.97	2.47
16	60	2.24	2.78
30	60	1.44	1.80
41	60	2.50	3.11
62	60	0.76	0.93

Table 2 summarises the peak flood levels in the 100 year ARI event and the 1.2 x the 100 year ARI event, following the adjustments made to the alignment of the proposed pipes.

Table 2 Summary Peak Flood Levels

ARI Event	Critical Storm	Pipe Configuration	Water Surface Level @ Node IN/1 (m AHD)	Water Surface Level @ Node NS60 (m AHD)	Water Surface Level @ Node NS50 (m AHD)
100 Year ARI Event	60	3 x 1650 @ 0.1%	5.31	5.43	5.53
1.2 Times 100 Year ARI Event	60	3 x 1650 @ 0.1%	5.67	5.71	5.75

As outlined above, the design criteria for the 1.2 x 100 year ARI flood event is to ensure no discharge towards the beach while maintaining a 500mm freeboard to the floor levels of the adjoining lots. Based on the survey information provided by NDC, the existing lowest surveyed level along footpath was RL5.56mAHD, and the existing lowest surveyed level along the beach front was RL5.90mAHD.

During the 1.2 times 100 Year ARI event at the location of the low point in the path the peak flood level is approximately RL5.71mAHD, as shown in Table 1 above.

Cardno (Qld) Pty Ltd | ABN 57 051 074 992
Level 2 Podium Level - Emerald Lakes Town Centre
1/3321 Central Place, Carrara, Qld 4211
PO Box 391, Nerang, Qld 4211
Tel: 07 5539 9333 Fax: 07 5502 1586
Email: gco@cardno.com.au Web: www.cardno.com.au

Cardno® Shaping the Future

EXISTING CULVERT No. 11

CREEK

LOut11

TWEED COAST ROAD

OUTLET 11

BASIN B

BASIN C

TCW

TCSC

TCNW

D/S SWALE

CENT

OUT/1

TCN

BASIN A

TCSW

BASIN D

TCS

TCE

EAST-WEST PIPE CULVERT SYSTEM 3 x ϕ1650mm RCP

E-W PIPE

3/1

TCSE

PIPE SE

FS

TCS3

TCNE

IN/1

NS60

NS50

1

O1

7

O7

PACIFIC OCEAN

W CATCHMENT
Q_{100} = 0.6 m^3/sec
C_{100} = 0.90
A = 0.89ha
T_c = 6.5min

SC CATCHMENT
Q_{100} = 1.2 m^3/sec
C_{100} = 0.90
A = 1.65ha
T_c = 6.5min

NW CATCHMENT
Q_{100} = 1.4 m^3/sec
C_{100} = 0.86
A = 2.86ha
T_c = 15min

STAGE 3A IAD1
Q_{100} = 0.2 m^3/sec
C_{100} = 0.80
A = 0.30ha
T_c = 6min

CENTRAL CATCHMENT
Q_{100} = 3.0m^3/sec
C_{100} = 0.78
A = 9.78ha
T_c = 22.5min

N CATCHMENT
Q_{100} = 1.7 m^3/sec
C_{100} = 0.84
A = 3.70ha
T_c = 17.5min

SW CATCHMENT
Q_{100} = 0.6 m^3/sec
C_{100} = 0.80
A = 1.28ha
T_c = 14min

SANTAI
Q_{100} = 0.5 m^3/sec
C_{100} = 0.85
A = 0.74ha
T_c = 8min

OUTLET 7
Q_{100} = 2.0 m^3/sec
C_{100} = 0.80
A = 5.00ha
T_c = 19.9min

OUTLET 1
Q_{100} = 1.5 m^3/sec
C_{100} = 0.84
A = 3.60ha
T_c = 17.5min

S CATCHMENT
Q_{100} = 1.1 m^3/sec
C_{100} = 0.82
A = 2.40ha
T_c = 16.5min

E CATCHMENT
Q_{100} = 1.9 m^3/sec
C_{100} = 0.83
A = 4.03ha
T_c = 16min

SE CATCHMENT
Q_{100} = 0.9 m^3/sec
C_{100} = 0.83
A = 1.97ha
T_c = 16min

NE CATCHMENT
Q_{100} = 1.4 m^3/sec
C_{100} = 0.75
A = 3.26ha
T_c = 15min

SE CATCHMENT
PIPE FLOWS DISCHARGE TO EAST FRONTAL SWALE. OVERLAND FLOWS TO DISCHARGE TO WEST.

FS CATCHMENT
Q_{100} = 0.8 m^3/sec
C_{100} = 0.54
A = 1.65ha
T_c = 5min

FROM INFORMATION SUPPLIED BY NDC, LOWEST SURVEYED PROPERTY LEVEL ON 7F ZONE BOUNDARY RL 5.92. FLOOR LEVEL RL6.2

FROM INFORMATION SUPPLIED BY NDC, LOWEST SURVEYED FOOTPATH LEVEL RL5.56, LOWEST SURVEYED LEVEL ALONG BEACH FRONT RL5.90.

LEGEND:

- TOWN CENTRE SITE BOUNDARY
- TOWN CENTRE CATCHMENT BOUNDARY
- CENTRAL CATCHMENT BOUNDARY
- NORTHERN CATCHMENT BOUNDARY
- XP STORM NODES
- XP STORM LINKS – COMBINED PIPE & OVERLAND FLOW
- XP STORM LINKS – PIPE FLOW ONLY
- XP STORM LINKS – OVERLAND FLOW ONLY
- PIPE FLOW DISCHARGE LOCATION
- OVERLAND FLOW DIRECTION
- 7F ZONE WESTERN BOUNDARY
- Q100 FLOOD LEVEL CONTROL POINT LOCATIONS

SUMMARY OF PEAK FLOOD LEVELS

ARI EVENT	WATER SURFACE LEVEL @ NODE IN/1 (mAHD)	WATER SURFACE LEVEL @ NODE NS60 (mAHD)	WATER SURFACE LEVEL @ NODE NS50 (mAHD)
100 YEAR ARI EVENT	5.310	5.430	5.530
1.2 x 100 YEAR ARI EVENT	5.670	5.710	5.750

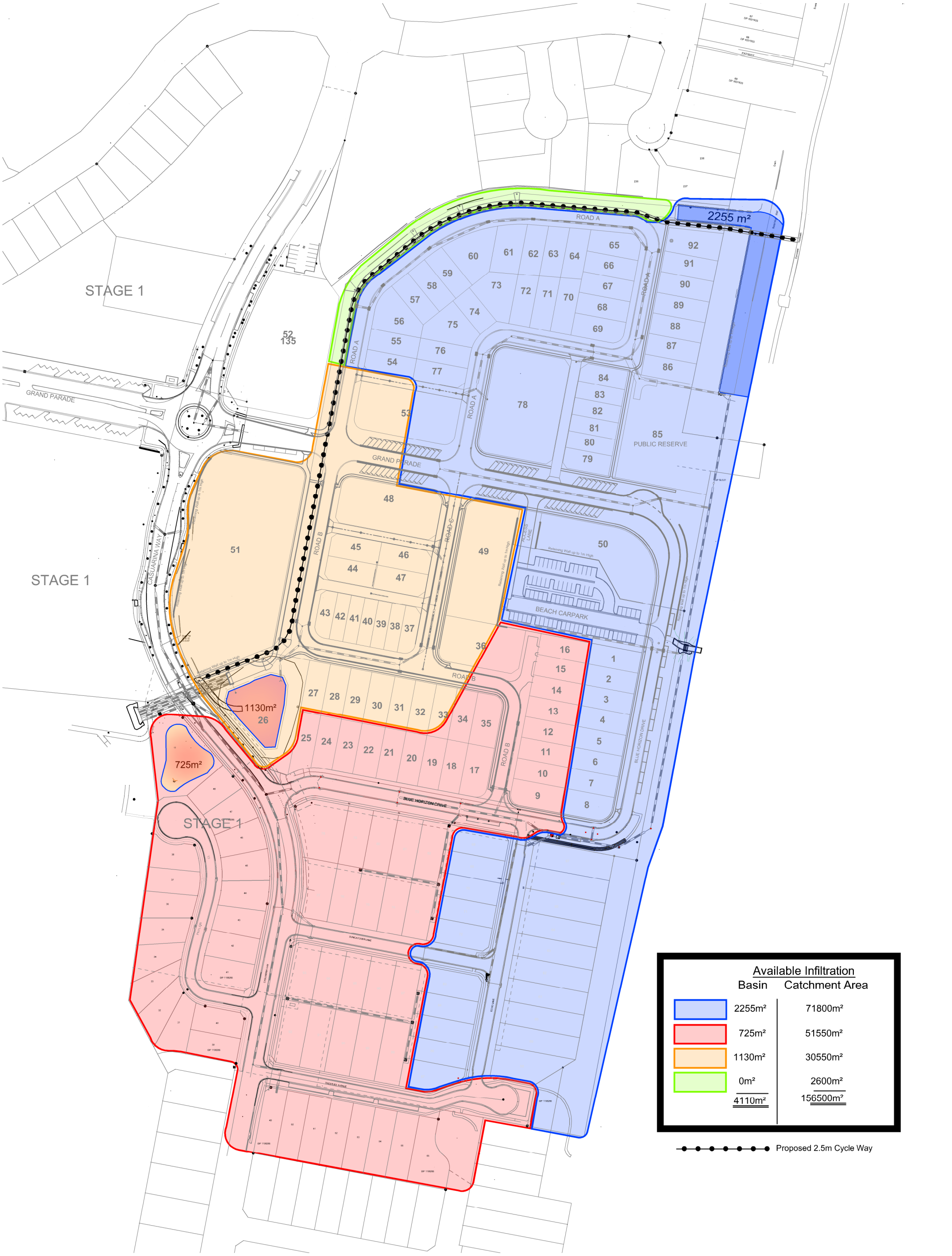
0 50 100 150m
SCALE @ A1 1 : 1500

Clarence Property Corporation Limited
Casuarina Town Centre
East - West Drainage Scheme
Option 4 - Pipe Through To Frontal Swale

Date: August 2013
Drawing Number: 721783-002 SK008
Revision: A

DATE PLOTTED: 14 July 2015 10:55 AM
CAD FILE: P:\721783 Casuarina Pipe Drainage of Existing Swale\03 Design\Cad\03 Sketches\721783_002_SK008_A.dwg

AUSTRALASIA ASIA AFRICA MIDDLE EAST UK/EUROPE NORTH AMERICA LATIN AMERICA



REV	DATE	AMENDMENT
A	July 15	Cycleway Added, Basin Revised
B	Dec 15	Infiltration Area Lots 86-92 Extended
C		
D		
E		

SOURCE PLAN: MJO - 13/054 Design Rev4 & 13169 WAX & Linen

k:\jobs\2013\13054 - clarence property\engineering\prelim engineering plans\13054 design rev4.dwg - a3 portrait

Newton Denny Chapelle
Surveyors Planners Engineers
Email: office@newtondennychapelle.com.au
LISMORE 31 Carrington St. Lismore 2480 PH: 6622 1011
CASINO 100 Barker St. Casino 2470 PH: 6662 5000
ABN: 86 220 045 469

SWINF 01 Infiltraton Equivalency Catchment Plan
Rev B

CLIENT: Clarence Property Trust P/L
LOCATION: Casuarina Town Centre

DATE: Dec 2015
SCALE: 1:2000 @ A3
REF: 13/054
DRAWN: ps

Appendix C Cardno – Acid Sulfate Management Plan

CASUARINA BEACH DEVELOPMENT
TOWN CENTRE ACID SULFATE SOIL MANAGEMENT PLAN

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Purpose

The aim of this Acid Sulfate Soils Management Plan is to provide design, management, monitoring, and remedial action measures to minimise the potential impact on the environment caused by the possible disturbance of acid sulfate soils as a result of construction activity associated with the Town Centre Stage 2 of the Casuarina Beach Development.

1.2 Description of Project

The Casuarina Beach development will be a staged residential precinct which will ultimately accommodate a population of about 5,600. The development area, which is located on the northern New South Wales coast south of Kingscliff, is bounded to the west by Cudgen Creek and to the east by the Pacific Ocean.

Stage 1 of the development involved the construction of a new coast road to the west of the previous alignment, and the formation of 7 management lots. Following stages are involved with the urban development of each or several of these management lots.

Following stages have been involved with the construction of residential development throughout the site. The Town Centre area will be the commercial hub for the Casuarina precinct, as well as providing medium and low density housing for residents and tourists. The work to be carried out on the site includes the construction of Casuarina Way between the Casuarina Central and Northern Precincts, as well as clearing of vegetation and significant earthworks reshaping of the site. The site will eventually be developed as an urban community, involving the provision of all relevant urban infrastructure such as roads, water supply, sewerage, power and telecommunications.

1.3 Description of Existing Environment

1.3.1 Existing Ground Levels

The site is presently dominated by a ridge with a maximum level of between 10 and 12 m AHD, which runs from south to north through the central section of the site. This ridge is a remnant of the construction of the new Coast Road in the first stage of Casuarina. On the western side of the ridge, substantial earthworks took place in 1999 as part of this construction. The ground levels in this part of the site vary from about 10 m AHD adjacent to the ridge, to about 3 m AHD on the eastern edge of the road.

On the eastern side of the ridge, the site remains unchanged in level from its pre-existing condition. From the east to the west, levels fall from 10 m AHD on the line of the beach dunes to a depression with a level of about 6 m AHD, before rising again to meet the ridge level of 12 m AHD.

1.3.2 Soils

The site comprises dunal sands and beach ridges, extending from the beach dune to beyond the alignment of the Coast Road. Quartzose sand is identified in surface deposits. Previous studies by Douglas Partners determined the underlying soils to be generally clean beach and dunal sands.

On the elevated land containing the beach ridges, underlying soils comprise loose sands up to 0.5 m in depth, becoming medium dense below 0.5 to 1.0 m depth. Dense and very dense sands occur below 8 m to 11 m depth. Some minor traces of silt layers, and silty sand, are interbedded with the clean sands at depth.

1.3.3 Surface Water

There is no permanent surface water within the Town Centre development area.

1.3.4 Ground Water

A groundwater ridge exists under the high part of the site, generally coincident with the location of the old coast road. Previous investigations have determined that the water table has a consistent level of slightly above 1 m AHD in this area. A positive hydraulic gradient therefore exists for groundwater discharges to both Cudgen Creek and the Pacific Ocean.

1.4 Previous Investigations

A number of previous acid sulfate soils investigations have been completed in relation to the Kings Beach development area. These are reported upon in detail in the Acid Sulfate Soil Management Plan prepared by Cardno MBK for Stage 1 of this project, and submitted to Tweed Shire Council in August, 1999.

In general, these previous investigations have determined that the majority of the site to be developed, including all of the area covered by the Town Centre Stage 2, is unlikely to have any ASS or PASS constraints. For example, testing by Douglas Partners included a terrain evaluation which identified the following two terrain units within the study area:

- Terrain Unit QS_1. This area generally corresponds to the area above RL 5 m AHD located along the more elevated central and eastern portions of the site and the previously mined area.

- Terrain Unit QS_2. This area lies to the west of terrain unit QS_1 and generally corresponds to the low lying area below RL 5 m AHD along the western part of the site adjacent to Cudgen Creek.

The Town Centre site is mostly (more than 90%) contained within the QS_1 unit. Boreholes DP5, BH2, BH4, AS-A and AS-L are located within, or adjacent to the proposed development area. Previous testing carried out on soil or water quality samples from each of these holes indicated generally low acid potential.

No acid sulfate soils were disturbed in this area during the construction of the Coast Road.

2. PROPOSED WORKS

In relation to ASS and PASS, it is considered that there are only two mechanisms whereby potential disturbance could occur. These are:

- Preliminary earthworks movements, involved with reshaping of the land profile
- Excavation associated with construction of sewers and other buried infrastructure

On the basis that the water table level over the Town Centre site is generally at or below 1.0 m AHD, there are no planned works which could affect groundwater conditions. Mobilisation of acid as a consequence of exposure of PASS materials by lowered water levels will therefore not be a problem. The changes in surface level will not be significant in relation to the water table.

No changes in ground level are proposed for the western part of the site. The construction of Casuarina Way in this area will take place at levels that are not significantly different to existing ground levels. This is illustrated on the attached plans which show the developed land form. Excavation of high points, and filling of low points, is proposed on the eastern part of the site, to produce a more consistent land form than currently exists.

While these earthworks will be significant, no material will be disturbed below a level of at least 6 m AHD. This excavation will also take place on that part of the site which is free of acid sulfate soils. Consequently, it is not expected that there will be any disturbance of ASS or PASS material during the bulk earthworks phase of the project.

Infrastructure installation may involve limited disturbance of deeper soils. Consequently, and on the basis of the previous ASS testing completed by Douglas Partners and Sinclair Knight Merz, it is recommended that all earthworks to be carried out below 6.0 m AHD in the area west of Casuarina Way be classed as having ASS potential, and be tested and treated accordingly.

3. CONSTRUCTION ACTIVITIES

3.1 Responsibility of Contractor

The Contractor(s) for civil works on the site shall conduct operations in accordance with this document. Prior to the commencement of works, the Contractor shall provide the following information to the consultant:

- Contractor's environmental policy,
- Names and responsibilities of supervisory staff involved with the implementation of the acid sulfate management plan.
- Schedule of site inspections (and personnel responsible) to identify environmental problems, and maintenance actions to remedy any environmental problems identified.
- An Incidents and Events Register, in which all environmental problems identified during inspections and monitoring, and complaints received are recorded and acted upon.
- Environmental training plan and Training Record Plan for all personnel involved in development of the site.

Emphasis shall be placed upon the timely resolution of any complaints received in relation to development of the site and the development and implementation of corrective actions in response to non-conformities to the Management Plan (identified by the monitoring process).

The Performance Objective regarding complaint resolution is for the issue causing each complaint to be resolved in such a manner that there is no further complaint for the same reason.

The Contractor is to maintain an "Incidents and Events Register" which lists the date of the incident or complaint and the type of incident or complaint. For each incident, an incident/ complaint log is to be completed nominating:

- Date of incident,
- Nature of incident and associated information,
- Location of incident,
- Name of person or body which reported incident,
- Employee who received notice of incident,
- Project Manager's review and comment,
- Recommended action to resolve incident,
- List of organisations to be contacted with regard to incident,
- Outcome of actions undertaken subsequent to incident being recorded, and
- Date of resolution of incident.

Each incident is to be assigned a number to be entered on the master Incident and Event Register. Further, Tweed Shire Council and the Environment Protection Agency are to be notified and directions with regard to corrective action sought for incidents which have the potential to cause environmental harm.

3.2 Notification to Council

Prior to the commencement of works, Council shall be notified in writing of the Consultant and contact officer nominated to be responsible for Acid Sulfate Soil Management as defined by this management plan.

3.3 Acid Sulfate Management Plan

POLICY: To minimise the impact of disturbance of acidic and potential acidic soils upon surface and ground water quality.

PERFORMANCE OBJECTIVES: To avoid detrimental impact on the water quality and aquatic environment of the Cudgen Creek and the Pacific Ocean, as a result of the discharge of acidic waters from the site.

To comply with relevant legislation and to manage acid sulfate soils in accordance with the Environment Protection Agency publication *Assessing and Managing Acid Sulfate Soils, Guidelines for Land Management in NSW Coastal Areas* (June 1995) and the NSW Department of Urban Affairs and Planning publication *Acid Sulfate Soils Guidelines* (November 1997).

To avoid detrimental impact on the groundwater resource of the region.

CONTROL MEASURES: The Contractor and his site representatives shall be trained in the recognition of possible acid sulfate soils.

All soil excavations below 6.0 m AHD in the area west of Casuarina Way shall be considered to potentially contain PASS, and should be handled accordingly, including appropriate site testing. If PASS is detected, limiting rates should be determined from laboratory analysis if soil is to be exposed for more than 12 hours. If exposure will be for less than 12 hours, the Contractor shall liaise with the consultant in relation to determining an amount of lime to be added.

Sampling, storage and testing of samples shall be completed in accordance with Part 4 (Laboratory Methods) of the ASSMAC Manual, 1998. Laboratory testing shall use the POCAS (Peroxide Oxidation Combined Acidity & Sulfate) method. Field testing shall be via the field peroxide pH test.

ASS and PASS material shall be neutralised if necessary by the addition of fine agricultural lime well mixed through the soil. Lime addition rate shall be determined from test results carried out at regular frequency eg. 1 test per 500 m^3 with a factor of safety for inefficiencies. Mixing may be carried out by spreading in thin layers and use of agricultural spreader and disc plough or similar. Lime storage, application and mixing shall be carried out in accordance with Part 2 (Management) of the ASSMAC Manual, 1998.

A supply of agricultural lime ($CaCO_3$) shall be available at all times for treatment of acid sulfate soils. The supply shall be stored in a covered and bunded area to prevent accidental release to waters.

A similar quantity of hydrated lime shall also be available at all times for treatment of acidic waters. Storage requirements for hydrated lime shall be identical to that specified above for agricultural lime.

In the event that ASS conditions are present at any specific location, runoff controls will be implemented, with neutralisation of acid generating material by the addition of lime. Opened ground shall be isolated from upstream catchments, by the construction of earth bunds around the upstream side of the excavation. A detention basin shall be formed immediately downstream of the excavation, to capture runoff from the site. The basin shall be sized to completely hold 50 mm of runoff from the excavated area. Impounded water shall be tested and treated with lime to bring the pH to a minimum of 6.5 if necessary. Testing and neutralisation of water stored on the site prior to release shall be carried out in accordance with Part 2 (Management) of the ASSMAC Manual, 1998.

Lime stabilised water may be released when this pH criterion is satisfied, provided that there is no floating matter and no visible oil or grease in the discharged water. A precautionary approach is to be used with the storage and addition of hydrated lime, since it has an inherently high pH and can cause extreme alkaline conditions if overdosing occurs.

If required, a permanent storage site for ASS and PASS spoil material excavated from the site, and deemed to be unsuitable for reuse, shall be designated by the Consultant. This site shall provide for detention of potential acid sulfate material in anoxic conditions below the water table with minimum final cover of 3 m water depth or 1 m of sand or other non acid generating fill. The site must be approved by Tweed Shire Council.

The disposal location should be excavated and a survey carried out to enable accurate records to be provided to Tweed Shire Council and the Environment Protection Agency. Council shall be consulted with respect to suitable locations for disposal and called to inspect any disposal area during its use and prior to its capping.

It is noted in this regard that studies completed to date indicate that all excavated material will be reusable in embankment and filling activities, and that it is therefore unlikely that a permanent storage site will be required.

All acidic soils used for filling purposes shall be treated with agricultural lime at the appropriate rate determined from soil testing.

Regardless of whether acid sulfate material is encountered on the site, all water to be discharged shall be tested to ensure that the pH of any discharged water is between 6.5 and 8.5.

Where stockpiling is necessary, the following will occur:

- Any ASS to be treated immediately with lime,
- Stockpiles to be located in areas which will minimise environmental impact,
- Design of stockpiles to minimise the surface area exposed to oxidation, the amount of infiltration, and will include diversion banks to isolate stockpiles from runoff.
- An apron of limestone will be placed beneath stockpiles.

VERIFICATION: Soil material which has been treated with lime shall be sampled at a rate of 1 test per 1,000 m^3, to determine the adequacy of the liming rate and the mixing process. Appropriate remedial action shall be implemented if acidic potential still remains.

MONITORING: Regular monitoring and laboratory testing of water quality will be undertaken. Such monitoring shall include the testing of surface water in Cudgen Creek and groundwater in a number of boreholes, as outlined in the Water Quality Monitoring Program.

Monitoring will be undertaken on a monthly basis prior to and during the construction phase, and on a three monthly basis for 12 months following completion of the works.

In addition, regular on-site monitoring of water quality will be required during the construction phase. Such monitoring shall include:

- Daily measurements of any discharge from known ASS or PASS sites, recording pH and NFR. This shall also apply to any excavation below RL 5.0 m AHD, whether ASS is recognised or not.

The Contractor shall maintain records of any fauna kills in adjacent waterways and leachate staining.

Water pumped into any temporary basins shall be tested for pH and treated if necessary prior to discharge.

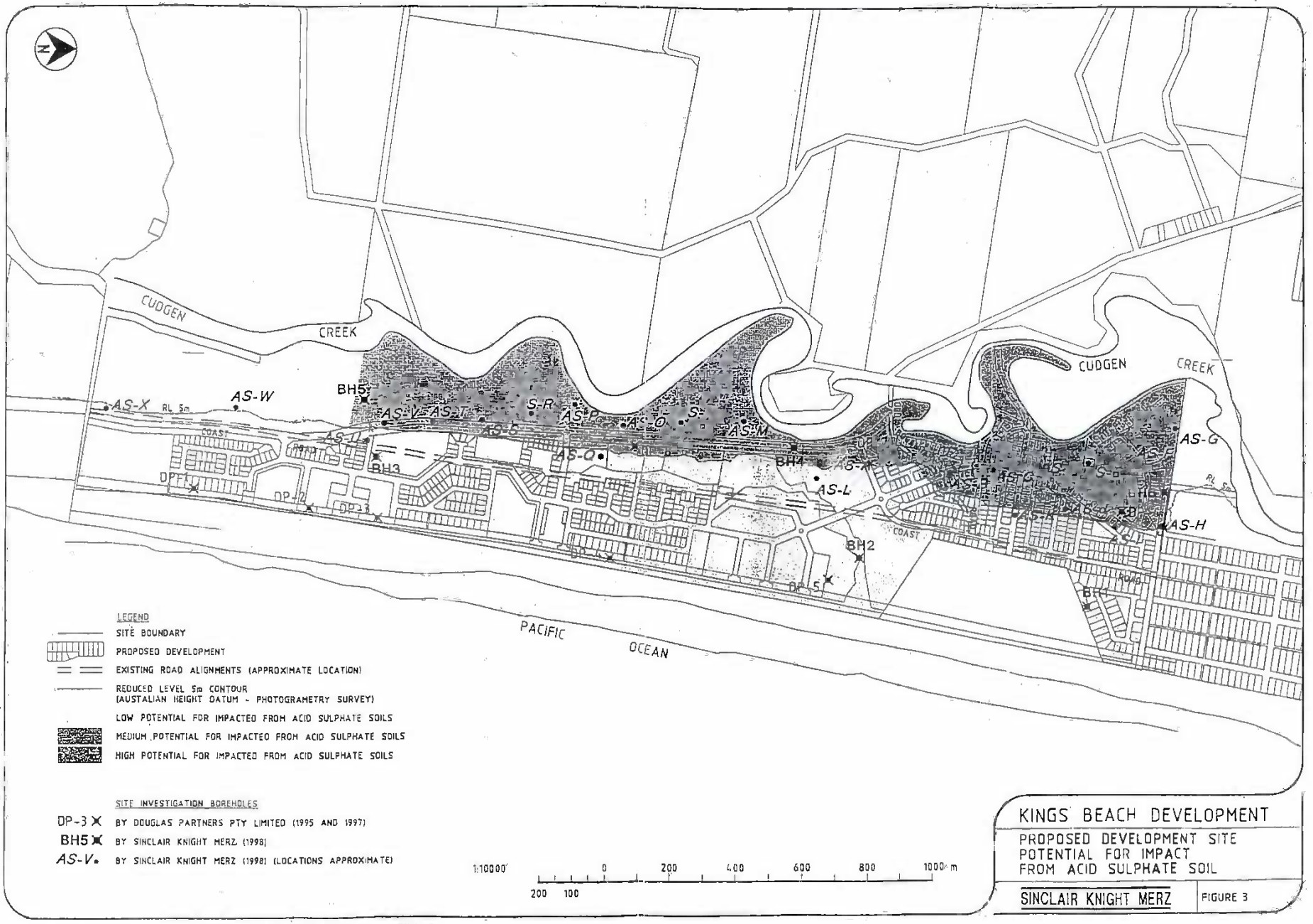
REPORTING: Monthly reports by the Consultant (copy to Contractor) on the monitoring during construction, and of all corrective action taken to maintain the performance requirement. Copies to Environment Protection Agency and Tweed Shire Council.

CORRECTIVE ACTION: Water shall not be discharged from the site if the water quality is assessed as not being suitable for discharge. In general, this will require pH to be at least 6.5, and the average suspended solids concentration to be less than 50 mg/L.

Remedial measures shall be applied when the following water quality indicator levels are exceeded:

pH	between 6.5 and 8.5.
Fe (iron) total	< 500 µg/L
Total Dissolved Solids	<1,500 mg/L
Aluminium Al (total)	<5 µg/L (pH <6.5)
	<100 µg/L (pH >6.5)

Corrective action shall be undertaken by the Contractor to the satisfaction of the Consultant, and may include dosing with chemicals and extended holding times in detention basins. Dosing rates for materials such as lime (for pH stabilisation) and polyelectrolyte coagulants (for precipitation of suspended solids) shall be in accordance with monitored results.



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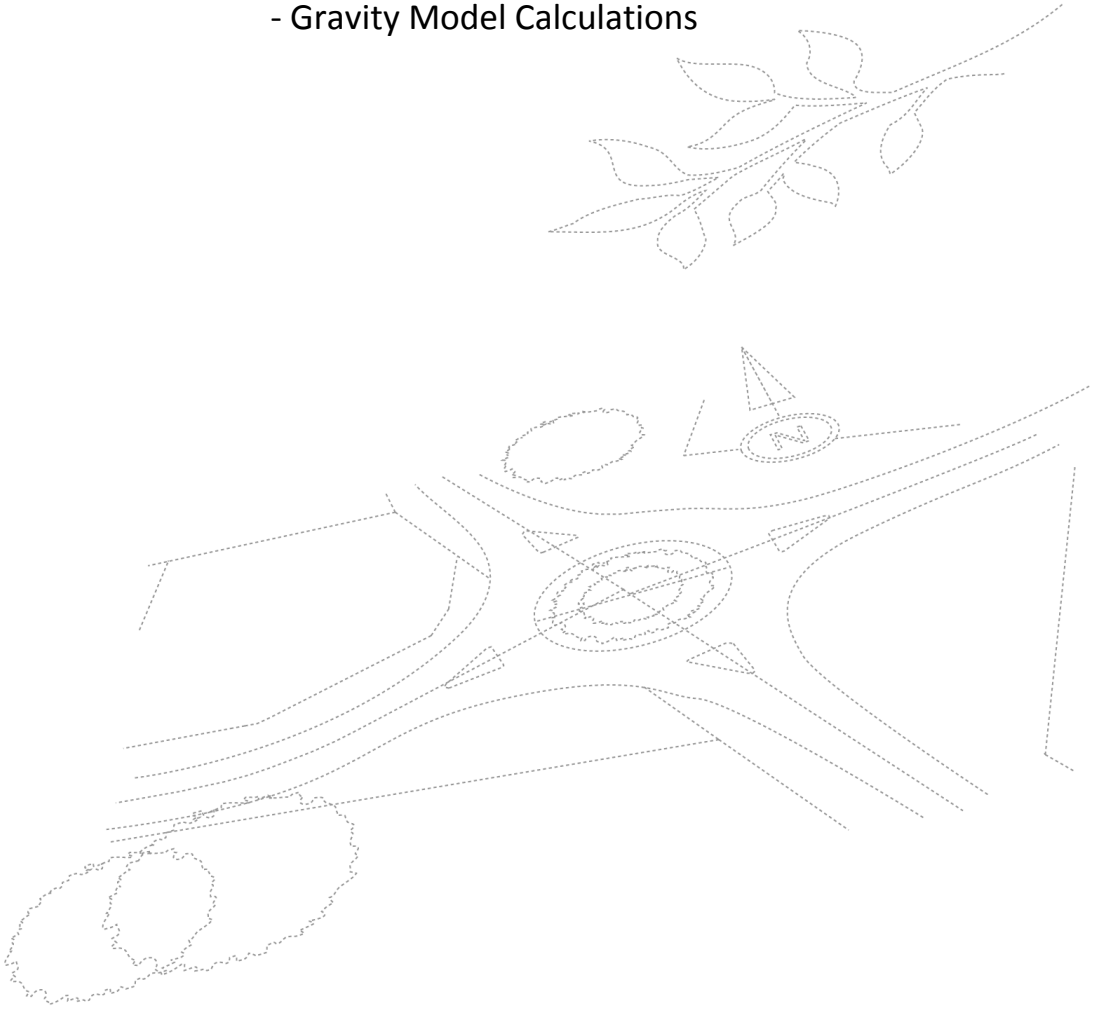
Appendix D Engineering Calculation Sheets

- Gravity Model Calculations



Casuarina Town Center
Traffic Gravity Model

Newton Denny Chapelle
CONSULTING SURVEYORS & PLANNERS

Dec-15

Intersection Catchment Generation	Standard Allotments			3 Storey Residential			4 Storey Residential			Retail			Total Daily Trips	Peak Hrly Trips based on 15%	
	No.	Daily Trip Rate	Total Daily Trips	No.	Daily Trip Rate	Total Daily Trips	No.	Daily Trip Rate	Total Daily Trips	GFA	Daily Trip Rate	Total Daily Trips			
Traffic Catchment A	16	6.5	104	14	3.9	55	40	3.9	156	0.0	0	0	314.6	47.2	Complies with Access Street - TSC VPD <1000)
Traffic Catchment B	10	6.5	65	14	3.9	55	64.8	3.9	253	0.0	0	0	372.3	55.8	Complies with Access Street - TSC VPD <1000)
Traffic Catchment C	17	6.5	111	6	3.9	23	25.6	3.9	100	0.0	0	0	233.7	35.1	Complies with Access Street - TSC VPD <1000)
Traffic Catchment D	8	6.5	52	44	3.9	172	0	3.9	0	0.0	0	0	223.6	33.5	Complies with Access Street - TSC VPD <1000)
Traffic Catchment E	4	6.5	26	0	3.9	0	6.4	3.9	25	0.0	0	0	51.0	7.6	Complies with Lane - TSC VPD <300)
Traffic Catchment F	0	6.5	0	26	3.9	101	0	3.9	0	800.0	2.8	222	323.8	48.6	Complies with Lane - TSC VPD <300)
Traffic Catchment G	10	6.5	65	0	3.9	0	7.2	3.9	28	0.0	0	0	93.1	14.0	Complies with Access Street - TSC VPD <1000)
Grand Pde - Coast Road	4	6.5	26	0	3.9	0	0	3.9	0	1800.0	2.8	210	236.4	35.5	200 + 2.8 vehicles per 100m2 of GFA
BH Drive - Coast Road	13	6.5	85	0	3.9	0	0	3.9	0	600.0	2.8	57	141.3	21.2	
	82		533	104		406	144		562	3200		490	1990	298	

Intersection Turning Movement (vph peak)	A		B		C		D		E		F		G		
Intersection	Left Turn	Right Turn	Left Turn	Right Turn	Left Turn	Right Turn	Left Turn	Right Turn	Left Turn	Right Turn	Left Turn	Right Turn	Left Turn	Right Turn	
GP1	4.7	42.5	50.3	5.6											
GP2					3.5	31.6	30.2	3.4							
GP3									0.8	6.9					
GP4											38.9	9.7			
BH1													1.4	12.6	vph
Peak - Grande Pde		42.5	50.3			31.6	30.2			6.9	38.9		1.4		**237**
Peak - BH Drive	4.7			5.6	3.5			3.4	0.8			9.7		12.6	**61**
	47.2		55.8		35.1		33.5		7.6		48.6		14.0		

Public Carpark Generation				
Number of parking bays within the development			172	Spaces
Carpark Turnover rate (Southport Broadwater)			225%	
Number of Trips generated (vpd)			387	vpd
Apportionment		**vpd**	**vph**	**Total peak vph**
Grande Parade	60%	232.2	35	**272**
Blue Horizon Drive	40%	154.8	23	**85**

Rate from Adam Pekol Consulting 2009

Trip Generation Calculations (Excluding Public Parking)		
Screen Line	**VPD**	**Peak (VPH)**
A	315	48
B	373	56
C	234	36
D	224	34
E	51	8
F	324	49
G	94	14
H	1580	237
I	409	61

Trip Generation Calculations (Including Public Car parking)		
Screen Line	**VPD**	**Peak (VPH)**
H	1813	272
I	565	85