

ANNEXURE C

Mosquito Risk Assessment by Mosquito Consulting Services

Mosquito Risk Assessment
Proposed Residential Development
Lot 2 DP 1119830
Alexandra Drive
Bellwood

Prepared for
Geoff Smyth Consulting

Prepared by
Darryl McGinn
Director and Medical Entomologist

Mosquito Consulting Services Pty Ltd

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1.0 Introduction

Mosquito Consulting Services Pty Ltd was engaged by the Developer (via Geoff Smyth Consulting) to undertake a mosquito risk assessment at Lot 2 DP 1119830, Alexandra Drive, Bellwood. The brief issued by Nambucca Shire Council required that:

“A Mosquito Risk Assessment prepared by a suitably qualified person to investigate the likely impact of nearby Mosquito habitat and which details appropriate buffering or other measures for the proposed residential land use/subdivision....”

An entomological investigation to characterise the current mosquito fauna and to assess the potential risk associated with the proposed development was undertaken in April 2012. A site visit was conducted 11-12 April to collect mosquitoes present at the time and to observe and record potential breeding habitat. The proposed development plan was provided showing the location of allotments, roadways and other open space relative to the habitat.

2.0 Mosquito Survey

2.1 Adult mosquito trapping

Mosquito trapping was undertaken over 11-12 April 2012. Two trapping locations near branches of Bellwood Creek adjacent to the eastern boundary were chosen as being likely worst-case for mosquito exposure. Map 1 shows the trap locations along with the habitat survey GPS tracks.

Map 1: Mosquito Trap Locations and Habitat Survey Tracks

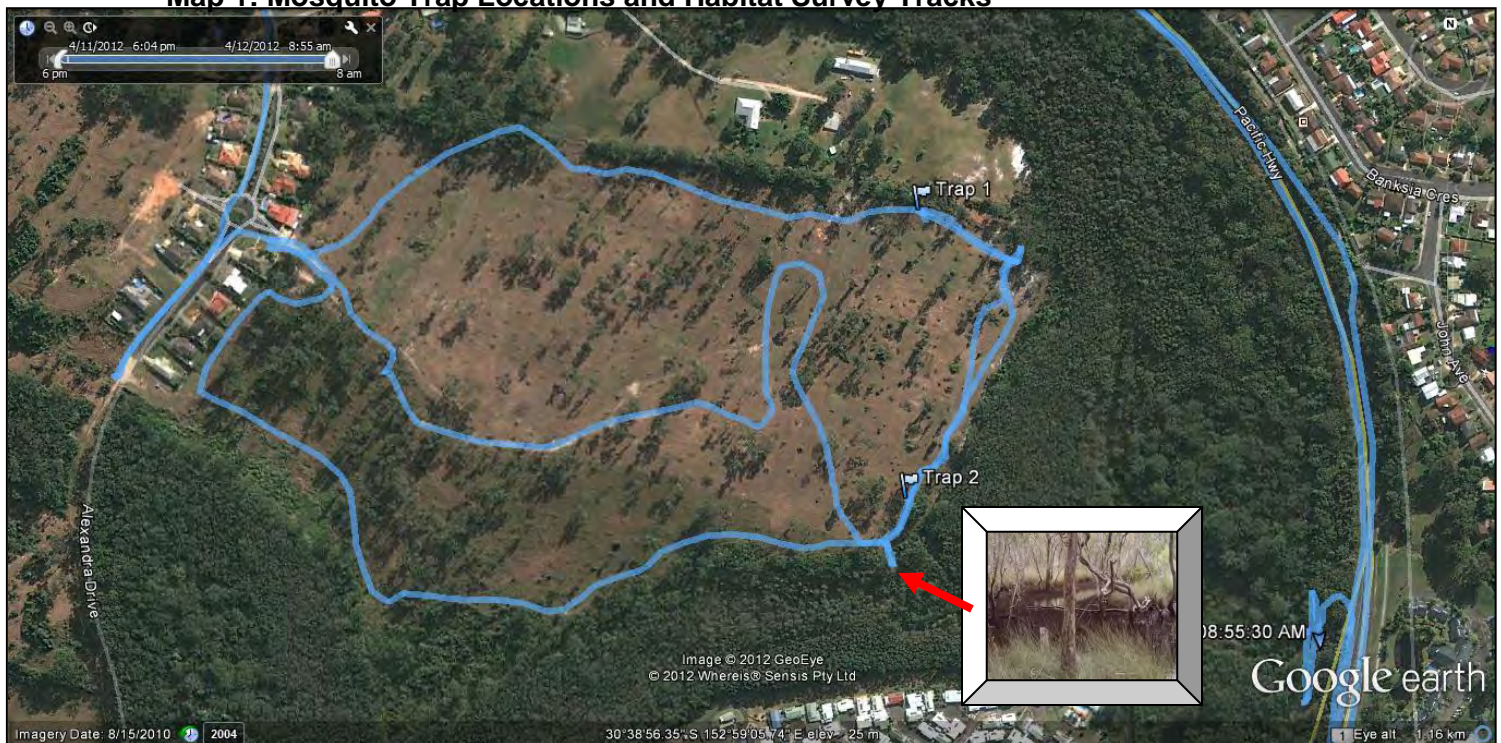


Plate 1 shows the mosquito light traps deployed 11-12 April.

Plate 1: Trap Site 1



Trap Site 2



Traps were baited with carbon dioxide (as dry ice @ 1kg/trap/night) and Octenol (1-octen-3-ol) and deployed at approx. 18:00 hrs. Traps performed correctly during the night and were still operating when collected at approx. 08:00 hrs the next morning. The insulated containers contained around 100g of dry ice indicating carbon dioxide was produced over the entire trapping period. Mosquitoes were collected directly into 70% ethanol to kill and preserve them in good condition for laboratory identification. Plate 2 shows the collections in traps 1 & 2 prior to recovery.

Plate 2: Collections from Trap 1



Trap 2



Mosquito collections were returned to the laboratory for identification under dissecting microscope.

2.2 Mosquito Habitat Survey

The site is generally elevated with fairly steep grades towards the creek branches. No mosquito breeding habitat was observed within the development footprint. The environmental buffer to the SEPP 14 was crossed to observe the nature of the creek near the eastern boundary. The creek was observed to be tidal and colonised by the grey mangrove (*Avicennia marina*). The creek was clearly defined within a narrow central channel bounded by steeply sloping banks. A narrow sedge margin was observed that apparently is flooded by high spring tides but does not appear to retain tide waters after flooding. Plate 3 shows views of the creek channel and sedge margins. No mosquito breeding was found in the creek or its margins at the time of inspection. Some pooling of water in the centre of the creek channel appears to be flushed by tides on a near daily basis.

Plate 3 Grey mangrove in tidal branch of Bellwood Creek



2.3 Trapping Results

Light traps collected mosquitoes from 10 species. Trap 1 produced 256 mosquitoes and Trap 2 only 197. Species listed by abundance (combined) were:

• <i>Culex annulirostris</i>	75%
• <i>Culex australicus</i>	15%
• <i>Mansonia uniformis</i>	> 3%
• <i>Coquillettidia xanthogaster</i>	> 2%
• <i>Anopheles annulipies</i>	<u>> 2%</u>
	97%
• 5 other species	<u>3%</u>
	100%

3.0 Discussion of Survey Results

The development site is located close to a tidal creek. In many situations, tidal waterways lead to creation of salt-marsh habitat. A number of mosquito species may exploit salt-marsh including *Aedes vigilax*, the most important coastal nuisance biting mosquito in Australia. It is also known to transmit human diseases including Ross River virus. From trapping of the site under very good conditions for mosquito production, there were no *Ae vigilax* recovered. Informal observation of biting mosquitoes during deployment of traps on 11 April showed almost no aggressive biting behaviour in general and in particular by *Ae vigilax*.

It is an important observation that there were no *Ae vigilax* present at the development site at the time of the investigation. Habitat survey however had not found any typical salt-marsh breeding sites for this species. Absence of this species is considered favourable for the prospect of residential development of the site.

The most abundant mosquito collected, *Culex annulirostris* is an important vector of a number of human diseases including Ross River virus. This species breeds in ephemeral freshwater ground pools typically produced by rainfall. The development site is relatively steeply sloped and no ground pools were observed. In the general region of Nambucca Heads however, many pasture areas, grassy roadside swales, playing fields etc would likely be producing *Cx annulirostris* following recent high rainfall. This species disperses widely over several kilometres from its breeding sites. It is therefore likely that its presence at the development site is representative of its general background abundance within the region at the time the investigation was made. It is not likely that the site in any special way is more or less exposed to *Cx annulirostris* than the general region.

For the other species noted, their abundance was low. *Culex australicus* rarely bites humans. It feeds mostly on birds. Some biting activity may be expected however from *Ma uniformis*, *Cq xanthogaster* and *An annulipes*. They are however not considered human health risks in the context of general exposure in Australia at this time.

It is the opinion of the Author that the development site's exposure to mosquito related risk to amenity and public health is acceptably low.

4.0 Development Master Plan Considerations Regarding Mosquito Exposure

Plate 4 is the Master Plan for the development showing the conservation line (green).

Plate 4 Master Plan



The mosquito risk for the development is regarded as already acceptably low. Notwithstanding that, the master plan provides buffer areas for other purposes that will also serve to further minimise risk of mosquito movement into residential allotments.

A premier roadway has been provided generally between residential allotments and the conservation line. This provides open space for a number of functions including ecological buffering and asset protection. The open space also discourages mosquitoes from transiting from the conservation area (with some level of mosquito harbourage) and home allotments. A minimum 27 metre Asset Protection Zone is proposed on the eastern portion of the development. This will contain a roadway, verges and limited street plantings offering very limited harbourage for mosquitoes. This open space is considered adequate to reduce mosquito passage risk even in areas of high mosquito activity. As a result of existing proposed buffers, there is no recommendation that any specific mosquito buffer should be considered for this development.

5.0 General Conclusions and Recommendations

The absence of any significant population of the salt-marsh mosquito, *Aedes vigilax*, apparently due to lack of suitable breeding habitat along Bellwood Creek is a positive outcome for the development site. Other species of mosquito recorded from two trap locations adjacent to the creek were either representative of a general regional distribution (i.e. *Culex annulirostris*); do not bite humans (*Culex australicus*) or were present in very low numbers (*Mansonia uniformis*, *Coquillettidia xanthogaster* and *Anopheles annulipies*).

The overall assessment of mosquito related risk for the development site is that it is acceptably low and unlikely to produce unreasonable exposure to residents in the foreseeable future.

Buffer arrangements for ecological protection and asset protection produce open space between mosquito harbourage of not less than 27 meters. This dimension would be considered reasonable to minimise mosquito dispersal into residential allotments even in areas of moderate to high mosquito risk. Existing buffering at this site further minimises potential risk to the point that no specific recommendations for specific mosquito buffers are made in this report.

It is the opinion of the Author that existing mosquito activity is not unreasonable for the normal enjoyment of residential living in the context of the development site at Lot 2 DP 1119830, Alexandra Drive, Bellwood.

Recommendations:

No specific recommendations are made in relation to further minimisation of mosquito related risk.

Darryl McGinn
Mosquito Consulting Services Pty Ltd

ANNEXURE D

Supplementary Engineering Information by De Groot Benson Pty Ltd



Ref: 91111

21 June 2012

The General Manager
Coffs Harbour City Council
Locked Bag 155
COFFS HARBOUR NSW 2450

**de Groot &
Benson Pty Ltd**

**Consulting
Engineers &
Planners**

Dear Sir

**DEVELOPMENT APPLICATION NO, 2012/011, 346 LOT RESIDENTIAL
SUBDIVISION PLUS RESIDUE AND ASSOCIATED WORKS - STAGED,
LOT: 2 DP: 1119830 ALEXANDRA DRIVE, NAMBUCCA HEADS
Supplementary Engineering Information**

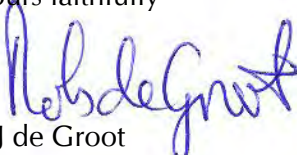
In All About Planning's letter dated 29 February 2012, it noted various engineering issues that it required comment on. This letter summarises these responses:

4) Traffic

The attached Table addresses the various issues

Should you have any further queries, please contact Rob de Groot on 02 6652 1700, or mobile 04 1883 1700 or by email at rob@dgb.com.au.

Yours faithfully


R J de Groot



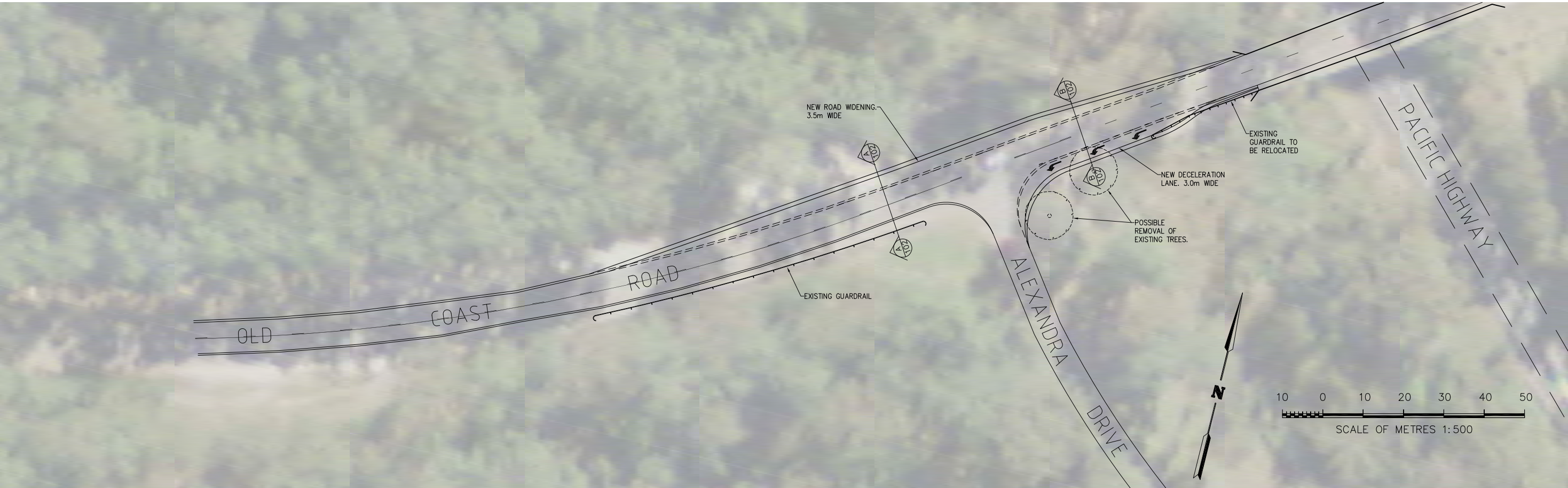
All About Planning Comment	DGB Response
4. A Revised Traffic Assessment is required that addresses the following matters:	Given the points made by the reviewers, we felt they could be best addressed by a letter response, rather than a revised traffic assessment.
<p>a) A Traffic Assessment of the Alexandra Drive extension which is required to Service Stage E of the proposed subdivision and which will be required to provide a vehicular and pedestrian connection to the proposed redeveloped Farringdon Fields and the local Nambucca Plaza.</p> <p>The plans for the subject development outline that the 15 proposed residential lots in stage E of the project are to be accessed off an extension of Alexandra Dve.</p>	<p>The proposed development is not dependent upon the connection southwards and can stand alone with access from the north from Old Coast Road. Similarly, Stage E can stand alone as a simple cul-de-sac extension off Alexandra Drive.</p> <p>The traffic assessment looked at two scenarios:</p> <ul style="list-style-type: none"> A) All traffic going northwards along Alexandra Drive and recommended Works B) Should Council decide to construct the link near the playing fields, where we assumed a 60% / 40% south / north traffic split. A steh existing Marshalls Way has been designed as a Collector Road, no specific works were recommended for this section of roadway
<p>Furthermore the description of the proposal within (section 3.3 – Development Stages), of the submitted SEE (p- 19) states that <i>"The proposed 15 lots in this precinct needs to wait for the extension of Alexandra Dve to be completed. This section of Alexandra Dve provides the link to the Farringdon Playing Fields for future residents."</i></p>	<p>The purpose of this statement was to suggest that economically, the lots in Stage E are among the most expensive to produce given that the roadway connecting this Stage to the rest of the development needs to cross an ephemeral water course and has only dwellings on one side. Should Council wish to proceed with the extension to Marshalls Way, then the economics of Stage E change,</p>



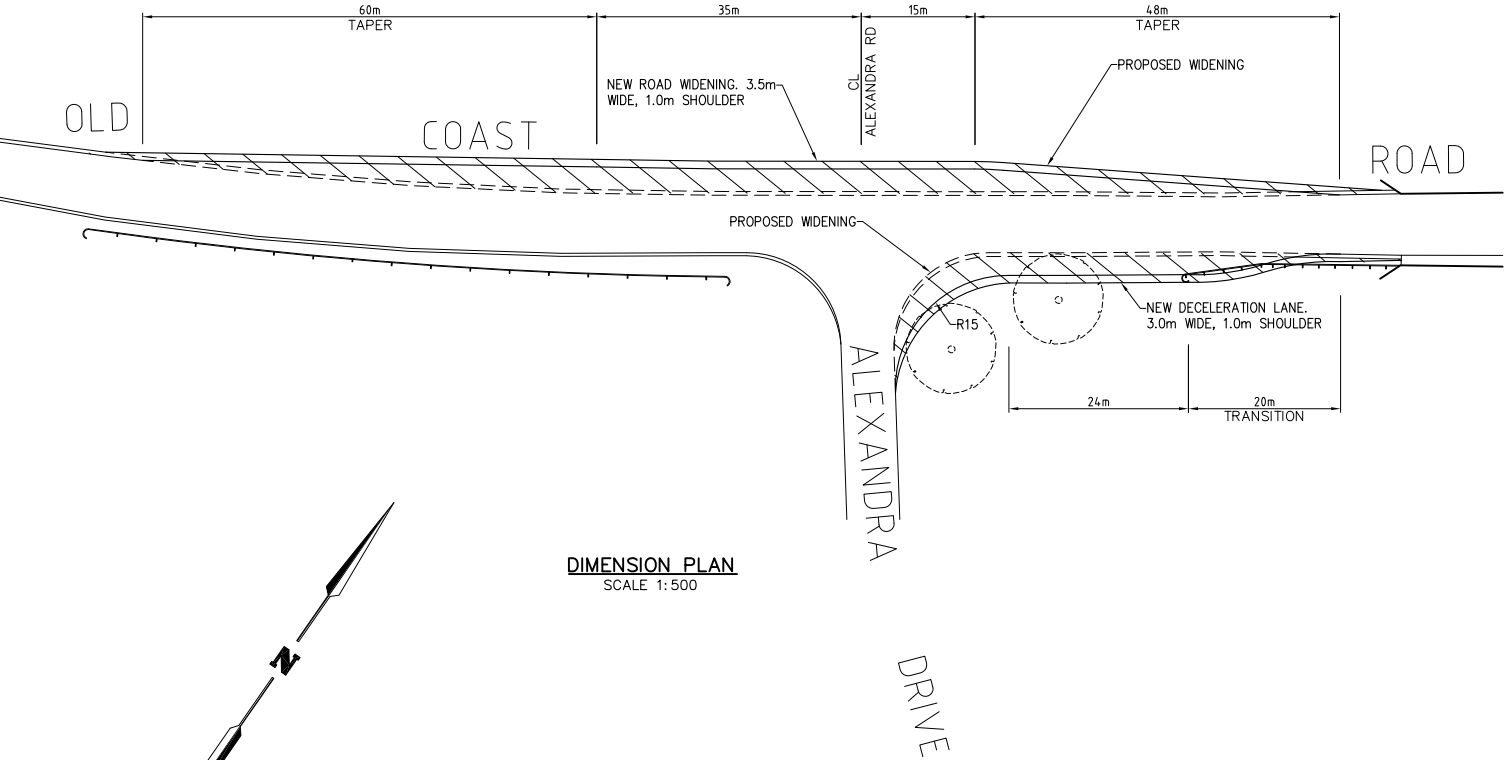
All About Planning Comment	DGB Response
<p>Thus stage E of the proposal cannot be considered without an environmental assessment of the impacts of providing the required road access. To date Council has not undertaken any environmental, ecological, archaeological, social or traffic assessment of the subject link road. The Section 94 Plan only addresses how Council proposes to finance the future road.</p> <p>Consequently (based on the information submitted) it is not possible to establish with sufficient certainty that the proposed road access to stage E of the development can be achieved.</p> <p>In view of the above, the description of the proposed development must be amended to include the construction of the extension of Alexandra Drive and an assessment of the environmental impacts (including the ecological, archaeological, social and traffic impacts of same as discussed elsewhere) shall be provided.</p>	<p>Given the above, we believe that the assessments contained in the SEE are sufficient for consideration of Stage E.</p> <p>In relation to the section of the roadway within the development site, we comment as follows:</p> <ul style="list-style-type: none"> - The road corridor has already been cleared and reviewed by the flora and fauna consultants. - The road corridor already contains services. There is a sewerage rising main and Telstra cables laid within the corridor
<p>b) . Further justification for the estimated 60% / 40% split in traffic north and south under the Link Road scenario</p>	<p>The Traffic Assessment has shown that there is adequate road capacity if all traffic from the development headed northwards. The 60%/40% option was discussed to show some impacts if a proportion of the traffic headed southwards. As this roadway has been designed for Collector Road standard, no specific measures were recommended.</p>
<p>c) . The impact of through traffic and additional traffic generated by the proposed residential subdivision on Marshall Way and Alexandra Drive residents of provision of a Link Rd.</p> <p>An analysis of through traffic generated by the proposed Link Road along Marshall Way and Alexandra Drive when combined with the proposed traffic from the subject development is required</p>	<p>Marshall Way was originally designed as a Collector class road with the expectation that the link northwards being constructed. Its width and construction standard are in excess of Council's current requirements.</p> <p>In fact, in some of the earlier stages of the development, we designed traffic calming along Marshalls Way, but Council directed the Developers not to install them.</p> <p>We acknowledge that the traffic environment in the northern end of Marshalls Way will change from being essentially a cul-de-sac to a through road (if Council construct the missing link). However, that was the original design intent of Marshalls Way.</p>



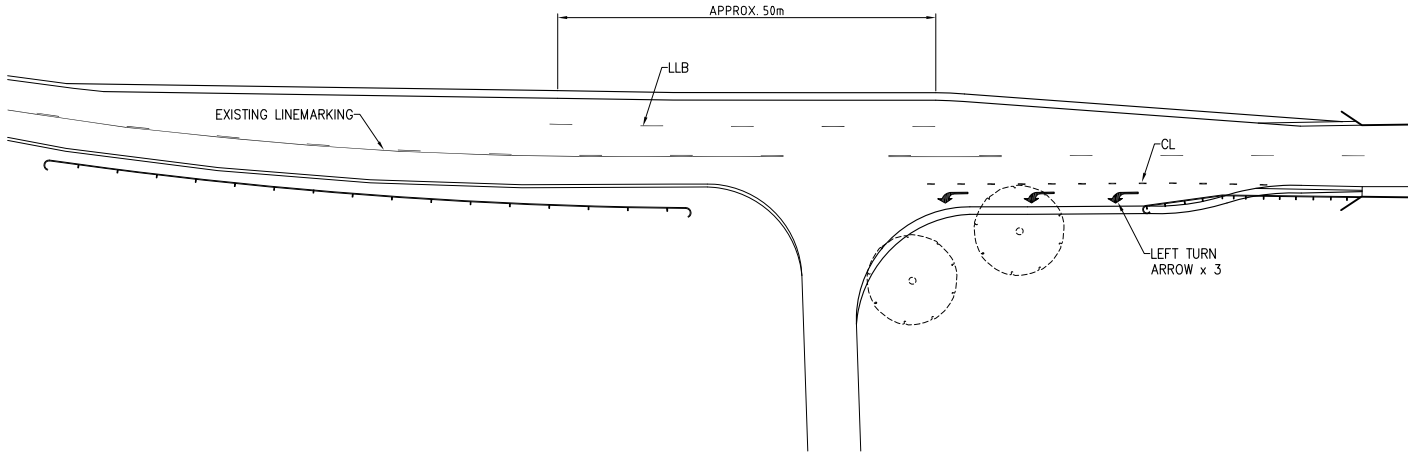
All About Planning Comment	DGB Response
	If required, Council could condition the consent to provide the traffic calming measures originally designed, or perhaps other such measures. However, these should be as allowed for in the Contribution Plan that Council has in place for the Marshalls Way extension .
d) . Recommended traffic calming and pedestrian link options along Marshall Way and Alexandra Drive	See comments above
e) . Design details for the required roundabout at the intersection of Old Coast Road and Alexandra Drive, this intersection upgrade being needed as a consequence of the proposed development.	The traffic Assessment did not propose a roundabout at the intersection of Old Coast Road and Alexandra Drive, rather a simple T intersection. Attached is drawing 91111-C101 and C102 which show a suggested layout plan of the intersection,
f) . Proposed kerb and gutter and swale drain design details for the proposed internal roads to the development, including relevant cross sections	In the absence of specific design guidelines from Nambucca Shire Council, we have proposed (like Coffs Harbour City Council) using those from Brisbane City Council and the South East Queensland region. Attached are standard drawings proposed for use in the design of the WSUD elements in the development.



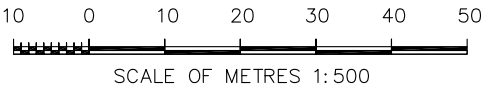
LAYOUT PLAN
SCALE 1:500



DIMENSION PLAN
SCALE 1:500



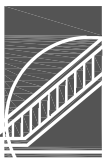
LINEMARKING PLAN (SEE PAGE C102 FOR DETAILS)
SCALE 1:500



DA1	30/03/12	FOR APPROVAL	APR	RDG
REV.	DATE	REVISION	DR.BY	AP.BY

de Groot &
Benson

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Scale	AS SHOWN @ A1	Cad File No.	ACAD-61111_OCR Intersection.dwg
Surveyed	APR/JAT	Datum	AHD
Drawn	APR	Designed	APR
Checked	RDG	Approved	RDG
Date	MARCH 2012	No. of dwgs	—

Project:
**OLD COAST ROAD &
ALEXANDRA DRIVE
INTERSECTION ADJUSTMENTS**

Client:
NAMBUCCA GARDENS ESTATE

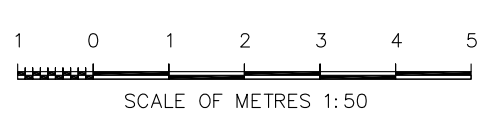
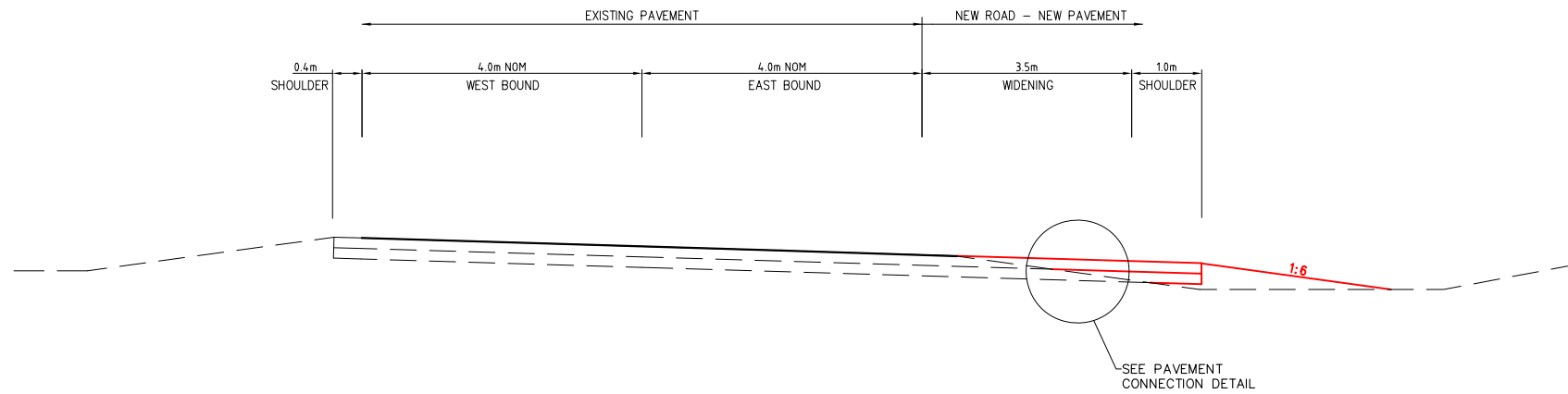
Title:
SITE PLAN

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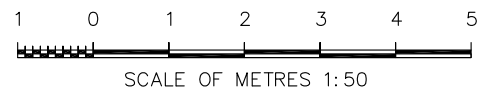
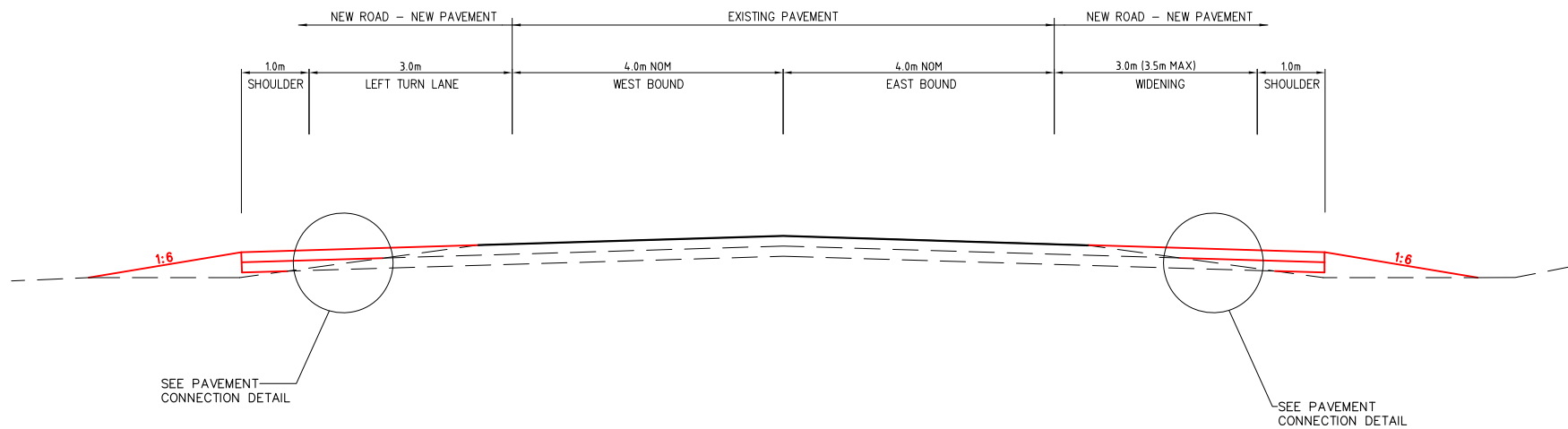
Project No.
91111

Drawing No.
C101

Amendment No.
DA1

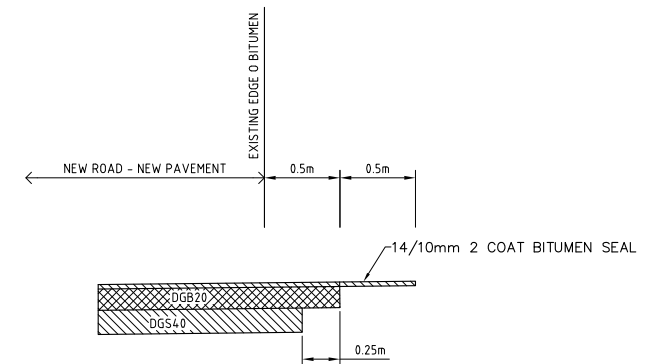


SECTION A-A
SCALE 1:50



SECTION B-B
SCALE 1:50

ROADS OTHER THAN FREEWAYS		Width mm	
		Min.	Preferred
Separation lines			
(a) Two lane road-(TLR)		80	80
(b) Multilane road-(MR)		150	150
Holding line-(HL)		300	300
Barrier lanes			
(a) One direction-(BL1)		80 80 80	80 80 80
(b) Both directions-(BL2)		80 80 80	80 80 80
Lane lines			
(a) Broken-(LLB)		80	80
(b) Unbroken-(LLU)		80	80
Edge line-(EL) (left and right side)		80	100
Continuity line-(CL)		100	200
Turn line-(TL)		80	100
Outline markings-(OM) (Safety bars excluded)		100	150
Exit line-(XL)		100	100

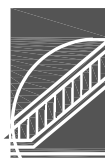


CONNECTION TO EXISTING ROADWAY DETAIL
(PAVEMENT DESIGN TO BE CONFIRMED)

DA1	30/03/12	FOR APPROVAL	APR	RDG
REV.	DATE	REVISION	DR,BY	AP,BY

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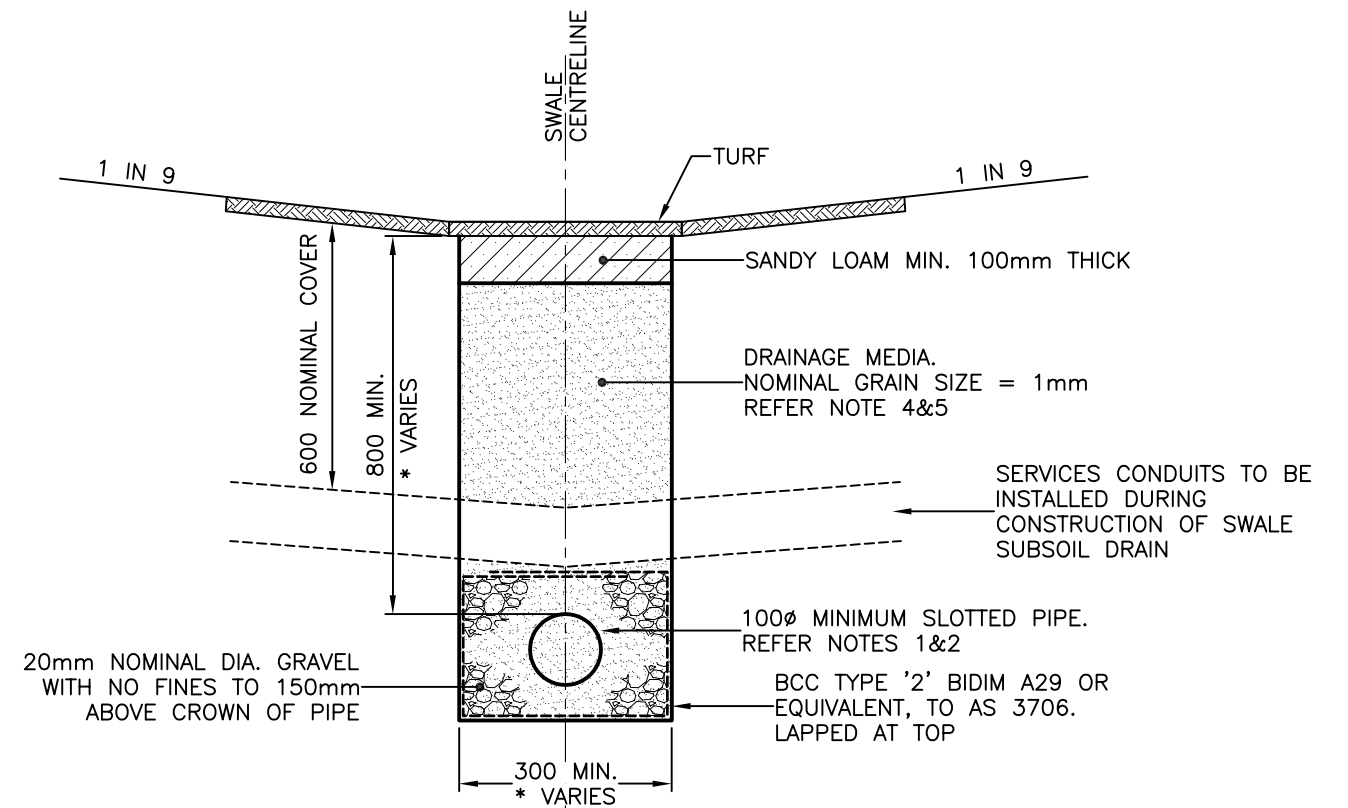
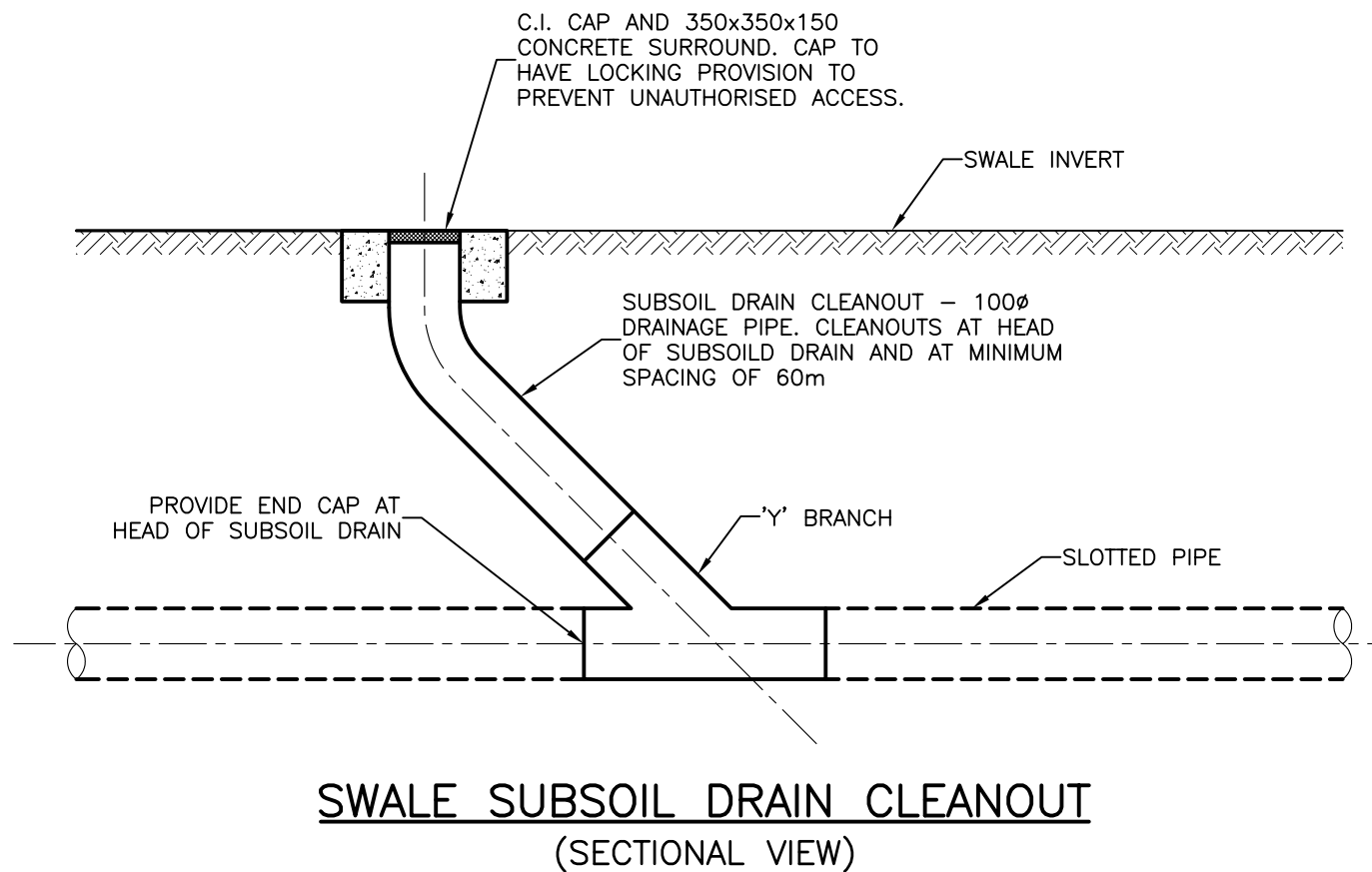
Phone (02) 6652 1700
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Scale	AS SHOWN @ A1		Cad File No.	
Surveyed	APR/JAT		Datum	
Drawn	APR	Designed	APR	Approved
Checked	RDG	Date	MARCH 2012	No. of dwgs
				--

Project:	OLD COAST ROAD & ALEXANDRA DRIVE INTERSECTION ADJUSTMENTS
Client:	NAMBUCCA GARDENS ESTATE

Title:	SECTIONS & DETAILS
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Project No.	91111
Drawing No.	C102
Amendment No.	DA1



* WHEN USED FOR BIO RETENTION, TRENCH WIDTH AND DEPTH MAY BE INCREASED WITH THE APPROVAL OF THE APPROPRIATE PUBLIC UTILITY AUTHORITY. REFER PROJECT DRAWINGS FOR DETAILS.

NOTES:

- SUBSOIL DRAIN MAY HAVE TWO FUNCTIONS; DEWATERING THE VEGETATED SWALE AND THE CONVEYANCE OF ROOFWATER IN ACCORDANCE WITH UMS 154. THE SLOTTED PIPE DIAMETER SHALL BE DETERMINED IN ACCORDANCE WITH UMS 154, DEPENDING ON THE NUMBER OF HOUSES CONNECTED TO THE SYSTEM. FOR COMPLEX SYSTEMS A DETAILED HYDRAULIC DESIGN IN ACCORDANCE WITH QUDM SHALL BE UNDERTAKEN.
- SLOTTED PIPES TO SUBSOIL DRAINS TO BE MINIMUM 100mm DIAMETER:
 - uPVC PIPES AND FITTINGS FOR DRAIN, WASTE AND VENT APPLICATIONS, JOINT TYPE, SOLVENT WELDED, MINIMUM SEWER CLASS SN8 MANUFACTURED IN ACCORDANCE WITH AS1260.
 - FIBRE REINFORCED CONCRETE PIPE MINIMUM CLASS 2, MANUFACTURED TO AS4139. JOINT TYPE, RUBBER RING (SUPERTITE).
 - POLYOLEFIN PIPES MANUFACTURED IN ACCORDANCE WITH DRAFT A0308-2003-06-10 "POLYETHYLENE AND POLYPROPYLENE PIPES AND FITTINGS FOR DRAINAGE AND SEWERAGE APPLICATIONS".

- MINIMUM PIPE GRADES TO COMPLY GENERALLY WITH AS3500 – NATIONAL PLUMBING AND DRAINAGE CODE PART 3 STORMWATER DRAINAGE:
 - 1.0% GRADE FOR PIPES %U<%U 150 DIAMETER.
- DRAINAGE MEDIA TO BE CLEAN SAND WITH LITTLE OR NO FINES (USCS CLASSIFICATIONS SW AND SP).
- FOR FILTRATION MEDIA PARTICLE SIZE FOR BIO RETENTION REFER BIO-RETENTION CELL WIDTH DESIGN CHARTS AND OR PROCEDURE (CHAPTER 3, WATER SENSITIVE URBAN DESIGN ENGINEERING GUIDELINES – STORMWATER).

DRAFT DESIGN APPROVED FOR ISSUE
SIGNATURE : P Cotton signature on original DATE : 03/09/04
MANAGER INFRASTRUCTURE MANAGEMENT - R.P.E.Q: 2546

DFT2	REDUCED PIPE DIAMETER, CLASSES AND TYPES	FEB '05	KP '05	PC '05
DRAFT	DRAFT ISSUE FOR DISCUSSION	JUN '03	JUL '04	JUL '04
ISSUE	AMENDMENT	DRAWN DATE	CHK'D DATE	APPR'D DATE

DESIGN AUTHORISED FOR ISSUE	DESIGN	CD/UMD	DATE	Jun '03
MANAGER INFRASTRUCTURE MANAGEMENT R.P.E.Q:	DRAWN	CD/UMD	DATE	Jun '03
DESIGN APPROVED	CHECKED	IM - UMD	DATE	Jul '04
PRINCIPAL ENGINEER STRATEGIC INFRASTRUCTURE MANAGEMENT	DRAWING FILENAME	\UMS 153 (DRAFT)		
	ASSOCIATED PLANS			



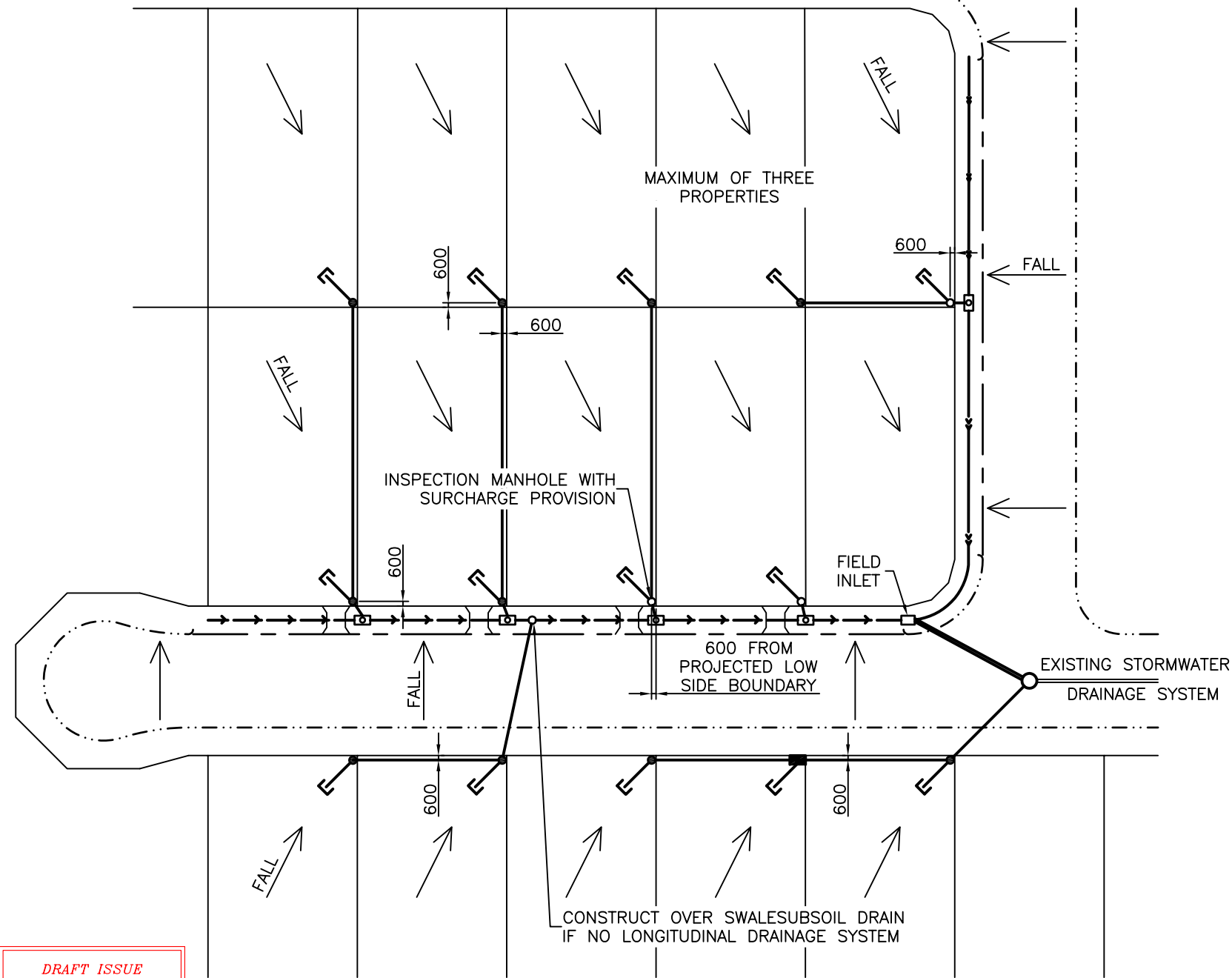
BRISBANE CITY COUNCIL - URBAN MANAGEMENT DIVISION	
WATER SENSITIVE URBAN DESIGN SWALE SUBSOIL DRAIN SECTIONS TO GRASSED SWALES	
SCALE DWG No.	NOT TO SCALE UMS 153
ORIGINAL SIZE	REVISION A3 DFT2

DESIGN CRITERIA FOR LEVEL II ALLOTMENT DRAINAGE SYSTEM

DRAFT ISSUE
FOR DISCUSSION PURPOSES

EASEMENT WIDTH (m)	NOMINAL PIPE DIAMETER (mm)	MINIMUM PIPE SLOPE (%)	FLOW (L/s) – NOTE 5							
			PIPE GRADIENT % – NOTE 6							
			0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0
NOT REQUIRED – NOTE 3	150	1.0	N/A	18	23	26	30	33	38	42
1.5	225	0.5	38	56	67	78	87	96	110	125
1.5	300	0.5	84	120	146	170	190	210	N/A	N/A

DRAFT ISSUE
FOR DISCUSSION PURPOSES



DRAFT ISSUE
FOR DISCUSSION PURPOSES

TYPICAL PLAN ROOFWATER DRAINAGE SYSTEM

LEGEND

- ROOFWATER INSPECTION MANHOLE AS PER UMS 352 WITH GRATED COVER
- ROOFWATER INSPECTION MANHOLE AS PER UMS 352 WITH SOILD COVER
- ROOFWATER INSPECTION OPENING WITH 100mm DIA STUB AND END CAP
- U.P.V.C. Y JUNCTION WITH 100mm DIA STUB AND END CAP
- ROOFWATER SURCHARGE PIT AS PER UMS 158
- VEGETATED SWALE WITH SUBSOIL DRAIN AS PER UMS 153. (MAXIMUM 300mm dia)
- VEGETATED SWALE WITHOUT SUBSOIL DRAIN
- VEHICLE ACCESS (REFER UMS 152)

DRAFT ISSUE
FOR DISCUSSION PURPOSES

DRAFT DESIGN APPROVED FOR ISSUE
SIGNATURE : P Cotton signature on original DATE : 03/09/04
MANAGER INFRASTRUCTURE MANAGEMENT - R.P.E.Q: 2546

NOTES:

- ROOFWATER RUNOFF TYPICALLY CONTAINS HIGH NITROGEN CONCENTRTATIONS WHICH CAN BE HARMFULLTO AQUATIC RECEIVING ENVIRONMENTS. WHERE ROOFWATER IS CONNECTED DIRECTLY TO SWALE SUBSOIL DRAINS OR TRUNK DRAINAGE SYSTEMS ADDITIONAL END OF LINE WATER QUALITY TREATMENT WILL BE REQUIRED.
- DESIGN FLOWS CALCULATED BASED ON MANNING'S 'n' OF 0.011. PIPE SIZED IN ACCORDANCE WITH QUEENSLAND URBAN DRAINAGE MANUAL ASSUMING A DISCHARGE OF 10 L/s FROM EACH ALLOTMENT BASED ON ROOF AREAS OF 180m² AND ARI OF 20 YEARS FOR S.E. QUEENSLAND. ALL PIPES SHALL HAVE A MINIMUM DIAMETER OF 150mm, EXCEPT ACROSS FOOTPATH.
- WHERE THE PIPE GRADIENT EXCEEDS 5%, UNDERTAKE A MORE DETAILED HYDRAULIC ANALYSIS INCLUDING THE ASSESSMENT OF HEAD LOSSES, WHERE APPROPRIATE.
- AN EASEMENT IN FAVOUR OF COUNCIL IS REQUIRED WHEN THE ROOFWATER LINE IS DESIGNED TO SERVICE MORE THAN 3 ALLOTMENTS, IRRESPECTIVE OF PIPE SIZE.
- PROVIDE MINIMUM 600 COVER TO PIPES EXCEPT WHERE REDUCED COVER IS NECESSARY TO EFFECT DISCHARGE TO KERB AND CHANNEL. PIPE TYPES AND CLASSES TO COMPLY WITH THE FOLLOWING REQUIREMENTS:
 - UPVC PIPE (MINIMUM SEWER CLASS SN8) MANUFACTURED IN ACCORDANCE WITH AS1260 PVC PIPES AND FITTINGS FOR DRAIN, WASTE AND VENT APPLICATIONS. JOINT TYPE, SOLVENT WELDED.
 - STEEL REINFORCED CONCRETE PIPE MINIMUM CLASS 2, MANUFACTURED TO AS 4058. JOINT TYPE, RUBBER RING.
 - FIBRE REINFORCED CONCRETE PIPE MINIMUM CLASS 2, MANUFACTURED TO AS 4139. JOINT TYPE, RUBBER RING (SUPERTITE).
 - POLYOLEFIN PIPES MANUFACTURED IN ACCORDANCE WITH DRAFT A0308-2003-06-10 "POLYETHYLENE AND POLYPROPYLENE PIPES AND FITTINGS FOR DRAINAGE AND SEWERAGE APPLICATIONS.
- MINIMUM PIPE GRADES TO COMPLY GENERALLY WITH AS 3500 NATIONAL PLUMBING AND DRAINAGE CODE PART 3 STORMWATER DRAINAGE:
 - 1.0% GRADE FOR PIPES ≤ 150 DIAMETER
 - 0.5% GRADE FOR PIPES > 150 BUT < 375 DIAMETER
 - 0.3% GRADE FOR PIPES ≥ 375 DIAMETER
- PROVIDE ROOFWATER INSPECTION MANHOLES:
 - AT MAXIMUM 100m SPACING.
 - AT ALL CHANGES IN PIPE SIZES.
 - AT ALL DIRECTION CHANGES EXCEEDING 15°
 - AT LINE TERMINATION.
- PROVIDE "AS CONSTRUCTED" INFORMATION FOR:
 - OFFSETS OF THE MAIN LINE TO THE PROPERTY BOUNDARY.
 - THE LOCATIONS OF INSPECTION MANHOLES AND Y JUNCTIONS MEASURED FROM THE PROPERTY BOUNDARY.
 - PIPE DIAMETERS.
- DIMENSIONS IN MILLMETRES (U.N.O.)

DRAFT ISSUE
FOR DISCUSSION PURPOSES

DFT2	ROOF WATER SURCHARGE PIT ADDED, PIPE CLASS AND TYPE ALTERED	FEB '05	KP '05	PC '05
DRAFT	DRAFT ISSUE FOR DISCUSSION	JUN '03	JUL '04	JUL '04
ISSUE	AMENDMENT	DRAWN DATE	CHK'D DATE	APPR'D DATE

DESIGN AUTHORISED FOR ISSUE	DESIGN	CD/UMD	DATE	Jun '03
MANAGER INFRASTRUCTURE MANAGEMENT	DRAWN	CD/UMD	DATE	Jun '03
R.P.E.Q:	CHECKED	IM - UMD	DATE	Jul '04
DESIGN APPROVED	DRAWING FILENAME	UMS 154 (DRAFT)		
PRINCIPAL ENGINEER	ASSOCIATED PI ANS			
STRATEGIC INFRASTRUCTURE MANAGEMENT				



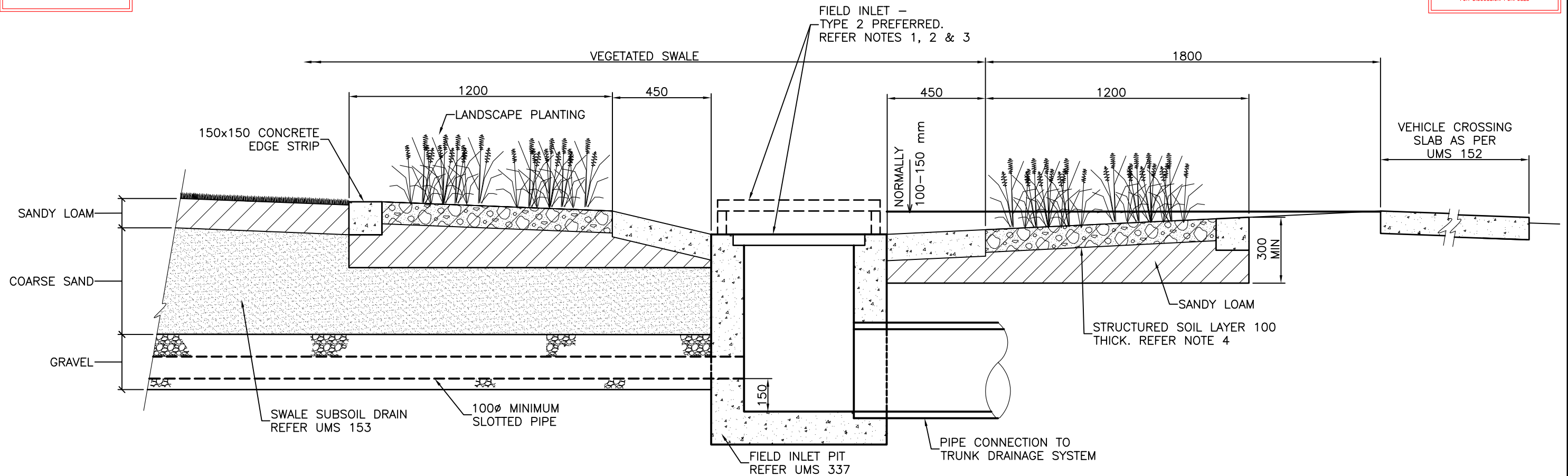
BRISBANE CITY COUNCIL - URBAN MANAGEMENT DIVISION

ROOFWATER DRAINAGE FOR
LOW DENSITY RESIDENTIAL
WSUD SUBDIVISIONS

SCALE	NOT TO SCALE
DWG No.	UMS 154
ORIGINAL SIZE	A3
REVISION	DFT2

DRAFT ISSUE
FOR DISCUSSION PURPOSES

DRAFT ISSUE
FOR DISCUSSION PURPOSES



FOOTPATH GRASS SWALE INLET DETAIL

DRAFT ISSUE
FOR DISCUSSION PURPOSES

NOTES:

- FOR APPROVED FIELD INLET GRATES REFER UMS 377. ALTERNATIVE GRATE DESIGNS MAY BE SUBSTITUTED IF APPROVED BY THE MANAGER, INFRASTRUCTURE MANAGEMENT BRANCH.
- INLET GRATES MAY BE DESIGNED TO COMPLIMENT A PARTICULAR STREETSCAPE OR PUBLIC ART THEME. DESIGNERS MUST CONSIDER PEDESTRIAN AND BICYCLE SAFETY AS WELL AS HYDRAULIC EFFICIENCY AND MAINTANCE ACCESS.
- CENTRE MEDIANS SHOULD BE ASSESSED FOR LIKELY PEDESTRIAN TRAFFIC AND IF NECESSARY, BOLLARDS OR SAFETY BARRIERS SHOULD BE INSTALLED AROUND RAISED GRATES WHERE LANDSCAPED BUFFERS ARE NOT PROVIDED. ADEQUATE PROVISION IS TO BE PROVIDED FOR THE PASSAGE OF PEDESTRIANS AROUND OBSTRUCTION (TYPICALLY 1.8m MIN. CLEARANCE).
- SELECTED SPALLS 50–75mm dia. VOIDS FILLED WITH SOIL MEDIA. SOIL LEND CONFORMNG TO AS4419, WITH NO MORE THAN 5% SCREENED COMPOSTED ORGANIC MATTER, MINIMUM HYDRAULIC CONDUCTIVITY OF 5–25cm/hr AND A MINIMUM CEC (CATHION EXCHANGE CAPACITY) OF 20meq/100g, AND pH RANGE OF 5–6.5.
- CONCRETE N25 IN ACCORDANCE WITH AS1379 AND AS3600.
- DIMENSIONS IN MILLIMETRES (U.N.O.).

DRAFT ISSUE
FOR DISCUSSION PURPOSES

DRAFT DESIGN APPROVED FOR ISSUE

SIGNATURE : P Cotton signature DATE : 09/03/05
on original
MANAGER INFRASTRUCTURE MANAGEMENT - R.P.E.Q: 2546

DRAFT ISSUE
FOR DISCUSSION PURPOSES

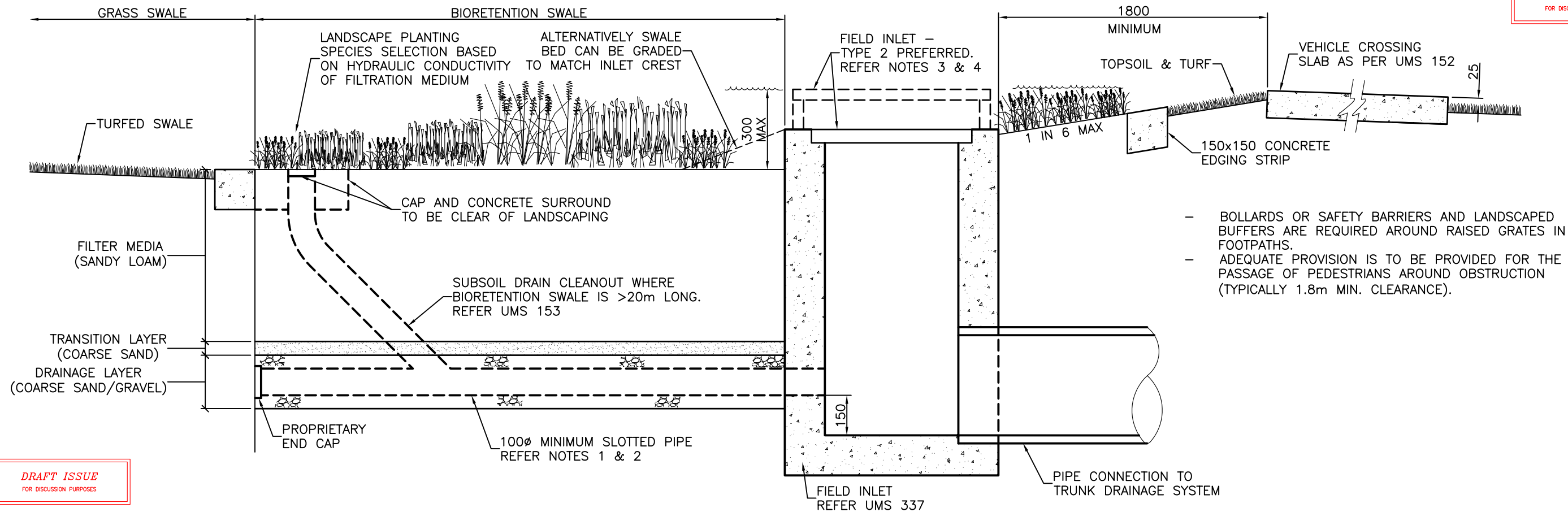
DRAFT	DRAFT ISSUE FOR DISCUSSION	FEB '05	MAR '05	MAR '05
ISSUE	AMENDMENT	DRAWN DATE	CHK'D DATE	APPR'D DATE

DESIGN AUTHORISED FOR ISSUE	DESIGN	CD/UMD	DATE	Feb '05
MANAGER INFRASTRUCTURE MANAGEMENT	DRAWN	CD/UMD	DATE	Feb '05
R.P.E.Q:	CHECKED	IMB (KP)	DATE	Mar '05
DESIGN APPROVED	DRAWING FILENAME	\UMS 157 (DRAFT)		
PRINCIPAL ENGINEER	ASSOCIATED PLANS			
STRATEGIC INFRASTRUCTURE MANAGEMENT				

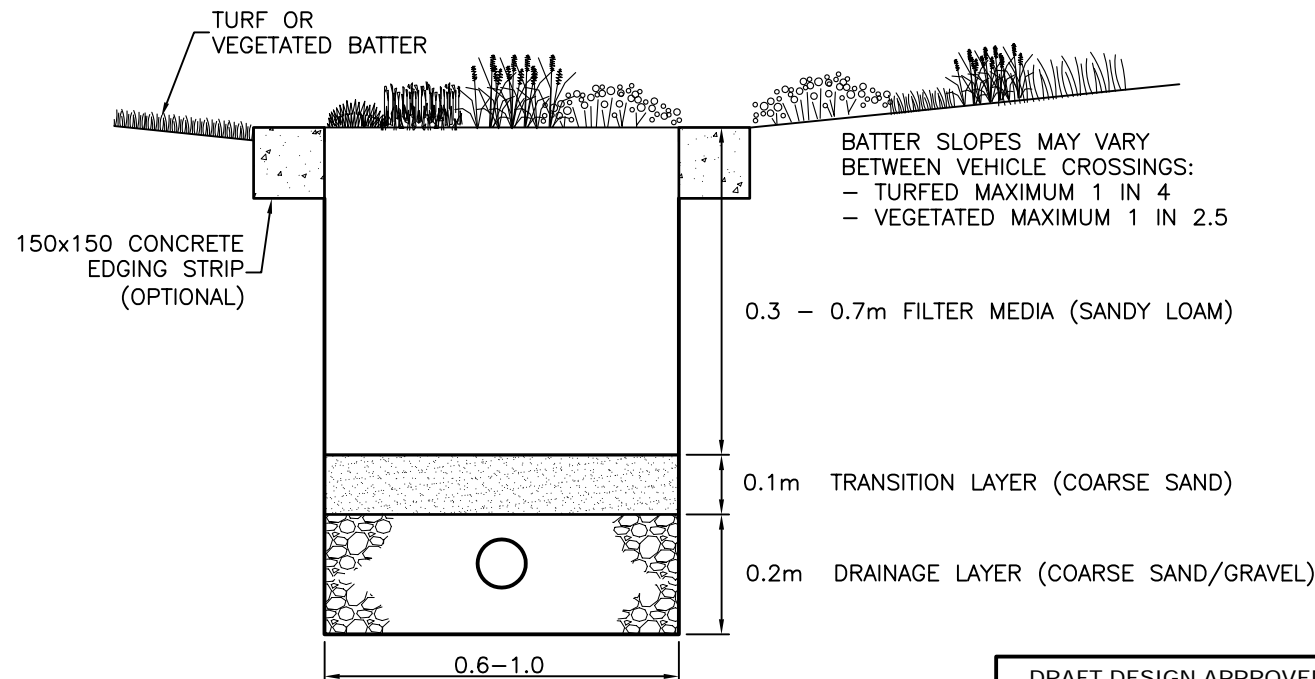


BRISBANE CITY COUNCIL - URBAN MANAGEMENT DIVISION	
FOOTPATH GRASS SWALE INLET DETAIL	
SCALE DWG No.	NOT TO SCALE UMS 157
ORIGINAL SIZE A3	REVISION DRAFT

DRAFT ISSUE
FOR DISCUSSION PURPOSES



BIORETENTION CELL LAYOUT (SECTIONAL VIEW)



TYPICAL SECTION

DRAFT DESIGN APPROVED FOR ISSUE

SIGNATURE : P Cotton signature DATE : 09/03/05
on original
MANAGER INFRASTRUCTURE MANAGEMENT - R.P.E.Q. : 2546

NOTES:

- SLOTTED PIPES TO SUBSOIL DRAINS TO BE MINIMUM 100mm DIAMETER:
 - PVC PIPES AND FITTINGS FOR DRAIN, WASTE AND VENT APPLICATIONS, JOINT TYPE, SOLVENT WELDED, MINIMUM SEWER CLASS SN6 MANUFACTURED IN ACCORDANCE WITH AS1260.
 - FIBRE REINFORCED CONCRETE PIPE MINIMUM CLASS 1, MANUFACTURED TO AS4139. JOINT TYPE, RUBBER RING (SUPERTITE).
 - POLYOLEFIN PIPES MANUFACTURED IN ACCORDANCE WITH DRAFT A0308-2003-06-10 "POLYETHYLENE AND POLYPROPYLENE PIPES AND FITTINGS FOR DRAINAGE AND SEWERAGE APPLICATIONS".
- MINIMUM PIPE GRADES TO COMPLY GENERALLY WITH AS3500 - NATIONAL PLUMBING AND DRAINAGE CODE PART 3 STORMWATER DRAINAGE:
 - 1.0% GRADE FOR PIPES ≤150 DIAMETER.
- FOR APPROVED FIELD INLET GRATES REFER UMS 337. ALTERNATIVE GRATE DESIGNS MAY BE SUBSTITUTED IF APPROVED BY THE MANAGER, INFRASTRUCTURE MANAGEMENT BRANCH.
- INLET GRATES MAY BE DESIGNED TO COMPLIMENT A PARTICULAR STREETSCAPE OR PUBLIC ART THEME. DESIGNERS MUST CONSIDER PEDESTRIAN AND BICYCLE SAFETY AS WELL AS HYDRAULIC EFFICIENCY AND MAINTANCE ACCESS.
- CONCRETE N25 IN ACCORDANCE WITH AS1379 AND AS3600.
- DIMENSIONS IN MILLIMETRES (U.N.O.).

DRAFT ISSUE
FOR DISCUSSION PURPOSES

DRAFT	DRAFT ISSUE FOR DISCUSSION	FEB '05	MAR '05	MAR '05
ISSUE	AMENDMENT	DRAWN DATE	CHK'D DATE	APPR'D DATE

DESIGN AUTHORISED FOR ISSUE	DESIGN	CD/UMD	DATE	Feb '05
MANAGER INFRASTRUCTURE MANAGEMENT	DRAWN	CD/UMD	DATE	Feb '05
R.P.E.Q.	CHECKED	IMB (KP)	DATE	Mar '05
DESIGN APPROVED	DRAWING FILENAME	UMS 155 (DRAFT)		
PRINCIPAL ENGINEER	ASSOCIATED PLANS			
STRATEGIC INFRASTRUCTURE MANAGEMENT				



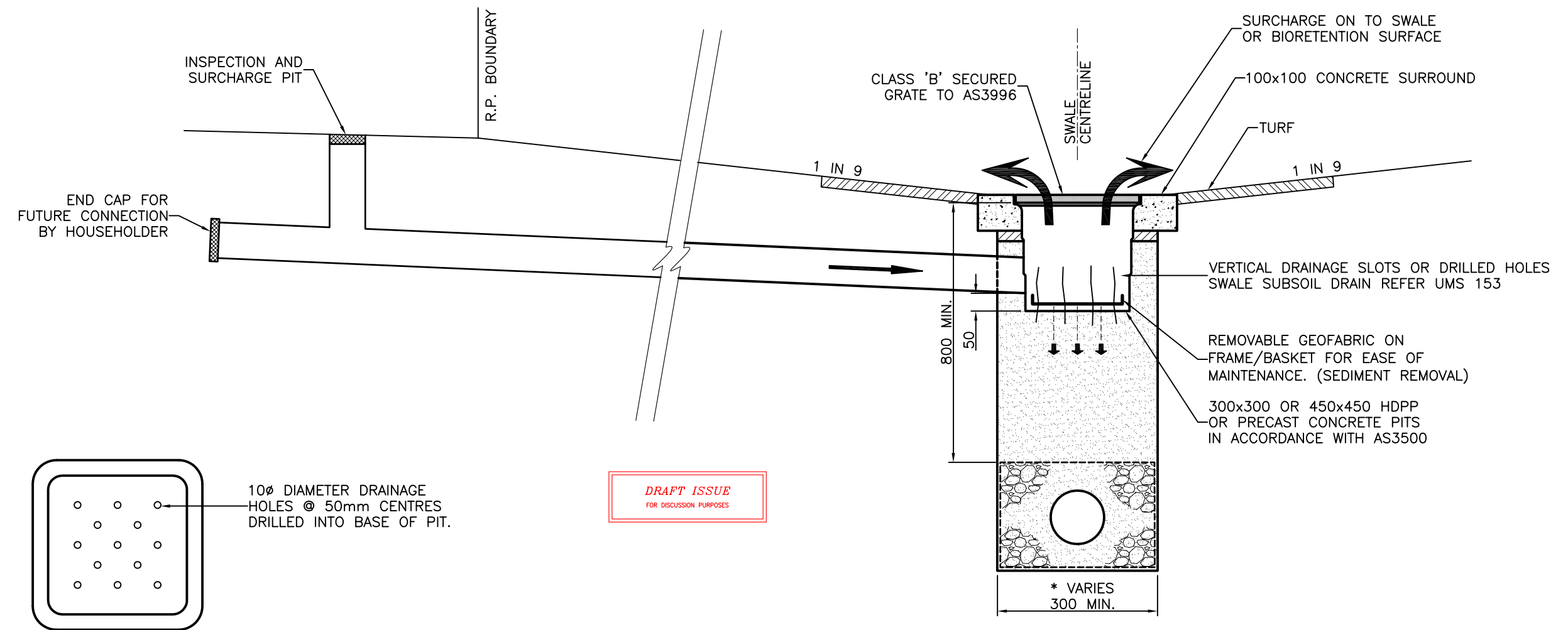
BRISBANE CITY COUNCIL - URBAN MANAGEMENT DIVISION

FOOTPATH BIORETENTION CELL AND FIELD INLET DETAILS

SCALE	NOT TO SCALE
DWG No.	UMS 155
ORIGINAL SIZE	A3
REVISION	DRAFT

DRAFT ISSUE
FOR DISCUSSION PURPOSES

DRAFT ISSUE
FOR DISCUSSION PURPOSES



SURCHARGE PIT
(PLAN VIEW)

SURCHARGE PIT DETAIL
(ELEVATION)

NOTES:

1. ROOFWATER SURCHARGE PITS ARE TO BE CONSTRUCTED OVER SWALE SUBSOIL DRAINS OR BIORETENTION SYSTEMS.
2. PIT SIZES AND/OR VARYING PIPE CONNECTION DIAMETERS ARE AS FOLLOWS:
 - < 100mmø – 300x300mm
 - < 225mmø – 450x450mm
 - > 225mmø – NOT SUITABLE FOR SURCHARGE PITS IN FOOTPATHS
3. DIMENSIONS IN MILLIMETRES (U.N.O.).

DRAFT ISSUE
FOR DISCUSSION PURPOSES

DRAFT DESIGN APPROVED FOR ISSUE
SIGNATURE : P Cotton signature DATE : 09/03/05
on original
MANAGER INFRASTRUCTURE MANAGEMENT - R.P.E.Q: 2546

DRAFT ISSUE
FOR DISCUSSION PURPOSES

DRAFT	DRAFT ISSUE FOR DISCUSSION	FEB '05	MAR '05	MAR '05
ISSUE	AMENDMENT	DRAWN	CHK'D DATE	APPR'D DATE

DESIGN AUTHORISED FOR ISSUE	DESIGN	CD/UMD	DATE	Feb '05
MANAGER INFRASTRUCTURE MANAGEMENT	DRAWN	CD/UMD	DATE	Feb '05
R.P.E.Q:	CHECKED	IMB (KP)	DATE	Mar '05
DESIGN APPROVED	DRAWING FILENAME	\UMS 158 (DRAFT)		
PRINCIPAL ENGINEER	ASSOCIATED PLANS			
STRATEGIC INFRASTRUCTURE MANAGEMENT				



BRISBANE CITY COUNCIL - URBAN MANAGEMENT DIVISION	
WATER SENSITIVE URBAN DESIGN SWALE SUBSOIL DRAIN SECTIONS TO GRASSED SWALES	
SCALE DWG No.	NOT TO SCALE UMS 158
ORIGINAL SIZE A3	REVISION DRAFT