



Premise

CAERLEON MUDGE PTY LTD

CAERLEON ESTATE MUDGE

STORMWATER MANAGEMENT REPORT

Report No: 319171/R04

Rev: 04

Date: 15 March 2022



TABLE OF CONTENTS

1	INTRODUCTION	4
1.1	Objective of Report.....	4
1.2	Scope of Work	4
2	SITE CHARACTERISTICS.....	5
2.1	Site location	5
3	DESIGN CRITERIA.....	8
3.1	Assessment of Stormwater Runoff	8
3.2	Detention Basins	12
3.3	Drainage Channel.....	14
3.4	Basin 3 Concept Design and Interim Operation.....	16
3.5	Assessment of Water Quality.....	17
4	DATA.....	18
5	RESULTS AND CONCLUSION.....	18
6	REFERENCES.....	19

FIGURES

FIGURE 1 – BASIN 3 – CAERLEON ESTATE (SOURCE: PREMISE STAGE 12 CONCEPT, 2021).....	6
FIGURE 2 - STAGE 14 CAERLEON.....	7
FIGURE 3 - STAGE 14 AND BASINS 4, 5 AND 6 LOCATION (SOURCE: PREMISE STAGE 14 DRAFT 2022).....	7
FIGURE 4 – PRE DEVELOPMENT CATCHMENTS (SOURCE: NORTHROP SMR – FIG 1A – PRE DEV FLOW)	9
FIGURE 5 - PRE-DEVELOPED DRAINS MODEL (SOURCE: NORTHROP SMR FIGURE A3.).....	9
FIGURE 6 - POST DEVELOPMENT CATCHMENTS.....	11
FIGURE 7 - CHANNEL DESIGN FOR DRAINS MODELLING.....	14
FIGURE 8 - POST-DEVELOPED DRAINS MODEL (SOURCE: NORTHROP SMR FIGURE A3.).....	15
FIGURE 9 - MUSIC RESULTS SCREEN SHOT (SOURCE: NORTHROP SMR FIGURE A3.).....	17

TABLES

TABLE 1 - REMOVAL TARGETS (SOURCE: COUNCIL'S DRAINAGE DESIGN MANUAL).....	8
TABLE 2 - BASINS 3, 4, 5 AND 6 FRACTION IMPERVIOUS.....	12
TABLE 3 – BASIN DETAILS.....	12
TABLE 4 – MAIN CHANNEL 1% AEP RESULTS.....	15
TABLE 5 – BASIN DETAILS.....	18

APPENDICES

APPENDIX A POST DEVELOPMENT CATCHMENT PLANNING.....	
---	--

DOCUMENT AUTHORISATION					
Rev	Rev. Date	Report Details	Prepared By	Reviewed By	Authorized By
			Signature	Signature	Signature
01	08/11/21	Stormwater Management Report - DRAFT			
02	24/11/21	Stormwater Management Report V02 – Updated Basin 3			
03	09/02/2022	Stormwater Management Report V03 – Updated %impervious			
04	15/03/2022	Stormwater Management Report V04 – Updated Stage 14 Catchment and Basins			

EXECUTIVE SUMMARY

This Stormwater Management Report (SMR) assesses the Premise Australia Pty Ltd (Premise) redesign of retention Basin 3 and the conceptual design of retention Basins 4, 5 and 6 within the proposed Stage 14 of Caerleon Estate and their corresponding catchments with respect to the Northrop Stormwater Flow Regimes Caerleon Subdivision, 2013 (Northrop SMR).

The Northrop SMR has been previously adopted by Mid-Western Regional Council (Council) as the Caerleon Estate Stormwater Masterplan (Stormwater Masterplan) and hence this report will also encompass updated calculations for Stage 14 and its detention Basins 4, 5 and 6 located in future developments to the south of the Basin 3 catchment

Council have requested the reuse of the Northrop SMR DRAINS and MUSIC analysis files, however due to changes in software and industry guidelines, Premise has used updated modelling to ensure the Stormwater Masterplan meets the design stormwater flow objectives and operating satisfactorily and are fit for purpose.

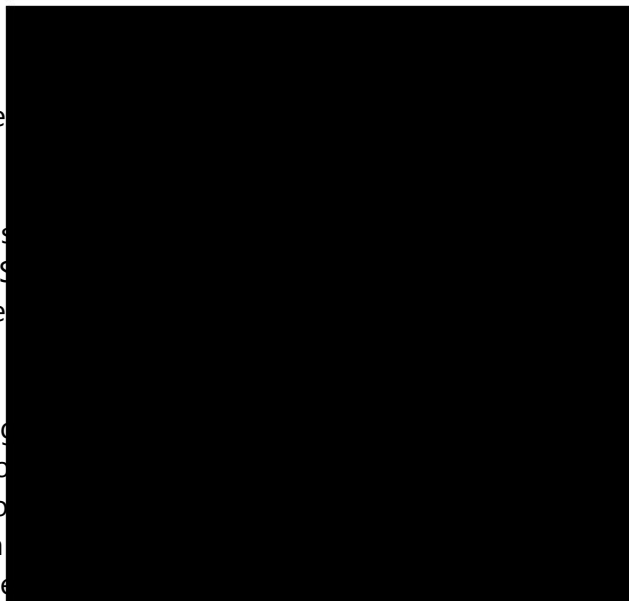
Council have also requested the use of a 50% Fraction Impervious for the Urban Residential catchments rather than the 35% Fraction Impervious previously used in the Northrop SMR.

This SMR provides assessment of the drainage channel characteristics conveying stormwater runoff from the rural catchments external to the site and through the subdivision and discharging to the existing culverts beneath the Gwabegar to Wallerawang rail line.

For the 1% AEP design event, the following discharges at the railway culvert have been assessed:

Pre Development peak discharge: 15.5m³/s

Post Development peak discharge:



Therefore, the design criteria for limiting post development peak discharge levels has been achieved.

The assessment of the operation of retention Basin 3 and its connection to Basin 3 on an interim basis with minor reworks including the 1% AEP design event.

The submission of this SMR to Mid-Western Regional Council that the stormwater drainage system to be developed for the remaining stages of the subdivision draining to the railway culvert of Stage 14 of Caerleon Estate and its retention basins will perform in accordance with accepted design criteria.

1 INTRODUCTION

Premise has been commissioned by Caerleon Mudgee Pty Ltd to prepare:

- A SMR for the concept design of retention Basin 3 located in the south eastern corner of Stage 12, Caerleon Estate;
- An open drainage channel located to the south of Stage 13 and Stage 12; and
- Assessment of the catchment, hydraulic calculations and conceptual design of the retention Basins 4, 5 and 6 in Stage 14 of the subdivision.

The stormwater catchments draining to retention Basin 3 and its design addresses the stormwater treatment requirements of Stages 8 to 13 (excluding Stage 11 that drains via the roadway system through Stage 6 and into Basin 2) ensuring functionality in terms of water quality and quantity controls.

The assessment of stormwater runoff to and the design of retention Basin 1 and Basin 2 is in accordance with the previous designs carried out for the subdivision by others.

Residential lots are required to include rainwater tanks as part of the Basix assessment for dwelling approvals. A 3,000 litre rainwater tank can be provided for household reuse purposes and to aid water quality treatment of roof water systems.

The assessment of the various catchments draining to the retention Basins 3, 4, 5 and 6 has been carried out using DRAINS modelling for stormwater quantity control and MUSIC modelling for quality control.

1.1 Objective of Report

This report details the procedures used and runoff analysis undertaken in developing the integrated approach of utilising the existing urban design based on water sensitive urban design as outlined in the relevant Sections of this Report

This Report is intended to provide Council with assessment and analysis of the stormwater management of Stages 8, 9, 12, 13, all of which have subdivisions lodged with Council and for the Development App

1.2 Scope of Work

The purpose of the analysis was to:

- check Northrop SMR design criteria against
- provide input data for the sizing of retention Basins 3, 4, 5 and 6 to cater for the updated design criteria and catchments;
- determine the size of the retention basins, drainage channel and the internal piped

- drainage network;
- provide DRAINS solutions and files for the Basins 3, 4, 5 and 6; and
 - provide MUSIC solution and file for Basin 3, this can be used as a default design for Basins 4, 5 and 6 as their basin floor area is better than 1.5% of the catchment area (industry standard rule for initially sizing Bio Basins).

The following assessments have taken into consideration the concept civil design of retention Basin 3 which includes Stage 12 and the open drainage channel. Particular emphasis has been placed on keeping to the design criteria of the Northrop SMR and updating the modelling criteria for retention Basins 4, 5 and 6.

2 SITE CHARACTERISTICS

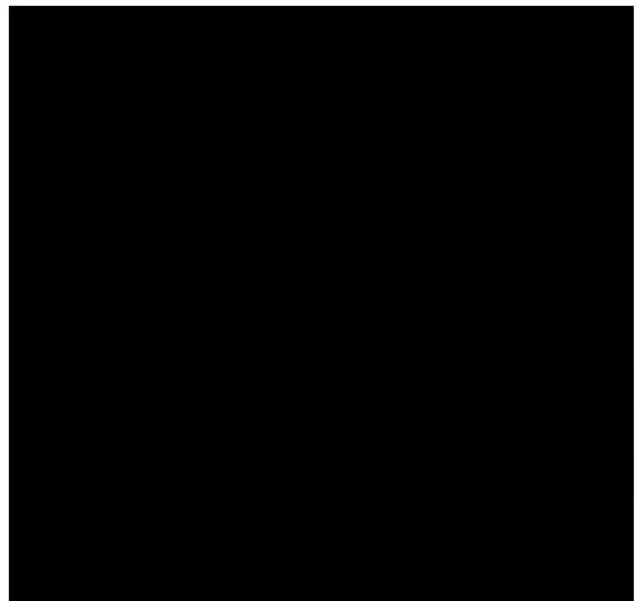
2.1 Site location

Retention Basin 3 is located within Caerleon Estate at the south eastern corner of Stage 12 and is bound to the south and east by the proposed drainage channel.

This basin was originally part of the Northrop SMR Stage 1 study area but its location and characteristics have been modified due to minor changes to the lot layout and an increased catchment area.

Figure 1 indicates the location of detention Basin 3 within the subdivision.

Figures 2 and **3** provides the Stage 14 layout providing context for the road system, residential lots and detention basins and a more detailed layout for the positioning of Basins 4, 5 and 6 respectively.



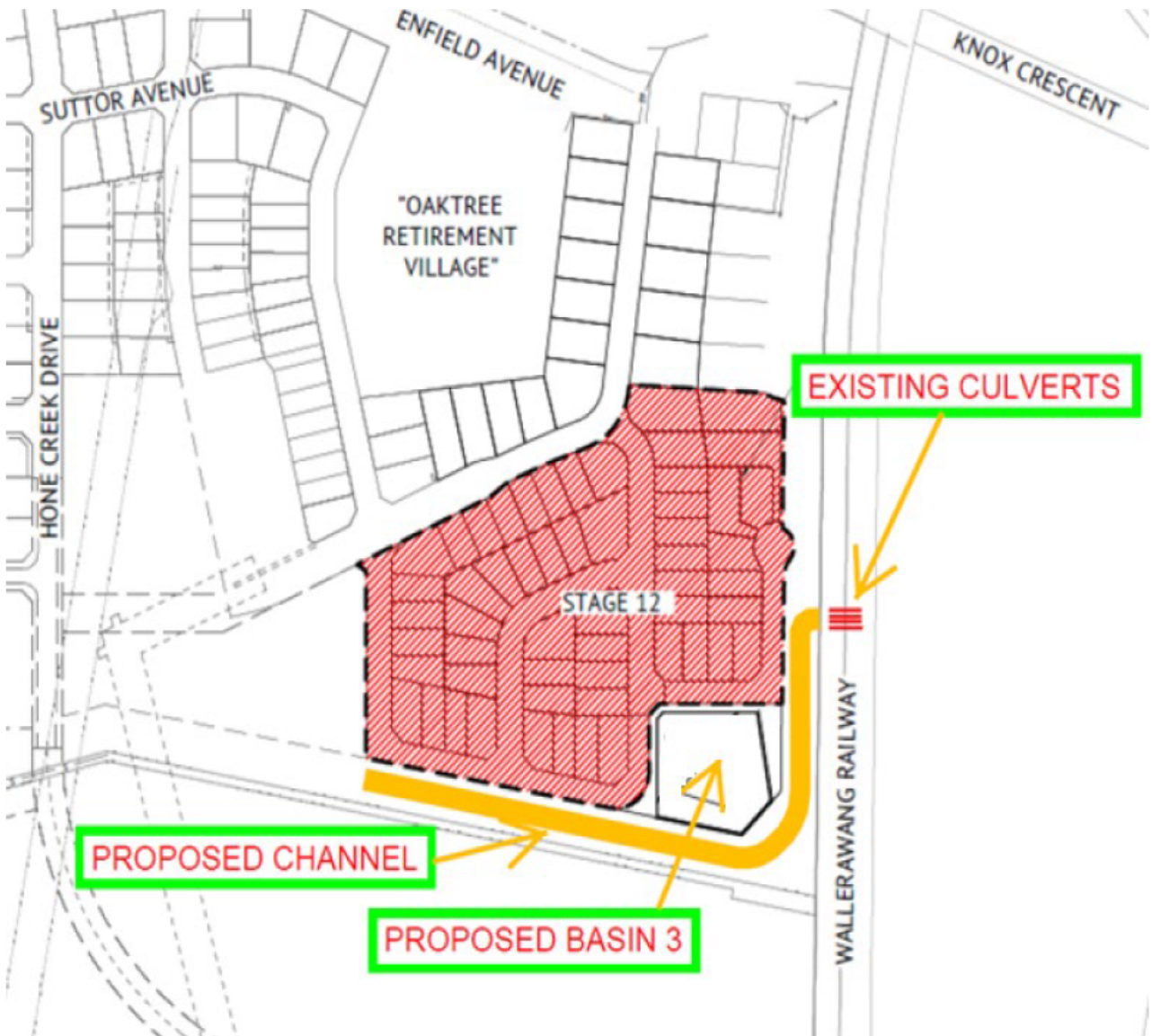
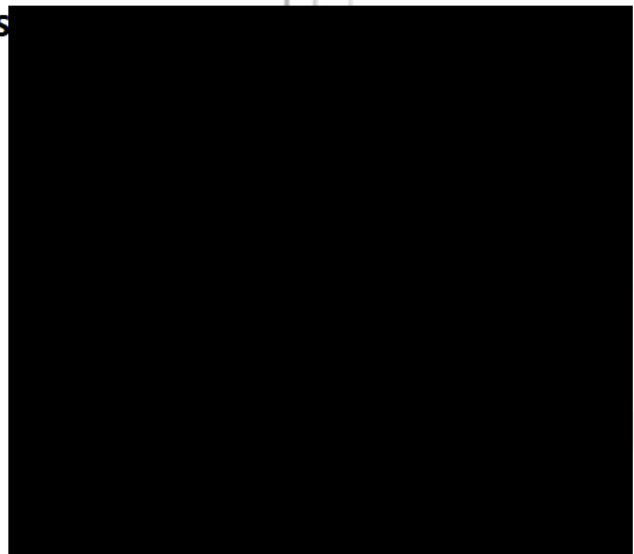


Figure 1 – Basin 3 – Caerleon Estate (S



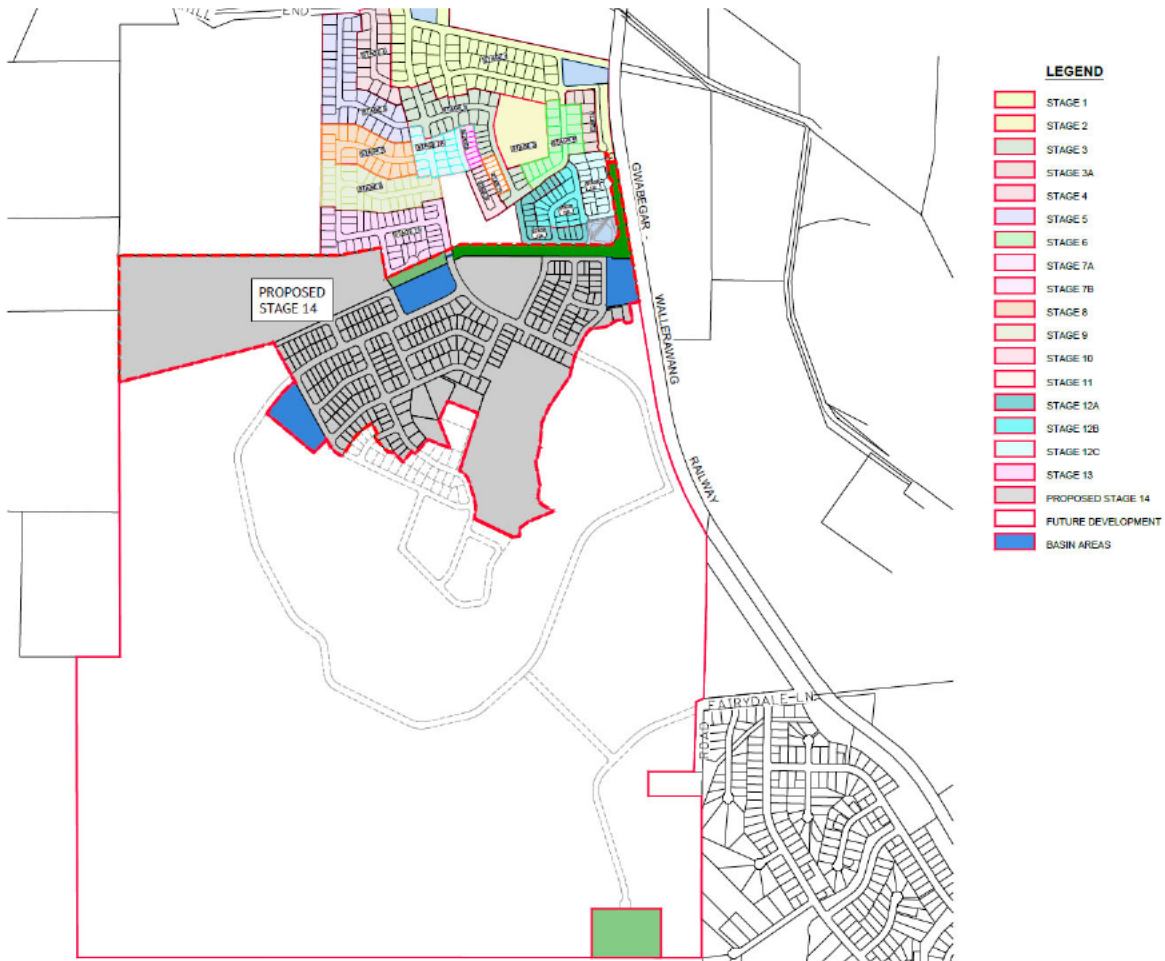


Figure 2 - Stage 14 Caerleon

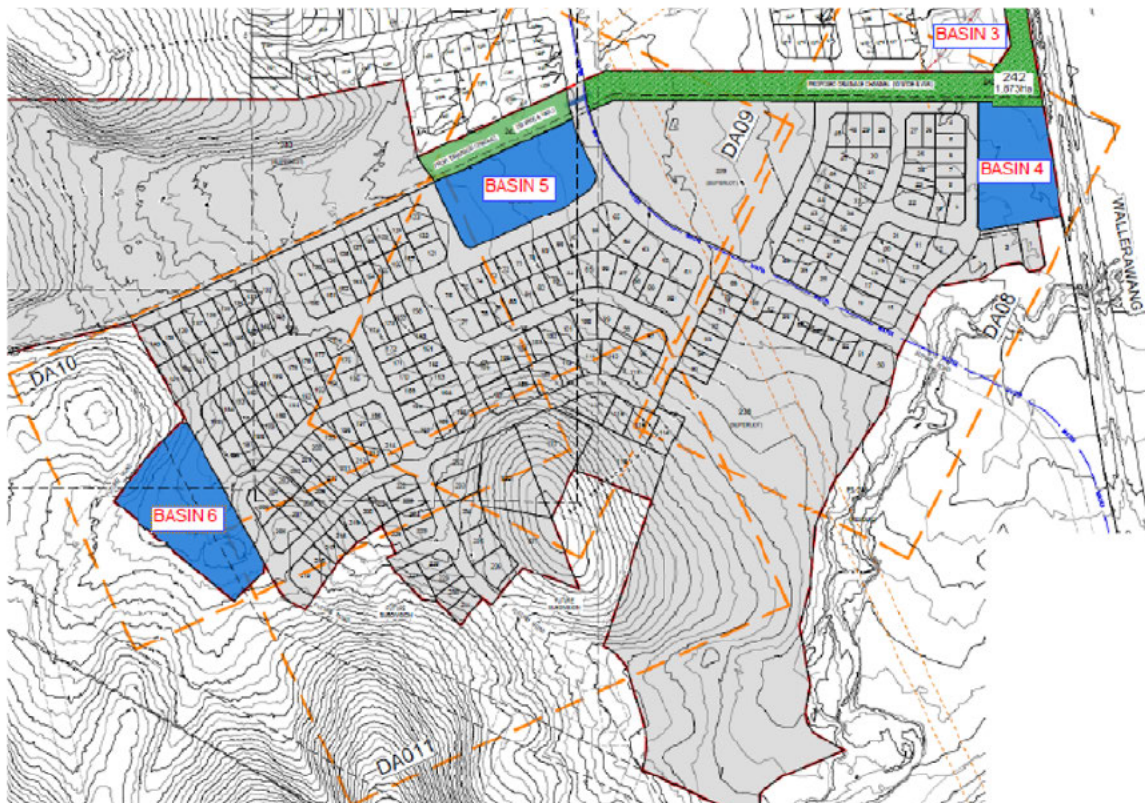


Figure 3 - Stage 14 and Basins 4, 5 and 6 Location (source: Premise Stage 14 Draft 2022)

3 DESIGN CRITERIA

The Northrop SMR design criteria was,

'... to manage stormwater runoff such that it is not increased beyond the existing undeveloped state for the 1 in 100 year ARI storm event.'

The WSUD removal targets are as per Council's DCP 2013, Northrop SMR and shown below:

Table 1 - Removal Targets (Source: Council's DCP, 2013)

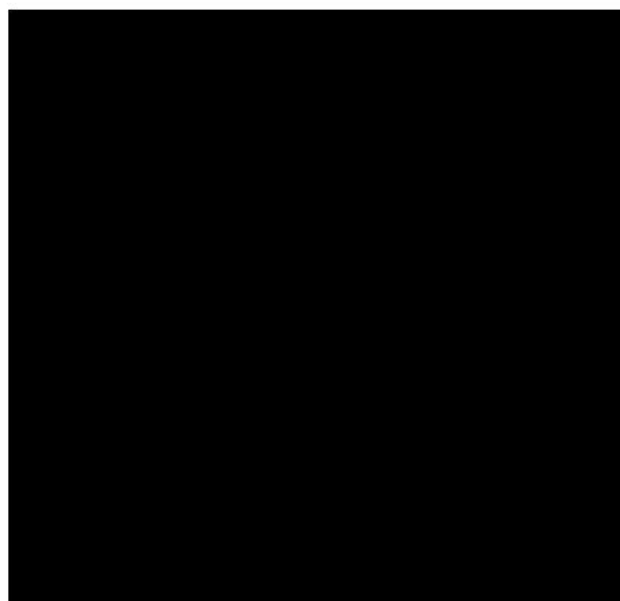
Pollutant	Reductions in mean annual load from unmitigated development (%)
Suspended Solids	85
Total Phosphorus	65
Total Nitrogen	45
Gross Pollutants	90

3.1 Assessment of Stormwater Runoff

Northrop SMR proposed a network of On Site Detention (OSD) basins in the study area to control site stormwater discharge at a flowrate less than the existing undeveloped flowrate for the 1 in 100 year ARI storm event.

The following Sections provides pre and post developed catchments.

The predeveloped catchment and DRAINS screenshot from the Northrop SMR is as shown in **Figure 4** and **5** respectively



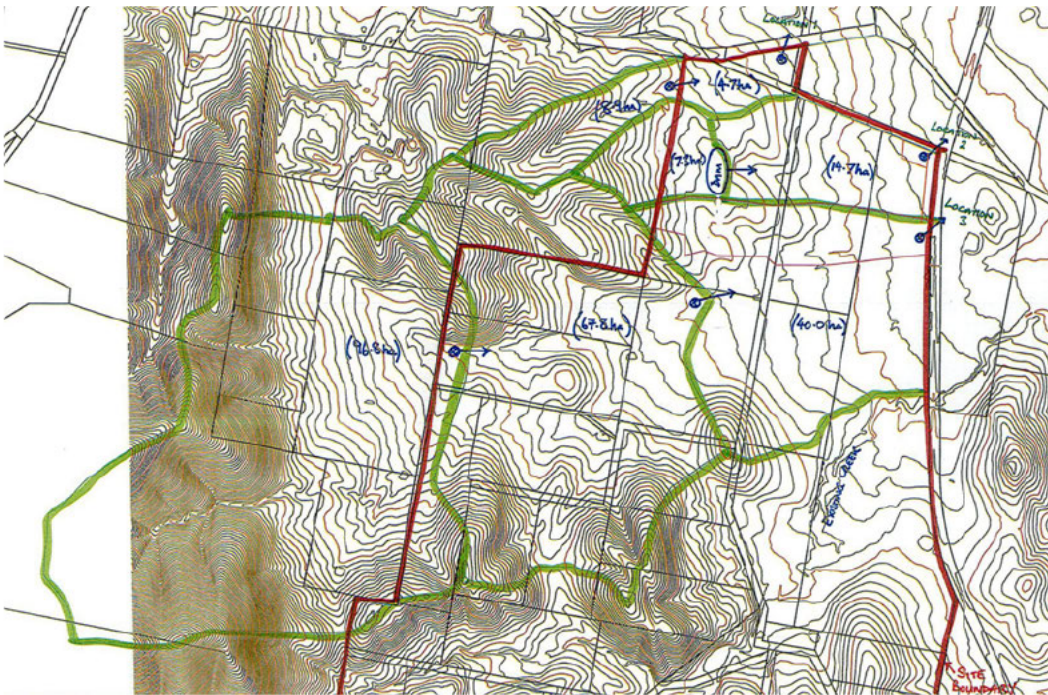


Figure 4 – Pre Development Catchments (Source: Northrop SMR – Fig 1A – Pre Dev Flow)

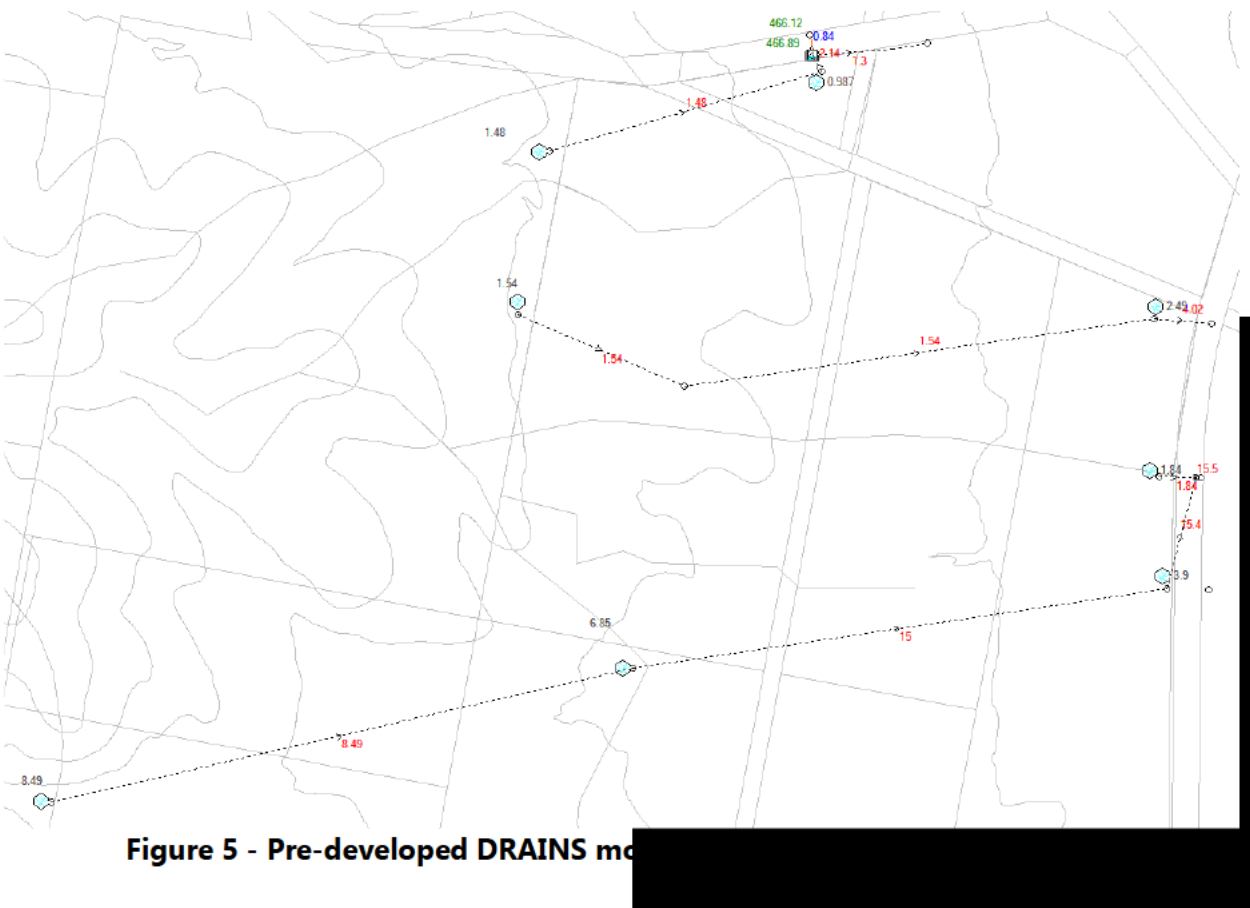


Figure 5 - Pre-developed DRAINS mo

The post developed drainage catchments as assessed in this Premise SMR are shown in **Figure 6**. The catchment plan includes a drainage channel to convey stormwater runoff from the rural catchments located upstream of Caerleon Estate as outlined in the Northrop SMR.

The Premise post development catchment plan is also attached in **Appendix A** of this Report.

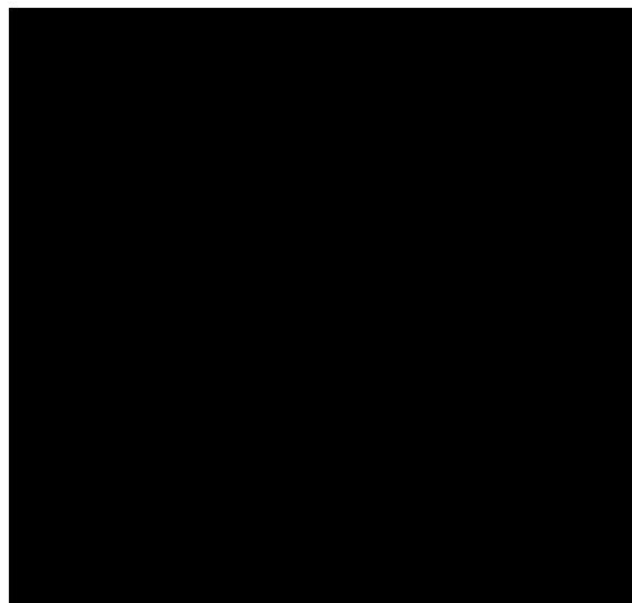
The catchments in **Figure 6** include the corresponding retention basins with the increase in impervious area from 35% (Northrop SMR) to 50% as now required by Council as assessed in this SMR, the following is proposed:

- Basins 1 and 2 have previously been constructed and some upstream catchment to Basin 2 has been diverted to Basin 3 to alleviate the increase in peak flow to Basin 2; and
- proposed Basins 3, 4, 5 and 6 have increased in volume.

It is noted that each catchment will strictly drain to the corresponding basin within that catchment and that the network of basins will be sized to ensure the development proposed school site (15.24Ha) as a school does not require detention. The school site has been modelled with an overall Fraction Impervious of 20% in keeping with the range of open space areas, recreation areas etc usually developed with a school. This is in line with the Northrop SMR.

However, if the school site is not developed for educational purposes and reverts to residential development then additional onsite detention will be required to maintain the discharge from the 15.24ha catchment as 20% Fraction Impervious compared to 50% for residential development.

The future retention Basins 4, 5 and 6 (on the southern side of the drainage channel) are independent of Basins 1, 2 and 3 and are associated with the development of Stage 14 of Caerleon Estate.



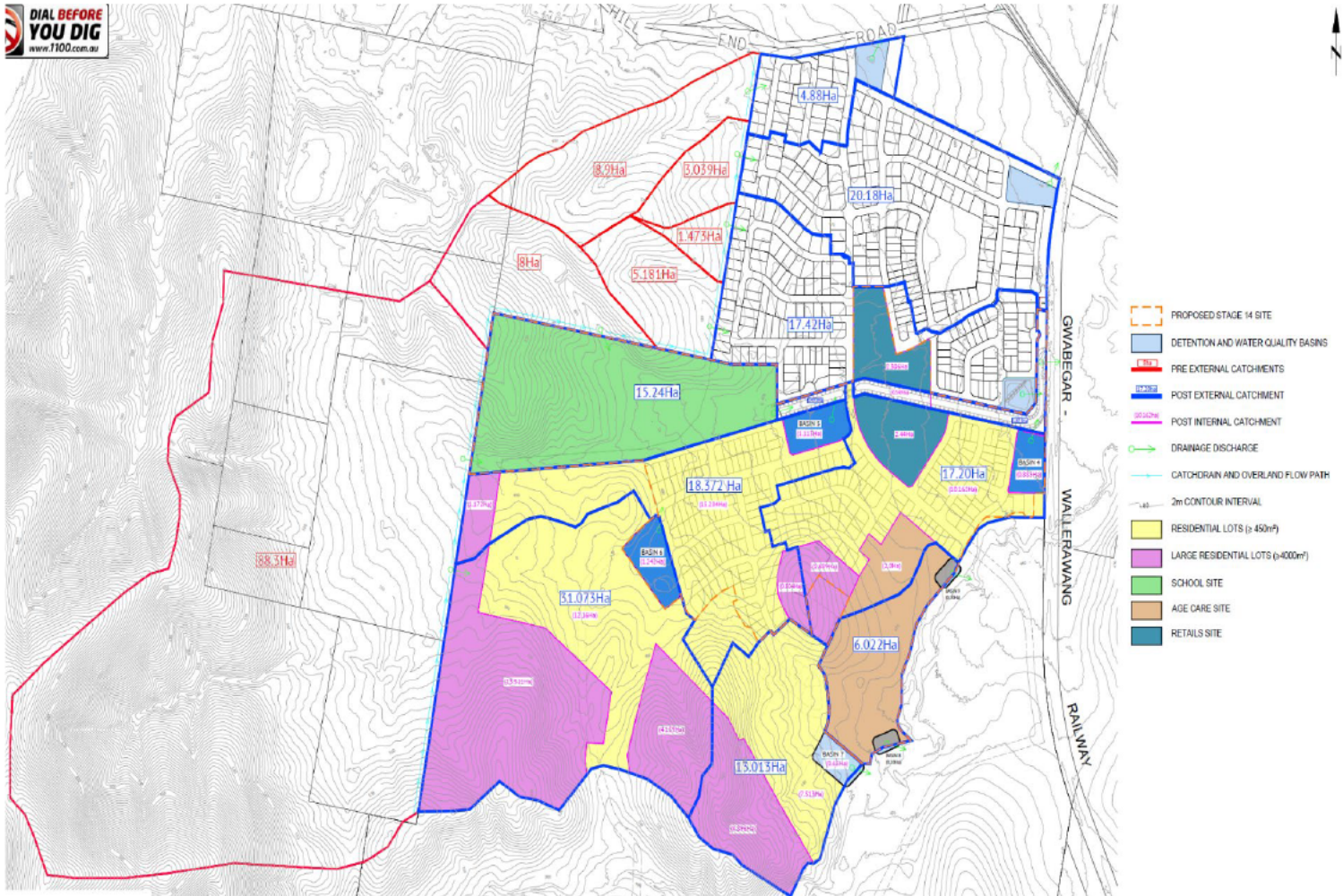
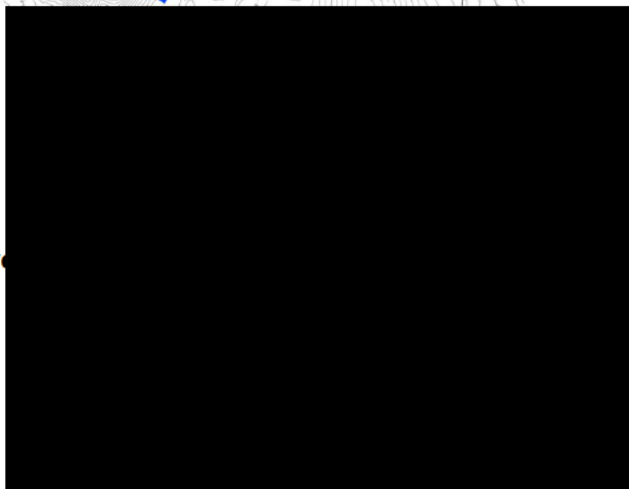


Figure 6 - Post Dev



3.2 Detention Basins

The detention basin assessment was undertaken using the 1-dimensional hydraulic/hydrologic modelling software DRAINS with the following parameters:

- Soil type 2.5;
- Paved area depression storage 2mm;
- Supplementary area depression storage 100mm;
- Grassed area depression storage 10mm;
- Pre-development catchments 100% pervious; and
- Developed catchments were considered as 50% impervious. This was updated from the Northrop SMR value of 35% impervious by Council’s request.

Table 2 below provides the fraction impervious used for each basin catchment.

Table 2 - Basins 3, 4, 5 and 6 Fraction Impervious

Basin No.	Total	Urban Residential		Rural Residential		Basin/Undeveloped		Commercial		Age Care		Average %IMP
		Area (Ha)	%IMP	Area (Ha)	%IMP	Area (Ha)	%IMP	Area (Ha)	%IMP	Area (Ha)	%IMP	
3	24.078	14.602	50			7.166	0	2.31	95			39
4	17.2	10.162	50	1.689	35	0.885	0	2.44	95	2	95	58
5	18.372	15.284	50	1.976	35	1.113	0					45
6	31.073	12.159	50	17.671	35	1.243	0					39

This assessment has maintained the Northrop SMR upstream catchment area of approx. 115ha. The development layout has made provision to convey upstream flows through the Caerleon Estate via various means, one being an open drainage channel conveying some 96.3ha of the total 115ha catchment. The remainder of the catchment (urban residential development) will flow to the OSD basins within the subdivision.

Key design details of the proposed retention Basins are provided in the following table:

Table 3 – Basin Details

Basin	Primary Outlet	Spillway	Volume @ spillway, m ³	Volume @ Top of Bank, m ³	Modelled 1% AEP maximum basin level, m AHD
Basin 3	675 mmm RCP	10 m wide @ RL 457.5 m AHD			
Basin 4	525 mmm RCP	10 m wide @ RL 457.7 m AHD	6,110	9,880	457.62
Basin 5	675 mmm RCP	10 m wide @ RL 467.7 m AHD			
Basin 6	675 mmm RCP	10 m wide @ RL 481.6 m AHD	12,035	16,320	481.24

Basins 3, 4 and 5 are located adjacent to the open drainage channel within the subdivision and the discharge for each of these basins is directed into the drainage channel via the piped discharge.

Whilst Basin 6 is located remote from the drainage channel, the piped discharge from the basin is via a 675mm diameter pipe to be constructed as an independent pipeline within the road reserves to discharge to the channel near to Basin 5

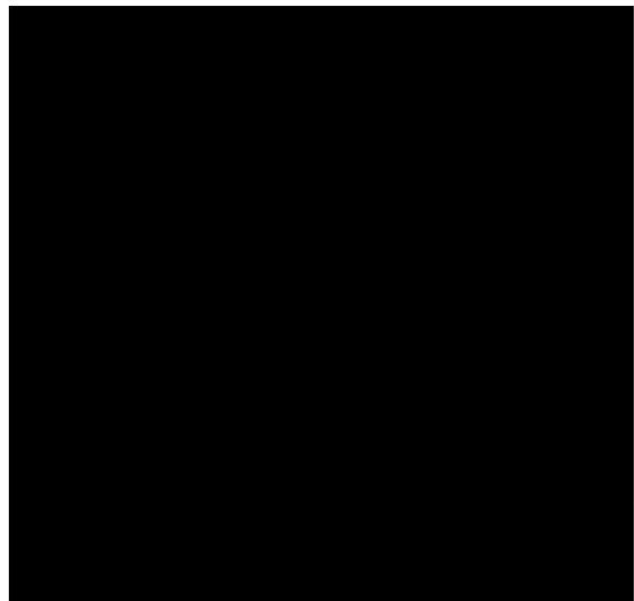
It should be noted for each basin, the discharge from the basin up to and including the 1% AEP rainfall event is via pipe flow only with no flow over the spillway.

The assessment of the stormwater runoff for various storm events for the post development catchment compared to the pre development catchments for stormwater discharging to the railway culvert outlet from the subdivision retarding basin system has been carried out.

For the 1% AEP design event, the following discharges have been assessed:

Pre Development peak discharge:	15.5m ³ /s
Post Development peak discharge:	15.3m ³ /s

Therefore, the design criteria for limiting post development discharge to less than pre development levels has been achieved.



3.3 Drainage Channel

The proposed drainage channel has been adopted from the Northrop SMR with minor variations adjacent to Basin 3 and the Gwabegar to Wallerawang Railway as shown in **Figure 7** below.

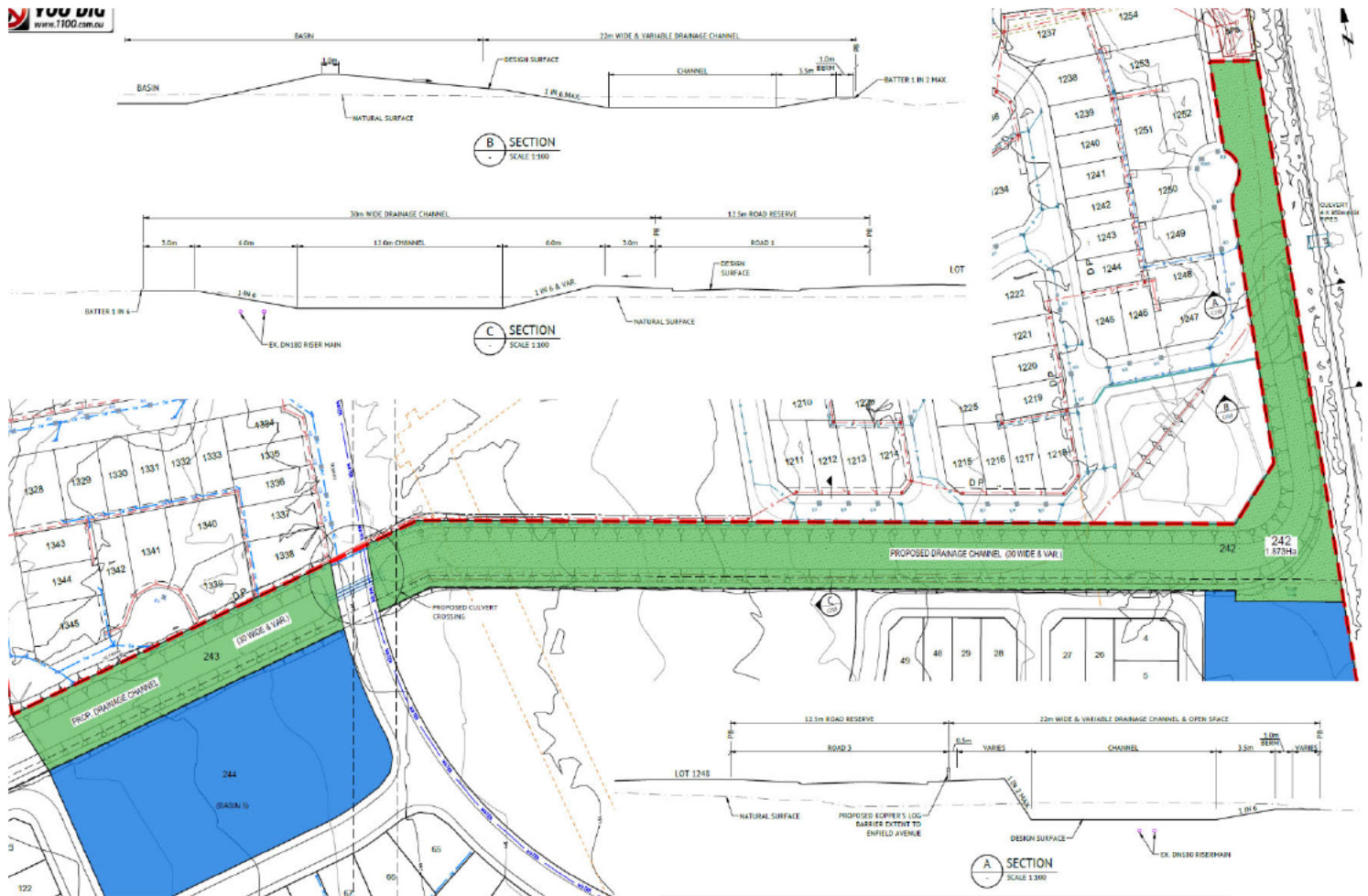
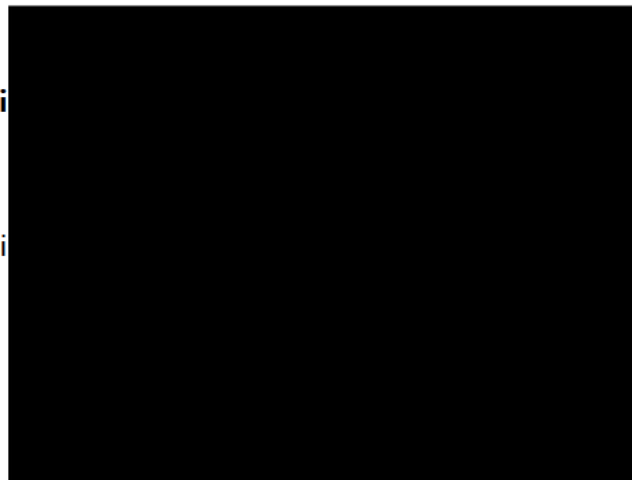


Figure 7 - Channel Design

The POST-developed DRAINS model for the drain



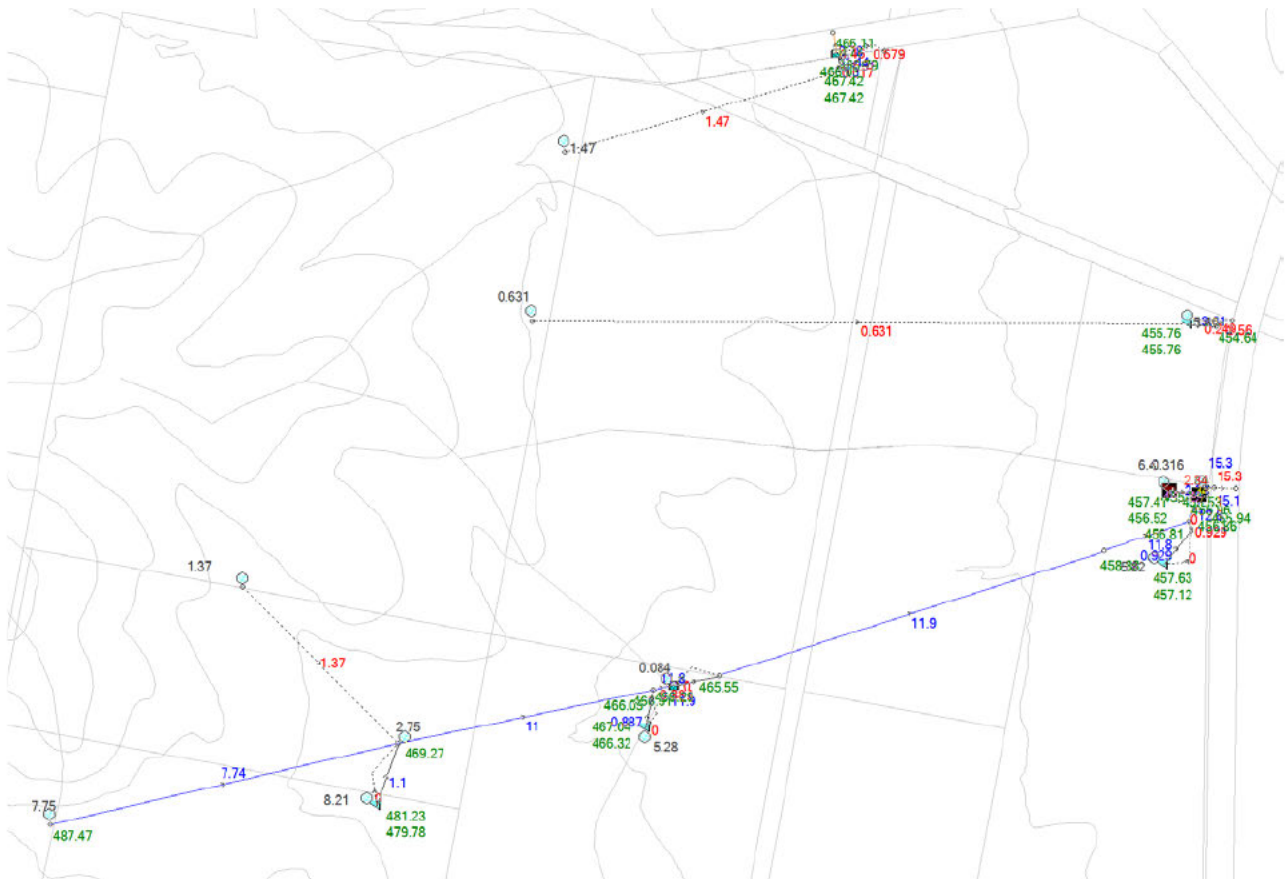


Figure 8 - Post-developed DRAINS model (source: SMR 2022)

Stormwater flows from the rural catchments to the west of the development and from the internal stormwater system have been assessed and will be conveyed through to the railway in a grassed lined channel. The channel would be located within a nominal 30 m wide drainage reserve and would have a shallow trapezoidal section. A summary of the results of hydraulic modelling for the 1% AEP event is provided in Table 4.

Modelling results show that the peak 1% AEP flow rate is 11.9 m³/s. The peak flow velocity is within recommended limits and longitudinal grades will be made during detailed design.

Table 4 – Main channel 1% AEP results

Location	Channel Dimensions			1% AEP Results	
	Base Width, m	Channel Depth, m	Side Batters H:V	Flow Depth, m	Max. Velocity ⁽¹⁾ , m/s
School to road crossing	8.0	1.0	3:1	0.44 – 0.45	1.86
Road crossing to Basin 4 outlet	12.0	1.0	3:1	0.46 – 0.67	2.06
Basin 4 to Basin 3 outlet	12.0	1.0	3:1	0.52 – 0.67	1.61

(1) recommended maximum velocity for grass lined channel is typically 2 m/s although velocity of up to 2.2 m/s can be managed in moderately erodible soils and inundation of less than 6 hours (Landcom, 2004).

3.4 Basin 3 Concept Design and Interim Operation

Retention Basin 3 captures the stormwater runoff via:

- The proposed piped network from Stages 8, 9, 13 and 12; and
- The larger storm runoff via road flows.

These stormwater flows will be treated by:

- Individual lots rainwater tanks used for Basix requirements (also for roof water quality control) but excluding any detention function; and
- Within Basin 3 via
 - o a GPT; and
 - o detention storage.

The proposed retention Basin 3 would manage runoff from a 24.07 ha catchment on the northern side of the main channel. This catchment includes a 6.7 ha rural catchment area (west of the development) which will be conveyed through the development to the catchment outlet at the railway, and 17.42 ha urban area.

The objective of the stormwater management system is to limit post development peak flow at the railway culvert to equal to, or less than, pre-development peak discharge.

The modelled peak 1% AEP pre-development discharge at the outlet of the catchment on the northern side of the main channel (location of proposed Basin 3) is 1.84 m³/s. Discharge from this part of the catchment would combine with flow from the southern section and result in a combined peak pre-development discharge of 15.5 m³/s at the railway culvert.

Modelling of the developed catchment shows that the post development flow from the catchment on the northern side of the main channel would increase to 6.4 m³/s and that Basin 3 would reduce this to 2.3 m³/s which is slightly higher than the pre-development peak discharge.

Modelling of the overall proposed development shows that the combined post development peak discharge at the railway culvert is 2.3 m³/s, which is less than the pre-development peak discharge. However, this is not the case for the overall catchment. Therefore, there is the potential for the peak discharge at the railway culvert to exceed the pre-development peak discharge if the stormwater management system is completed.

However, examination of the peak discharge hydrographs shows that the peak discharge at the railway culvert from the southern part of the catchment (future Stage 14) occurs between 60 and 70 minutes in the critical 1% AEP event. The peak discharge at this time is around 1.8 to 2.1 m³/s. Therefore, the peak discharge at the railway culvert is likely to be very similar to the pre-development peak discharge.

On this basis, the development of Stages 8, 9, 13 and 12 can be implemented on an interim basis with minor reduction in performance for the 1% AEP design event.

3.5 Assessment of Water Quality

The WSUD measures proposed are in line with the Northrop SMR principles by 'end of line' treatment which minimises on-going maintenance costs.

The treatment is gained from (and is consistent with the water quality measures outlined in the Northrop SMR and adopted for the detailed design of the constructed Basin 1 and Basin 2):

- 3,000 litre rainwater tanks within each residential lot for household reuse is in compliance with the Basix requirements;
- Gross Pollutant Trap positioned upstream of the bio retention basin; and
- Bio retention Basin.

The GPT shall be designed and constructed as per Northrop SMR Basin 1 and 2 GPT and in line with:

'A key consideration in this process was ease of maintenance.'

MUSIC computer software was used to quantify the removal efficiency in line with industry best practices. The MUSIC screen shot shown below in **Figure 9**

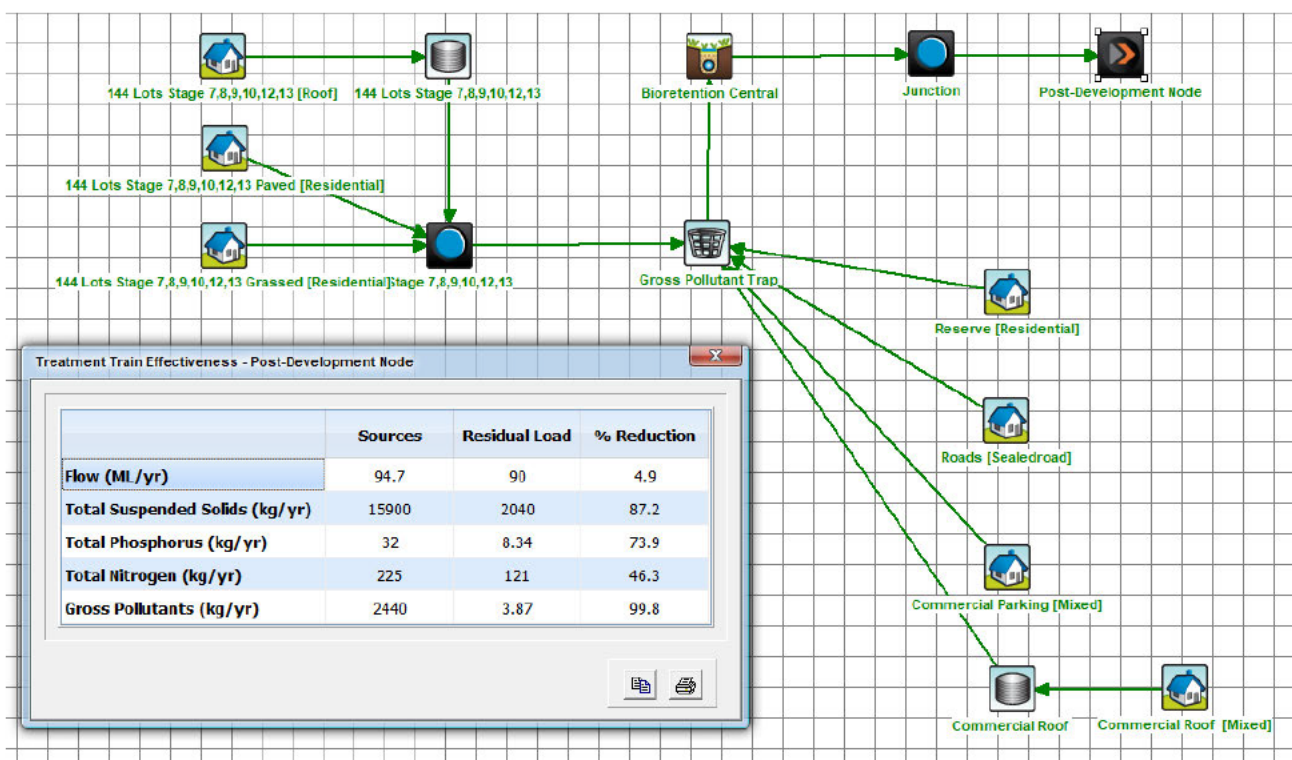


Figure 9 - MUSIC results screen shot

It is noted that Council is considering the replacement of the Bio Basin in favour of a mechanical solution (such as upgraded GPT's or filter cartridge unit) for the removal of pollutants.

The design and modelling of these units are readily available but do not form part of this Report.

4 DATA

The following information sources were used:

- Northrop SMR;
- Midwestern Council’s Development Control Plan 2013; and
- Rainfall and Meteorological Data by the Australian Bureau of Meteorology.

5 RESULTS AND CONCLUSION

The following tables provide results for the stormwater retention for Basins 3, 4, 5 and 6.

Table 5 – Basin Details

Basin	Primary Outlet	Spillway	Volume @ spillway, m ³	Volume @ Top of Bank, m ³	Modelled 1% AEP maximum basin level, m AHD
Basin 3	675 mmm RCP	10 m wide @ RL 457.5 m AHD	4,580	6,500	457.39
Basin 4	525 mmm RCP	10 m wide @ RL 457.7 m AHD	6,110	9,880	457.62
Basin 5	675 mmm RCP	10 m wide @ RL 467.7 m AHD	9,040	12,360	457.62
Basin 6	675 mmm RCP	10 m wide @ RL 481.6 m AHD	12,035	16,320	481.24

The channel is as shown in **Figure 7** and the H... G... D... L... to comprise three (3) 3.6m x 0.9m box culverts

The Pre/Post Development Flow Rates for 1 in 10

The assessment of the stormwater runoff for ... ent catchment compared to the pre development ... the railway culvert outlet from the subdivision retard

For the 1% AEP design event, the following disch

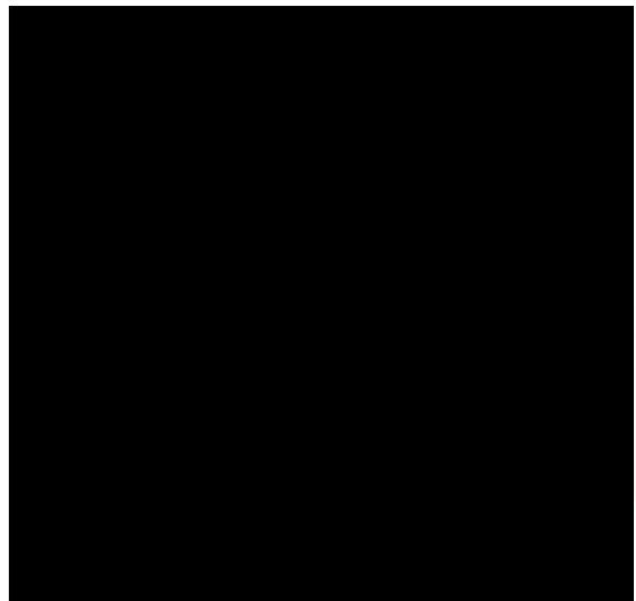
Pre Development peak discharge:

Post Development peak discharge:

Therefore, the design criteria for limiting post de ... ent levels has been achieved.

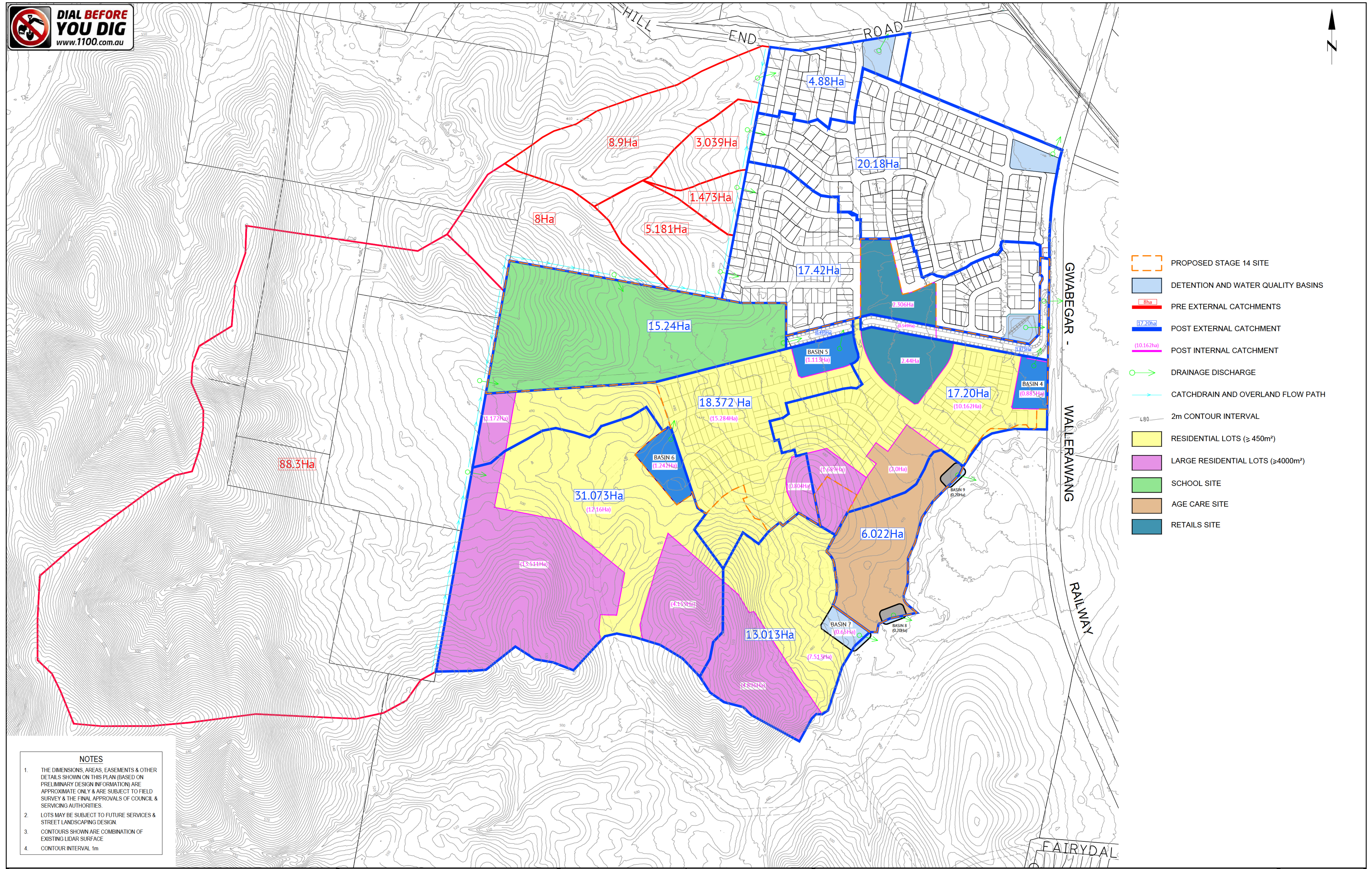
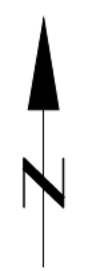
6 REFERENCES

1. Northrop Consulting. (2013). Pre-Development and Post-Development Stormwater Flow Regimes Caerleon Subdivision
2. Bureau of Meteorology, *2016 IFDs – Rainfall Data*. Available at: <http://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016>
3. Midwestern Council. Midwestern Council Development Control Plan (2013).



APPENDIX A

POST DEVELOPMENT CATCHMENT PLAN



- PROPOSED STAGE 14 SITE
- DETENTION AND WATER QUALITY BASINS
- PRE EXTERNAL CATCHMENTS
- POST EXTERNAL CATCHMENT
- POST INTERNAL CATCHMENT
- → DRAINAGE DISCHARGE
- CATCHDRAIN AND OVERLAND FLOW PATH
- 2m CONTOUR INTERVAL
- RESIDENTIAL LOTS (≥ 450m²)
- LARGE RESIDENTIAL LOTS (≥ 4000m²)
- SCHOOL SITE
- AGE CARE SITE
- RETAILS SITE

NOTES

1. THE DIMENSIONS, AREAS, EASEMENTS & OTHER DETAILS SHOWN ON THIS PLAN (BASED ON PRELIMINARY DESIGN INFORMATION) ARE APPROXIMATE ONLY & ARE SUBJECT TO FIELD SURVEY & THE FINAL APPROVALS OF COUNCIL & SERVICING AUTHORITIES.
2. LOTS MAY BE SUBJECT TO FUTURE SERVICES & STREET LANDSCAPING DESIGN.
3. CONTOURS SHOWN ARE COMBINATION OF EXISTING LIDAR SURFACE.
4. CONTOUR INTERVAL 1m

NOT FOR CONSTRUCTION			
03/22	A	ISSUED FOR REVIEW - PROPOSED SUBDIVISION STAGE 14 - 237 RESIDENTIAL LOTS	PS REC
DATE	REV	DESCRIPTION	MT APP
REVISIONS			

ORAN PARK OFFICE
 SUITE 301, LEVEL 3 ORAN PARK PODIUM
 351 ORAN PARK DRIVE
 ORAN PARK, NSW 2570
 PH: (02) 4632 6500
 WEB: www.premise.com.au

DESIGNED
 P. SITHIRAJVONGSA
 CHECKED
 S. HOYNES
 PROJECT MANAGER
 M. THORNE

SCALE
0 50 100 150m
SCALE 1:2500 (A1)

DRAFT

ORIGINAL SHEET SIZE A1

CLIENT
CAERLEON MUDGEY PTY LTD

PROJECT
STAGE 14 - DEVELOPMENT APPLICATION

LOCATION
"CAERLEON ESTATE", MUDGEY

SHEET TITLE
PROPOSED STORMWATER CATCHMENT PLAN

JOB CODE 319171-31	
SHEET NUMBER DA14	REV A



Premise

1300 017 736
mail@premise.com.au

PREMISE.COM.AU