

PLANS AND DOCUMENTS
referred to in the ULDA
APPROVAL dated 9/ 3 /11

The Reserve, Flagstone

Revised Stormwater Management Plan- Stormwater Quality (Response to ULDA Information Request)

Project Number: 721711/006/R2

The Reserve, Flagstone

Revised Stormwater Management Plan – Water Quality (Response to ULDA Information Request)



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Document Control: The Reserve, Flagstone – Revised Stormwater Management Plan

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EXECUTIVE SUMMARY

This revised Stormwater Management Plan – Water Quality (SWMP) has been prepared by Cardno (Water Resources and Coastal), specialist hydrologic and hydraulic consultants, for the proposed residential development of 'The Reserve' at Flagstone, New Beith in Logan City. This report has been completed for MTAA Superannuation Fund Pty Ltd to provide a response to Urban Land Development Authority's (ULDA's) information request dated 14th December 2010 (ULDA Ref No: DEV2010/085) for each of the items relating to stormwater quality management. A separate report, *Revised Stormwater Management Plan – Hydraulic Analysis*, has also been prepared by Cardno to address the hydraulic issues raised in ULDA's information request.

The overall Flagstone development site has an approximate total area of 20 square kilometres, with 'The Reserve' (previously known as Stages 14A and 14B) covering approximately 12.8 hectares of this. 'The Reserve' is bound by Stage 12 of the Flagstone development to the south, by Stage 13 and Sandy Creek to the west and north, and by an unnamed tributary of Sandy Creek to the east.

Cardno has developed a stormwater quality model (MUSIC) to determine the treatment sizes for the proposed development to meet with current load reduction requirements.

A Frequent Flow Management assessment has also been undertaken to ensure the frequency of hydraulic disturbance to in-stream ecosystems in developed catchments is similar to fully pervious pre-developed catchment condition.

1 INTRODUCTION

This revised Stormwater Management Plan – Water Quality (SWMP) has been prepared by Cardno (Water Resources and Coastal), specialist hydrologic, hydraulic and water quality consultants, for the proposed residential development of 'The Reserve' at Flagstone, New Beith. The Real Property description of the site is Lot 900, SP216471, in the Logan City Council (LCC) Local Authority area. The site location and extents are shown on Figure 1.

The developer has previously facilitated the preparation of a SWMP for 'The Reserve' of the Flagstone development (Cardno report 7214/63-02 dated 30th April 2008). The original SWMP commented on the peak flow rates corresponding to different design storms events across 'The Reserve' site and gave measures to be implemented to ensure that the runoff discharged from the site would not adversely impact on existing peak flow rates and flooding conditions of adjacent properties and receiving water bodies. The original report also commented on the water quality side of the stormwater runoff from the developed site and outlined the stormwater quality treatment measures to be established with 'The Reserve' to ensure the downstream environment would not be adversely impacted.

The original SWMP has been updated to reflect the revised development layout and increased residential densities. The proposed site and drainage layout are shown on Cardno drawing number 7217/11/04-Figure No. 007. A copy of this plan is included in the reference drawing section of this report.

This revised SWMP follows on from the original SWMP and has been prepared to provide a response to ULDA's information request dated 14th December 2010 (ULDA Ref No: DEV2010/085) for each of the items relating to stormwater quality. This report will be submitted in conjunction with a separate report, *Revised Stormwater Management Plan – Hydraulic Analysis* which addresses the hydraulic issues raised in ULDA's information request.

2 THE EXISTING SITE AND PROPOSED DEVELOPMENT

2.1 Existing Site Description

The subject site, as shown in Figure 1, is approximately 12.8ha in area and is located at 34 Creekside Crescent. The site is bound by Stage 12 of the Flagstone development to the south, by Stage 13 and Sandy Creek to the west and north, and by an unnamed tributary of Sandy Creek to the east.

The topography of the site is defined by a ridge running diagonally through the site in a north-easterly direction. This crest results in two main flow paths that affect flooding on the site. The northern catchment drains in a north-easterly direction and discharges directly to the Sandy Creek. The southern catchment drains in a south-easterly direction discharging further downstream into the Sandy Creek. Some parts of the site drain via sheet flow directly to the Sandy Creek. The site elevations range from approximately 45m AHD at the south-western corner to around 32m AHD where the site meets Sandy Creek. The site grades towards Sandy Creek and the tributary at an approximate average slope of 3-5%.

The current site is generally cleared, with scattered existing trees. The surface remains well grassed.

2.2 The Proposed Development

The proposed 'The Reserve' of the Flagstone development is approximately 12.8ha in size and comprises construction of 126 residential allotments ranging in size from approximately 230m² and also includes a central park space. Details of 'The Reserve' site layout are shown on Cardno drawing number 7217/11/04-Figure No. 007.

3 DATA

The water quality assessment within this report has been based on:

- Detailed site survey data provided by MTAA Superannuation Fund;
- Proposed development layout provided by MTAA Superannuation Fund;
- Land use maps from Logan City Council (LCC's) online database;
- Aerial imagery from Google Earth and Near Map;
- 1:25,000 scale topographic maps, supplied by SUNMAP;
- Rainfall and evaporation data supplied by the Bureau of Meteorology.

4 WATER QUALITY ASSESSMENT

4.1 Methodology

Cardno has carried out detailed pollutant export analysis using MUSIC Version 3.01 to assess the possible pollutant loads from the proposed development. The pollutant impact analysis has been carried out in accordance with the latest South East Queensland pollutant guidelines and data, detailed in:

- CRC for Catchment Hydrology, 2005, '*Model for Urban Stormwater Improvement Conceptualisation Version 3.01 User Manual*';
- Healthy Waterways, 2010, '*MUSIC Modelling Guidelines- Version 1.0*';
- FAWB, 2009, '*Stormwater Biofiltration Systems – Adoption Guidelines*';
- BCC, 2003, '*Guidelines for Pollutant Export Modelling in Brisbane Version 7 – Draft*';
- Healthy Waterways, 2006, '*Water Sensitive Urban Design Technical Design Guidelines for South East Queensland*'; and
- LCC, 2004, '*Logan Planning Scheme*'.

Cardno has considered the following modelled catchment conditions:

- Post-Development Case – Post-development catchment conditions without treatment; and
- Mitigated Case – Post-development catchment conditions with treatment.

4.2 Model Assumptions

Table 4.1 lists the catchment areas and land uses assumed in the MUSIC assessment as shown on Diagram 1. The catchments and land uses are also presented on Figure 3.

Diagram 1 – MUSIC Model Schematic

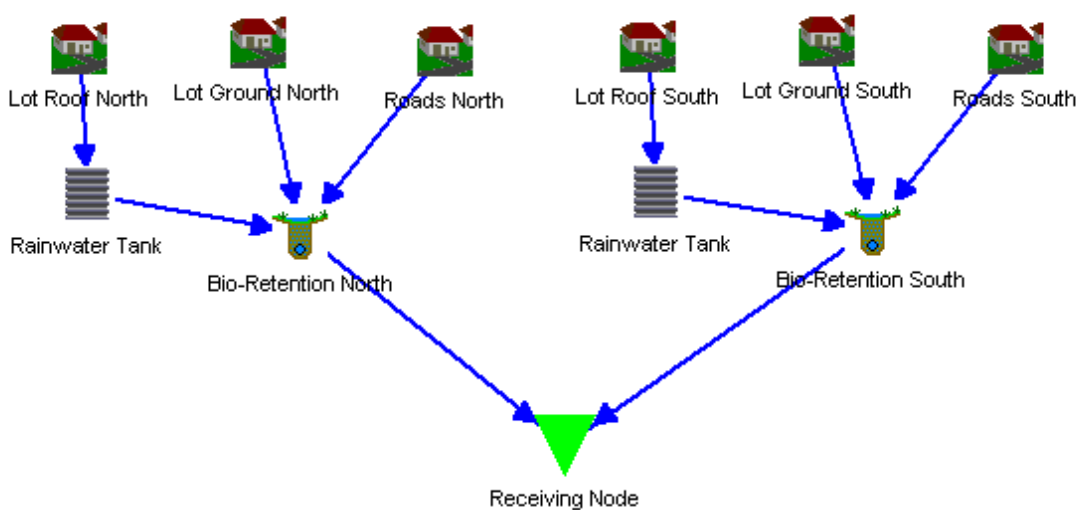


Table 4.1 MUSIC Model Post-Development Adopted Land Uses

Catchment Label	Land Use Type	Fraction Impervious	Catchment Area (ha)	Total Area (ha)
Lot Roof North	Urban Roof	100%	1.058	10.386
Lot Ground North	Urban Residential	20%	1.587	
Roads North	Urban Road	80%	1.412	
Lot Roof South	Urban Roof	100%	1.781	
Lot Ground South	Urban Residential	20%	2.672	
Roads South	Urban Road	80%	1.876	

Ten years of continuous rainfall data for New Beith (Station Number 40312) was obtained from the Bureau of Meteorology for the period 01/01/1980 to 31/12/1989. This period included an average rainfall over the 10 years of 855mm.

The potential evaporation details were obtained from the Bureau of Meteorology using the co-ordinates of the New Beith Station.

The stormwater quality improvement devices assessed in the MUSIC model include a combination of the following at source treatments as shown on Figure 2.

- Rainwater Tanks; and
- End-of-line Bio-retention Systems.

The following assumptions were made in the modelling:

- A 6 minute time step was adopted to ensure accurate assessment of the proposed treatment devices.
- The pollutant generation parameters are adopted from Logan City Council's (LCC) '*Guidelines for Pollutant Export Modelling in Brisbane Version 7 – Draft*' (2003) and Gold Coast City Council's (GCCC's) '*MUSIC Modelling Guidelines*' (2006), with a break down into macro scale parameters. (i.e. roof water, roads and ground)
- Where catchments included multiple lots, catchment areas and treatment device areas were combined into a single node area to reduce run times and memory space.
- No flow routing was assumed, which provides a conservative estimate of treatment device efficiency.
- The surface area of the end-of-line bio-retention systems has been optimised to achieve the load based objectives for South East Queensland (80%, 60% and 45% for suspended solids, total phosphorus and total nitrogen respectively). Other details used include filter media depth of 600mm (excluding the 100mm transition and 200mm drainage layers), extended detention depth of 300mm and hydraulic conductivity of 180mm/hr.

- Default MUSIC pollutant removal efficiencies were adopted for all other treatment devices.

4.3 Results

4.3.1 Water Quality Results

The annual average pollutant loads discharged from the site catchments and overall site are shown in Table 4.2.

Table 4.2 10 Year Predicted Annual Pollutant Loads

Pollutant	Annual Load (kg/yr)		Reduction – Mitigated to Unmitigated	Required Reduction	Reduction Met?
	Post Development	Mitigated			
Northern Catchment					
TSS	4720	935	-3785	-80	Yes
TP	8.9	2.87	-6	-68	Yes
TN	44.3	24.50	-20	-45	Yes
Southern Catchment					
TSS	6360	1280	-5080	-80	Yes
TP	12	3.93	-8	-67	Yes
TN	64	34.70	-29	-45	Yes
Total from Site					
TSS	11100	2220	-8880	-80	Yes
TP	20.9	6.80	-14	-67	Yes
TN	108.0	59.10	-49	-45	Yes

Table 4.2 shows that the reduction of mitigated loads over the unmitigated post developed loads meets the load based objectives for South East Queensland. (TSS 80% reduction, TP 60% reduction and TN 45% reduction).

Based on the results presented above, the preliminary treatment sizes are detailed below in Table 4.3. The location and relative sizes of the bio-retention basins proposed are shown on Figure 2.

Table 4.3 Treatment Train Preliminary Sizes

Treatment Device	Size
Northern Catchment Rainwater Tanks	Total Volume = 159 kL
Southern Catchment Rainwater Tanks	Surface Area = 246 kL
Northern Catchment Bio-Retention Basin	Surface Area = 255 m ²
Southern Catchment Bio-Retention Basin	Surface Area = 355 m ²

4.3.2 Frequent Flow Management Results

A Frequent Flow Management assessment has been undertaken to address the Frequent Flow Management criteria set out in 'South East Queensland Regional Plan 2009-2031 – Implementation Guideline No. 7' (2009).

Of the total area of the development site (10.386 ha), approximately 60% is impervious; therefore, the first 15mm runoff volume from the impervious portion is to be captured in accordance with the above guideline. This volume is calculated to be approximately 935m³. This storage will be achieved by re-use from the rainwater tanks and filtration through the bio-retention systems. Bio-retention systems will drain in a few hours, and so will therefore be able to treat more than 15mm of runoff per day.

To assess the amount of runoff that passes through the bio-retention systems and whether the frequent flow criterion is satisfied, the methodology presented in the Bligh Tanner and DesignFlow publication 'Stormwater Infrastructure Options to Achieve Multiple Water Cycle Outcomes' (report for Queensland Water Commission, 2009, p34) was adopted:

- Use MUSIC to calculate the percentage of annual runoff produced by the first 15mm of runoff from impervious areas (for the 10 year rainfall record at New Beith); and
- Use MUSIC to calculate the proportion of annual runoff that is treated by the bio-retention system.

The results of the frequent flow volume MUSIC analysis show that:

- | | |
|--|-----------------------|
| • Average annual runoff from site: | 51559.7m ³ |
| • Average annual runoff produced by first 15 mm of runoff from impervious areas: | 30426.9m ³ |
| • Proportion of annual runoff produced by first 15 mm of runoff from impervious areas: | 50.01% |
| • Proportion of runoff treated: | 65.89% |

As the percentage of annual runoff that passes through the bio-retention system is greater than the percentage of annual runoff that the first 15mm of runoff, it can be concluded that the frequent flow objective has been met.

5 CONCLUSION

This revised SWMP follows on from the original SWMP dated 30th April 2008 prepared by Cardno and has been prepared to provide a response to ULDA's information request dated 14th December 2010 (ULDA Ref No: DEV2010/085) for each of the items relating to stormwater quality.

The original SWMP has been updated to determine what impacts the change in allotment will have on the downstream environment. The review of the previous SWMP included MUSIC modelling of the amended development scenario which showed that the increase in lot numbers will increase the area required for bioretention requirements to the extents generally shown on Figure 2.

With the proposed treatment system both the water quality requirements and the frequent flow management will be achieved.

6 REFERENCES

Logan City Council, March 2006, 'Logan Planning Scheme'.

Australian Institute of Engineers, 1998, 'Australian Rainfall & Runoff'

Department of Natural Resources & Water, 2008 'Queensland Urban Drainage Manual'

IECA, 2008, 'Best Practise Erosion and Sediment Control'

CRC for Catchment Hydrology, 2005, 'Model for Urban Stormwater Improvement Conceptualisation Version 3.01 User Manual'

FAWB, 2009, 'Guidelines for Soil Filter Media in Bio-Filtration Systems (Version 3.01)'

Gold Coast City Council, 2006, 'MUSIC Modelling Guidelines'

Brisbane City Council, 2003, 'Guidelines for Pollutant Export Modelling in Brisbane Version 7-Draft'

Healthy Waterways, 2010, 'MUSIC Modelling Guidelines Version 1.0'

Healthy Waterways, 2006, 'Water Sensitive Urban Design Technical Design Guidelines for South East Queensland'

Healthy Waterways, 2009, 'Water Sensitive Urban Design Deemed to Comply Solutions for South East Queensland'

Healthy Waterways, 2009, 'Construction and Establishment Guidelines: Swales, Bio-Retention Systems and Wetlands'

7 QUALIFICATIONS

This report has been prepared by Cardno (Water Resources and Coastal) specifically for MTAA Superannuation Fund Property Pty Ltd and specifically to provide advice on Stormwater Quality Management Planning for 'The Reserve' of Flagstone development.

Our analysis and overall approach has been specifically catered for the particular requirements of MTAA Superannuation Fund Property Pty Ltd, and may not be applicable beyond this scope. For this reason any other third parties are not authorised to utilise this report without further input and advice from Cardno.

Cardno has relied on the following information provided by others:

- Detailed site survey data provided by MTAA Superannuation Fund;
- Proposed development layout provided by MTAA Superannuation Fund;
- Land use maps from Logan City Council (LCC's) online database;
- Aerial imagery from Google Earth and Near Map;
- 1:25,000 scale topographic maps, supplied by SUNMAP;
- Rainfall and evaporation data supplied by the Bureau of Meteorology.

The accuracy of the report is dependent upon the accuracy of this information.

While Cardno's report accurately assesses catchment water quality performance, using industry standard theoretical modelling techniques, actual future observed catchment water quality may vary from predicted.

Our assessments are based on standard engineering practices.

Cardno acknowledge that Council and ULDA may rely on this qualification and associated documentation in its assessment of the proposal.

Figures

Figure 1 Site Location

Figure 2 Conceptual Stormwater Management Plan

Figure 3 Post-Development MUSIC Model Catchment Layout



Scale 1:10,000(A4)

FIGURE 1 SITE LOCATION

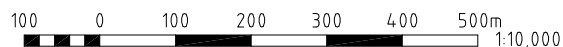
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Rev: 2 Date: Jan 2011

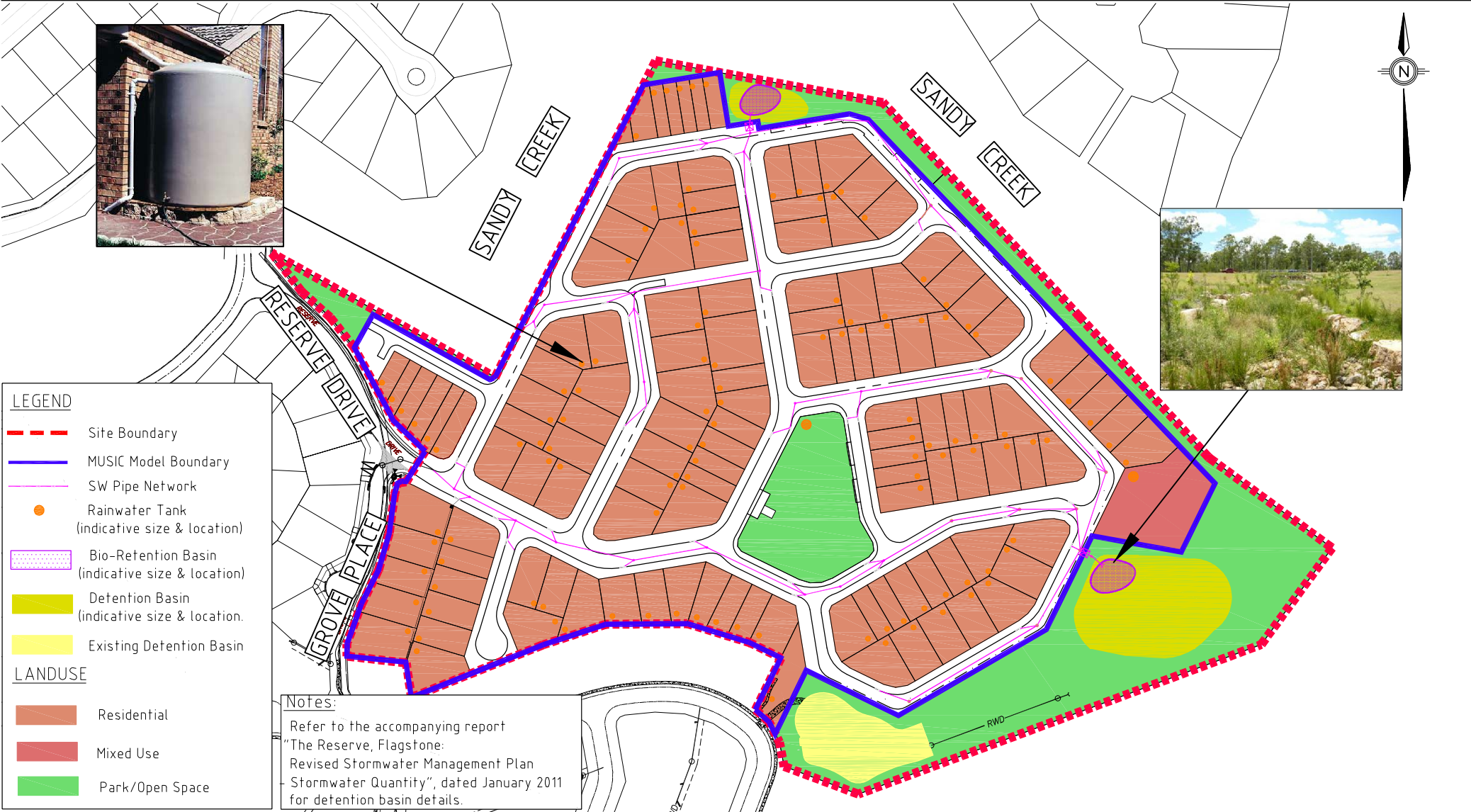
MTAA Superannuation Fund Property Pty Ltd

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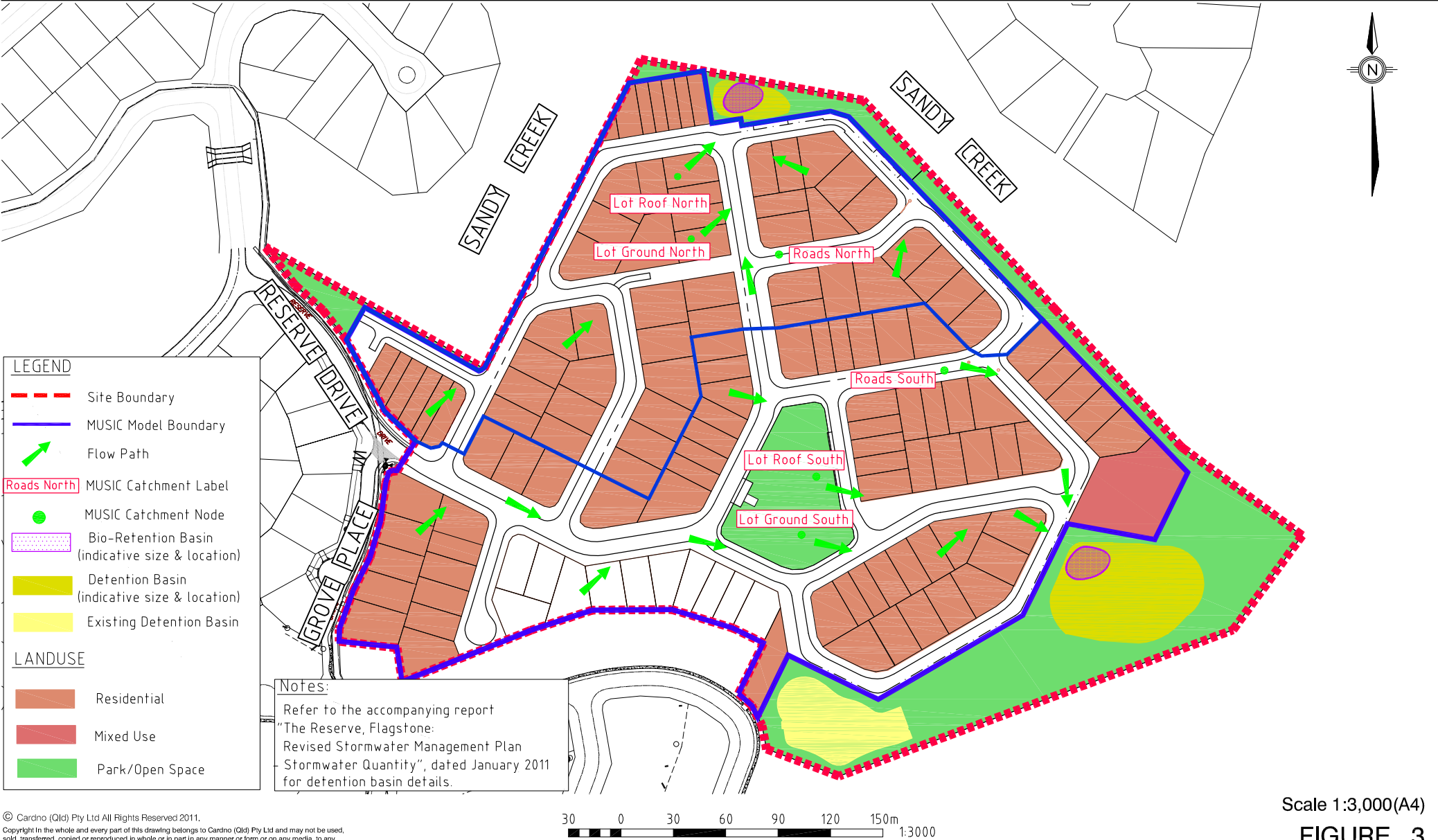
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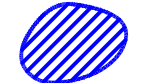
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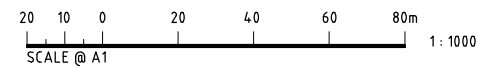
Project No.: 721711/006

PRINT DATE: 01 February, 2011 - 4:18pm

REFERENCE DRAWING

LEGEND:

-  PROPOSED STORMWATER DRAINAGE
-  EXISTING STORMWATER DRAINAGE
-  STORMWATER TREATMENT DEVICE
-  BIO-RETENTION BASIN
-  OFF-LINE DETENTION BASIN OPTION



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MTAA SUPERANNUATION FUND PROPERTY PTY LTD

FLAGSTONE ESTATE - THE RESERVE

ULDA APPLICATION

SCALE :- 1:1000

DATE :- OCTOBER, 2010

JOB No.

7217/11/04

A1

Rev. A

FIGURE No. 007

**STORMWATER DRAINAGE
LAYOUT PLAN**