ATTACHMENT 12 – STORMWATER MANAGEMENT PLAN

Planning Proposal – SP20018 – Croft Developments (November 2021)

Biofilta Pty Ltd
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University Park

Aged Care, Residential and Commercial Development

20 Hely Avenue, Turvey Park

Municipality of Wagga Wagga

Stormwater Management Plan

Prepared for: Croft Developments

20 October 2021

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Document Control

Version	Date	Description	Prepared	Client Review
REV 1	30 April 2020	Issue	MN	Peter Perkins
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1 Introduction

Biofilta Pty Ltd was engaged by Croft Developments Pty to develop a holistic stormwater management plan for the proposed re-development of the former Charles Sturt University property in Turvey Park, Wagga Wagga.

This report is to be read in conjunction with the approved Stormwater Management Plan submitted by CJ Arms for the Aged Care development site which forms a part of the overall University Park development project.

This report details the stormwater quality infrastructure and calculations that demonstrate the proposed solution will manage stormwater to Best Practice for the entire University Park and create drainage infrastructure that creates improved flood mitigation for the site and downstream landowners.

2 Site Description

University Park is a proposed 13ha subdivision of land with road frontages on Urana Street to the north, Charleville Road and Hely Ave on the east and Fernleigh Road to the south. To the west, the site is abutted by the St Mary Mackillop College, the Riverina Conservatorium of Music and residential development as shown in Figure 1 below.

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Figure 1: Development Site

The site is described as Lot 2 on Deposited Plan 1183166

Folio: 2/1183166

Centre co-ordinates: Lat: -35.128555 Long: 147.348945

Responsible Municipality: City of Wagga Wagga

The current site slopes generally in a north westerly direction towards Urana Street, with overland flows predicted to flow through new subdivision works.

Survey of the existing site shows the general direction of overland flows:

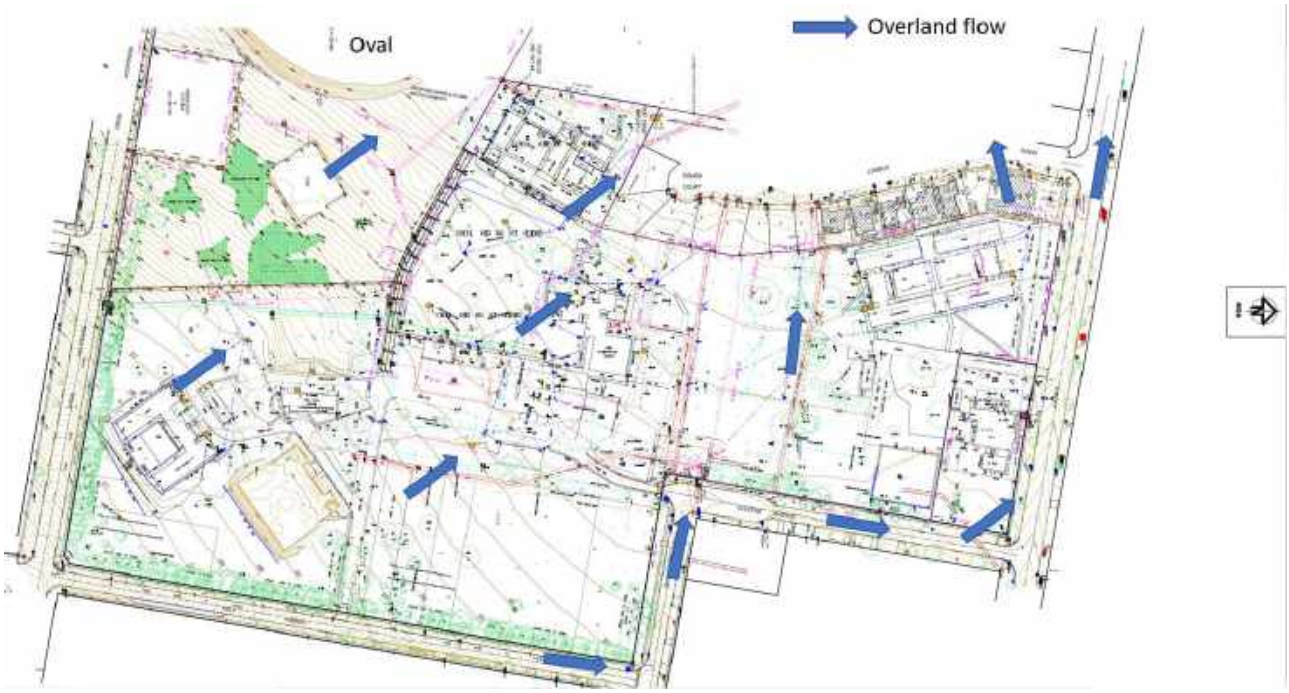

Figure 2: Site Survey and Existing Flow Paths

The site varies in elevation from RL 214.0m AHD in the south east corner at the intersection of Fernleigh Road and Hely Avenue to RL 193.4m AHD at Urana Street to the north.

Total length of the site is approximately 693m which provides an average slope of 3%.

As shown in Figure 2, the south-western portion of the site adjacent to the Ambulance Station currently falls towards an oval.

Within the development area, current site usage includes:

- Numerous building facilities associated with the Mary Mackillop College, CSU Regional Archives, Riverina Conservatorium of Music, Residences
- Expansive open grassed areas
- Tennis courts and hardstands

3 Pre-development Flows

To provide a more accurate analysis of the site, XPStorm 2019 was used to develop the existing flow estimate for the site using the ARR2016 procedures.

ARR values for infiltration and continuing loss recommended by the BoM are:
Initial loss: 26mm
Continuing loss: 4.7mm

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In relation to the ARR loss parameters, Council Engineering staff have advised that NSW OEH developed a guide which is summarised on the NSW specific tab. An extract follows:

> *It identified that default continuing losses from ARR data hub over-estimated losses and therefore were not fit for purpose and should only be used where better information was not available. If default continuing losses from ARR data bub are to be used, these should only be used with a multiplier of 0.4 applied.*

Hence, the loss model to be adopted is:

Initial loss: 26mm
Continuing loss: 1.88 (4.7mm x 0.4)

IFD values for the site were downloaded directly from the BoM and storm events modelled for the 10yr and 100yr ARI in the following durations:

- 25min
- 30min
- 45min
- 60min
- 90min
- 120min

The existing site was divided into two main catchments for analysis:

Figure 3: Existing Catchment Plan – Subject Site

Each catchment has the following areas:

Catchment A:	4.66ha
Catchment B:	7.80ha
Total:	12.46ha

The existing conditions scenario for the site includes a mix of open space, buildings and roads.

Catchment A and B currently have buildings and roads spread throughout the property and have an estimated fraction imperviousness of 20% and an average 3% catchment slope. Refer to the site plan and existing survey.

Sensitivity to the initial fraction impervious on calculated pre-development flow rates is provided to indicate that range of flows from 15% impervious to 25% impervious.

Each catchment was modelled in XPStorm to determine the existing peak runoff.

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3.1 Catchment A – Predevelopment Hydrograph

20% impervious - Storm durations from 15minutes to 2hours were modelled:

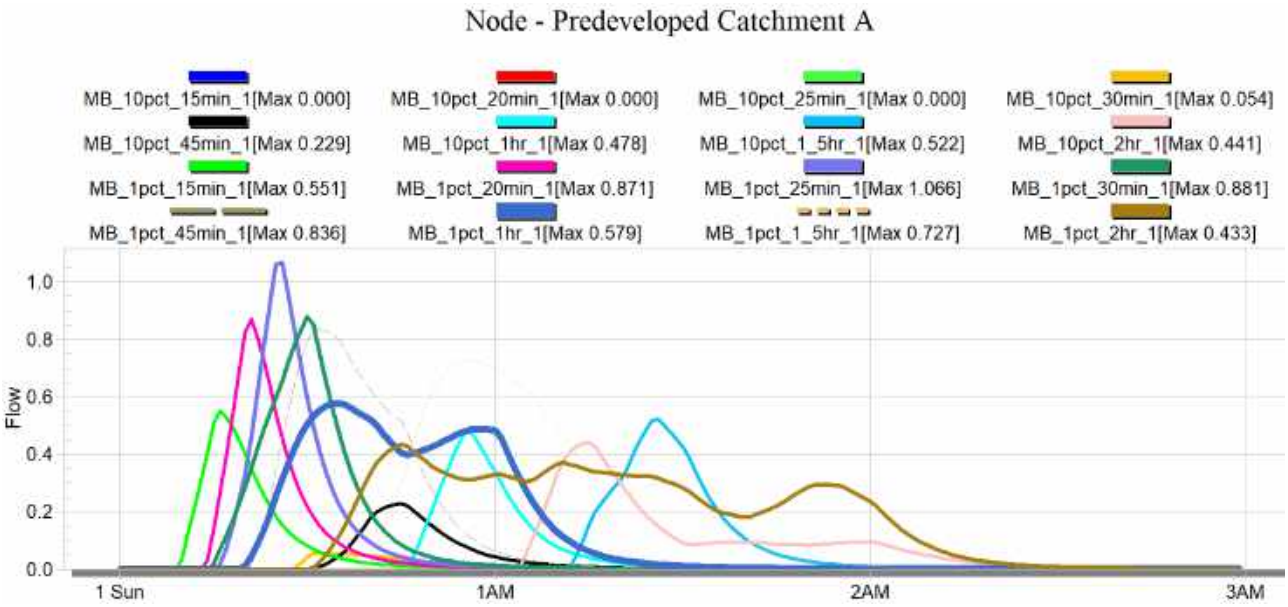

Figure 4: Catchment A Predevelopment Flows – Subject Site

Peak flows from the hydrographs:

10yr AEP 0.522m3/s 1.5hr critical duration
100yr AEP 1.07m3/s 25min critical duration

ARR procedures indicate that given the combination of fraction impervious, catchment size, slope and losses, the 1.5hr duration governs the 10 year peak flow from the catchment.

Traditional methods such as the Rational Method would not have selected the 1.5hr duration as the critical storm because the initial 26mm of flow would not have been extracted from the calculation.

The above critical durations will be used in the developed scenario to manage retardation of storms back to the predevelopment levels.

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3.2 Catchment B – Predevelopment Hydrograph

For Catchment B, the site runoff for a range of storms for the 10 and 100 year events are shown below.

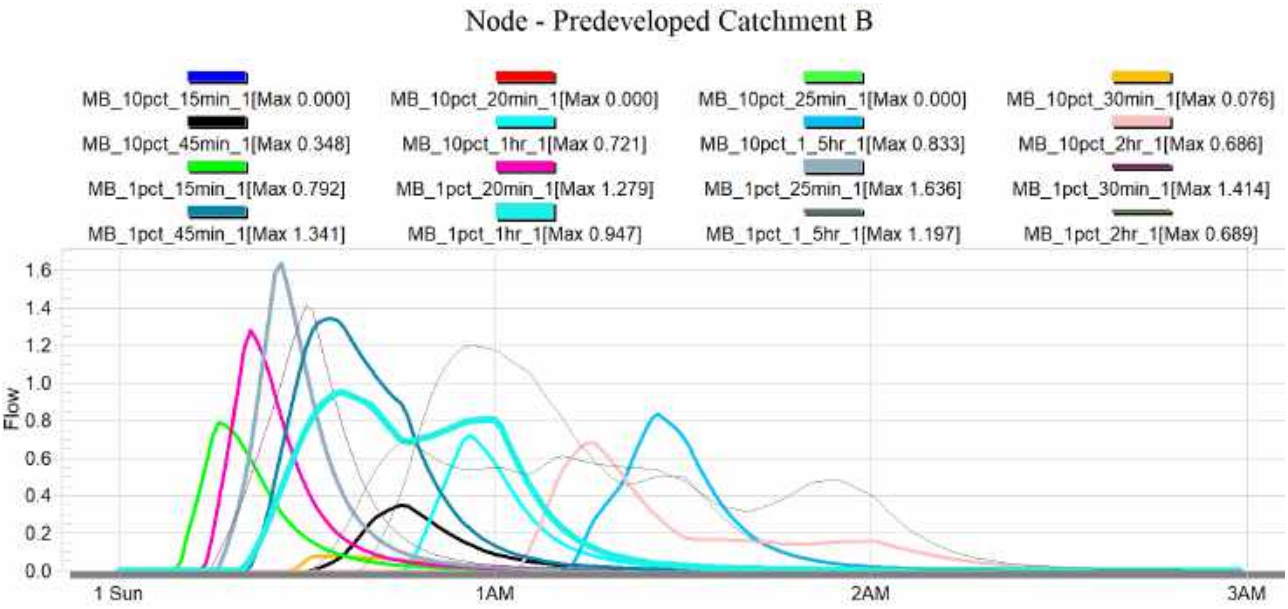

Figure 5: Catchment B Predevelopment Flows – Subject Site

Peak flows from the hydrographs:
10yr AEP 0.833m3/s 1.5hr critical duration
100yr AEP 1.636m3/s 25min critical duration

Summary of pre-development flows (20% impervious):

Catchment	10yr AEP Peak m3/s	Critical duration	100yr AEP Peak m3/s	Critical duration
A	0.522	1.5hr	1.07	25min
B	0.833	1.5hr	1.636	25min

Key Objective: All stormwater shall be retarded in the developed scenario to ensure that post-development outflow matches the pre-development flows as per the above summary table.

A sensitivity analysis for 15% and 25% fraction impervious conditions would result in the following peak flows:

Catchment	10yr AEP Peak m3/s	Critical duration	100yr AEP Peak m3/s	Critical duration
A 15% imp	0.481	1.5hr	0.924	25min
A 20% imp	0.522	1.5hr	1.070	25min
A 25% imp	0.545	1.5hr	1.193	25min
B 15% imp	0.738	1.5hr	1.364	25min
B 20% imp	0.833	1.5hr	1.636	25min
B 25% imp	0.887	1.5hr	1.848	25min

Variance of the initial fraction impervious has a smaller impact on catchment A than it does for the larger catchment B.

Catchment A varies in flow by 64l/s with a 10% change in fraction impervious for the 10yr AEP and 0.269m3/s for the 100yr AEP.

Catchment B varies in flow by 149l/s with a 10% change in fraction impervious for the 10yr AEP and 0.484m3/s for the 100yr AEP.

It is proposed to adopt a 20% fraction impervious value for the purposes of this report.

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4 External Flood Flows

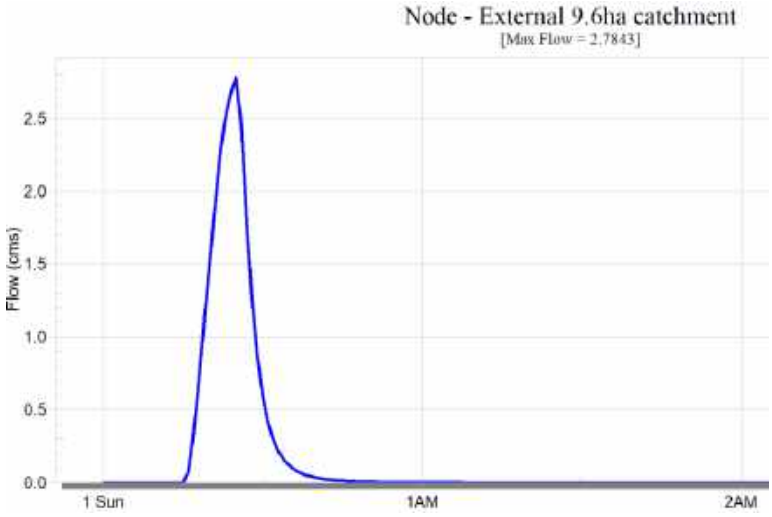
An external catchment of approximately 9.6ha east of Hely Avenue contributes flows to Charleville Road and converges at the corner of Charleville and College Avenue.

Figure 6: External Catchment

At the corner of Charleville Road and College Avenue, flow will split at the new roundabout to convey some overland flow through the Aged Care carpark and the balance will flow along College Avenue.

The existing Council pipe drainage system provides 1.2m3/s conveyance of flow with the balance overland as per the CJArms Report.

Peak flows from the external catchment are modelled with a 60% fraction impervious and are expected to produce a peak 1 in 100year AEP flow of 2.78m3/s.



The hydraulic model will be set with a boundary condition for this overland flow of: 2.78 – 1.2 = 1.58m3/s.

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5 Developed Scenario

It is proposed to develop a mixed Commercial, Aged Care and Residential Development over several stages. The master plan for the site, referenced from Croft Developments Drawing T-1901-10-A is shown:

Figure 7: Developed Site and Detention Basin Locations (north right of page)

Figure 7 shows the direction of overland flow for the residential development as it is intended to function as a holistic site.

The development plan provides for an Aged Care development site (refer CJArms Stormwater Management Plan), residential development surrounding the existing Riverina Conservatorium of Music, Hely Avenue and Fernleigh Road.

The catchment plan for the developed site is shown in Figure 8.

Figure 8: Developed Catchment Plan

External piped flows from the Charleville Road catchment will be routed through a relocated existing drainage line running west along the future Mary Mackillop College site. Refer Croft Developments Drg no. 1900-451. Overland flow from the external catchment will be split between the new internal road and College Avenue to reduce flood impacts on existing residential development to the west.

A linear parkland will be created to detain and treat residential stormwater conveyed northwards along Croft Boulevard and a new overland flow channel will be created to provide outfall as well as flood protection for existing residential properties that front Wade Street.

The new overland flow channel will include a low flow pipe system to ensure that small stormwater events are not sitting in the channel and are discharged to the existing drainage system along Urana Street.

To cater for larger flows, the overland channel will discharge to a new outfall extension pipeline along Urana Street.

Detail of the channel and the outflow arrangements are contained within Croft Developments Plan D-1901-20-A and CJ Arms Plans EW Series issued for construction.

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The existing Riverina Conservatorium will drain to a relocated internal drain adjacent to the proposed overland flow channel and connect into the existing drainage system that flows to the west through Wade Street. This catchment will have no effect on the University Park drainage system or overland flows.

5.1 Developed Catchment A

Catchment A drains via conventional pits and pipework to the corner of Mackillop Circuit and low flows connect to a stepped bioretention treatment basin (Basin 3). Once the bioretention basin is full, it overtops a large internal pit and flows under Mackillop Circuit into the larger Basin 4 for retention and detention. See Figure 8.

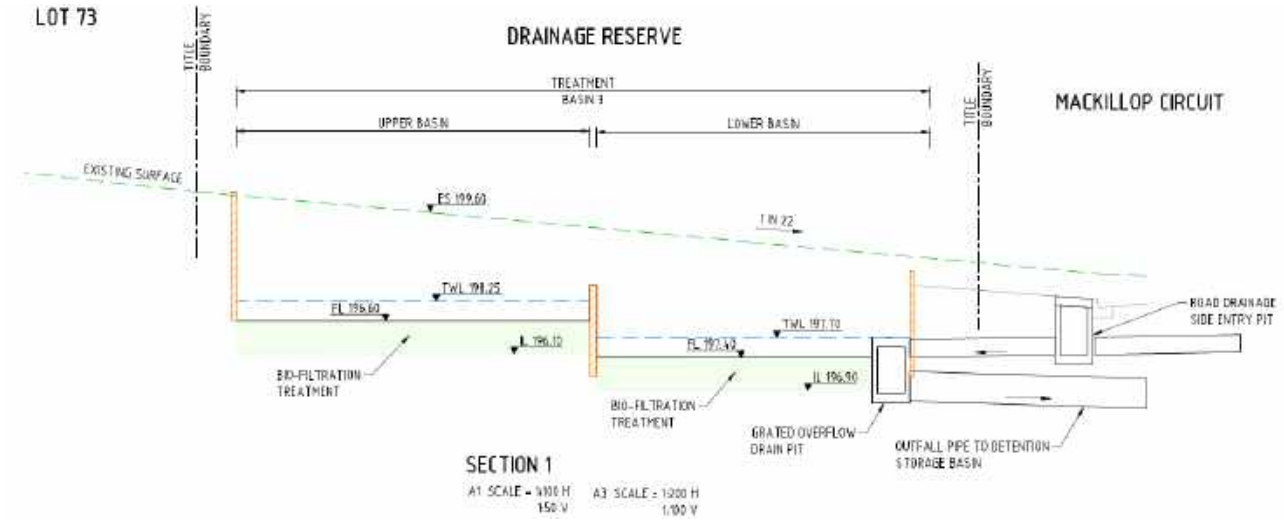
The catchment area of 4.66ha is modelled as a residential development with a total fraction impervious of 60% and an overall 3% average catchment slope.

Basin 4 is modelled as a detention basin with a total reserve area of 682m2 to provide a total storage volume of 760m^3 at it's top water surface.

Outflow from Basin 4 is via a piped via a 750mm diameter pipe to carry pre-development discharge west and then north within drainage easements aligned through the Saint Mary Mackillop Colleges land.

The new outfall pipe will connect to an existing 750mm pipe on the southern boundary of Lot 6 Couch Court as the legal point of discharge directed by Council.

A sketch of the basins used for the model as provided by Croft Developments is shown in Figures 8 and 9.



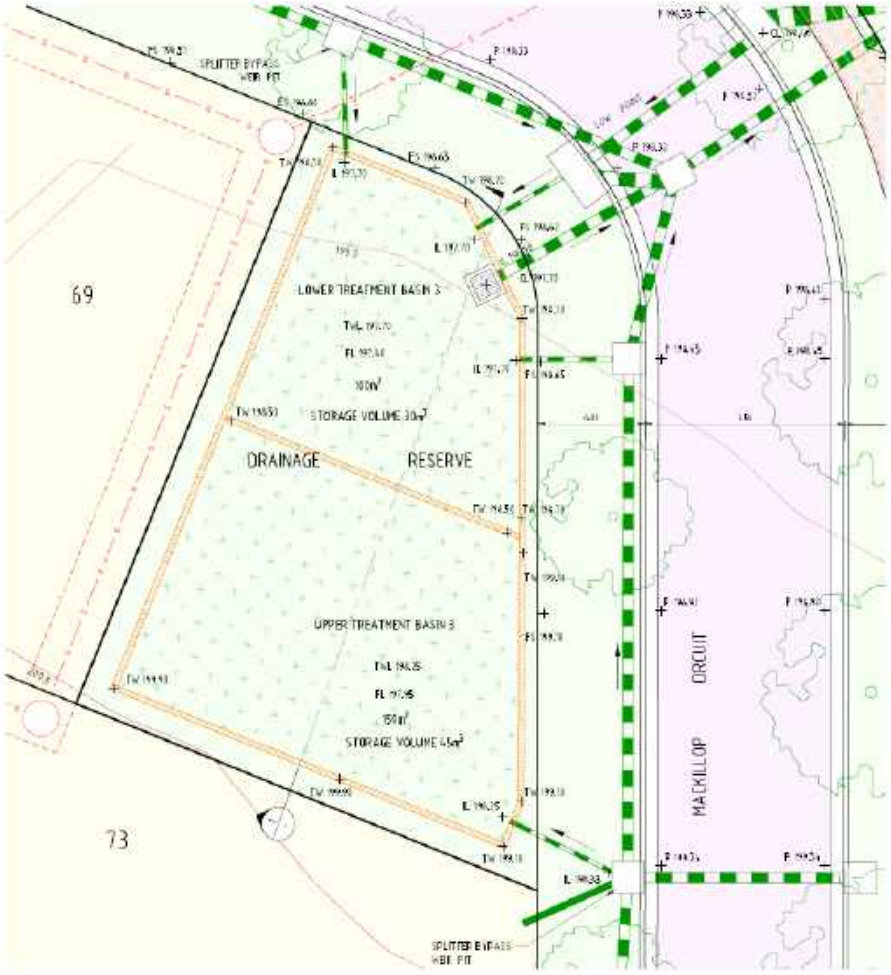
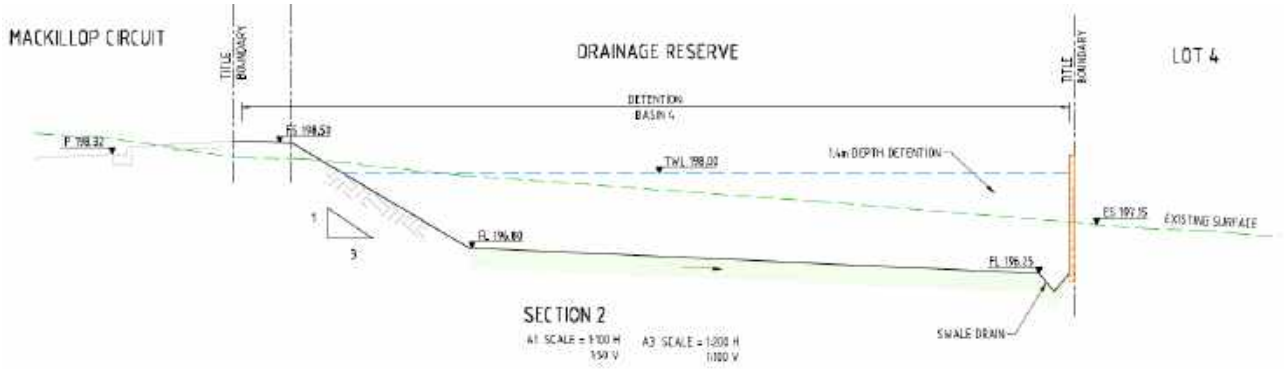


Figure 9: Catchment A Basin 3 Layout (Ref Dwg T-1901-17-A)



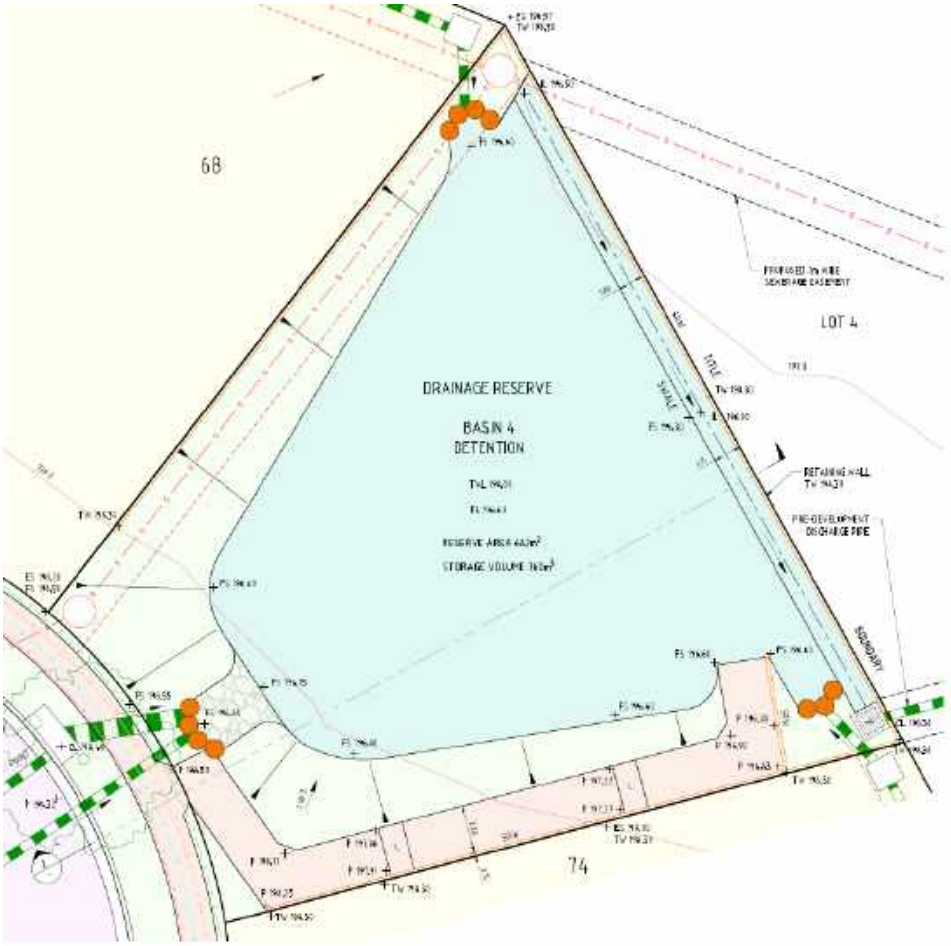
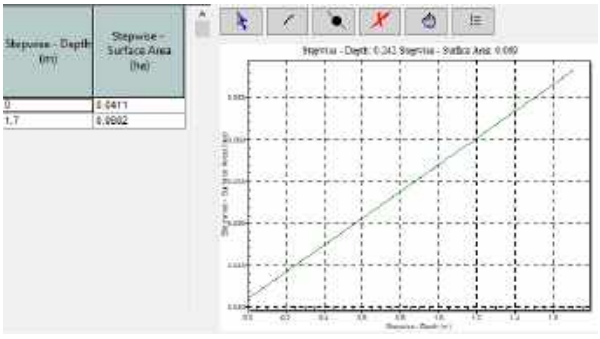


Figure 10: Catchment A Basin 4 Layout (Ref Dwg T-1901-17-A)

Basin properties:

Name	Top Area m2	Invert AHD	Top AHD	Outlet	Comment
Basin 3	250	196.9	199.1	300mm	Links to 4
Basin 4	See below stage-depth	196.6	198.3	750mm	Links to outfall pipeline



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The model was run with developed conditions and the resulting outflow from the combined basins for flows up to and including the 100 year AEP are:

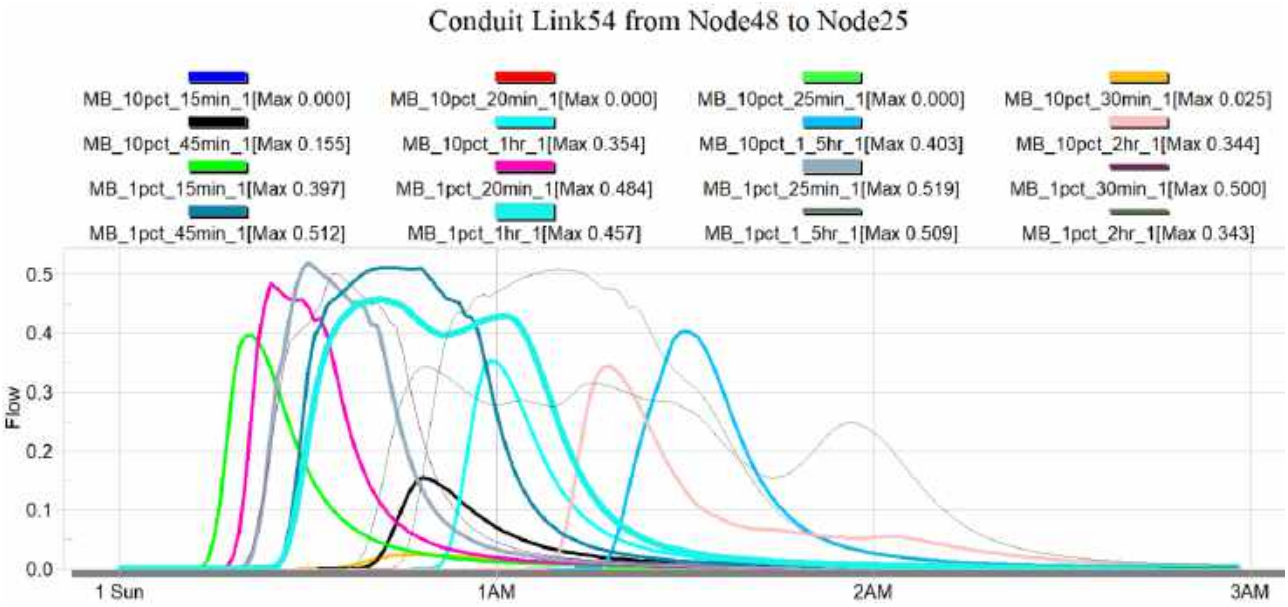

Figure 11: Catchment A- Outflow Characteristics

Peak flows from the critical storm durations are:

10yr AEP 0.403m3/s

100yr AEP 0.519m3/s

Comparison with pre-developed flows:

Catchment A	10yr AEP m3/s	100yr AEP m3/s
Pre-Dev	0.484	1.030
Developed	0.403	0.519

Flows are shown to be retarded well below pre-developed levels using the above combination of flood storage and pipe configurations.

A check of stage-time relationship for Basin 4 is required to confirm that the flows are contained within the basin.

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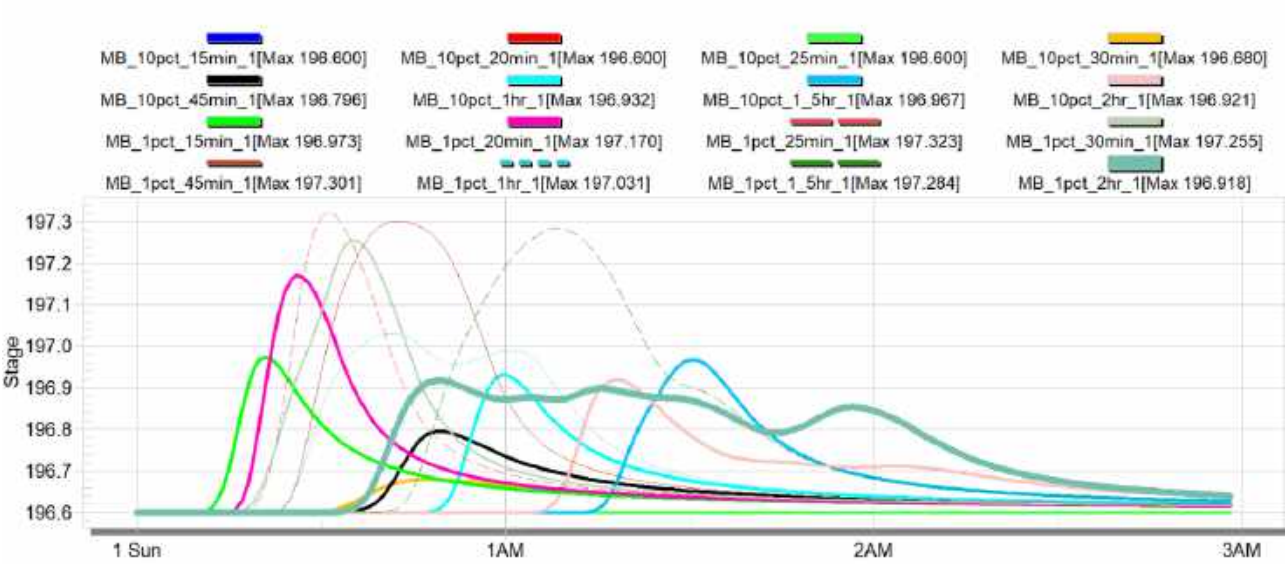

Figure 12: Basin 4 Stage-Storage

From Figure 12, across the range of storm events, the basin does not reach it's full crest level of 198.3m AHD and instead peaks at RL 197.3m AHD for the peak Q100 event.

This indicates that the basin has 1.0m freeboard and additional capacity than is necessary.

Basin 3 also contains all storm events below it's crest level and achieves a maximum depth of 197.93m AHD which indicates a depth of 530mm.

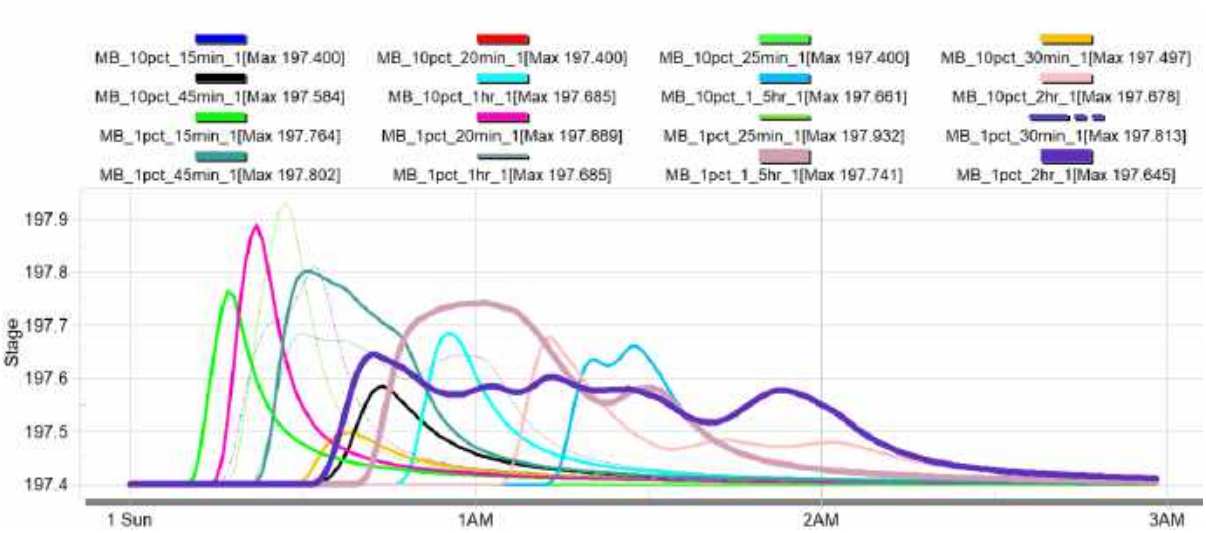

Figure 13: Basin 3 Stage-Storage

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5.2 Catchment B

Catchment B comprises a number of separate sub-catchments including a central parkland and an Aged Care development site. Developed flows are piped to a grassed channel that has a low flow pipe connected to existing drainage infrastructure and also provides flow capacity for overland flows and discharge to a new outfall drain along Urana Street.

The central parkland configuration shows two stepped basins that are all connected to a common 450mm x 900mm box culvert outlet outfalling north-westwards under Charles Sturt Drive. Refer Croft Developments Drg no. 1901-25-A. These basins provide treatment with a bioretention filter in the base and also provide retardation to the upper catchments. The central parkland configuration is shown below:

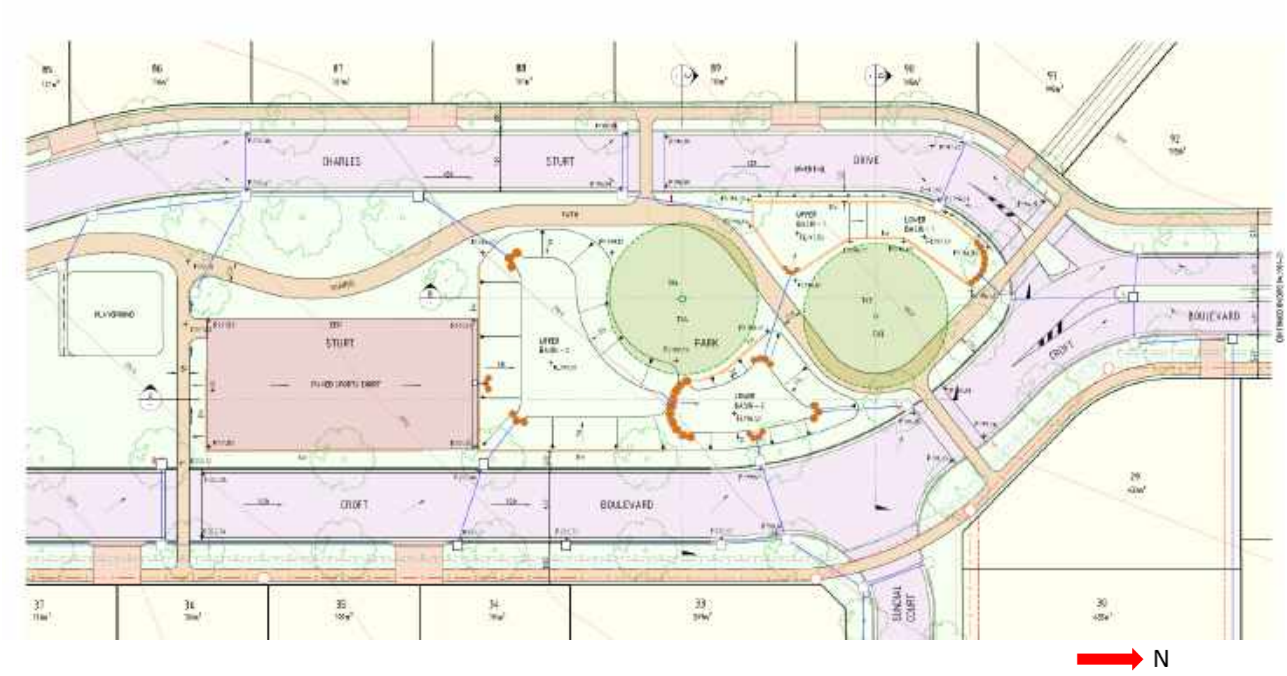

Figure 14: Central Parkland Layout

Contributing catchment areas and modelled fraction impervious:

Basin Node	Total ha	Developed Fraction Imp
Basin 1 upper	1.20	60
Basin 1 lower	1.11	60
Basin 2 upper	0.136	60
Basin 2 lower	0.52	60

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5.3 Basin 1 Upper

Basin 1 is modelled as a shallow detention basin with a piped orifice outlet to a channel that runs north-south adjacent to Charles Sturt Drive.

Basin 1 also receives retarded flow from the lower Basin 2.

Basin 1 is split into two main areas with direct catchments inflow.

Basin Node	Catchment	Base Area	Top Area	Invert	Crest	Outlet pipe
Basin 1 upper	0.14ha	70	100	197.0	198.7	500 diam
Basin 1 lower	0.52ha	75	100	197.0	198.6	300 diam

After modelling, the stage-storage for Basin 1:

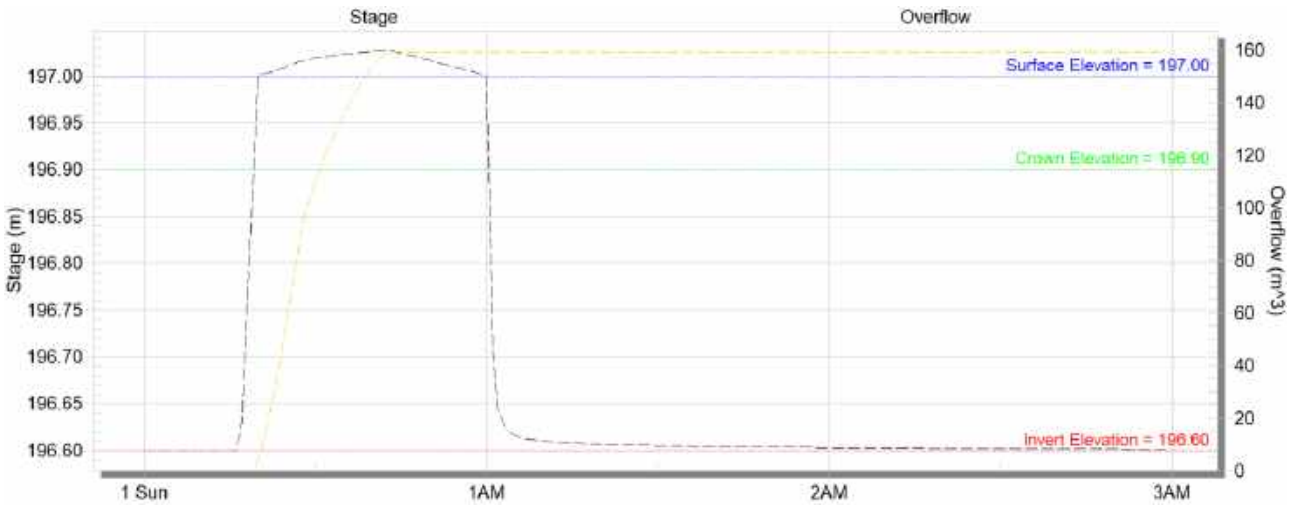


Figure 15: Basin 1 Stage – Storage

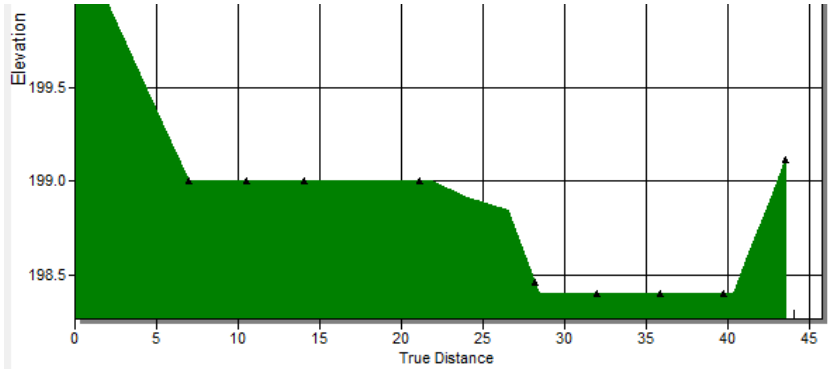
Outflow from Basin 1 is modelled with a 300mm pipe outlet although a 450 x 900mm box culvert is provided. To obtain the detention within the basins, a 300mm orifice plate is recommended to throttle the flows.

5.4 Basin 2 Design

Due to grade, basin 2 has a stepped level proposed and shown below.

Basin Node	Catchment	Base Area	Invert	Crest	Outlet pipe
Basin 2 upper	1.2ha	350m2	199.0	200.0	150mm + weir
Basin 2 lower	1.1ha	130m2	197.0	199.4	225mm diam

The cross section of the basin is represented in the hydraulic model as:



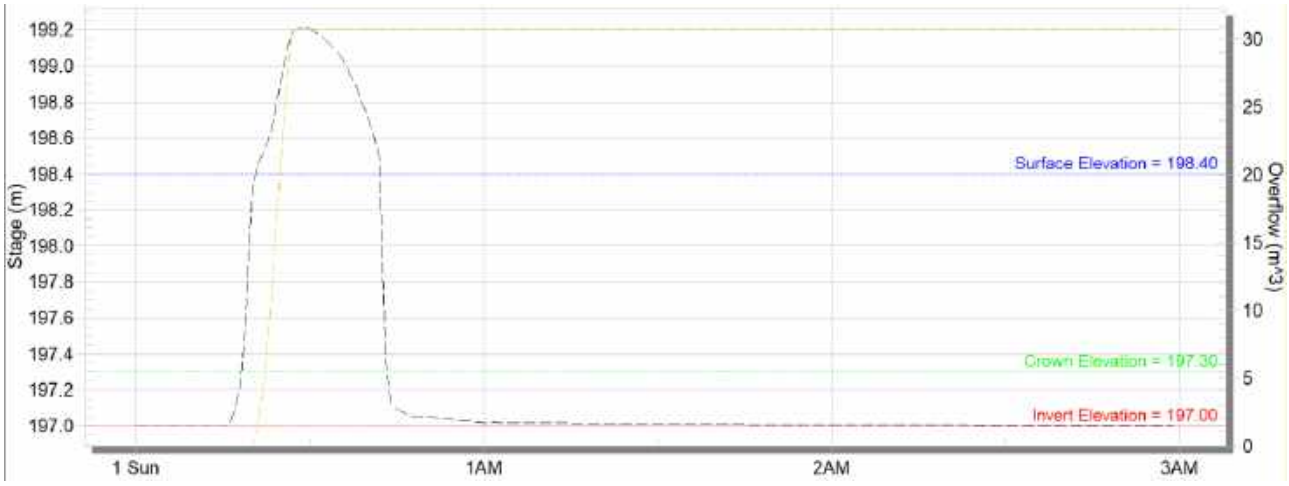


Figure 16: Basin 2 Stage-Storage

Flood flows within the basins are contained within the available depth for all events and does not overtop.

The central park basins provide mid-catchment retardation before flows enter the lower section of Catchment B.

5.5 AGED CARE SITE

The Aged Care site occupies 2.7ha of the northern portion of the site.

Hydraulic analysis for the Aged Care site has been designed and documented by CJ Arms and reference should be made to their report and plans.

Floor level for the building is set at RL 196.5m AHD.

Detention for the northern half the site is via a 200m2 detention basin with an invert set at RL 194.2m AHD and a spill crest of RL 196m AHD.

The main detention basin is designated on the development plan as Basin 5.

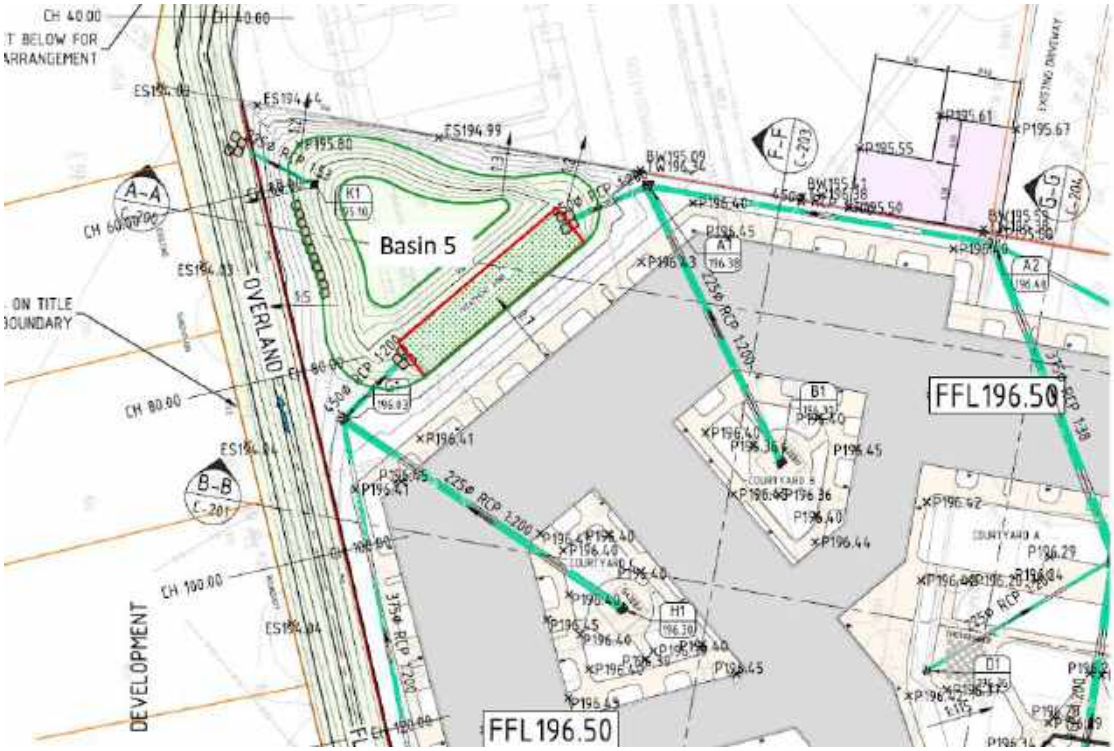


Figure 17: Basin 3 Stage-Storage

Basin 5 releases retarded water to the open channel before discharging to Urana Street.

The majority of the Aged Care site is roof area and a fraction imperviousness of 80% has been assumed.

A stage-storage relationship for Basin 5 was modelled by Biofilta and shown to contain all inflow below the crest level of the basin:

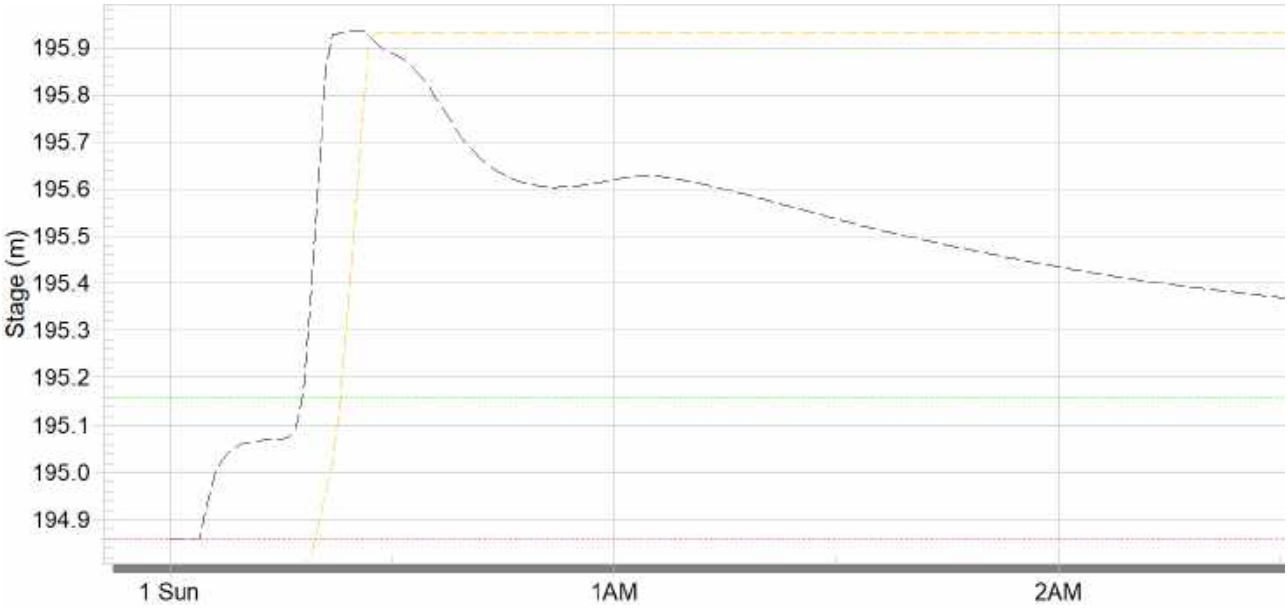


Figure 18: Basin 5 Stage-Storage

For the 100yr AEP, maximum height within the basin: 1,000mm

As the maximum height of the basin is RL 196m AHD, all flow is contained within the basin footprint with 0.5m freeboard.

Low flows are treated prior to entering Basin 5 by a perched bio-filtration constructed in the embankment. Refer to CJ Arms report for detailed modelling of the biobasin.

For the southern portion of the Aged Care site and car parking, flows are directed to a 69m2 biobasin that acts as a detention storage and treatment facility.

Layout for the biobasin is reproduced from the CJArms report:

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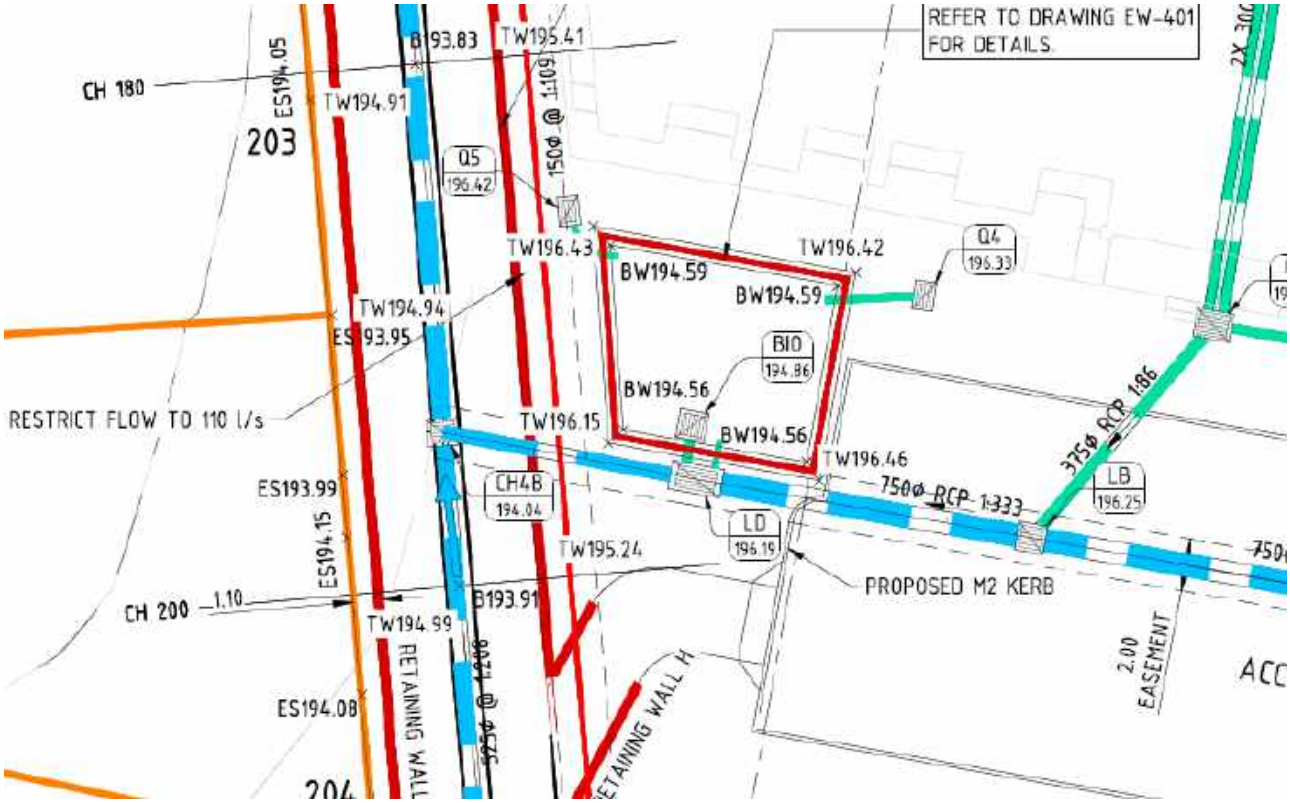


Figure 19: Biobasin (South of Aged Care site)

Contributing catchment:	0.96ha
Base Area:	69m2
Depth:	1.6m
Side slope:	1:1 (retaining walls)
Invert:	RL 194.86m AHD
Top level:	RL 196.46m AHD
Outlet:	300mm diameter to open channel
Resulting stage-storage:	

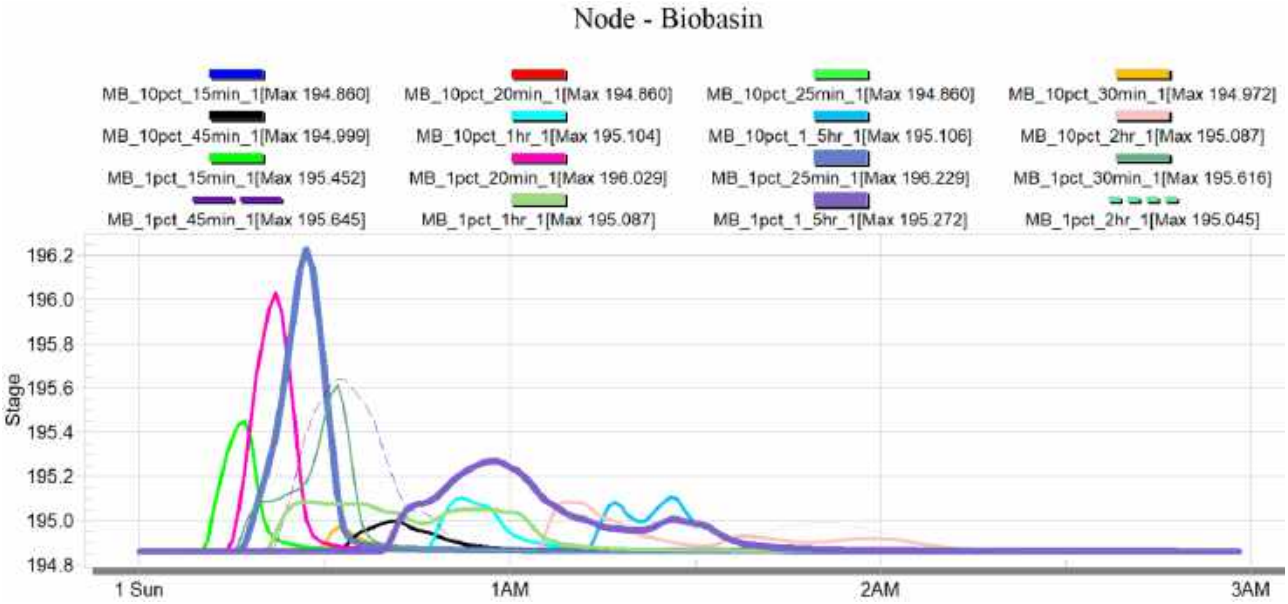


Figure 20: Biobasin Stage-Storage (South of Aged Care site)

For the 10yr AEP, maximum height within the basin: 306mm

For the 100yr AEP, maximum height within the basin: 1,429mm

Major flows from the catchment are contained within the biobasin.

5.6 Overland Flow Channel

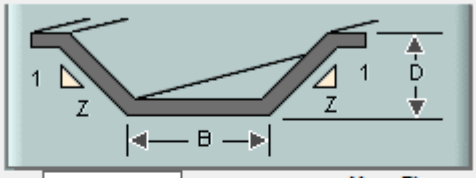
A key feature of the site drainage is the construction of a 200m long, 6m wide open channel which abuts existing developments that front Wade Street.

The purpose of the open channel includes:

- Enabling shallow conveyance of flow from the upstream catchments to the outlet point at Urana Street;
- Provision of an overland flow cut-off from existing runoff that would naturally flow into the existing developments fronting Wade Street. The channel effectively provides immunity to upstream flooding which is a positive outcome;
- Provision of large storage capacity for the overall site retardation
- A safe overland flow path for major flood events.
- Provision of a low flow pipe to ensure that flood capacity exists and that the channel is not holding water for excessive periods of time, enabling easy maintenance access.

The hydraulic properties of the overland flow channel with an assumed 800mm depth are:

Trapezoidal Channel Design : CH4B to CH4A : Conduit 2



Solve for :				
Flow	3.498	cms	Max. Flow	
Base Width (B)	1.	m	Min. Flow	
Side Slopes (Z)	3.	Vertical	U/S Invert	194.04
Depth (D)	0.8	m	D/S Invert	193.89
Manning's n	0.025		Length	49.83
Long. Slope	.30102	%	U/S Surface	195.0
Velocity :	1.2862	m/s	D/S Surface	195.000
Surface Slope:	0	%		

Figure 21: Open Channel Parameters

The channel will have a spill crest set at RL 194.2m AHD at the downstream end which matches the nature strip surface level at Urana Street.

A new 450mm outlet drain will be connected to a downstream pit in Urana Street at RL 193.27m AHD and then connected to a 75m section of 750mm RCP pipe laid along Urana Street and connected to an existing drainage pit for major flows.

The open channel is designed to be “dry” for the majority of the time with a low flow pipe varying from 450mm to 600mm at the downstream end to carry minor flows.

The low flow pipe, outlet drainage upgrade and channel construction details are described in the CJArms stormwater report and form part of the Stage 1 works.

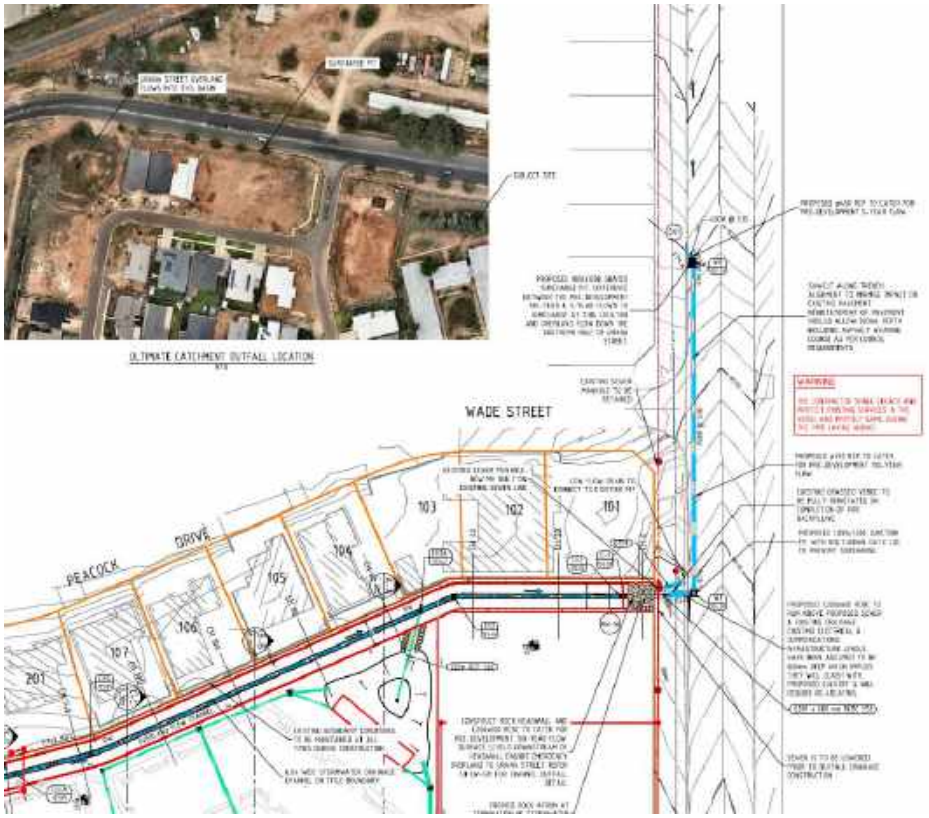


Figure 22: Outlet To Urana Street

For the residential development to the north of the Aged Care site and abutting Urana Street, it is assumed that no retardation is provided and the site discharges directly to the open channel.

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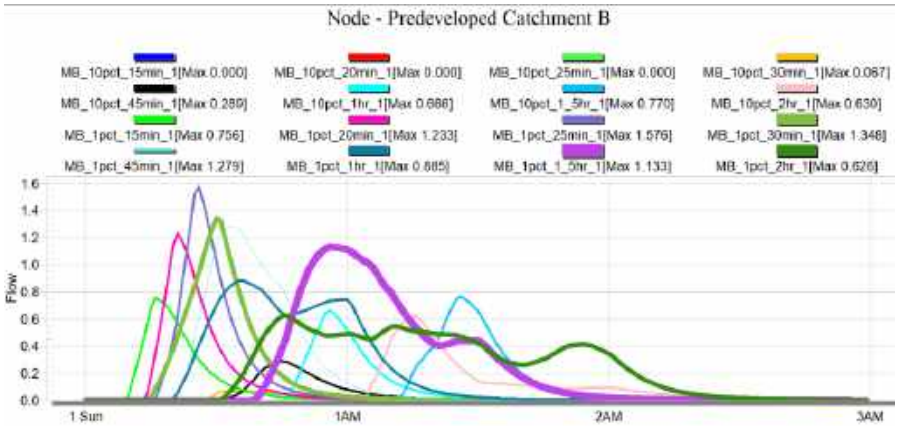
6 Catchment B Outflow Results

The result of the upstream drainage system's interconnected and retarded flows to Urana Street has been modelled as a holistic site in XPStorm.

The hydraulics of the drainage system are complicated with varying retardation effects and split low flows and overland channel flows.

Pre-development flows from Catchment B peak at 0.77m3/s for the Q10 AEP and 1.6m3/s for the Q100 AEP.



Predicted outflow patterns for the peak 100 year AEP is modelled with the main upgraded drainage outlet along Urana Street via a 750mm outlet:

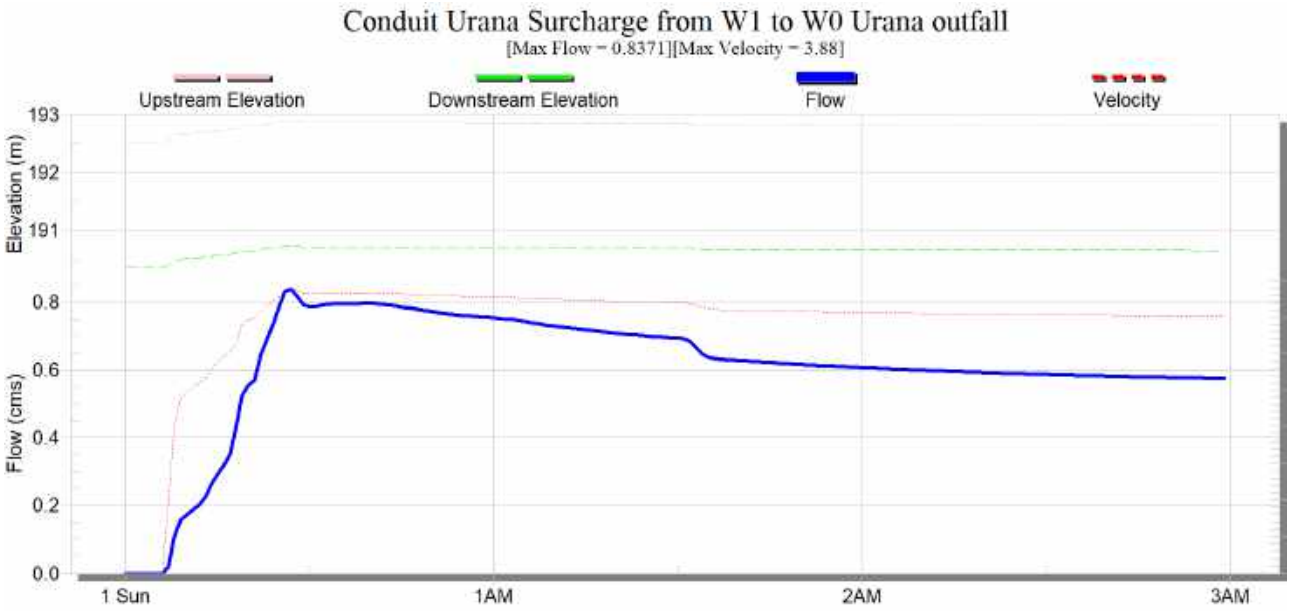


Figure 23: Catchment B Developed Outlet Flows

From Figure 22, a summary of total outflow to both drains compared to pre-development flows calculated earlier.

AEP	Pre-Development	Post-Development
100yr AEP	1.60m3/s	0.84m3/s

Peak flood levels are maintained below pre-development rates for the major storm event.

The result also shows that no overland flow is expected given the upstream storage on site and all flows up to the 100year AEP will be piped.

7 2D Flood Mapping

A 2d surface model for the developed scenario was developed and all basin storages included from the 1d analysis into a holistic 2d model.

The peak 25minute Q100 AEP event was routed through the catchments and allowed to fill basins in 2d to produce flood maps and confirm overland flows can be maintained within the road network.

For catchment B, the flood map in Figure 24 shows the linear basins fill and relieve the lower drainage channel.

Further, the flow split at the corner of College and Charleville Roads accept flows evenly with the 1.78m3/s split at the roundabout.

All flows are contained within the road network.

Along the northern boundary, the flood flow channel provides effective immunity to flooding for the existing residential development with all flow contained within the channel and downstream pipe network to Urana Street.

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Figure 24: Catchment B 2D Flood Model

At the northern carpark of the Aged Care site, the flood level is modelled to be 196.2m AHD.

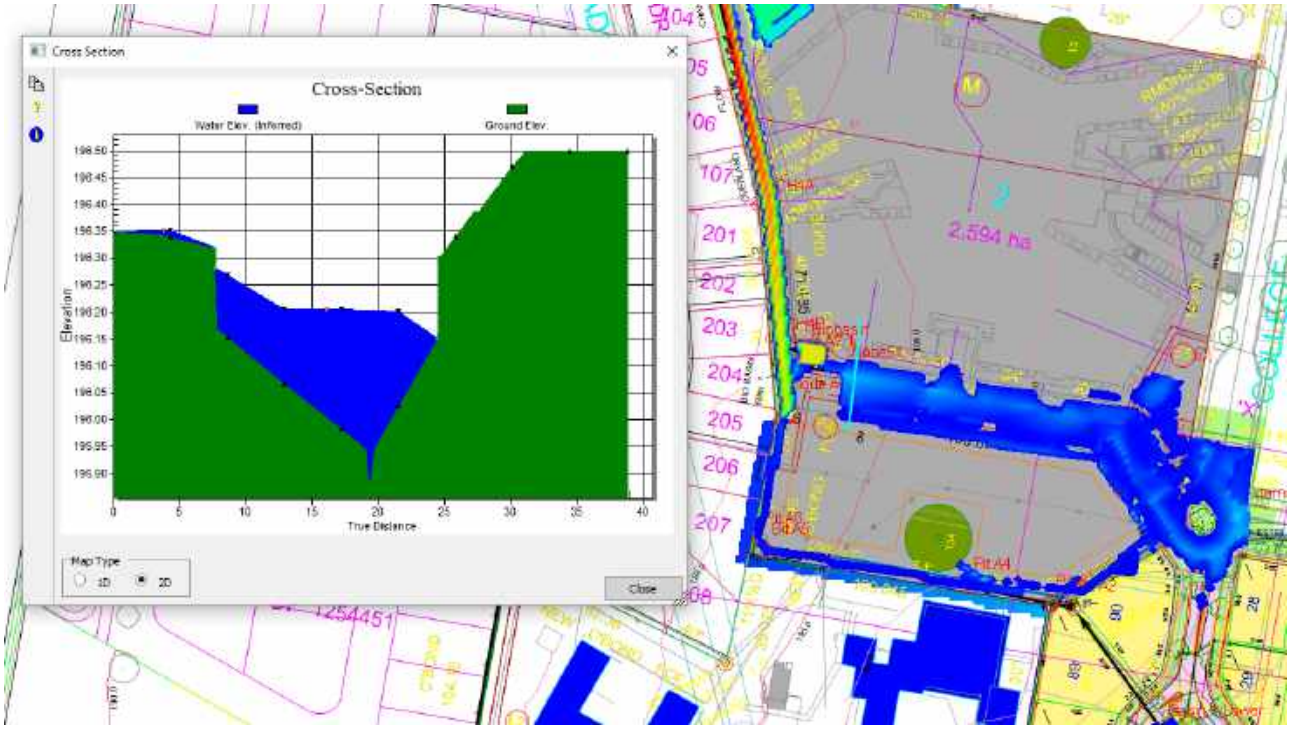

Figure 25: Catchment B Carpark Flood Levels

For Catchment A, the proposed basins also contain all flows within their respective basin areas.

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Figure 26: Catchment A Flood Levels

Overall, Biofilta have modelled the proposed drainage system and found that the site will release all flows to below pre-development levels and in fact, relieve downstream properties from flood risk.

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8 Water Quality Treatment

The objective for the site is to treat runoff to Best Practice environmental guidelines.

For NSW, the treatment objectives are:

Parameter	Best Practice % removal objective
Total suspended solids	80
Total Phosphorus	60
Total Nitrogen	45

A MUSIC model for the entire site was developed to demonstrate the performance of the treatment train approach.

Rainfall patterns for the local area with long-term records were used to model real rainfall patterns through the treatment train.

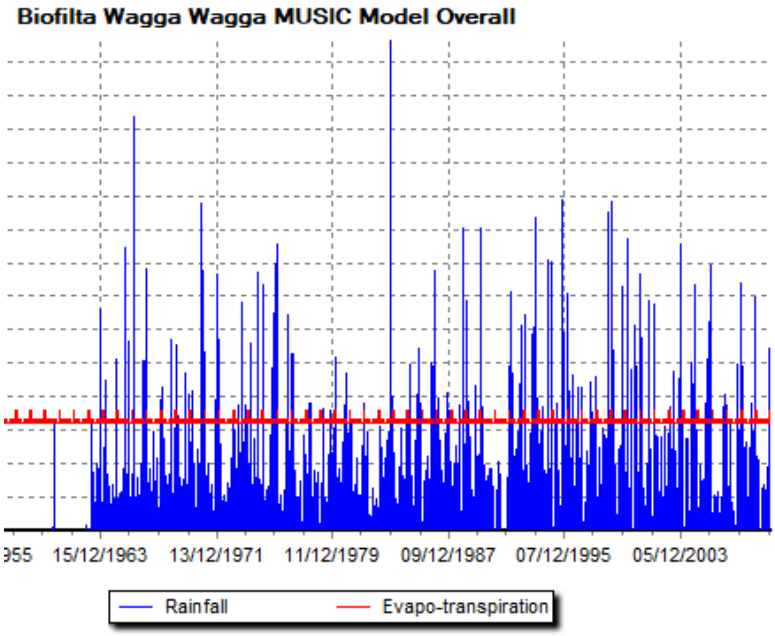

Figure 27: Rainfall and Evapo-Transpiration values

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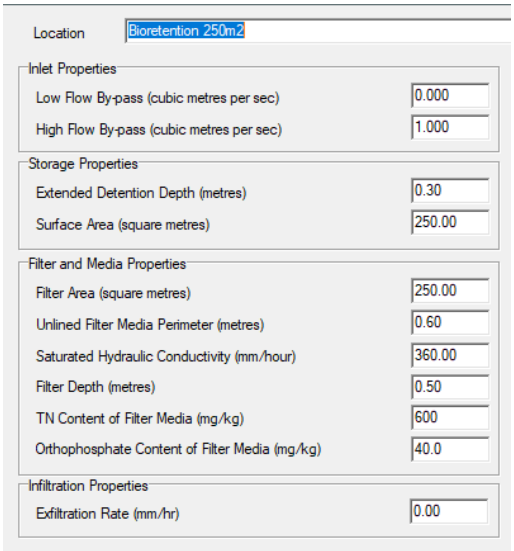
The water quality model for the site is shown below:

Figure 28: Treatment Train

8.1 Key features in each catchment

Catchment A discharges all low flow into a 250m2 bio basin in Basin 3.

Properties of the bioretention Basin 3:



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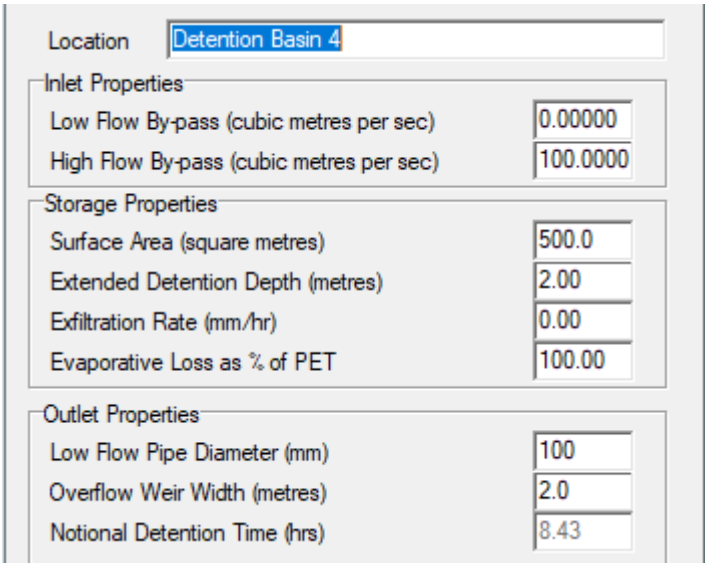
Detention Basin 4:

All low flows will pass through the filter in the floor of the basin before filling the storage in Basin 4.



Biobasin in Central Parkland:

Bio basin in Carpark south of Aged Care

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Biobasin north for Aged Care (Basin 5)

The model was run and the outcome of the treatment train is summarised below:

Parameter	Best Practice % removal objective	Modelled outcome % removal	Target Achieved
Total suspended solids	80	92.7	YES
Total Phosphorus	60	71.2	YES
Total Nitrogen	45	53.6	YES

All targets for water quality will be met and exceeded.

8.2 WSUD Maintenance

All maintenance responsibility for the treatment within the Aged Care site will be the ongoing responsibility of the facility management.

The basins will be regularly inspected and cleaned out, pits cleared and the bioretention planter maintained in working order in line with industry practice.

Maintenance of the basins located elsewhere for the subdivision and the open channel will be handed to the City of Wagg Wagga in the longer term once they are established.

9 Summary and Recommended Actions:

Biofilta has analysed the proposed development and provided a holistic approach to the flood management of all contributing flows through the development up to and including the 1 in 100 year AEP event.

9.1 Reduced Discharge

Through the incorporation of a distributed system of integrated detention basins and swale conveyance infrastructure, discharge from the development of the site will be retarded below pre-development outflow characteristics for the major storm events.

Detention facilities have been modelled to show that for the major storm events, the detention basins and open channel will halve the flood flows to Urana Street compared to the predicted existing conditions.

9.2 Overland Flow Management

A wide, linear open channel constructed along the southern and western boundaries will provide immunity for abutting property development from overland flood flows, where previously they were exposed to inundation. Thus, the proposed development will better manage site flood mitigation and protect downstream properties.

9.3 Stormwater Outfall

New drainage outfall works will be undertaken enabling retarded flows to be discharged to the downstream drainage system with provision for safe relief of surface flow into Urana Street.

9.4 Flood Modelling of External Catchments

Detailed 2D flood modelling for the developed scenario and external flows shows that the combination of internal storage basins, road design and open channel conveyance will provide an effective flood mitigation effect for the site and existing residential development.

All flood flows up to and including the 100 year AEP event will be contained with the road and drainage system with a lower risk of flooding to existing downstream properties as a result.

9.5 Water Quality Outcomes

Water quality treatment facilities have been designed to integrate within the detention basins to achieve Best-Practice environmental management objectives, with the least cost of ongoing maintenance.

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Small distributed bio-filtration beds located within the floor of the detention basins have been chosen to provide an efficient treatment mechanism for water quality and a high standard of aesthetic appeal, without the need to manage shallow wetland type water bodies that can be problematic on small developments with limited inflows.

9.6 Maintenance of Facilities

Maintenance of the detention and water quality treatment facilities within the Aged Care site will be undertaken by the facility manager.

The constructed subdivision drainage and retardation system will be managed as part of Council's local drainage network.

In summary, we recommended that Council approves in principle this Stormwater Management Plan for the proposed development, to assist in the guidance of detailed civil design plans that will be prepared and submitted to Council for approval.

Marc Noyce
Biofilta
20/10/2021

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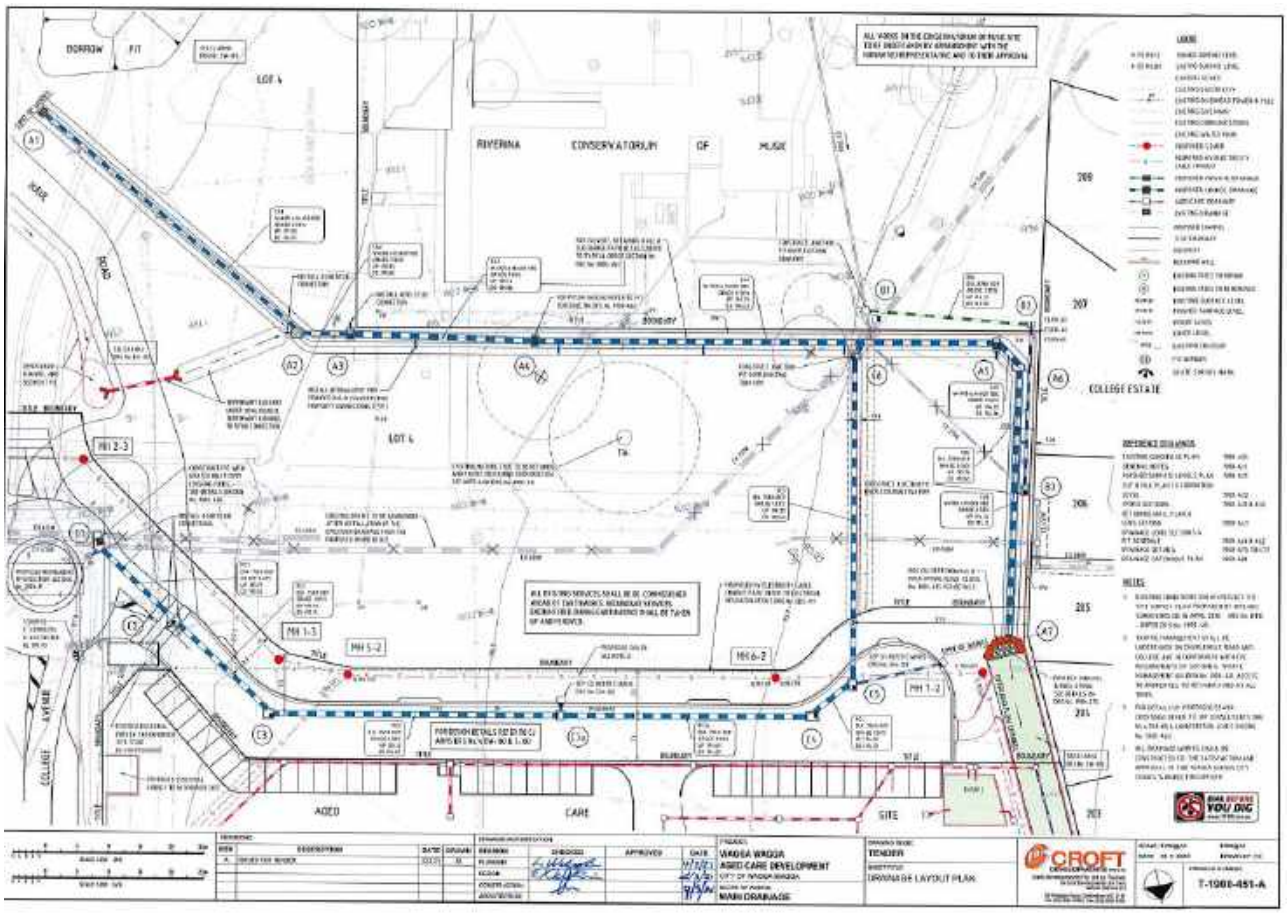
10 Appendix – Croft Developments Drawing 1900-451



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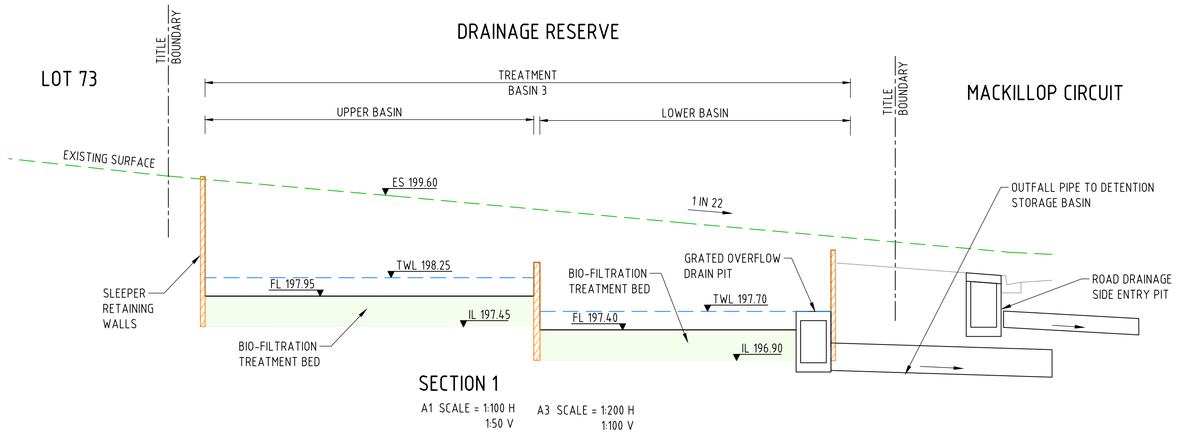

SECTION 1

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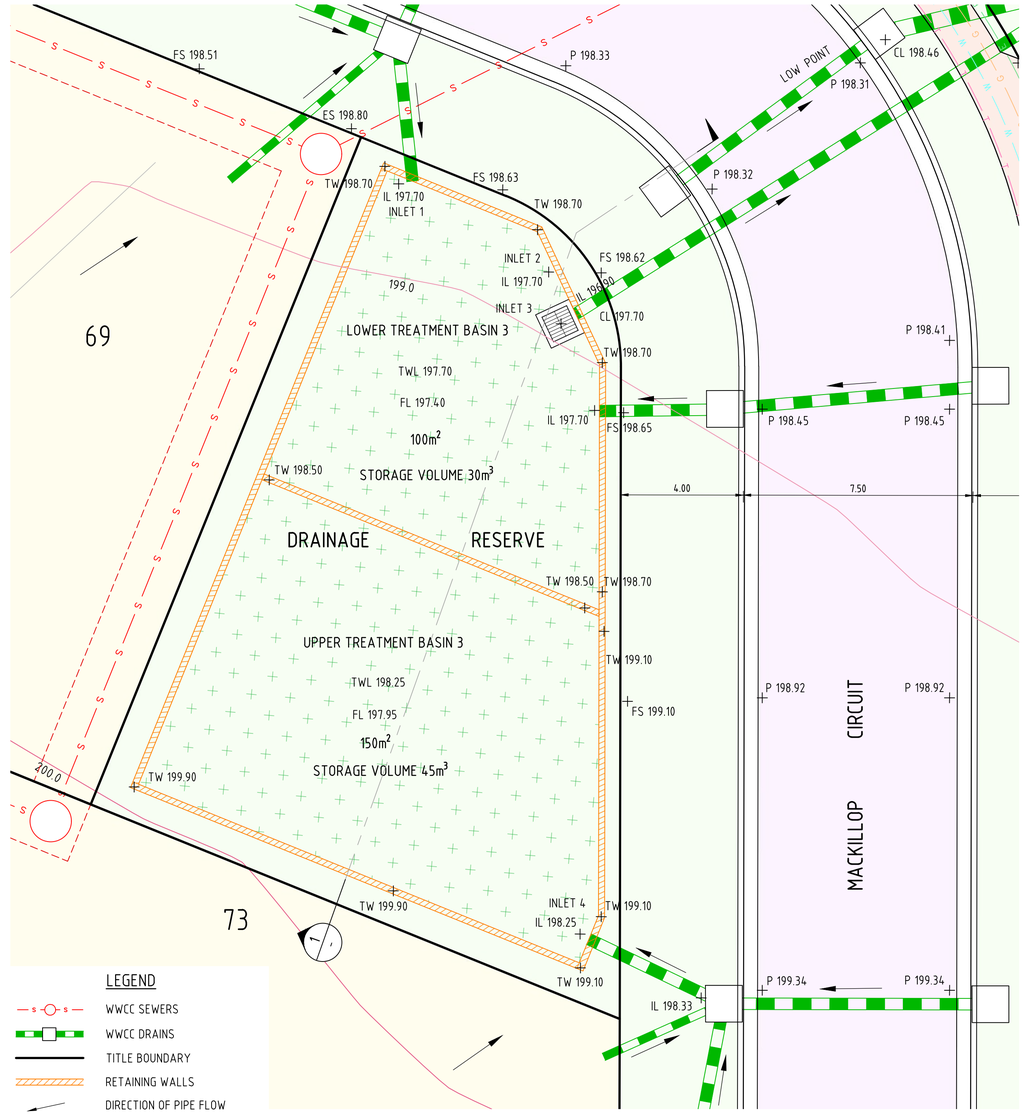
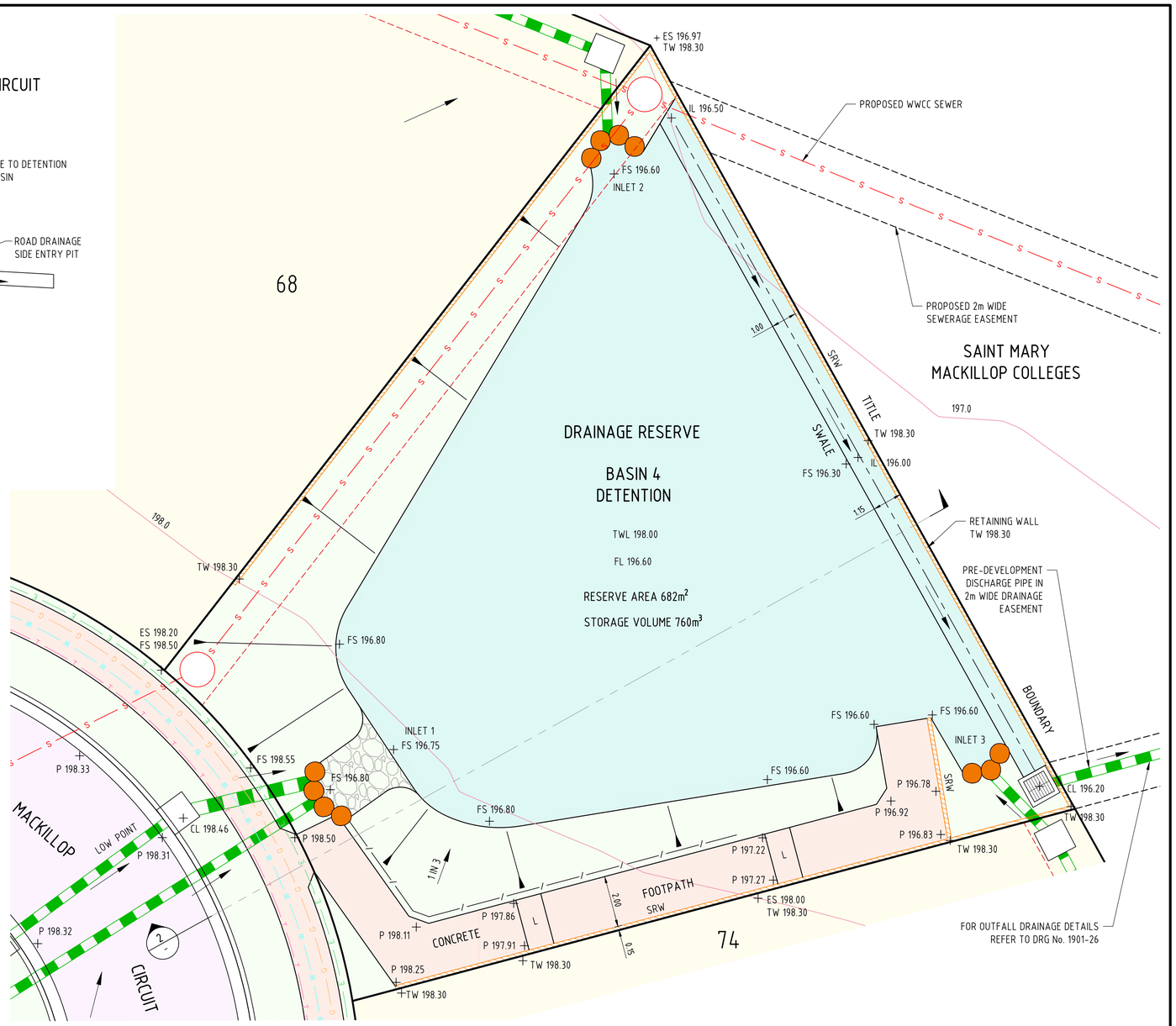
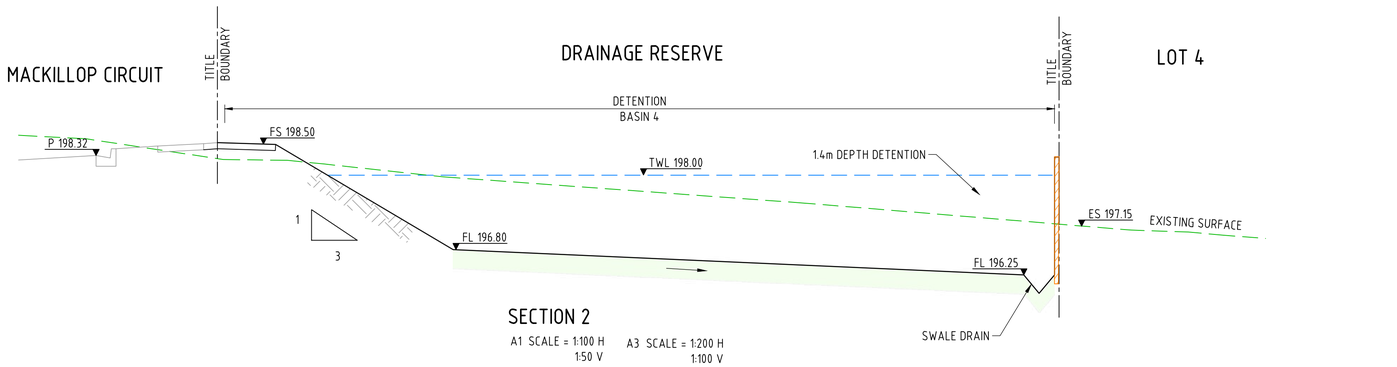


LEGEND

- WWCC SEWERS
- WWCC DRAINS
- TITLE BOUNDARY
- RETAINING WALLS
- DIRECTION OF PIPE FLOW
- BOULDER ENDWALL





SECTION 2

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2 1 SCALE 1:100 (A1)
0 2 4 6 8 10m
2 1 SCALE 1:200 (A3)

REVISIONS:			
REV	DESCRIPTION	DATE	DRAWN
A	ISSUED FOR INFORMATION	1.11.21	DK
	~~WORK IN PROGRESS (01/11/21 18:12)~~		

DRAWING AUTHORISATION:			
DIVISION	CHECKED	APPROVED	DATE
PLANNING			
DESIGN			
CONSTRUCTION			
ARCHITECTURE			

PROJECT:
UNIVERSITY PARK RESIDENTIAL DEVELOPMENT
CITY OF WAGGA WAGGA

SCOPE OF WORKS:
CIVIL INFRASTRUCTURE

DRAWING ISSUE:
TENDER

SHEET TITLE:
SOUTHERN CATCHMENT DRAINAGE BASINS LAYOUT PLANS & SECTIONS

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SCALE: 1:100@A1 1:200@A3
DATE: 11.02.2021 DRAWN BY: SS

DRAWING NUMBER:
D-1901-25-A

PRINTED: 01.11.21 18:12

LEGEND

- TITLE BOUNDARY
- EASEMENT
- EXISTING CONTOURS
- PROPOSED COUNCIL STORMWATER DRAIN & PIT
- 1 IN 100 YEAR OVERLAND FLOW PATH
- CONTRIBUTING CATCHMENT AREA

DIAL BEFORE YOU DIG www.1100.com.au

NOTES

1. EXISTING CONDITIONS SHOWN REFLECT THE SITE SURVEY PLAN PREPARED BY RIVLAND SURVEYORS ON 10 OF JULY 2020. DRG No. DT01 REVISION 0.

SCALE 1:750 (A1)

SCALE 1:1500 (A3)

REVISIONS:

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	~~WORK IN PROGRESS (01/11/21 18:13)~~		

DRAWING AUTHORISATION:

DIVISION	CHECKED	APPROVED	DATE
PLANNING			
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PROJECT:
UNIVERSITY PARK RESIDENTIAL DEVELOPMENT
CITY OF WAGGA WAGGA

SCOPE OF WORKS:
CIVIL INFRASTRUCTURE

DRAWING ISSUE:
TENDER

SHEET TITLE:
SOUTHERN CATCHMENT STORMWATER LAYOUT PLAN

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DATE: 20.09.2021 DRAWN BY: DK

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D-1901-26-A

PRINTED: 01.11.21 18:13