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STORMWATER MANAGEMENT REPORT

PROJECT OXYGEN
CENTRAL HILLS BUSINESS PARK
CAMDEN VALLEY WAY, GREGORY HILLS

PREPARED FOR

DART WEST DEVELOPMENTS Pty Ltd

Revision 1 – 09.09.10
Revision 2 – 13.09.10
Revision 3 – 14.09.10
Revision 4 – 22.09.10

TABLE OF CONTENTS

INTRODUCTION

Dart West Developments Pty Ltd are proposing to develop a new 3.358Ha site within the Central Hills Business Park, Gregory Hills – Lot 90 DP 1137298

The nature of the proposed development will comprise the following:

- Oxygen Hardware Store;
- On site car parking;
- Heavy vehicle delivery access

Northrop Consulting Engineers were engaged by Dart West Developments to prepare a concept stormwater management plan to support the Development Application. All new works will be designed in accordance with the requirements of Camden City Council for stormwater drainage collection and disposal.

SITE LOCATION & DESCRIPTION

The subject site is defined as Lot 90 DP 1137298 (630 Camden Valley Way) and is located on the corner of Camden Valley Way and a yet to be named access road to the Central Hills Business Park (currently under construction). The subject site area is calculated by survey to be 3.358 Ha. It is bound by Camden Valley Way (west) and internal roads which form part of the Central Hills Business Park.

Customer access to the site will generally be via:

- Southern access road
- Eastern road – main entry

Deliveries access to be via a roundabout incorporated within the northern access road.

EXISTING STORMWATER CONDITIONS

The subject site and surrounding civil infrastructure within the Park are currently being developed by Dart West Developments and, as such, there are no defined existing stormwater drainage conditions relevant to the site. These development works involve extensive earthworks and are currently being designed by Cardno – Consulting Engineers.
However, prior to the commencement of development, the site tended to drain towards a small culvert under Camden Valley Way.

Subsequent upgrading works to Camden Valley Way - adjacent to the site are currently under construction and the existing culvert has been upgraded to a 1200mm x 900mm RCBC within the new Camden Valley Way road design – design by Brown Consulting.

The culvert which is identified in the "Proposed Road Upgrade, Cobbitty Road to Turners Road, Gregory Hills- Detailed Design Report" prepared by Brown Consulting and dated September 2009, identifies the culvert as being designed to cater for all pre development flows within its catchment. These flows have been calculated as 1,246L/s and are provided in the report.

External drainage infrastructure within the Park has been designed by Cardno to capture and convey all post development flows up to and including the 100 year ARI Event to the new 1200mm x 900mm culvert under Camden Valley Way. No surface flows are permitted to discharge into Camden Valley Way. Northrop is advised that these maximum 100 year ARI Event pipe flows do not exceed to culvert's design flows – 1,246L/s

PROPOSED STORMWATER DRAINAGE WORKS

A Stormwater Management Concept has been prepared by Northrop and aims to address the requirements of Camden City Council. The Concept Stormwater Management Plans are presented in Appendix B. Camden City Council's DCP for the Central Hills Business Park requires the incorporation of On-site Stormwater Detention (OSD) and water quality treatment within all development sites.

HYDROLOGICAL MODELLING – 'DRAINS'

As stated in EXISTING STORMWATER CONDITIONS above, all external stormwater drainage works have been designed to convey the 100 year ARI Event flows within the adjacent catchment, to a 1200mm x 900mm RCBC under Camden Valley Way. As a consequence, all stormwater flows up to and including the 100 year ARI Event emanating from the site are detained via an OSD and conveyed to the external drainage via underground pipes. There are NO overland flows into the external road network.

Cardno (Engineering Consultants for the design of external infrastructure within the Park) advised that a site PSD of 887L/s was achievable as a result of their DRAINS modelling of the external infrastructure.
A DRAINS model based upon the provided Permissible Site Discharge (PSD) model was then prepared by Northrop to assess the site runoff and OSD requirements.

However in order to increase the accuracy of the modelling, Cardno provided Northrop with their DRAINS model (external infrastructure). This enabled Northrop to combine the models to confirm that the maximum permissible 100 Year ARI Event flows draining to the new culvert under Camden Valley Way – 1,246L/s (as identified in EXISTING STORMWATER CONDITIONS above) and the advised PSD – 887L/s were not exceeded. The following results were achieved:

- Site PSD (872L/s)
- Maximum 1,159L/s flows to the culvert under Camden Valley Way.

The following data was input to DRAINS to design the stormwater drainage system:

- Catchment area 3.358Ha – 95% impervious;
- Catchment Time of concentration = 19mins - pervious;
- PSD = 872L/s,

- Pit levels & pipe depths (determined by contour mapping and site inspections);
- Tailwater Levels within the southern access road

OSD

A combination of above and below ground OSD is incorporated in the design:

- 230m^3 below ground (238m^3 provided)
- 223m^3 above ground (230m^3 provided)
    - Above ground permitted to pond to a maximum depth of 150mm at the surface inlet pits
    - TWL = RL 102.80
- HED is provided to cater for the roof flows.
- Total outflow from OSD = 872L/s
    - 872L/s piped to boundary pit (point of connection provided by external drainage works) via a 600mm diameter pipe.

An emergency overland flow weir at RL 102.80 has been incorporated in the design to cater for storm flows above the 100 year ARI Event. The weir is located adjacent to the southern boundary.

A copy of the Northrop DRAINS model for the calculation of the OSD is available upon request. Northrop however are unable to provide a copy of the combined Cardno / Northrop DRAINS model without the expressed permission of Cardno.

WATER QUALITY

Camden City Council's Water Quality targets are outlined in the table below.

WATER QUALITY TARGETS				
	Gross Pollutants (>5mm)	Total Suspended Solids - TSS	Total Phosphorus - TP	Total Nitrogen - TN
Objective	90%	85%	65%	45%

The site water quality runoff has been modelled using MUSIC.

The above objectives have been achieved utilising:

- Discharging all roof drainage directly to the HED pit incorporated within the proposed OSD

  - Northern portion of the roof to drain via rainwater tanks – total volume = $40m^3$. Tanks to be utilised for toilet flushing and irrigation.
- Collection off pavements and landscaping via a series of collection pits and underground pipework to drain to the proposed OSD via:
  - Humeceptor – STC 60
  - Filter media incorporated within the base of the proposed OSD.

POST DEVELOPMENT POLLUTANT LOAD REDUCTIONS			
	Before Treatment Train	After Treatment Train	% Reduction
TSS (Kg/Yr)	12.0×10^3	1.06×10^3	91.20%
TP (Kg/Yr)	14.70	4.95	66.30%
TN (Kg/Yr)	184	69.20	62.40%
GROSS POLLUTANTS (Kg/Yr)	984	14.10	98.60%

The MUSIC model is available upon request.

DETERMINATION OF BUILDING FLOOR LEVELS

Camden City Council requires the floor level for the development to be a minimum of 300mm above the 100 year ARI Event. The 100 year ARI Event level has been set at RL 102.80:

RECOMMENDED FINISHED FLOOR LEVEL = RL103.10

CONCLUSIONS

The proposed piped stormwater system has generally been designed in accordance with Councils requirements to convey all stormwater flows (within pipes) up to and including the 100 year ARI Event emanating from the site to the proposed stormwater drainage system within the southern Central Hills Business Park access road.

The PSD of 885L/s as advised by Cardno has been utilised to calculate the required OSD volume and outlet flows to ensure that the advised PSD is not exceeded.

By limiting the site discharge to the proposed external stormwater drainage system (with the incorporation of OSD) we have aimed at controlling and minimising the additional runoff generated by the proposed development.

The floor level has been determined to ensure runoff from pavements is contained within the site and captured within the proposed OSD and Water Quality Treatment System. Boundary retaining structures have been incorporated where necessary to permit the capture of pavement runoff.

Yours faithfully,

Kevan Meldrum
Principal
NORTHROP CONSULTING ENGINEERS

APPENDIX A – PROPOSED EXTERNAL STORMWATER DRAINAGE INFRASTRUCTURE

- **PREPARED BY CARDNO**

REFER DRAWING 294092-2-101 FOR CONTINUATION

CAMDEN VALLEY WAY

ROAD 1901

ROAD 1904

BATTER VARIES
1:6 (MAX)

CONTRACTOR MUST VERIFY LEVEL AND LOCATION OF EXISTING CONDUITS PRIOR TO TRENCHING FOR STORMWATER DRAINAGE

LIMIT OF WORKS
Ø825

900x300 BOX CULVERT

EXISTING GAS LINE.

EXISTING ELECTRICAL LINE.

MODIFY EXISTING HEADWALL AND CONSTRUCT NEW JUNCTION PIT, REFER DRAWING 501 FOR DETAIL

CONSTRUCT 900x300 BOX CULVERT

I.L= 100.550
LENGTH= 5m
Ø= 375
GRADE= 1.0%
I.L= 100.500

I.L= 100.501
LENGTH= 5m
Ø= 375
GRADE= 1.0%
I.L= 100.451

I.L= 100.006
LENGTH= 5m
Ø= 675
GRADE= 1.0%
I.L= 99.956

I.L= 101.243
LENGTH= 5m
Ø= 375
GRADE= 1.0%
I.L= 101.193

I.L= 101.900
LENGTH= 5m
Ø= 375
GRADE= 1.0%
I.L= 101.850

I.L= 100.624
LENGTH= 5m
Ø= 375
GRADE= 1.0%
I.L= 100.574

4 (TYP)

RETAINING WALL TO FUTURE DETAILS

RETAINING WALL REFER TO FUTURE DETAILS

SUBSOIL DRAINAGE (TYP.)

FUTURE FOOTPATH (TYP.)

EXISTING EARTH EMBANKMENT TO REMAIN

LIMIT OF WORKS
2m BERM

PROVIDE REFLECTIVE FLEXIBLE GUIDE POST 1.5m CENTRE (TYP.)

TEMPORARY OPEN CHANNEL AT 0.5% MIN GRADE, REFER DRAWING 501 FOR DETAILS. PART OF STAGE 2 CATCHMENT DRAINS THRU CHANNEL TO STAGE 1 DRAINAGE SYSTEM, REFER DRAWING 102 FOR DETAILS.

FUTURE STAGE 6

FUTURE STAGE 3

204
RL103.20

205 206 207 208 209

LOT 204 LOT 205 LOT 206 LOT 207 LOT 208 LOT 209

REFER DRAWING 294092-2-102 FOR CONTINUATION

Rev	Date	Description	Drawn	Appr.
C	09.09.10	FINAL ISSUE FOR CONSTRUCTION CERTIFICATE	JB	RL
B	10.08.10	REISSUED FOR CONSTRUCTION CERTIFICATE	LDB	RL
A	14.07.10	ISSUE FOR CONSTRUCTION CERTIFICATE	RC	RL

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

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Quality Endorsed Company
AS 9001 Lic. 5960
Standards Australia

Drawn	RC	Date JULY '10
Checked	RL	Date JULY '10
Designed	AG	Date JULY '10
Verified	MKH	Date JULY '10
Approved	RL	Date JULY '10

Client: DART WEST DEVELOPMENTS

CENTRAL HILLS BUSINESS PARK STAGE 2

ROADWORKS & STORMWATER PLAN SHEET 1

Status: FOR CONSTRUCTION CERTIFICATE

Date	Datum	Scale	Size
JULY'10	AHD	1:500@A1	A1

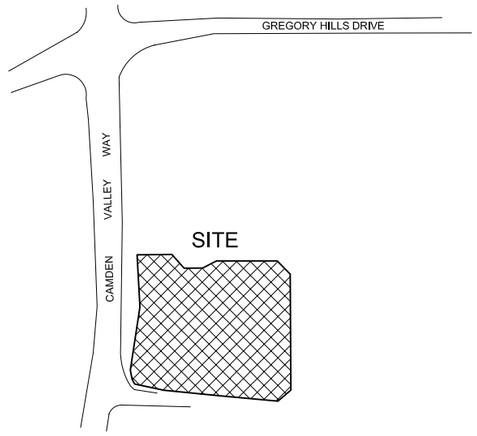
Drawing Number: 294092-2-100
Revision: C

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

APPENDIX B – CONCEPT STORMWATER DRINAGE MANAGEMENT PLANS

PROJECT OXYGEN

DEVELOPMENT APPLICATION
CAMDEN VALLEY WAY, GREGORY HILLS, NSW



LOCALITY SKETCH
Not to Scale

INDEX	
SHEET No	DRAWING TITLE
DA0.01	COVER SHEET, LOCALITY SKETCH & INDEX
DA1.01	SITEWORKS & GRADING PLAN
DA1.02	CONTOUR PLAN
DA2.01	STORMWATER DRAINAGE PLAN
DA2.02	OSD TANK DETAIL PLAN
DA3.01	DETAIL SHEET 1
DA3.02	DETAIL SHEET 2
DA4.01	DRAINS DATA
DA4.02	DRAINS RESULTS OUTPUT TABLE

VERIFIER:
JOB MANAGER:
DESIGNED:
DRAWN:

August, 2010

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ISSUE	AMENDMENT	VERIFIED	APPROVED	DATE
1	ISSUED FOR DA		KM	09.09.10
2	ISSUED FOR DA		KM	10.09.10

CLIENT
DART WEST DEVELOPMENTS

ARCHITECT
LEFFLER SIMES ARCHITECTS

ALL DIMENSIONS TO BE VERIFIED ON SITE BEFORE MAKING ANY SHOP DRAWINGS OR COMMENCING ANY WORK.

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PROJECT
PROJECT OXYGEN
CAMDEN VALLEY WAY
GREGORY HILLS, NSW

DRAWING TITLE
COVER SHEET, LOCALITY SKETCH & INDEX

JOB NUMBER **10131**
DRAWING NUMBER **DA0.01**
REVISION **2**
DRAWING SHEET SIZE = A1

LEGEND

- DENOTES PROPOSED BOUNDARY LOCATION
- DENOTES ADJACENT BOUNDARY LOCATION
- DENOTES PROPOSED KERB (ALL KERB TO BE INTEGRAL KERB U,N,O)
- RL... DENOTES FINISHED SURFACE LEVEL
- CL... DENOTES FINISHED SERVICE COVER LEVEL
- TK... DENOTES TOP OF KERB LEVEL
- KF... DENOTES KERB FACE LEVEL
- FFL... DENOTES FINISHED FLOOR LEVEL
- DENOTES RETAINING WALL
- DENOTES SURFACE FALL DIRECTION
- DENOTES SURFACE INLET PIT CLEAR OPENING
- JP DENOTES JUNCTION PIT WITH SOLID COVER. COVER LEVEL TO MATCH FINISHED SURFACE GRADING
- 22.70 DENOTES EXISTING SURFACE LEVEL CONTOUR
- DENOTES EXTENT OF NEW TRAFFICABLE CONCRETE PAVEMENT

ROAD 1904

EXTENT OF RETAINING WALL - MAX 800 HIGH

FFL103.10

1.35m WIDE FOOTPATH

RIDGE

CONSTRUCT VEHICULAR CROSSING TO COUNCIL STANDARDS AND SPECIFICATIONS.

BATTER LINES INDICATE SITE CONDITIONS UPON COMPLETION OF PRE DEVELOPMENT BULK EARTHWORKS FOR THE SITE.

PROVIDE SAFETY RAIL TO OVERFLOW WEIR.

EXTENT OF RETAINING WALL - MAX 550 HIGH

CONSTRUCT VEHICULAR CROSSING TO COUNCIL STANDARDS AND SPECIFICATIONS.

ROAD

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1	PRELIMINARY ISSUE		KM	19.08.10
2	ISSUED FOR DA		KM	09.09.10
3	ISSUED FOR DA		KM	10.09.10
4	REISSUED FOR DA		KM	14.09.10
5	REISSUED FOR DA		KM	22.09.10

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0 5 10 15 20 25m SCALE 1:500 @ A1
0 5 10 15 20 25m SCALE 1:1000 @ A3

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PROJECT
PROJECT OXYGEN
CAMDEN VALLEY WAY
GREGORY HILLS, NSW

DRAWING TITLE
SITEWORKS & GRADING PLAN

JOB NUMBER **10131**
DRAWING NUMBER **DA1.01**
REVISION **5**
DRAWING SHEET SIZE = A1

LEGEND

- DENOTES PROPOSED BOUNDARY LOCATION
- DENOTES ADJACENT BOUNDARY LOCATION
- DENOTES PROPOSED KERB
- FFL... — DENOTES FINISHED FLOOR LEVEL
- 103.00 — DENOTES PROPOSED FINISHED SURFACE LEVEL CONTOUR (MAJOR)
- 103.10 — DENOTES PROPOSED FINISHED SURFACE LEVEL CONTOUR (MINOR)
- 102.50 — DENOTES EXISTING SURFACE LEVEL CONTOUR
- DENOTES SURFACE INLET PIT CLEAR OPENING
- DENOTES JUNCTION PIT WITH SOLID COVER. COVER LEVEL TO MATCH FINISHED SURFACE GRADING
- DENOTES RETAINING WALL
- DENOTES EXTENT OF NEW TRAFFICABLE CONCRETE PAVEMENT

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3	REISSUED FOR DA		KM	14.09.10
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GREGORY HILLS, NSW

DRAWING TITLE
CONTOUR PLAN

JOB NUMBER **10131**
DRAWING NUMBER **DA1.02**
REVISION **4**
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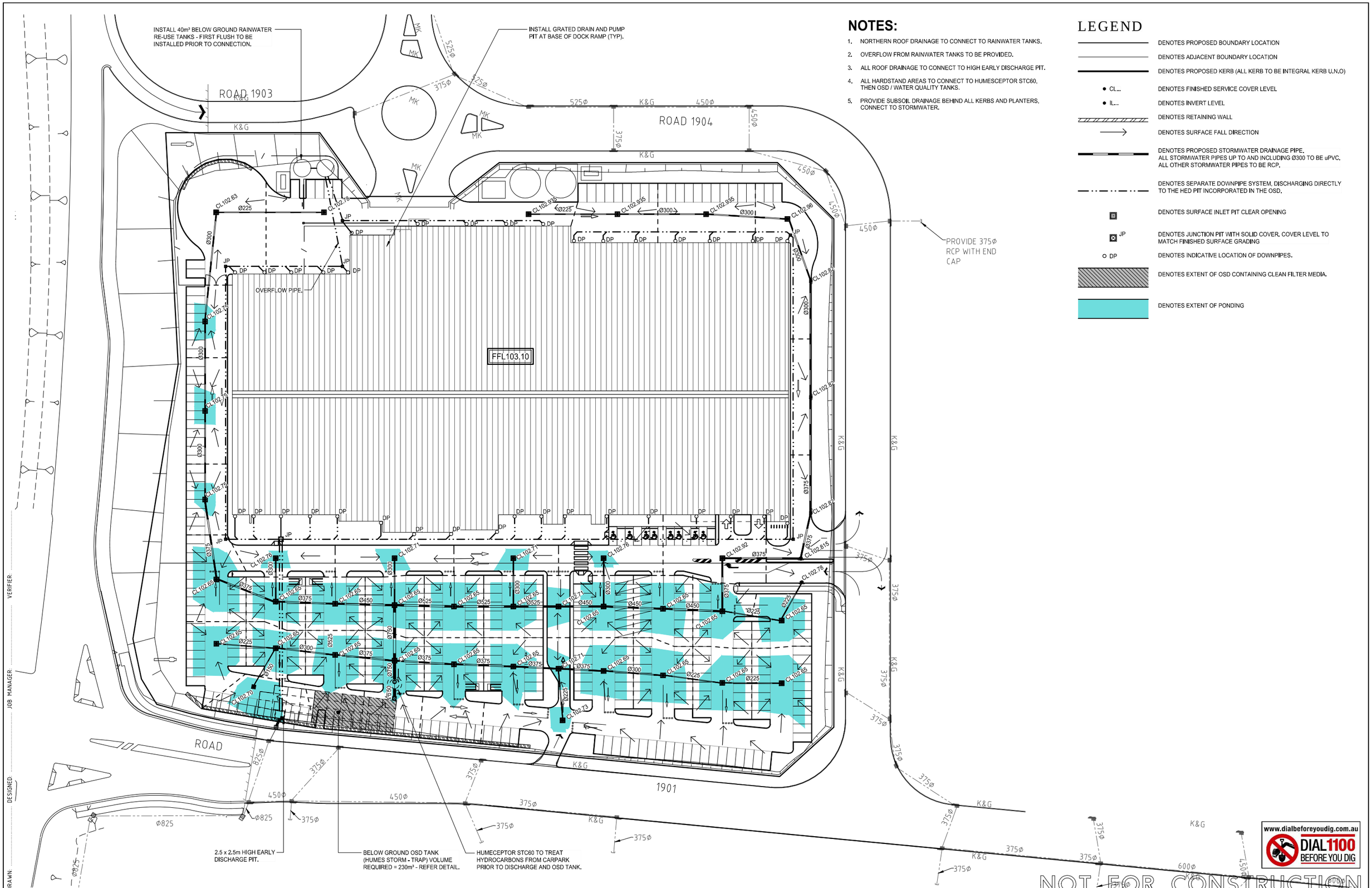

NOTES:

1. NORTHERN ROOF DRAINAGE TO CONNECT TO RAINWATER TANKS.
2. OVERFLOW FROM RAINWATER TANKS TO BE PROVIDED.
3. ALL ROOF DRAINAGE TO CONNECT TO HIGH EARLY DISCHARGE PIT.
4. ALL HARDSTAND AREAS TO CONNECT TO HUMESCEPTOR STC60, THEN OSD / WATER QUALITY TANKS.
5. PROVIDE SUBSOIL DRAINAGE BEHIND ALL KERBS AND PLANTERS, CONNECT TO STORMWATER.

LEGEND

- DENOTES PROPOSED BOUNDARY LOCATION
- DENOTES ADJACENT BOUNDARY LOCATION
- DENOTES PROPOSED KERB (ALL KERB TO BE INTEGRAL KERB U.N.O)
- CL... DENOTES FINISHED SERVICE COVER LEVEL
- IL... DENOTES INVERT LEVEL
- DENOTES RETAINING WALL
- DENOTES SURFACE FALL DIRECTION
- DENOTES PROPOSED STORMWATER DRAINAGE PIPE. ALL STORMWATER PIPES UP TO AND INCLUDING Ø300 TO BE uPVC. ALL OTHER STORMWATER PIPES TO BE RCP.
- DENOTES SEPARATE DOWNPIPE SYSTEM, DISCHARGING DIRECTLY TO THE HED PIT INCORPORATED IN THE OSD.
- DENOTES SURFACE INLET PIT CLEAR OPENING
- JP DENOTES JUNCTION PIT WITH SOLID COVER. COVER LEVEL TO MATCH FINISHED SURFACE GRADING
- DP DENOTES INDICATIVE LOCATION OF DOWNPIPES.
- DENOTES EXTENT OF OSD CONTAINING CLEAN FILTER MEDIA.
- DENOTES EXTENT OF PONDING

VERIFIER: JOB MANAGER: DESIGNED: DRAWN:

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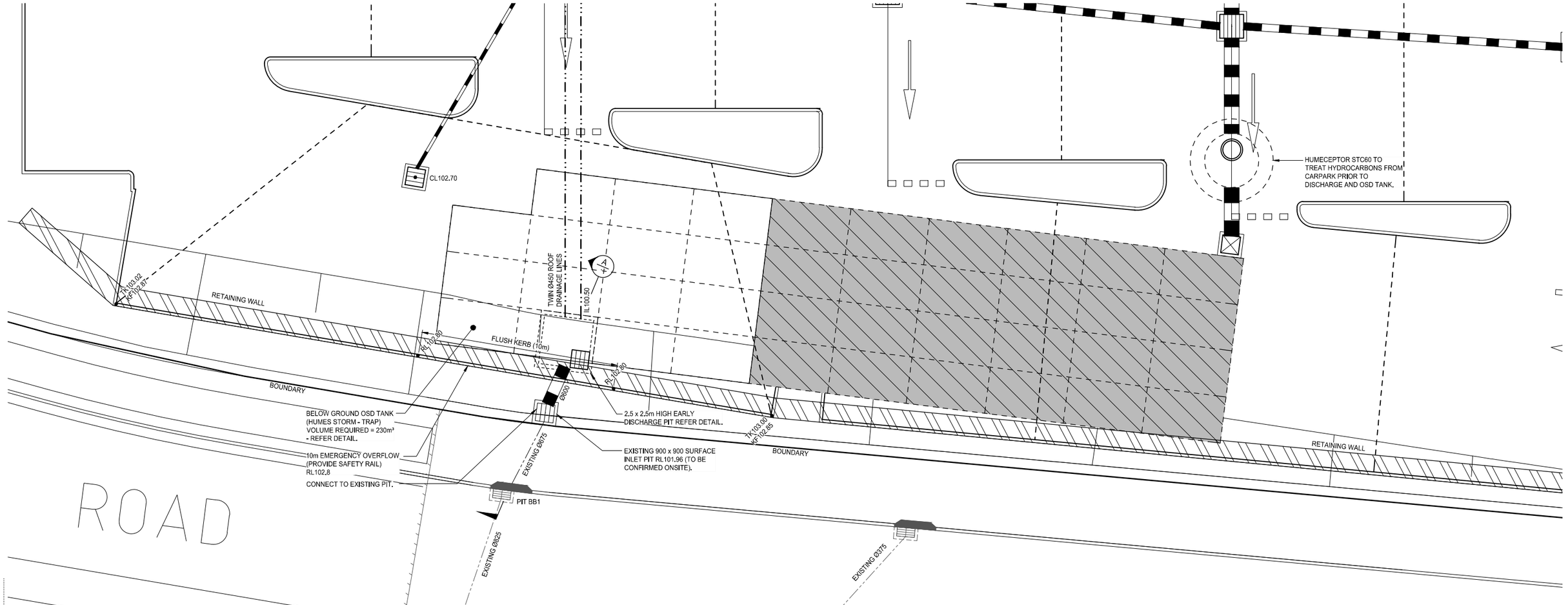
DRAWING TITLE
STORMWATER DRAINAGE PLAN

JOB NUMBER **10131**
DRAWING NUMBER **DA2.01**
REVISION **5**
DRAWING SHEET SIZE = A1



LEGEND

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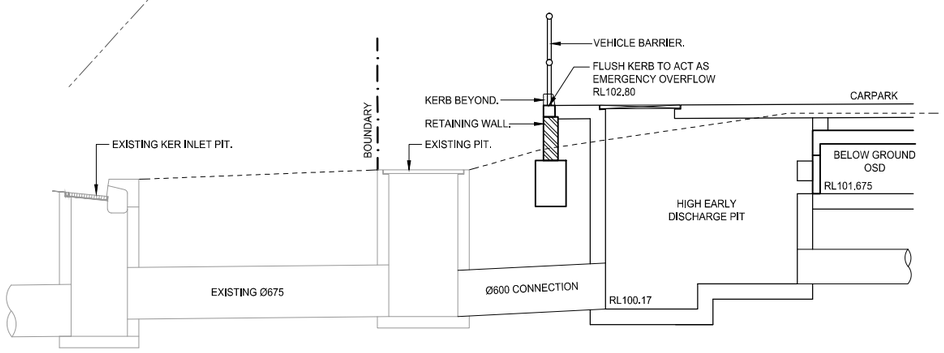
- DENOTES ADJACENT BOUNDARY LOCATION
- DENOTES PROPOSED KERB
- DENOTES RETAINING WALL
- DENOTES PROPOSED STORMWATER DRAINAGE PIPE. ALL STORMWATER PIPES UP TO AND INCLUDING Ø300 TO BE uPVC. ALL OTHER STORMWATER PIPES TO BE RCP.
- DENOTES uPVC PIPE (Ø150 UNO) TO DRAIN DOWNPIPE SYSTEM, LAID AND JOINTED IN ACCORDANCE WITH MANUFACTURER INSTRUCTION (LAID AT MIN 0.5% LONGITUDINAL GRADE AND MIN 200mm COVER).
- DENOTES SURFACE INLET PIT WITH CLEAR OPENING
- DENOTES JUNCTION PIT WITH SOLID COVER. COVER LEVEL TO MATCH FINISHED SURFACE GRADING
- DENOTES EXTENT OF OSD CONTAINING CLEAN FILTER MEDIA.



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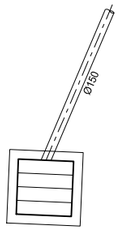
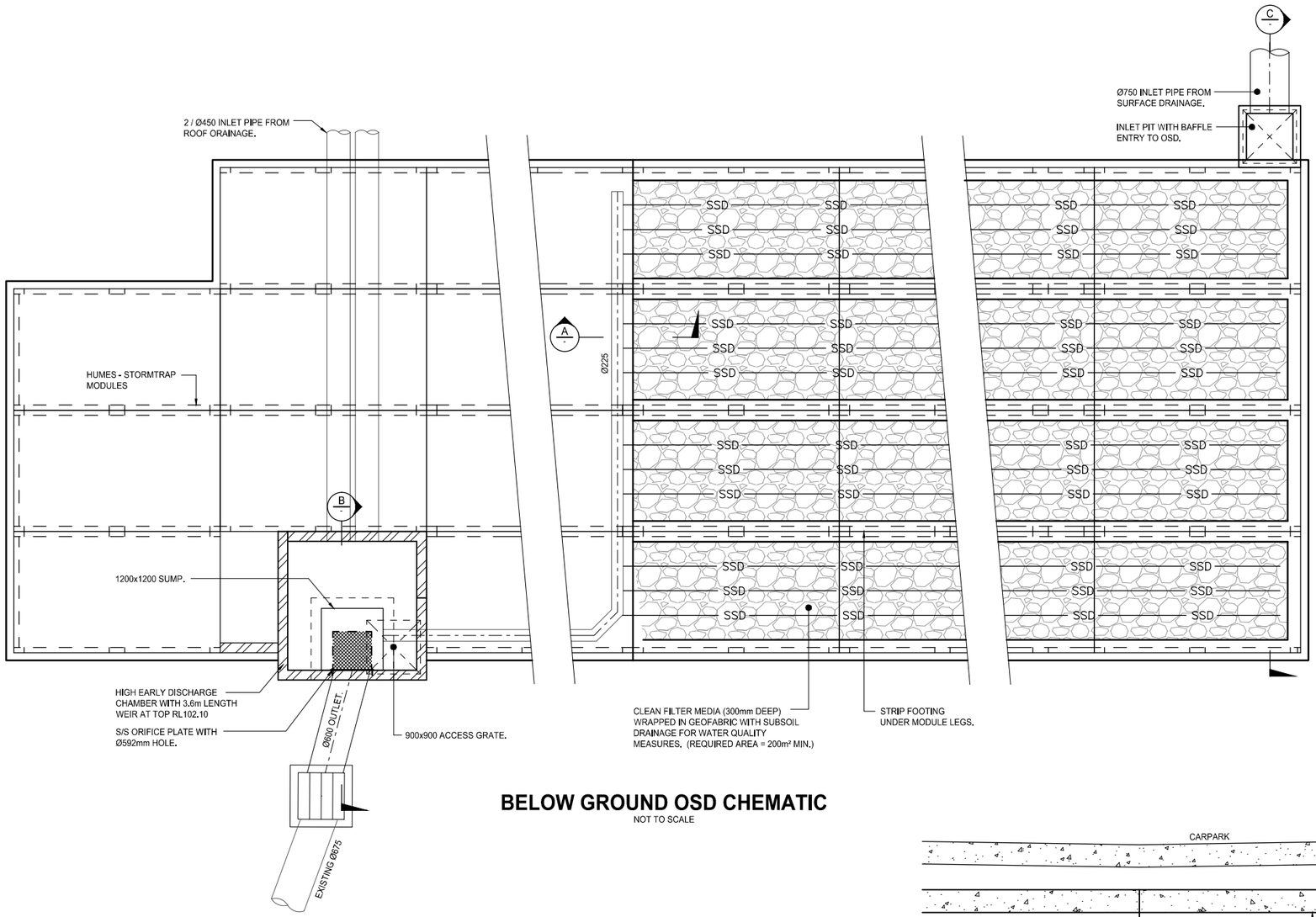
DRAWING TITLE
OSD TANK DETAIL PLAN

JOB NUMBER **10131**
DRAWING NUMBER **DA2.02**
REVISION **3**
DRAWING SHEET SIZE = A1





BELOW GROUND OSD CHEMATIC

NOT TO SCALE

STORMWATER CALCULATIONS

NOTE: SITE DRAIN TO SMALL CATCHMENT (EXTERNAL DRAINAGE WORKS) WHICH IN TURN FLOWS TO CULVERT UNDER CAMDEN VALLEY WAY. POST DEVELOPMENT FLOWS DO NOT EXCEED PRE DEVELOPMENTS FLOWS.

NOTE: DRAINS AND MUSIC MODELS AVAILABLE FOR ANALYSIS.

OSD STORAGE VOLUME
BELOW GROUND = 230m³ REQUIRED (238m³ PROVIDED)
ABOVE GROUND = 223m³
TOTAL STORAGE VOLUME = 453 REQUIRED (461m³ PROVIDED)

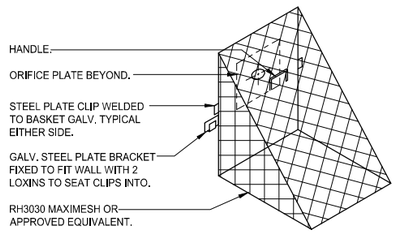
WATER QUALITY MEASURES

A HUMECEPTOR IS TO BE INSTALLED TO TREAT HYPROCARBONS. - BASED ON OUR MUSIC MODEL:

POST-DEVELOPMENT POLLUTANT LOAD REDUCTIONS

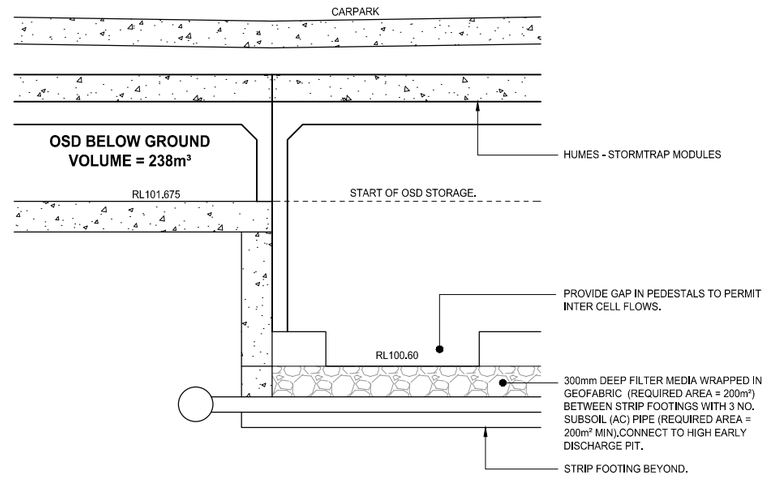
	BEFORE TREATMENT TRAIN	AFTER TREATMENT TRAIN	% OF REDUCTION
TSS (KG/YR)	12.0 x 10³	1.06 x 10³	91.20%
TP (KG/YR)	14.700	4.950	66.30%
TN (KG/YR)	184	69.200	62.40%
GROSS POLLUTANT (KG/YR)	984	14.100	98.60%

TREATMENT TRAIN INCLUDES: HUMECEPTOR, RAINWATER TANKS AND FILTER MEDIA WITH SUBSOIL UNDER OSD (HUMES STORM - TRAP).



TRASH SCREEN DETAIL

NOT TO SCALE



SECTION A

NOT FOR CONSTRUCTION

VERIFIER:
JOB MANAGER:
DESIGNED:
DRAWN:

ISSUE	AMENDMENT	VERIFIED	APPROVED	DATE
1	PRELIMINARY ISSUE		KM	19.08.10
2	ISSUED FOR DA		KM	09.09.10
3	ISSUED FOR DA		KM	10.09.10
4	REISSUED FOR DA		KM	14.09.10

CLIENT
DART WEST DEVELOPMENTS

DRAWING NOT TO BE USED FOR CONSTRUCTION UNLESS VERIFICATION SIGNATURE HAS BEEN ADDED

ARCHITECT
LEFFLER SIMES ARCHITECTS

ALL DIMENSIONS TO BE VERIFIED ON SITE BEFORE MAKING ANY SHOP DRAWINGS OR COMMENCING ANY WORK.

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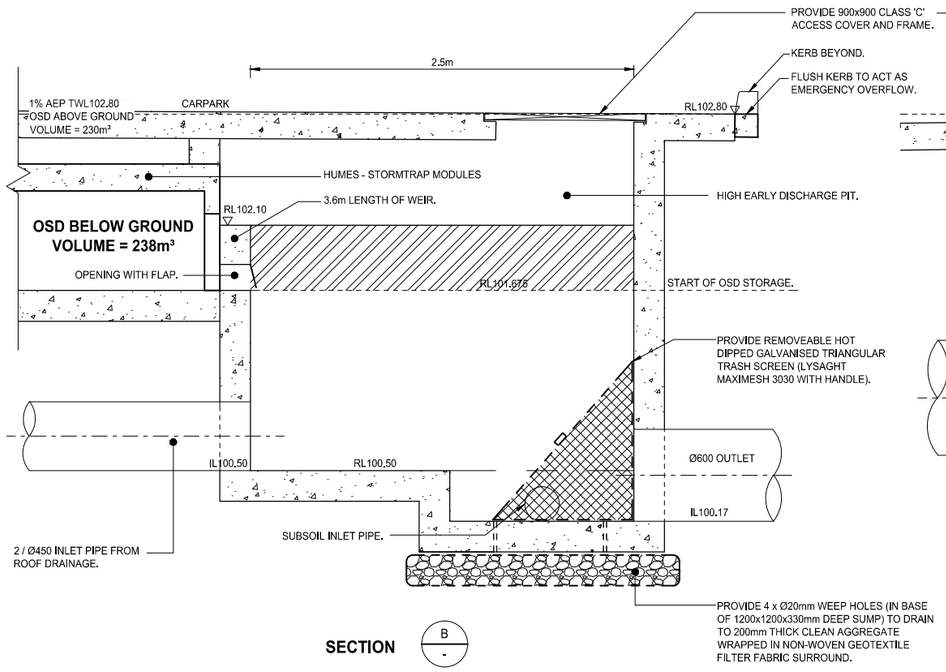
ABN 81 094 433 100

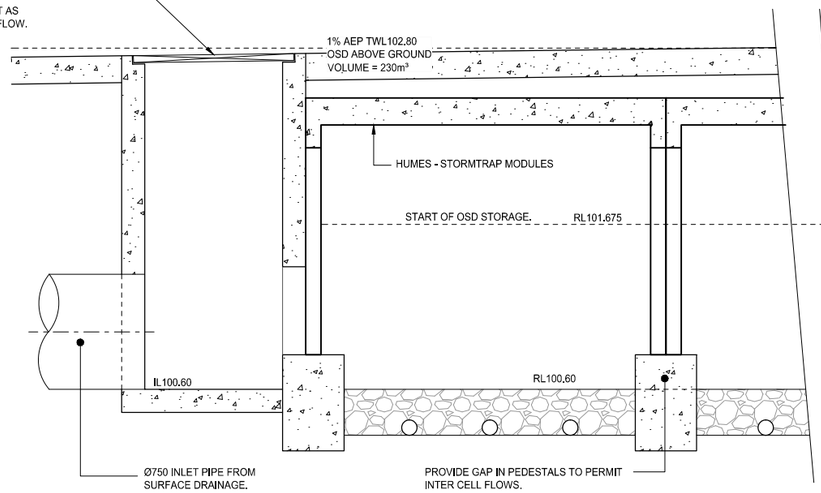
PROJECT
PROJECT OXYGEN
CAMDEN VALLEY WAY
GREGORY HILLS, NSW

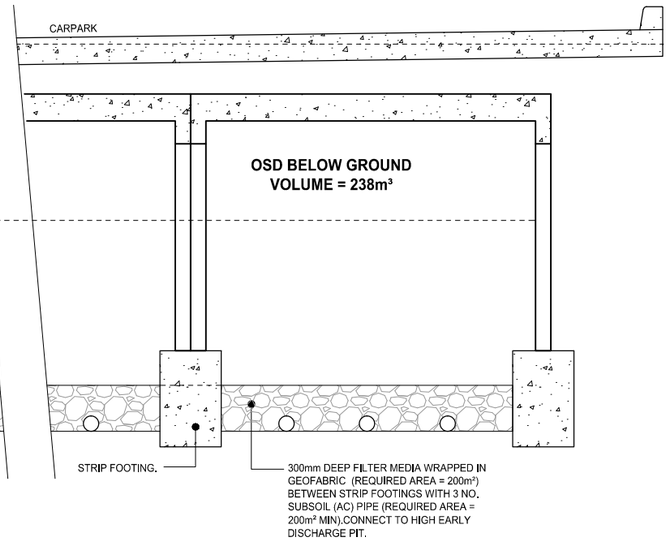
DRAWING TITLE
DETAIL SHEET 1

JOB NUMBER **10131**
DRAWING NUMBER **DA3.01**
REVISION **4**
DRAWING SHEET SIZE = A1



SECTION B -





SECTION C -

DRAWN: ..... DESIGNED: ..... JOB MANAGER: ..... VERIFIER: .....

NOT FOR CONSTRUCTION

ISSUE	AMENDMENT	VERIFIED	APPROVED	DATE
1	ISSUED FOR DA		KM	09.09.10
2	ISSUED FOR DA		KM	10.09.10
3	REISSUED FOR DA		KM	14.09.10

CLIENT
DART WEST DEVELOPMENTS

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PROJECT
PROJECT OXYGEN
CAMDEN VALLEY WAY
GREGORY HILLS, NSW

DRAWING TITLE
DETAIL SHEET 2

JOB NUMBER **10131**

DRAWING NUMBER **DA3.02**

REVISION **3**

DRAWING SHEET SIZE = A1

DRAINS DATA

PIT / NODE DETAILS			Version 9																			
Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss								
Lot205	OnGrade	Misc	DUMMY		5.9	101.75		0	0	8048.059	6867.744	No	1348519607	1 x Ku								
AA/2	OnGrade	Hornsby Council Inlets (Kl+grate), 3% crossfall, all grades	1.8 m lintel (all grades)		0.1	102.29		0	0.5	8041.585	6884.555	No	1358781373	1 x Ku								
AA/1	OnGrade	Hornsby Council Inlets (Kl+grate), 3% crossfall, all grades	1.8 m lintel (all grades)		0.7	101.35		0	0.5	8028.771	6885.174	No	1601598751	1 x Ku								
culvert - outlet	Node					100.8		0		7965.698	6928.868		1585721954									
Lot208	OnGrade	Misc	DUMMY		5.9	104.75		0	0	8243.21	6809.324	No	1348519681	1 x Ku								
AA/8	OnGrade	NSW Dept. of Housing RM10 Inlet, 3% crossfall, all grades	1.8 m lintel		1.2	103.074		0	0.5	8242.764	6820.965	No	1348519667	1 x Ku								
AA/7	OnGrade	NSW Dept. of Housing RM10 Inlet, 3% crossfall, all grades	1.8 m lintel		1.6	102.502		0	0.5	8207.871	6842.773	No	1348519657	1 x Ku								
AA/6	OnGrade	NSW Dept. of Housing RM10 Inlet, 3% crossfall, all grades	1.8 m lintel		1.3	101.868		0	0.5	8172.575	6867.165	No	1348519648	1 x Ku								
AA/5	OnGrade	NSW Dept. of Housing RM10 Inlet, 3% crossfall, all grades	1.8 m lintel		1.4	101.736		0	0.5	8146.325	6882.108	No	306303474	1 x Ku								
AA/4	OnGrade	NSW Dept. of Housing RM10 Inlet, 3% crossfall, all grades	1.8 m lintel		0.7	101.564		0	0.5	8087.594	6917.485	No	1348519610	1 x Ku								
AA/3	OnGrade	Hornsby Council Inlets (Kl+grate), 3% crossfall, all grades	1.8 m lintel (all grades)		0	101.757		0	0.5	8069.311	6916.277	No	1348519606	1 x Ku								
CC/1	OnGrade	NSW Dept. of Housing RM10 Inlet, 3% crossfall, all grades	1.8 m lintel		2.7	101.925		0	0.5	8193.397	6868.483	No	1348519707	1 x Ku								
DD/1	OnGrade	NSW Dept. of Housing RM10 Inlet, 3% crossfall, all grades	1.8 m lintel		3.6	102.551		0	0.5	8220.974	6850.292	No	1348519719	1 x Ku								
Lot206	OnGrade	Misc	DUMMY		3	102.2		0	0	8174.045	6852.272	No	1348519726	1 x Ku								
Lot207	OnGrade	Misc	DUMMY		4.1	104.25		0	0	8210.294	6831.627	No	1348519735	1 x Ku								
Lot204	OnGrade	Misc	DUMMY		2.8	103		0	0	8177.421	6905.935	No	1348519698	1 x Ku								
BB/1	OnGrade	NSW Dept. of Housing RM10 Inlet, 3% crossfall, all grades	1.8 m lintel		0	101.681		0	0.5	8158.441	6891.396	No	1348519689	1 x Ku								

DETENTION BASIN DETAILS																
Name	Elev	Surf. Area	Init Vol. (cu.m)	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length(m)	id	
OSD	100.3	1	0	Culvert	1					8184.966	6911.168	Yes	102.1	3.6	1900554502	
	101.674	1														
	101.675	350														
	102.325	350														
	102.326	2.4														
	102.65	2.4														
	102.8	2970														

SUB-CATCHMENT DETAILS																						
Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFactor
CatLot205	Lot205	0.25	0	100	0	5		15	0									0			
CatLot208	Lot208	0.2251	0	100	0	5		15	0									0			
CatAA/8	AA/8	0.0269	80	20	0	5		10	0									0			
CatAA/7	AA/7	0.0445	80	20	0	5		10	0									0			
CatAA/6	AA/6	0.0515	80	20	0	5		10	0									0			
CatAA/5	AA/5	0.0131	80	20	0	5		10	0									0			
CatCC/1	CC/1	0.0467	80	20	0	5		10	0									0			
CatDD/1	DD/1	0.0679	80	20	0	5		10	0									0			
CatLot206	Lot206	0.25	0	100	0	5		15	0									0			
CatLot207	Lot207	0.23	0	100	0	5		15	0									0			
CatLot204	OSD	3.3586	95	5	0	9		19	0									0			
CatBB/1	BB/1	0.0272	80	20	0	5		10	0									0			

PIPE DETAILS																			
Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	RI (m)	Chg (m)	RL (m)	etc (m)
Lot205-AA/2	Lot205	AA/2	5	100.55	100.5	1	Concrete, not under roads	375	375	0.3	New	1	AA/2	0					
AA2-AA1	AA/2	AA/1	5.762	98.879	98.85	0.5	Box Culvert	0.9W x 0.3H		0.3	Existing	1	AA/1	0					
existing culvert	AA/1	culvert - outlet	63.48	98.8	98.4	0.63	Box Culvert	1.2W x 0.9H		0.3	Existing	1	culvert - outlet	0					
Lot208-AA8	Lot208	AA/8	5	101.9	101.85	1	RCP - 3	375	375	0.6	New	1	AA/8	0					
AA8-AA7	AA/8	AA/7	44.578	101.8	101.193	1.36	RCP - 3	375	375	0.6	New	1	AA/7	0					
AA7-AA6	AA/7	AA/6	50.816	101.118	100.426	1.36	RCP - 3	450	450	0.6	New	1	AA/6	0					
AA6-AA5	AA/6	AA/5	12.612	100.376	100.204	1.36	RCP - 3	450	450	0.6	New	1	AA/5	0					
AA5-AA4	AA/5	AA/4	36.103	99.62	99.362	0.71	Concrete, not under roads	825	825	0.3	New	1	AA/4	0					
AA4-AA3	AA/4	AA/3	10.459	99.312	99.237	0.72	Box Culvert	0.9W x 0.3H		0.3	Existing	1	AA/3	0					
AA3-AA2	AA/3	AA/2	36.078	99.187	98.929	0.72	Concrete, not under roads	825	825	0.3	New	1	AA/2	0					
CC1-AA6	CC/1	AA/6	20.981	100.598	100.451	0.7	RCP - 3	375	375	0.6	New	1	AA/6	0					
DD1-AA7	DD/1	AA/7	13.587	101.263	101.168	0.7	RCP - 3	375	375	0.6	New	1	AA/7	0					
Lot206-AA6	Lot206	AA/6	5	100.501	100.451	1	Concrete, not under roads	375	375	0.3	New	1	AA/6	0					
lot207-AA7	Lot207	AA/7	5	101.243	101.193	1	Concrete, not under roads	375	375	0.3	New	1	AA/7	0					
OSD Outlet 675mm	OSD	Lot204	5	100.356	100.106	5	RCP - 3	600	600	0.6	NewFixed	1	Lot204	0					
EE2-EE1	Lot204	BB/1	10	100.056	99.956	1	Concrete, not under roads	675	675	0.3	New	1	BB/1	0					
EE1-AA5	BB/1	AA/5	19.013	99.806	99.67	0.72	RCP - 3	825	825	0.6	New	1	AA/5	0					

DETAILS of SERVICES CROSSING PIPES											
Pipe	Chg (m)	Bottom Elev (m)	Height of Service (m)	Chg (m)	Bottom Elev (m)	Height of Service (m)	Chg (m)	Bottom Elev (m)	Height of Service (m)	etc	etc

CHANNEL DETAILS												
Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Width (m)	L.B. Slope (1:?)	R.B. Slope (1:?)	Manning n	Depth (m)	Roofed

OVERFLOW ROUTE DETAILS													
Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storms (m)	SafeDepth Minor Storms (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id
OF-Lot205	Lot205	AA/1	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781474
OF-AA2 DUMMY	AA/2	AA/1	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781478
OF-AA1	AA/1	culvert - outlet	1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1585721959
OF-Lot208	Lot208	AA/8	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781447
OF-AA8	AA/8	AA/7	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781449
OF-AA7	AA/7	AA/6	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781455
OF-AA6	AA/6	AA/5	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781461
OF-AA5 DUMMY	AA/5	AA/1	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781469
OF-AA4 DUMMY	AA/4	AA/1	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781471
OF-AA3 DUMMY	AA/3	AA/1	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781476
OF-CC1	CC/1	BB/1	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781459
OF-DD1	DD/1	CC/1	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781453
OF-Lot206	Lot206	AA/6	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781457
OF-Lot207	Lot207	AA/7	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781451
OF-Lot204	Lot204	BB/1	0.5				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781463
OF-BB1 DUMMY	BB/1	AA/1	1				Dummy used to model flow across road low points	0.2	0.05	0.6	1	0	1358781467

VERIFIER: JOB MANAGER: DESIGNED: DRAWN:

NOT FOR CONSTRUCTION

ISSUE	AMENDMENT	VERIFIED	APPROVED	DATE
1	ISSUED FOR DA		KM	09.09.10
2	REISSUED FOR DA		KM	14.09.10

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PROJECT
PROJECT OXYGEN
CAMDEN VALLEY WAY
GREGORY HILLS, NSW

DRAWING TITLE
DRAINS DATA

JOB NUMBER **10131**
DRAWING NUMBER **DA4.01**
REVISION **2**
DRAWING SHEET SIZE = A1

DRAINS RESULTS OUTPUT TABLE

DRAINS results prepared 14 September, 2010 from Version 2010.09

PIT / NODE DETAILS — Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Lot205	101.03		0.072		0.7	0	None
AA/2	99.72		0		2.97	0	None
AA/1	99.43		0		1.9	0	None
culvert - outlet	99.3		0				
Lot208	102.34		0.065		2.41	0	None
AA/8	102.09		0.013		0.98	0	None
AA/7	101.67		0.022		0.83	0	None
AA/6	101.38		0.023		0.49	0.001	Inlet Capacity
AA/5	101.06		0.007		0.67	0	None
AA/4	100.62		0		0.94	0	None
AA/3	99.72		0		2.04	0	None
CC/1	101.38		0.026		0.34	0.001	Inlet Capacity
DD/1	101.69		0.033		0.87	0.003	Inlet Capacity
Lot206	101.45		0.072		0.73	0	None
Lot207	101.74		0.067		2.31	0	None
Lot204	101.88		0		1.12	0	None
BB/1	101.11		0.014		0.97	0	None

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Dute to Storm
Catlot205	0.072	0	0.072	5	15	0	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
Catlot208	0.063	0	0.063	5	15	0	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
CatAA/8	0.013	0.012	0.002	5	10	0	AR&R 100 year, 15 minutes storm, average 140 mm/h, Zone 1
CatAA/7	0.022	0.02	0.003	5	10	0	AR&R 100 year, 15 minutes storm, average 140 mm/h, Zone 1
CatAA/6	0.023	0.023	0.003	5	10	0	AR&R 100 year, 15 minutes storm, average 140 mm/h, Zone 1
CatAA/5	0.006	0.006	0.001	5	10	0	AR&R 100 year, 15 minutes storm, average 140 mm/h, Zone 1
CatCC/1	0.023	0.02	0.003	5	10	0	AR&R 100 year, 15 minutes storm, average 140 mm/h, Zone 1
CatDD/1	0.033	0.03	0.003	5	10	0	AR&R 100 year, 15 minutes storm, average 140 mm/h, Zone 1
Catlot206	0.072	0	0.072	5	15	0	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
Catlot207	0.067	0	0.067	5	15	0	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
Catlot204	1.533	1.525	0.036	9	19	0	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
CatBB/1	0.013	0.012	0.002	5	10	0	AR&R 100 year, 15 minutes storm, average 140 mm/h, Zone 1

Outflow Volumes for Total Catchment (3.41 impervious + 1.18 pervious = 4.59 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 minutes storm, average 219 mm/h, Zone 1	837.93	655.58 (78.2%)	588.73 (84.3%)	66.86 (31.1%)
AR&R 100 year, 10 minutes storm, average 167 mm/h, Zone 1	1277.87	1073.81 (84.0%)	915.80 (96.4%)	157.81 (48.1%)
AR&R 100 year, 15 minutes storm, average 140 mm/h, Zone 1	1607.02	1383.06 (86.1%)	1160.39 (97.1%)	224.67 (54.3%)
AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1	1831.91	1613.06 (87.1%)	1342.41 (97.5%)	272.65 (57.4%)
AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1	2066.17	1810.53 (87.8%)	1501.68 (97.8%)	308.87 (58.2%)
AR&R 100 year, 30 minutes storm, average 98 mm/h, Zone 1	2249.83	1979.33 (88.0%)	1638.20 (98.0%)	341.13 (59.1%)
AR&R 100 year, 45 minutes storm, average 79 mm/h, Zone 1	2720.46	2413.73 (88.7%)	1988.02 (98.3%)	425.70 (61.0%)
AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1	3076.9	2740.63 (89.1%)	2252.32 (98.5%)	488.13 (61.8%)
AR&R 100 year, 1.5 hour storm, average 52 mm/h, Zone 1	3581.37	3198.19 (89.3%)	2627.94 (98.7%)	570.23 (61.0%)
AR&R 100 year, 2 hours storm, average 42.9 mm/h, Zone 1	3939.51	3517.12 (89.3%)	2894.14 (98.8%)	622.98 (61.6%)
AR&R 100 year, 3 hours storm, average 33 mm/h, Zone 1	4543.58	4056.06 (89.2%)	3344.75 (99.0%)	711.30 (61.0%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Dute to Storm
Lot205-AA/2	0.072	1.7	100.7	100.63	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
AA2-AA1	1.159	4.3	99.661	99.434	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
existing culvert	1.159	1.8	99.331	99.3	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
Lot208-AA8	0.065	0.9	102.23	102.094	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
AA8-AA7	0.074	1.9	101.947	101.67	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
AA7-AA6	0.186	1.2	101.537	101.379	AR&R 100 year, 1.5 hours storm, average 52 mm/h, Zone 1
AA6-AA5	0.302	1.9	101.184	101.065	AR&R 100 year, 1.5 hours storm, average 52 mm/h, Zone 1
AA5-AA4	1.087	2	100.766	100.619	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
AA4-AA3	1.087	4	99.909	99.722	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
AA3-AA2	1.087	3	99.722	99.722	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
CC1-AA6	0.023	0.2	101.381	101.379	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
DD1-AA7	0.03	0.3	101.673	101.67	AR&R 100 year, 15 minutes storm, average 140 mm/h, Zone 1
Lot206-AA6	0.072	0.7	101.385	101.379	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
lot207-AA7	0.067	0.6	101.674	101.67	AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1
OSD Outlet 675mm	0.872	3.1	101.947	101.878	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
EE1-EE1	0.872	2.4	101.173	101.113	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1
EE1-AA5	0.872	1.6	101.113	101.065	AR&R 100 year, 20 minutes storm, average 121 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Chainage (m)	Max HGL (m)	Dute to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Dute to Storm
OF-Lot208	0	0	7.665	0	0	0	0	
OF-AA2 DUMMY	0	0	7.665	0	0	0	0	
OF-AA1	0	0	7.665	0	0	0	0	
OF-Lot208	0	0	7.665	0	0	0	0	
OF-AA8	0	0	7.665	0	0	0	0	
OF-AA7	0	0	7.665	0	0	0	0	
OF-AA6	0.001	0.001	7.665	0.003	0	1.83	0.14	AR&R 100 year, 15 minutes storm, average 140 mm/h, Zone 1
OF-AA5 DUMMY	0	0	7.665	0	0	0	0	
OF-AA4 DUMMY	0	0	7.665	0	0	0	0	
OF-AA3 DUMMY	0	0	7.665	0	0	0	0	
OF-CC1	0.001	0.001	7.665	0.003	0	1.83	0.16	AR&R 100 year, 25 minutes storm, average 108 mm/h, Zone 1
OF-DD1	0.003	0.003	7.665	0.009	0	3.14	0.2	AR&R 100 year, 15 minutes storm, average 140 mm/h, Zone 1
OF-Lot206	0	0	7.665	0	0	0	0	
OF-Lot207	0	0	7.665	0	0	0	0	
OF-Lot204	0	0	7.665	0	0	0	0	
OF-BB1 DUMMY	0	0	7.665	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
OSD	102.8	376.8	0.872	0.872	0

CONTINUITY CHECK for AR&R 100 year, 1 hour storm, average 67 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
Lot205	103.58	103.58	0	0
AA/2	2746.19	2746.2	0	0
AA/1	2746.2	2753.06	0	-0.2
culvert - outlet	2753.06	2753.06	0	0
Lot208	93.26	93.26	0	0
AA/8	109.7	109.7	0	0
AA/7	273.34	273.41	0	0
AA/6	437.35	437.27	0	0
AA/5	2688.09	2687.82	0	0
AA/4	2687.82	2687.83	0	0
AA/3	2687.83	2642.61	0	-0.2
CC/1	28.89	28.88	0	0
DD/1	41.5	41.49	0	0
Lot206	103.38	103.38	0	0
Lot207	95.29	95.29	0	0
OSD	2173.13	2173.03	0.09	0
Lot204	2173.03	2174.91	0	0
BB/1	2191.34	2192.82	0	-0.1

Run Log for IN284092_CHBP STG2_HARDWARE SITE ISSUED 135ep10_Northrop.drn run at 12:28:52 on 14/9/2010

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

NOT FOR CONSTRUCTION

DRAWN: ..... DESIGNED: ..... JOB MANAGER: ..... VERIFIER: .....

ISSUE	AMENDMENT	VERIFIED	APPROVED	DATE
1	ISSUED FOR DA		KM	09.09.10
2	REISSUED FOR DA		KM	14.09.10

CLIENT
DART WEST DEVELOPMENTS

DRAWING NOT TO BE USED FOR CONSTRUCTION UNLESS VERIFICATION SIGNATURE HAS BEEN ADDED

ARCHITECT
LEFFLER SIMES ARCHITECTS

ALL DIMENSIONS TO BE VERIFIED ON SITE BEFORE MAKING ANY SHOP DRAWINGS OR COMMENCING ANY WORK.

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ABN 81 094 433 100

PROJECT
PROJECT OXYGEN
CAMDEN VALLEY WAY
GREGORY HILLS, NSW

DRAWING TITLE
DRAINS RESULTS OUTPUT TABLE

JOB NUMBER **10131**
DRAWING NUMBER **DA4.02**
REVISION **2**
DRAWING SHEET SIZE = A1