NEAPEAN SPECIALIST MEDICAL CENTRE & SUITES

84-88 Parker Street, Kingswood

Site Based Stormwater Management Report

Cornerstone Building Developments

19 December 2018

Document Verification

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Approval for Issue

Name	Signature	Date
Matthew Brown		19 December 2018
Justin Hill		19 December 2018

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EXECUTIVE SUMMARY

ADG Engineers (Aust.) Pty Ltd has been engaged by Cornerstone Building Developments to produce a Site Based Stormwater Management Design and Report suitable for submission to Penrith Council for a site located at 84-88 Parker Street, Kingswood. The proposed development is for a new commercial building containing medical consultation suites, a basement carpark and access to the existing on grade carpark adjacent to the site as described by the Aspect architectural drawings dated 22nd May 2018.

The report comprises of stormwater quantity and quality assessments. The quantity assessment is undertaken to confirm a 'non-worsening' of peak flow discharges from the site and the quality assessment is undertaken to determine the required stormwater treatment measures to be implemented on site.

ADG have determined that development of the site results in an increase in the impervious area. As such, on-site detention measures will be required. An On-Site Detention tank of 1.18m^3 volume was found to be sufficient to mitigate flows to predevelopment levels.

In accordance with the Penrith Development Control Plan 2014 Section C3 Water Management it is required to remove from site stormwater discharge of gross pollutants, suspended solids, nitrogen and phosphorus to target reduction levels. To this end, the following Stormwater Quality Improvement Devices are proposed:

- 2x EnviroPods; and
- 5x 690mm PSorb Stormfilter cartridges.

All relevant standards and guidelines are addressed in this Stormwater Management Plan including criteria from the Penrith City Council WSUD Technical Guidelines, Version 1 (Dec 2013). The required infrastructure will be subject to the conditions attached to the Development Approval to be provided by Penrith Council.

1 INTRODUCTION

1.1 General

ADG Engineers (Aust.) Pty Ltd has been engaged by Cornerstone Building Developments to carry out a Site Based Stormwater Management Report suitable for submission to Penrith Council for a site located at 84-88 Parker Street, Kingswood. The proposed development is for a new commercial building containing medical consultation suites, a basement carpark and access to the existing on grade carpark adjacent to the site as described by the Aspect architectural drawings dated 22nd May 2018.

The purpose of this Site Based Stormwater Management Report is to provide advice as to the development proposal detailed in the Aspect Architecture architectural drawings in **Appendix A**. The works described herein are subject to further approvals and cover works required to service the proposed development with regard to stormwater management.

1.2 Background Information

This report was compiled using information from the following sources:

- 'Dial Before You Dig' (DBYD) As-Constructed information;
- Council Mandatory On-Site Detention (OSD) Mapping (Refer to **Appendix E**);
- Detailed survey plan prepared by Freeburn Surveying (Refer to **Appendix B**);
- Architectural drawings by Aspect Architecture (Refer to **Appendix A**); and
- Google Maps Aerial Imagery.

1.3 Property Detail

The site is located in Kingswood, NSW. The north and east side of the site is bound by an existing carpark, the west side of the site is bound by Parker Street and the south side is bound by Barber Avenue. The existing land titles that make up the site are given in **Table 1**. Refer to the architectural drawings in **Appendix A** for further details. **Figure 1** displays the locality of the subject site.

Table 1 – Property Detail

Title	Lot 4, 5 and 6 on DP29524
Street Address	84-88 Parker Street, Kingswood, NSW 2747
Area of Proposed Development	1,964m^2

Figure 1 - Site Location (As accessed from Google Maps 18.06.2018)

1.4 Existing Site Features

The subject site falls in a south-west direction to an existing low point within the roadway at the corner of Parker St and Barber Street at an approximate grade of 4.5%. The existing high point on the site is 52.51m AHD located in the north-eastern corner of the site, with the existing low point of 50.23m AHD located in the south-western corner of the site.

The total site area is 0.1964ha. The Great Western Highway is located 50m north of the proposed site. The predeveloped site consists of an existing sealed carpark area and what would have once been a landscape buffer around its perimeter. Based on our observations whilst on site it is apparent that a noticeable part of the landscape area is being used for parking with the area being unvegetated and heavily compacted to the point of holding water. As such, for the purposes of stormwater design, this area it was intended that the site be assessed as being impervious area. However, after receiving Council advice that the carpark area was only approved as a temporary construction the catchment has been modelled as though it was residential in nature.

The areas of over-parking and other existing site features can be seen in **Figure 2.**

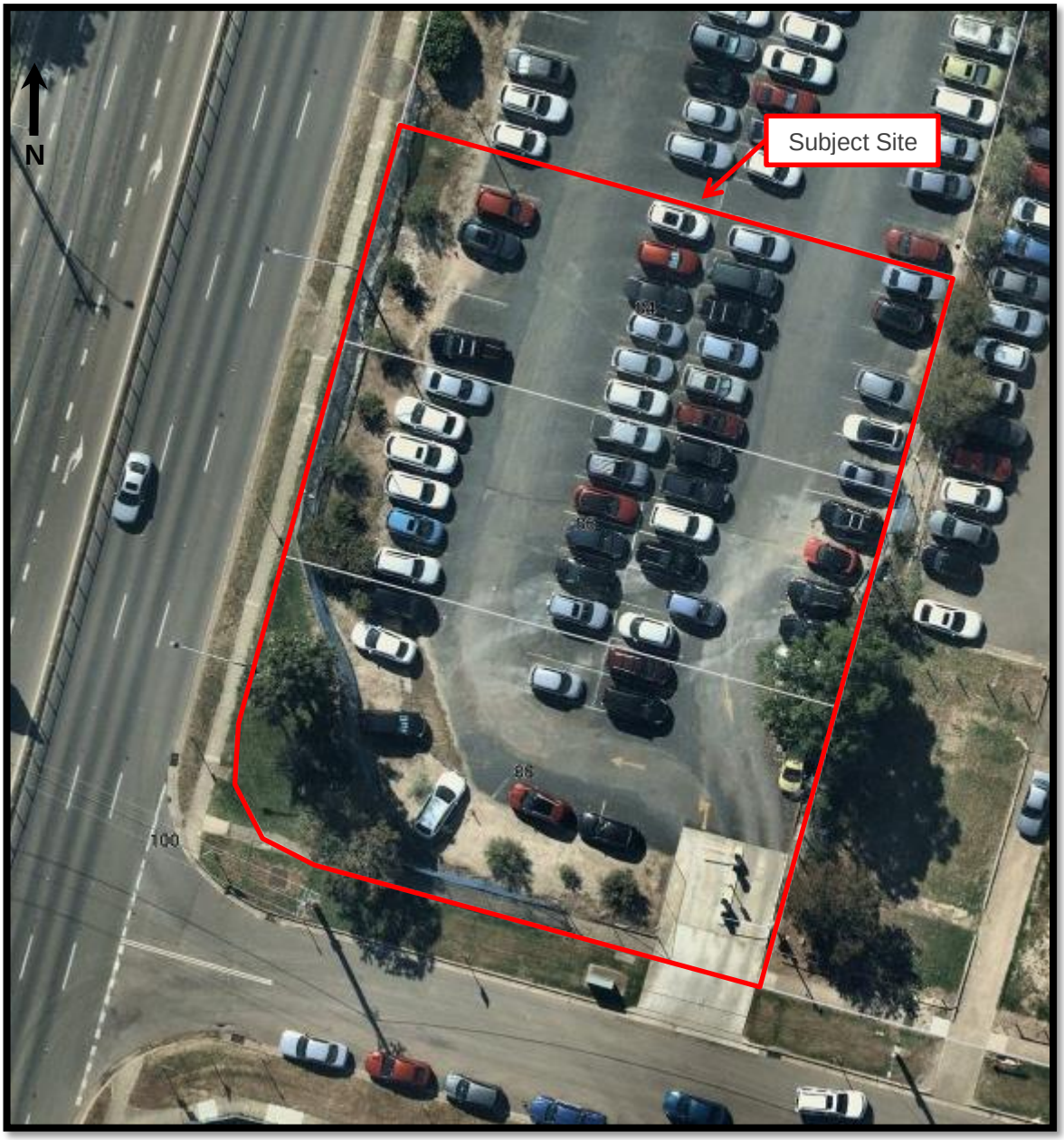

Figure 2 - Site Layout (As accessed from Nearmap 18.06.2018)

The existing contours, surface levels and the location of the existing features are identified on the survey plan drawing as attached in **Appendix B** of this report.

2 PROPOSED DEVELOPMENT

The proposed development as described in the architectural drawings in **Appendix A** is for a multi-storey medical centre.

A breakdown of the surface areas exposed to rainfall for the proposed development is presented in **Table 2**.

Table 2 – Proposed Development Areas

Catchment ID	Land Type	Area (m^2)	Percentage of Total Site Area
C1	Roof & Podium Area (100% Impervious)	1730	88%
	Hardstand Bypass (100% Impervious)	130	7%
	Ground Surface (50% Impervious)	104	5%
TOTAL		**1,964**	**100%**

Refer to the architectural drawings in **Appendix A** for further information regarding the proposed development.

2.1 Flooding Considerations

Please refer to the detailed Hydraulic Impact Assessment prepared by ADG for the proposed development.

2.2 External Catchments

The detailed site survey's contour information shows that neighbouring properties to the east with contours directing flow toward the proposed development site are intersected by an existing Kerb and Gutter channel directing these flows to an existing stormwater inlet pit.

Therefore, no significant upstream catchments act on the proposed site.

3 STORMWATER INFRASTRUCTURE

3.1 Existing Infrastructure

Detail survey and site investigations have identified the following stormwater infrastructure within the vicinity of the subject site:

- Kerb inlet pits located at the kerb tangent points on the northern side if the Parker St / Barber Ave intersection and another adjacent to the eastern boundary.

Refer to the detail survey information in **Appendix B** for further information regarding the existing stormwater infrastructure.

3.2 Lawful Point of Discharge (LPD)

3.2.1 Existing LPD

Based on information gathered via survey and contour data it has been determined that the subject site sheet flows to the south-western corner of the subject site, prior to discharging to the kerb inlet pits in Barber Avenue.

3.2.2 Proposed LPD

It is proposed to discharge the combined mitigated development site discharge to the two existing kerb inlet pits within Barber Avenue. Most of the site (including the entire roof area) will discharge via the OSD to the kerb inlet pit located in the low point of the Barber Ave and Parker St intersection. The proposed driveway access bypasses and the OSD will discharge to the kerb inlet pit adjacent to the eastern boundary within Barber Avenue.

4 STORMWATER QUANTITY ASSESSMENT

As per Section 3.1 of the Penrith City Council Stormwater Drainage Specification for Building Developments there are catchments within Lemongrove that require mandatory OSD, as seen in **Appendix E** the site falls outside this area.

Section 3.1 of the Penrith City Council Document *Stormwater Drainage Specification for Building Developments* also states that OSD may be required outside the nominated mandatory area if one of the following conditions is met:

- Runoff from the development may have an adverse impact on the environment or external drainage network;
- The site discharges to an inter-allotment drainage system;
- Drainage is directed outside of the immediate local catchment;
- The development is outside the Local Environment Plan provisions; or
- The development is an intensification of the standard use of zone such as education establishments or places of worship in rural zones.

As discussed in Section 3.2 the proposed primary point of discharge for the site is the kerb and channel on Barber Avenue with most of the site (including the entire roof area) discharging via the OSD to the nearby kerb inlet pit. The proposed driveway access bypasses and the OSD will discharge to the kerb inlet pit adjacent to the eastern boundary within Barber Avenue.

4.1 Proposed Development and Associated Issues

As noted above, one of the implications of an increase in impervious area is that the total volume and flow rate of stormwater runoff from the catchment will increase. It is essential that these increases are mitigated such that post-developed peak flows do not exceed those for the pre-developed case. The proposed development will increase the imperviousness of the site and as such Council has advised that OSD will be required. A stormwater quantity assessment has subsequently been performed. The aim of the stormwater quantity assessment is to:

- Ensure the development imposes no adverse effects on downstream properties or receiving water bodies;
- Ensure the conveyance of flows will be in a safe manner with minimal risk of human endangerment;
- Address the need for stormwater quantity control measures;
- Ensure there is no increase in peak discharges from the subject site for events up to and including the 1 in 100 year ARI event; and
- Ensure proposed quantity control measures detain and convey flows in accordance with Penrith City Council requirements.

This section of the report should be read in conjunction with **Appendix D** which shows the results of the stormwater detention analysis, performed using XP-STORM hydraulic modelling software.

4.2 Flow Rate Methodology

Based on recommendations within the Penrith City Council's Design Guidelines the major and minor storm events were adopted:

- Minor Event: 1 in 5 year ARI
  - Surface drainage infrastructure sized for a 1 in 5 year ARI through to point of discharge.
- Major Event: 1 in 100 year ARI
  - Roof water capture system is to capture and pipe all flows up to and including the 1 in 100 year ARI through to the detention tank/LPD.
  - Detention tank designed to attenuate flows up to and including the 1 in 100 year ARI.
  - Surface drainage overflows in events up to and including the 1 in 100 year ARI will not present a hazard to people or cause significant damage to property.

4.3 XPSTORM Hydrology

An XP-STORM Hydraulic and Runoff model was created to analyse the pre-developed and post-developed scenarios. The model includes a typical node-link connectivity identifying the catchments and hydraulic parameters. The proposed strategy was designed to reduce all increases of developed runoff to pre-development levels.

Global storms were used to run all design storm events with the same model. XP-STORM uses Australian Rain and Runoff nomographs with an absolute depth multiplier to produce site specific hydrographs for use within the hydraulic analysis. Where:

Depth Multiplier = Rainfall Intensity (mm/hr) x Storm Duration (mins) / 60.

4.3.1 XPSTORM Rainfall Parameters

IFD data for the Kingswood region was used for the hydrologic analysis for the determination of the XP-STORM absolute depth multipliers. **Table 3** and **Table 4** display tabulated summaries of the adopted rainfall intensities as well the depth multipliers used for the XP-STORM analysis.

Table 3 – Adopted Intensity Frequency Data (mm/hr)

Storm Duration (mins)	Average Recurrence Interval (Years)						
	1	2	5	10	20	50	100
10	57.15	74.08	96.63	109.95	127.40	150.67	168.41
15	47.75	61.85	80.56	91.59	106.07	125.36	140.05
20	41.56	53.82	70.06	79.63	92.21	108.94	121.69
25	37.10	48.03	62.52	71.06	82.30	97.21	108.59
30	33.69	43.62	56.78	64.54	74.76	88.30	98.65
45	26.95	34.89	45.43	51.66	59.86	70.70	79.01
60	22.86	29.60	38.55	43.84	50.81	60.00	67.06

Table 4 – XP-STORM Rainfall Multipliers Applied to Temporal Patterns (mm)

Storm Duration (mins)	Average Recurrence Interval (Years)						
	1	2	5	10	20	50	100
10	9.525	12.346	16.105	18.324	21.233	25.112	28.069
15	11.938	15.463	20.141	22.896	26.518	31.340	35.012
20	13.854	17.940	23.353	26.542	30.737	36.313	40.563
25	15.458	20.014	26.050	29.607	34.290	40.503	45.246
30	16.847	21.812	28.391	32.272	37.381	44.150	49.326
45	20.210	26.168	34.074	38.747	44.895	53.023	59.257
60	22.860	29.599	38.548	43.843	50.806	60.002	67.065

4.3.2 Assumptions and Methodology

The following modelling assumptions were used to create the XP Storm Model

- Laurenson's method was used for catchment routing with an 'n' value of -0.285 and 'B' value calculated by XP-STORM.
- Infiltration was modelled as 'uniform loss' with the following parameters:
  - Impervious Areas
    - Initial loss of 1;
    - Continuing loss of 0.1; and
    - Appropriate Manning's 'n' to suit the surface.
  - Pervious Areas
    - Initial loss of 5;
    - Continuing loss of 2; and
    - Appropriate Manning's 'n' to suit the surface.
  - Note: initial and continuing losses were determined based on 'likely' values and should be confirmed via geotechnical data.
- The existing case for the single catchment is modelled as a single node representing the catchment.
- The post-development case for each catchment includes a node representing catchment areas draining to the OSD Tank and a separate node for any areas not draining to the basin (bypass areas).
- The OSD Tank was modelled with a constant storage areas and orifice type outlets.

4.3.3 Pre-Development Case Model

The Hydraulic mode of XP-Storm is used to assess the stormwater runoff calculated in the Runoff mode by introducing factors such as storage and outlet configurations. The pre-development scenario model consisted of a single node representing the contributing catchment areas associated with the architectural drawings found in **Appendix A**. A link with negligible energy loss was added to the downstream end of the runoff node and connected to a single outfall node as to provide a single point of comparison between the pre- and post-development cases.

4.3.4 Post-Development Case Model

The developed model includes separate nodes for the detained catchment and bypass catchment. These flows from these catchments are combined downstream and directed through a general link with negligible energy loss to provide a single point of comparison between the pre- and post-development cases.

The OSD Tank for catchment 'C1' along the western boundary of the site was modelled by applying a storage area of $5m^2$ to the detained catchment. A series of outlets has been modelled from this catchment to throttle flows as they leave the storage volume until the flow leaving the site is limited below pre-development rates (for all events from Q_2 up to Q_{100}). An emergency overflow weir capable of accepting the full 1% AEP flow has also been modelled 0.8m above the invert level of the OSD tank to serve in the event that all other outlets are blocked.

XP-STORM modelling indicated a maximum storage volume of $1.18m^3$ was required to mitigate the discharged flows for the Q_{100} event for 'Catchment C1'. A summary of the configuration of these outlets is presented in **Table 5**.

Table 5 – Detention Basin Configuration Summary

	Proposed Tank 'C1'
Required Detention Volume (1% AEP = 100yr ARI)	$1.18m^3$
Maximum Water Depth (1% AEP=100yr ARI)	0.24m
Low-Level Detention Basin Orifice Details	Rectangular Orifice: 200mm (H) x 500mm (W)
Low-Level Detention Basin Orifice Invert Level	Side Outlet At Invert Level
High-Level Detention Basin Emergency Overflow Weir Details	Weir Length = 1.0m
High-Level Weir Wall Crest Emergency Overflow Invert Level	0.8m From Invert Level

Refer to the preliminary engineering drawings in **Appendix C** for the details of the proposed OSD tank.

The details of the OSD tank and associated outlets are subject to confirmation following finalisation of the proposed development site layout and site levels in the detailed design phase. Refer to **Appendix C** for the conceptual stormwater drainage layout and details.

4.4 Results

A comparison of the peak discharge values between pre- and post-development scenarios is presented in **Table 6**.

Table 6 – Catchment 'C1' XP STORM Modelling Results

Design Storm (ARI)	Pre-Development Flows (m^3/s)	Post-Development Flows, Unmitigated (m^3/s)	Post-Development Flows, Mitigated (m^3/s)	Flow change from Pre-Development
Q2	0.041	0.050	0.031	-24.39%
Q5	0.057	0.066	0.047	-17.54%
Q10	0.066	0.075	0.056	-15.15%
Q20	0.089	0.094	0.074	-16.85%
Q50	0.087	0.920	0.074	-14.94%
Q100	0.098	0.102	0.084	-14.29%

As seen in **Table 6**, the proposed detention tank successfully mitigates the post-development flows to or below pre-development conditions. For further details of the XP-STORM model and model outputs refer to **Appendix D**.

4.5 Recommendation

ADG recommend that all roof water and, where ever possible, stormwater generated within the site be conveyed to a detention tank system to aid in mitigating the peak discharge from the proposed development. As demonstrated in **Table 6** there has been an increase in peak flow from the pre- to post-development unmitigated stages for Catchment 'C1'. In order to mitigate this increases in flow, a detention tank with a minimum volume of 1.18m^3 will be required to be installed prior to the point of discharge.

The arrangement of the proposed detention system can be seen in the ADG Stormwater Management Layout Sketch in **Appendix C**.

The nominated volumes specified above shall be reserved for detention purposes only and will be in addition to any desired roof water harvesting volume (i.e. for reuse purposes such as irrigation).

4.6 Onsite Detention Lifecycle Costs

A lifecycle cost analysis is not a part of the scope of this report. All stormwater infrastructure associated with the development shall be maintained and serviced by the owners of the development at **no cost to Council**.

5 STORMWATER QUALITY ASSESSMENT

Water Quality and Water Quantity Flow measures are required under the criteria set out in Table C3.1 of the Penrith Development Control Plan 2014 Section C3 - Water Management.

This assessment identifies issues relating to stormwater runoff quality and assesses possible methods of treatment and the subsequent impacts on the drainage strategy. The aim of this section of the report is to determine practical approaches in achieving improvements for the quality of the stormwater run-off from the site as set out by the State Planning Policy and the MUSIC Modelling Guidelines, Version 1.0 (2010).

This section will address the following:

- Treatment devices; and
- Ensuring treatment device selection criteria is in accordance with Industry Best Practice and, WSUD Engineering Guidelines.

5.1 Site Analysis and Design Strategy

Currently no stormwater quality management measures are in place for the subject site. The proposed development offers the opportunity to provide stormwater quality treatment where none exists at present. The proposed development areas are summarised in **Table 2** in Section 2 of this report.

A MUSIC model analysis was undertaken to determine the extent of the treatment required for the proposed development. It is noted that due to site constraints, a small portion of the subject site discharges untreated. As such the treatment measures have been increased accordingly to compensate for the untreated portion of the site.

A MUSIC model analysis was undertaken to determine the extent of the treatment required for the proposed development. Refer to the Post-Development Stormwater Management Layout Sketch in **Appendix F** for details on the respective catchment. The following treatment devices have been proposed for Catchments ‘C1’ and ‘C2’.

Catchment ‘C1’:

- Catchment C1: Minimum one (1) Eviropod and five (5) PSorb Stormfilter cartridges

Catchment ‘C2’:

- Catchment C2: Minimum one (1) Eviropod

5.2 Music Modelling

The sites stormwater run-off was modelled using MUSIC version 6.3.0. The 6-minute rainfall data from the Penrith rainfall station number 67113 monitoring site was utilised in the modelling (as per MUSIC-link). The utilised data was over a 10 year timeframe from 1/1/1999 to 31/12/2008. Pollutant export parameters for the catchment’s different land use types were applied in accordance with Table 3.8 of the above stated guidelines. The objective was to achieve the desired target pollutant reduction levels at the LPD.

The target pollutant reduction levels were as follows:

- 85% Reduction in Total Suspended Solids (TSS);
- 60% Reduction in Total Phosphorus (TP); and
- 45% Reduction in Total Nitrogen (TN).

The following results meet the percent reduction water quality objectives identified by Council standards, the Urban Stormwater Quality Planning Guidelines 2010 and the SPP.

Refer to **Appendix D** for further information on the MUSIC Model and MUSIC-link output compiled by ADG.

A representation of the stormwater configuration for MUSIC Model is presented in **Figure 3**.

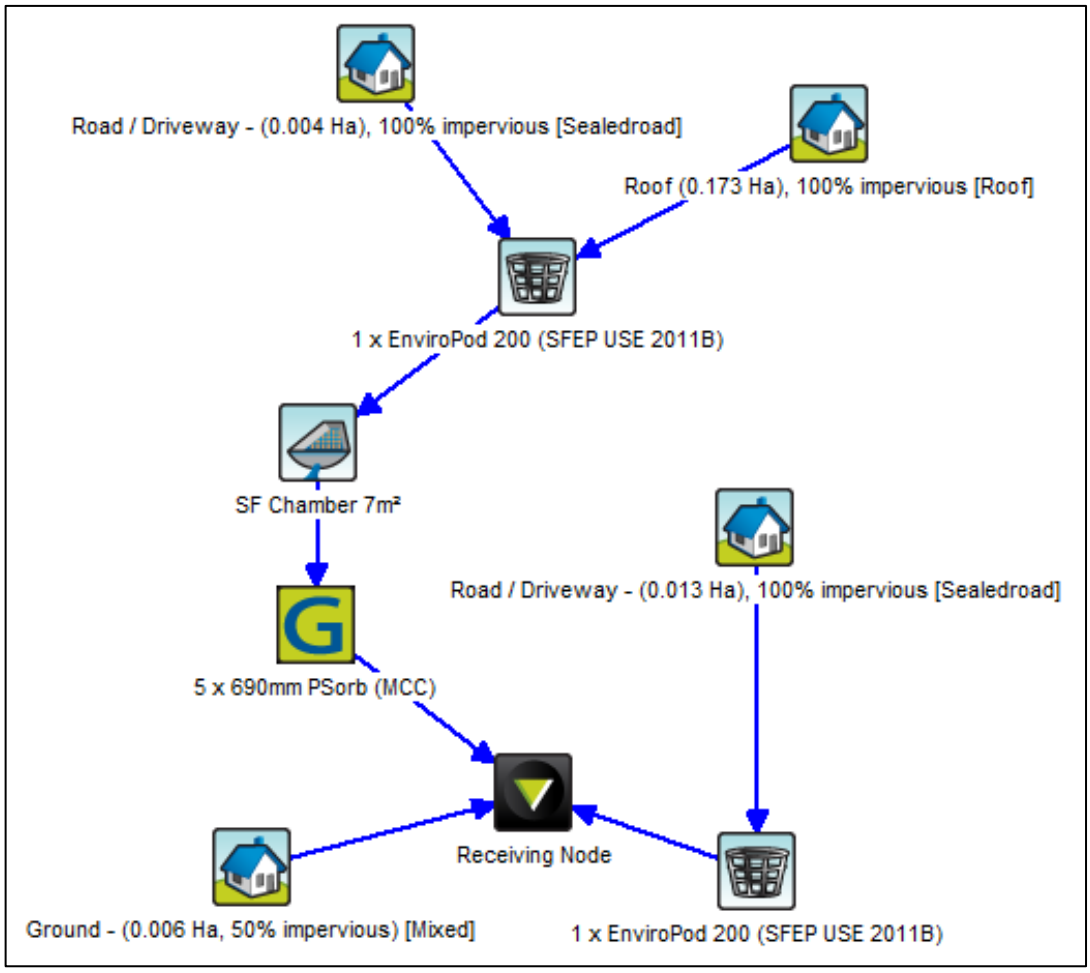

Figure 3 - Treatment Train Layout

The results of the MUSIC modelling are provided in **Figure 4**.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	1.14	1.14	0
Total Suspended Solids (kg/yr)	63.9	9.53	85.1
Total Phosphorus (kg/yr)	0.218	0.0669	69.3
Total Nitrogen (kg/yr)	2.54	1.14	55
Gross Pollutants (kg/yr)	32.2	0.694	97.8

Figure 4 - Treatment Train Effectiveness

The results indicate that the proposed Stormwater Quality Improvement Devices (SQIDs) satisfy the required reduction of TSS, TP and TN for the proposed development. More detail for the MUSIC modelling parameters and catchment areas can be found in **Appendix F**.

5.3 Construction phase

During the construction phase of this development, there is a higher risk of sedimentation transport during construction due to the large areas of disturbed land. A sediment and erosion control plan shall be implemented during the construction phase of the development as follows:

Stage 1: Pre construction

- All erosion and sediment control (ESC) devices are to be installed prior to any earth disturbing activities

Stage 2: Construction

- All ESC devices are to be maintained to operational levels, as specified in the management plans and drawings.
- The maintenance plan needs to be in accordance with the Water by Design Construction and Establishment Guidelines.
- During Excavation, the contractor shall provide a temporary sediment basin (sump pit) and pump out stormwater only once the water has settled and has achieved an acceptable quality to the satisfaction of Council (i.e. no turbidity and acceptable pH levels).

Stage 3: Pre-Operational Stage (all disturbed areas stabilized, 90% of all structures completed)

- Property owner to implement a maintenance plan to ensure correct establishment of plants.
- All ESC devices can be removed only if approved by the superintendent and engineers.

5.4 Operational phase

Once directed to be commissioned by the superintendent and engineers, the SQIDs will provide the required level of stormwater quality treatment to runoff from the site prior to discharging into Council's stormwater drainage infrastructure. It is expected that sediment laden runoff and the erosion potential at the subject site during the operational phase will be minimal. This is due to the high amount of permanent impervious area in the form of roofs, paths, courtyards, driveways and other impervious structures. The proposed landscaped areas will be maintained in a manner that will minimise erosion.

5.5 Lifecycle Costs

A lifecycle cost analysis is not a part of the scope of this report. All the recommended water quality treatment infrastructure lies within the development site and it shall be maintained and serviced by the owners of the development at **no cost to Council**.

5.6 Water Quality Monitoring

No water quality monitoring is proposed for this development at this stage due to the nature of the development and the fact that no monitoring currently takes place.

5.7 Maintenance

The site operator will be responsible for organising all monitoring and maintenance activities associated with the operation of the proposed Stormwater Quality Improvement Devices (SQID) in accordance with the manufacturer's specifications.

6 CONCLUSION

As outlined in **Section 4** of this report, a total detention volume of 1.18m^3 is successful at mitigating the post-development peak stormwater discharge to pre-development rates for events up to and including the Q_{100} event.

As discussed in **Section 5** of this report, a two (2) Stormwater360 Enviropods and five (5) Stormwater360 Stormfilters (or approved equivalents) are adequate to reduce pollutants that leave the site by levels that comply with Council stated requirements.

In preparing this report, we have achieved all requirements for Stormwater Management Plans as required by Penrith City Council Stormwater Drainage Policy, Water Management Policy and Design Guidelines for Engineering Works.

Detailed engineering diagrams and management requirements for the proposed development are to be submitted to Council for approval prior to any works commencing on site with design certification prepared by a qualified stormwater engineer or scientist.

Appendix A
Architectural Drawings

LEGEND

FH FIRE HYDRANT

NLA Breakdown

Number	Name	Area
Podium		
0_A	MED / RETAIL TENANCY	249 m²
0_B	MED / RETAIL TENANCY	204 m²
0_C	MED / RETAIL TENANCY	156 m²
0_D	MED / RETAIL TENANCY	37 m²
0_E	MED / RETAIL TENANCY	27 m²
0_F	MED / RETAIL TENANCY	44 m²
0_G	MED / RETAIL TENANCY	36 m²
Level 1		
1_A	MEDICAL TENANCY	199 m²
1_B	MEDICAL TENANCY	110 m²
1_C	MEDICAL TENANCY	111 m²
1_D	MEDICAL TENANCY	256 m²
1_E	MEDICAL TENANCY	130 m²
1_F	MEDICAL TENANCY	124 m²
1_G	MEDICAL TENANCY	110 m²
Level 2		
2_A	MEDICAL TENANCY	241 m²
2_B	MEDICAL TENANCY	112 m²
2_C	MEDICAL TENANCY	113 m²
2_D	MEDICAL TENANCY	260 m²
2_E	MEDICAL TENANCY	87 m²
2_F	MEDICAL TENANCY	76 m²
2_G	MEDICAL TENANCY	160 m²
2_H	MEDICAL TENANCY	158 m²
2_I	MEDICAL TENANCY	81 m²
2_J	MEDICAL TENANCY	90 m²
Level 3		
3_A	MEDICAL TENANCY	241 m²
3_B	MEDICAL TENANCY	112 m²
3_C	MEDICAL TENANCY	113 m²
3_D	MEDICAL TENANCY	260 m²
3_E	MEDICAL TENANCY	87 m²
3_F	MEDICAL TENANCY	76 m²
3_G	MEDICAL TENANCY	159 m²
3_H	MEDICAL TENANCY	158 m²
3_I	MEDICAL TENANCY	81 m²
3_J	MEDICAL TENANCY	90 m²
Level 4		
4_A	MEDICAL TENANCY	241 m²
4_B	MEDICAL TENANCY	112 m²
4_C	MEDICAL TENANCY	113 m²
4_D	MEDICAL TENANCY	260 m²
4_E	MEDICAL TENANCY	87 m²
4_F	MEDICAL TENANCY	76 m²
4_G	MEDICAL TENANCY	159 m²
4_H	MEDICAL TENANCY	158 m²
4_I	MEDICAL TENANCY	81 m²
4_J	MEDICAL TENANCY	90 m²
Grand total		5923 m²

2 **Podium**
1 : 100

1 **Mezzanine Floor Plan**
1 : 100

NEPEAN Ground Plan

A.100

Project No. 17-1110

ASPECT
ARCHITECTURE
INTERIORS
PROJECT MANAGEMENT
QUANTITY SURVEYING

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CONCEPT DESIGN ISSUE

Revision H | 22/05/18

Designer WTE

Scale 1 : 100 @ A1

LEGEND

FH FIRE HYDRANT

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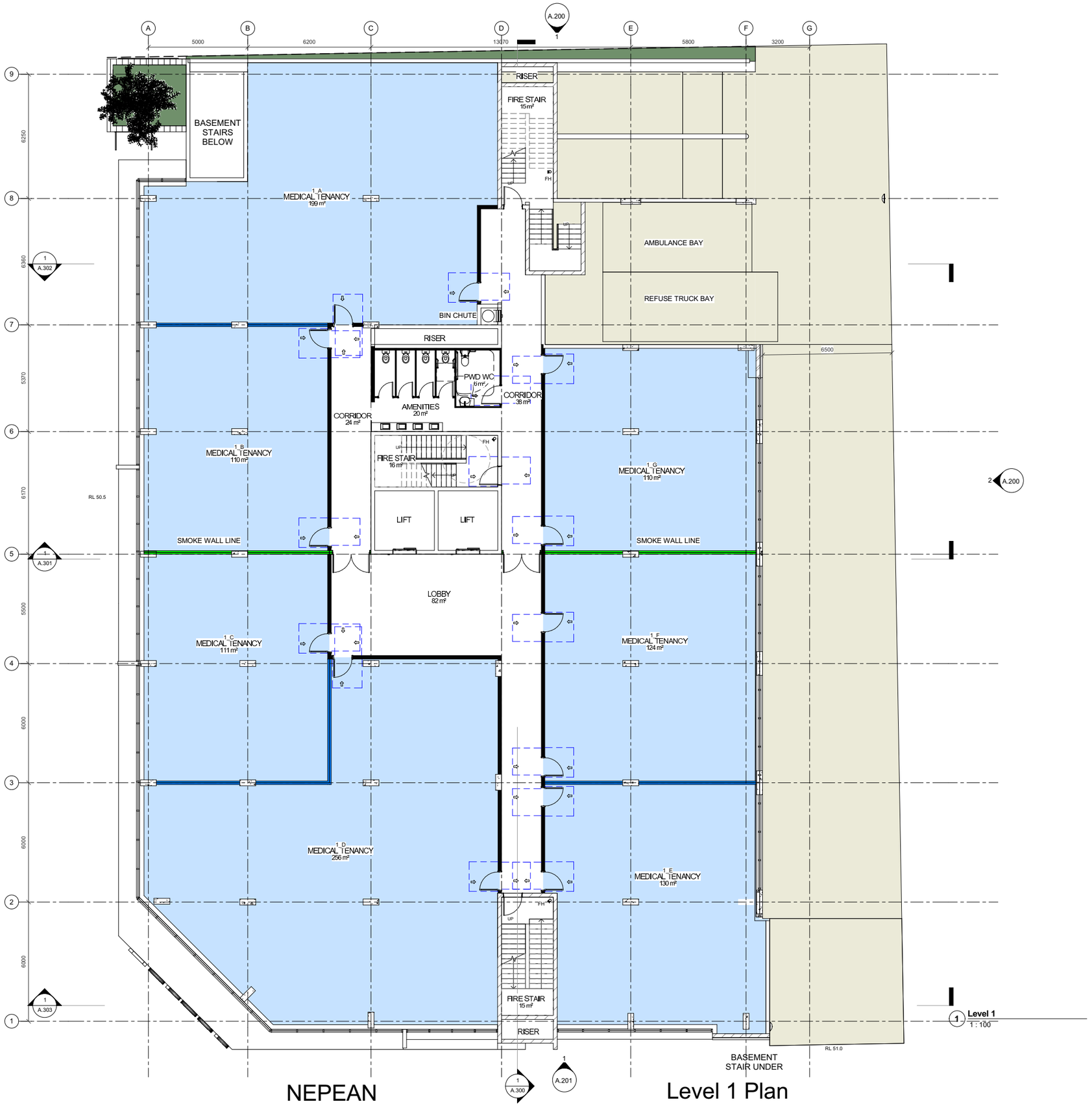
3_E	MEDICAL TENANCY	87 m²
3_F	MEDICAL TENANCY	76 m²
3_G	MEDICAL TENANCY	159 m²
3_H	MEDICAL TENANCY	158 m²
3_I	MEDICAL TENANCY	81 m²
3_J	MEDICAL TENANCY	90 m²
Level 4		
4_A	MEDICAL TENANCY	241 m²
4_B	MEDICAL TENANCY	112 m²
4_C	MEDICAL TENANCY	113 m²
4_D	MEDICAL TENANCY	260 m²
4_E	MEDICAL TENANCY	87 m²
4_F	MEDICAL TENANCY	76 m²
4_G	MEDICAL TENANCY	159 m²
4_H	MEDICAL TENANCY	158 m²
4_I	MEDICAL TENANCY	81 m²
4_J	MEDICAL TENANCY	90 m²
Grand total		5923 m²



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Level 1 Plan

A.101

Project No. 17-1110

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CONCEPT DESIGN ISSUE

Revision G | 22/05/18

Designer WTE

Scale 1 : 100 @ A1

LEGEND

FH FIRE HYDRANT

NLA Breakdown

Number	Name	Area
Podium		
0_A	MED / RETAIL TENANCY	249 m²
0_B	MED / RETAIL TENANCY	204 m²
0_C	MED / RETAIL TENANCY	156 m²
0_D	MED / RETAIL TENANCY	37 m²
0_E	MED / RETAIL TENANCY	27 m²
0_F	MED / RETAIL TENANCY	44 m²
0_G	MED / RETAIL TENANCY	36 m²
Level 1		
1_A	MEDICAL TENANCY	199 m²
1_B	MEDICAL TENANCY	110 m²
1_C	MEDICAL TENANCY	111 m²
1_D	MEDICAL TENANCY	256 m²
1_E	MEDICAL TENANCY	130 m²
1_F	MEDICAL TENANCY	124 m²
1_G	MEDICAL TENANCY	110 m²
Level 2		
2_A	MEDICAL TENANCY	241 m²
2_B	MEDICAL TENANCY	112 m²
2_C	MEDICAL TENANCY	113 m²
2_D	MEDICAL TENANCY	260 m²
2_E	MEDICAL TENANCY	87 m²
2_F	MEDICAL TENANCY	76 m²
2_G	MEDICAL TENANCY	160 m²
2_H	MEDICAL TENANCY	158 m²
2_I	MEDICAL TENANCY	81 m²
2_J	MEDICAL TENANCY	90 m²
Level 3		
3_A	MEDICAL TENANCY	241 m²
3_B	MEDICAL TENANCY	112 m²
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3_D	MEDICAL TENANCY	260 m²
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4_A	MEDICAL TENANCY	241 m²
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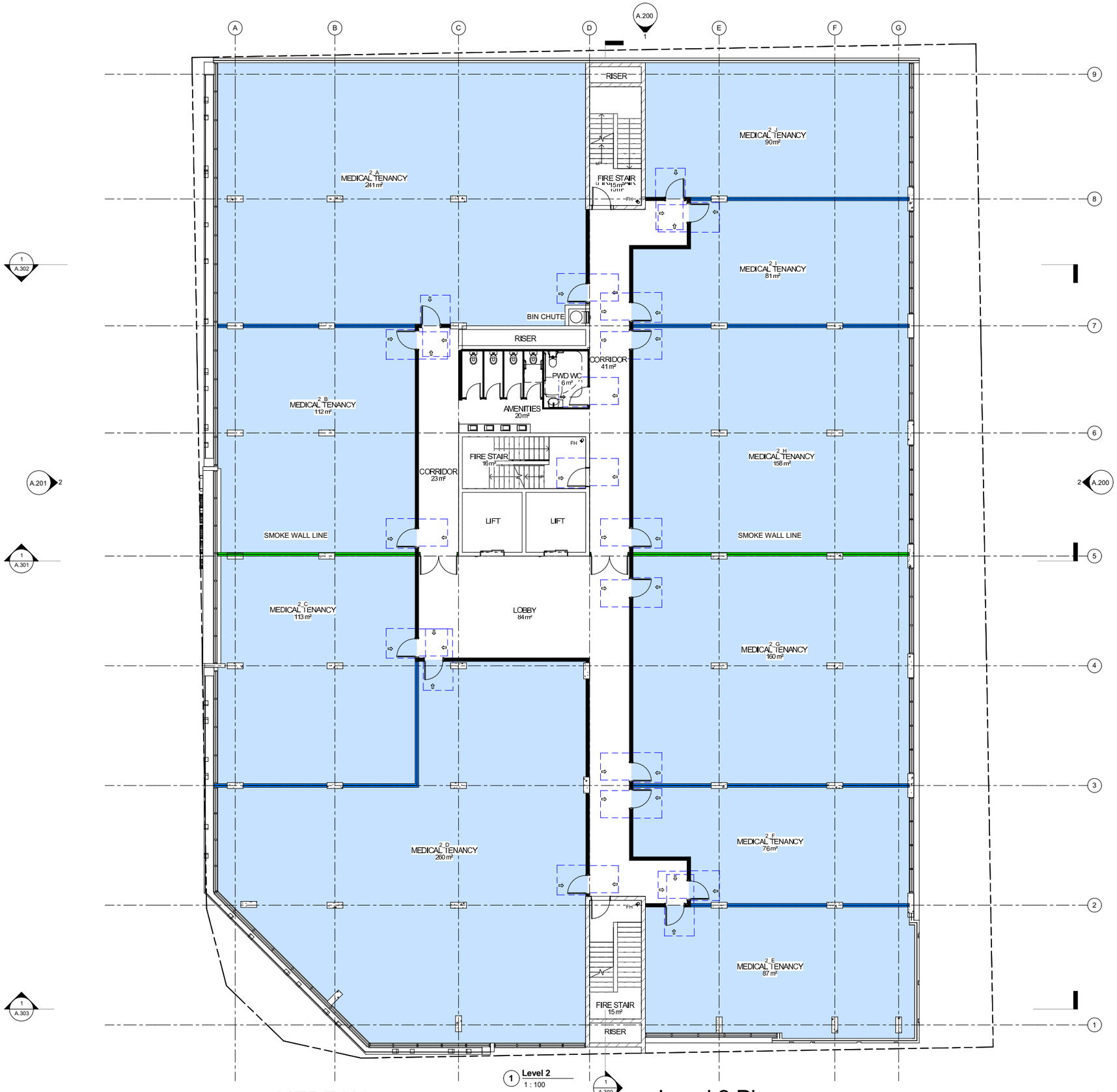
4_H	MEDICAL TENANCY	158 m²
4_I	MEDICAL TENANCY	81 m²
4_J	MEDICAL TENANCY	90 m²
Grand total		5923 m²



1 **Level 2**
1 : 100

NEPEAN

Level 2 Plan

A.102

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CONCEPT DESIGN ISSUE

Revision G | 22/05/18

Designer WTE

Scale 1 : 100 @ A1

LEGEND

FH FIRE HYDRANT

NLA Breakdown

Number	Name	Area
Podium		
0_A	MED / RETAIL TENANCY	249 m²
0_B	MED / RETAIL TENANCY	204 m²
0_C	MED / RETAIL TENANCY	156 m²
0_D	MED / RETAIL TENANCY	37 m²
0_E	MED / RETAIL TENANCY	27 m²
0_F	MED / RETAIL TENANCY	44 m²
0_G	MED / RETAIL TENANCY	36 m²
Level 1		
1_A	MEDICAL TENANCY	199 m²
1_B	MEDICAL TENANCY	110 m²
1_C	MEDICAL TENANCY	111 m²
1_D	MEDICAL TENANCY	256 m²
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1_F	MEDICAL TENANCY	124 m²
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Level 2		
2_A	MEDICAL TENANCY	241 m²
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Level 3		
3_A	MEDICAL TENANCY	241 m²
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4_F	MEDICAL TENANCY	76 m²
4_G	MEDICAL TENANCY	159 m²
4_H	MEDICAL TENANCY	158 m²
4_I	MEDICAL TENANCY	81 m²
4_J	MEDICAL TENANCY	90 m²
Grand total		5923 m²

1 Level 3
1 : 100

NEPEAN

Level 3 Plan

A.103

Project No. 17-1110

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CONCEPT DESIGN ISSUE

Revision G | 22/05/18

Designer WTE

Scale 1 : 100 @ A1

LEGEND

FH FIRE HYDRANT

NLA Breakdown

Number	Name	Area
Podium		
0_A	MED / RETAIL TENANCY	249 m²
0_B	MED / RETAIL TENANCY	204 m²
0_C	MED / RETAIL TENANCY	156 m²
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0_F	MED / RETAIL TENANCY	44 m²
0_G	MED / RETAIL TENANCY	36 m²
Level 1		
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1_E	MEDICAL TENANCY	130 m²
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Level 2		
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3_I	MEDICAL TENANCY	81 m²
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Level 4		
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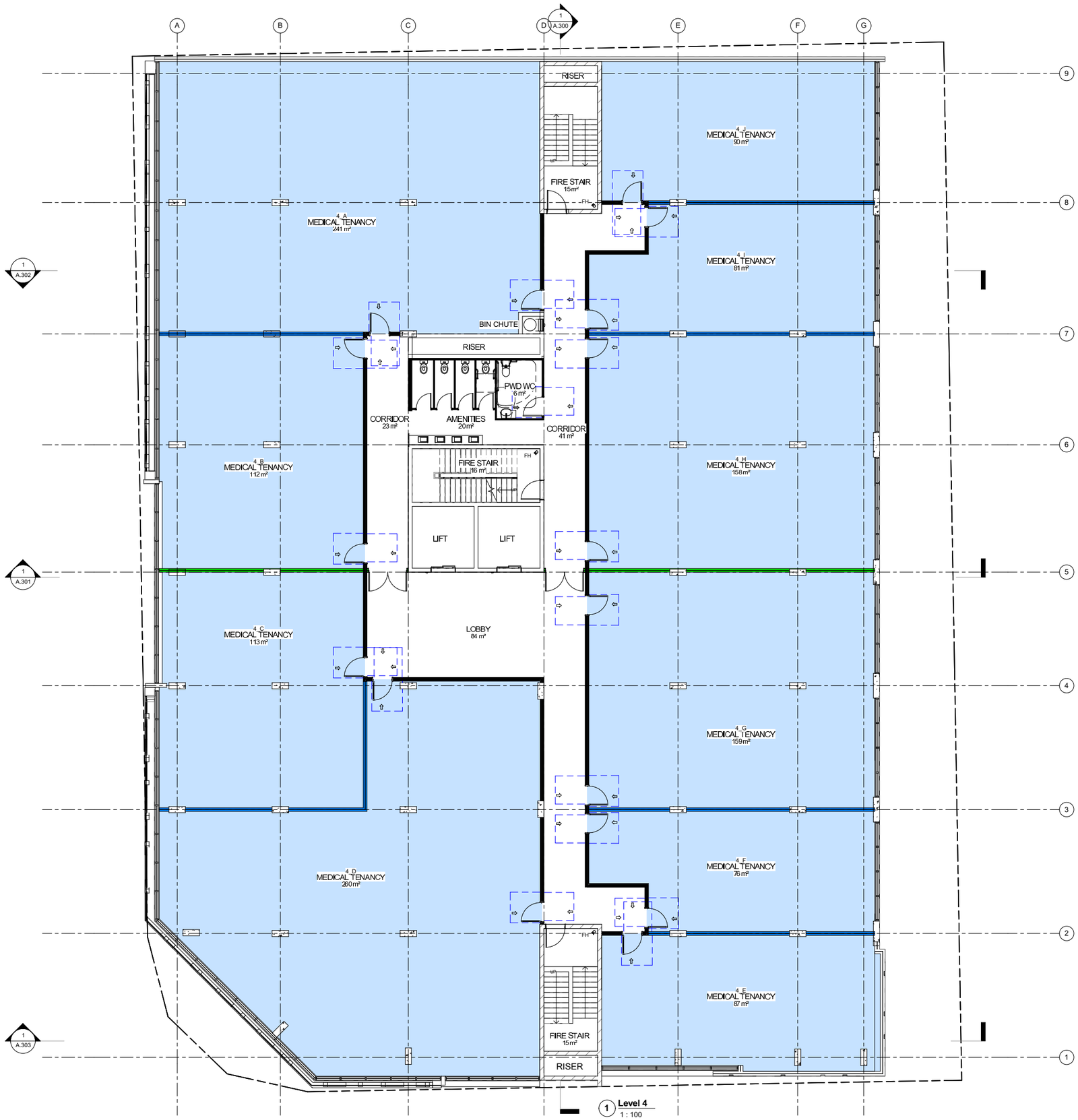
4_G	MEDICAL TENANCY	159 m²
4_H	MEDICAL TENANCY	158 m²
4_I	MEDICAL TENANCY	81 m²
4_J	MEDICAL TENANCY	90 m²
Grand total		5923 m²



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Level 4 Plan

A.104

Project No. 17-1110

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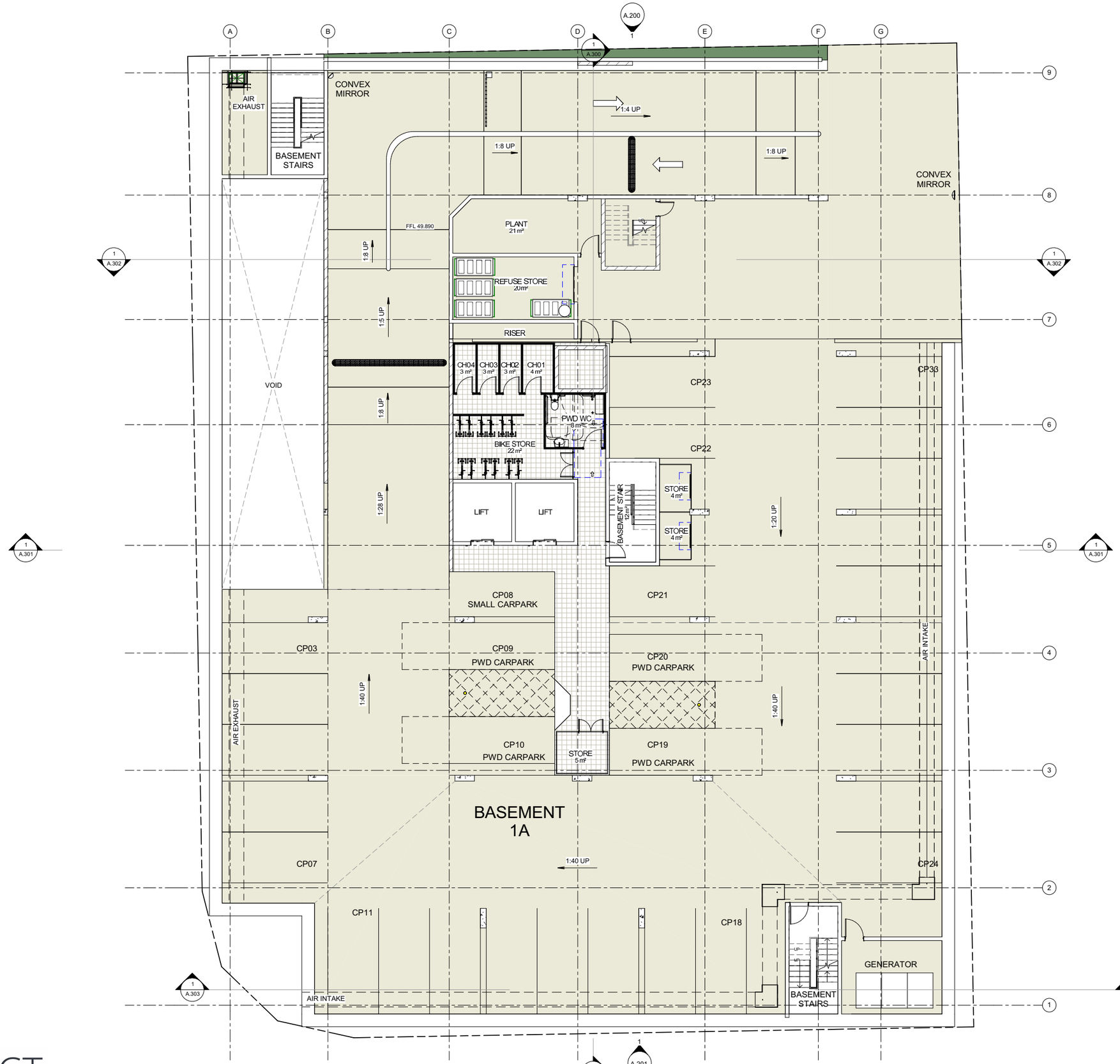
CONCEPT DESIGN ISSUE

Revision G | 22/05/18

Designer WTE

Scale 1 : 100 @ A1



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DESIGN DEVELOPMENT ISSUE

Basement Level 1A

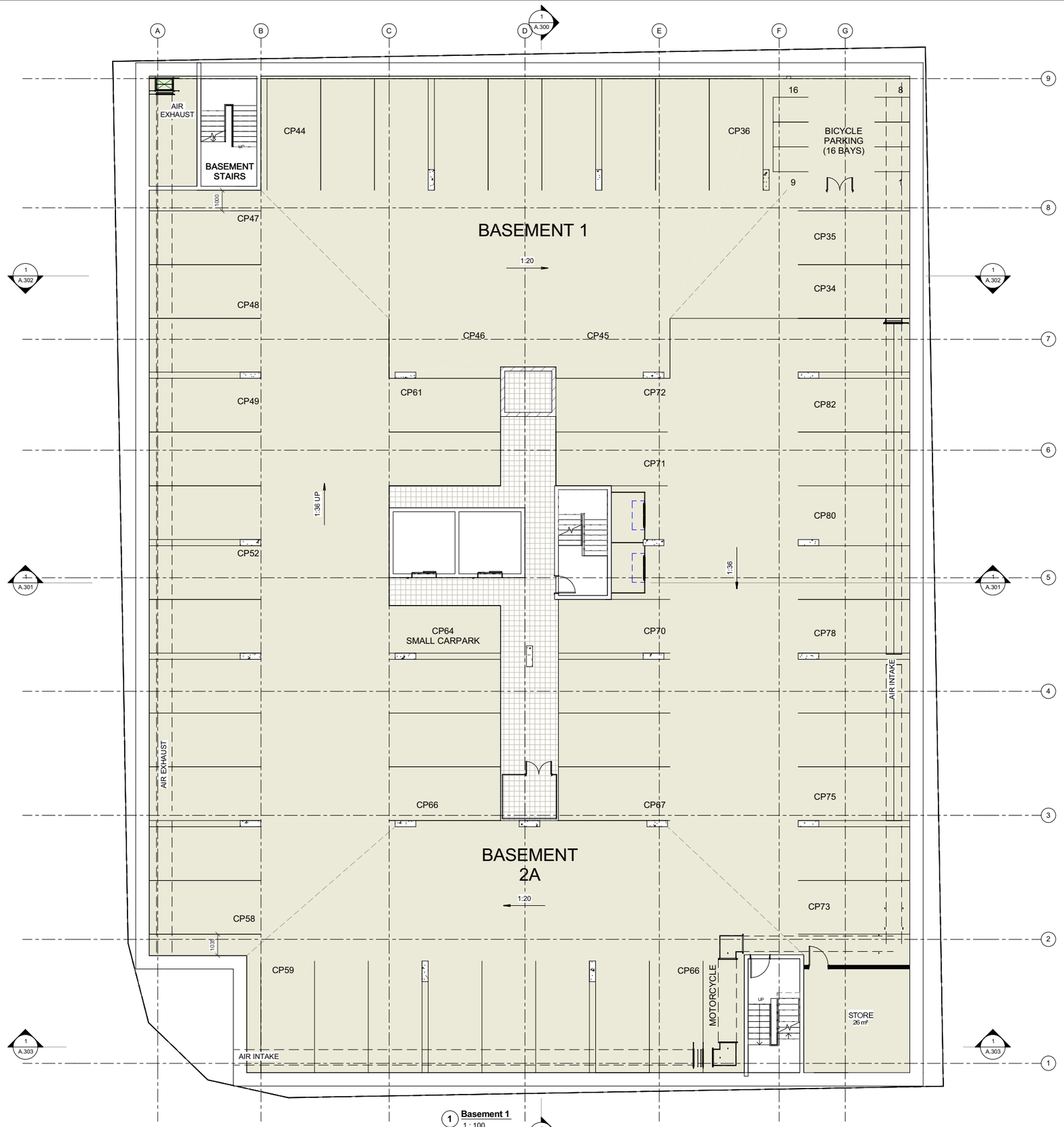
A.111

Project No. 17-1110

Revision E | 22/05/18

Designer WTE

Scale 1 : 100 @ A1



1 **Basement 1**
1 : 100

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Basement 1_2A Plan

A.112

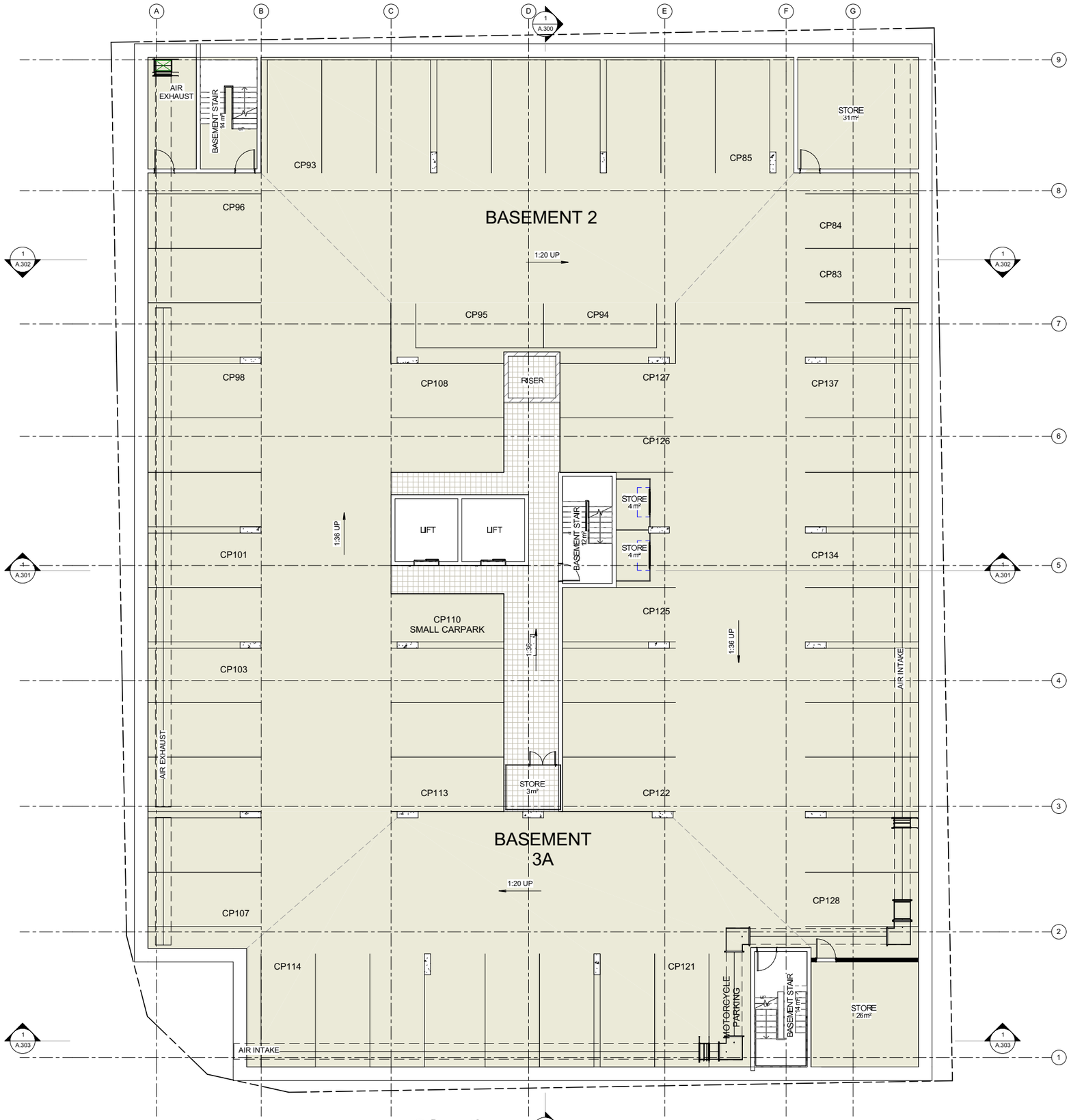
Project No. 17-1110

CONCEPT DESIGN ISSUE

Revision G | 22/05/18

Designer WTE

Scale 1 : 100 @ A1



1 **Basement 2**
1 : 100

1
A.300

NEPEAN

Basement 2_3A Plan

A.113

Project No. 17-1110

ASPECT
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DESIGN DEVELOPMENT ISSUE

Revision G | 22/05/18

Designer WTE

Scale 1 : 100 @ A1

1 **Basement 3**
1 : 100

1
A.300

NEPEAN

Basement 3_4A Plan

A.114

Project No. 17-1110

ASPECT
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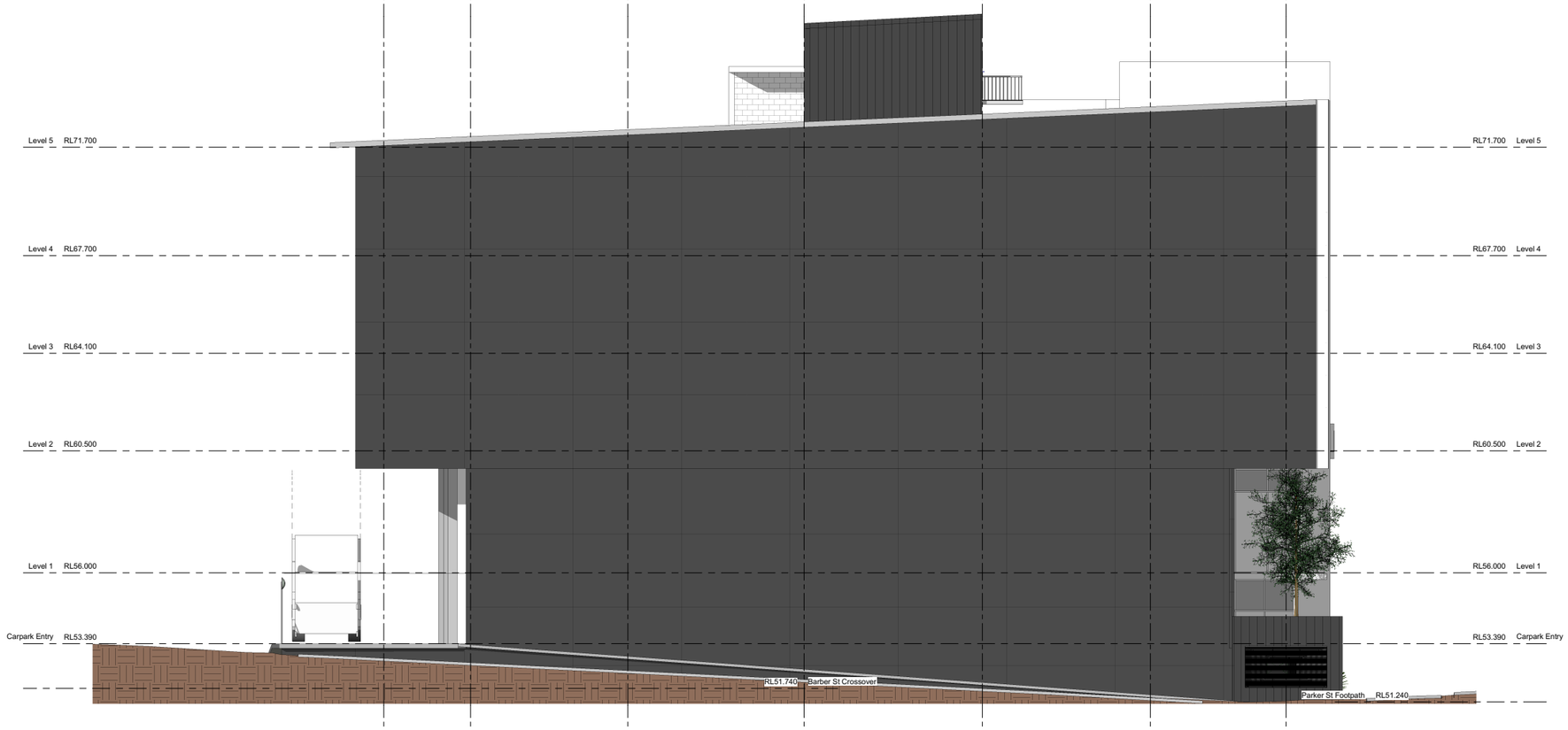
DESIGN DEVELOPMENT ISSUE

Revision G | 22/05/18

Designer WTE

Scale 1 : 100 @ A1

LEGEND



1 **North Elevation**
1 : 100

2 **East Elevation**
1 : 100

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Proposed Elevations

A.200

Project No. 17-1110

CONCEPT DESIGN ISSUE

Revision F | 22/05/18

Designer WTE

Scale 1 : 100 @ A1

LEGEND

1 **South Elevation**
1 : 100

2 **West Elevation**
1 : 100

ASPECT
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QUANTITY SURVEYING

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Proposed Elevations

A.201

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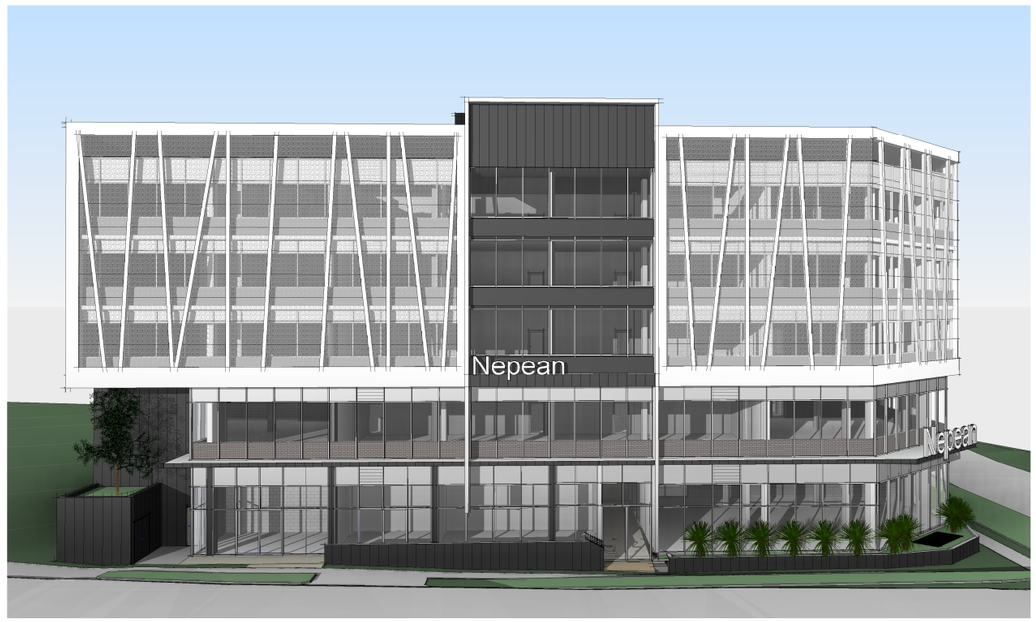
CONCEPT DESIGN ISSUE

Revision F | 22/05/18

Designer WTE

Scale 1 : 100 @ A1

1 **Parker Street Perspective A**



2 **Parker Street Perspective B**

3 **Barber Avenue Perspective**

4 **Parker Street Perspective C**

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Perspectives

A.900

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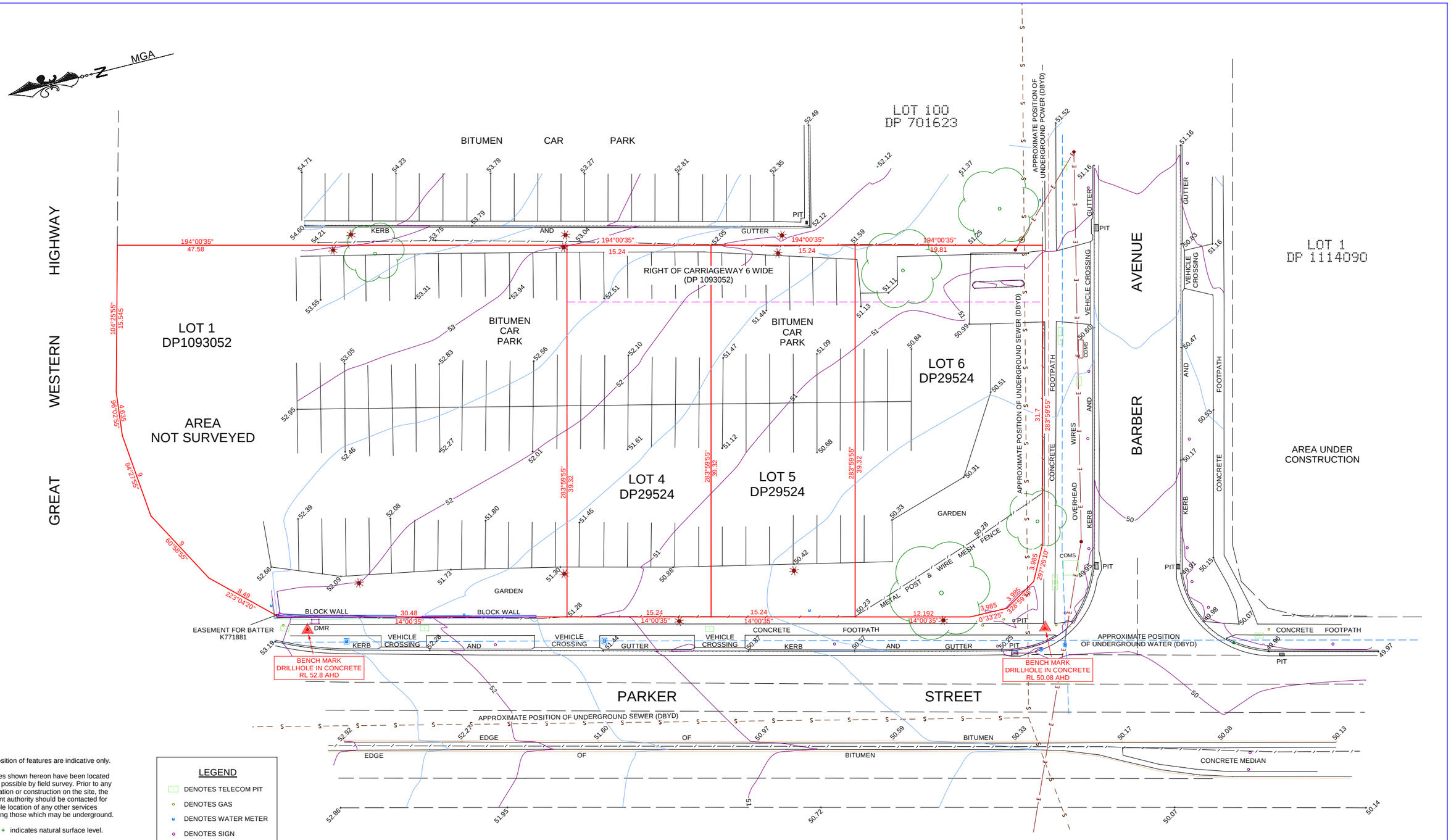
CONCEPT DESIGN ISSUE

Revision H | 22/05/18

Designer WTE

Scale @ A1

Appendix B
Detailed Survey



NOTES:

* The position of features are indicative only.
* Services shown hereon have been located where possible by field survey. Prior to any excavation or construction on the site, the relevant authority should be contacted for possible location of any other services including those which may be underground.
* 52.12 + indicates natural surface level.
* Contours shown depict the general topography. They do not represent exact levels other than at spot levels shown.
* Relationship of improvements to boundaries is diagrammatic only. Where offsets are critical they should be confirmed by further survey.
* Bearings and distances are by title only. No boundary investigation has been carried out.
* The shapes, sizes, position, heights and species of trees are approximate only. Further field inspection should be carried out where tree details are considered to critically affect design.

LEGEND

- DENOTES TELECOM PIT
- DENOTES GAS
- DENOTES WATER METER
- DENOTES SIGN
- DENOTES STOP VALVE
- DENOTES HYDRANT
- DENOTES LIGHT POLE
- DENOTES POWER POLE
- DENOTES INSPECTION LID

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AMENDMENTS
* LOCATED SMH AND MOVED DBYD SEWER LINE TO MATCH (27/4/18)

LEVELS BASED ON SSM 14758 RL 51.585 AHD (SCIMS 12/3/18)

MGA COORDINATES BASED ON SSM 103622 (SCIMS 12/3/18)

Client: CORNERSTONE BUILDING DEVELOPMENTS	Project: PLAN SHOWING DETAIL, LEVELS & CONTOURS OVER LOTS 4,5 & 6 IN DP 29524 AND LOT 1 IN DP 1093052. CORNER OF BARBER AVE AND PARKER STREET, PENRITH.	FREEBURN W E SURVEYING	MATTHEW FREEBURN LAND, ENGINEERING & MINING SURVEYOR SUITE 2, FIRST FLOOR, "SURVEYOR HOUSE" 2 CASTLEREAGH STREET PENRITH 2750	Telephone 02 4721 2289 Fax 02 4721 5646 email matthew@freeburnsurveyors.com	Date: 14/03/2018	Ref: 36337	Sheet 1 of 1
					Scale 1: 200	Datum: AHD	Contour: 0.5 INT
					Surveyor: TB/DC	Drawn By: TB	Checked: MF
					DATA - 36337		A1 SHEET

Appendix C
ADG Preliminary Plans

LEGEND

- 12.0 — FINISHED SURFACE CONTOURS
- SITE BOUNDARY
- EXISTING PROPERTY BOUNDARY
- EXISTING EASEMENT BOUNDARY
- 3.42 — EXISTING SURFACE LEVEL
- 3.42 — FINISHED SURFACE LEVEL
- EXISTING NOMINAL KERB LINE
- EXISTING EDGE OF BITUMEN
- EXISTING ROAD CENTERLINE
- dSWD — EXISTING STORMWATER DRAINAGE (RECORDS)
- dS — dS — EXISTING SEWER (RECORDS)
- dW — dW — EXISTING WATER (RECORDS)
- dE — dE — EXISTING UNDERGROUND ELECTRICITY (RECORDS)
- OE — OVERHEAD ELECTRICITY
- dG — dG — EXISTING GAS (RECORDS)
- dT — dT — EXISTING TELECOMMUNICATIONS (RECORDS)
- EXISTING FENCE
- LIMIT OF WORKS
- SWD — PROPOSED STORMWATER DRAINAGE
- KG — PROPOSED KERB & GUTTER IN ACCORDANCE WITH PCC STD DRG SD1003/1
- 1/1 — DRAINAGE STRUCTURE LABEL
- PROPOSED 1.2m WIDE FOOTPATH IN ACCORDANCE WITH PCC STD DRG. SD1001
- PROPOSED DRIVEWAY HARDSTAND
- PROPOSED TYPE 'INDUSTRIAL' DRIVEWAY CROSSOVER IN ACCORDANCE WITH PCC STD DRG. SD1004.
- EXISTING ROAD

STORMWATER STRUCTURE TABLE

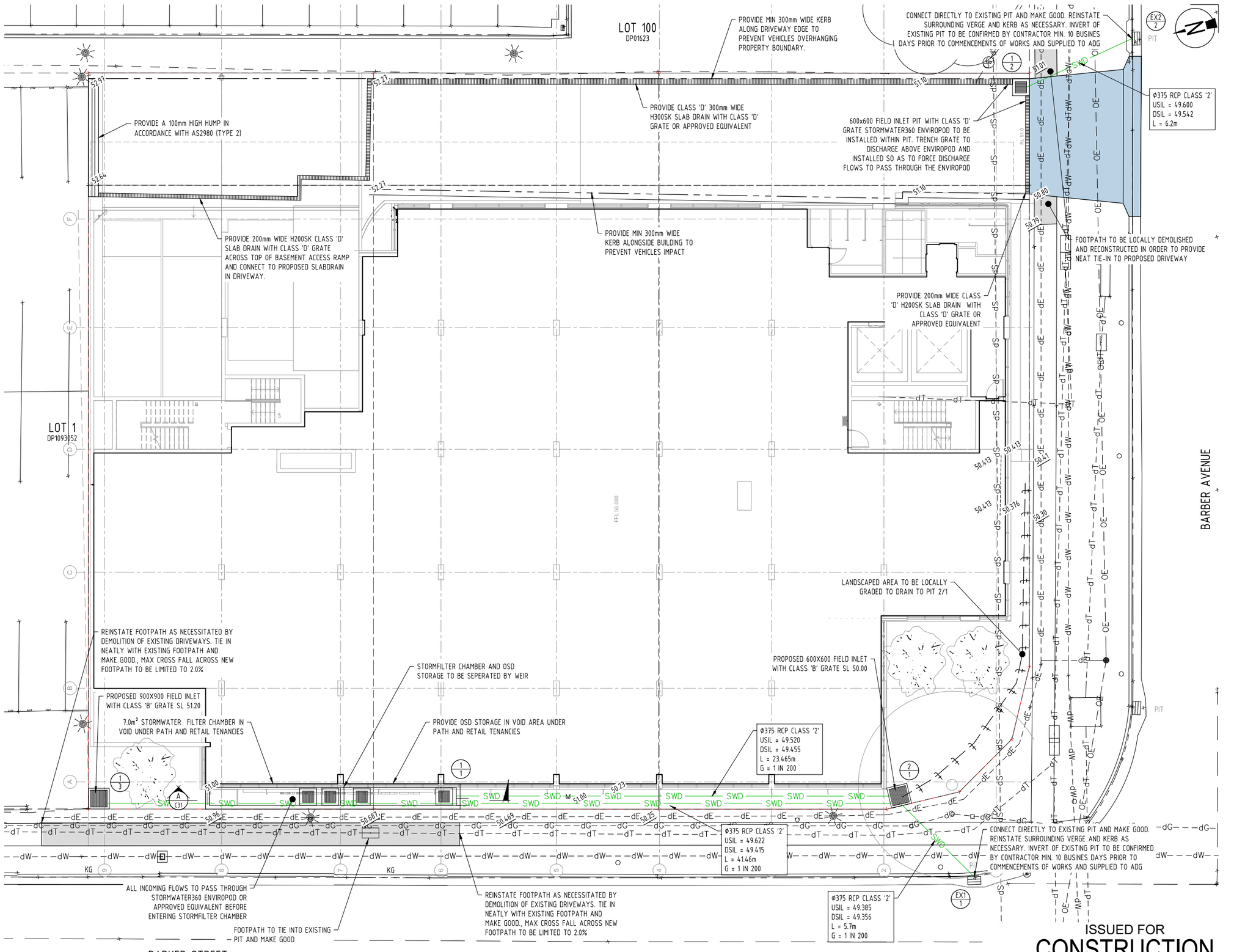
STRUCTURE ID	INVERT	SURFACE LEVEL	DESCRIPTION
1/1	49.520	VARIES	COMBINED STORMWATER TREATMENT / DETENTION TANK
2/1	49.385	50.000	600x600 FIELD INLET PIT WITH CLASS 'B' GRATE
EX/1	TBC	50.100	EXISTING KERB GULLY PIT
1/2	49.600	50.970	600X600 INLET PIT WITH CLASS 'D' GRATE
EX2/2	TBC	50.800	EXISTING KERB GULLY PIT
1 / 3	49.622	52.10	900X900 FIELD INLET PIT WITH CLASS 'B' GRATE

LANDSCAPE ARCHITECT COORDINATION

ALL STREETSCAPE AND CROSS LINK PATHWAY WORKS TO BE BUILT REFERENCING LANDSCAPE DRAWINGS. ANY DISCREPANCY BETWEEN CIVILS AND LANDSCAPE ARCHITECT DRAWINGS ARE TO BE HIGHLIGHTED TO SUPERINTENDENT PRIOR TO CONSTRUCTION.

NOTE

1. FOR TANK DETAIL REFER TO ORG No. C31



ISSUED FOR
CONSTRUCTION

Rev	Date	Description	By	Chk
B	19.12.18	ISSUED FOR APPROVAL - AMENDED AS PER COUNCIL COMMENTS	TL	JH
A	23.11.18	ISSUED FOR APPROVAL - AMENDED AS PER COUNCIL COMMENTS	TL	JH
01	26.06.18	ISSUED FOR DA APPROVAL	LDV	JH

SCALE 1:100
AT ORIGINAL SIZE (A1)

Sydney Office
Suite 802, Level 8, 181 Miller Street
North Sydney, New South Wales 2060, Australia
T 1300 657 402 F +617 3871 2266
E info@adgce.com W www.adgce.com
BRISBANE / SYDNEY / MELBOURNE / GOLD COAST / SUNSHINE COAST / DARWIN / PERTH

Client: CORNERSTONE BUILDING DEVELOPMENTS
Project Name: NEPEAN SPECIALIST MEDICAL CENTRE & SUITES
84-88 PARKER STREET,
KINGSWOOD, NSW, 2747

Discipline	Status
CIVIL	CONSTRUCTION

Designed By	Checked By	Approved By
JH/MB	DS	JH

Project No.	Drawn By	Scale at A1
21196	LDV	1:100

Title: ROADWORK & DRAINAGE LAYOUT PLAN

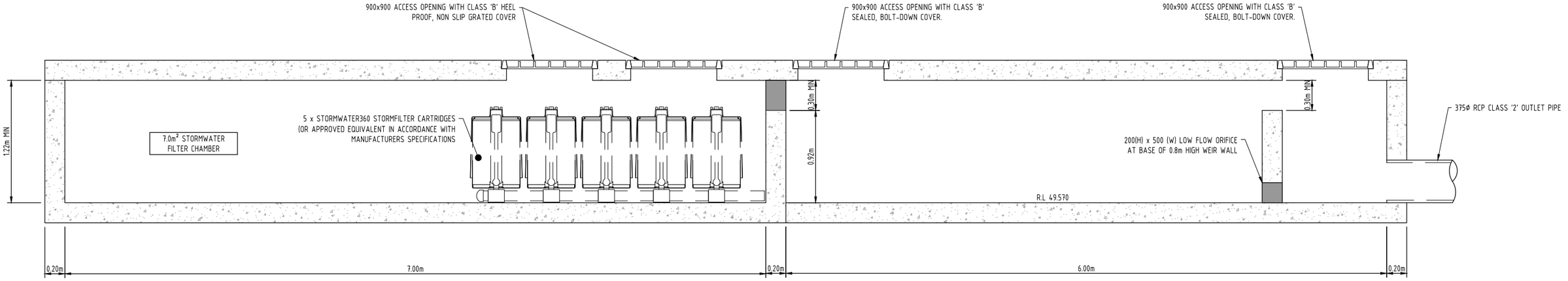
Drawing No.: C30
Revision: B

PLOT DATE: 12/20/2018 1:11 AM FILENAME: Z:\21000\21196\CVL\DWG\21196_C30_ROADWORK & DRAINAGE LAYOUT PLAN.DWG

FULL SIZE ON ORIGINAL 0 10 20 30 40 50 60 70 80 90 100mm

ROADWORKS & DRAINAGE NOTES

1. FOR GENERAL NOTES REFER TO DRG No. C01, WHICH IS TO BE REQUESTED AND VIEWED PRIOR TO COMMENCEMENT OF CONSTRUCTION IF NOT SUPPLIED.
2. REFER TO HYDRAULIC DRAWINGS FOR BASEMENT, ROOF AND UPPER LEVEL TERRACES DRAINAGE.
3. ALL ROADWORKS & DRAINAGE (EXTERNAL TO SITE BOUNDARIES AND/OR COUNCIL OWNED DRAINAGE PIPES INTERNAL TO THE SITE BOUNDARIES) CONSTRUCTION AND TESTING TO BE IN ACCORDANCE WITH PENRITH CITY COUNCIL DEVELOPMENT GUIDELINES, DRAWINGS AND SPECIFICATIONS.
4. ALL DRAINAGE CONSTRUCTION (PRIVATELY OWNED DRAINAGE LINES INTERNAL TO THE SITE BOUNDARIES) CONSTRUCTED AND TESTED TO BE IN ACCORDANCE WITH RELEVANT AUSTRALIAN STANDARDS.
5. ALL ROOFWATER PITS SHALL BE PROVIDED WITH 150Ø STUB TO SERVICE THE LOT AT 50mm ABOVE INVERT OF PIT.
6. DRAINAGE PITS TO BE PROVIDED WITH Ø150 STUB FOR FUTURE HYDRAULIC CONNECTION TO BE MINIMUM 50mm ABOVE INVERT OF PIT.
7. UNLESS NOTED OTHERWISE, ALL STORMWATER DRAINAGE PIPES SHALL BE:
   a) 225 DIA UPVC SN8 RUBBER RING JOINTED
   b) 300 DIA AND GREATER CLASS 2 R.C. RUBBER RING JOINTED
8. ALL STORMWATER DRAINAGE PIPES INTERNAL TO SITE SHALL BE:
   a) 225 DIA TO 375 DIA uPVC SN8 RUBBER RING JOINTED, BLACKMAX OR APPROVED EQUIVALENT.
   b) 450 DIA TO 600 DIA PP SN8 RUBBER RING JOINTED, BLACKMAX OR APPROVED EQUIVALENT.
9. ALL STORMWATER DRAINAGE PIPES EXTERNAL TO SITE SHALL BE:
   a) 300 DIA AND GREATER CLASS 2 OR 3 R.C. RUBBER RING JOINTED
10. ALL STORMWATER PIPES ARE TO BE MANUFACTURED TO RELEVANT AUSTRALIAN STANDARDS INCLUDING BUT NOT LIMITED TO AS4058 & AS1992.
11. STORMWATER DRAINAGE AND STRUCTURES HAVE BEEN DESIGNED FOR OPERATIONAL LOADS ONLY. CONTRACTOR TO CONSIDER CONSTRUCTION LOADINGS AND ENSURE NO EXCESSIVE LOADS ARE PLACED ON STORMWATER DRAINAGE OR STRUCTURES.
12. ALL PRECAST END STRUCTURES TO BE CONSTRUCTED WITH REINFORCED CONCRETE END WALL.
13. CONTRACTOR TO CONFIRM LOCATION AND LEVEL OF EXISTING STORMWATER DRAINAGE WHERE CONNECTING ON TO EXISTING.
14. CONTRACTOR TO NOTIFY THE SUPERINTENDENT OF ANY UNSUITABLE FOUNDING MATERIAL WITHIN DRAINAGE TRENCH OR STORMWATER STRUCTURES AND AWAIT DIRECTION PRIOR TO LAYING OF PIPES.
15. TRENCH BACKFILL UNDER PAVEMENT TO BE COMPACTED TO 100% STANDARD DRY DENSITY (AS1289 5.1.1) IN LAYERS NOT EXCEEDING 150mm OF CBR 15 MATERIAL OR APPROVED EQUIVALENT. TRENCH BACKFILL IN ROADS TO BE MINIMUM CBR15 MATERIAL UP TO ROAD SUBGRADE LEVEL.
16. ALL STORMWATER GRATES/LIDS WITHIN TRAFFICABLE AREAS TO BE CLASS "D" IN ACCORDANCE WITH AS3996.
17. ALL GRATES AND LIDS SHALL SIT FLAT WITH ITS SURROUND AND NOT BE LOOSE OR MOVE UNDER WHEEL LOADS.
18. ALL STORMWATER STRUCTURES TO BE CONSTRUCTED IN ACCORDANCE WITH PROJECT SPECIFICATION, AND LOCAL AUTHORITY GUIDELINES AND SPECIFICATIONS. WHERE STRUCTURES EXCEED MAXIMUM DEPTH AS IDENTIFIED WITHIN STANDARD DRAWINGS THE CONTRACTOR WILL ENSURE AN ADEQUATE STRUCTURAL DESIGN IS UNDERTAKEN FOR THE SUBJECT STRUCTURE TO BE CONSTRUCTED TO.
19. CONTRACTOR TO ENSURE ALL MANHOLE STRUCTURES COMPLY WITH THE MAXIMUM DEPTH SPECIFIED IN THE PROJECT SPECIFICATION OR LOCAL AUTHORITY FROM FINISHED SURFACE LEVEL TO UNDERSIDE OF ROOF SLAB. ANY NON CONFORMANCE IS TO BE RECTIFIED AT THE CONTRACTORS EXPENSE.
20. CONTRACTOR TO INSTALL STEP IRONS WITHIN MANHOLES/FIELD INLETS WHERE REQUIRED BY LOCAL AUTHORITY.
21. ALL FOOTPATHS TO BE CONSTRUCTED IN ACCORDANCE WITH ARCHITECTURAL/LANDSCAPING DRAWINGS AND RELEVANT AUTHORITY STANDARD DRAWINGS AND SPECIFICATIONS. FOOTPATHS TO BE CONSTRUCTED WITH MAXIMUM 2% CROSSFALL. SHOULD CONSTRUCTED FOOTPATHS EXCEED 2.5% CROSSFALL, THE CONTRACTOR WILL BE REQUIRED TO RECTIFY BY REMOVING AND REPLACING AT THEIR COST.
22. WHERE A STORMWATER DRAINAGE TRENCH HAS BEEN CONSTRUCTED LONGITUDINALLY IN THE ROAD, THEN THE FINAL PAVEMENT SURFACE REPAIR WIDTH IS TO MATCH THE EXISTING LANE WIDTH AND TERMINATE 50mm CLEAR OF THE ROAD CENTERLINE OR LANE LINE LINEMARKING TO ALLOW FOR THE BITUMEN EMULSION JOINT SEAL. REINSTATEMENT OF SURFACE ADJACENT TO THE KERB OR ROAD PAVEMENT EDGE TO EXTEND FULLY TO THE KERB LINE OR EDGE OF PAVEMENT.
23. THE CONTRACTOR IS TO CONFIRM THE LOCATION OF SERVICE CONDUITS WITH THE SUPERINTENDENT PRIOR TO LAYING STORMWATER DRAINAGE. ALL TRENCH EXCAVATION AND CONSTRUCTION SHALL COMPLY WITH THE REQUIREMENTS OF THE QUEENSLAND WORKPLACE HEALTH AND SAFETY ACT 2011.
24. REMOVE ANY REDUNDANT DRAINAGE OUTLETS FROM THE KERB AND CHANNEL INCLUDING ANY ASSOCIATED PIPEWORK ACROSS THE FOOTWAY AND REINSTATE THE KERB AND CHANNEL AND THE FOOTWAY AREA IN ACCORDANCE WITH COUNCIL GUIDELINES.
25. ALL STORMWATER PITS TO BE LINEMARKED "FLOWS TO CREEK".
26. CONTRACTOR TO UNDERTAKE ROADWORKS TESTING IN ACCORDANCE WITH PCC GUIDELINES, DRAWINGS AND SPECIFICATIONS.
27. CONTRACTOR TO UNDERTAKE AND PROVIDE CCTV OF ALL STORMWATER LINES AT ON MAINTENANCE AND OFF MAINTENANCE. SHOULD THE CCTV IDENTIFY DAMAGE OR CRACKING WITHIN THE STORMWATER PIPES, THE CONTRACTOR WILL RECTIFY THE DAMAGE WITHIN THE PIPES BY MEANS DIRECTED BY THE SUPERINTENDENT WHICH MAY INCLUDE BUT NOT BE LIMITED TO PIPE RELINING OR PIPE REPLACEMENT.



SECTION A
SCALE 1:50
C30

ISSUED FOR
APPROVAL

Rev	Date	Description	By	Chk
A	23.11.18	ISSUED FOR APPROVAL - AMENDED AS PER COUNCIL COMMENTS	TL	JH
01	26.06.18	ISSUED FOR DA APPROVAL	LDV	JH

SCALE 1:20
AT ORIGINAL SIZE (A1)

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BRISBANE / SYDNEY / MELBOURNE / GOLD COAST / SUNSHINE COAST / DARWIN / PERTH

Client: CORNERSTONE BUILDING DEVELOPMENTS
Project Name: NEPEAN SPECIALIST MEDICAL CENTRE & SUITES
84-88 PARKER STREET,
KINGSWOOD, NSW, 2747

Discipline: CIVIL
Status: APPROVAL
Designed By: JH
Checked By: JH
Approved By: JH
Project No.: 21196
Drawn By: LDV
Scale at A1: 1:20

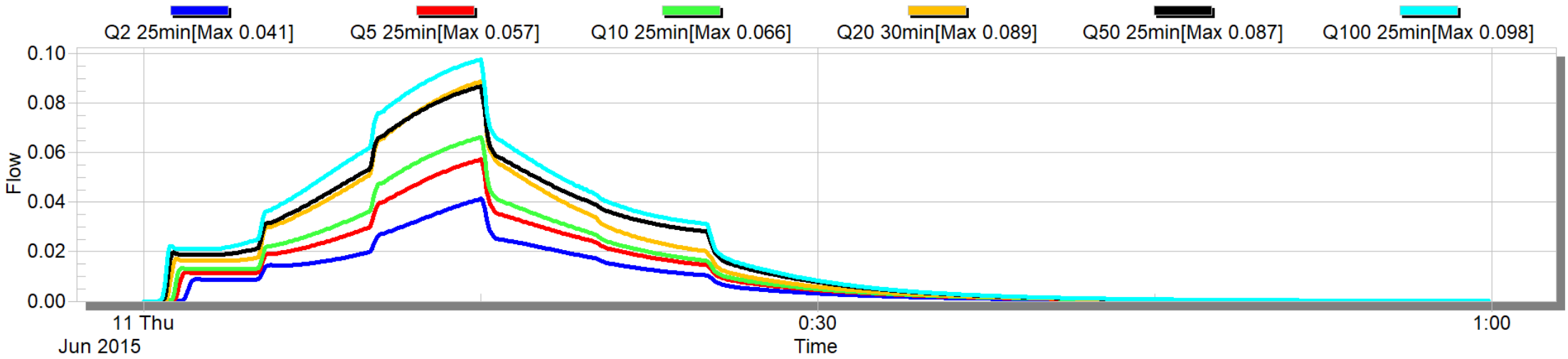
Title: ROADWORK & DRAINAGE NOTES & DETAILS
Drawing No.: C31
Revision: A

PLOT DATE: 11/23/2018 5:19 PM FILENAME: J:\21000\21196\CVL\DWG\21196_C31_ROADWORK & DRAINAGE NOTES & DETAILS.DWG

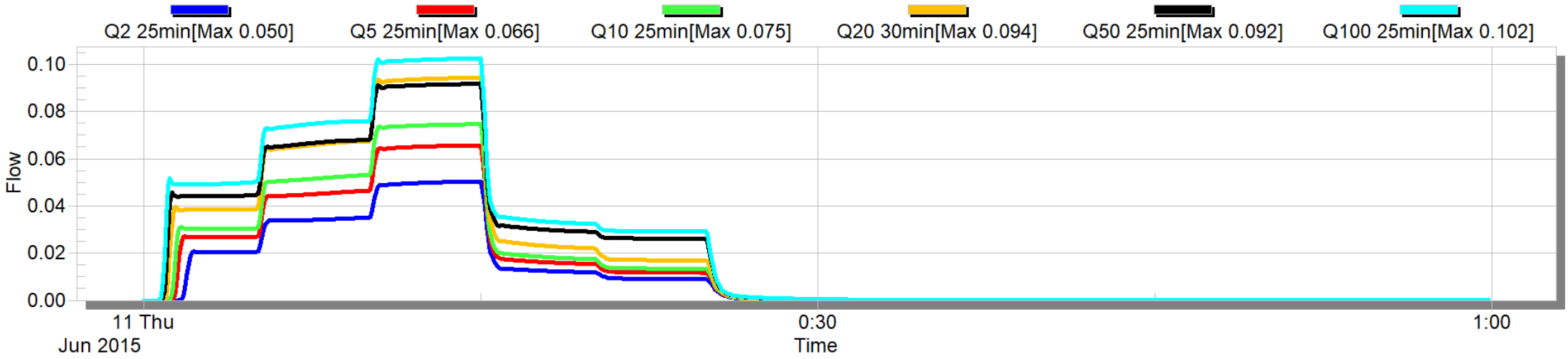
FULL SIZE ON ORIGINAL 0 10 20 30 40 50 60 70 80 90 100mm

Appendix D
XP-Storm Outputs

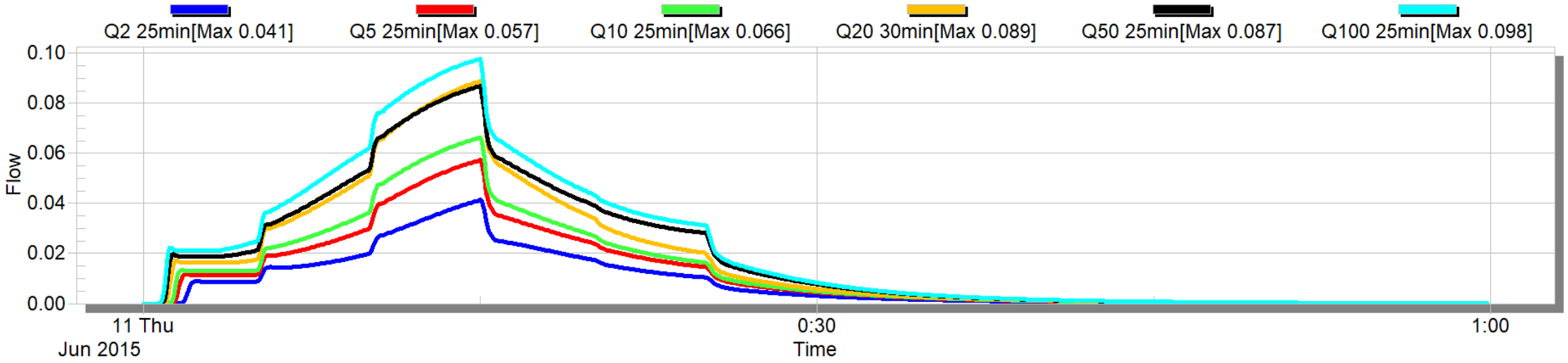
PRE-DEVELOPMENT PEAK FLOW RATE 'EX1' (m3/s)



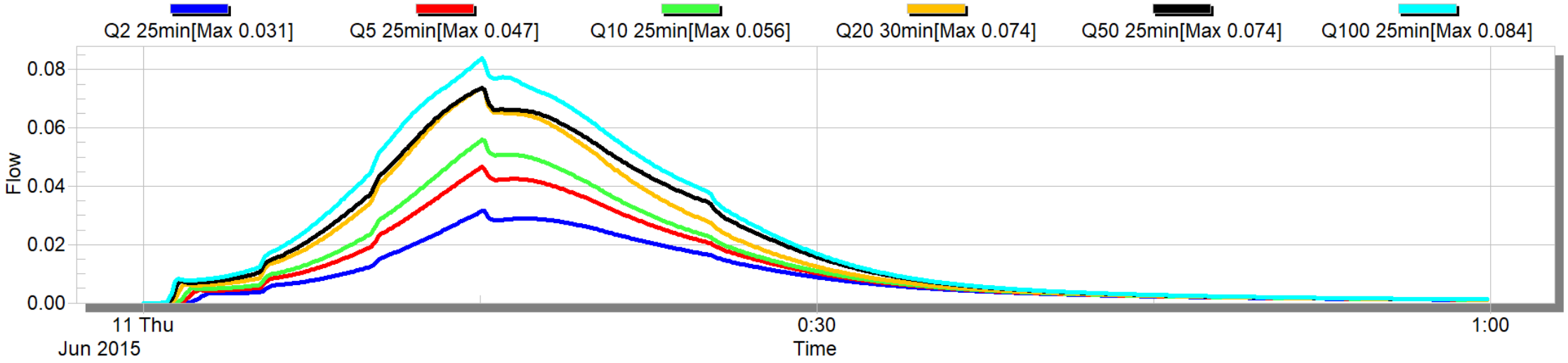
POST-DEVELOPMENT PEAK FLOW RATE - UNMITIGATED (m3/s)



PRE-DEVELOPMENT PEAK FLOW RATE 'EX1' (m3/s)



POST-DEVELOPMENT MITIGATED PEAK FLOW RATE 'C1' (m3/s)



E20

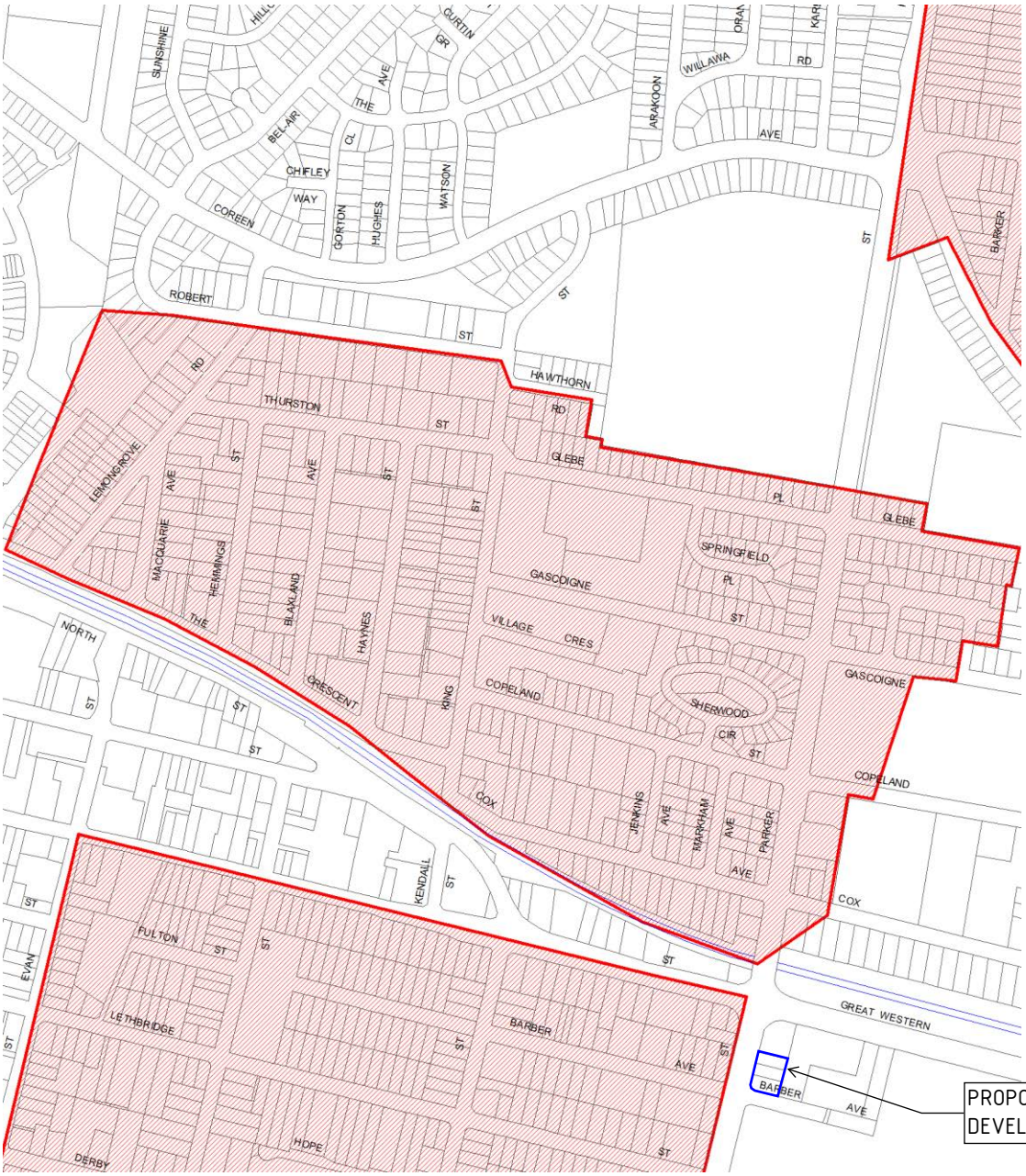
Name	Storm	Node Name	Flood Loss	Max Water Ele
EXISTING SITE (40% IMPERVIOUS)	Q2 25min	EXISTING SITE	0.000	0.081
EXISTING SITE (40% IMPERVIOUS)	Q5 25min	EXISTING SITE	0.000	0.094
EXISTING SITE (40% IMPERVIOUS)	Q10 25min	EXISTING SITE	0.000	0.101
EXISTING SITE (40% IMPERVIOUS)	Q20 30min	EXISTING SITE	0.000	0.116
EXISTING SITE (40% IMPERVIOUS)	Q50 25min	EXISTING SITE	0.000	0.115
EXISTING SITE (40% IMPERVIOUS)	Q100 25min	EXISTING SITE	0.000	0.122
PROPOSED SITE (DETAINED CATCHMENT)	Q2 25min	PROPOSED SIT	0.000	0.124
PROPOSED SITE (DETAINED CATCHMENT)	Q5 25min	PROPOSED SIT	0.000	0.154
PROPOSED SITE (DETAINED CATCHMENT)	Q10 25min	PROPOSED SIT	0.000	0.170
PROPOSED SITE (DETAINED CATCHMENT)	Q20 30min	PROPOSED SIT	0.000	0.204
PROPOSED SITE (DETAINED CATCHMENT)	Q50 25min	PROPOSED SIT	0.000	0.201
PROPOSED SITE (DETAINED CATCHMENT)	Q100 25min	PROPOSED SIT	0.000	0.237
PRE OUT	Q2 25min	PRE OUT	0.000	-0.220
PRE OUT	Q5 25min	PRE OUT	0.000	-0.207
PRE OUT	Q10 25min	PRE OUT	0.000	-0.200
PRE OUT	Q20 30min	PRE OUT	0.000	-0.184
PRE OUT	Q50 25min	PRE OUT	0.000	-0.186
PRE OUT	Q100 25min	PRE OUT	0.000	-0.179
POST OUT	Q2 25min	POST OUT	0.000	-0.531
POST OUT	Q5 25min	POST OUT	0.000	-0.515
POST OUT	Q10 25min	POST OUT	0.000	-0.508
POST OUT	Q20 30min	POST OUT	0.000	-0.495
POST OUT	Q50 25min	POST OUT	0.000	-0.495
POST OUT	Q100 25min	POST OUT	0.000	-0.487
JUNCTION.1	Q2 25min	JUNCTION.1	0.000	-0.229
JUNCTION.1	Q5 25min	JUNCTION.1	0.000	-0.215
JUNCTION.1	Q10 25min	JUNCTION.1	0.000	-0.207
JUNCTION.1	Q20 30min	JUNCTION.1	0.000	-0.194
JUNCTION.1	Q50 25min	JUNCTION.1	0.000	-0.194
JUNCTION.1	Q100 25min	JUNCTION.1	0.000	-0.187
BYPASS	Q2 25min	BYPASS	0.000	0.035
BYPASS	Q5 25min	BYPASS	0.000	0.039
BYPASS	Q10 25min	BYPASS	0.000	0.042
BYPASS	Q20 30min	BYPASS	0.000	0.047
BYPASS	Q50 25min	BYPASS	0.000	0.046
BYPASS	Q100 25min	BYPASS	0.000	0.049
UNMITIGATED POST	Q2 25min	UNMITIGATED	0.000	0.088
UNMITIGATED POST	Q5 25min	UNMITIGATED	0.000	0.100
UNMITIGATED POST	Q10 25min	UNMITIGATED	0.000	0.107
UNMITIGATED POST	Q20 30min	UNMITIGATED	0.000	0.121
UNMITIGATED POST	Q50 25min	UNMITIGATED	0.000	0.119
UNMITIGATED POST	Q100 25min	UNMITIGATED	0.000	0.126
POST OUT.1	Q2 25min	POST OUT.1	0.000	-0.212
POST OUT.1	Q5 25min	POST OUT.1	0.000	-0.201
POST OUT.1	Q10 25min	POST OUT.1	0.000	-0.194
POST OUT.1	Q20 30min	POST OUT.1	0.000	-0.181
POST OUT.1	Q50 25min	POST OUT.1	0.000	-0.183
POST OUT.1	Q100 25min	POST OUT.1	0.000	-0.176

E20

Name	Storm	Max Water De	Max Volume	Freeboard
EXISTING SITE (40% IMPERVIOUS)	Q2 25min	0.081	0.098	998.920
EXISTING SITE (40% IMPERVIOUS)	Q5 25min	0.094	0.115	998.910
EXISTING SITE (40% IMPERVIOUS)	Q10 25min	0.101	0.123	998.900
EXISTING SITE (40% IMPERVIOUS)	Q20 30min	0.116	0.142	998.880
EXISTING SITE (40% IMPERVIOUS)	Q50 25min	0.115	0.140	998.890
EXISTING SITE (40% IMPERVIOUS)	Q100 25min	0.122	0.148	998.880
PROPOSED SITE (DETAINED CATCHMENT)	Q2 25min	0.124	0.619	998.880
PROPOSED SITE (DETAINED CATCHMENT)	Q5 25min	0.154	0.770	998.850
PROPOSED SITE (DETAINED CATCHMENT)	Q10 25min	0.170	0.851	998.830
PROPOSED SITE (DETAINED CATCHMENT)	Q20 30min	0.204	1.020	998.800
PROPOSED SITE (DETAINED CATCHMENT)	Q50 25min	0.201	1.007	998.800
PROPOSED SITE (DETAINED CATCHMENT)	Q100 25min	0.237	1.184	998.760
PRE OUT	Q2 25min	0.080	0.097	999.220
PRE OUT	Q5 25min	0.093	0.113	999.210
PRE OUT	Q10 25min	0.100	0.122	999.200
PRE OUT	Q20 30min	0.116	0.141	999.180
PRE OUT	Q50 25min	0.114	0.140	999.190
PRE OUT	Q100 25min	0.121	0.147	999.180
POST OUT	Q2 25min	0.069	0.084	999.530
POST OUT	Q5 25min	0.085	0.103	999.520
POST OUT	Q10 25min	0.092	0.112	999.510
POST OUT	Q20 30min	0.105	0.128	999.490
POST OUT	Q50 25min	0.105	0.128	999.490
POST OUT	Q100 25min	0.113	0.137	999.490
JUNCTION.1	Q2 25min	0.071	0.086	999.230
JUNCTION.1	Q5 25min	0.085	0.104	999.210
JUNCTION.1	Q10 25min	0.093	0.113	999.210
JUNCTION.1	Q20 30min	0.106	0.129	999.190
JUNCTION.1	Q50 25min	0.106	0.130	999.190
JUNCTION.1	Q100 25min	0.113	0.138	999.190
BYPASS	Q2 25min	0.035	0.042	998.970
BYPASS	Q5 25min	0.039	0.048	998.960
BYPASS	Q10 25min	0.042	0.051	998.960
BYPASS	Q20 30min	0.047	0.057	998.950
BYPASS	Q50 25min	0.046	0.056	998.950
BYPASS	Q100 25min	0.049	0.059	998.950
UNMITIGATED POST	Q2 25min	0.088	0.108	998.910
UNMITIGATED POST	Q5 25min	0.100	0.122	998.900
UNMITIGATED POST	Q10 25min	0.107	0.131	998.890
UNMITIGATED POST	Q20 30min	0.121	0.147	998.880
UNMITIGATED POST	Q50 25min	0.119	0.145	998.880
UNMITIGATED POST	Q100 25min	0.126	0.154	998.870
POST OUT.1	Q2 25min	0.088	0.107	999.210
POST OUT.1	Q5 25min	0.099	0.121	999.200
POST OUT.1	Q10 25min	0.106	0.129	999.190
POST OUT.1	Q20 30min	0.119	0.145	999.180
POST OUT.1	Q50 25min	0.117	0.143	999.180
POST OUT.1	Q100 25min	0.124	0.151	999.180

Appendix E
Council Mandatory OSD Area Map

ON-SITE DETENTION AREA - LEMONGROVE



Not to Scale

Appendix F
MUSIC Model Details

MUSIC Model Information

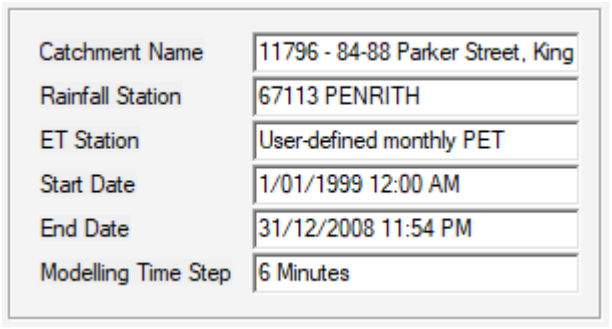
Introduction:

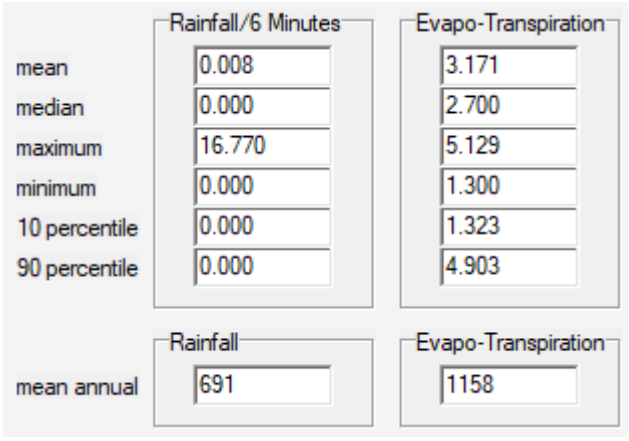
The quality of stormwater runoff and the impact of the proposed stormwater quality improvement measures were analyzed using MUSIC Version 6.3.0 according to the *MUSIC Modeling Guidelines Version 1.0, Water by Design 2010.* The source nodes in the model are split into various types and a summary of the area breakdown is presented below:

Meteorological Data:

The MUSIC model was carried out using the following parameters:

- Modeling period should be 10-years with a time step of 6 minutes
- The nearest available 6-minute time step rainfall series to the subject site is sourced from Rainfall Station 67113 PENRITH, with a mean annual rainfall of 691mm, and data from: 1/1/1999 to 31/12/2008





Evaporation was applied as monthly mean. The mean annual evaporation was 1158 mm.

Source Nodes, Fractions Impervious:

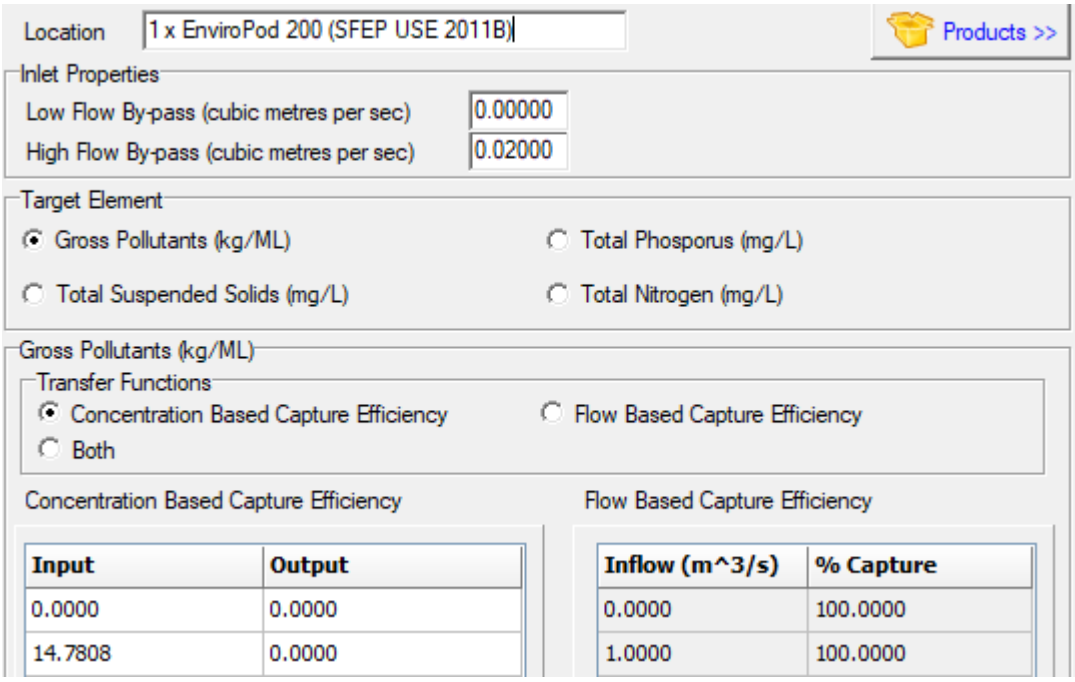
The areas of the source nodes were estimated from the architectural drawings as shown in **Appendix A**.

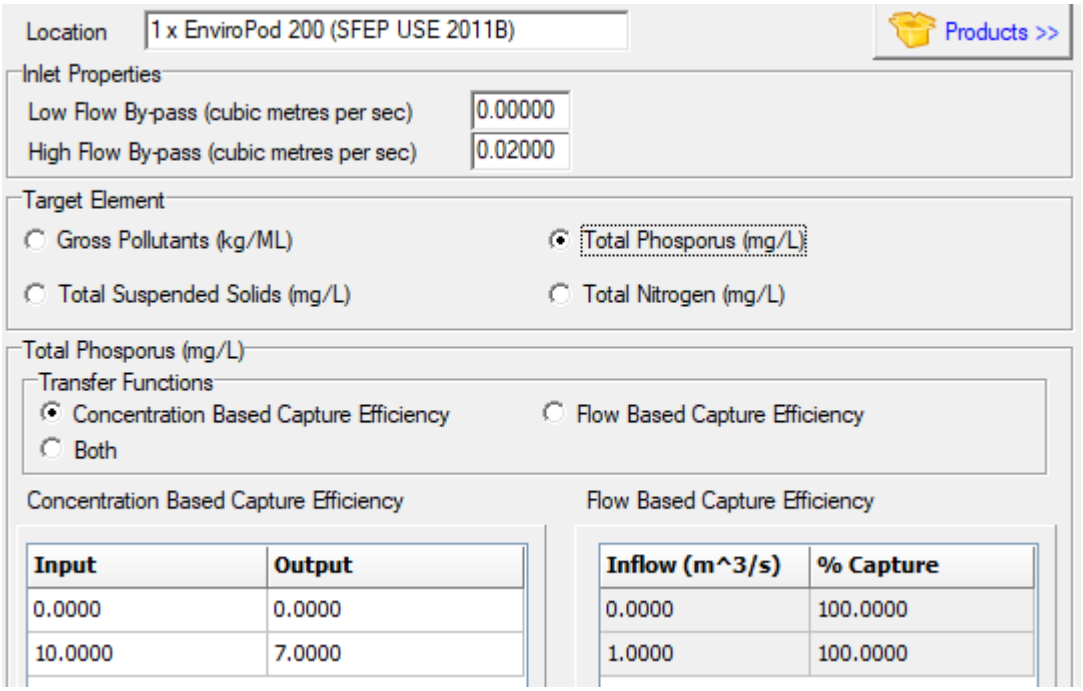
Source Nodes - Pollutant Exports:

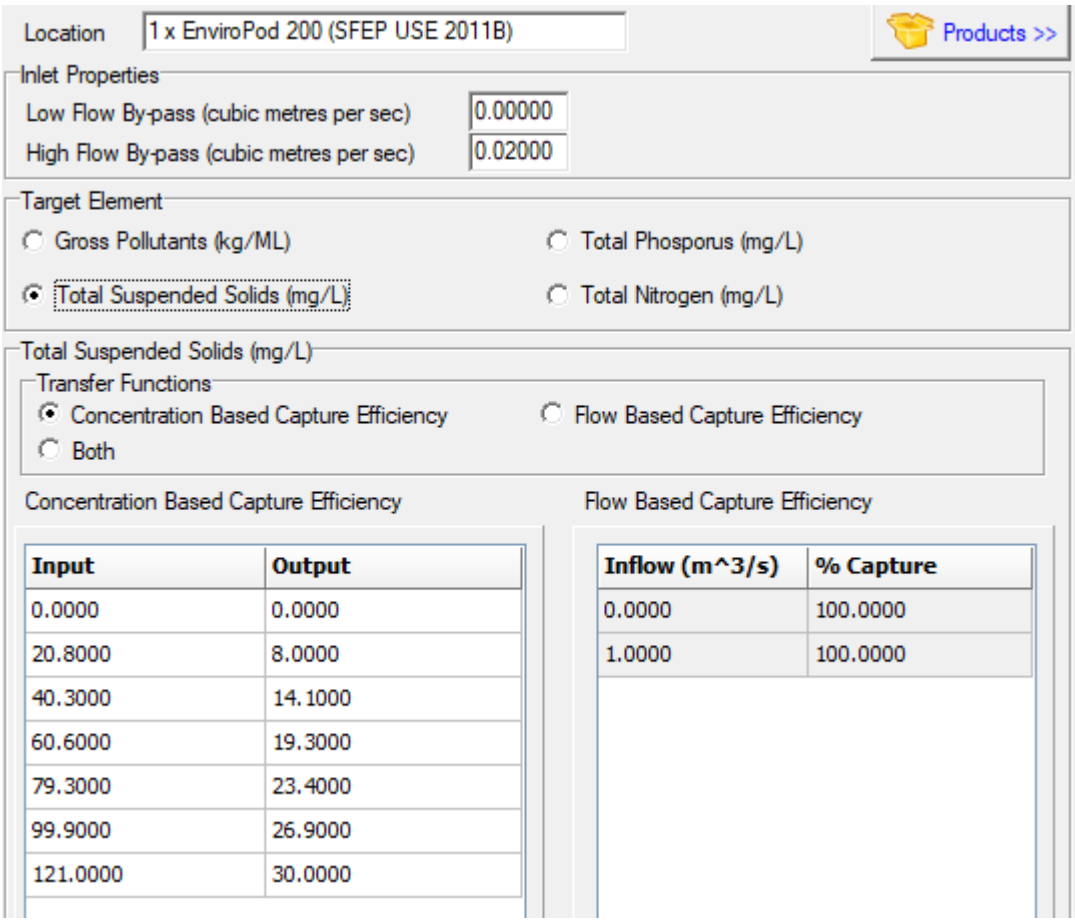
Rainfall runoff and pollutant export parameters were assigned per Tables 3.7 and 3.8 of the Water by Design MUSIC Modeling Guidelines Version 1.0 (2010).

Rainfall runoff and pollutant export parameters compliant with City of Gold Coast MUSIC-Link were adopted.

Enviropod Input Data:







Location: 1 x EnviroPod 200 (SFEP USE 2011B) — Products >>

Inlet Properties
- Low Flow By-pass (cubic metres per sec): 0.00000
- High Flow By-pass (cubic metres per sec): 0.02000

Target Element
- ○ Gross Pollutants (kg/ML)
- ○ Total Phosporus (mg/L)
- ◉ Total Suspended Solids (mg/L)
- ○ Total Nitrogen (mg/L)

Total Suspended Solids (mg/L)

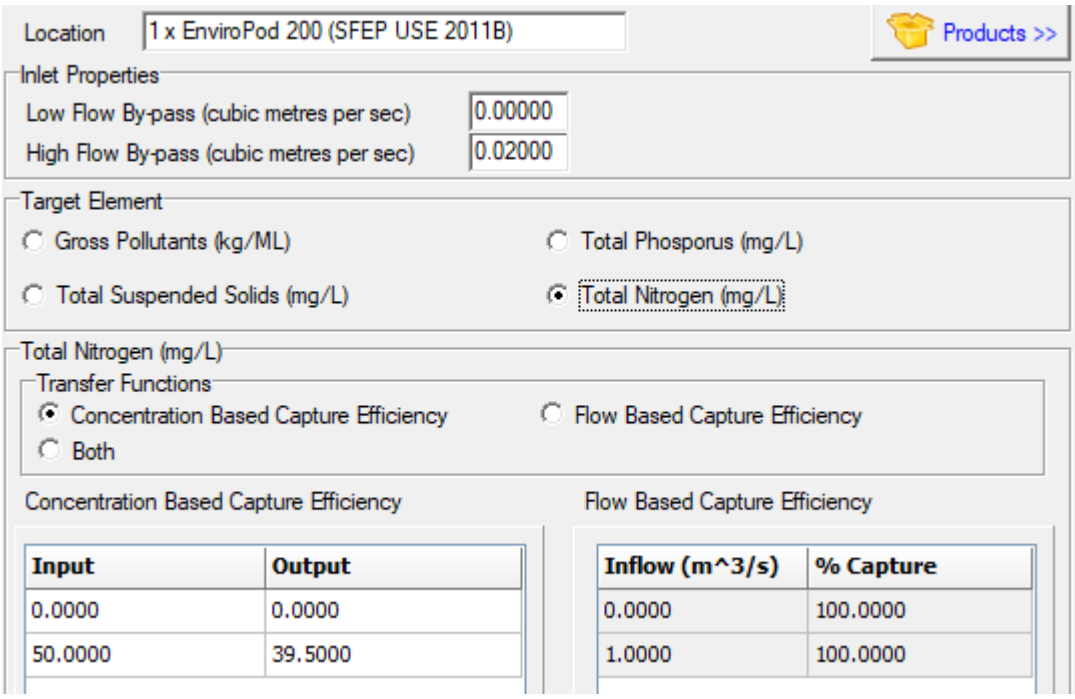
Transfer Functions
- ◉ Concentration Based Capture Efficiency
- ○ Flow Based Capture Efficiency
- ○ Both

Concentration Based Capture Efficiency

Input	Output
0.0000	0.0000
20.8000	8.0000
40.3000	14.1000
60.6000	19.3000
79.3000	23.4000
99.9000	26.9000
121.0000	30.0000

Flow Based Capture Efficiency

Inflow (m^3/s)	% Capture
0.0000	100.0000
1.0000	100.0000



Location: 1 x EnviroPod 200 (SFEP USE 2011B) — Products >>

Inlet Properties
- Low Flow By-pass (cubic metres per sec): 0.00000
- High Flow By-pass (cubic metres per sec): 0.02000

Target Element
- ○ Gross Pollutants (kg/ML)
- ○ Total Phosporus (mg/L)
- ○ Total Suspended Solids (mg/L)
- ◉ Total Nitrogen (mg/L)

Total Nitrogen (mg/L)

Transfer Functions
- ◉ Concentration Based Capture Efficiency
- ○ Flow Based Capture Efficiency
- ○ Both

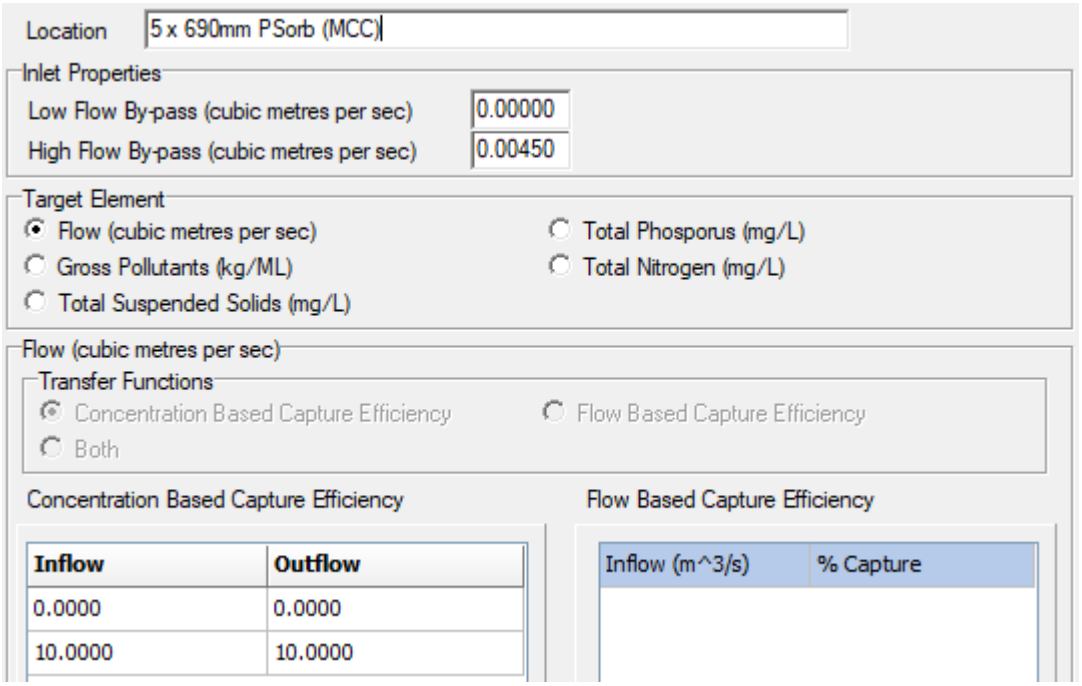
Concentration Based Capture Efficiency

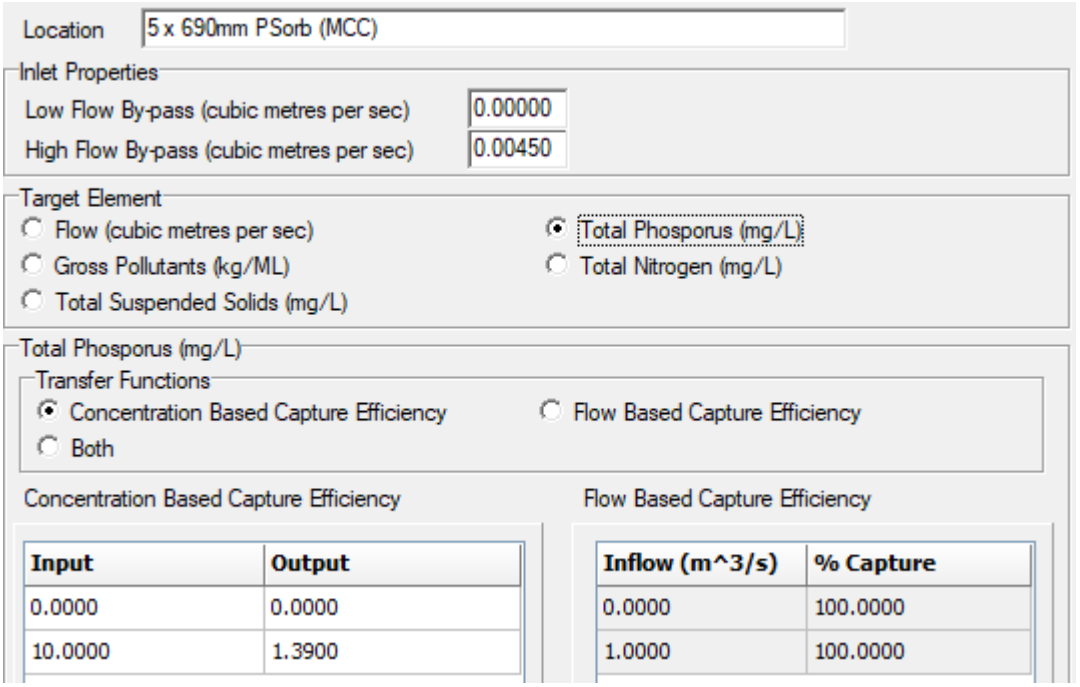
Input	Output
0.0000	0.0000
50.0000	39.5000

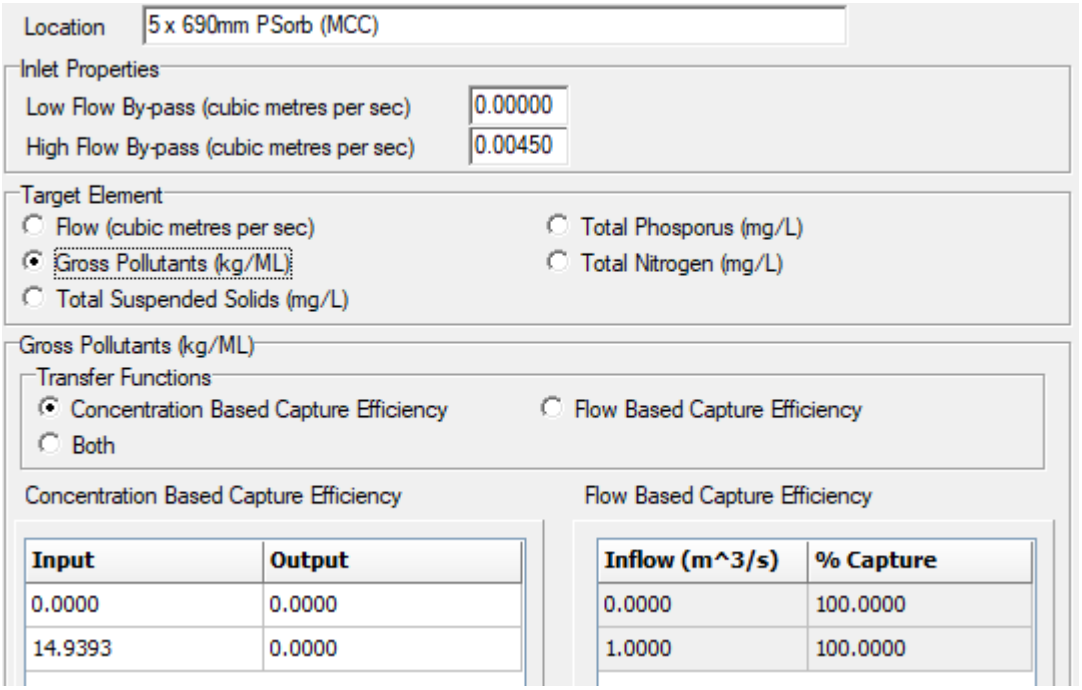
Flow Based Capture Efficiency

Inflow (m^3/s)	% Capture
0.0000	100.0000
1.0000	100.0000

Stormfilter Input Data:



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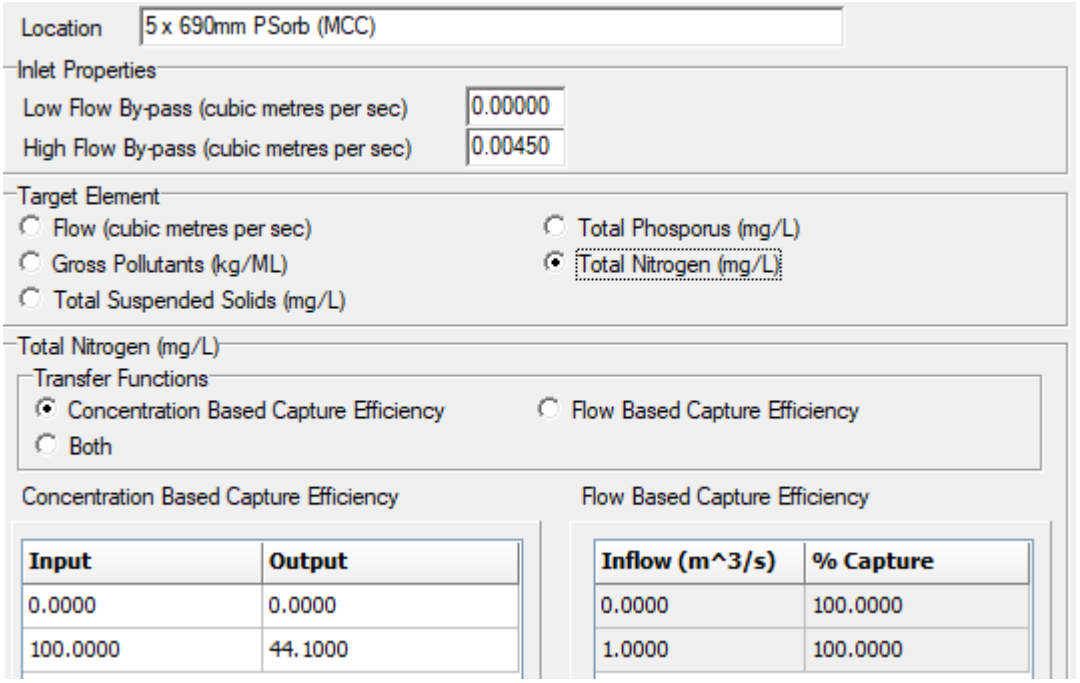
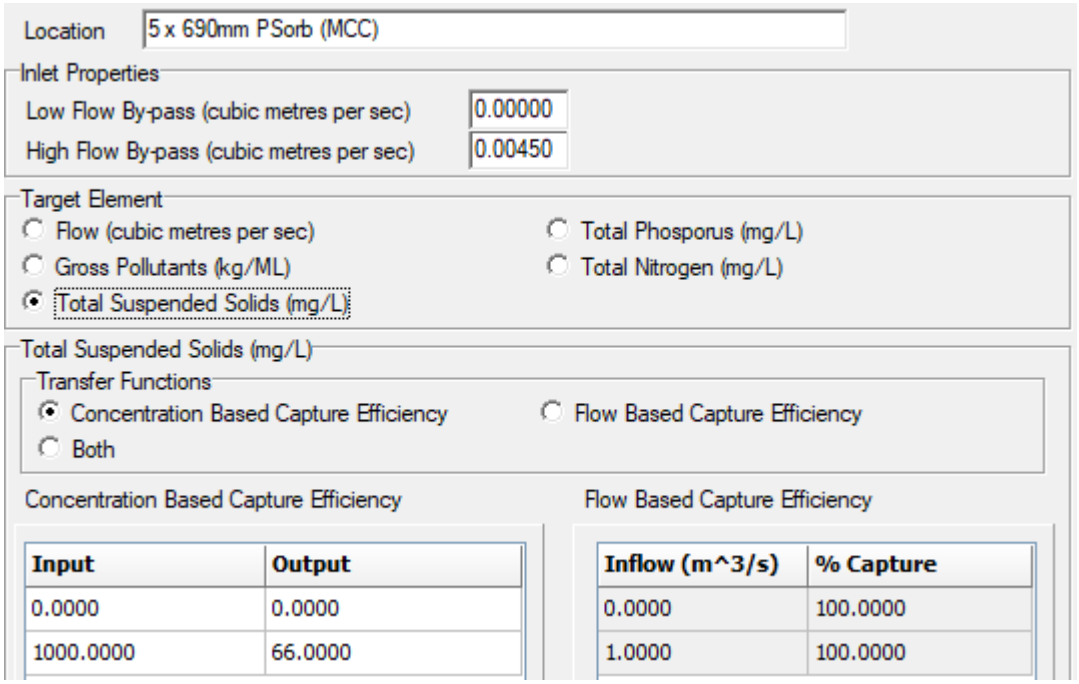
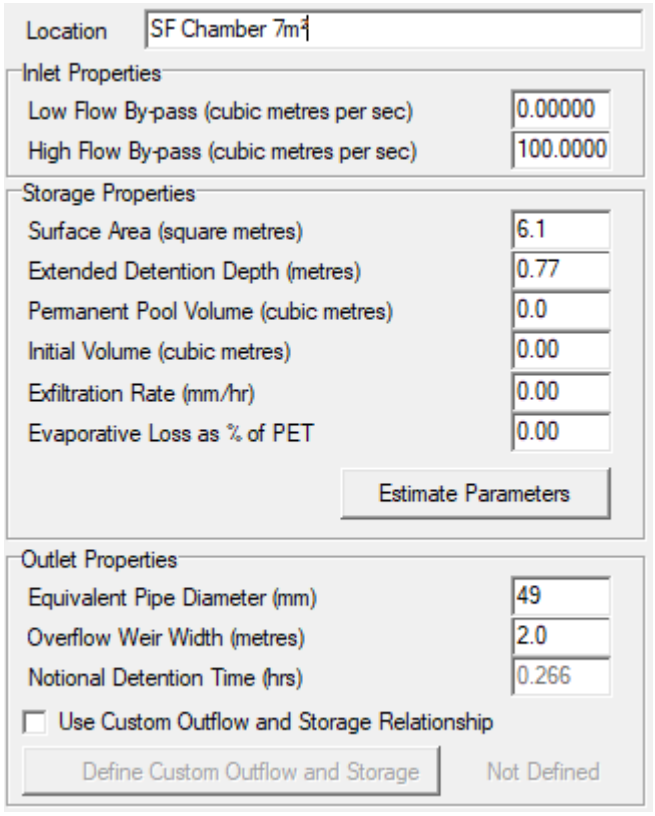
5 x 690mm PSorb (MCC)
Inlet Properties
Low Flow By-pass (cubic metres per sec)
0.00000
High Flow By-pass (cubic metres per sec)
0.00450
Target Element
Flow (cubic metres per sec)
Gross Pollutants (kg/ML)
Total Suspended Solids (mg/L)
Total Phosporus (mg/L)
Total Nitrogen (mg/L)
Gross Pollutants (kg/ML)
Transfer Functions
Concentration Based Capture Efficiency
Flow Based Capture Efficiency
Both
Concentration Based Capture Efficiency
Input
Output
0.0000
0.0000
14.9393
0.0000
Flow Based Capture Efficiency
Inflow (m^3/s)
% Capture
0.0000
100.0000
1.0000
100.0000


Location
5 x 690mm PSorb (MCC)
Inlet Properties
Low Flow By-pass (cubic metres per sec)
0.00000
High Flow By-pass (cubic metres per sec)
0.00450
Target Element
Flow (cubic metres per sec)
Gross Pollutants (kg/ML)
Total Suspended Solids (mg/L)
Total Phosporus (mg/L)
Total Nitrogen (mg/L)
Total Nitrogen (mg/L)
Transfer Functions
Concentration Based Capture Efficiency
Flow Based Capture Efficiency
Both
Concentration Based Capture Efficiency
Input
Output
0.0000
0.0000
100.0000
44.1000
Flow Based Capture Efficiency
Inflow (m^3/s)
% Capture
0.0000
100.0000
1.0000
100.0000



Stormfilter Chamber Input Data:



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