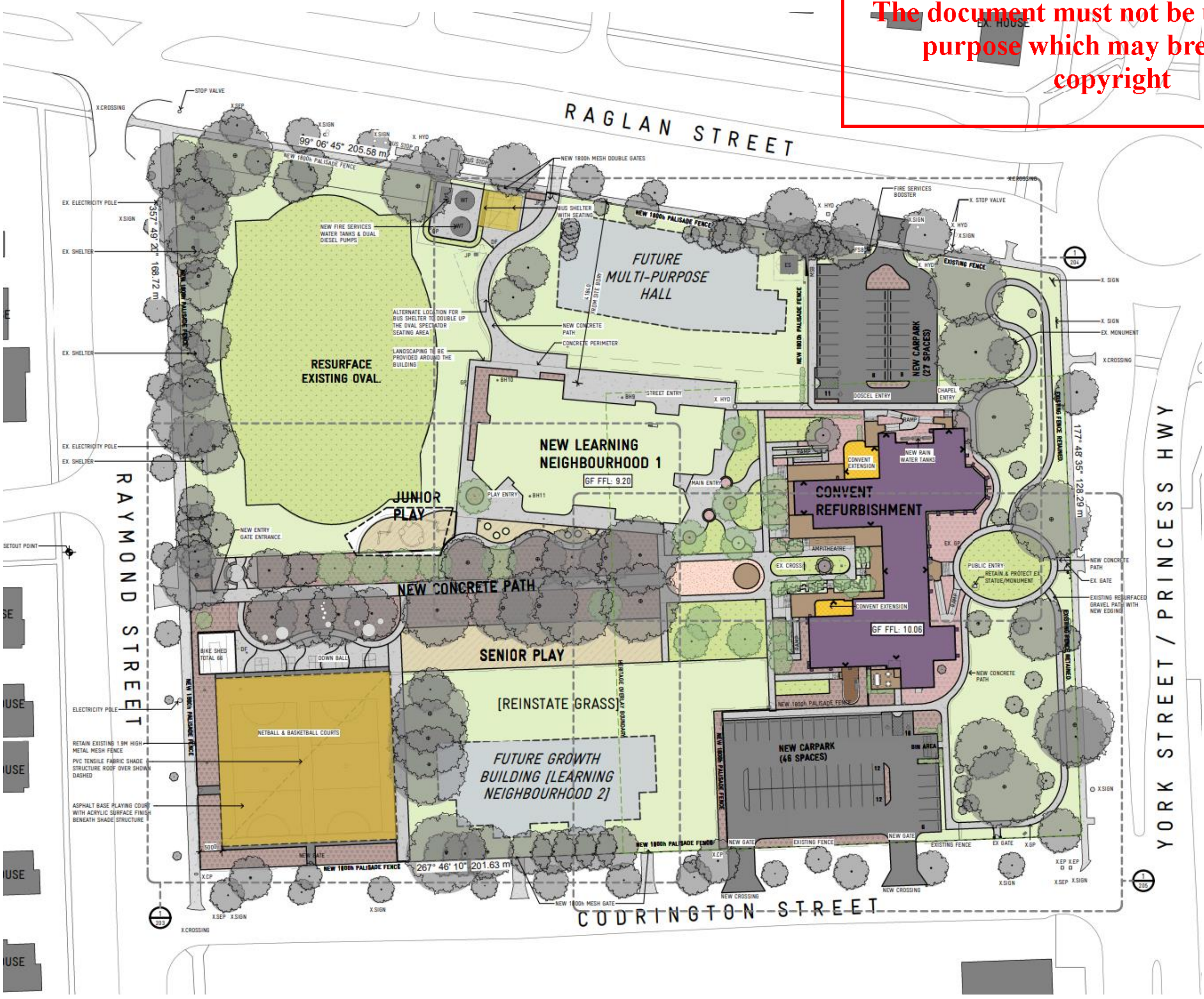

Y2 Architecture

Stormwater Management Strategy

St Thomas Primary School – Sion Campus – 1-23 Codrington St, Sale VIC 3850

Job Reference: 220401

September 2023

This report has been prepared by the office of RMG.

RMG (Aus) Pty Ltd

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RMG Job Number: 220401

Ver No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1.0	E. Ringor / J.Bish	ER		JB		22/06/2023
2.0	E.Ringor / J.Bish	ER		JB		28/08/2023
3.0	E.Ringor / J.Bish	ER		JB		21/09/2023

CONTENTS

APPENDICIES

1. INTRODUCTION

1.1 SCOPE

RMG has been engaged by Y2 Architecture Pty Ltd to prepare a Stormwater Management Strategy to support the town planning application for the development of St Thomas School – Sion Campus in Sale. The strategy will demonstrate that the appropriate drainage requirements are met for the proposed development, which includes:

- Conveyance of minor (piped) and major (overland) flows through the site,
- Flood Analysis
- Stormwater Treatment

This drainage strategy has been prepared in consideration of the standards and specifications outlined in the Infrastructure Design Manual version 5.4 (IDM).

1.2 LOCATION

The proposed development is approximately 3 hectares in size, located at 1-23 Codrington Street, Sale. The site occupies the entire block and therefore has street frontages along Raymond Street, York Street / Princess Hwy and Raglan Street. (Figure 1).

Figure 1 – Site Location

1.3 BACKGROUND INVESTIGATION

1.3.1 SITE FEATURES

The site is currently operating as a Primary School with the inclusion on multiple buildings, a shelter, gravel and bitumen carparks, sports oval, hardcourt facilities, landscaped areas and footpaths.

The proposed area for the development is generally flat with minimal grades across the site. The highest elevation is located at the north-west corner at RL 9.5m and has a subtle grade towards the lowest point located in the south-east corner of the site at RL8.7m.

The feature survey of the site includes numerous pits and pipes surrounding the existing building. However, the configuration of the existing network is in relation to how it all connects together is very limited. Nevertheless, many of the pipes appear to undersized and do not meet minimum cover requirements. Therefore, the proposed development will include new drainage pipes and pits for all new features and will retain the use of the existing infrastructure where possible.

The school has reported localised drainage issues which are likely to be the result of a flat site, with inadequate existing drainage infrastructure.

The site currently operates with multiple Legal Points of Discharge (LPOD) to the site which include:

- Drainage pit in South-East corner of the site (Codrington Street)
- Drainage pit in South-West corner of the site (Codrington & York Street)
- Kerb adaptor on northern boundary of the site (Raglan Street).
- Overland flow to side entry pit on Western boundary (Raymond Street).

The existing site survey can be seen below in figure 2 and appendix A.

Figure 2 - Site Features

1.3.2 FLOOD DATA

A preliminary flood analysis was undertaken for the site assessing the relevant online maps which provide flood overlays on the site. Based on the VICPLAN online map and West Gippsland Catchment Management Authority online map, the proposed development site is not subject to flooding based on a 1% annual exceedance probability. The flood overlay maps can be seen in appendix B.

Additional flood advice can be obtained by contacting West Gippsland Catchment Management Authority who will provide a report tailored to the proposed site.

1.3.3 ABORIGINAL CULTURAL HERITAGE

An analysis was undertaken for the site regarding any aboriginal cultural heritage and no aboriginal heritage overlays were discovered within the proposed development area. However, there is a Heritage Overlay (HO94) which covers part of the site and includes the convent building.

1.3.4 OVERLAYS

The site is located within a General Residential Zone 1 (GRZ1). The surrounding priorities are predominately GRZ1 as well. However, the parcels adjacent to the school on the eastern boundary (York Street) are zoned Commercial 2.

The site includes a Design & Development Overlay (DDO) and Heritage Overlay (HO94) which cover part of the site, which includes the existing convent building.

Figure 3 below shows the GRZ1 and DDO Overlays on the proposed development site.

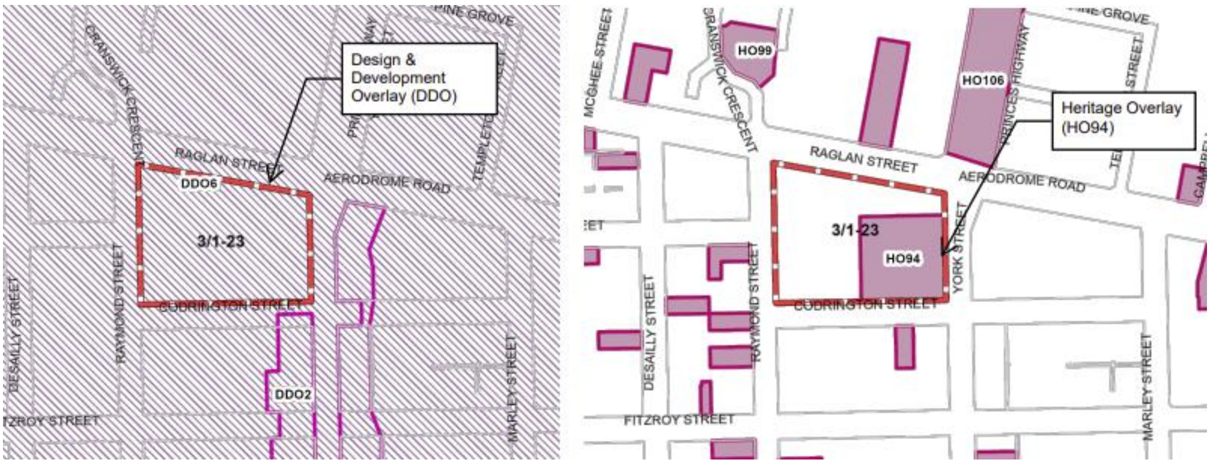


Figure 3 – Environmental Overlays and Zoning

2. PROPOSED DEVELOPMENT

The proposed development consists of two (2) new asphalted carparks, refurbishment of the existing convert building, new learning neighbourhood building, new timber decking, new footpaths/ramps and landscaping. An overall site plan of the proposed development is shown in figure 4 below and Appendix C.

To make was for the proposed infrastructure, the scope includes the demolition of six (6) existing building and one (1) bus shelter. Additional works also include demolishing two (2) existing carparks and pedestrian concrete paving areas. A detailed demolition plan for the proposed development is shown in Appendix D.

Due to the flat nature of the site, it is proposed that the development utilises multiple LPODs consistent with the existing arrangement.

Figure 4 – Proposed Development

3. DEVELOPMENT CONSTRAINTS

3.1 EXISTING SITE CONDITIONS

As noted in Section 1.3.1, there is very minimal fall across the entire site. As a result, it not possible to convey stormwater flows via underground gravity drainage to one singular nominated legal point of discharge while achieving acceptable pipe grades and pipe cover. Therefore, to achieve acceptable pipe capacities, pipe cover and grades, multiple points of discharge are required.

The existing site is heavily developed and include many impervious surfaces (i.e., roofs and hardstands).

Figure 5 – Existing Conditions

3.2 EXTERNAL CATCHMENT

Since the existing school site is higher than the road surfaces on all sides, it’s highly unlikely that external catchments will traverse through the site during both major and minor rainfall events. Hence, external catchments can be omitted in the design.

4. HYDROLOGY

4.1 CATCHMENTS

The site was divided into three (3) catchment areas based on the existing surface contours and proposed development layout. Refer to Figure 6 and Appendix E for the catchment plan.

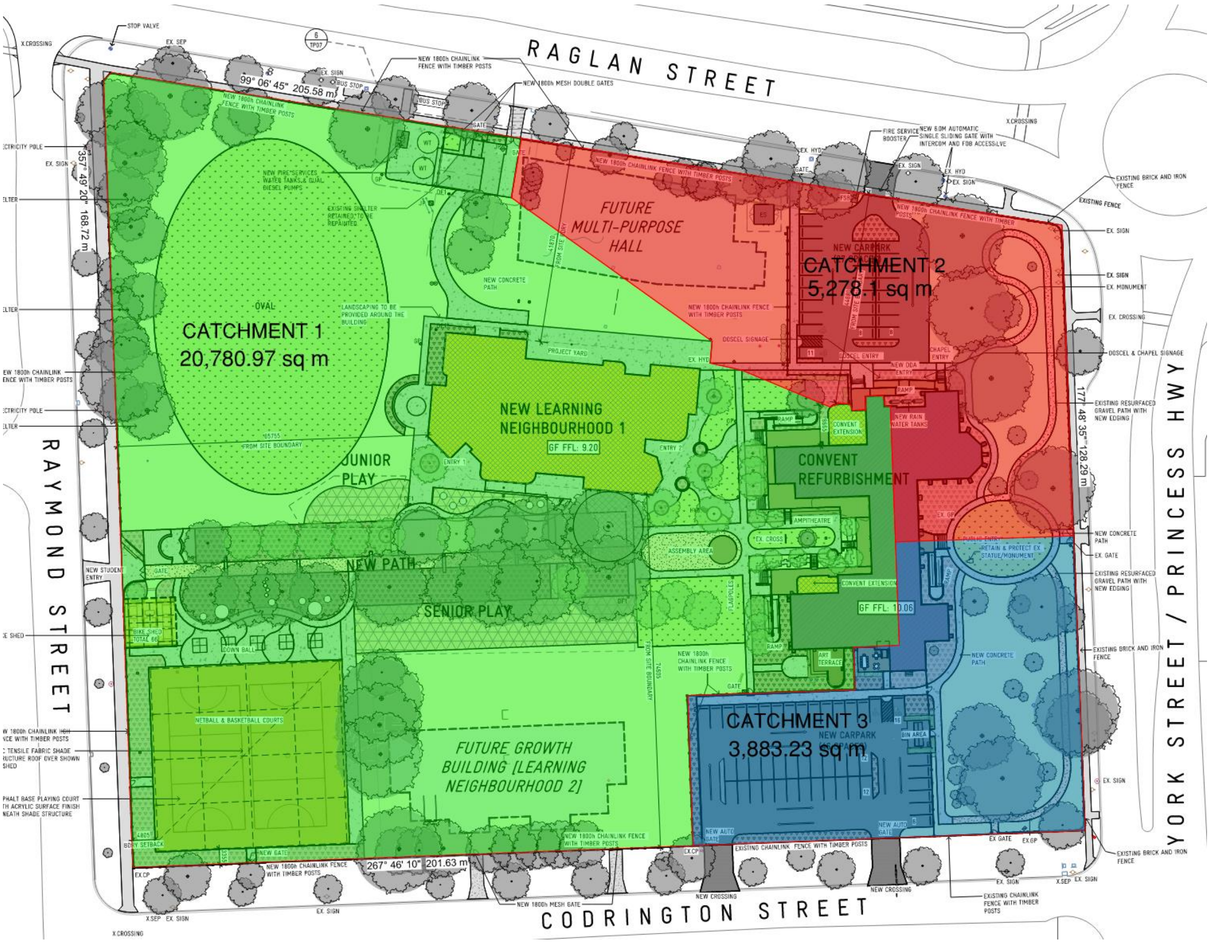


Figure 6 - Catchment Plan

Runoff coefficients for the given rainfall events were based on values for different land uses from the Infrastructure Design Manual (IDM) and the calculation methods outlined in the Australian Rainfall and Runoff guidelines. The following runoff coefficients were used in the rational calculations and MUSIC modelling and can be seen in Table 1 below.

An analysis on impervious areas shows that the impervious areas in the predevelopment scenario is larger than the impervious areas in the post-developed stage. This can be seen in Appendix E. On this basis, it is assumed that the predevelopment runoff from the site is larger than the post-development runoff, therefore, predevelopment runoff calculations have been omitted.

Table 1 - Runoff Coefficients

	Catchment 1	Catchment 2	Catchment 3
Post-development	0.4	0.4	0.7

4.2 RAINFALL

Rainfall Intensity Frequency Duration (IFD) information was obtained from the Bureau of Meteorology website for the subject site. In accordance with the Infrastructure Design Manual (IDM), the 2016 IFD rainfall design information was adopted for the strategy.

4.3 PEAK FLOWS

4.3.1 FLOW CALCULATIONS

The rational method was used to determine the peak 1% and 20% AEP events for the post developed site. The post development flow calculations can be seen in Appendix F. A summary of the three key catchments and post development flows can be seen in Table 2 below. Note, the velocities were calculated based on the average pipe grade of 1:200.

- Catchment 1 – North Catchment to be conveyed to the pits in Raglan Street.
- Catchment 2 – Southwest Catchment to be conveyed to a pit in Raymond Street.
- Catchment 3 – Southeast Catchment to be conveyed to a pit in Codrington Street.

Table 2 - Peak Flows

Peak Flows (m^3/s)	20% AEP (m^3/s)	1% AEP (m^3/s)
Catchment 1	0.240	0.639
Catchment 2	0.076	0.202
Catchment 3	0.059	0.156

5. HYDRAULICS

A more detailed investigation of the pipe design will be undertaken at the detailed design stage. A high-level investigation of the overland flow paths and piped drainage was undertaken to determine the approximate sizing of the pipes.

5.1 LEGAL POINT OF DISCHARGE

RMG applied for a LPOD and received a formal response on the 1st June 2023. The LPOD stated that 'All storm water runoff from roofs, hard standing areas and water tanks is to be discharged into the existing stormwater system located within the property'. RMG has determined that the existing pipe connections to the existing LPODs are undersized based on current design standards. Therefore, further discussion with council is required to determine whether the client would be permitted to upgrade the existing LPOD connections.

Figure 7 – Legal Point of Discharge

5.2 MINOR DRAINAGE SYSTEM (20% AEP EVENT)

Flows less than the 20% AEP event from the developed site will be conveyed via an underground drainage network consisting of pipes and pits around the perimeter and through the development site. This includes runoff collected from the carpark, landscaped areas, paved areas and the proposed building roofs. The minimum approximate size for the minor flows can be seen in Appendix F and Table 2. These sizes are subject to change following detailed design.

Table 2 - Minor Drainage Sizing

Minor Drainage	Catchment 1	Catchment 2	Catchment 3
Design flow (m^3/s) (10% AEP)	0.283	0.074	0.058
Pipe Diameter (mm)	525	375	375
Pipe Grade	1 in 200	1 in 200	1 in 200
Pipe Capacity (m^3/s)	0.304	0.124	0.124

5.3 MAJOR DRAINAGE SYSTEM (1% AEP EVENT)

In the 1% AEP event, overland (gap) flows from the developed area are to be conveyed by the general grading of the site away from buildings towards the surrounding streetscape which then follow natural overland flow paths. The overland flow paths can be seen in figure 8. The site grading will be designed to ensure 300mm of freeboard to the finished floor levels of the proposed buildings. Further investigation is recommended with the flood authority to determine the flood level of the site in the post developed condition.

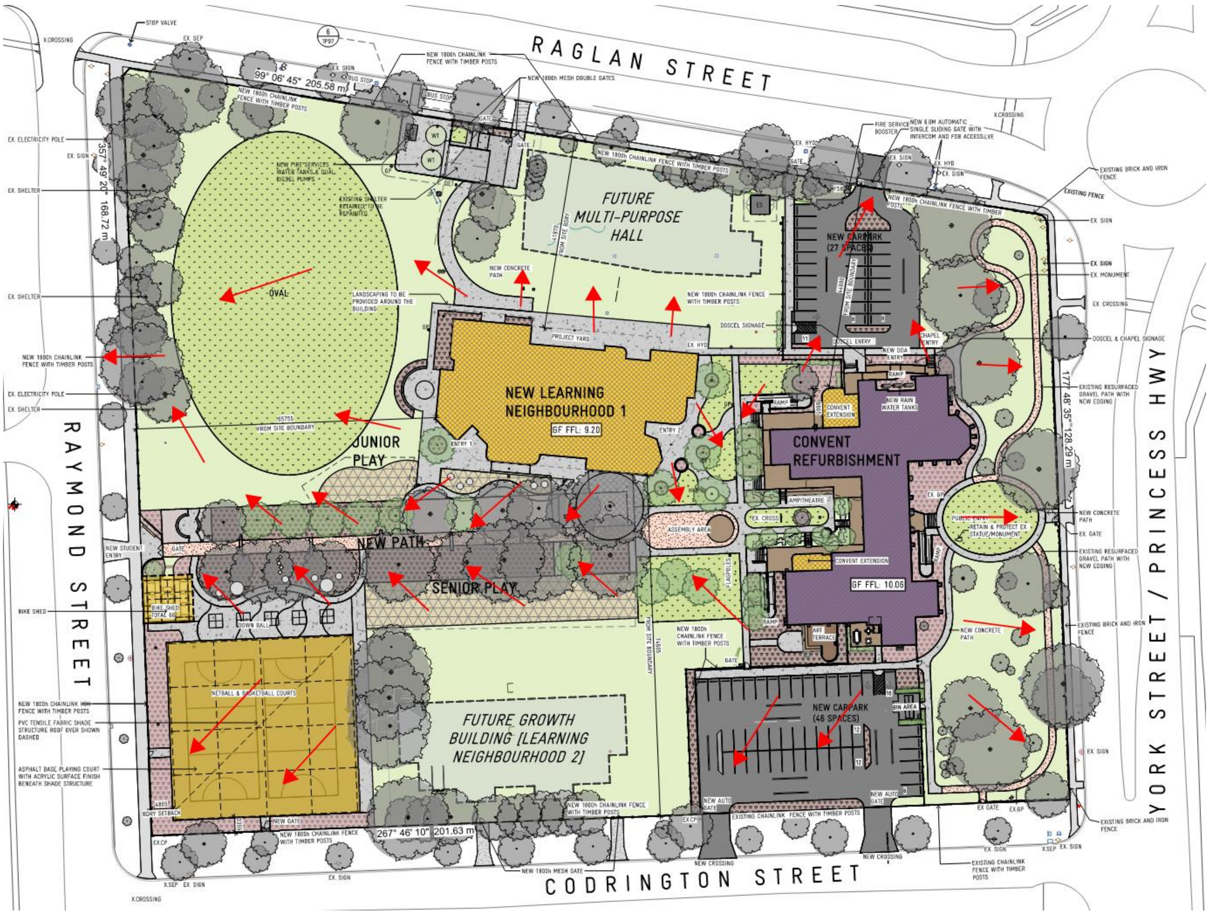


Figure 8 – Overland Flow Paths

5.4 DETENTION STORAGE

An analysis was conducted to determine the runoff coefficient of the site in the predeveloped state, post stage 1 construction and a final masterplan developed state. On this basis, the Swinburne Method of calculation has been used to determine the detention volume required. Both permissible site discharge and storage volume were calculated based on a 10% AEP event.

Firstly, for the predeveloped state, the existing survey mentioned in section 1.3 was used to determine the approximate runoff coefficient of the site in its existing state. The results are shown below:

- Runoff coefficient, C_p = 0.55
- Using the rational method: discharge, Q = 372.63 L/s

For the stage 1 construction, the proposed development has a runoff coefficient less than that of the predeveloped state indicating that the runoff from the site will be less than the existing runoff.

- Runoff coefficient, Stage 1 C_w = 0.48
- Discharge, Q = 325.20 L/s

For the full masterplan developed site, the runoff coefficient has a similar result to the predeveloped state. For this exercise, post development flows will be detained to the discharge calculated for stage 1 above. The results using the Swinburne method of OSD calculation is shown below:

- Runoff coefficient, C_w = 0.55
- Nominated post development permissible site discharge, Q_a = 325.20 L/s
- Storage volume required for above ground storage, V = 102.40 m^3

The results of the calculation show that a ~103m^3 volume is required. Due to the flat nature of the site, both carparks and landscaped area east of the Convent will be considered uncontrolled. The rest of the site will be utilising the existing oval to act as a basin for detention purposes. This will be achieved through the use of an orifice plate installed within a stormwater pit prior to the connection to the nominated LPOD.

6. WATER SENSITIVE URBAN DESIGN

6.1 WATER QUALITY OBJECTIVES

The proposed development is required to meet stormwater quality objectives outlined in the Urban Stormwater – Best Practice Environmental Management Guidelines. The purposes of this guideline are listed in Table 5 below.

Table 5 - Pollution Reduction Targets

Pollutant	Performance Objective
Total Suspended Solids (TSS)	80% retention of the typical urban load
Total Phosphorus (TP)	45% retention of the typical urban load
Total Nitrogen (TN)	45% retention of the typical urban load
Gross Pollutants (GP)	70% retention of the typical urban load

6.2 RAINFALL AND TRANSPIRATION

Melbourne 1959 6-minute rainfall meteorological data was used in accordance with the Infrastructure Design Manual (IDM) and Melbourne Water MUSIC Guidelines.

The evapotranspiration distribution is also provided in the meteorological data provided by Melbourne Water, and the mean annual evapotranspiration is given as 1050mm. The distribution graph is shown in Figure 9 below.

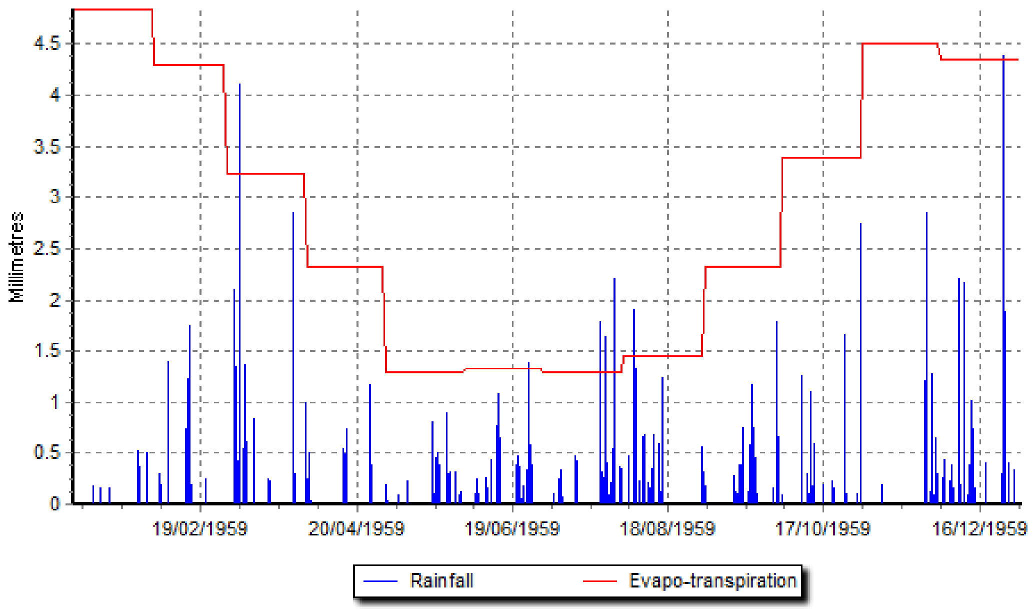


Figure 9 - Rainfall and Evapotranspiration Distribution Graph

Additionally, the soil storage and field capacity are 120mm and 50mm, respectively and pollution concentration data for source node base flows, and storm flows have been adjusted as recommended within the Melbourne Water MUSIC Guidelines.

6.3 TREATMENT

The treatment targets for the site can be achieved through a mixture of raingardens, swales, tree pits and pit basket insert to meet BPEMG reduction targets. This has been modelled in MUSIC using the appropriate treatment nodes. It is to be noted that given the minimal fall across the site, the treatment train may need to be updated in the design development phase as there is a possibility that issues may arise regarding invert levels of the underground stormwater network design.

6.4 MODELLING AND RESULTS

Figure 10 shows the MUSIC model layout. The fraction impervious for each area was based on the areas used for the rational calculations.

The subject site has been separated into three catchments for stormwater design and treatment areas. Catchment 1 will be treated with the use of multiple raingardens and swales around the site. Site grading would allow for surface flows from surrounding surfaces into the nearest treatment unit. Additionally, the detention basin would provide additional treatment when activated and this has been modelled as a bypass flow. Both carparks will be treated through the use of adjacent raingardens prior to the relevant LPOD connection. An additional pit basket will be retrofitted into an existing pit to the southeast to provide minor treatment to the existing runoff on the eastern side of the Convent.

The results of the MUSIC modelling are shown in Figure 11. As shown below, the model achieves the treatment objectives listed in Section 6.1 of this report.

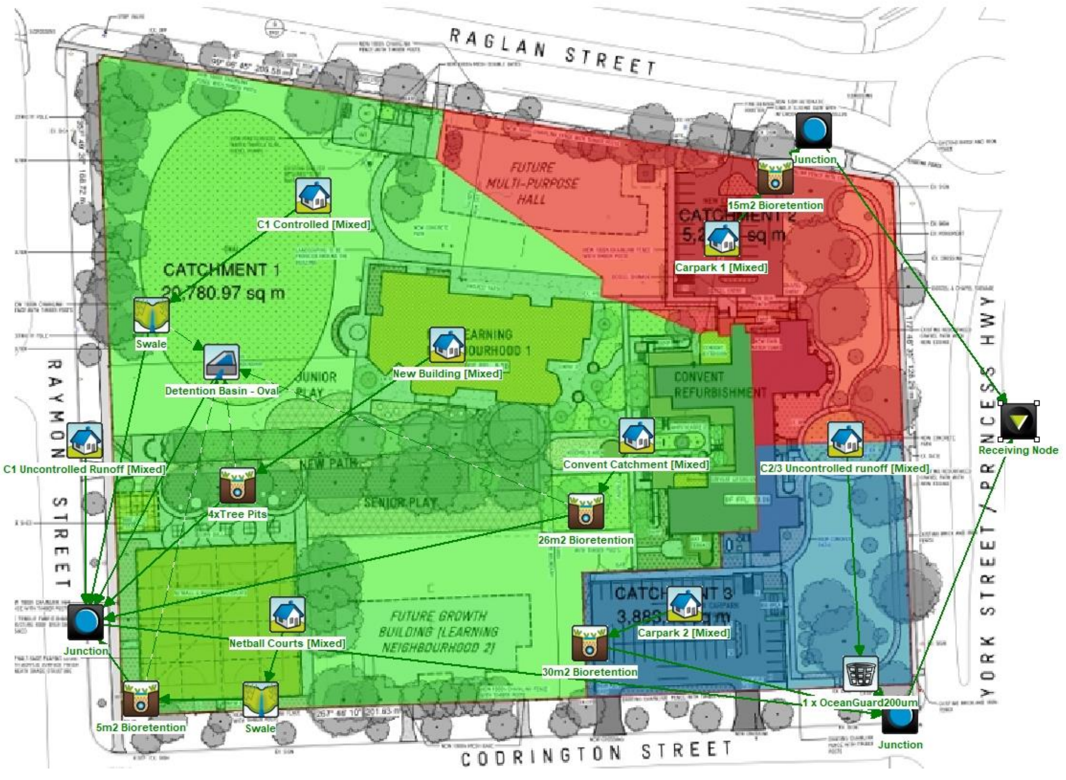


Figure 10 – MUSIC Model Layout

Treatment Train Effectiveness - Receiving Node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	8.58	8.41	2
Total Suspended Solids (kg/yr)	1780	284	84
Total Phosphorus (kg/yr)	3.55	1.55	56.4
Total Nitrogen (kg/yr)	24.1	13.2	45.1
Gross Pollutants (kg/yr)	349	29.3	91.6

Figure 11 – Treatment Train Effectiveness Results

6.5 ALTERNATIVE SOLUTION

Alternatively, the client may be receptive to providing a contribution towards downstream WSUD initiatives with the council drainage network in-lieu of achieving Best Practice reduction targets through the use of onsite treatment strategies.

Further discussion with council will be required for confirmation.

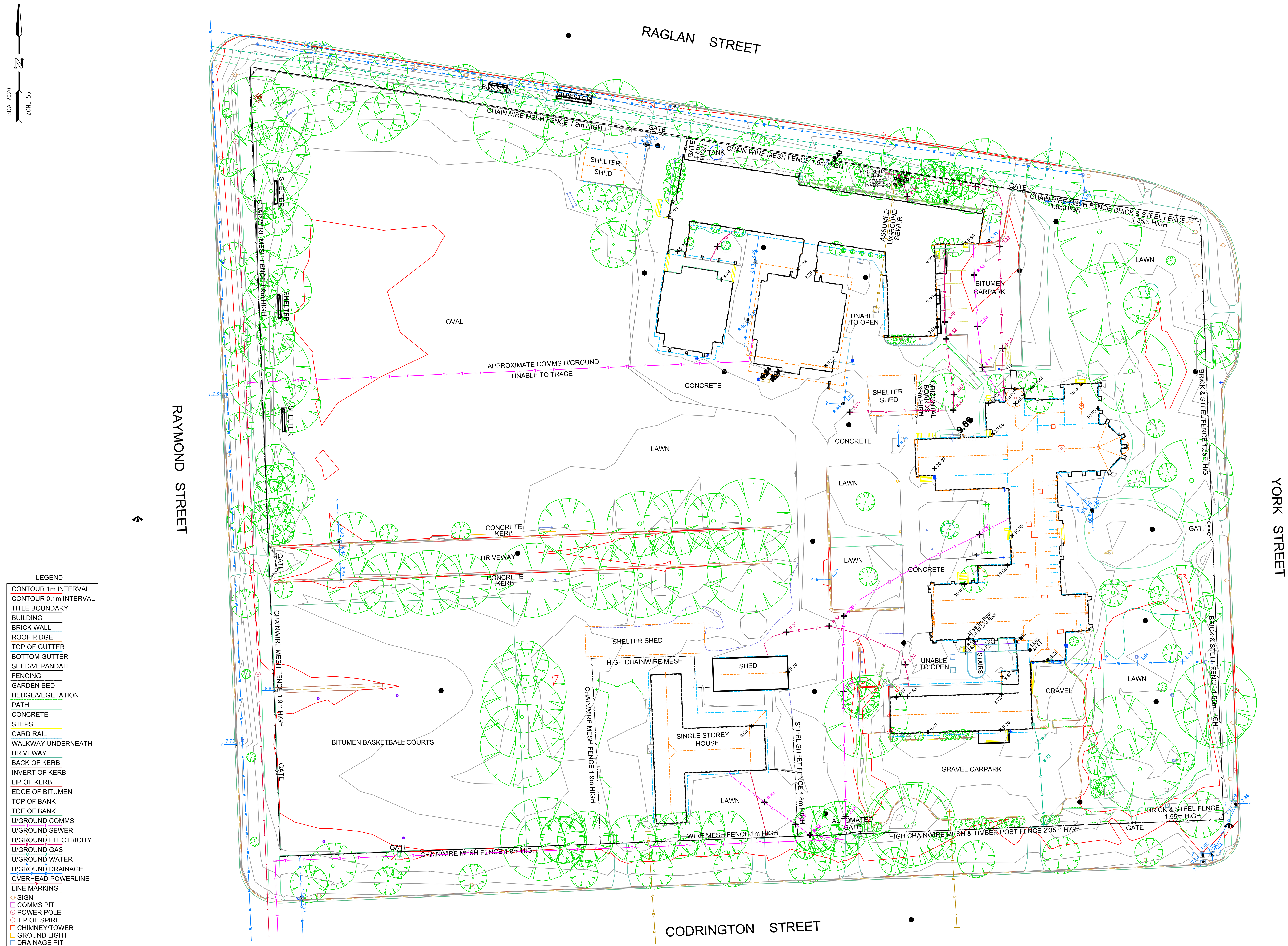
7. SUMMARY/CONCLUSION

As detailed in the above report, the proposed drainage strategy for St Thomas Primary School – Sion Campus is to be as follows:

- Given the existing nature of the site, the catchments shall be split between 3 catchments: northern, southwestern, and southeastern catchment.
- Multiple legal points of discharge is recommended for the site given the minimal fall across the site as well as the state of the existing drainage.
- Proposed development site is not subject to inundation based on planning map overlays.
- The all catchments will connect to the existing pits within the road reserve.
- Minor drainage flows (20% AEP) will be conveyed via underground pipes and pits and connected to the existing pits within the road reserves.
- Overland flows will be conveyed via the internal site grading and discharged to the road reserve where flows will then follow natural overland flow paths.
- The permissible site discharge has been calculated based on the fraction impervious of the site in a predeveloped state versus a post developed state.
- Based on the PSD results, a detention storage will be required. The location will be the existing oval acting as an above ground storage basin. The volume required is 103m^3 in total.
- Calculations at this stage are preliminary and final pipe sizing will be confirmed upon further analysis during the design development stage.
- Regarding stormwater treatment, BPEMG reduction targets will be achieved with the use of a mixture of raingardens, swales and a pit basket insert. The detention would also provide treatment during rain events where the basin is activated.
- An alternative solution to the stormwater treatment can be discussed with council to provide a contribution to downstream WSUD initiatives.

Appendix A

EXISTING SITE LAYOUT & FEATURE SURVEY



LEGEND

- CONTOUR 1m INTERVAL
- CONTOUR 0.1m INTERVAL
- TITLE BOUNDARY
- BUILDING
- BRICK WALL
- ROOF RIDGE
- TOP OF GUTTER
- BOTTOM GUTTER
- SHED/VERANDAH
- FENCING
- GARDEN BED
- HEDGE/VEGETATION
- PATH
- CONCRETE
- STEPS
- GARD RAIL
- WALKWAY UNDERNEATH
- DRIVEWAY
- BACK OF KERB
- INVERT OF KERB
- LIP OF KERB
- EDGE OF BITUMEN
- TOP OF BANK
- TOE OF BANK
- U/GROUND COMMS
- U/GROUND SEWER
- U/GROUND ELECTRICITY
- U/GROUND GAS
- U/GROUND WATER
- U/GROUND DRAINAGE
- OVERHEAD POWERLINE
- LINE MARKING
- SIGN
- COMMS PIT
- POWER POLE
- TIP OF SPIRE
- CHIMNEY/TOWER
- GROUND LIGHT
- DRAINAGE PIT
- SEWER PIT
- HYDRANT
- WATER METER
- WATER TAP
- STOP VALVE
- WATER UNCLASSIFIED
- IRRIGATION
- GAS PIT
- GAS METER
- BOLLARD

SURVEYOR: B.W.
DRAWN: B.W.
CHECKED: S.W.

VER	BY	AMENDMENTS	DATE
B	BW	UPPER FLOOR LEVELS/FENCE HEIGHTS	13/12/22
C	BW	SERVICE LOCATION ADDED	21/02/23
D			
E			

NOTATIONS:

LEVELS ARE TO A.H.D. VIDE SALE PM 280 (R.L. 8.931 VIDE S.M.E.S. 01/12/2022)
CONTOUR INTERVALS AT 0.1 METRES.

FEATURE AND LEVEL PLAN

SION CONVENT
1-23 CODRINGTON STREET
SALE, VIC, 3850

Beveridge Williams
development & environment consultants
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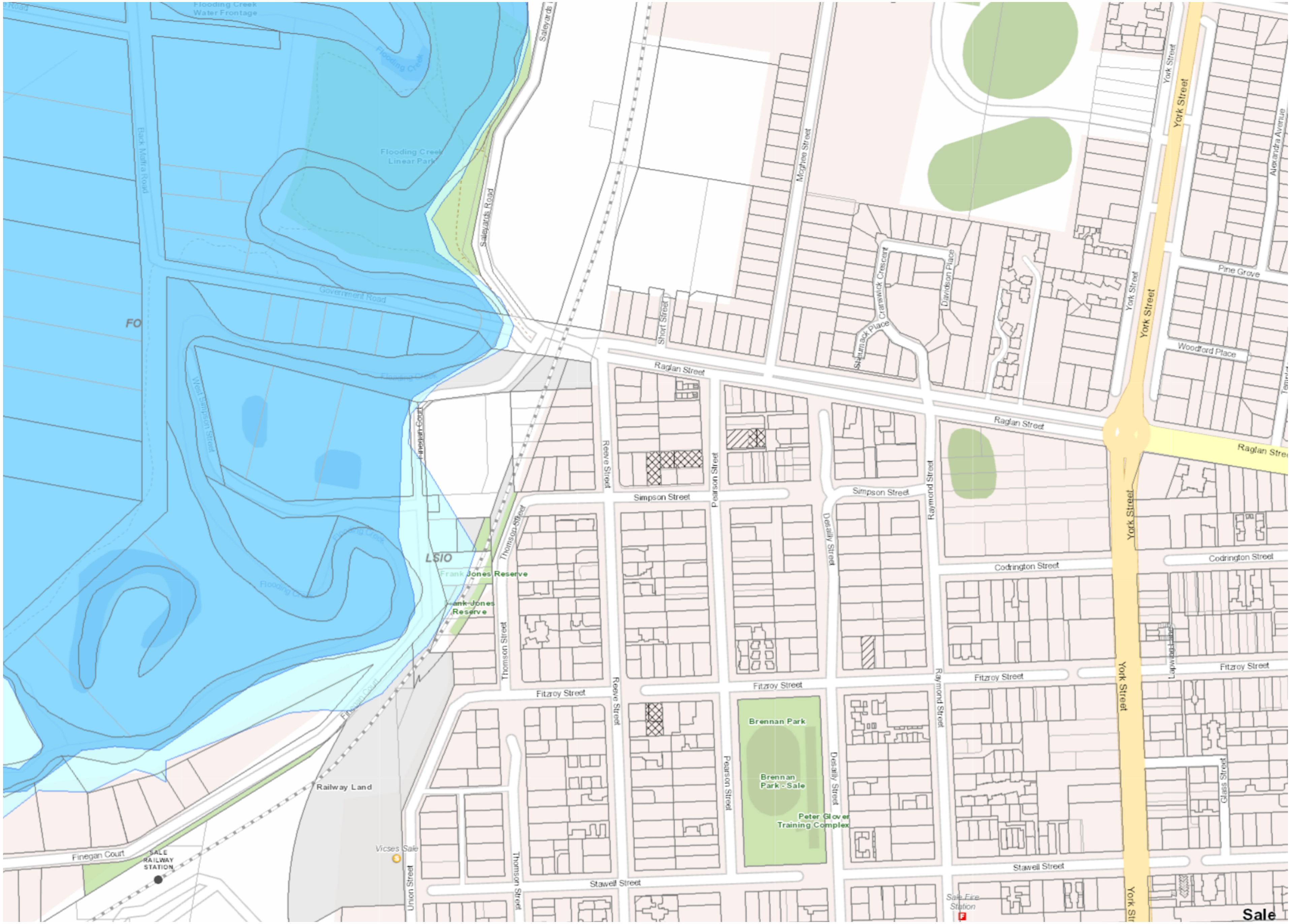
SURVEYORS REF.
2202507
VERSION C
DATE: 21/02/2023
SHEET 1 OF 1

ORIGINAL
SCALE 1:400
SHEET SIZE A1
0 4 8 12 16
LENGTHS ARE IN METRES

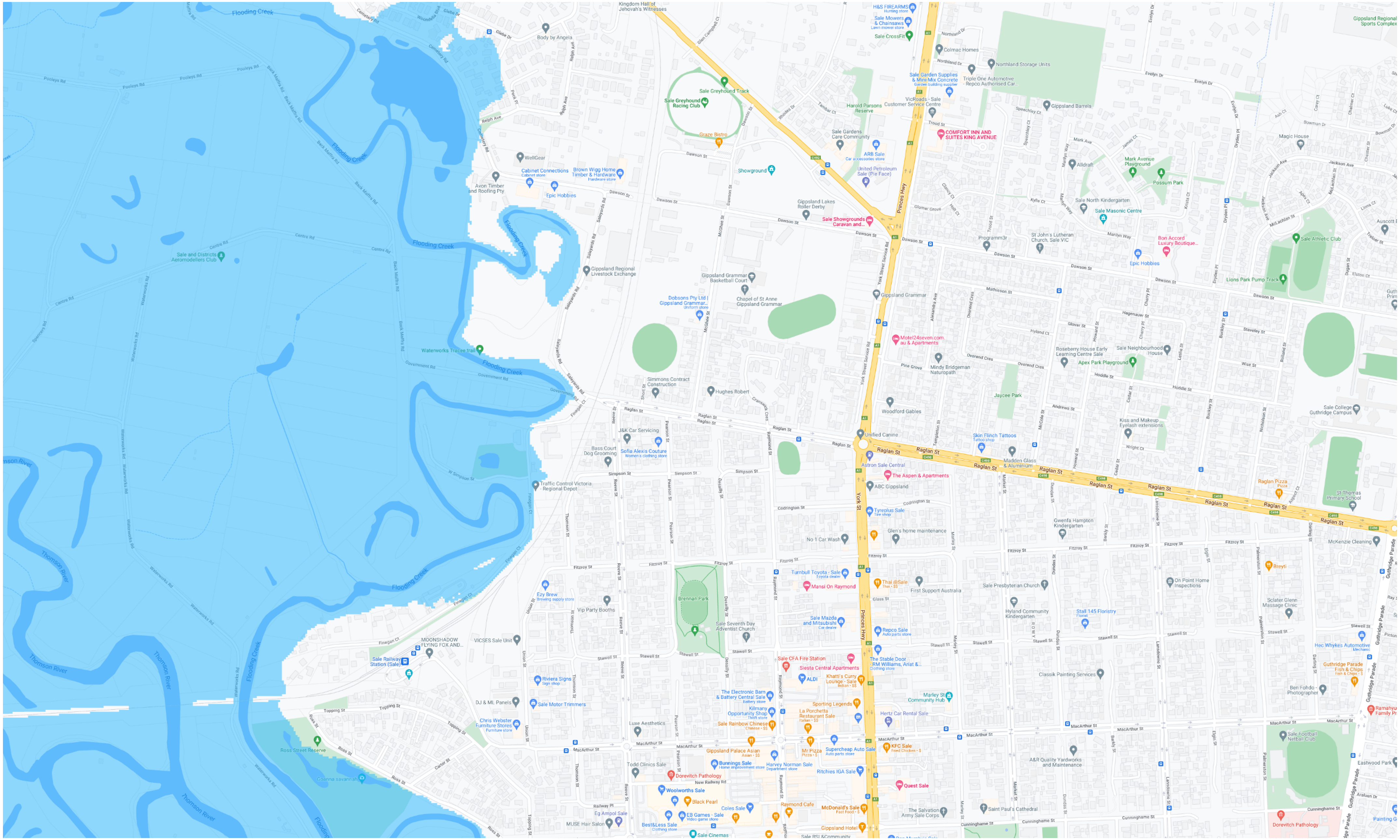
CAD REFERENCE: 2202507-MASTER-3D-Version B.dwg

Appendix B

FLOOD MAP ANALYSIS



Appendix B1 - VicPlan Flood and Land Subject to Inundation Overlays



Appendix B2 - WGCMA Flood and Land Subject to Inundation Overlays

Appendix C

PROPOSED SITE LAYOUT

PROPOSED SITE WORKS LEGEND

	PROJECT SETOUT LOCATION
	EXISTING BUILDINGS
	NEW BUILDING WORK
	REFURBISHMENT WORKS
	NEW SOFTFALL MULCH
	NEW BITUMEN PAVING OR SIMILAR
	NEW CONCRETE PAVING, VARIOUS FINISHES.
	NEW GARDEN BEDS
	NEW GRASSED AREAS
	NEW PERMEABLE PAVED SURFACE.
	EXISTING FENCING
	NEW FENCING
	DENOTES SITE HOARDING. (NOTE: 2.1M HIGH WIRE MESH FENCING).PROVIDE SHADECLOTH TO AREAS. ALLOW TO MODIFY LOCATION OF HOARDINGS AS REQUIRED DURING THE COURSE OF THE WORKS
DF1	DRINKING FOUNTAIN
CP	
FP1	FLAGPOLE
GP	GRATED PIT
HYD.	NEW FIRE HYDRANTS- REFER TO HYDRAULIC ENGINEERS DWG'S
W.M	WATER METER- REFER TO HYDRAULIC ENGINEERS DWG'S
	EXISTING TREES TO BE RETAINED
	PROPOSED TREES- REFER TO LANDSCAPE DWG'S

REVISION	BY	DATE	DESCRIPTION
P1	AS	13/07/2023	ISSUED FOR DISCUSSION
P2		18/08/2023	FINAL REVIEW

Print date: 18/08/2023 3:37:19 PM

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URBAN PLANNING

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Issue: TOWN PLANNING
NOT FOR CONSTRUCTION

Project: ST THOMAS PRIMARY SCHOOL: SION CAMPUS
DESIGN DEVELOPMENT

Title: B0: COVER AND SITE DRAWINGS
PROPOSED SITE PLAN

0 1.0m 5.0m 10.0m

Scale: As indicated@A1
Date: JULY 2023
Drawn: AS
Checked: DK
Project: 2201
File: A_2201_ST THOMAS_S_C_2022.rvt
Drawing: TP03 P2

Appendix D

DEMOLITION PLAN

DEMOLITION LEGEND

- REMOVE EXISTING GRAVEL, TOPSOIL ETC TO PREPARE FOR NEW WORK
- REMOVE EXISTING BITUMEN PAVING
- DEMOLISH EXISTING LAWN/ GARDEN BED
- DEMOLISH EXISTING TILED/BRICK PAVING
- DEMOLISH EXISTING CONCRETE PAVING
- EXISTING BUILDINGS TO BE RETAINED
- EXISTING BUILDINGS TO BE REFURBISHED (REFER TO DEMOLITION FLOOR PLAN FOR ADDITIONAL DETAILS)
- EXISTING BUILDING TO BE DEMOLISHED
- EXISTING TREES TO BE RETAINED
- EXISTING TREES TO BE DEMOLISHED
- DENOTES SITE HOARDING. (NOTE: 2.1M HIGH WIRE MESH FENCING).PROVIDE SHADECLOTH TO AREAS AS DIRECTED. ALLOW TO MODIFY LOCATION OF HOARDINGS AS REQUIRED DURING THE COURSE OF THE WORKS
- DENOTES TREE PROTECTION ZONE (TPZ).

X.FH	EXISTING FIRE HYDRANT	X.CP	EXISTING COMMS PIT
X.GP	EXISTING GRATED PIT	X.DP	EXISTING DRAINAGE PIT
X.JP	EXISTING JUNCTION PIT	X.MH	EXISTING SEWER MAIN HOLE
X.SEP	EXISTING SIDE ENTRY PIT	X.SIGN	EXISTING SIGNAGE
X.S	EXISTING SEWER	X.EP	EXISTING ELECTRICAL PITS
X.WT	EXISTING WATER TAP		
	FOOTING INSPECTION		BOREHOLE

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL, LANDSCAPE AND CONSULTANTS DRAWINGS AND THE SPECIFICATION FOR THE FULL SCOPE OF DEMOLITION WORKS.
2. MAKE GOOD ALL PAVING OR LANDSCAPING SURFACES AFTER DEMOLITION TO MATCH EXISTING ADJOINING OR TO SUIT THE NEW FINISH AS SCHEDULED OR AS REQUIRED.
3. TERMINATE, CUT, SEAL AND REMOVE ALL DISUSED SERVICES. DEMOLISH AND REMOVE FROM SITE, UNLESS OTHERWISE NOTED,
4. ANY REMOVED MATERIALS ARE TO BE DISPOSED OF, OFF SITE BY THE BUILDER UNLESS NOTED OTHERWISE.
5. ELECTRICAL SERVICES (EG. SUBMAINS / SUB CIRCUITS) ARE TO BE INSTALLED / RECONNECTED AS NECESSARY TO ALLOW THE CONTINUED OPERATION OF ALL EXISTING SERVICES IN THE ADJOINING AREAS - REFER TO SERVICES ENGINEERS DOCUMENTS FOR FULL EXTENT OF WORKS
6. NO EXCAVATION OR EARTH COMPACTION IN TREE ROOT ZONES (EXCLUDES AREA REQUIRED FOR CONSTRUCTION OF RETAINING WALLS & PAVING), CHECK EXTENT (DRIP LINE) ON SITE.
7. MAINTAIN EXISTING EXIT PATHS - WHERE NECESSARY PROVIDE SAFE TEMP ACCESS, CONFIRM WITH THE SUPERINTENDENT PROPOSED SAFE ROUTE OF TRAVEL
8. NO EXCAVATION OR EARTH COMPACTION IN TREE ROOT ZONES (EXCLUDES ARE REQUIRED FOR CONSTRUCTION OF RETAINING WALLS & PAVING) CHECK EXTENT (DRIP LINE) ON SITE. REMOVE BRICK PAVERS IN THIS ZONE BY HAND (IFF APPLICABLE)
9. EXISTING CROSSOVERS NOTE- DELETE IF NOT APPLICABLE
10. EXISTING IRRIGATION ACCESS- DELETE IF NOT APPLICABLE
11. CONTRACTORS ACCESS NOTE- DELETE IF NOT APPLICABLE
12. EXISTING SERVICES TO MOVED RELOCATABLES TO BE RECONNETCED- DELETE IF NOT APPLICABLE

REVISION	BY	DATE	DESCRIPTION
A	AS	05/05/2023	ISSUE TO QS
B	AS	12/05/2023	ISSUE TO CONSULTANTS
C	AS	19/05/2023	ISSUE TO CONSULTANTS
D	AS	31/05/2023	ISSUE FOR COST PLAN C
E	AS	09/06/2023	ISSUE TO CONSULTATNS

1 / 207 EXISTING SITE PLAN
SCALE 1 : 500

Print date: 9/06/2023 4:30:26 PM

ARCHITECTURE
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Issue: TOWN PLANNING
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Project: ST THOMAS PRIMARY SCHOOL: SION CAMPUS
DESIGN DEVELOPMENT

Title: B0: COVER AND SITE DRAWINGS
EXISTING / DEMO SITE PLAN

0 5.0m 25.0 50.0 m

Scale: 1:500 @ A1
Date: JUNE 2023
Drawn: AS
Checked: DK
Project: 2201
File: A_2201_ST THOMAS_S_C_2022.rvt
Drawing: 201 E

Appendix E

CATCHMENT ANALYSIS

PROPOSED SITE WORKS LEGEND

- PROJECT SETOUT LOCATION
- EXISTING BUILDINGS
- NEW BUILDING WORK
- REFURBISHMENT WORKS
- NEW SOFTFALL MULCH
- NEW BITUMEN PAVING OR SIMILAR
- NEW CONCRETE PAVING, VARIOUS FINISHES.
- NEW GARDEN BEDS
- NEW GRASSED AREAS
- NEW PERMEABLE PAVED SURFACE.
- EXISTING FENCING
- NEW FENCING
- DENOTES SITE HOARDING. (NOTE: 2.1M HIGH WIRE MESH FENCING) PROVIDE SHADECLOTH TO AREAS. ALLOW TO MODIFY LOCATION OF HOARDINGS AS REQUIRED DURING THE COURSE OF THE WORKS
- DF1 DRINKING FOUNTAIN
- CP
- FP1 FLAGPOLE
- GP GRATED PIT
- HYD. NEW FIRE HYDRANTS- REFER TO HYDRAULIC ENGINEERS DWG'S
- W.M WATER METER- REFER TO HYDRAULIC ENGINEERS DWG'S
- EXISTING TREES TO BE RETAINED
- PROPOSED TREES- REFER TO LANDSCAPE DWG'S

REVISION	BY	DATE	DESCRIPTION
P1	AS	13/07/2023	ISSUED FOR DISCUSSION
P2		18/08/2023	FINAL REVIEW

Print date: 18/08/2023 3:37:19 PM

ARCHITECTURE
INTERIOR DESIGN
URBAN PLANNING

Y2 ARCHITECTURE
www.y2architecture.com.au
MELBOURNE: 466 malvern road prahran victoria 3181 t 03 9510 7860 f 03 9521 1464
BENDIGO: 5/41-43 mundy street (PO Box 660) bendigo victoria 3550 t 03 5407 2130 f 03 9521 1464

Issue: TOWN PLANNING
NOT FOR CONSTRUCTION

Project: ST THOMAS PRIMARY SCHOOL: SION CAMPUS
DESIGN DEVELOPMENT

Title: B0: COVER AND SITE DRAWINGS
PROPOSED SITE PLAN

5.00 m

Scale: As indicated@A1
Date: JULY 2023
Drawn: AS
Checked: DK
Project: 2201
File: A_2201_ST THOMAS_S_C_2022.rvt
Drawing: TP03 P2

Appendix F

HYDRAULIC AND HYDROLOGIC CALCULATIONS

Client	Y2 Architecture
Project Name	St Thomas Sion Primary School
Date	25/08/2023
Designed	E.Ringor
Checked	
Title	Fraction Impervious and C values for Post Developed Catchments

Catchment	FI	Description
Type 1	0.70	LDRZ

	Area (ha)					1 in 100 year	1 in 5 year	
Catchment	**Type 1**	**Type 2**	**Type 3**	**Total**	**Fraction Impervious (FI)**	**C1%**	**C20%**	**C?**
Catchment 1	2.0781			2.0781	0.700	0.805	0.637	
Catchment 2	0.5278			0.5278	0.700	0.805	0.637	
Catchment 3	0.3883			0.3883	0.700	0.805	0.637	

Client: Y2 Architecture
Project Name: St Thomas Sion Primary School
Date: 25/08/2023
Designed: E.Ringor
Checked
Title Predevelopment Flow Peak Discharge Approximation Estimation

AR&R - Strict Rational Method with Adams Tc

$Q = C_{100}I_{100}A/3.6$

$C_{100} = C_{10}F_{100}$

$t_c = 0.76A\text{^}0.38$

$I_{tc100} = [\exp(C0 + C1(\ln(tc)) + C2(\ln(tc))^2 + C3(\ln(tc))^3 + C4(\ln(tc))^4 + C5(\ln(tc))^5 + C6(\ln(tc))^6]/(tc/60)$

		Developed	Rural
AEP	ARI	Fy	Fy
0.632	1	0.8	0.8
0.2	4.48	0.95	0.9
0.1	10	1	1
0.05	20	1.05	1.1
0.02	50	1.15	1.2
0.01	100	1.2	1.3

Coefficients	1% AEP	20% AEP
C0	1.5623	0.8156
C1	0.7771	0.7295
C2	-0.0042	0.0753
C3	-0.0148	-0.0606
C4	-0.0009	0.0105
C5	0.0005	-0.0007
C6	-3.32E-05	0.0000

Rural Runoff Coefficient	
C10	0.15

Source AR&R Vol 2 Fig 5.3

Rural Runoff Estimate (1% AEP)			
Catchment	1	2	3
$C_{1\%}$	0.805	0.805	0.805
Area (ha)	2.0781	0.5278	0.3883
tc (hr)	0.17	0.10	0.09
tc (mins)	10.46	6.22	5.53
$I_{tc1\%}$ (mm/hr)	137.47	171.52	179.17
$Q_{1\%}$ (m3/s)	0.639	0.202	0.156

Rural Runoff Estimate (20% AEP)			
Catchment	1	2	3
$C_{20\%}$	0.637	0.637	0.637
Area (ha)	2.0781	0.5278	0.3883
tc (hr)	0.17	0.10	0.09
tc (mins)	10.46	6.22	5.53
$I_{tc20\%}$ (mm/hr)	65.17	81.52	85.14
$Q_{20\%}$ (m3/s)	0.240	0.076	0.059

Client:	Y2 Architecture
Project Name:	St Thomas Sion Primary School
Date:	25/08/2023
Designed:	E.Ringor
Checked	
Title	Post Development Flow Calculations

http://www.bom.gov.au/water/designRainfalls/revised-ifd/

AEP %	ARI
63.20%	1
50%	1.44
20%	4.48
10%	10
5%	20
2%	50
1%	100

Coefficient	63.20%	50%	20%	10%	5%	2%	1%
C0	0.30248243	0.444939	0.8156454	1.0231836	1.2030779	1.4151798	1.5622946
C1	0.75717741	0.745218	0.7294774	0.7255007	0.7262424	0.747868	0.7771126
C2	0.05739787	0.067284	0.0753348	0.0745269	0.0688612	0.036372434	-0.004172016
C3	-0.06149208	-0.06316	-0.0605617	-0.057238	-0.0523285	-0.03499849	-0.014750074
C4	0.01262626	0.012349	0.0104665	0.0091759	0.0077013	0.003617357	-0.000933532
C5	-0.00106607	-0.00099	-0.0006966	-0.0005276	-0.0003539	7.06E-05	0.000531607
C6	3.22E-05	2.77E-05	1.42E-05	6.92E-06	-7.83E-08	-1.60E-05	-3.32E-05

IFD Design Rainfall Coefficients				
Issued:	14-Nov-22			
Location Label:				
Requested coordinate:	Latitude	-36.1174	Longitude	144.7397
Nearest grid cell:	Latitude	36.1125	Longitude	144.7375

Velocities calculated with average slope of site 1 in 150

Urban ARI Drainage Calculations - Developed Catchment

Catchment	Description	Area (ha)	ξ Area (ha)	C1%	C20%	Ae 1% (ha)	ξ Ae 1% (ha)	Ae 20% (ha)	ξ Ae 20% (ha)	Flow Length (m)	Velocity 1% (m/s)	Velocity 20% (m/s)	Tc 1% (mins)	Tc 20% (mins)	Int 1% (m^3/s)	Int 20% (m^3/s)	Q 1% (m^3/s)	Q 20% (m^3/s)	Q gap (m^3/s)	Comments
Catchment 1		2.0781	2.0781	0.805	0.637	1.672	1.672	1.324	1.324	185	0.6	1.40	10.14	7.19	139.50	76.93	0.648	0.283	0.365	
Catchment 2		0.5278	0.5278	0.805	0.637	0.425	0.425	0.336	0.336	120	0.6	1.12	8.33	6.78	152.26	78.79	0.180	0.074	0.106	
Catchment 3		0.3883	0.3883	0.805	0.637	0.312	0.312	0.247	0.247	53	0.6	1.12	6.47	5.79	168.86	83.75	0.147	0.058	0.089	

Client: Y2 Architecture
Project Name: St Thomas Sion Primary School
Date: 25/08/2023
Designed: E.Ringor
Checked
Title: Minor Drainage Calculation

Note: Average grade of catchment approx 1 in 120
For calculations assume grade of 1 in 200

RMG

Pipe Name	Design Flow m^3/s	Pipe Type	n	Pipe Diameter mm	Grade 1 in	Grade	Area m^2	Velocity m^2/s	Flow m^3/s	Flow Diff. m^3/s
Catchment 1	0.283	RCP	0.013	525	200	0.0050	0.216	1.405	0.304	-0.021
Catchment 2	0.074	RCP	0.013	375	200	0.0050	0.110	1.123	0.124	-0.050
Catchment 3	0.058	RCP	0.013	375	200	0.0050	0.110	1.123	0.124	-0.066

STORMWATER DETENTION V5.04 RMG (Aus) Pty Ltd

Location: **Melbourne, VIC (Copy)**
Site: **30678m² with tc = 12 and tcs = 5 mins.**
PSD: **AEP of 10%, Custom specified PSD = 325.20L/s**
Storage: **AEP of 10%, Refer table for above, pipe and underground tank options**

Design Criteria

(Custom AEP IFD data used)

Location = Melbourne, VIC (Copy)
Method = E (A)RI 2001,A(E)P 2019

PSD annual exceedance probabiliy (APE) = 10 %
Storage annual exceedance probabiliy (APE) = 10 %

Storage method = C (A)bove,(P)ipe,(U)nderground,(C)ustom
Permissible site discharge (Qu=Custom) = 325.200 L/s

Site Geometry

Site area (As) = 30678 m² = 3.0678 Ha
Pre-development coefficient (Cp) = 0.55
Post development coefficient (Cw) = 0.55

Total catchment (tc) = 12 minutes
Upstream catchment to site (tcs) = 5 minutes

Coefficient Calculations

Pre-development

Zone	Area (m²)	C	Area * C
Concrete	0	0.90	0
Roof	15464	0.90	13918
Gravel	0	0.90	0
Garden	15214	0.20	3043
Total	30678 m²		16960

Cp = ΣArea*C/Total = 0.553

Post development

Zone	Area (m²)	C	Area * C
Concrete	3146	0.90	2831
Roof	7259	0.90	6533
Gravel	4953	0.90	4458
Garden	15320	0.20	3064
Total	30678 m²		16886

Cw = ΣArea*C/Total = 0.550

Permissible Site Discharge (PSD) (AEP of 10%)

PSD Intensity (I) = 79.5 mm/hr For catchment tc = 12 mins.
Pre-development (Qp = Cp*I*As/0.36) = 372.63 L/s
Peak post development (Qa = 2*Cw*I*As/0.36) = 745.26 L/s =(9.374 x I) Eq. 2.24

Storage method = C (A)bove,(P)ipe,(U)nderground,(C)ustom
Permissible site discharge (Qu = PSD) = 325.200 L/s

Above ground - Eq 3.8

0 = PSD² - 2*Qa/tc*(0.667*tc*Qp/Qa + 0.75*tc+0.25*tcs)*PSD + 2*Qa*Qp
Taking x as = PSD and solving
a = 1.0 b = -1770.2 c = 555413.7
PSD = -b±√(b²-4ac)/(2a)
PSD = 407.600 L/s

Below ground pipe - Eq 3.3

Qp = PSD*[1.6*tcs/{tc*(1-2*PSD/(3*Qa))}-0.6*tcs^2.67/{tc*(1-2*PSDp/(3*Qa))}^2.67]
= 372.63
PSD = 428.212 L/s

Below ground rectangular tank - Eq 3.4

t =tcs/(tc*(1-2*PSD/(3*Qa))) = 0.667
Qp = PSD*[0.005-0.455*t+5.228*t²-1.045*t³-7.199*t⁴+4.519*t⁵]
= 372.63
PSD = 419.282 L/s

Design Storage Capacity (AEP of 10%)

Above ground (Vs) = [0.5*Qa*td-[(0.875*PSD*td)(1-0.917*PSD/Qa)+(0.427*td*PSD²/Qa)]]*60/10³ m³ — Eq 4.23
Below ground pipe (Vs) = [(0.5*Qa-0.637*PSD+0.089*PSD²/Qa)*td]*60/10³ m³ — Eq 4.8
Below ground rect. tank (Vs) = [(0.5*Qa-0.572*PSD+0.048*PSD²/Qa)*td]*60/10³ m³ — Eq 4.13

td (mins)	I (mm/hr)	Qa (L/s)	Above Vs (m³)	Pipe Vs (m³)	B/G Vs (m³)
5	113.2	1061.0	85.01	99.67	104.79
7	100.6	942.8	96.17	115.18	122.13
8	95.4	894.2	99.34	120.24	128.05
9	90.8	851.0	101.29	123.87	132.53
10	86.6	812.1	102.24	126.30	135.78
11	82.9	777.1	102.35	127.71	137.98
12	79.5	745.3	101.77	128.24	139.27
13	76.4	716.2	100.61	128.00	139.77
14	73.6	689.6	98.98	127.10	139.58
15	71.0	665.2	96.95	125.63	138.78

Table 1 - Storage as function of time for AEP of 10%

Type	td (mins)	I (mm/hr)	Qa (L/s)	Vs (m³)
Above	10.7	84.0	787.2	**102.40**
Pipe	12.3	78.5	736.3	**128.24**
B/ground	5.1	112.5	1054.3	**105.86**

Table 2 - Storage requirements for AEP of 10%

Frequency of operation of Above Ground storage

Qop2 = 0.75 Cl 2.4.5.1
Qp2 =Qop2*Qp1 (where Qp1=PSD) = 243.90 L/s at which time above ground storage occurs
I = 360*Qp2/(2*Cw*As*10³) = 26.0 mm/h — Eq 4.24

Period of Storage

Time to Fill:

Above ground (tf) = td*(1-0.92*PSD/Qa) — Eq 4.27
Below ground pipe (tf) = td*(1-2*PSD/(3*Qa)) — Eq 3.2
Below ground rect. tank (tf) = td*(1-2*PSD/(3*Qa)) — Eq 3.2

Time to empty:

Above ground (te) = (Vs+0.33*PSD²*td/Qa*60/10³)*(1.14/PSD)*(10³/60) — Eq 4.28
Below ground pipe (te) = 1.464/PSD*(Vs+0.333*PSD²*td/Qa*60/10³)*(10³/60) — Eq 4.32
Below ground rect. tank (te) = 2.653/PSD*(Vs+0.333*PSD²*td/Qa*60/10³)*(10³/60) — Eq 4.36

Storage period (Ps = tf + te) — Eq 4.26

Type	td (mins)	Qa (L/s)	Vs (L/s)	tf (mins)	te (mins)	Ps (mins)
Above	10.7	787.2	102.4	6.6	7.6	14.3
Pipe	12.3	736.3	128.2	8.7	12.3	20.9
B/ground	5.1	1054.3	105.9	4.1	15.8	19.8

Table 3 - Period of Storage requirements for AEP of 10%

Orifice

Permissible site discharge (Qu=PSD) = 325.20 L/s (Custom PSD)
Orifice coefficient (CD) = 0.61 For sharp circular orifice
Gravitational acceration (g) = 9.81 m/s²
Maximum storage depth above orifice (H) = 400 mm
Orifice flow (Q) = CD*Ao*√(2*g*H)

Therefore:
Orifice area (Ao) = 190301 mm²
Orifice diameter (D = √(4*Ao/π)) = 492.2 mm