



**CONCEPT STORMWATER
MANAGEMENT PLAN AND ROAD
DESIGN**

**LOT 9 DP244002 & LOT 358
DP755242 MORISSET PARK
ROAD, MORISSET PARK**

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1. Introduction

1.1 Investigation Objectives

Northrop Engineers have been engaged by Postfox Pty Ltd to prepare a 'Concept Stormwater Management Strategy' for the subdivision of Lot 9 DP244002 and Lot 358 DP755242 on Morisset Park Road and Chifley Road, Morisset Park. These combined lots will be referred to in this report as the 'site'.

This report investigates the constraints of the proposed subdivision of the site with regard to stormwater and road construction. It intends to discuss these issues at a level appropriate for Development Application, and does not attempt to provide detailed design solutions.

The recommendations of this report have been determined in accordance with Lake Macquarie City Council's (LMCC) Development Control Plan No 1 and No 2 (DCP No. 1 and 2), and discussions with Greg Field (Lake Macquarie City Council's Development Engineer).

This report should be read in conjunction with all Development Application material.

1.2 Site Description

The site is generally cleared and used for grazing of cattle. Two residences and a number of existing sheds on site are accessed from Morisset Park Road. The site generally falls from Morisset Park Road towards the north with average grades of 5%. The south eastern portion of the site currently drains to Chifley Road.

Morisset Park Road and the western side of Chifley Road have unformed edges and are drained by road side swales.

2. Site Hydraulics and Hydrology

2.1 Overview

Stormwater management will be provided on a site wide approach with an above ground detention basin to be provided as part of the subdivision. In broad terms it is proposed that stormwater will be diverted from lots and road surfaces through a pit and pipe network to a Gross Pollutant Device prior to being discharged to an above ground detention basin. The detention basin will then direct controlled flows through an existing services easement between Lot 1 and 2 DP244002 to the existing drainage swale along the Western side of Chifley Road.

The development of individual lots will require future land owners to seek separate development approval from Lake Macquarie City Council (LMCC). As part of this process individual owners will need to comply with LMCC's DCP 1 and 2. By providing a regional detention basin, detention on individual lots will not be required when they are developed. However, runoff from individual lots will be treated by stormwater tanks or other means to remove pollutants and increase water quality in accordance with LMCC's DCP 1 and 2.

In accordance with the natural topography, the site has been broken into two sub-catchments (refer Figure 1). Flow from Morisset Park Road and upstream catchments have not been included in the modelling as it is understood that those portions of Morisset Park Road and Chifley Road which front the site will be provided with kerb and gutter and an underground pit and pipe stormwater system. As such Morisset Park Road will collect stormwater from upstream catchments and divert it around the site.

2.2 Detention Modelling Methodology

Due to the natural topography of the site Sub-catchment 2, will be directed straight to the drainage system in Chifley Road and will not be detained. As such the remainder of the site (Sub-catchment 1) will be over detained such that the peak combined flow from Sub-catchment 1 and 2, once developed, will be limited to the

peak pre-developed flow. Modelling of flows and the effects of detention has been undertaken in the runoff routing software DRAINS.

For the purpose of detention modelling the pre-developed site was assumed to be fully pervious. Developed sub-catchments include roads and footpaths as shown on Figure 1 and future impervious surfaces on lots. Table 1 outlines the Sub-catchment parameters used in the modelling.

Table 1: Sub-catchment Parameters

	Area (ha)	% impervious
Sub-catchment 1	5.41	50
Sub-catchment 2	0.86	50

Further to the table above the following assumptions were made in determining catchment parameters:

- The fire trail has not been included in the lot areas. Fire trails have been assumed 100% pervious in the developed case.
- Road reserves have been assumed to be 50% impervious in the developed case.
- Lot areas have generally been assumed 50% impervious to include future roofs, driveways and paved external areas. Please note that lot areas vary from 570 sq.m up to 1000 sq.m, however a flat 50% impervious percentage was used to be conservative.
- We understand that Lots 56, 57, 67 and 68 may be future dual occupancy sites and have been taken as 70% impervious in the developed case.

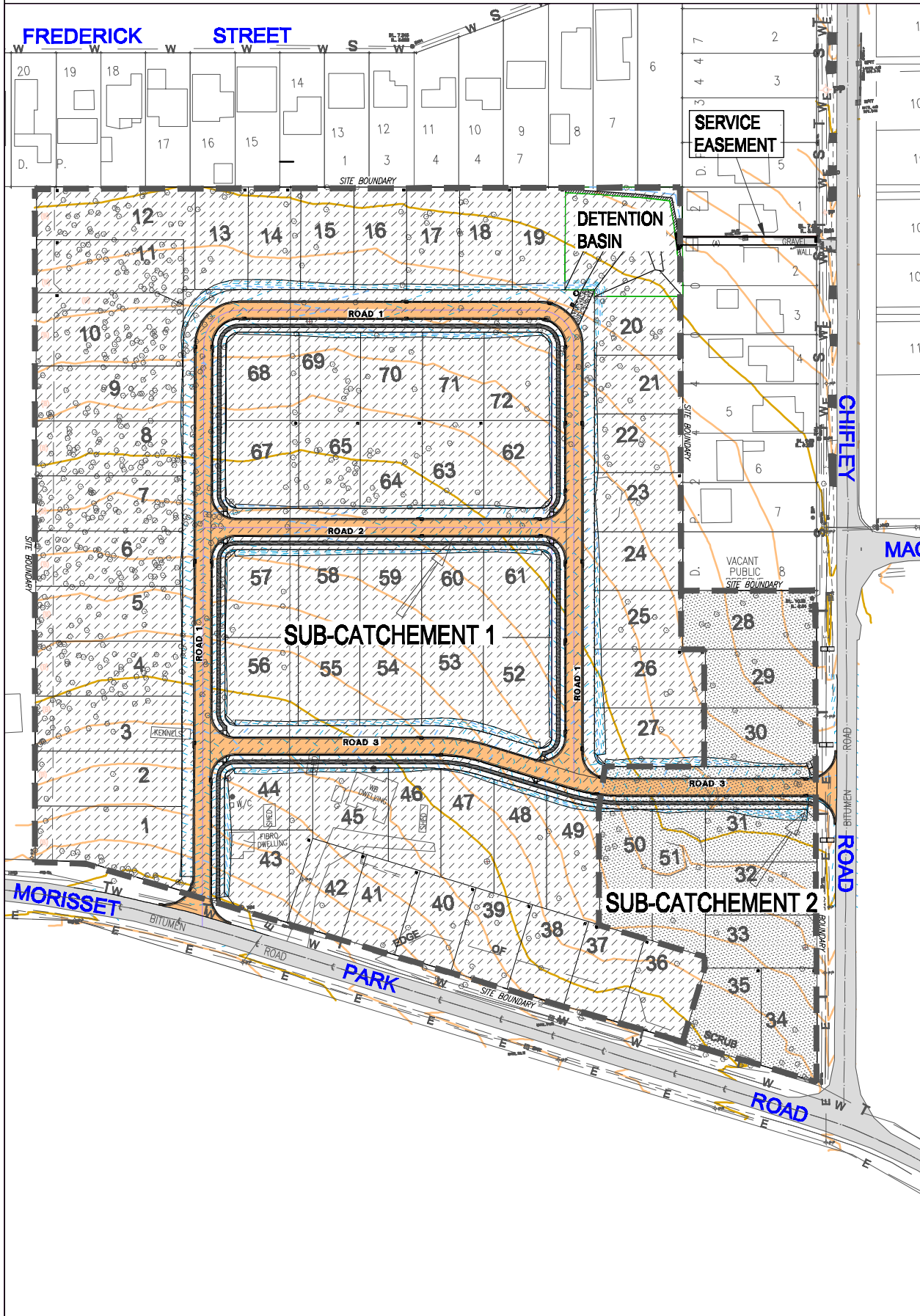
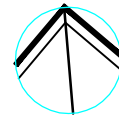


FIGURE 1- CATCHMENT BOUNDARIES

In sizing the detention basin peak flows were compared for the 20%, 10%, 5%, 2% and 1% Average Excedance Probability (AEP) storm events.

Peak flows produced by DRAINS have been checked using Statistical Rational Method calculations, refer Appendix A. The peak 1% AEP flow, as calculated using the Statistical Rational Method for the pre-developed sub-catchments correlates well with those produced by DRAINS. As such parameters used in the DRAINS model are considered suitable for the site and sub-catchments.

All parameters used in the DRAINS model and the Statistical Rational Method calculations are shown in Appendix A and B respectively. DRAINS output files are contained in Appendix C.

An illustration of the DRAINS model is shown in Figure 2.

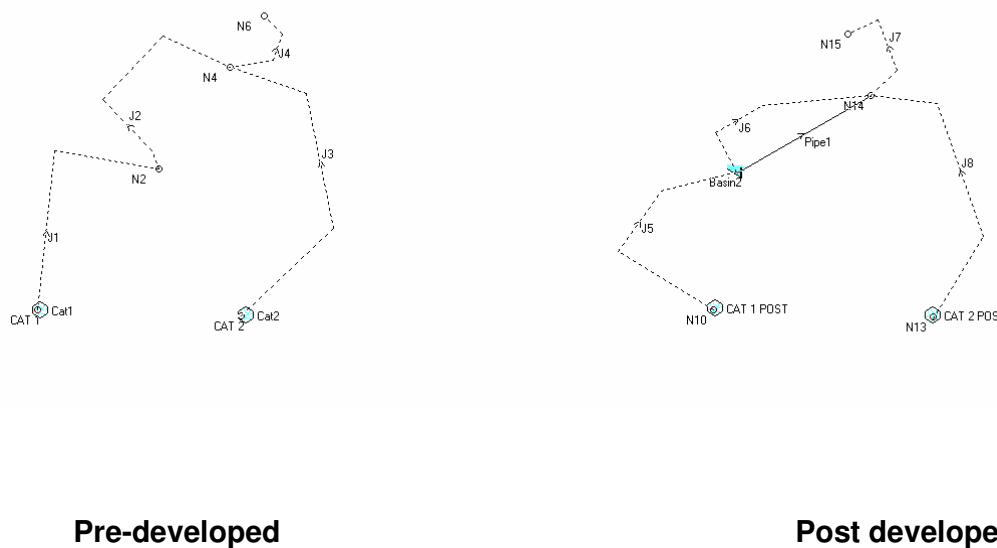


Figure 2 – Illustration of DRAINS Model

2.3 Detention Modelling Results

Table 2: Peak flows from the DRAINS modelling and peak detention storage.

	20% AEP (l/s)	10% AEP (l/s)	5% AEP (l/s)	2% AEP (l/s)	1% AEP (l/s)	Peak Detention Storage* (m ³)
Pre-developed Site	516	665	871	1,100	1,330	-
Post developed Site	490	540	716	996	1,300	1,183

* Peak detention storage in the 1% AEP event

Results contained in Table 2 show that the detention basin will reduce peak developed flow from the entire site to pre-developed levels. Detention basin outlet characteristics are discussed further in Section 2.4.

2.4 Detention Modelling Results

While full design calculations and construction documentation will be provided at Construction Certificate stage, on-site detention has been preliminary designed as an above ground detention basin located in the bottom corner of the site. The location and preliminary basin design is shown in Appendix D.

The basin has been design to generally have 1 in 3 cut and fill batters except where 1 in 6 batters are shown. The 1 in 6 batters have been designed to allow easy access and egress from the invert of the basin. The basin has been designed with twin 300mm diameter low flow pipes having an outlet invert of 7.15m AHD, and a 3m wide high level weir at RL 8.95m AHD. The stage storage relationship used in the modelling is shown in Table 3.

Table 3: Stage / Storage Relationship

Stage (m AHD)	Storage (cu.m)
7.15	0
8.15	376
9.15	1130
9.40	1372

The peak flow over the weir will be 654 l/s and a maximum height of 350mm or 9.2m AHD.

In large storm events overflow from the Detention Basin will be directed through the dedicated services easement (3m wide) to the existing stormwater swale in Chifley Road. From Mannings calculations (refer Appendix E) the peak depth of flow in the 1% AEP event through the easement will be less than 120mm. To manage the flow in this event a small kerbs should be construct on either side of the easement. This kerb/wall should be increased to approximately 300mm high on the northern side of the easement to allow for freeboard.

3. Stormwater Quality

It is proposed that stormwater runoff from the constructed subdivision be treated by a Gross Pollutant Trap, such as a CDS unit or similar, prior to it entering the detention basin. It should be noted that at the end of Chifley Road the local drainage network discharges to the Lake. Prior to discharging an existing large Gross Pollutant Trap currently treats runoff for gross pollutants and litter at the end of Chifley Road. This device will further treat runoff from our site but has not been included in our design.

The stormwater quality system described has been designed in accordance with LMCC's Stormwater Treatment Framework & Stormwater Quality Improvement Device Guidelines SQUID Guidelines (SQID Guidelines).

Table 3 outlines the effectiveness of the treatment options in comparison to the required treatment rates as specified in the SQID Guidelines.

Table 3: Water Quality Treatment

	Removal efficiencies						
Pollutant Species	Gross Pollutants	Coarse Sediments	Medium Sediments	Fine Sediments	Nutrients	Heavy Metals	Oils and Greases
SQID Guidelines Targets	High-Very High 50-100%	High-Very High 50-100%	Moderate-High 30-80%	Moderate 30-50%	Moderate 30-50%	Moderate 30-50%	Moderate 30-50%
CDS Unit	Very High (90%)	Very High (90%)	Moderate (45%)	Low (20%)	Low (20%)	Low (20%)	Moderate (45%)
OSD	High (70%)	Moderate (45%)	Low (20%)	Low (20%)	Low (20%)	Low (20%)	Low (20%)
System Efficiency	97.0%	94.5%	78%	36%	36%	36%	78%

Further to the treatment train described above, runoff from individual lots when developed will likely be treated via a number of devices on site including:

- First flush devices from roofs to provide treatment for sediment, coarse litter and some nutrient removal
- Roof water tanks which will collect sediment and nutrients from roofs.
- Grassed and landscaped areas of lots acting as a buffer strip which will provide treatment for sediments and nutrients attached to sediment) prior to runoff entering the street drainage system

4. Maintenance and Ownership

Maintenance of the stormwater system and its devices is critical for the satisfactory performance of the system. A number of guidelines provide information on the maintenance requirements of stormwater devices to be incorporated in the development. These documents including ‘LMCC’s SQID’

guidelines for detention basins and 'WSUD: Basic Procedures for 'Source Control' of Stormwater' (Argue, 2004).

Specifically regarding the detention basin and street drainage system, maintenance will include:

- Regular inspection of basin and outlet structures, particularly after large rain events
- The removal of any captured material evident in the basin on inspection, to reduce the likelihood of this material being transported downstream by future storm events and/or affecting the basin/outlet efficiency.

Based on the maintenance required for a CDS Unit procedures which will need to be carried out on the Gross Pollutant Device will include:

- Regular inspection of the device and cleaning via a vacuum truck. It is recommended that the device be clean approximately 3-4 times a year depending upon rainfall. A concrete pad will be located immediately adjacent to the Gross Pollutant trap such that a maintenance truck can be completely off the road pavement during times of cleaning.

As shown on the Engineering drawings in Appendix A, Detention Basin B has been designed with a batter leading to its invert level from Road 2. It is proposed that this batter will allow access for maintenance purposes during dry times.

5. Stormwater Drainage Index (SDI)

We note that Council requires the proposed subdivision to have an SDI of ≤ 0.1 . The site Discharge Index (SDI) is defined as 'the ratio of the impermeable area that drains directly to a drainage system to the total site area'.

Impermeable surfaces to be constructed on site as part of the subdivision include the road and footpath which approximately total 5742sq.m, or approximately 0.08 of the total site area (site area approximately 64,212sq.m).

Therefore LMCC requirements for the development have been met in regards to SDI.

6. Preliminary Road Grading

In accordance with discussions with Greg Field of LMCC's Engineering Department the new roads within the subdivision have a carriageway width of 6m and a minimum road reserve width of 14m. A 1.2m concrete footpath has been provided on all roads with services proposed to be located within a common services trench as outlined in LMCC's DCP No.1 and 2.

Preliminary grading, long-sections and typical cross sections of these roads have been shown in Appendix D. Longitudinal grades range from 0.5% to 10%. All roads will contain a roll kerb and gutter on either side of the carriageway.

Preliminary grading of roads show minimal cut and fill batters on all roads.

7. Conclusion and Recommendations

The Concept Stormwater Management Plan outlined and illustrated in Appendix D will mitigate stormwater quantity and quality impacts expected from the proposed development of the site. The protection of downstream waters including the Lake is the major driver behind the implementation of Stormwater Management Devices. Impacts of stormwater runoff can be mitigated in the development of the site by incorporating the following:

- Provision of a formalised road and stormwater network through the site which will generally control and direct runoff to the low point on site.
- An above ground detention basin at the bottom of the site.
- A Gross Pollutant Trap (CDS unit or similar) provided prior to the detention basin to treat runoff for pollutants.

Appendix A – Statistical Rational Method Calculations

Time of Concentration – Sub-catchment 1

Pilgrim & McDermott

$$\begin{aligned}t_c &= 60 \times 0.76 \times 0.0525^{0.38} \\ &= 14.9 \text{ mins}\end{aligned}$$

Flow Calculation (Statistical Rational Method Calculation for the 100yr event)

$$t_c = 15 \text{ minutes}$$

$${}^{15\text{min}} I_{100\text{yr}} = 152.6 \text{ mm/hr}$$

$$C_{10} = 0.43$$

$$FF_{100} = 1.2$$

$$\text{Area} = 54,168 \text{ sq.m}$$

$$\begin{aligned}Q_{100\text{yr}, 15\text{min}} &= 0.000278 (C_y FF_y A) I \\ &= 0.000278 \times 0.43 \times 1.2 \times 54,168 \times 152.6 \\ &= 1,185 \text{ l/s}\end{aligned}$$

Peak 1% AEP flow derived from DRAINS for Sub-catchment 1 = 1,190 l/s

Time of Concentration – Sub-catchment 2

Pilgrim & McDermott

$$\begin{aligned}t_c &= 60 \times 0.76 \times 0.0086^{0.38} \\ &= 7.48 \text{ mins}\end{aligned}$$

Flow Calculation (Statistical Rational Method Calculation for the 100yr event)

$$t_c = 6 \text{ minutes}$$

$${}^{6\text{min}} I_{100\text{yr}} = 221.5 \text{ mm/hr}$$

$$C_{10} = 0.43$$

$$FF_{100} = 1.2$$

$$\text{Area} = 8,565 \text{ sq.m}$$

$$\begin{aligned}Q_{100\text{yr}, 6\text{min}} &= 0.000278 (C_y FF_y A) I \\ &= 0.000278 \times 0.43 \times 1.2 \times 8,565 \times 221.5 \\ &= 272 \text{ l/s}\end{aligned}$$

Peak 1% AEP flow derived from DRAINS for Sub-catchment 2 = 269 l/s

Appendix B – DRAINS input files

PIT/NODE DETAILS														
Name	Type	Family	Size	Version 9	Ponding Volume (cu.m)	Pressure Change (kPa)	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down id	Part Full Shock Loss
CAT 1	Node							24	0	0				
N2	Node								288	-251			1	
CAT 2	Node							24	372	-154			3	
N4	Node								429	-259			4	
N6	Node								421	-34			5	
N8	Node								445	-48			15	
N10	Node								756	-251			29	
N13	Node								908	-256			30	
N14	Node								865	-103			33	
N15	Node								849	-61			34	
DETENTION BASIN DETAILS														
Name	Elev	Volume	Inlet Val (cu.m)	Outlet Type	K	Dia(m)	Centre RL	Pit Family	Pit Type	x	y	HED No	Crest RL	Crest Leng'id
Basin2	0	0	0	Culvert										
	1	376												
	2	1130												
	2.25	1372												
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 (%)
Cat1	CAT 1	5.42	0	100	0	0	0	0	-1	377	-1	-1	-1	4
Cat2	CAT 2	0.86	0	100	0	0	0	0	-1	140	-1	-1	-1	4
CAT 1 POIN3		5.41	45	50	5	0	0	0	377	377	377	4	4	4
CAT 2 POIN3		0.96	45	50	5	0	0	0	120	140	130	4	4	4
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
Pipe1	Basin2	N14	50	0	-0.5	1	uPVC, not under roads	300	303	0.03	New/rired	2	Basin2	0
DETAILS of SERVICES CROSSING PIPES														
Pipe	Chg (m)	Bottom Elev (m)	Height of Service (m)	Chg Elev (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	Sale Depth (m)	SaleDepth (m)	Minor Storms (sq m/sec)	Safe Divv Slope (%)	Bed Slope (%)	D/S Area Contributing	id
J1	CAT 1	N2	0.1				Dummy used to model fio	0.2	0.05	0.6	1	0	7	
J2	N2	N4	0.1				Pathway 4 m wide	0.3	0.15	0.6	1	0	14	
J3	CAT 2	N4	0.1				Dummy used to model fio	0.2	0.05	0.6	1	0	13	
J4	N4	N6	0.1				Dummy used to model fio	0.2	0.05	0.6	1	0	22	
J5	N10	Basin2	0.1				Dummy used to model fio	0.2	0.05	0.6	1	0	35	
J6	N13	N14	0.1				Dummy used to model fio	0.2	0.05	0.8	1	0	38	
J6	Basin2	N14	0.1				Glassed Swale	0.5	0.4	1	1	0	36	
J7	N14	N15	0.1				Dummy used to model fio	0.2	0.05	0.6	1	0	37	

Appendix C – DRAINS results files

DRAINS results prepared 04 April, 2008 from Version 2008.04									
PIT / NODE DETAILS									
Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint		
N14	-0.2		0.832						
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)	Due to Storm		
Cat1	1.194	0	1.194	0	36.89	0	AR&R 100 year, 1 hour storm, average 73 mm/h, Zone 1		
Cat2	0.269	0	0.269	0	16.86	0	AR&R 100 year, 25 minutes storm, average 117 mm/h, Zone 1		
CAT 1 PO:	1.685	1.224	0.593	9.12	30.54	9.12	AR&R 100 year, 25 minutes storm, average 117 mm/h, Zone 1		
CAT 2 PO:	0.355	0.22	0.151	4.59	16.86	4.81	AR&R 100 year, 25 minutes storm, average 117 mm/h, Zone 1		
Outflow Volumes for Total Catchment (3.13 impervious + 9.41 pervious = 12.6 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	2415.88	1510.21 (62.5%)	514.92 (85.3%)	995.28 (64.9%)					
AR&R 100	4674.87	3434.32 (73.5%)	1022.79 (87.6%)	2411.53 (68.8%)					
AR&R 100	6118.13	4616.04 (75.4%)	1347.27 (88.2%)	3268.77 (71.2%)					
AR&R 100	8000.63	6103.56 (76.3%)	1770.49 (88.6%)	4333.06 (72.2%)					
AR&R 100	9161.5	7051.84 (77.0%)	2031.48 (88.8%)	5020.36 (73.0%)					
AR&R 100	11106.75	8631.36 (77.7%)	2468.81 (89.0%)	6162.55 (74.0%)					
AR&R 100	12550	9749.79 (77.7%)	2793.28 (89.1%)	6956.51 (73.9%)					
AR&R 100	15285.9	11940.85 (78.1%)	3408.37 (89.3%)	8532.48 (74.4%)					
AR&R 100	18410.85	14307.28 (77.7%)	4110.92 (89.4%)	10196.37 (73.8%)					
AR&R 100	21008.7	16151.56 (76.9%)	4694.98 (89.5%)	11456.59 (72.7%)					
AR&R 100	25300.8	18863.10 (74.6%)	5659.98 (89.6%)	13203.12 (69.6%)					
PIPE DETAILS									
Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm				
Pipe1	0.463	3.2	0.993	-0.197	AR&R 100 year, 1.5 hours storm, average 59 mm/h, Zone 1				
CHANNEL DETAILS									
Name	Max Q (cu.m/s)	Max V (m/s)	Chainage (m)	Max HGL (m)	Due to Storm				
OVERFLOW ROUTE DETAILS									
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm	
J1	1.194	1.194	10.912	0.079	0.07	30.54	0.89	AR&R 100 year, 1 hour storm, average 73 mm/h, Zone 1	
J2	1.194	1.194	1.931	0.208	0.39	4	1.88	AR&R 100 year, 1 hour storm, average 73 mm/h, Zone 1	
J3	0.269	0.269	10.912	0.044	0.03	18.89	0.6	AR&R 100 year, 25 minutes storm, average 117 mm/h, Zone 1	
J4	1.33	1.33	10.912	0.083	0.08	31.07	0.92	AR&R 100 year, 1 hour storm, average 73 mm/h, Zone 1	
J5	1.685	1.685	10.912	0.091	0.09	32.13	1	AR&R 100 year, 25 minutes storm, average 117 mm/h, Zone 1	
J6	0.355	0.355	10.912	0.049	0.03	20.78	0.64	AR&R 100 year, 25 minutes storm, average 117 mm/h, Zone 1	
J6	0.654	0.654	1.945	0.332	0.49	2.66	1.48	AR&R 100 year, 1.5 hours storm, average 59 mm/h, Zone 1	
J7	1.295	1.295	10.912	0.082	0.08	30.95	0.91	AR&R 100 year, 1.5 hours storm, average 59 mm/h, Zone 1	
DETENTION BASIN DETAILS									
Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level				
Basin2	2.05	1182.5	1.117	0.463	0.654				
CONTINUITY CHECK for AR&R 100 year, 1 hour storm, average 73 mm/h, Zone 1									
Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %					
CAT 1	2757.92	2757.92	0	0					
N2	2757.92	2757.92	0	0					
CAT 2	444.14	444.14	0	0					
N4	3202.05	3202.06	0	0					
N6	3202.06	3202.06	0	0					
N10	3318.61	3318.61	0	0					
N13	531.18	531.18	0	0					
Basin2	3318.61	3247.41	71.26	0					
N14	3778.58	3777.92	0	0					
N15	3777.25	3777.25	0	0					
Run Log for MORRISSETRD 2008.04.03.drm run at 14:01:15 on 4/4/2008									

Appendix D – Concept Stormwater Management and Road Plans

Appendix E – Mannings Calculations

CAPACITY OF OPEN CHANNEL USING MANNINGS EQUATION

Job No. **NL 70295**
 Job Name **Morisset Road, Morisset**

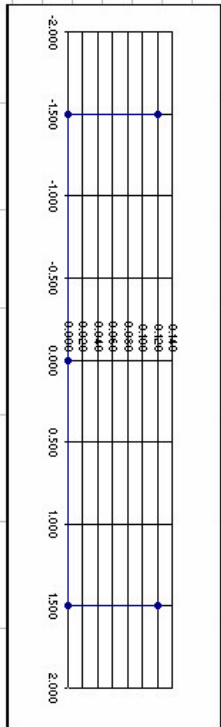
Calcs By **BAC**
 Date **08.04.08**

Channel Name = **Overflow through Easement**

AREA sq.m = 0.36
 WETTED PERIMETER m = 3.24
 VELOCITY m/s = 2.00
 VELOCITY HEAD m = 0.20
 VxD = 0.24

MANNING'S "n" = 0.020
 GRADE % = 3.0

CAPACITY cum/s = 0.721



CHANNEL PROFILE

	Left offsets (-m)				Centre	Right offsets (+m)			
Offsets	-1.500	-1.500	-1.500	-1.500	0.000	1.500	1.500	1.500	1.500
Depth (-m)	0.120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.120

Note: User to enter information only in cells coloured yellow.