Flood Impact Assessment Report

21-23 Victoria Avenue, Castle Hill

Prepared for Blueprint Australia Planning Development Management / 29 July 2022

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1.0 Executive Summary

Taylor Thomson Whitting (NSW) Pty Ltd (TTW) has prepared this flood impact assessment to support a Planning Proposal for a proposed mixed-use multi-storey development at 21-23 Victoria Avenue, Castle Hill (the site). This report documents the procedures and findings of hydraulic modelling of the site in existing and proposed conditions in the 1% AEP and PMF events.

A request made to Council to provide the flood model for The Hills Urban Overland Flood Study (May 2017), however, TTW were advised that Council are unable to provide the flood model and associated output files.

Discreet parts of the model and results were provided by The Hills Shire Council and these were used together with recent survey data and to prepare a hydraulic TUFLOW model for the site to assess the flood conditions of the site and its proximity in the existing conditions for the pre-development scenario.

As requested by Council, this report also includes an assessment of the trunk drainage access and maintenance (section 14) along with an outline Flood Emergency Response Plan (section 13), a detailed FERP will be developed during the detailed DA stage and prior to Occupation Certificate Stage. Additional responses to Council comments, and condition assessment report of the twin council pipe system are detailed in the following separate reports:

- Responses to Council Stormwater and Waterways Comments (Appendix A)
- Pipe Condition Assessment (Appendix B)
- Flood Emergency Response Plan (Appendix C)
- Maintenance and Construction Management Plan (Appendix D)
- CCTV Survey Report and Defects Markup (Appendix E)

1.1 Approved Predevelopment Flood Model

The pre-development flood model scenario and results were approved by Council on 5 July 2022, and this model was updated for the post development scenario. The approved flood model was used as a basis for this report and updated to reflect the post development scenario. All other parameters of the model have not been changed.

A summary of the approved pre-development scenarios provided by council is shown in Table 1; *Flood Modelling Clarification and Responses to Council Comments, 5 July 2022*.

1.2 Post development Flood Model

The post development flood model results confirm that:

- The site is generally flood free during the 1% AEP flood event.
- Minor local overland flows on the site are very shallow and are of low hazard during the in the 1% AEP flood event. With no overland flow entering the lower ground car park in the 1% AEP flood event,
- Proposed flood characteristics are largely consistent with existing conditions on the site.
- Maximum flood levels reach 85.12m AHD over the low point of Victoria Avenue. The entrance to the Lower ground car park level is RL85.30m and remains flood free in the 1% AEP.
- Flood hazards are low at the proposed northern and southern building egresses during the 1% AEP flood event as well as during the 0.2% AEP event.
- All openings and penetrations to the lower ground levels are to be protected up to 85.62m AHD (the 1% AEP flood level plus 0.5m freeboard).
- Flood refuge up to the PMF flood levels will be available on the proposed higher levels via internal stairs.
- The proposed development would have no offsite flood impacts greater than +/- 200mm on the adjacent lands during the 1% AEP and 0.2% AEP flood events.
- Compliance with the Council flood planning level requirements for building and car park levels are achieved.
- Access to existing easement is available through the site in proposed conditions.

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Table 1 - summary of the approved pre-development scenarios provided by council (refer to Flood Modelling Clarification and Responses to Council Comments, 5 July 2022)

Waterways Review Comments on Pre-Developed (Base Case) DRAINS and TUFLOW Models Submitted by Taylor Thompson Whitting (TTW)
4/2021/PLP Proposed Development at 15-23 Victoria Avenue, Castle Hill

Key for Colour Coding of Comments
Needs further action
Task completed
TTW response

Item	Minimum Requirements Based on	Council Review (20 April 2022)	TTW Response	Council Checks
A. THSC Comments/Action Items Emailed to TTW on 13 December 2021				
1	Based on the attached survey pit 11S2132 invert is 79.98 mAHD (TTW TUFLOW model 80.37mAHD-~390mm difference) and pit 11S2133 invert is 80.37 mAHD (equal to TTW TUFLOW model). Please clarify if this is interpreted correctly.	Pit 11S2132 and 11S2133 invert level is 80.42 mAHD in the updated submission. TTW to confirm this is reflected as per the new survey levels. This item is conditionally closed.	TTW confirm that the Pit invert level of 80.42 mAHD is consistent with the new survey.	This has been reflected in the new submitted models.
2	TTW TUFLOW Model; Pit 11S2132 and 11S2133 inlet type is set to "GrateA_0.2_GradeRd" (On-Grade pit type according to Council's UOFLS), however these are only junction pits (no flow intake) according to our site visit with TTW on 8/10/2021. See attached picture. Please clarify.	Pit 11S2133 Inlet type still remains as on-grade, it should be updated as junction pit type. No inflow intake is expected via this pit. Refer to the "Figure A1" tab for further details.	1D network in TTW TUFLOW model was modified to address the issue.	This has been reflected in the new submitted models.
3	What is the source of data for the downstream invert levels at the outlet of the pipes (11C2132A and 11C2133A) at the creek? Provided survey data does not extend to this location.	TTW to confirm the levels are updated as per the new site survey. This item is conditionally closed.	TTW confirm that the levels are updated as per the new survey.	This has been reflected in the new submitted models.
4	What is the source of data for the invert level of pits on the opposite side of Victoria Avenue? (Pit IDs:11S21203, 11S1200, 11S120 and 11S1202).	TTW to confirm the levels are updated as per the new site survey. This item is conditionally closed.	TTW confirm that pit & pipe invert levels are updated in line with the new survey.	This has been reflected in the new submitted models.
5	The TTW submission (dated 23/11/2021) pit inlet curves under 1D-bcdbase model folder are zero blockage curves (older data), please confirm that TTW has used the updated inlet curves provided by Council on 27/10/2021.	TTW to confirm that the model has since been updated with the representative blockage, i.e. using the latest pit inlet curves. This item is conditionally closed.	TTW confirm that the pit blockage factors in the model are consistent with the blockage curves provided by Council on 27/10/2021.	This has been reflected in the new submitted models.
B. THSC Comments/Action Items Sent to TTW on 14 September 2021				
6	It is recommended that the DRAINS modelling option be considered for analysis and design of the drainage system.	The submitted DRAINS model appears to have not been updated with the latest survey and CCTV information. The pipe flows through the site are significantly different in the DRAINS model compared to the TUFLOW models. For example, peak flows in pipe 11C01814 are estimated to be 6.08 m^3/s and 2.17 m^3/s in TUFLOW and DRAINS, respectively. Differences between the models are expected to be within +/- 20% tolerance. The baseline TUFLOW model should be compared against the DRAINS model. An updated DRAINS model will need to be submitted to reflect the changes based on CCTV and survey. Refer to "Figure A2" tab for further details.	TTW DRAINS model is now updated based on latest survey data. The results of TTW TUFLOW model agree well with the results of TTW DRAINS model and are within +/- 20% tolerance (refer submitted report)	Resolved.
7	The model shall be run for a range of storm durations sufficient to identify the critical duration.	Results provided. This item is closed.		
8	TUFLOW model to be updated with the pit blockages recommended by THSC Stormwater and Waterways Design.	It appears that this has been updated. TTW to confirm by adding text in the report. This item is conditionally closed.	TTW confirm that the pit blockage factors in the model are consistent with the blockage curves provided by Council. (also mentioned in the submitted report).	Resolved.
9	Large commercial/industrial buildings located within or adjacent to an overland flow path should be represented in the TUFLOW model using a completely impervious "wall" along the upstream face of each building and leaving a break in the wall to allow water to enter. This approach is shown conceptually in the "Attachment 2" Tab, wherein the downstream wall of the building was left open to allow rain falling on the building to "runoff" and contribute to catchment runoff.	TTW to confirm that the submitted model is updated using the approach. This item is conditionally closed.	TTW confirm that the building outlines extracted from Council's UOFS (2d_zshape file) were used to define the building blockages and consistent with recommended method by Council.	Resolved.
10	2D cell size to be modified so as to reasonably represent the terrain. Furthermore, as is the case within an urban environment, consideration of narrow overland flowpaths (such as between buildings and permanent obstructions) should ensure the minimum cell size is carefully chosen to represent the ground conditions appropriately. A 1 metre cell size is recommended for the proposed development unless a larger grid size is justified.	A 2m cell is used in the TTW model. TTW to confirm and justify that a 2m cell size used in the model is sufficiently representing the terrain. Adding a section to the report would be adequate.	The grid cell size of 2m2 is considered to be sufficiently fine to appropriately represent the variations in topography and land use within the study area. It should be noted that TUFLOW samples elevation points at the cell centres, mid sides and corners, therefore a 2 m2 cell size results in surface elevations being sampled every 1m.	Resolved.
11	Model verification and establishing the pre-developed models have to be completed to satisfy the minimum requirements. Following are the minimum requirements. I. Carry out peak flows comparison against the results from the UOLFS. The limits of the agreement are ±20% of UOLFS peak flows; ii. Carry out flood level/depths comparisons against the results from UOLFS. The limits of the agreement are ±20% of UOLFS depths; and iii. The Consultant shall obtain Council's concurrence on the verification outcome prior to proceeding with the design (post-developed case) run for the TUFLOW model.	This item is still outstanding. The submitted report missing any discussion of model verification.	Model verification was carried out and outcomes added in the report. It is important to note that the TTW TUFLOW model was updated with latest site-specific survey data which somehow differs considerably from the UOFS data. The data difference between TTW TUFLOW model, TTW DRAINS model and UOFS are summarised in the attached report.	Resolved.
C. Additional Comments				
12	The Model DEM (*TTW220301b_Pre_G2m_100yr120min_DEM_Z.flt*) shows a spike where elevation reaches up to 4,350 mAHD at the outlet of the culverts. The error appears to have come from an incorrect elevation point in the 2d_zsh files. This leads to an incorrect representation of flood behaviour leaving some part of the area dry at the outlet which should normally be wet. Refer to the "Figure A3" tab for further details.	DEM to be revised by rectifying the error. TUFLOW model to be updated with the revised DEM.	TTW TUFLOW model surface was modified at that area to address the issue.	Resolved.

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2.0 Introduction

Taylor Thomson Whitting (NSW) Pty Ltd has been engaged by Blueprint Australia Planning Development Management to prepare a Flood Impact Assessment Report in accordance with the Hills Shire Council requirements to support a Planning Proposal for the proposed mixed-use multi-storey development at 21-23 Victoria Avenue, Castle Hill.

The report provides an assessment on flood conditions of the site and summarises the flood modelling results for the Council approved existing and proposed post-development conditions in the 1% AEP and PMF events. The report also provides an impact assessment on neighbouring properties due to the proposed development.

2.1 Project Objectives and Methodology

Project scope and objectives are as follows:

- Prepare a detailed hydraulic model (TUFLOW) to suitably reflect the site's flood conditions in the predevelopment and post-development states.
- Determine site flood characteristics for the 1% annual exceedance probability (AEP) flood and probable maximum flood (PMF) events.
- Prepare relevant flood maps including flood extents, depths, levels, velocities, hazards and impacts.
- Comment on the site's flood characteristics and model outcomes in the existing and proposed conditions.
- Prepare a flood emergency response plan (FERP) for the proposed development.

2.2 Reference Documents

This report has been prepared in accordance with the following guidelines and policies:

- Australian Rainfall and Runoff Data (2019) with AR&R (2016) rainfall datasets sourced from BoM.
- Australian Rainfall and Runoff (2016) – A Guide to Flood Estimation.
- NSW Department of Infrastructure, Planning and Natural Resources (2005), Floodplain Development Manual.
- The Hills Shire Development Control Plan (DCP, 2012)
- The Hills Shire Local Environment Plan (LEP, 2019)
- THSC Design Guidelines for Subdivision and Developments (2011).
- Approved 'Masters DA' Scheme ref: 1/2014/JP

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2.3 Site

The site is located at 21-23 Victoria Avenue, Castle Hill and is within The Hills Shire Council Local Government Area, as shown in Figure 1.

The site is bordered by Victoria Avenue to the west, Salisbury Road to the north and Carrington Road to the south. The site in existing conditions is fully developed with commercial / industrial development and surrounded by similar commercial and industrial developments. Cattai Creek is located approximately 450m to the east of the site and flows north towards the Hawkesbury River.

The site generally falls from west to east with a natural depression between the two existing buildings within the southern half of the site. Existing levels are 87.70m at the southwest corner, 89.00m at the southeast corner, 90.70 at the northwest corner and 87.80 at the north east corner. Levels at the depression of the site are 85.20 at the eastern boundary, and 85.00 at the western boundary.

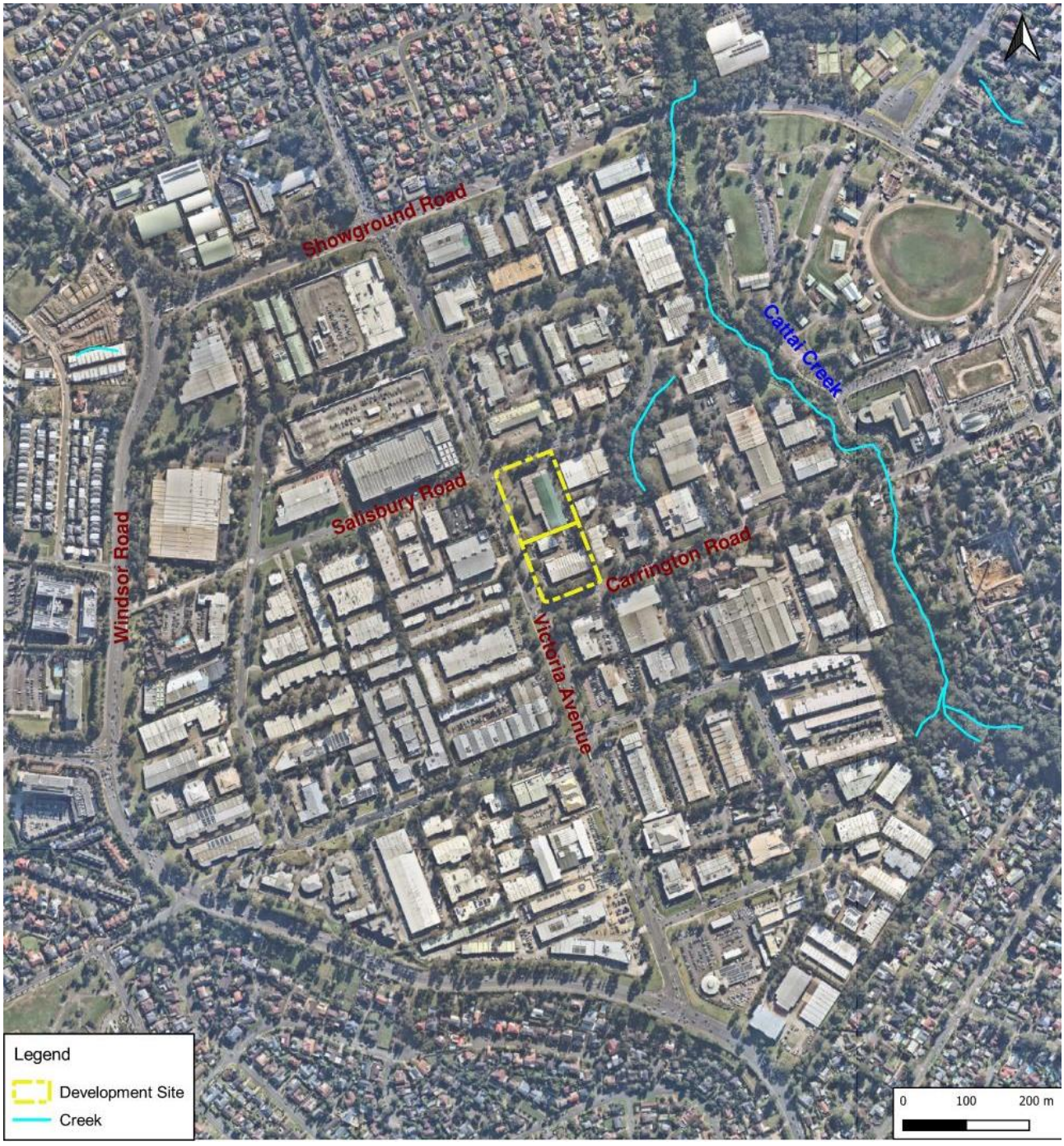

Figure 1 - Site Location and Surrounding area (Six Maps)

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3.0 Proposed Development

Architectural plan prepared by BatesSmart (06/07/2022) indicate that the proposed is a multi-storey mixed-use commercial development including:

- A basement car park with a vehicle access through Victoria Avenue (entrance level of 85.30m).
- A lower Ground retail and car park with a vehicle access through Victoria Avenue (entrance level of 85.30m) as well as through Salisbury Road with proposed entrance level of 85.70m.

The proposed upper ground floor, lower ground floor and basement car park plans provided by Bates Smart as shown in Figure 2, Figure 3 and Figure 4 respectively.

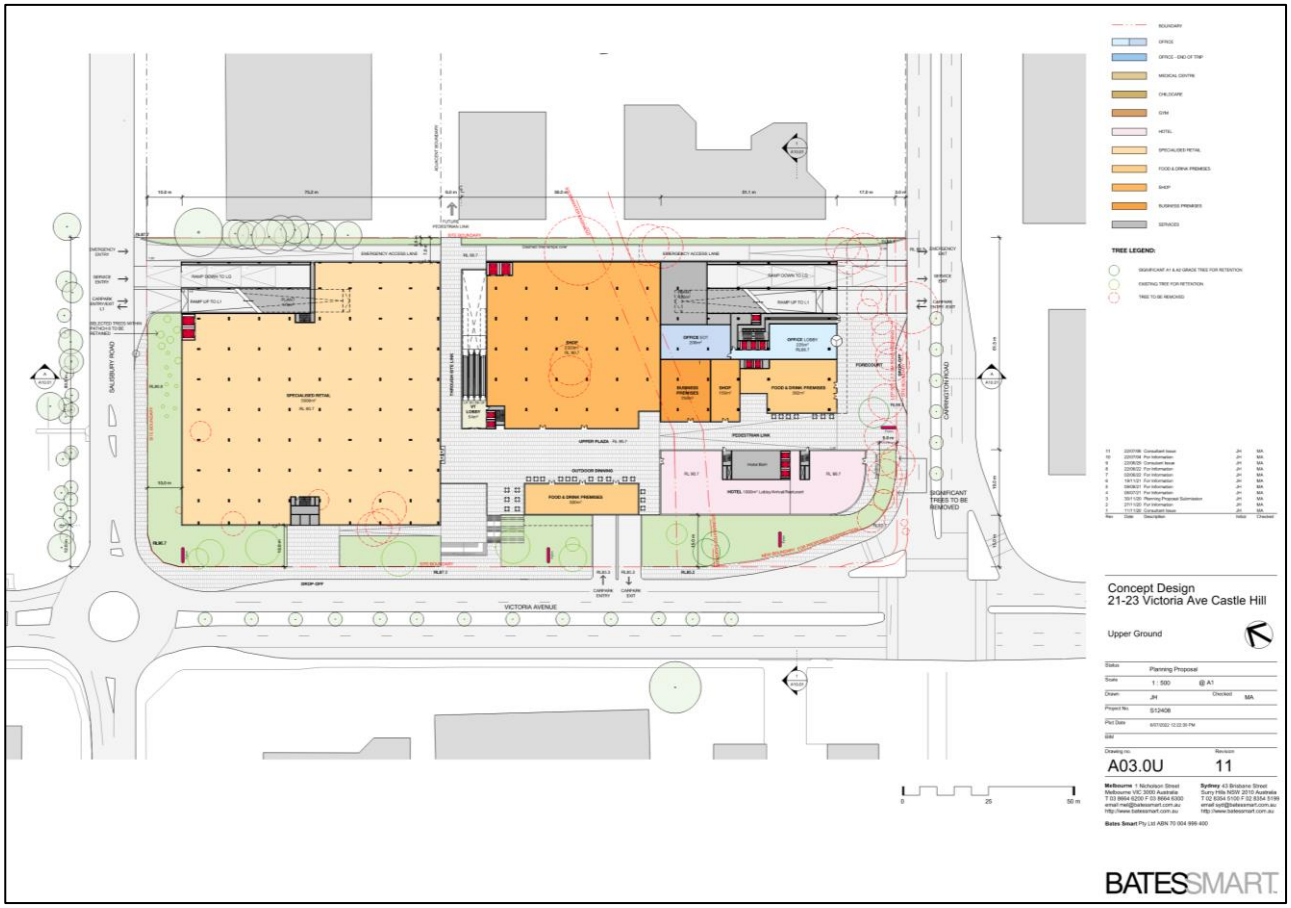

Figure 2 – Proposed Architectural Plan (Upper Ground Level)

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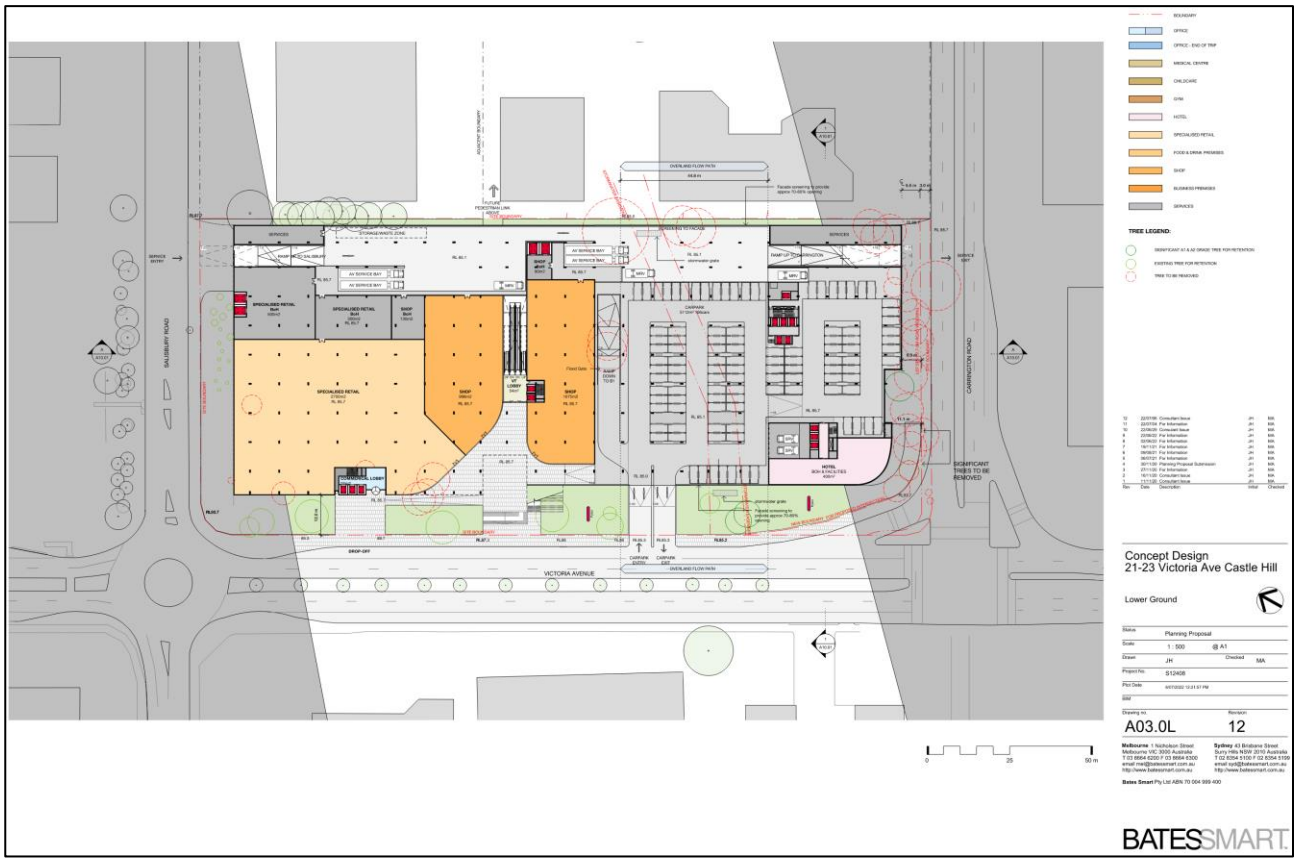

Figure 3 – Proposed Architectural Plan (Lower Ground Level)

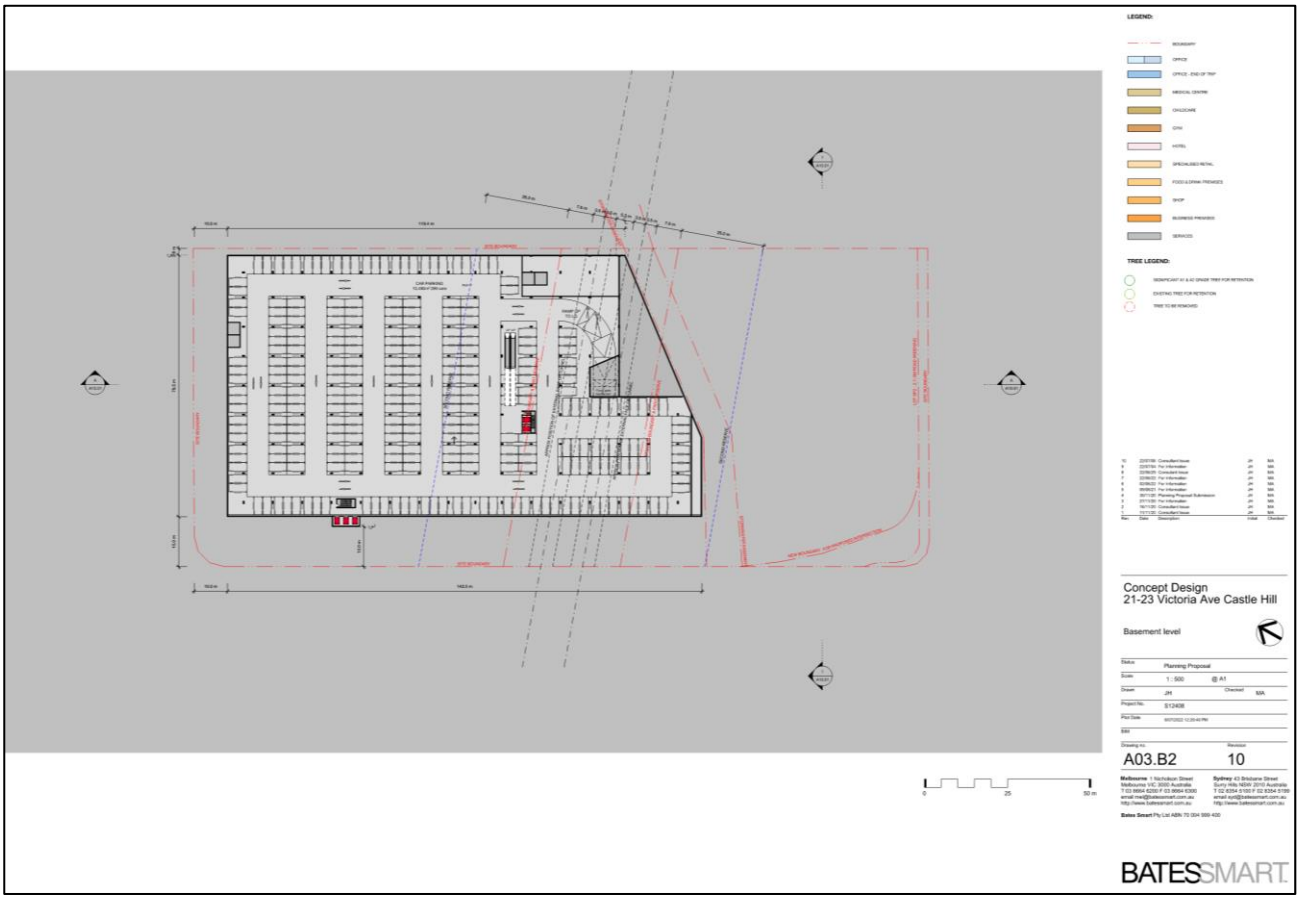

Figure 4 – Proposed Architectural Plan (Basement Car Park)

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4.0 Available Data

The site falls within the Cattai Creek Catchment which is a sub-catchment of Hawkesbury River Catchment. Catchment Simulation Solutions (CSS) have conducted a flood study for The Hills Shire Council and summarised the outcomes in The Hills Urban Overland Flow Study (May 2017) which is referred to as UOFS in this report. As part of the study, CSS have developed a flood model for the Hills Shire catchments which covers the subject site.

Despite a request made to Council for providing a copy of The Hills Urban Overland Flow Study and model, TTW were advised that the flood report is not publicly available, and Council is unable to provide the flood model and associated output files at the time the request was made. However, Council provided the following flood modelling data to help setting up a hydraulic TUFLOW model for the site in line with UOFS:

- Ground Surface Digital Elevation Model (DEM) data for the extent of the catchment
- Surface materials files
- Rainfall data
- Existing stormwater pit and pipe network GIS and database
- Pit inlet curves (.csv files)
- Map of the 1% AEP flood result extents and flood surface levels to the nearest 0.1m (PDF version).

5.0 Hydraulic Flood Model

TUFLOW software was used to develop a dynamic 1d/2d hydraulic model as part of the study. TUFLOW engine version 2013-12-AB-w64-iDP was used to maintain consistency with the UOFS Model.

5.1 2D Model Domain

The site upstream catchment delineated using Lidar data. Model boundary extents were generally placed along catchment ridgelines and / or connecting catchment high points surrounding the study area. Total model domain area is 183 ha (approx.). The catchment area is shown in Figure 5.

5.1.1 Ground surface elevations

Ground surface elevations were assigned to grid cells within the TUFLOW model based on the elevations data extracted from hydraulic model of The Hills Urban Overland Flow Study (May 2017) as received from Council.

5.1.2 Model Cell Size

A square grid was utilised for this study, with the grid size of 2m x 2m. The grid cell size of $2m^2$ is considered to be sufficiently fine to appropriately represent the variations in topography and land use within the study area. It should be noted that TUFLOW samples elevation points at the cell centres, mid sides and corners, therefore a $2m^2$ cell size results in surface elevations being sampled every 1m.

5.2 Hydraulic Roughness

The hydraulic roughness of a material is an estimate of the resistance to flow and energy loss due to friction between a surface and the flowing water. A higher hydraulic roughness indicates more resistance to the flow. Roughness in TUFLOW is modelled using the Manning's (n) roughness co-efficient.

Manning's zones were based on the UOFS model data as provided by Council.

5.3 1D Model Domain

Detailed stormwater pit and pipe data was provided by the Hills Shire Council for the extent of the catchment and incorporated into the 1d network within the TUFLOW model as shown in Figure 5.

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5.3.1 Pit Inlet Curves and Blockage Factors

Pit inlet curves were introduced to the 1d model based on the UOFS data (.csv files) as received from Council and factors for 20 and 50 percent blockage at grade and sag pits respectively.

5.4 Boundary Conditions

5.4.1 Inflow Boundary

The direct rainfall method was used for this study to apply rainfall directly to all cells within the study area, with runoff routed across the 2d domain and conveyed within the 1d hydraulic network. UOFS rainfall information was obtained from the Council and incorporated into the model.

Upstream inflows were incorporated into the model by way of flow hydrographs. Location of upstream inflows to the model domain are shown in Figure 5.

5.4.2 Downstream boundary

Downstream boundary was defined approximately 600m downstream of the site (downstream of the existing culvert headwall under Showground Road). Stage-discharge (water level versus flowrate) curve was adopted for the downstream boundary condition. The stage-discharge relationship was generated by TUFLOW by specifying downstream water surface slope. Location of downstream boundary is shown in Figure 5.

5.5 Building Footprints

The UOFS model defines the existing buildings by way of introducing high roughness coefficients. Therefore, the impact of existing buildings on overland flows will be included in the model through incorporating the obtained surface materials files from Council.

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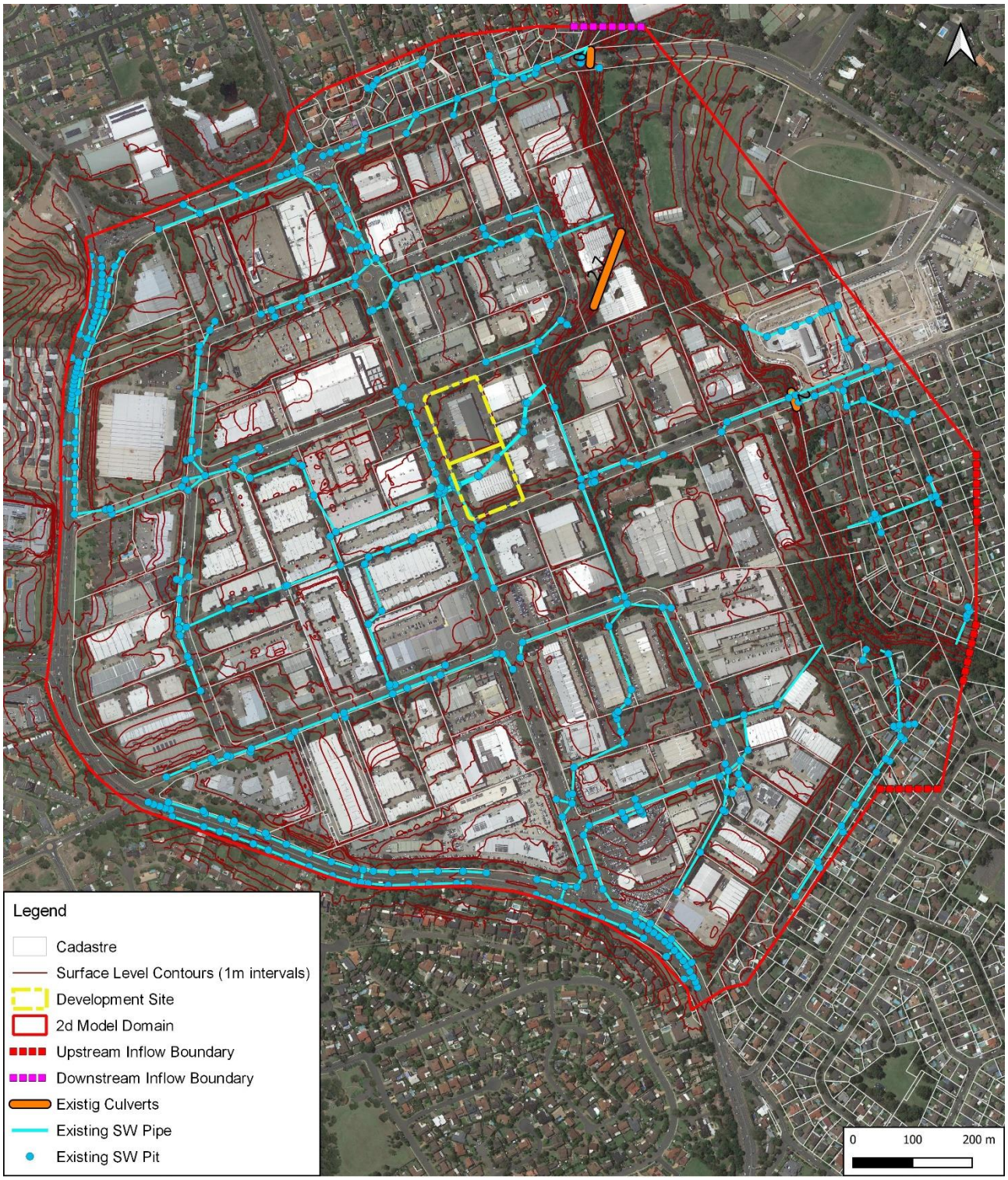

Figure 5 – TUFLOW 1d / 2d Model Domain

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6.0 Critical Storm Event Durations

The model was run for a range of 1% AEP flood durations as well as for a range of PMF durations to determine the site critical storm durations. The critical 1% AEP and PMF storm durations for the site were determined to be 120 minutes and 30 minutes, respectively. The 1% AEP flood results for various storm durations are compared in Table 2.

Table 2 – 1% AEP Flood Results – 1D & 2D Peak Flows at the Site

1% AEP Storm Duration	Combined Pipe Flow in twin 1800 pipes (cu.m/s)	Overland Flow across Victoria Avenue (cu.m/s)	Peak Flood Level on site (m AHD)
30 minutes	8.346	4.47	85.425
45 minutes	8.267	4.30	85.094
60 minutes	8.811	6.05	85.517
120 minutes	**9.212**	**7.16**	**85.549**
180 minutes	8.412	4.46	85.466
360 minutes	7.964	3.04	85.441

Figure 6 also shows the 1% AEP peak flood levels envelope which indicates that the critical storm duration is 120 minutes for the site.

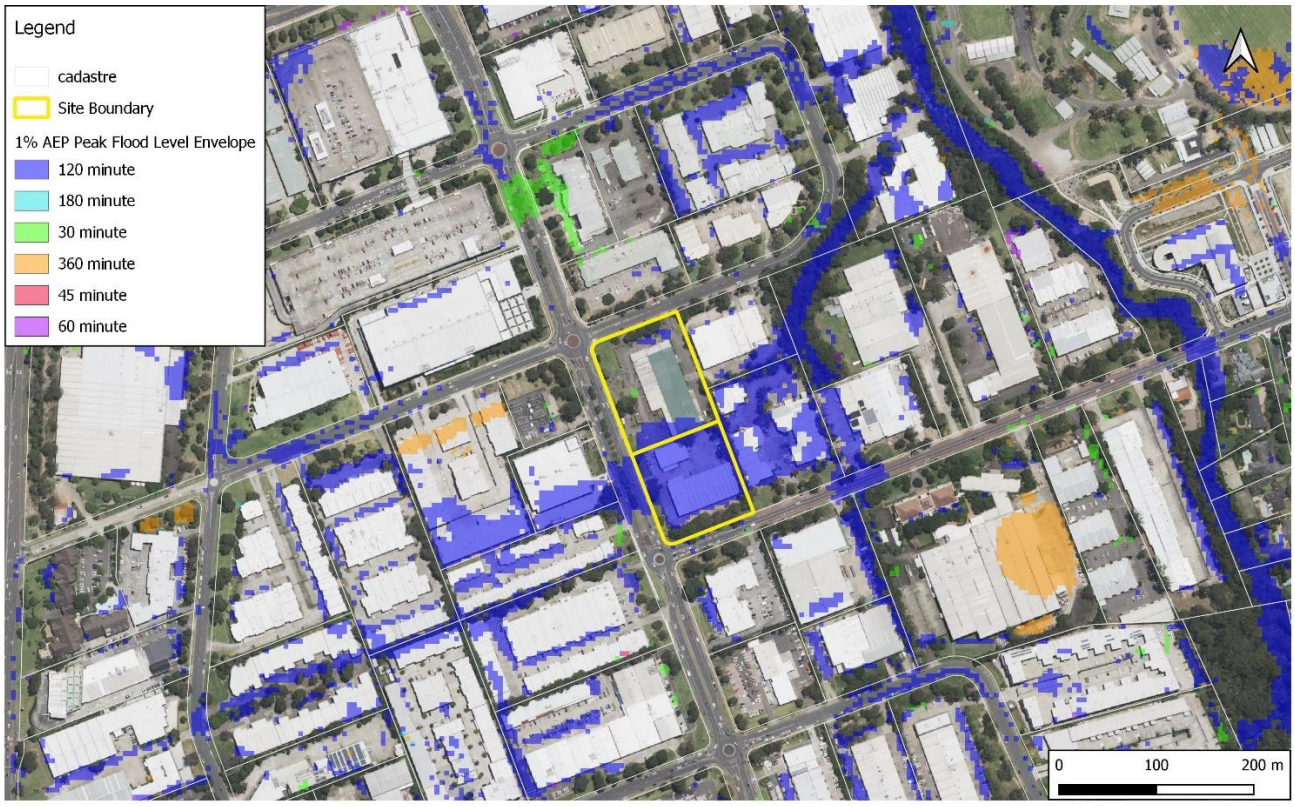

Figure 6 – 1% AEP Peak Flood Level - Envelope Results

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7.0 Flood Model Validation

In order to carry out a detailed assessment of stormwater pipe flows, overland flows, and flow depths across the site and also understand the potential flood impacts associated with the proposed development, it is first necessary to confirm flood behaviour for existing (i.e., pre-development) conditions.

The TTW existing model was produced based on available data as received from Council. Hence, the TTW model is to be validated based on UOFS model results.

7.1 TTW Model – Existing Conditions

The TTW existing model was produced based on available data as received from Council (refer Section 4.0 & Section 5.0).

A comparison between the TTW existing flood model results and UOFS results was carried out for various locations as requested by Council. The locations of comparison are shown in Figure 7 and include the following:

- Peak flow rate onto the site from Victoria Avenue (XS-1).
- Peak Flow rate at the downstream Creek (XS-2).
- Peak flow rate in the existing twin DN1800 pipes through the site.
- Maximum Flood level and depth at the observation point onsite.

The TTW flood extent is also shown to be similar to the UOFS model results as shown in Figure 7. The TTW flood model has a peak 1% AEP (2 hours) flood level within the site of just under RL85.55m which is approximately 50mm higher than the Council results and considered within Council's acceptable limit of +/- 20%.

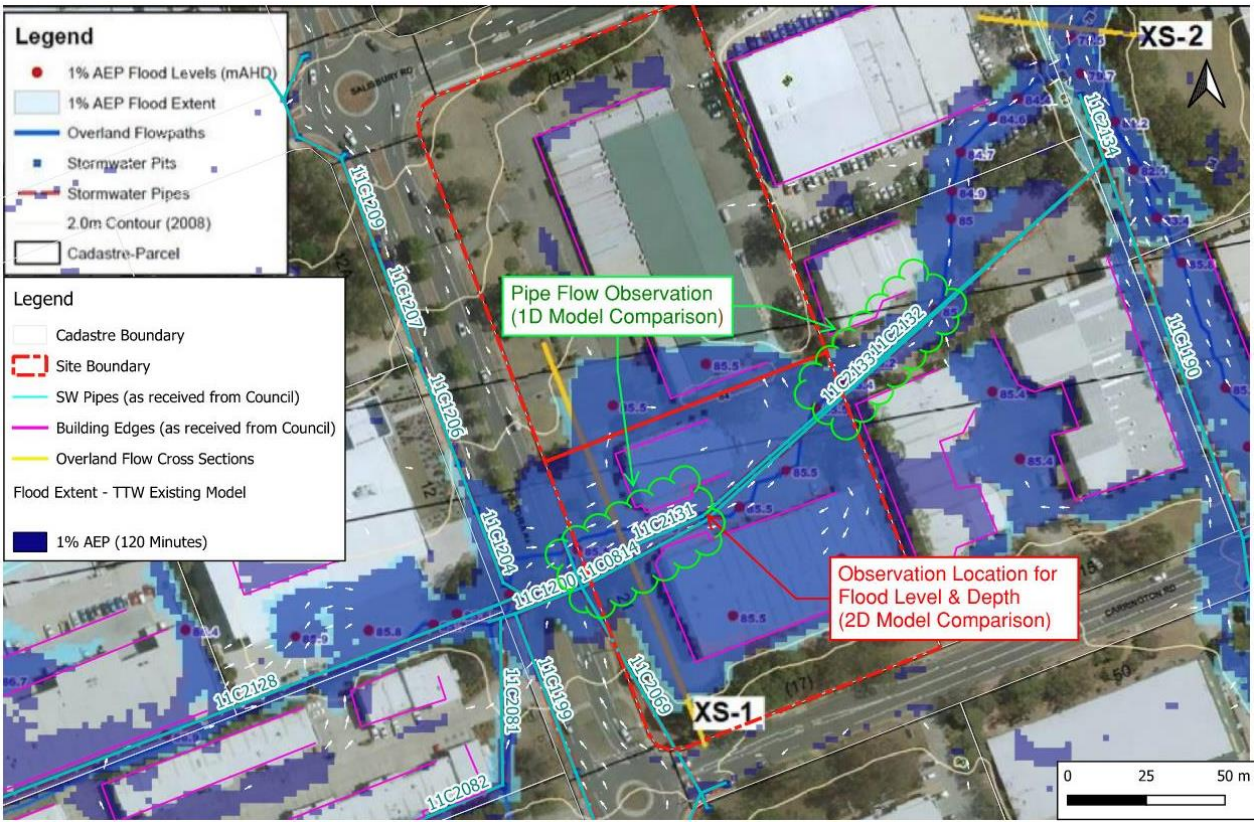

Figure 7 – Flood Comparison locations (1D & 2D) – Overlaid Council's Flood Map Received on 28/11/2021

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TTW also prepared a DRAINS model using available data from Council for further comparison to validate the TTW existing TUFLOW model. Figure 8.shows a screenshot of the DRAINS model for the existing site conditions and the results for the 1% AEP (2hrs) storm event.

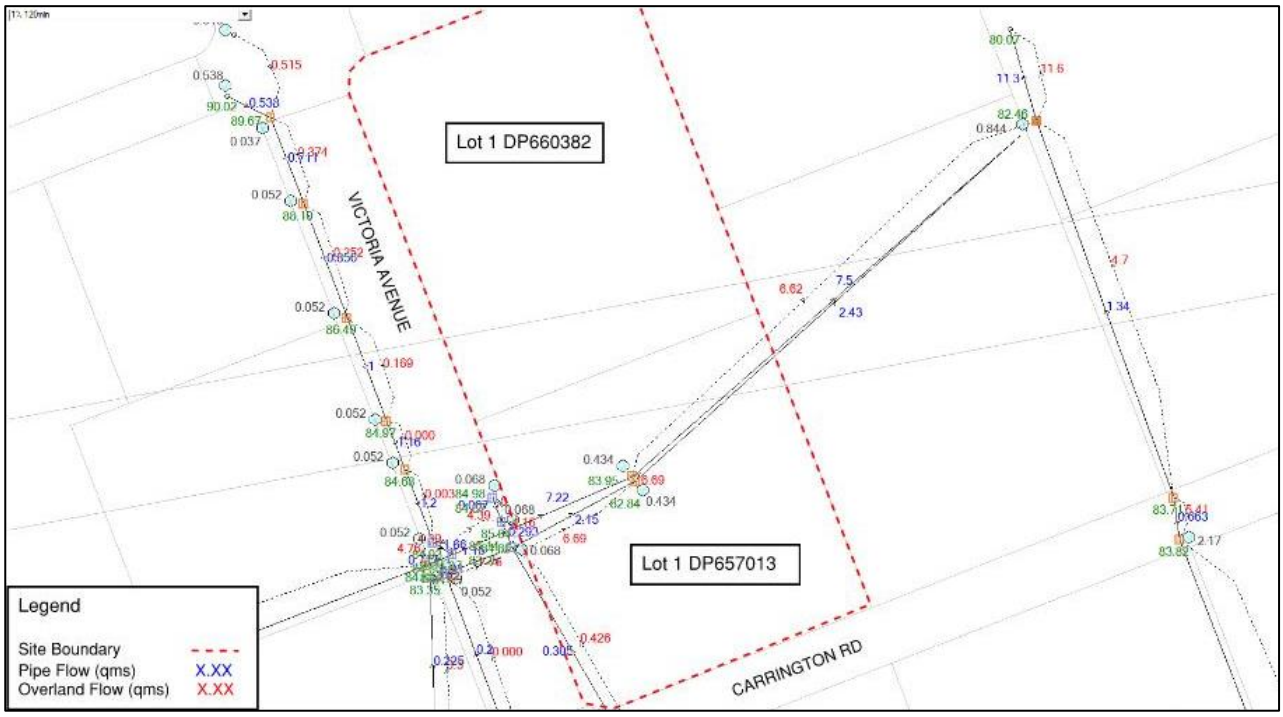

Figure 8 – DRAINS Model Results – 1% AEP (2 hours) Event – Existing Site Conditions

- The comparison between the UOFS, TTW Existing scenario model and TTW DRAINS model is summarised in Table 3 below.

Table 3 – 1% AEP Flood Results Compared with the UOFS

Location	Council UOFS	TTW Existing Scenario	% Diff to UOFS	TTW DRAINS Model	% Diff to UOFS	% Diff Between TTW DRAINS Model and TTW Existing Scenario
Pipe Flow 11C2131	5.61	5.43	-3.07	7.22	22.35	24.74
Pipe Flow 11C0814	3.84	3.95	3.00	2.15	-78.51	-83.86
Total	**9.44**	**9.39**	**-0.07**	**9.37**	**-0.79**	**-0.18**
Pipe Flow 11C2132	5.77	5.28	-8.36	7.50	23.13	29.56
Pipe Flow 11C2133	3.87	4.17	7.92	2.43	-59.05	-71.65
Total	**9.63**	**9.45**	**-1.83**	**9.57**	**-0.63**	**1.21**
Overland Flow XS-1	9.50	7.65	-19.48	6.69	-42.00	-14.33
Overland Flow XS-2	15.40	19.27	25.10	22.90	32.75	15.87
Overland Flow Leaving the site (via Eastern Boundary)	N/A	5.64	N/A	7.02	N/A	19.63
Flood Depth at Site (Measured over Pit 11S2132)	632mm	717mm	13.4	N/A	N/A	N/A

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The comparison confirms that the TTW Existing scenario model and DRAINS model closely match the UOFS results for the 1% AEP event and are within the Council limit of agreement of +/- 20% difference. The following points are notable in relation to the flow rate observations at XS-1 & XS-2:

- Based on the TTW Existing Model the peak overland flow onto the site from Victoria Avenue (XS-1) is 7.65 m^3/s which is 19.48% lower than that of reported by the Council UOFS Model (9.5 m^3/s). However, TTW DRAINS model results confirm that the peak flow from Victoria Avenue onto the site is 7.26 m^3/s which agrees well with that of reported by TTW Existing Model (variation of 5.36%).
- The downstream observation line (XS-2) is located across the Cattai Creek tributary which is a main drainage line to a relatively large catchment. Therefore, the estimated flowrates at XS-2 are not merely showing the flows from the site catchment. Therefore, an additional flowrate observation was defined along the site western boundary to measure the overland flows leaving the site.
- Council notes that their reported peak flows are sourced from Council's Draft Urban Overland Flow Study with help of the WaterRIDE tool and therefore, may not be 100% accurate.

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8.0 Flood Model Updates (Existing Conditions)

To ensure that the TTW flood model accurately represents the existing flood behaviour, the existing scenario model was further updated to include additional survey and pipe investigation data based on the latest site survey as completed by LTS (January 2022). The following updates applied to the TTW existing model based on the latest survey data:

- New surface tin provided by LTS was merged with previous site survey data as well as with the DEM surface of UOFS received from Council and incorporated into the TUFLOW model to represent the existing model surface. The existing model surface is comprised of:
    - UOFS surface DEM (as provided by Council),
    - Previous site survey data,
    - Latest survey of the overland flow path for the extent of Victoria Avenue all the way to the existing headwalls at downstream Creek.

Hence, the model surface includes all existing topographic surface features e.g., ridges, berms, retaining walls, etc.

- Existing pit & pipe network (1D model) from Victoria Avenue to the downstream discharge headwalls was updated based on the latest survey and CCTV data.

The following modelling factors were also implemented as per confirmed by Council:

- The model grid cell size of $2m^2$ was retained.
- Existing building outlines were represented as blockage on the upstream face of buildings, and an open building face on the downstream wall to allow water to be stored in the building and to allow direct rainfall to escape. Building outlines were provided by Council as 2d_zshape files (extracted from UOFS model) as shown in Figure 9.

The site flood assessment was carried out for the critical storm duration of 2 hours (as described in Section 6.0).

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Figure 9 – Existing Building Outlines in TUFLOW Model

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In addition, the TTW DRAINS model was updated in line with the TTW TUFLOW model and in accordance with the data provided by Council as well as the latest survey data provided by LTS (January 2022). Figure 8 shows a screenshot of the DRAINS model for the existing site conditions as updated and the results for the 1% AEP (2hrs) storm event. Refer updated DRAINS model as provided for more details.

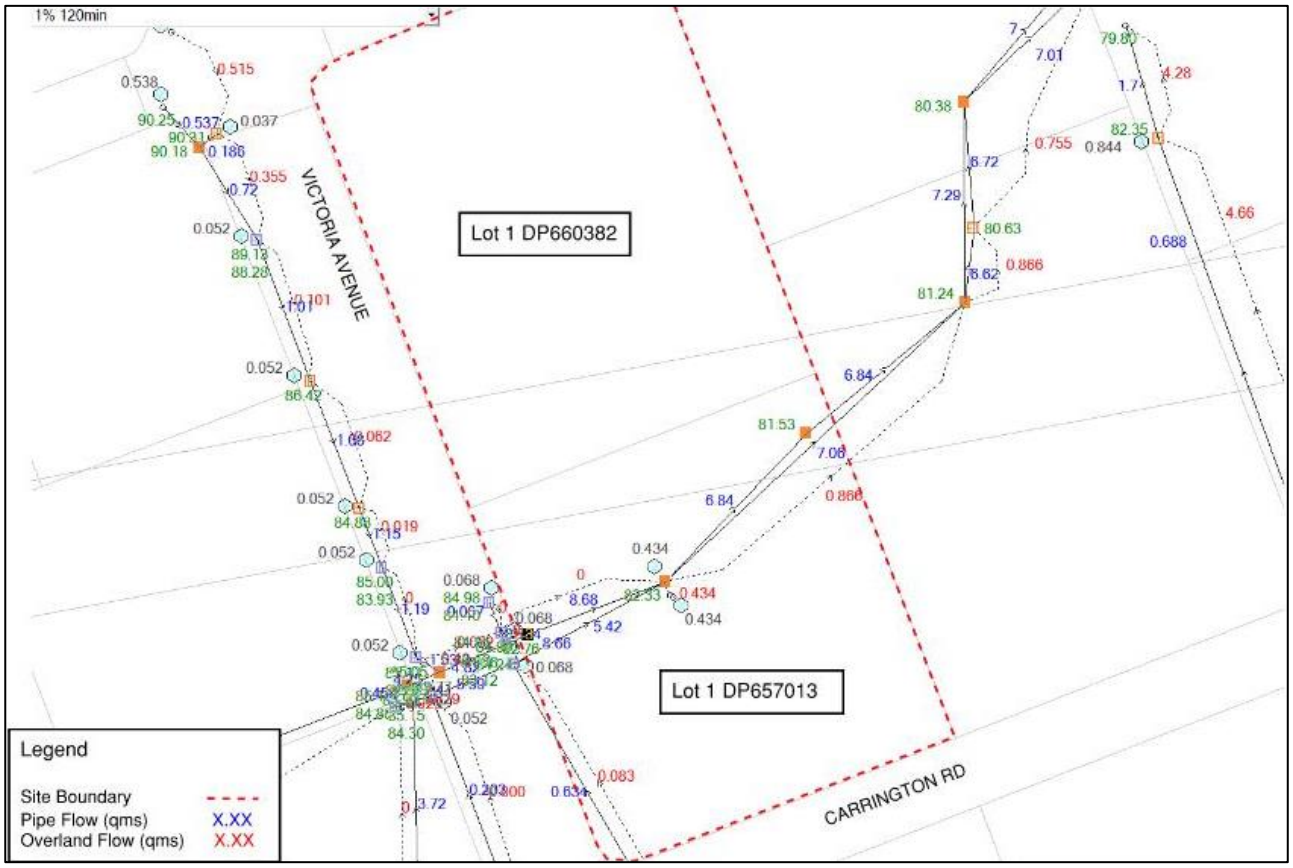

Figure 10 – DRAINS Model Results – 1% AEP (2 hours) Event – Existing Site Conditions (as updated)

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8.1 Flood Model Results Comparison (Updated TTW Model – Existing Conditions)

A comparison has been made of the UOFS, TTW TUFLOW and TTW DRAINS model for the existing scenario. The comparison (pipe flow & overland flow) was carried out at the locations as defined in flood model validation stage (refer Section 7.0).

The TTW flood extent overlay on the UOFS model results and locations of comparison are shown in Figure 11.

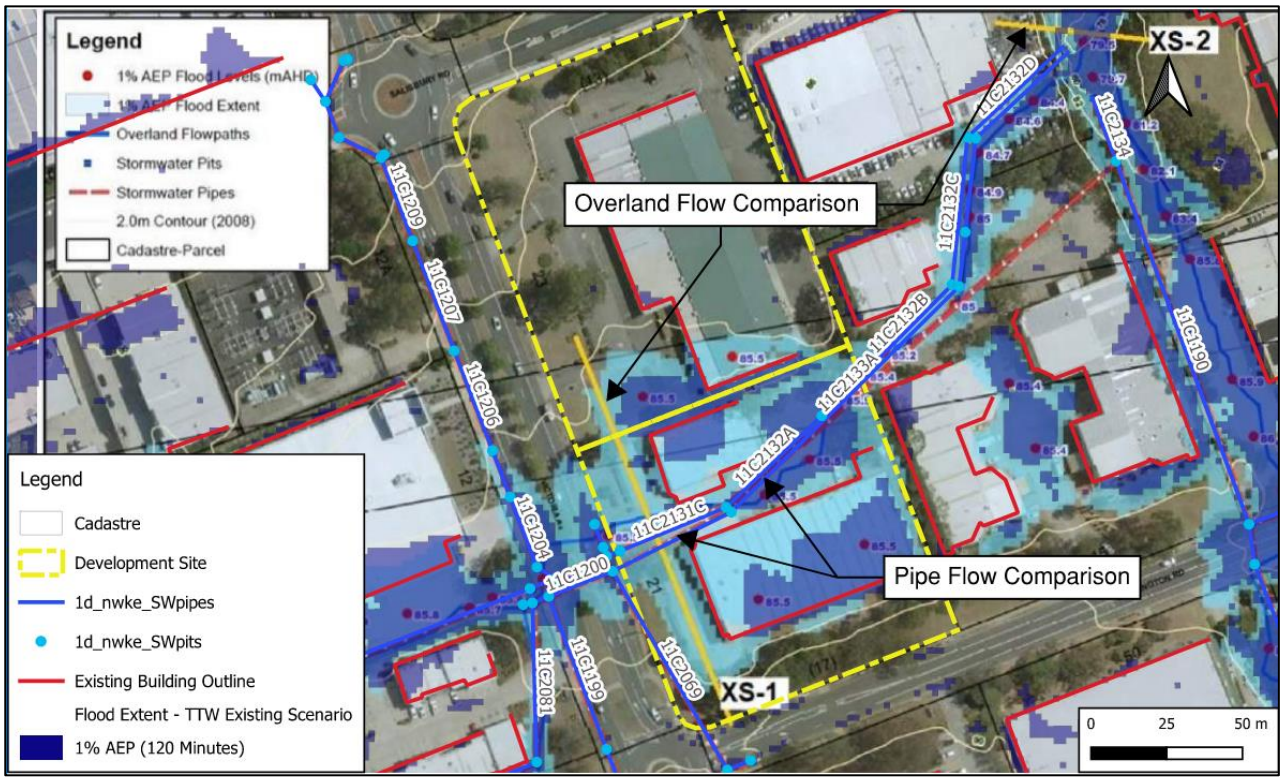

Figure 11 – Flood Comparison locations (1D & 2D) – Overlaid Council's Flood Map Received on 28/11/2021

However, further to Council's comments received on 4 May 2022, additional comparison locations were included to compare the existing flood results between the TTW models and Council's UOFS. These flow locations are shown in Figure 12, with the tabulated flood model results comparison between the UOFS, TTW TUFLOW and TTW DRAINS models for the existing scenario as detailed in

Table 4.

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Figure 12 – Flood Comparison locations (1D & 2D) – Based on Email from Council on 04/05/2022

Table 4 – 1% AEP Flood Results Comparison (TTW TUFLOW, TTW DRAINS & UOFS)

Location	Council UOFS	TTW TUFLOW - Existing Scenario	% Diff to UOFS	TTW DRAINS - Existing Scenario	% Diff to UOFS	% Diff (TTW DRAINS to TTW TUFLOW - Existing Scenario)
Pipe Flow 11C2128	5.77	6.05	5	7.70	-33	-27
Pipe Flow 11C2081	3.87	6.52	69	3.72	-4	-43
Combined Pipe Flow at Q1	9.63	12.57	31	11.42	18	-9
Overland Flow Q1	2.77	2.56	-8	1.38	N/A	-47
Combined Pipe and Overland Flow at Q1	12.40	15.13	25	12.80	3	-15
Pipe Flow 11C2131	5.42	7.38	36	8.68	60	18
Pipe Flow 11C0814	3.97	6.04	52	5.42	37	-10
Combined Pipe Flow at Q5	9.39	13.42	43	14.10	50	5
Overland Flow Q5	9.50	0.07	-99	0	N/A	N/A
Combined Pipe and Overland Flow at Q5	14.77	13.49	-9	14.32	-3	6
Peak Flood Height at H/D2	85.53	85.35	-0.2	N/A	N/A	N/A
Peak Flood Height at H3	85.53	85.31	-0.3	N/A	N/A	N/A
Peak Flood Height at H/D4	85.53	85.12	-0.5	N/A	N/A	N/A
Peak Flood Depth at H/D2	0.77	0.55	-39	N/A	N/A	N/A
Peak Flood Depth at H/D4	0.72	0.24	-66	N/A	N/A	N/A
Overland Flow Leaving the site (via Eastern Boundary)	N/A	0.89	N/A	1.94	N/A	218
Flood Depth at Site (Measured over Pit 11S2132)	0.63	0.13	-80	N/A	N/A	N/A

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8.2 Discussion

It is notable that the TTW TUFLOW model was originally based on the data provided by Council (i.e., catchment boundary, surface topography, rainfall data, surface material, pit & pipe network, etc.) which was extracted from UOFS model.

The TTW TUFLOW model, however, has been updated with latest site-specific survey data which differs considerably from the UOFS data. The data difference between TTW TUFLOW model and UOFS is summarised below:

- TTW TUFLOW model incorporates more accurate surface data (survey tin) for the extent of Victoria Avenue to the downstream headwalls.
- The existing twin drainage pipe has been updated in TTW TUFLOW model to represent the correct existing drainage pipe structure (i.e., pipe alignment, pipe size, invert levels).
- Downstream discharge point was updated based on the survey data to incorporate two discharge headwalls at downstream Creek.

Therefore, it is expectable that the TTW flood results (DRAINS and TUFLOW) would not be consistent with those of UOFS for the study area.

The main differences between the TTW models and the UOFS (shown in Table 4), are that the pipe flows observed in the twin pipes that run through the site and discharge to Cattai Creek tributary. Peak flow rates through the twin drainage pipes are reported lower in the UOFS than in the TTW models, whilst the overland flow is reported generally higher in the UOFS than the TTW models. These differences are due to the UOFS only having a single pipe and headwall discharging to Cattai Creek tributary, whereas site observation and survey confirms that twin pipes and outfalls exist, and these have been included in the TTW models.

The UOFS with the single pipe and outfall has a lower pipe flow capacity than the twin pipes and twin headwalls, this is reflected in the higher pipe flows observed in the TTW models, which is to be expected. The higher flows observed in the twin pipes in the TTW models is also the reason for the corresponding lower overland flows observed in the TTW models, as a greater proportion of the total flow is able to be conveyed by the twin pipe system. Conversely the lower capacity of the single pipe in the UOFS means that a greater proportion of the total flow is conveyed as overland flow.

When comparing the total combined pipe and overland flows across Victoria Avenue at Q1 (to the west) and Q5 (to the east), the TTW models correspond well with Councils UOFS. The TTW TUFLOW model has a 25% higher combined flow than the UOFS at Q1, and 9% lower combined flow at Q5. The TTW DRAINS model has a 3% higher combined flow than the UOFS at Q1, and 3% lower combined flow at Q5.

8.3 Conclusion

The TTW flood modelling results based on the latest survey data confirm that the TTW TUFLOW model results agree well with the TTW DRAINS model results and differences are less than the limits of agreement of ±20% (refer to Table 1). The following points are notable in relation to the flow rate observations in the modelling.

- Based on the TTW Existing Model the overland flow from Victoria Avenue onto the site (through Q5) is very minor (0.07 m3/s). TTW DRAINS model results also confirm that there is no flow from Victoria Avenue onto the site in the 1% AEP storm event.
- The downstream flows into the Cattai Creek tributary are estimated at 18.20 m^3/s and 20.88 m^3/s based on TTW TUFLOW and TTW DRAINS models respectively (variation of 12.8%).

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9.0 Flood Model Results – Existing Site Conditions

The updated TTW flood model as described in Section 0 was run for the 1% AEP and PMF critical duration events. Flood conditions of the site and the existing flow path in predevelopment state are described in the following sections:

9.1 1% AEP Event

The 1% AEP peak flood levels and depths, flood velocities and flood hazards for the updated existing site conditions are shown in Figure 13 to Figure 15.

The updated flood modelling results confirm that:

- Peak flood levels across the existing sag point at Victoria Avenue rise to 85.12m AHD.
- The vast majority of stormwater runoff from the upstream catchment is conveyed within the twin 1800mm pipes (13.42 m^3/s) that run east through the site and discharge to a tributary of Cattai Creek.
- Overland flows across the sag point at Victoria Avenue during the 1% AEP event are predominantly contained within the road reserve and therefore, the site is not materially affected by the overland flows from Victoria Avenue.
- Minor flood affection of the site is generally due to minor overland flows overtopping Victoria Avenue into the site via the western site boundary as well as local overland flows onsite which puddle across the low laying areas of the site.
- The site overland flows are largely controlled by the existing berm at the eastern site boundary and therefore, retained on the site.
- The maximum overland flow level across the site reaches up to 85.11m AHD which happens near the southwestern site boundary.
- Flood depths at a few areas across the site reach up to around 1.2m deep during the 1% AEP flood event due to local trapped depressions within the site.
- Flood hazards across the site and within Victoria Avenue are generally low based on NSW provisional hazard category.

Figure 13 – Flood Level & Depth (1%AEP) – Updated Existing Conditions

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Figure 14 – Flood Velocity (1%AEP) – Updated Existing Conditions

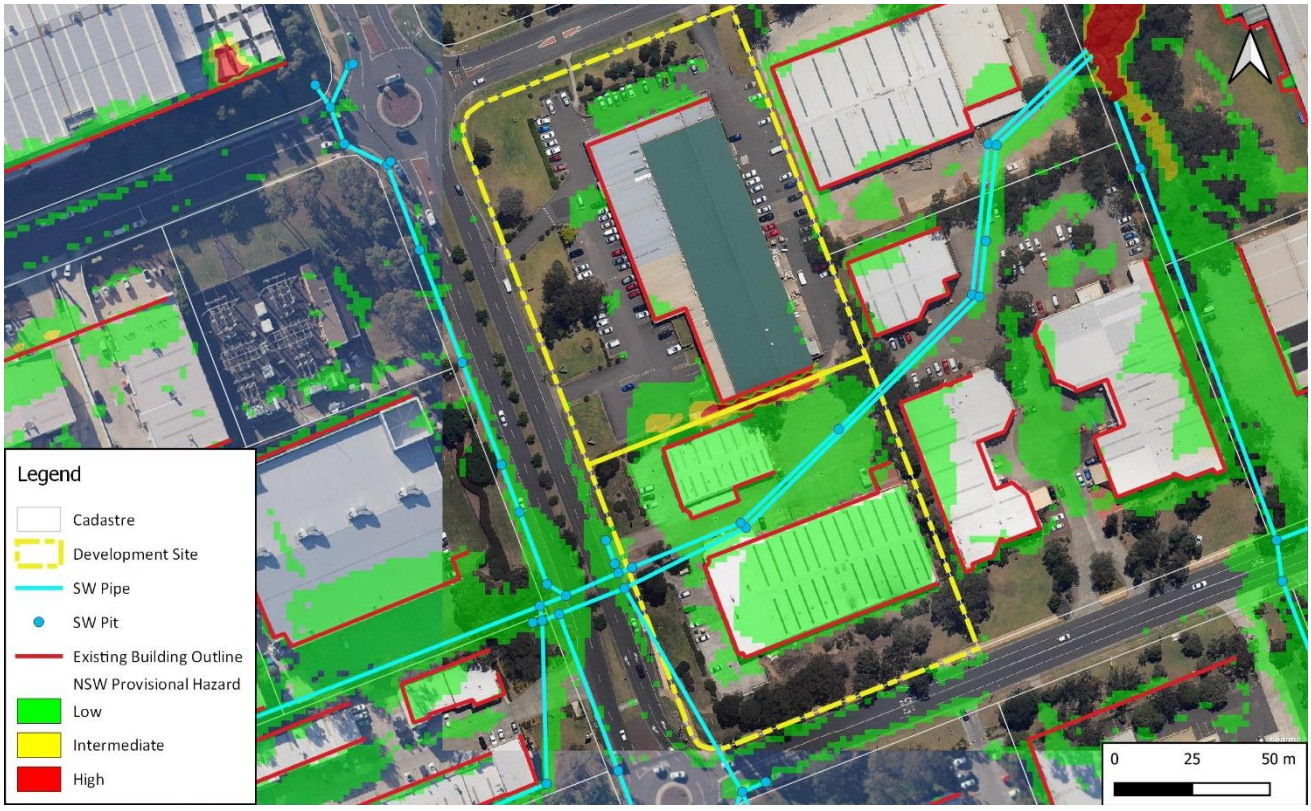

Figure 15 – Flood Hazard (1%AEP) – Updated Existing Conditions

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9.2 PMF Event

The PMF peak levels and depths, velocities and hazards for the updated existing site conditions are shown in Figure 16 to Figure 18. The flood modelling results confirm that:

- In the PMF event, substantial overland flow from the upstream catchment flows from the west across Victoria Avenue and continues east through the development site towards Cattai Creek
- Floodwaters raise to the level of 86.70m AHD across the exiting sag point at Victoria Ave and overtop onto the site.
- Overland flows enter the site via the western site boundary and raise up to 86.65m AHD before overtopping onto the downstream property.
- Flood depths at the site reach up to around 2.9m deep during the PMF event due to local trapped depressions within the site.
- Flood hazards over the site and across the sag point on Victoria Avenue are generally high based on NSW provisional hazard category.

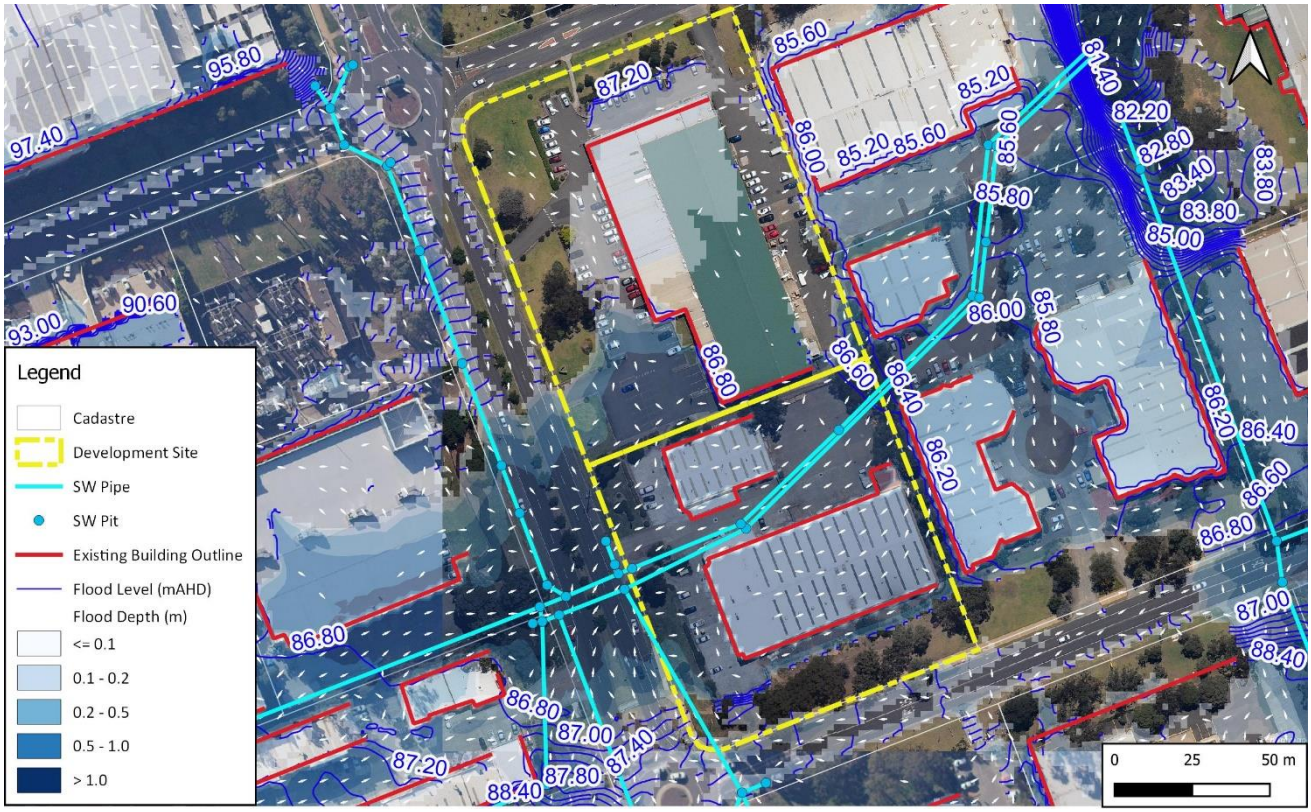

Figure 16 – Flood Level & Depth (PMF) – Updated Existing Conditions

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Figure 17 – Flood Velocity (PMF) – Updated Existing Conditions

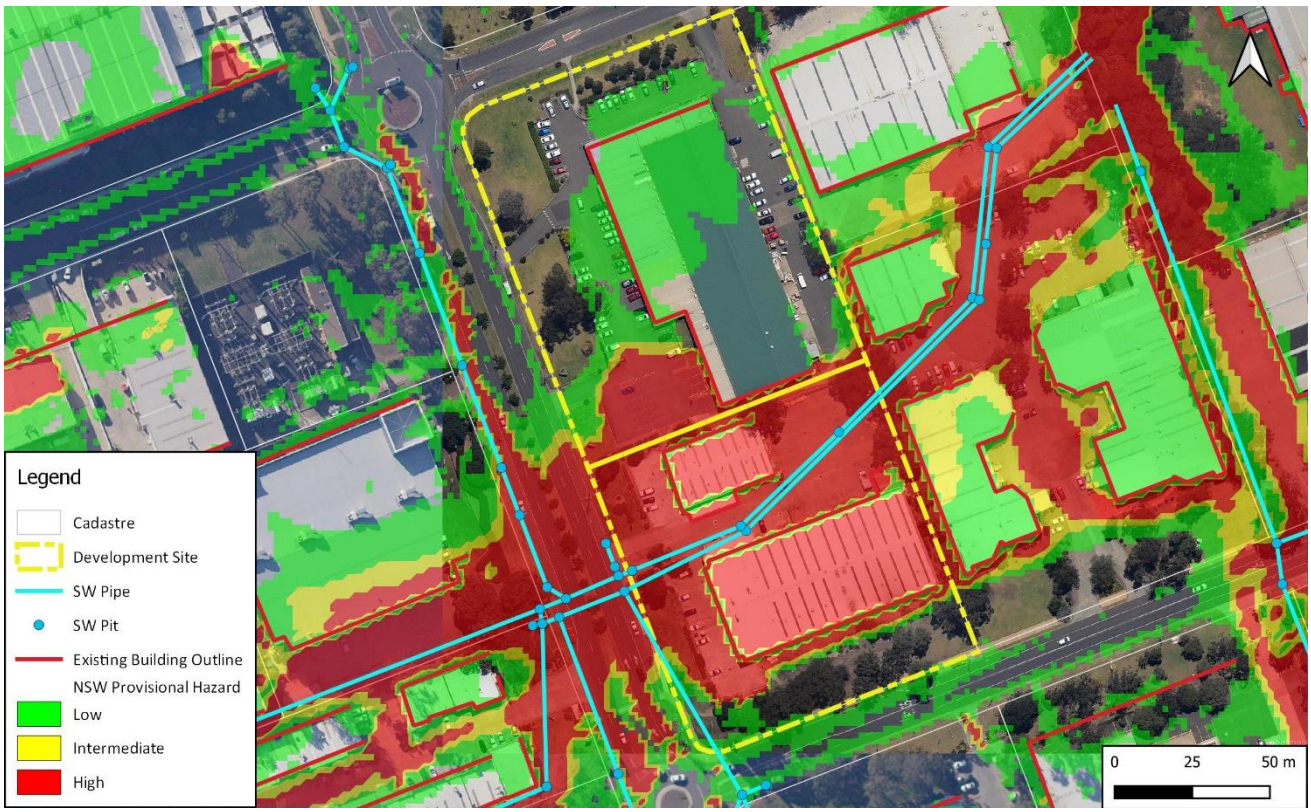

Figure 18 – Flood Hazards (PMF) – Updated Existing Conditions

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10.0 Flood Model Arrangement – Proposed Site Conditions

The post development scenario was modelled based on the latest proposed architectural layout prepared by BatesSmart (refer Section 3.0). The existing conditions model was modified as follows to simulate the proposed conditions:

- Existing model surface was updated to reflect the proposed site levels.
- Site manning's zones were updated to represent design surfaces.
- Existing buildings onsite were removed and replaced with the proposed buildings to model as flow obstructions.
- Proposed building façade for upper ground level was modelled as 70% permeable at the western side and eastern side of the building as shown in Figure 19.
- The 1D network was updated to include two proposed inlet pits connected to the twin DN1800 pipes. Location of the proposed pits are shown indicatively in Figure 19 and Figure 20. Further details of the proposed pits and connection arrangement to twin DN1800 pipes will be provided during the detailed design stage.
- The existing road drainage pipe at low point of Victoria Avenue was proposed to upsize from DN375 to DN450 as shown in Figure 20.

All other model construction elements remained consistent with the existing conditions model.

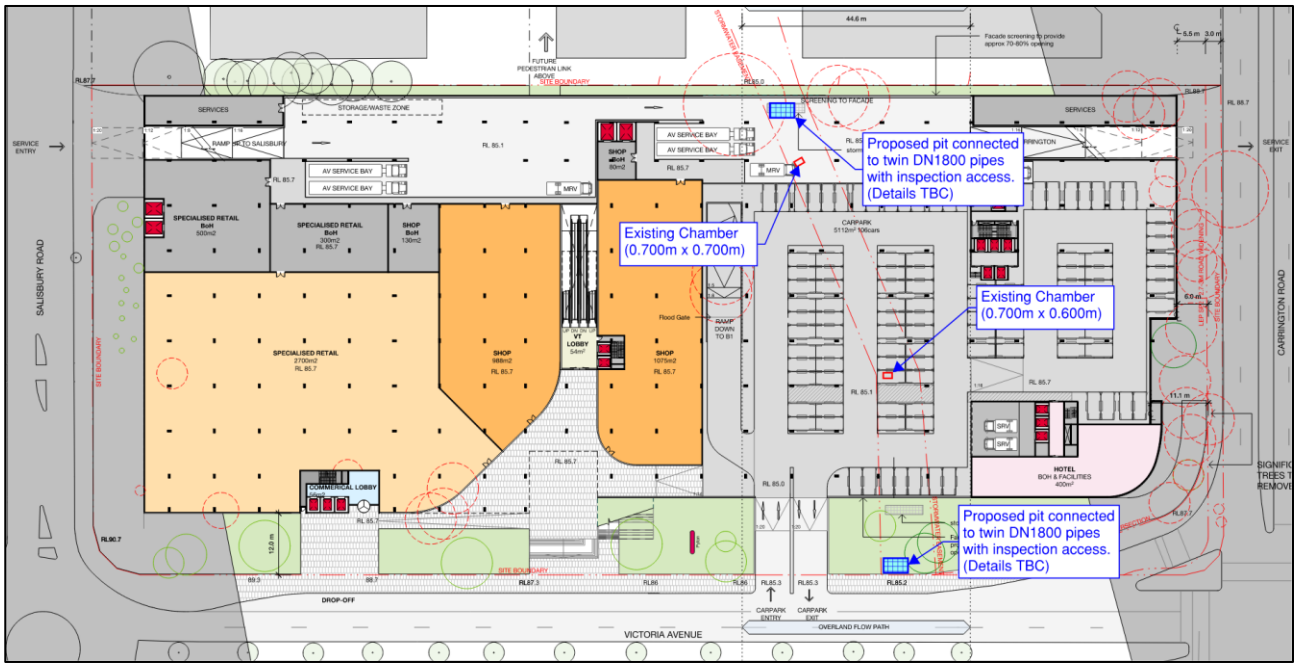

Figure 19 – Proposed Inlet Pit Locations Connected to Existing twin DN1800 Pipes

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Figure 20 – Proposed Pipe upgrade at Victoria Avenue

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11.0 Flood Model Results – Proposed Site Conditions

11.1 1% AEP Event

The 1% AEP post development flood depths/levels, flood velocities, flood hazard and flood impact are shown in Figure 21, Figure 22 and Figure 23 respectively and confirm that:

- Overland flow from Victoria Avenue is contained within the road reserve and effectively conveyed into the existing underground trunk drainage through the drainage network in Victoria Avenue.
- Maximum flood levels reach 85.07m AHD over the low point of Victoria Avenue. The entrance to the Lower ground car park level is RL85.30m and remains flood free in the 1% AEP.
- A minimum freeboard of 630mm is available for the lowest occupied commercial areas at 85.70m AHD. This is compliant with Council DCP which requires an FPL of 1% +500mm of freeboard for habitable commercial floors.
- Small water ponding at lower ground level entrance shown in Figure 21 is due application of rainfall-on-grid method. That small amount of overland flow will be redirected by way of detail earthworks design and internal drainage network.
- Flood hazards across the site and within Victoria Avenue are generally low based on NSW provisional hazard category.

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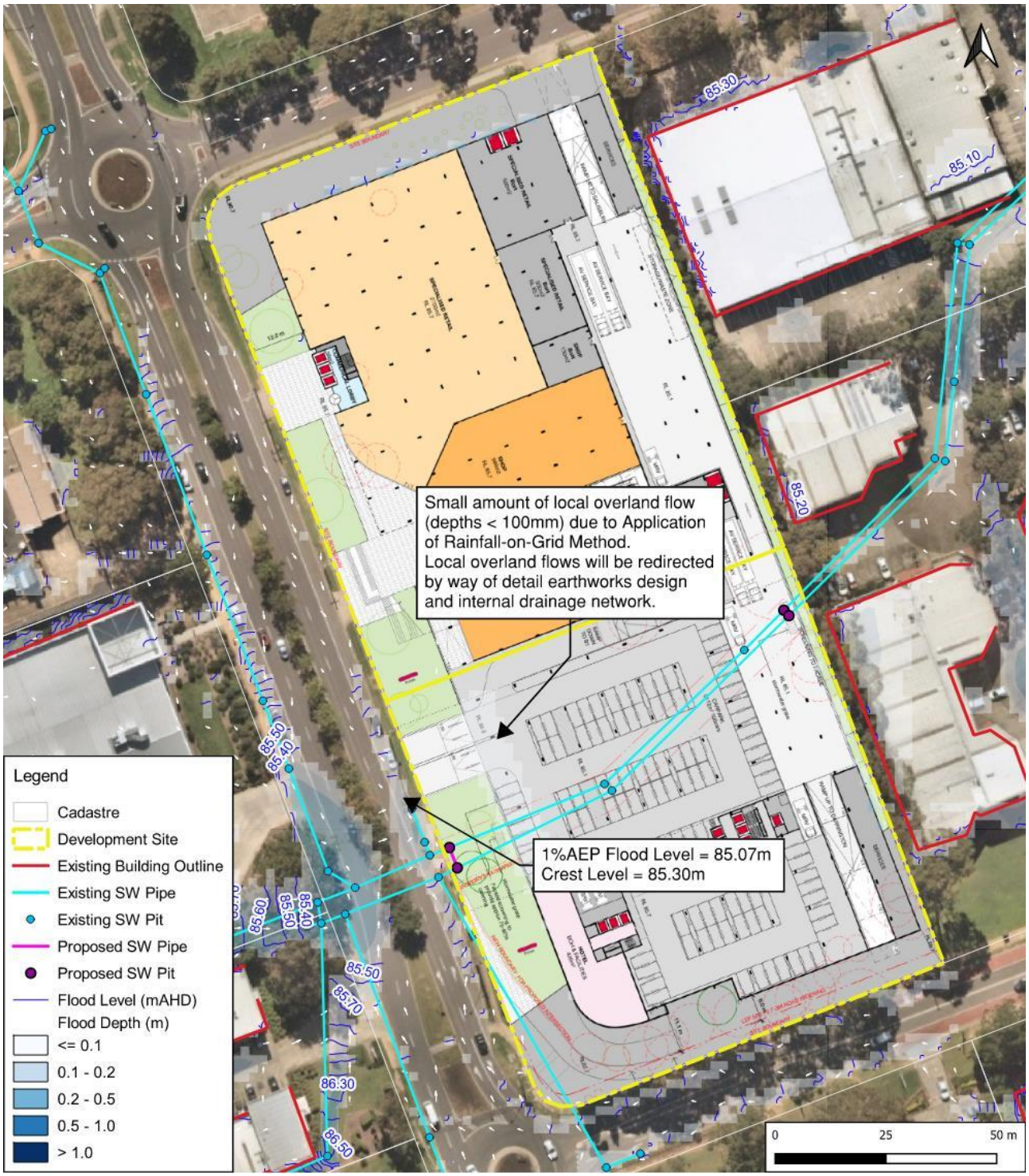

Figure 21 – Flood Levels & Depths (1%AEP) – Post Development Conditions

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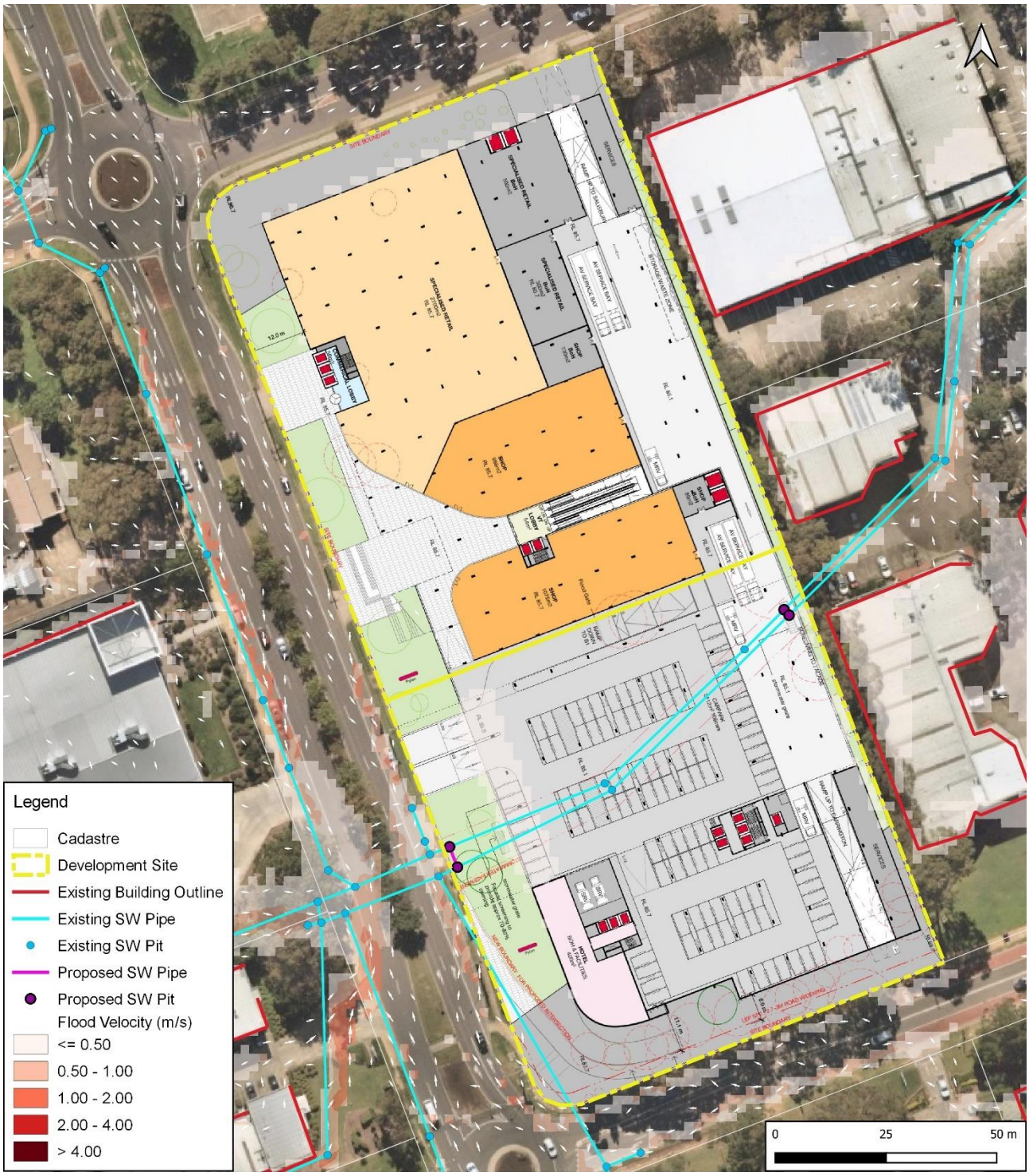

Figure 22 – Flood Velocity (1%AEP) – Post Development Conditions

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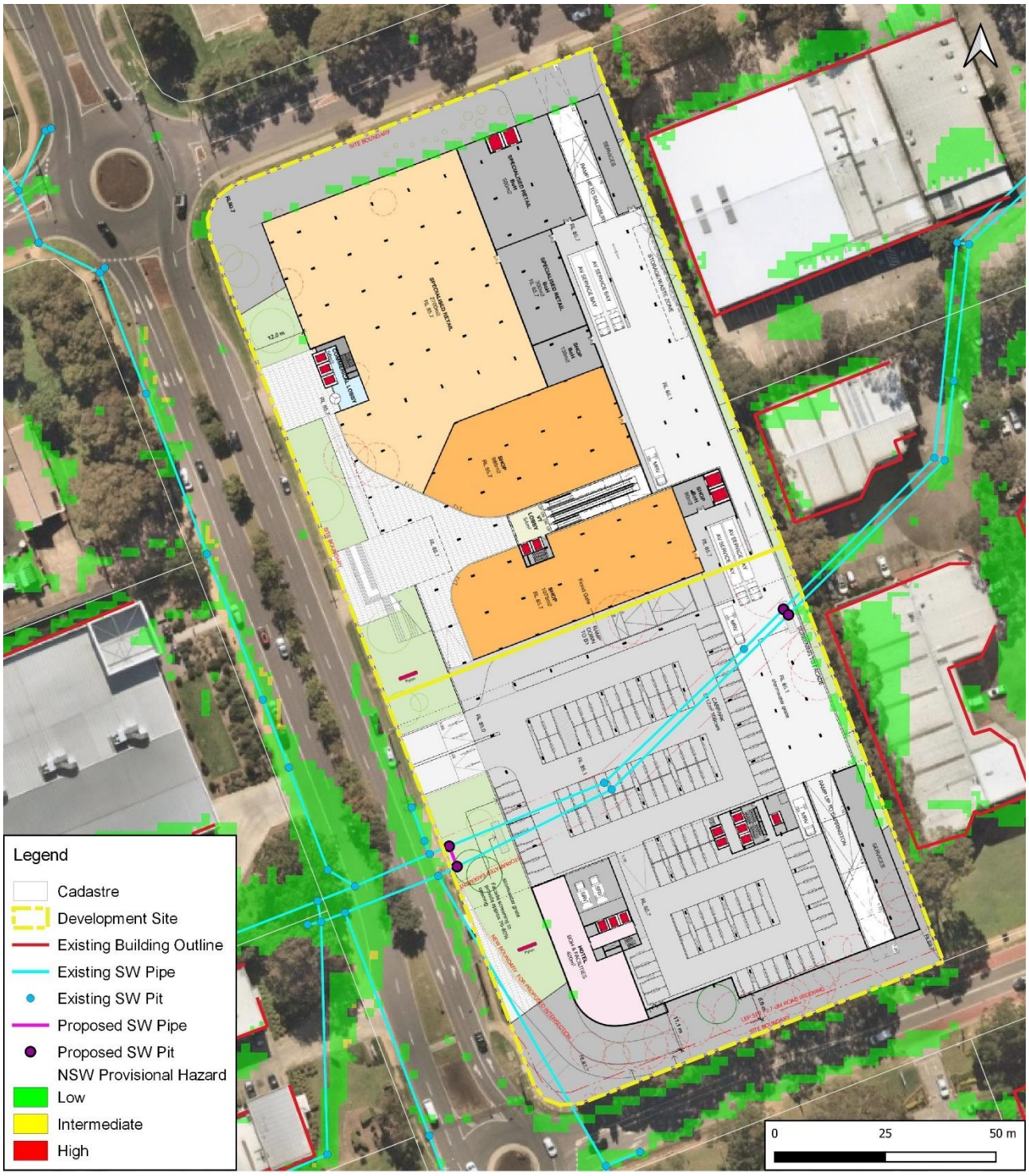

Figure 23 – NSW Provisional Flood Hazard (1%AEP) – Post Development Conditions

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11.2 0.2% AEP and PMF Events

The flood model was also run for the critical 0.2% AEP and PMF events under the post development conditions. Overland flow through the proposed lower ground car park (easement) was simulated in TUFLOW using a Layered Flow Constriction (LFC) element with no blockage.

The post development flood results confirm that:

- Overland flows from Victoria Avenue are largely contained within the road reserve and effectively conveyed into the existing underground trunk drainage through the drainage network in Victoria Avenue during the 0.2% AEP event.
- Overland flows from Victoria Avenue are effectively conveyed to the proposed lower ground carpark and discharge via the eastern building boundary during the PMF, similar to the existing flood behaviour. This is consistent with the Approved '*Masters DA'* scheme (1/2014/JP).
- Overland flows are confined with the proposed lower ground car park, with flood barriers proposed to prevent the overland flow entering any basement entrances.
- Floodwaters eventually discharge to the downstream property (lot 12 of DP711909) via the eastern site boundary.
- Maximum flood levels reach up to 85.20m AHD and 86.67m AHD across the exiting sag point at Victoria Ave during the 0.2% AEP and PMF events respectively, before flowing onto the site.
- Maximum flood depth through the lower ground car park is 1.60m during the PMF event.
- The amount of flow entering the lower ground car park during the 0.2% AEP event is insignificant in volume (crest level at entrance is 85.30m) and will be drained into exiting twin DN1800 drainage pipes through proposed internal drainage network.
- Flood hazards across the site and on Victoria Avenue are generally low during the 0.2% AEP event based on NSW provisional hazard category. Building floor levels at upper ground floor will be set above the 0.2% AEP flood levels at 85.70m with 500mm freeboard provided.
- Flood hazards are high through the main flow path during the PMF event based on NSW provisional hazard category.
- The 0.2% AEP peak flood levels and depths, flood velocities and flood hazards for the post development scenario conditions are shown in Figure 24, Figure 25 and Figure 26 respectively.
- The PMF peak flood levels and depths, flood velocities and flood hazards for the post development scenario conditions are shown in Figure 27, Figure 28 and Figure 29 respectively.
- The proposed development (including ancillary structures, facades, stairs and barriers) will be constructed with flood compatible materials below RL 85.57m AHD which is the 1% AEP flood level plus 500mm freeboard.
- The eastern façade of the lower ground car park and fencing at the western site boundary will be permeable as to not inhibit the overland flow through the car park up to the PMF event.
- The development is consistent with the approved '*Masters DA'* scheme and complies with Council's Flood Planning Controls, with 630mm freeboard provided to the commercial floor level (500mm required by Council). The Lower Ground Level car park entrance is at 85.30m which is 270mm above the 1% AEP flood level in Victoria Avenue and will be designed as a designated overland flow path for extreme floods, greater than the 0.2% AEP flood.

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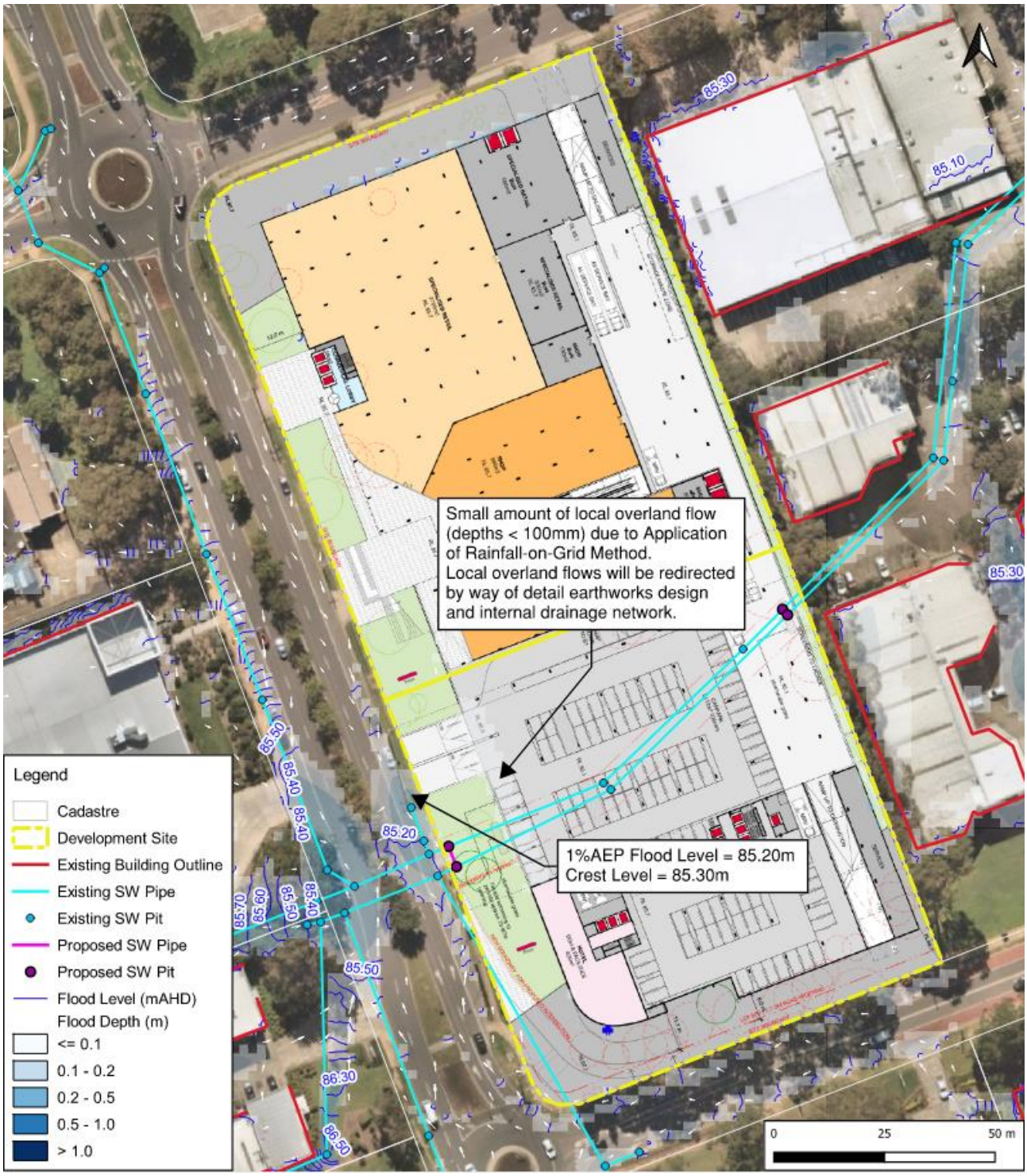

Figure 24 – Flood Levels & Depths (0.2% AEP) – Post Development Conditions (no blockage through car park)

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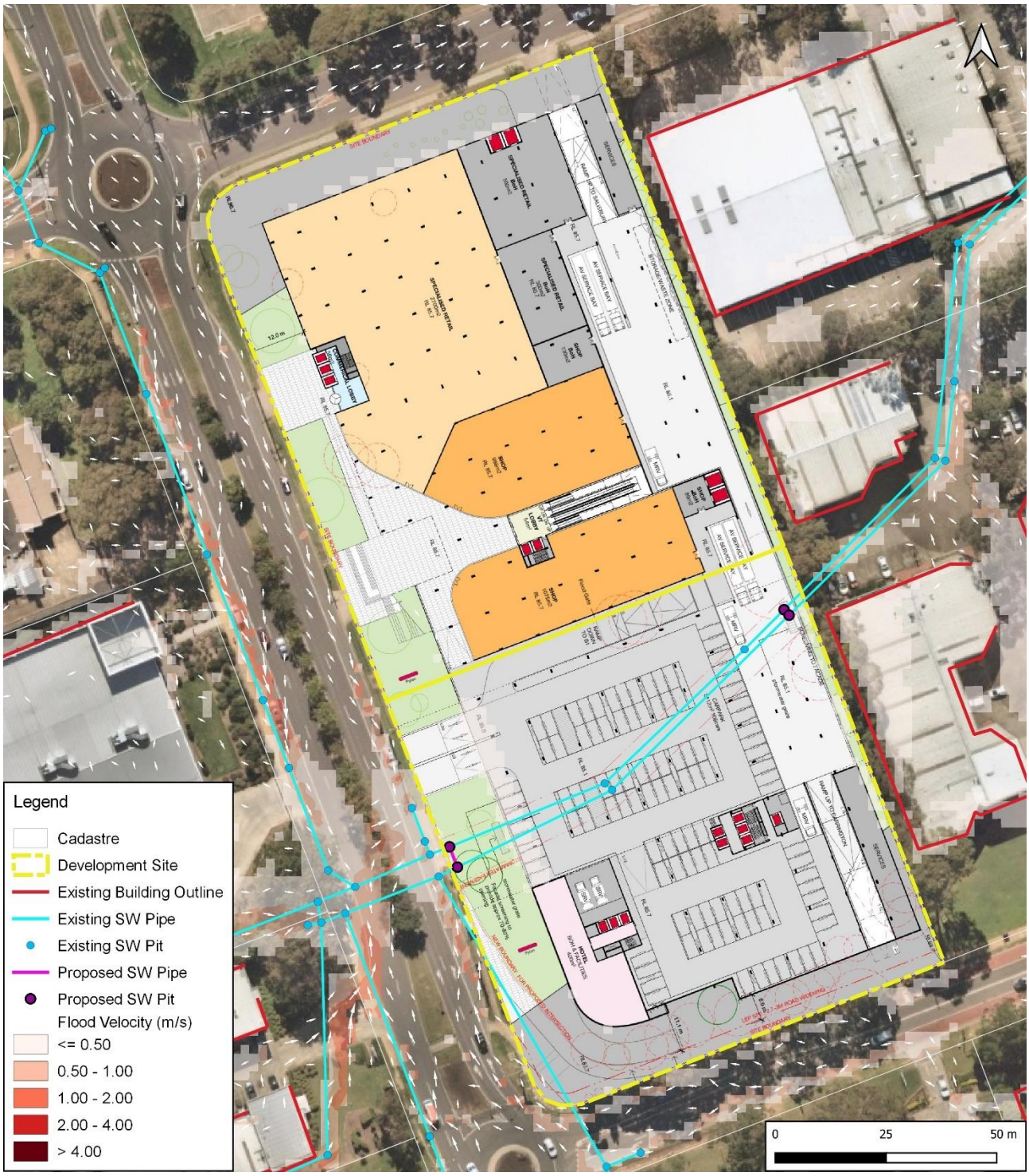

Figure 25 – Flood Velocity (0.2% AEP) – Post Development Conditions (no blockage through car park)

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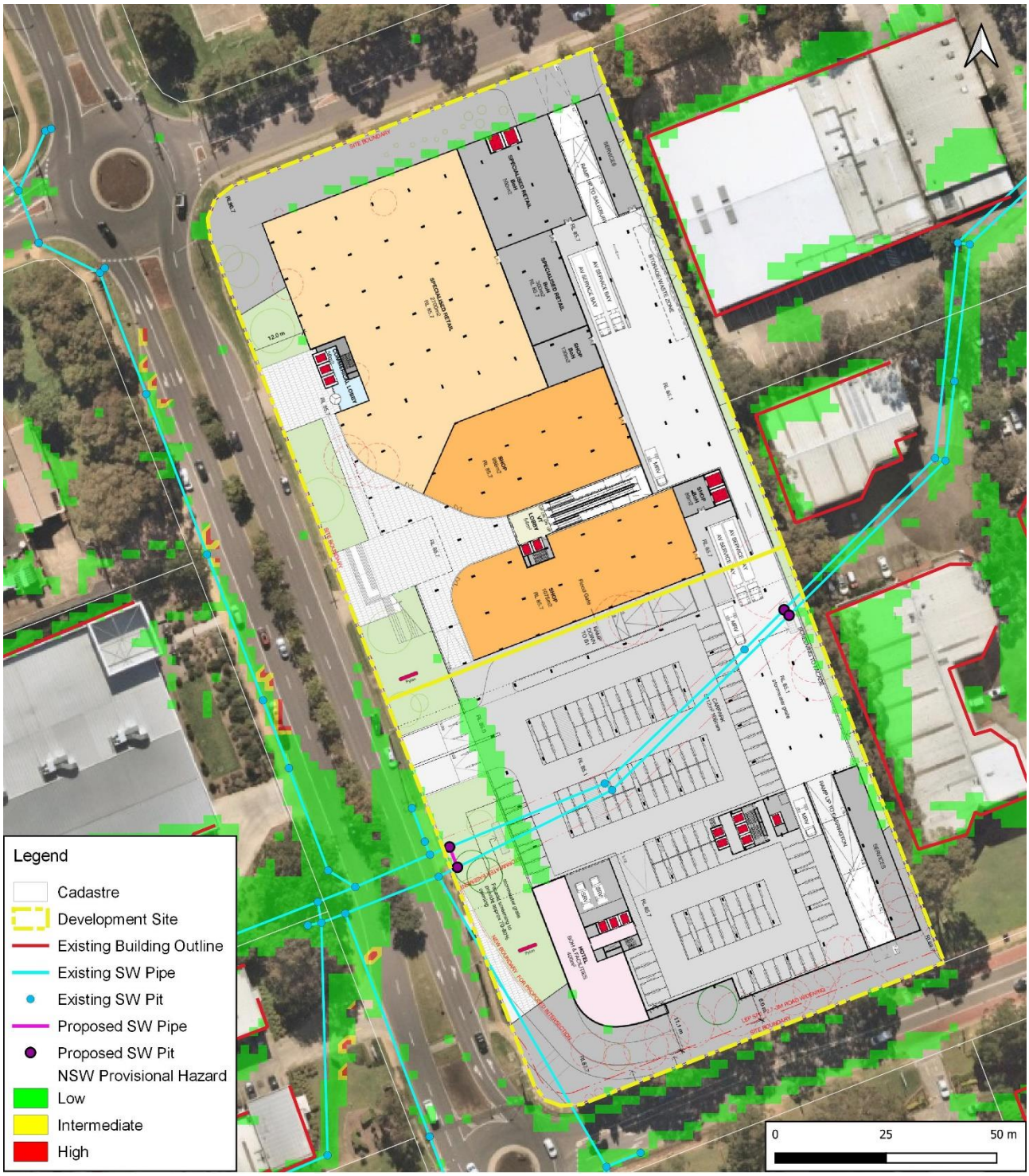

Figure 26 – NSW Provisional Flood Hazard (0.2% AEP) – Post Development Conditions (no blockage through car park)

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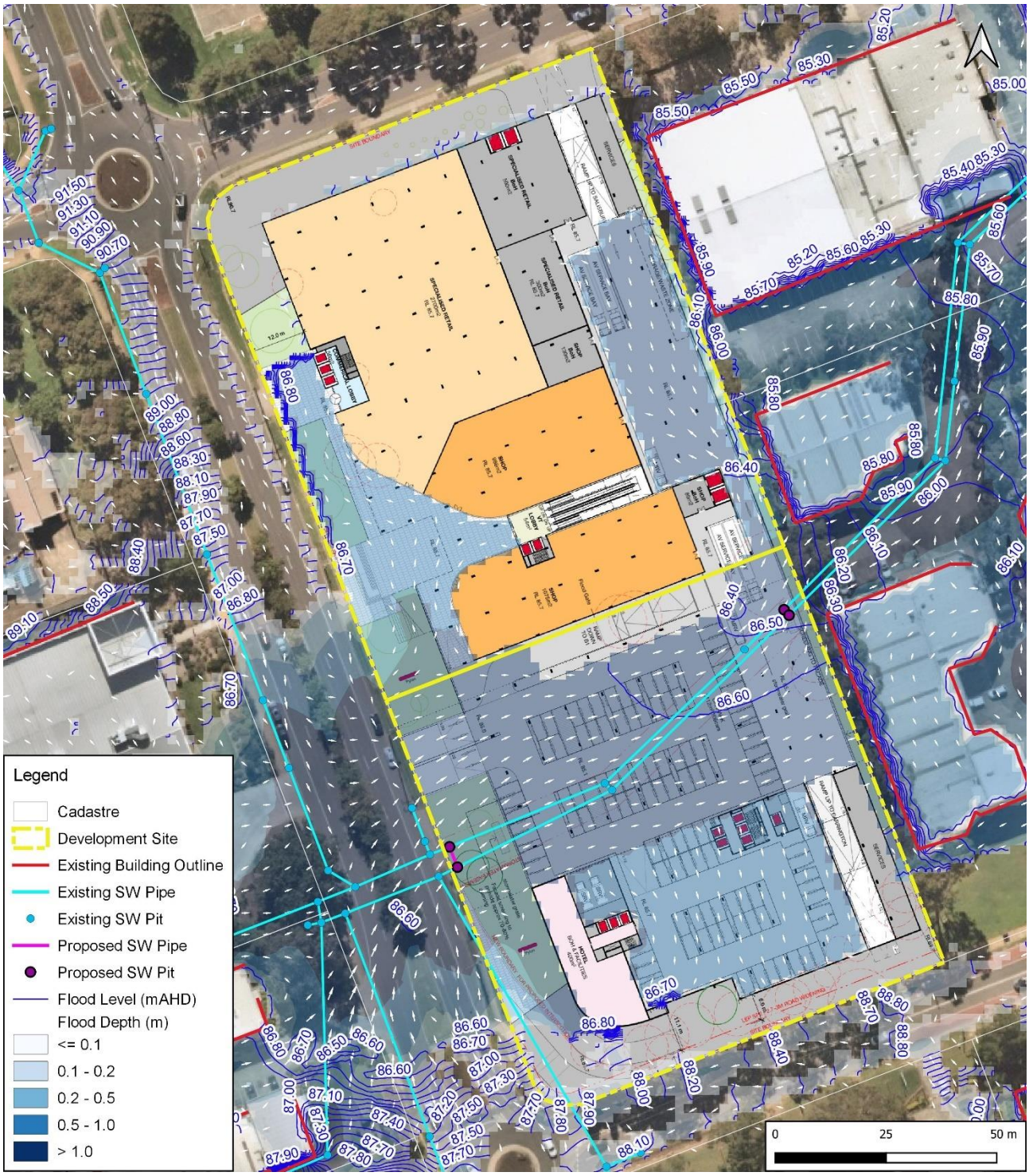

Figure 27 – Flood Levels & Depths (PMF) – Post Development Conditions (no blockage through car park)

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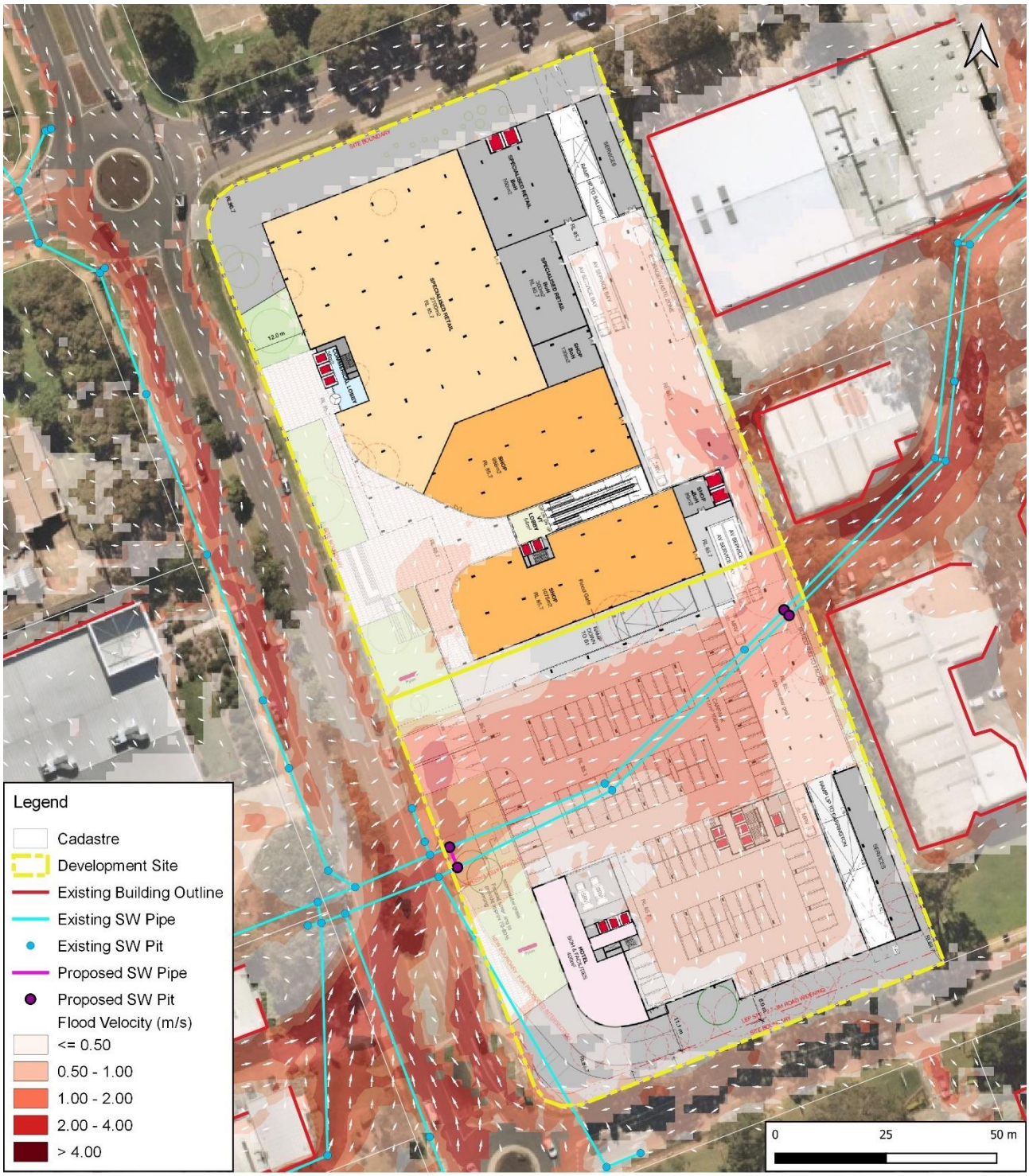

Figure 28 – Flood Velocity (PMF) – Post Development Conditions (no blockage through car park)

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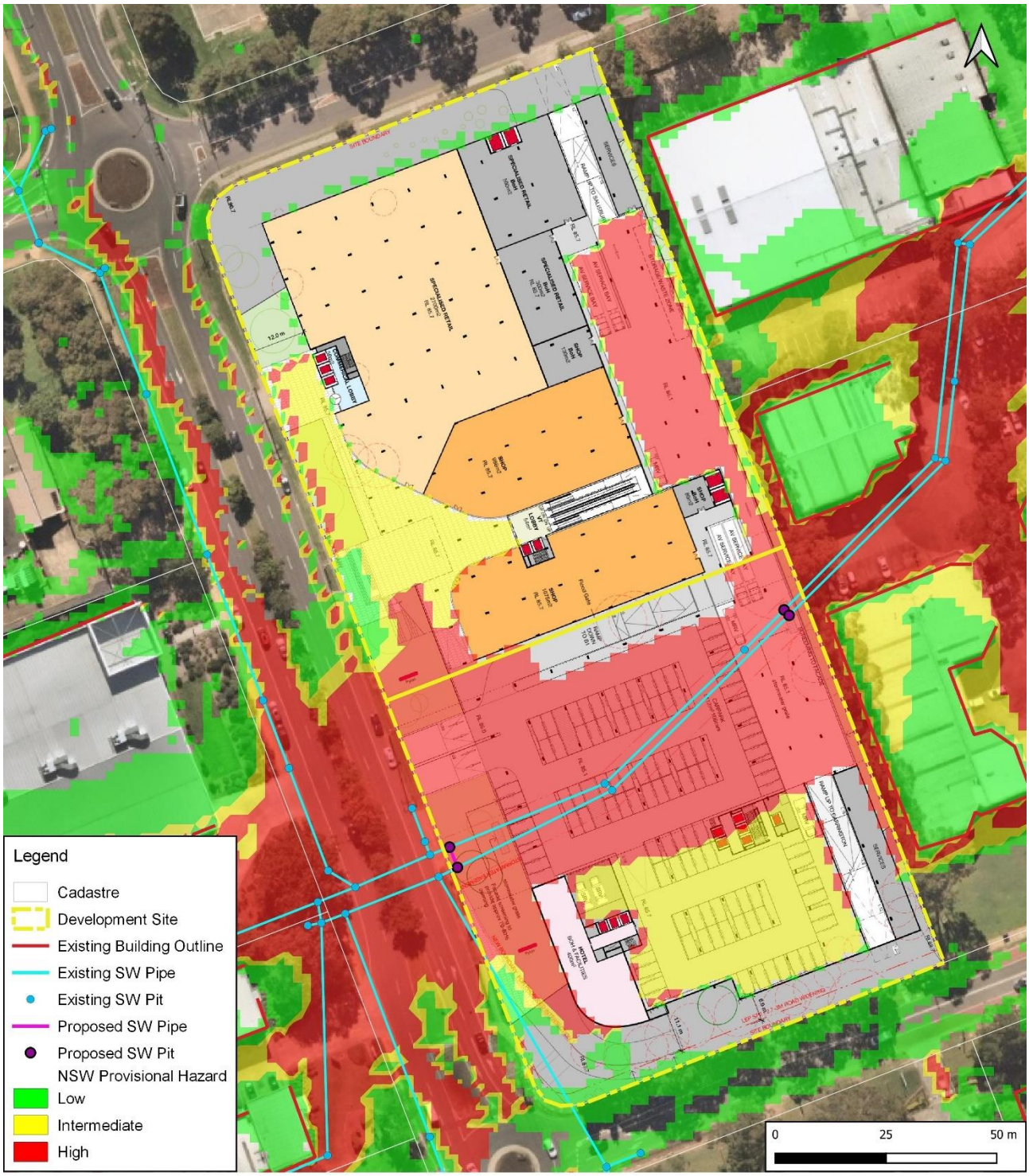

Figure 29 – NSW Provisional Flood Hazard (PMF) – Post Development Conditions (no blockage through car park)

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12.0 0.2% AEP and PMF Sensitivity Analysis with 40% and 100% Blockage Allowance

As part of the Hills Shire Council requirement, flood conditions of the site in post development state further investigated allowing 40% and 100% easement blockage across the proposed lower ground car park.

The flood results for 40% blockage across the car park confirm that:

- Overland flows from Victoria Avenue are largely contained within the road reserve and effectively conveyed into the existing underground trunk drainage through the drainage network in Victoria Avenue during the 0.2% AEP event.
- Overland flows are confined with the easement corridor across the proposed lower ground car park and discharge via the eastern building boundary during the PMF event.
- Floodwaters eventually discharge to the downstream property (lot 12 of DP711909) via the eastern site boundary.
- Maximum flood levels reach up to 85.20m AHD and 86.83m AHD across the exiting sag point at Victoria Ave during the 0.2% AEP and PMF events respectively.
- Maximum flood depth through the Lower ground car park is 1.63m during the PMF event.
- The 0.2% AEP peak flood levels and depths, flood velocities and flood hazards for the post development scenario conditions (with 40% blockage across car park) are shown in Figure 30, Figure 31 and Figure 32 respectively.
- The PMF peak flood levels and depths, flood velocities and flood hazards for the post development scenario conditions (with 40% blockage across car park) are shown in Figure 33, Figure 34 and Figure 35 respectively.
- Long sections at the proposed car park entrance in Victoria Avenue and through the proposed building with the 0.2% AEP and PMF levels (with and without blockage across car park) are shown in Figure 36 .
- A comparison of the 1% AEP Flood Levels within the site and in Victoria Avenue are shown in Table 5 below.

Table 5 – Flood Levels for Different Flood Model Scenarios

Location	Pre-Development	Post Development (0% Blockage at Car Park)	Post Development (40% Blockage at Car Park)
1% AEP			
Low Point in Victoria Avenue (East)	85.12m	85.07m	N/A
Within Development Site (At Pit 11S2133)	85.03m	N/A	N/A
0.2% AEP			
Low Point in Victoria Avenue (East)	85.20m	85.20m	85.20m
Within Development Site (At Pit 11S2133)	85.01m	N/A	N/A
PMF			
Low Point in Victoria Avenue (East)	86.71m	86.67m	86.83m
Within Development Site (At Pit 11S2133)	86.64m	86.62m	86.74m

- The 0.2% AEP peak flood levels and depths, flood velocities and flood hazards for the post development scenario conditions (with 100% blockage across car park) are shown in Figure 37, Figure 38 and Figure 39 respectively.
- The PMF peak flood levels and depths, flood velocities and flood hazards for the post development scenario conditions (with 100% blockage across car park) are shown in Figure 40, Figure 41 and Figure 42 respectively. This scenario was only modelled for model sensitivity analysis. Occurrence of this scenario is highly unlikely in the reality.

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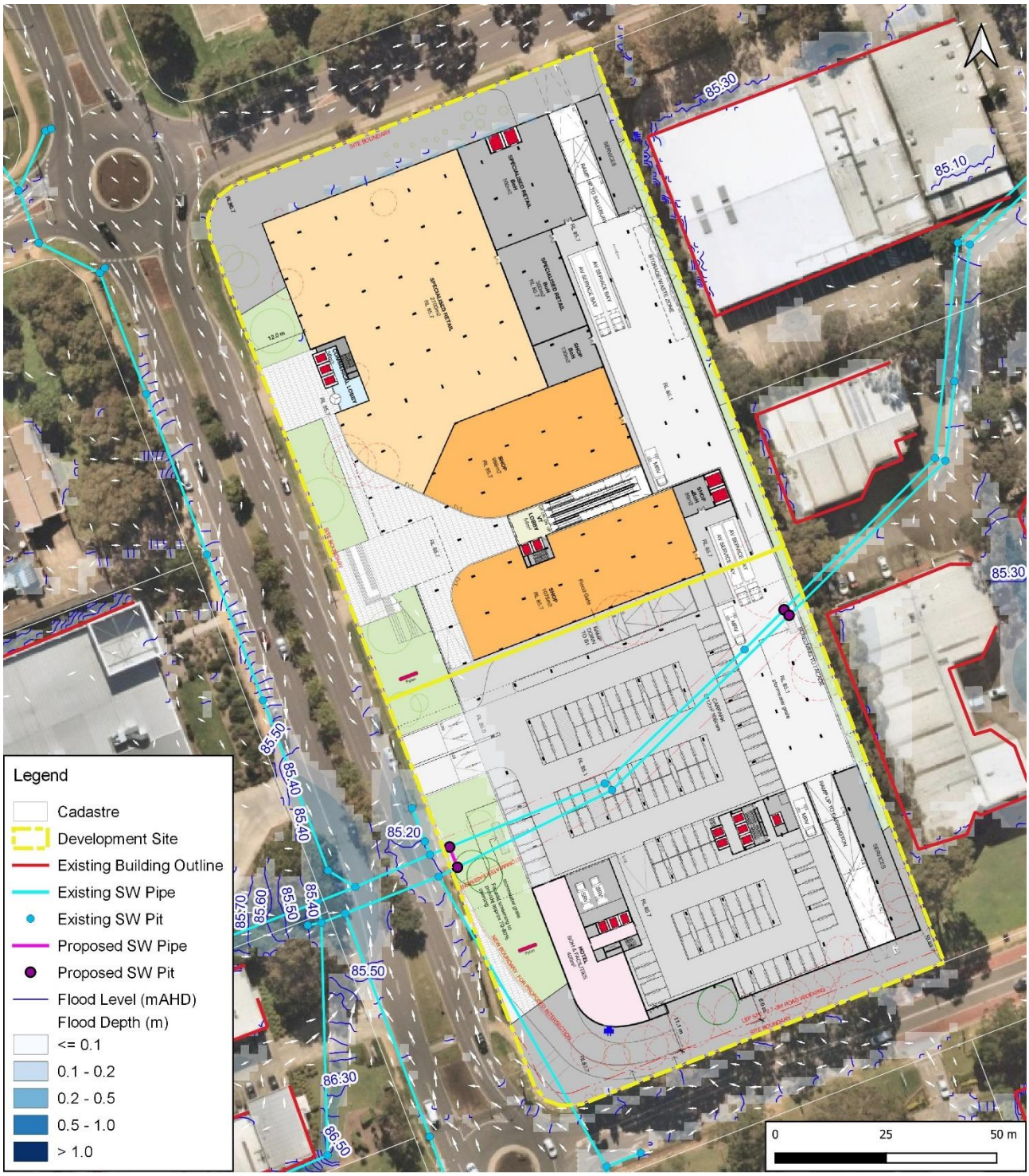

Figure 30 – Flood Levels & Depths (0.2%AEP) – Post Development Conditions (40% blockage through car park)

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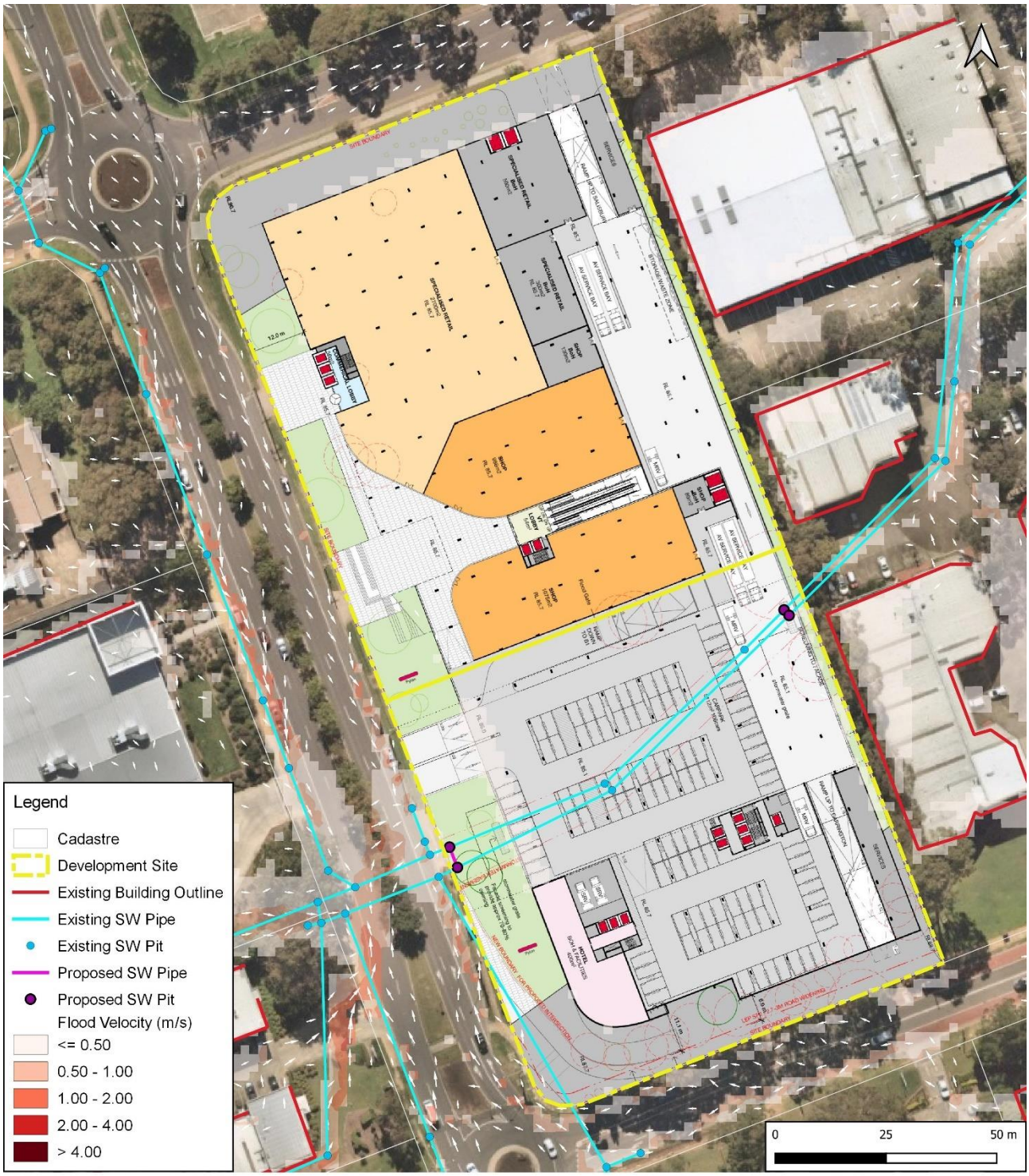

Figure 31– Flood Velocity (0.2%AEP) – Post Development Conditions (40% blockage through car park)

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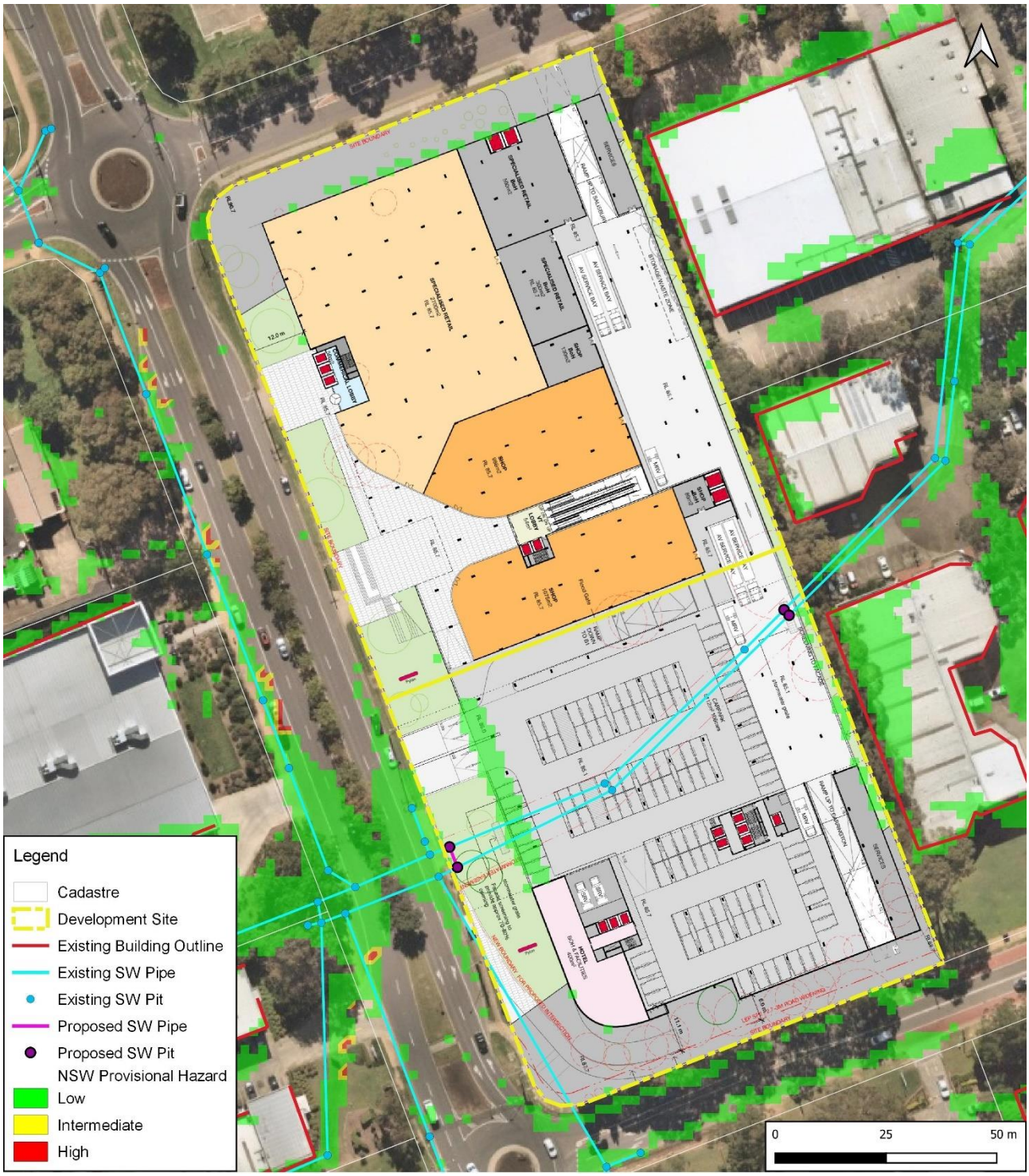

Figure 32– NSW Provisional Flood Hazard (0.2%AEP) – Post Development Conditions (40% blockage through car park)

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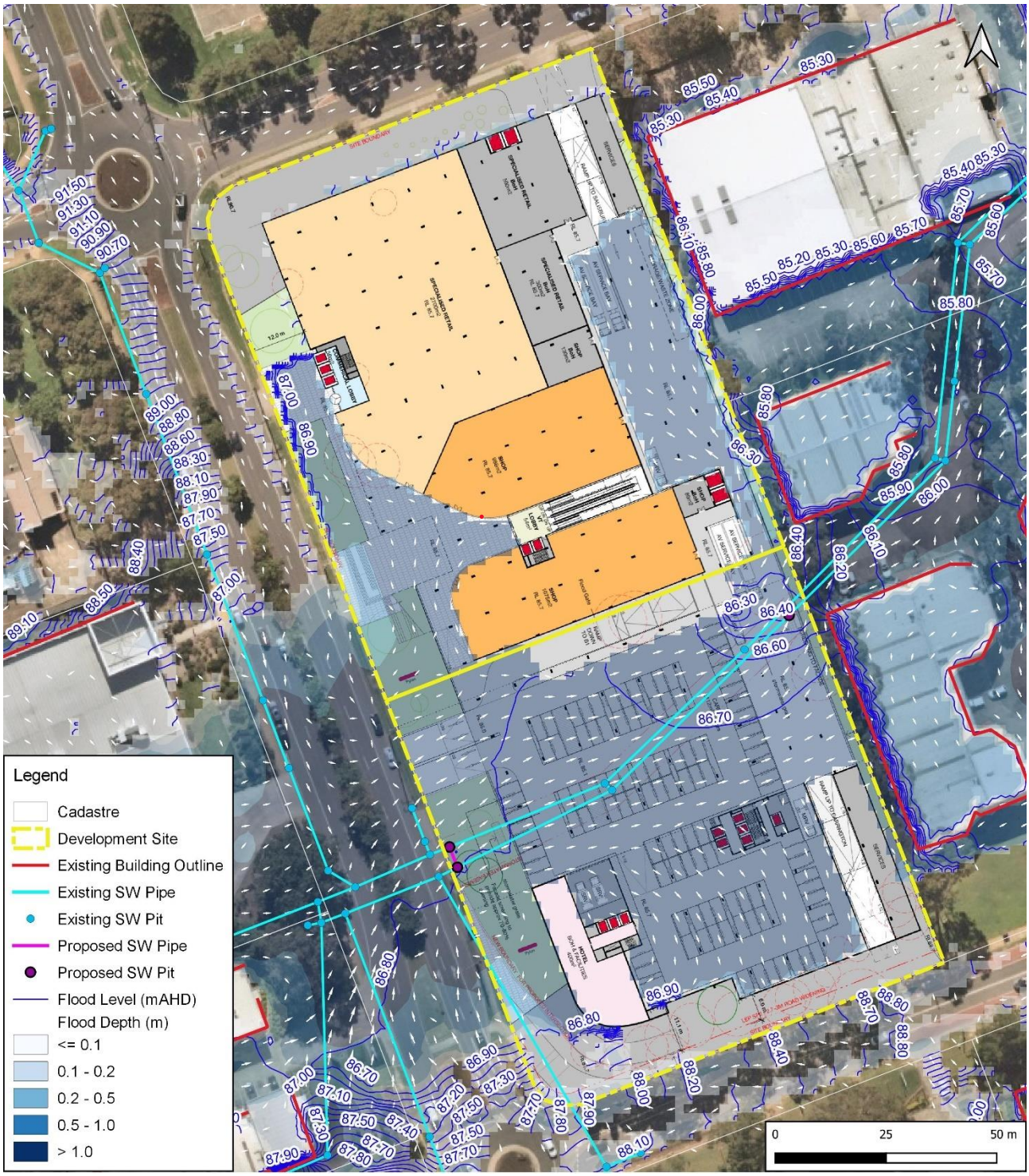

Figure 33– Flood Levels & Depths (PMF) – Post Development Conditions (40% blockage through car park)

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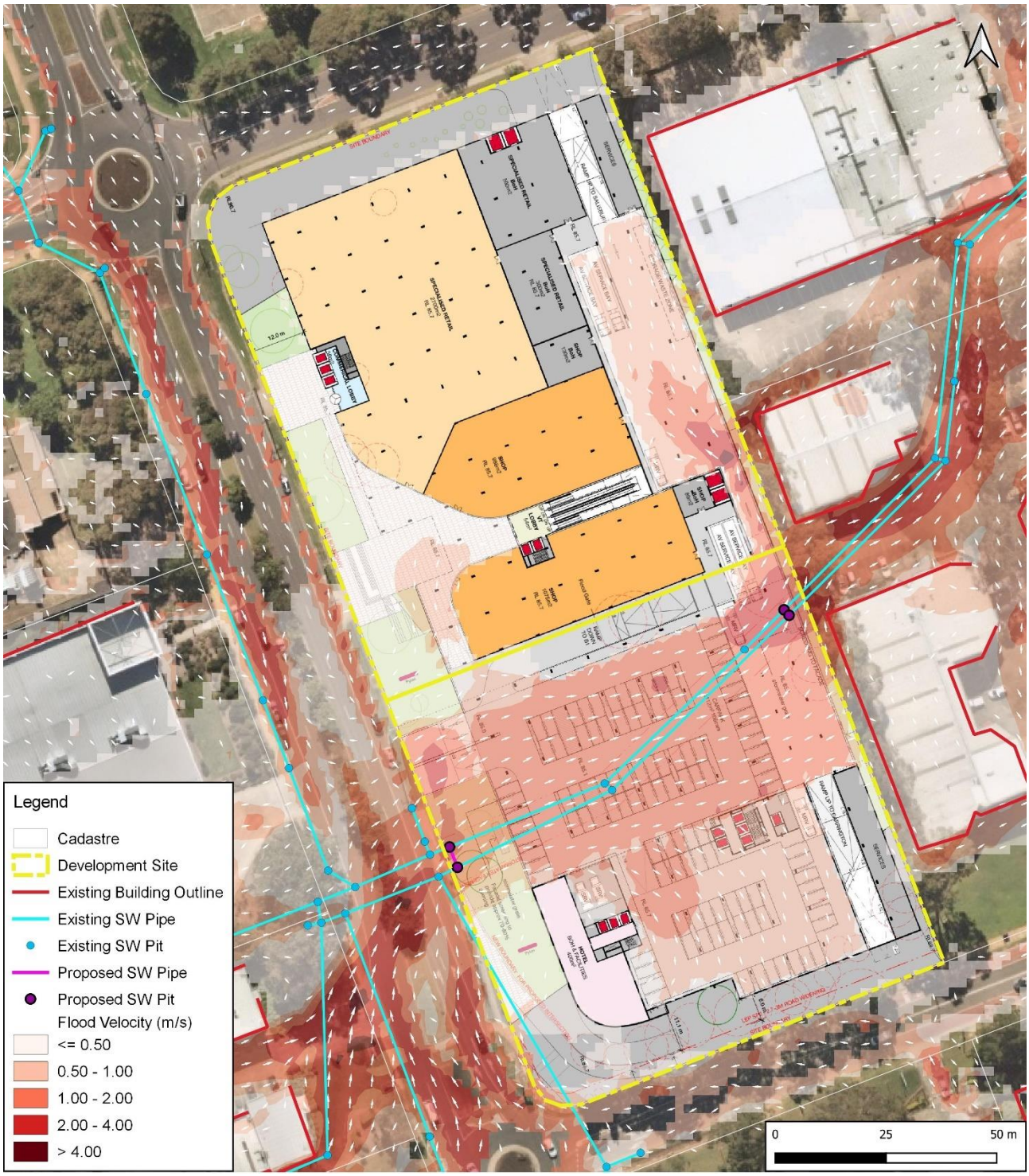

Figure 34– Flood Velocity (PMF) – Post Development Conditions (40% blockage through car park)

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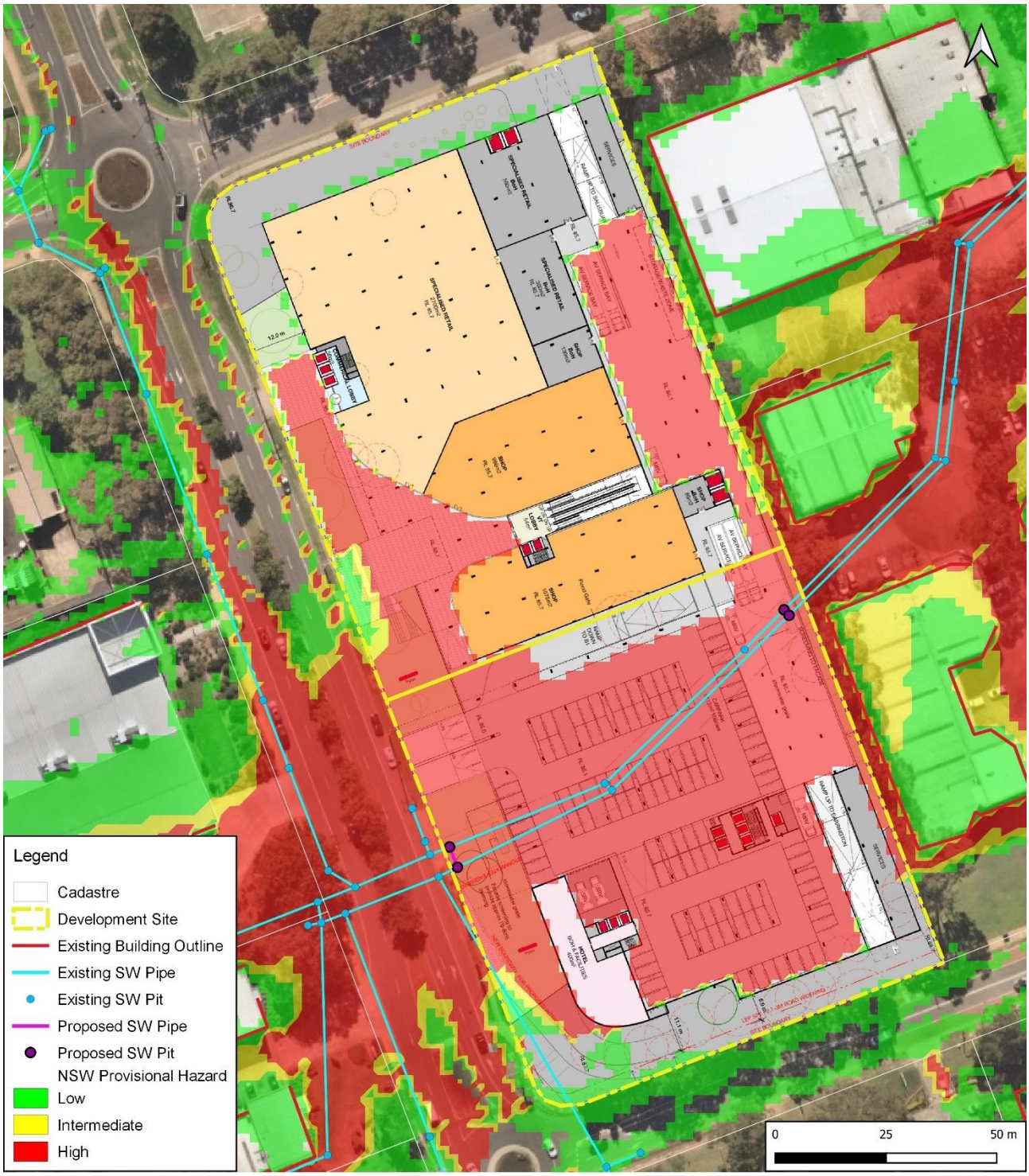

Figure 35 – NSW Provisional Flood Hazard (PMF) – Post Development Conditions (40% blockage through car park)

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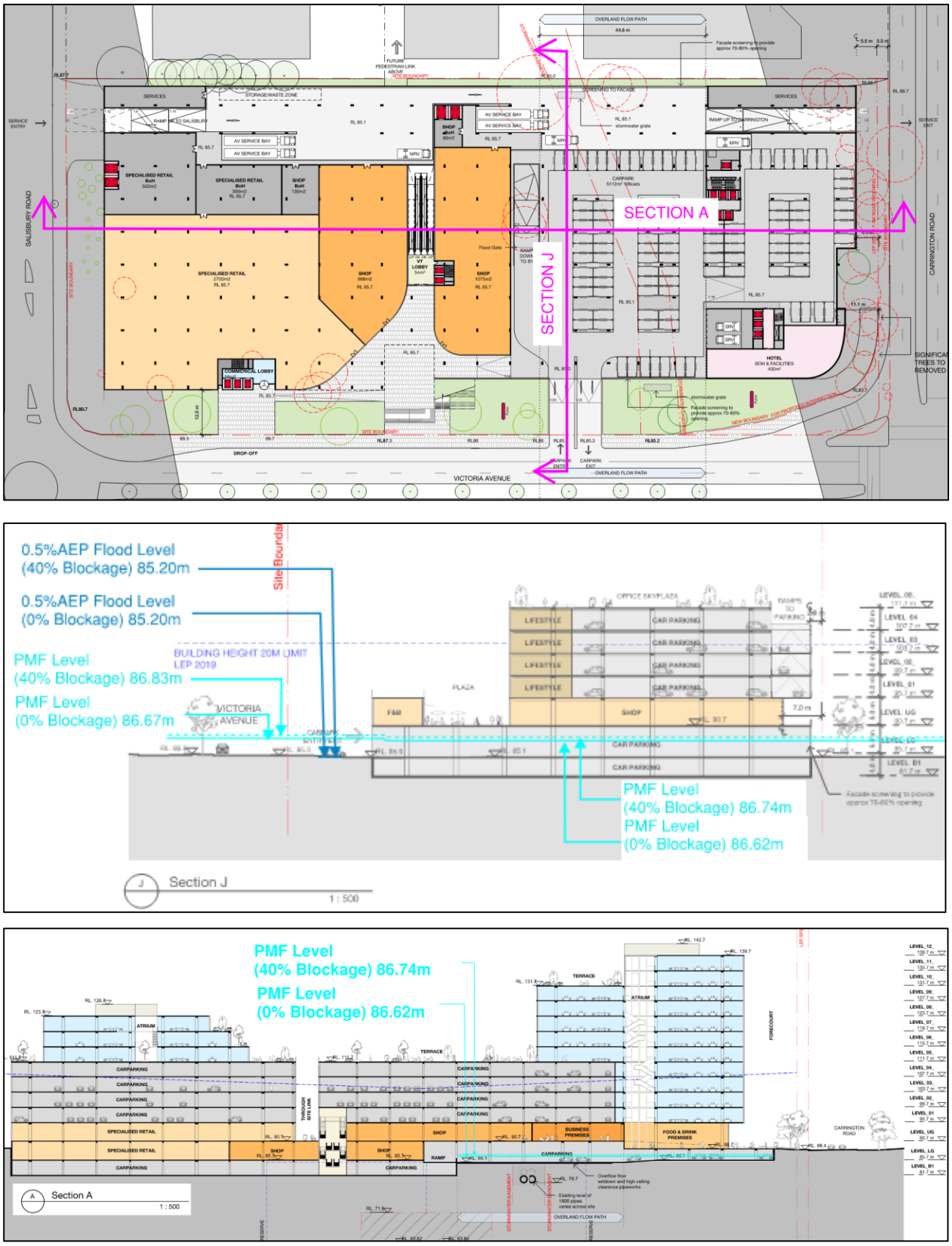

Figure 36 – Proposed West-East Building Section at Car Park Entrance in Victoria Avenue - 0.5% AEP & PMF Levels - with and without Blockage through Car Park

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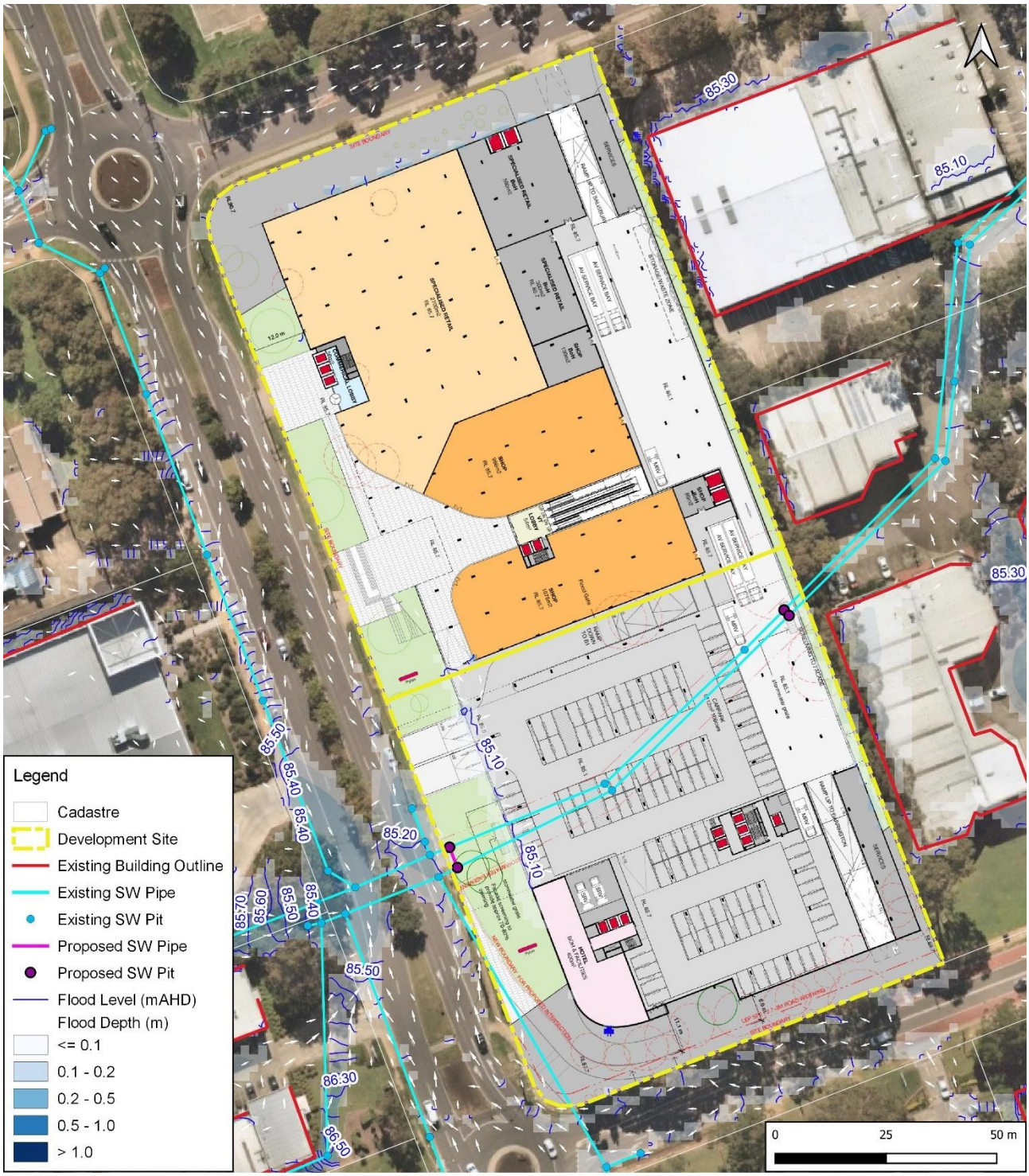

Figure 37 – Flood Levels & Depths (0.2%AEP) – Post Development Conditions (100% blockage through car park)

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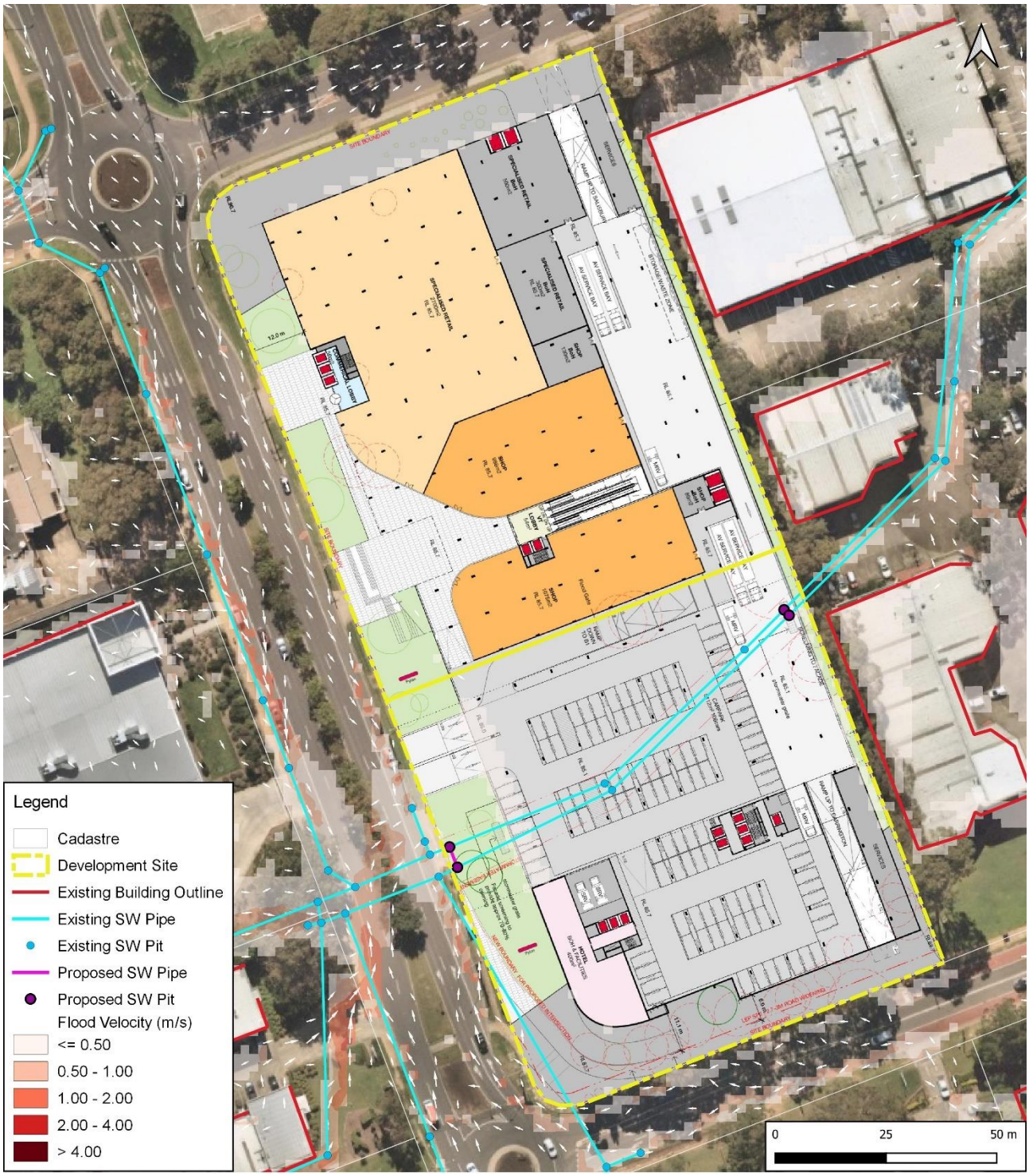

Figure 38– Flood Velocity (0.2%AEP) – Post Development Conditions (100% blockage through car park)

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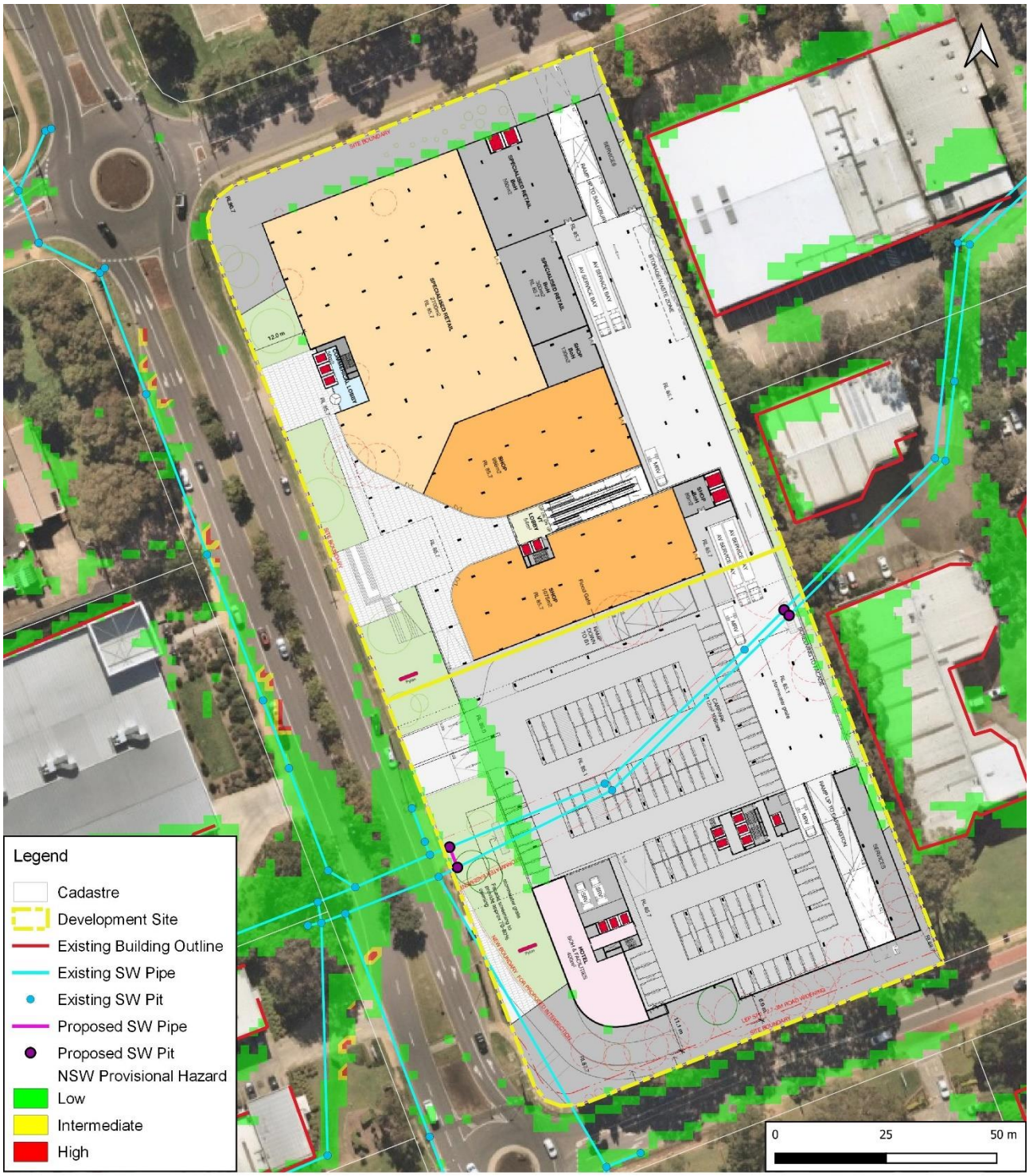

Figure 39– NSW Provisional Flood Hazard (0.2%AEP) – Post Development Conditions (100% blockage through car park)

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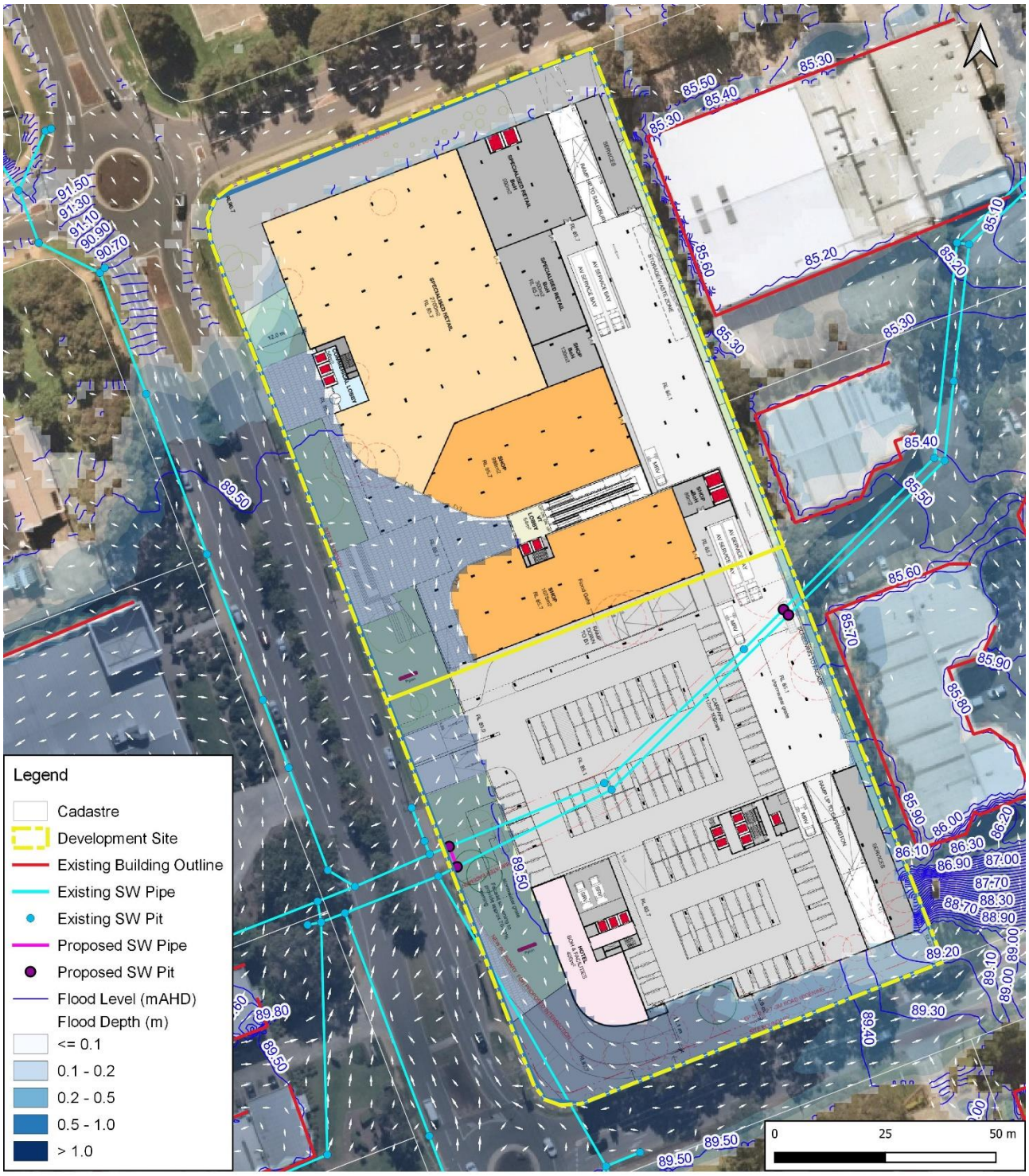

Figure 40– Flood Levels & Depths (PMF) – Post Development Conditions (100% blockage through car park)

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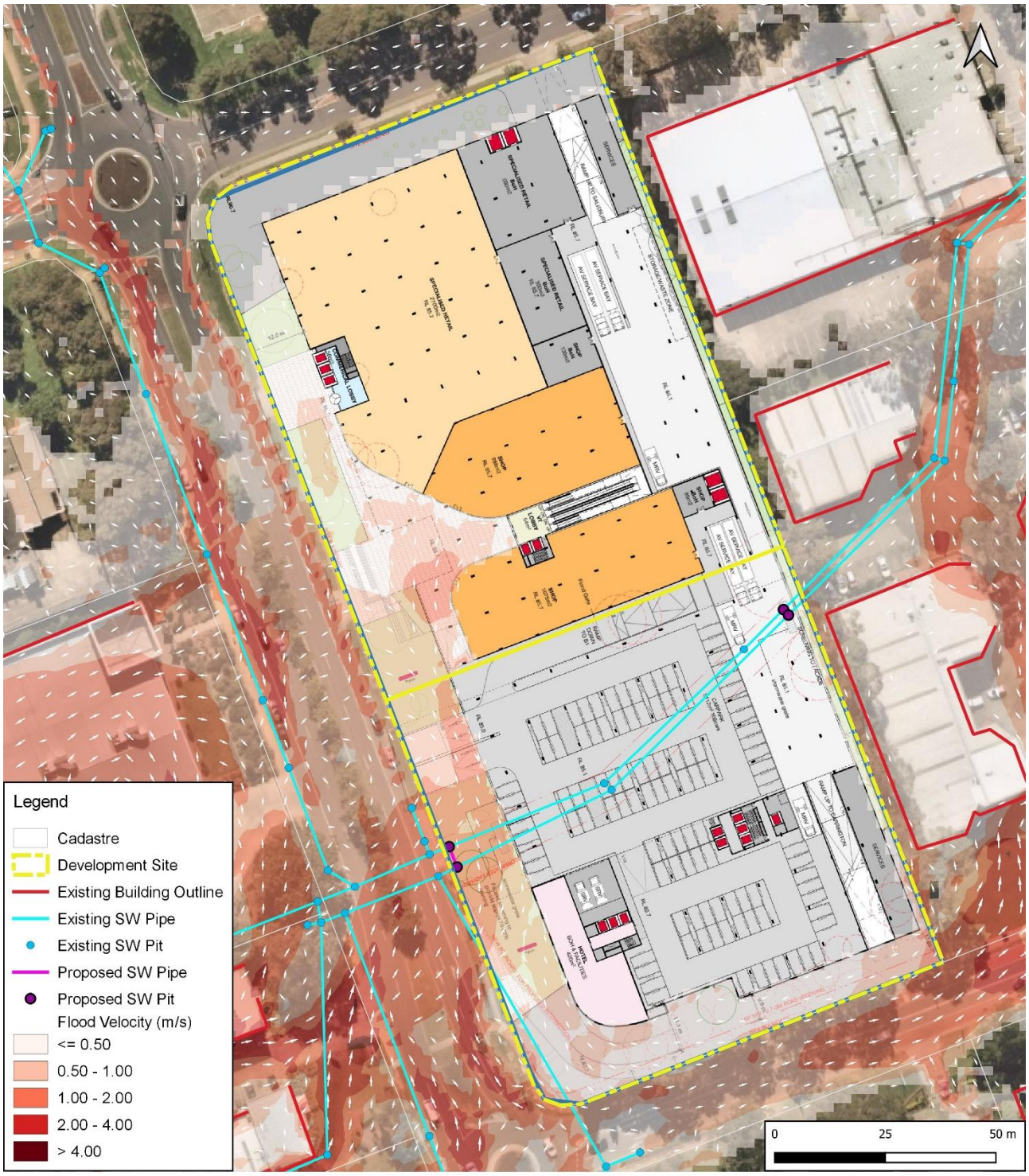

Figure 41– Flood Velocity (PMF) – Post Development Conditions (100% blockage through car park)

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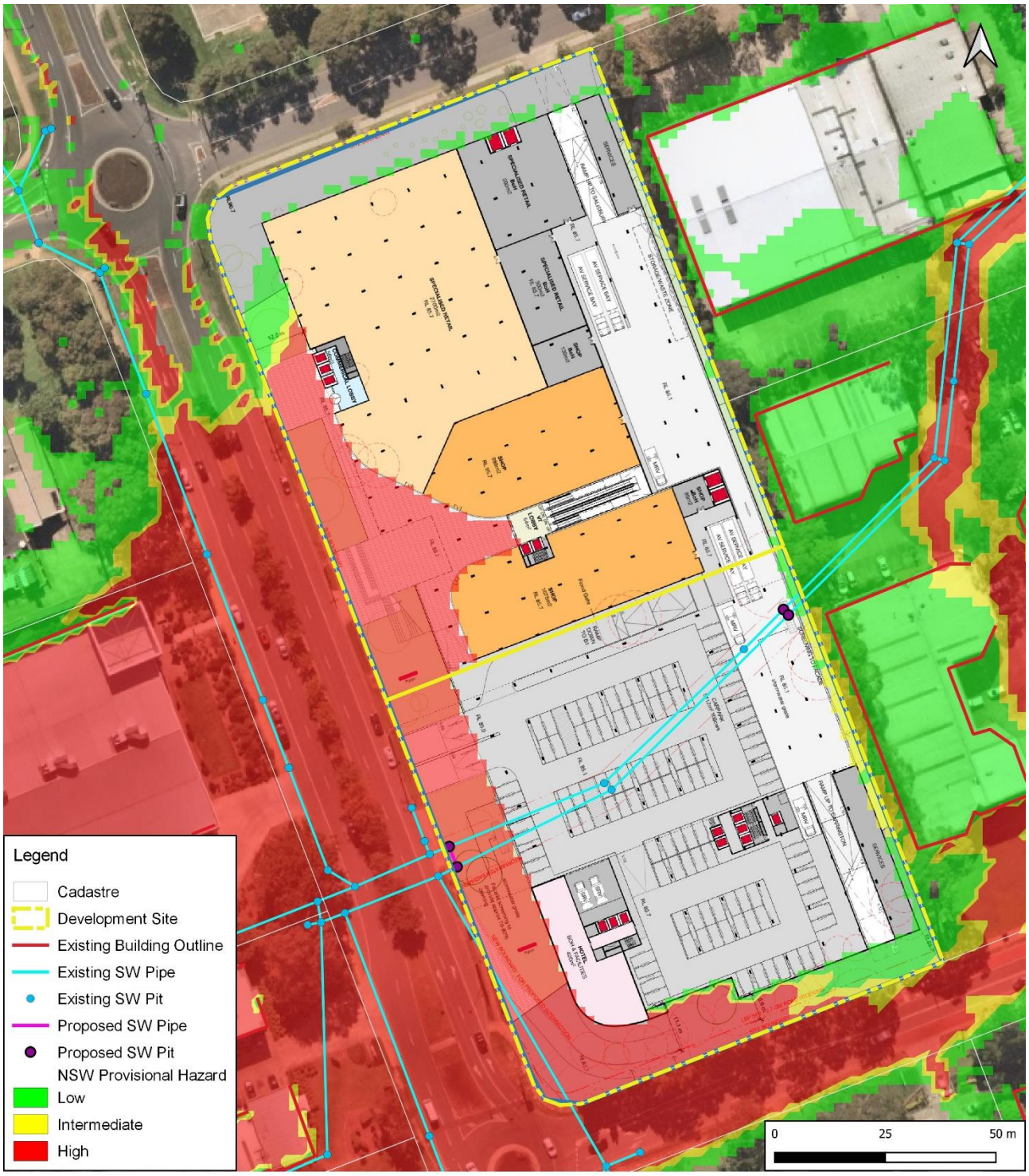

Figure 42– NSW Provisional Flood Hazard (PMF) – Post Development Conditions (100% blockage through car park)

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13.0 Offsite Flood Impact Assessment

The post development scenario shows that there is negligible (+/- 20mm) impact to existing upstream and downstream properties. There is a slight localised increase in flood levels (less than 40mm) within Victoria Avenue however the road is a designated major system designed to cater for the major storm events. There is no increase in Flood Hazard within Victoria Avenue or around the development site with Low hazard experienced in the post development scenario. There is a minor reduction in flood levels (approximately 50mm) across the Victoria Avenue low point.

The proposed development has negligible adverse impact to the existing flood behaviour or to existing properties, and the proposed lower ground car park level is flood free in the 1% AEP event.

Flood modelling confirms there is no significant upstream or downstream impact on adjacent properties and does not prejudice development options for these properties. There is also no increase in Flood Hazard within Victoria Avenue or around the development site and the flood hazard remains low in the post development scenario.

Flood level impact maps for the 1% AEP, 0.2% AEP (with no blockage across the car park) and 0.2% AEP (with 40% blockage across the car park) are shown in Figure 43, Figure 44 and Figure 45.

Flood level impact maps for the PMF with no blockage and 40% blockage across the car park are shown in Figure 46 and Figure 47.

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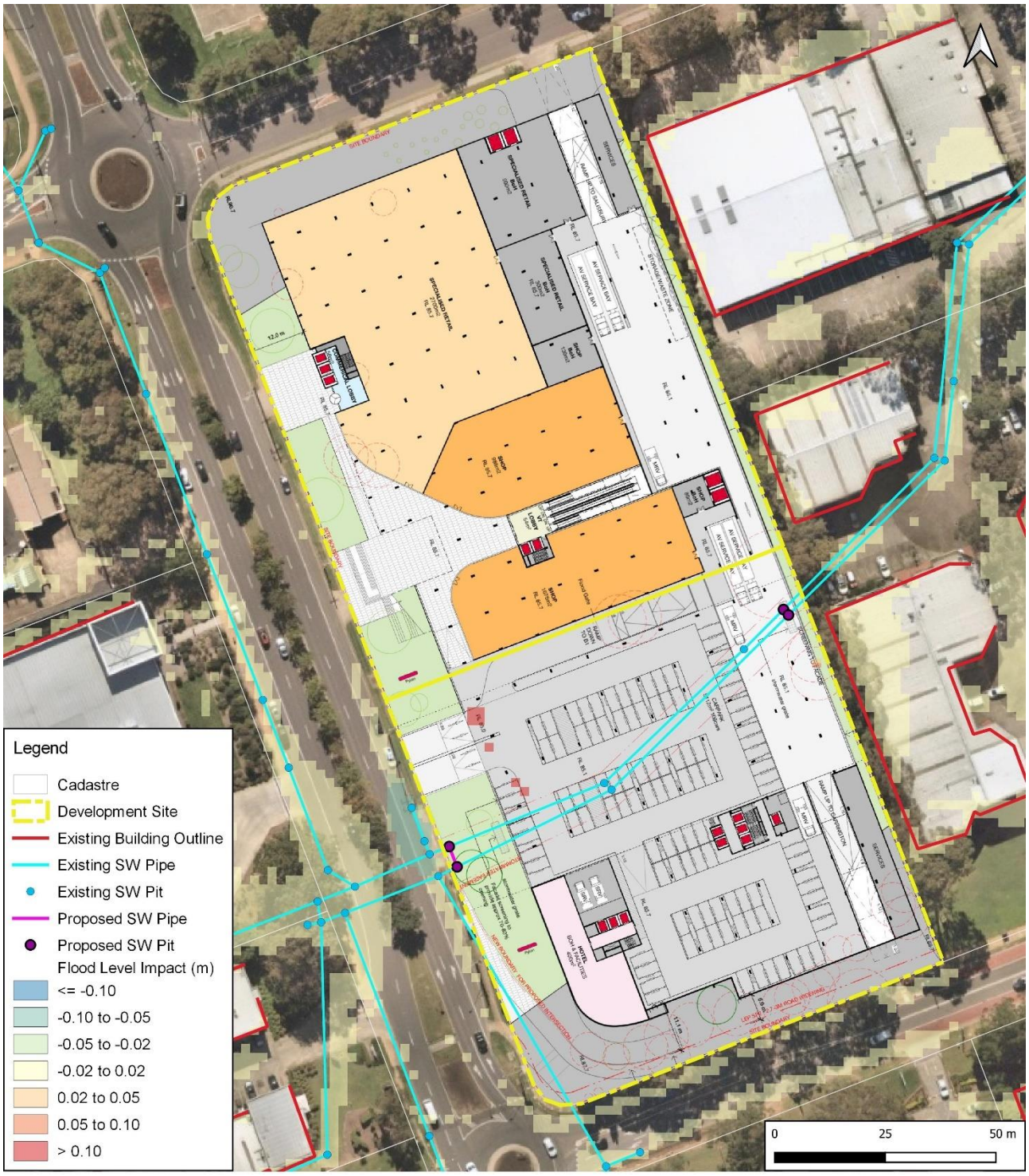

Figure 43 – 1%AEP Flood Level Impact

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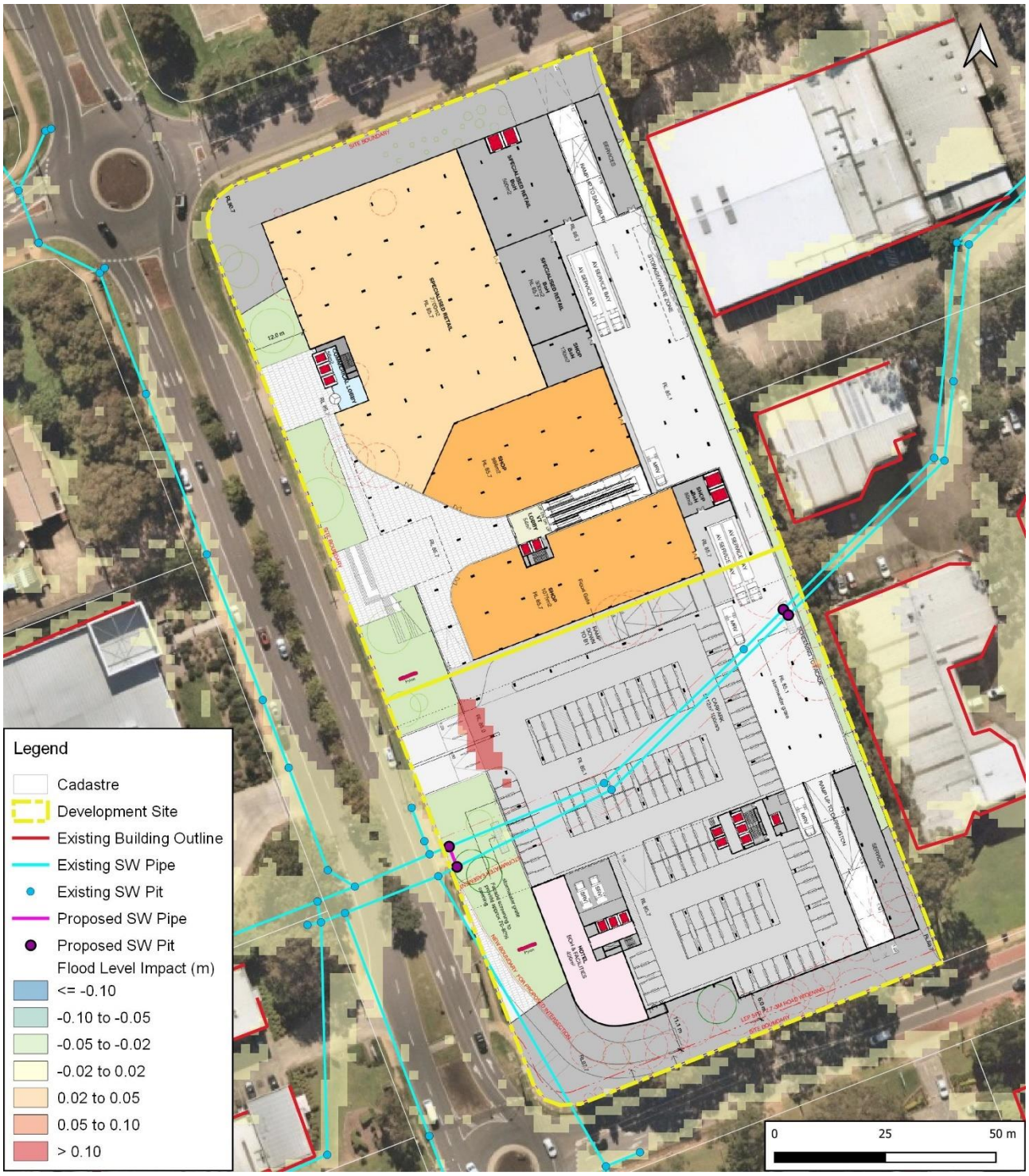

Figure 44 – 0.2%AEP Flood Level Impact (No Blockage Across Car Park)

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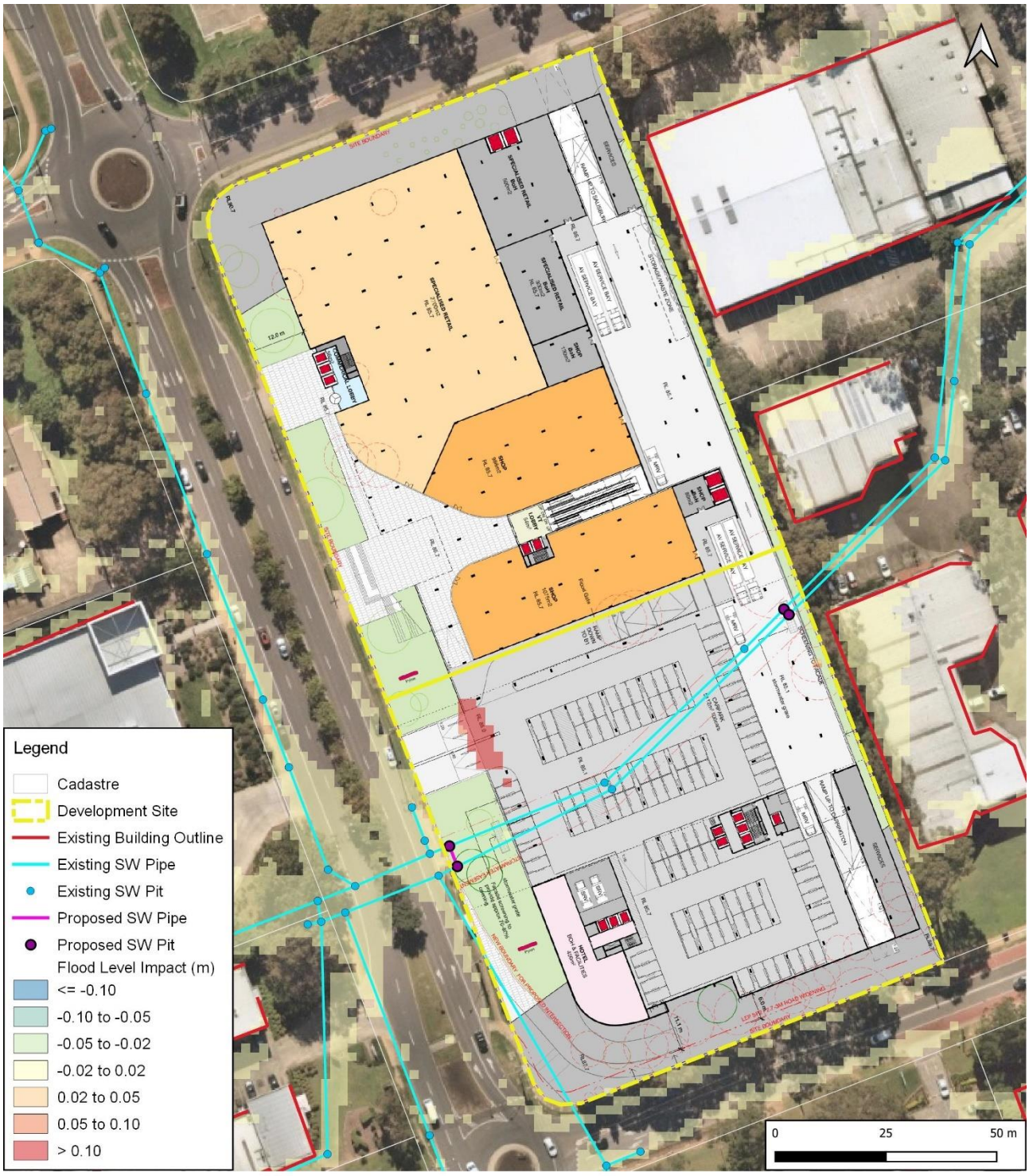

Figure 45 – 0.2%AEP Flood Level Impact (40% Blockage Across Car Park)

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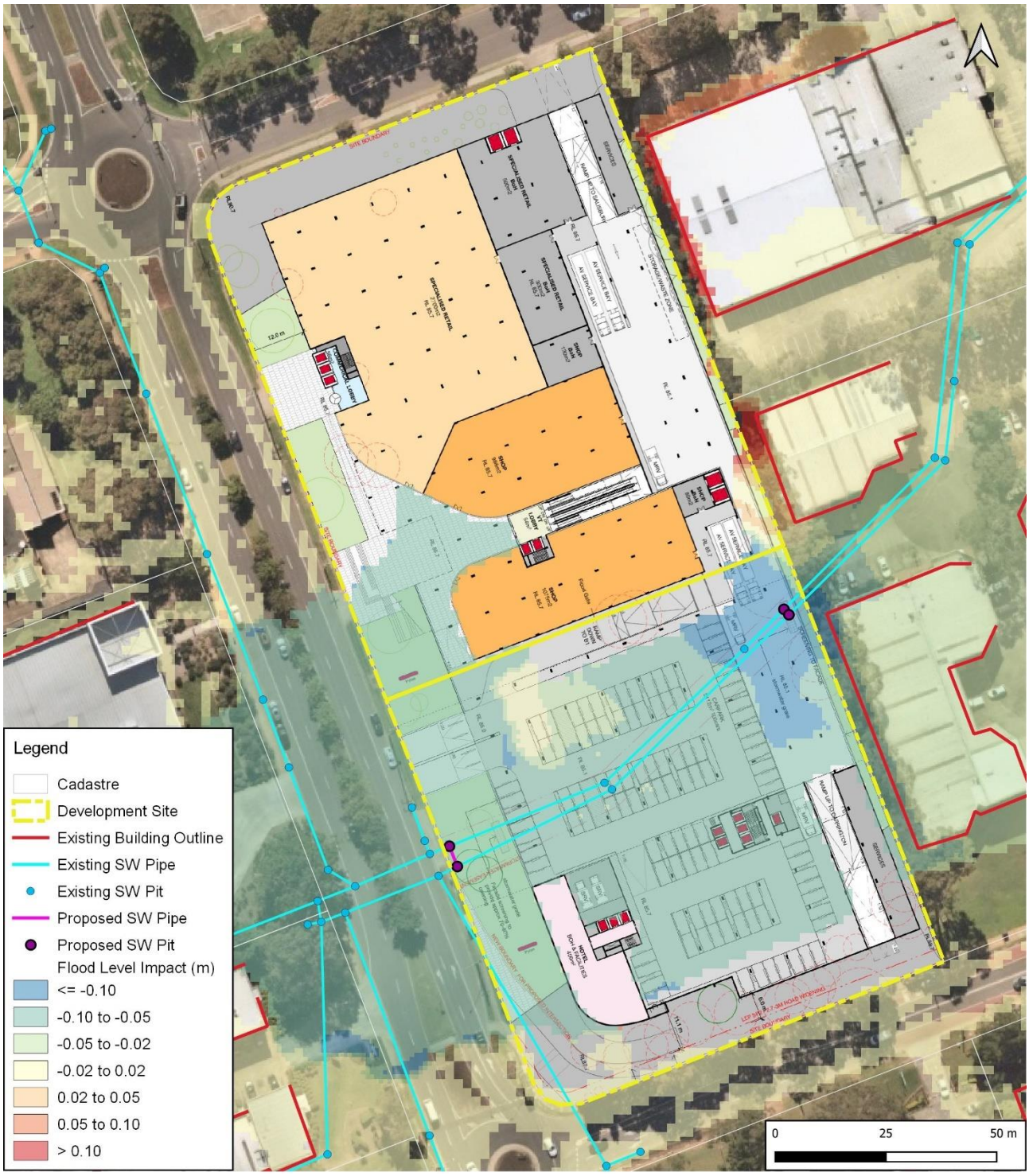

Figure 46 – PMF Level Impact (No Blockage Across Car Park)

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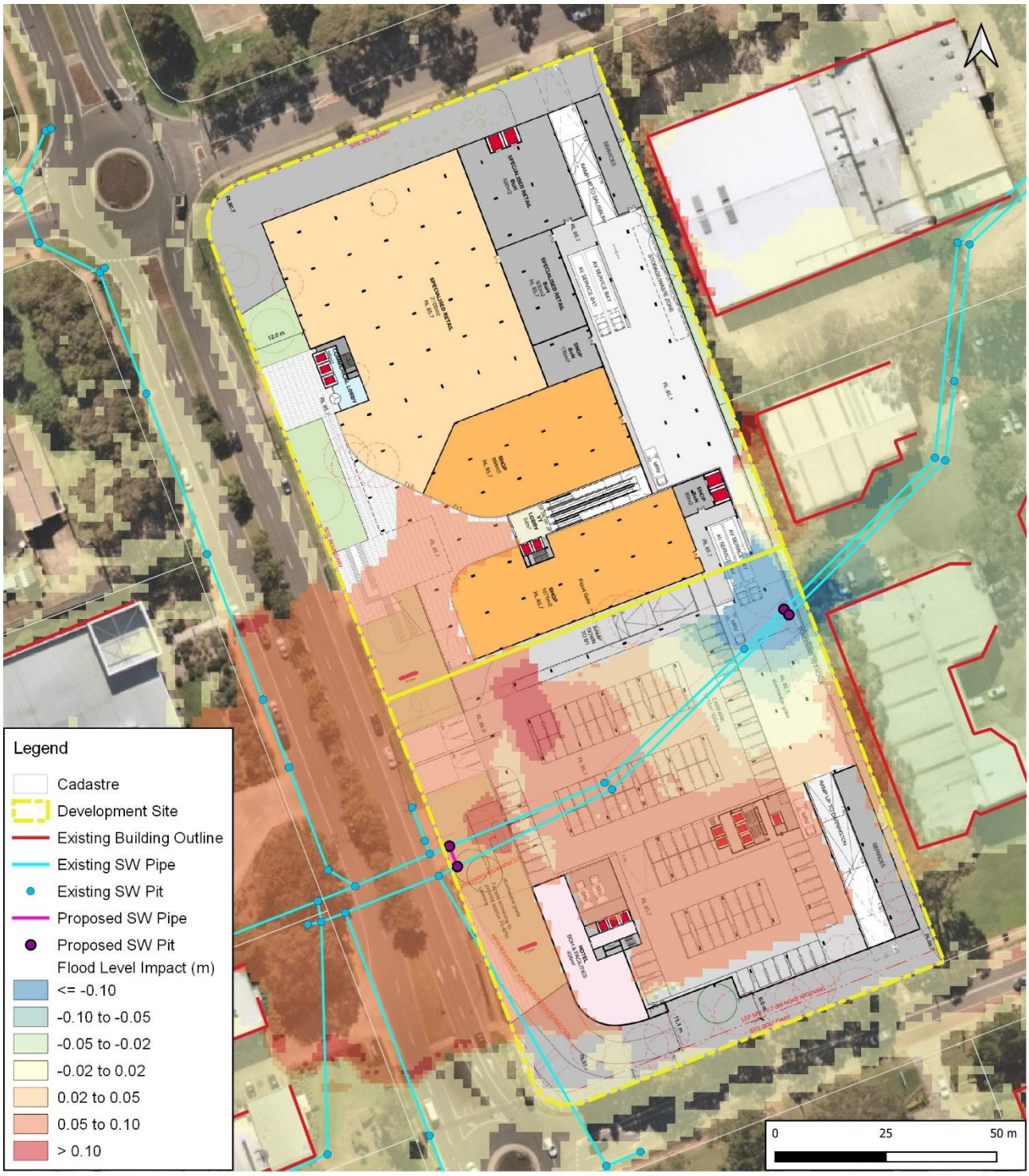

Figure 47 – PMF Level Impact (40% Blockage Across Car Park)

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14.0 Conclusions and Recommendations

A detailed hydraulic model has been developed to assess local flood characteristics for the site in the 1% AEP, 0.2% AEP and PMF events under both existing and proposed conditions. Modelling concluded that:

- The site is generally flood free during the flood events up to and including the 0.2% AEP.
- Minor local overland flows on the site are very shallow and are of low hazard during the in the 1% AEP and 0.2% AEP flood events, with no overland flow entering the lower ground car park.
- Overland flows from Victoria Avenue are effectively conveyed along the proposed lower ground carpark and discharge via the eastern building boundary during the PMF, similar to the existing flood behaviour. This is consistent with the Approved '*Masters DA'* scheme (1/2014/JP).
- Overland flows are confined with the proposed lower ground car park, with flood barriers proposed to prevent the overland flow entering any basement entrances.
- Proposed building's ground flood level entrance to the lower ground car park is 85.30m AHD which is 230mm above the 1% AEP flood levels at the low point in Victoria Avenue.
- Flood hazards across the site and on Victoria Avenue are generally low during the 1% AEP and 0.2% AEP storm events based on NSW provisional hazard category.
- The eastern façade of the lower ground car park and fencing at the western site boundary will be permeable as to not inhibit the overland flow through the car park up to the PMF event.
- All openings and penetrations to the lower ground levels are to be protected up to 85.62m AHD (the 1% AEP flood level plus 0.5m freeboard).
- Flood refuge up to the PMF flood levels will be available on the proposed higher levels via internal stairs.
- Compliance with the Council flood planning level requirements for building and car park levels are achieved.
- Access to existing easement for asset inspection and maintenance is available through the site in proposed conditions.
- Maintenance and Construction Management Plan (Appendix E) outlines the future access, maintenance, and replacement procedure of the existing services within the site.

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Authorised By
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Appendix A - Responses to Council Stormwater and Waterways Comments

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TTW Structural Civil Traffic Façade

19 July 2022 191928 CAAA

Eric Ruiz, Principal Coordinator-Stormwater & Waterways Management
The Hills Shire Council
Sent by email to jruiz@thehills.nsw.gov.au

21-23 Victoria Avenue, Castle Hill

Responses to Council Stormwater and Waterways Comments on dated 12/02/2021

Dear Eric and Team,

Please find below responses to the Stormwater and Waterways Management team comments dated 12 February 2021. Note that since these comments were made, the existing flood conditions and report has been approved; *21-23 Victoria Avenue, Castle Hill - Flood Modelling Clarification and Responses to Council Comments, TTW, 10 May 2022*, and the post development flood impact assessment has been completed and submitted to council awaiting final approval; *21-23 Victoria Avenue, Castle Hill - Post Development Flood Impact Assessment, TTW, 26 May 2022.*

The comments provided by Council have been replicated with responses made in red below each point.

1. Greater consideration to the Cattai Creek West, Cattai Creek and Showground Masterplans should be presented, demonstrating that the proposal is conducive to meeting the objectives of these masterplans.

- The Showground Precinct Structure Plan within the DCP requires an east-west future pedestrian link across properties from Cattai Creek to Victoria Avenue. The Showground Precinct Public Domain Plan reiterates the requirement for a pedestrian cross site link. A cross site link providing this connection is incorporated into the concept design.

  The Showground DCP and Public Domain Plans nominate Cattai Creek as a riparian corridor. The Cattai Creek Corridor Landscape Master Plan nominates public pedestrian connections across private land west of Cattai Creek. As mentioned above, the concept design incorporates a public cross site link consistent with this strategy.

  These documents provide no specific objectives or controls in relation to redevelopment of land containing stormwater pipes.

  We note the Cattai Creek West Masterplan has not been made available.

  The civil, stormwater and flooding associated with the proposed development at 21-23 Victoria Avenue has no impact on these masterplans.

2. The site of the proposed development is burdened by an existing Council-owned stormwater easement for twin 1800 mm diameter stormwater pipes. Being located at the lowest point of a 71 hectare highly impervious catchment, stormwater flows occurring either as piped or overland flows will be concentrating at this site and the conveyance of these flows through the site needs to be carefully considered in the configuration and design of the proposed development.

- Overland Flows and pipe flows from the upstream catchment in the existing and post development scenarios have been satisfactorily and comprehensively addressed in the TTW Flood reports that have previously been submitted to Council, ref:
  - 21-23 Victoria Avenue, Castle Hill - Flood Modelling Clarification and Responses to Council Comments, TTW, 10 May 2022
  - 21-23 Victoria Avenue, Castle Hill - Post Development Flood Impact Assessment, TTW, 06 July 2022

3. With reference to Council's Design Guidelines, **minor works** within a Council drainage easement may be approved subject to the following:
   a. The proposed works must not impact upon flood behaviour as it passes through the site;
      - The development has no detrimental impact on flood behaviour as confirmed in *21-23 Victoria Avenue, Castle Hill - Post Development Flood Impact Assessment, TTW, 26 May 2022*
   b. The proposed works must not interfere with the rights afforded to Council, specifically with respect for the maintenance of the pipes and other structures within the easement.
      - The easement and rights afforded to Council that currently existing will be maintained following the development. Access for maintenance will be provided through the car park, refer to *Maintenance & Construction Management Plan (Appendix D)* for further details.
   c. Any proposed encroaching structures must be easily dismantled (free- standing); and
      - The proposed architectural and structural details have been designed to ensure that no structural element will encroach on the 9m stormwater easement that runs through the site. Building footings will be located outside this easement and will extend below the existing twin DN1800 stormwater pipes, therefore placing them outside the zone of influence of these pipes. The Structural Engineer will certify that the proposed structure will not impose loads on the existing pipes within the easement.
   d. Any proposed encroaching structures must be registered on the title of the subject site via a deed with Council. The purpose of the deed is to protect Council's rights to access the easement area, requiring the removal of the encroaching structure.
      - All proposed structures will not encroach into the drainage easement.

The design of the proposed development involves the building of car parking and multi-storey buildings over the existing pipes which **cannot be classified as minor works** within the drainage easement.

- Although the development is not classed as minor works for the drainage easement, thhe proposed development scheme is in accordance with the approved 'Masters' scheme that was previously approved by Council (DA 1/2014/JP). The development is consistent with numerous approved and completed developments involving non-minor works constructed over existing pipes within drainage easements including;

  Atlassian Central, Sydney – A significant high-rise tower adjacent to Central Station with works over and adjacent to large Sydney Water assets including the heritage listed Bondi Ocean Outfall Sewer. Approvals including flood mitigation flood impact assessment obtained by City of Sydney Council and Sydney Water.

  Wetherill Park Shopping Centre - TTW have completed civil, and structural design with a flood study for a Stockland Shopping Centre at Wetherill Park which is located on flood prone land with construction adjacent to and over large council stormwater pipe. The proposed car civil and structural design has been approved by Fairfield City Council and constructed.

  Figtree Shopping Centre, Wollongong - TTW have completed a civil, traffic and structural design with flood study for a proposed building extension. Figtree Shopping Centre is located on flood prone land,and the design solution involved a suspended structure with the existing car park modified to allow safe flood passage underneath the proposed building as well as through the car park area.

  107 Mount Street, North Sydney - Diversion works for a large council stormwater pipe running through the basement of a new tower structure with detailed hydraulic assessment, civil and structural design works approved by North Sydney Council

  Brookfield Place, Sydney – A significant urban renewal development of a high rise tower over Wynyard Station with build over agreements approved for Council stormwater and Sydney Water assets along with flood modelling and impact assessment completed.

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4. Keeping public stormwater drainage network protected from damage and accessible for maintenance is important to Council. The presence of any structure over the drainage assets will make it difficult and costly for Council to maintain and replace the piped drainage system. As with the rest of the catchment, the stormwater infrastructure at this site is ageing with condition generally far from optimum. Emergency repairs to damaged sections or the total reconstruction of the drainage line will require heavy machinery/equipment that could only work with no vertical interference.

- Maintenance and access of the existing stormwater trunk drainage will be provided throughout the lifetime of the development – refer to *Maintenance & Construction Management Plan (Appendix D)* for further details.

  All load bearing structural elements (such as columns) will be located outside the existing stormwater easement to make pipe replacement works possible under post-development conditions.

  On-grade pavements in the lower ground car parking slab will be designed with expansion joints that correspond to the easement extents to improve pavement removability in the event of future excavation for maintenance.

  The existing sealed cover access lids over the twin 1800 pipes within the development boundary will be replaced with grated lids to allow better visual monitoring and access.

  Clearances in the proposed lower ground car park are designed to facilitate equipment and plant access for any potential future stormwater pipe replacement. The lower ground finished floor level (FFL) is 85.20m AHD and the upper ground FFL is 90.70m AHD. With the slab thickness being approximately 1m (including the space required for utilities and/or drop ceiling), vertical clearance on the lower ground level within the easement area would be around 4.50m. This is in accordance with, and unchanged from, the previously approved Development Application for the site (DA 1/2014/JP).

  For example, a CAT 320D excavator with a cab height of 2.95m would be capable of lifting a DN1800 concrete pipe as there would be sufficient height for the horizontal boom to operate as required. Additionally, a truck mounted Hiab crane could be used to lift and/ or lower the pipes within the clearances proposed.

5. Allowing this development to proceed can set a precedent for future development proposals that will also involve either building over or within Council-owned stormwater drainage easements or using publicly accessible enclosed spaces as a floodway.

- Building over drainage easements is acceptable by Sydney Water and many other NSW Council's. TTW have completed approvals with several NSW Council's including; City of Sydney Council, North Sydney Council, Wollongong Council, City of Fairfield Council, Liverpool City Council and Randwick City Council.

  These approvals have included detailed hydraulic and structural assessments confirming that the authority requirements have been met e.g. asset protection, structural independence, clearances etc. TTW have worked on numerous complex developments and have gained Authority approval for this type of work. The post development flood impact assessment confirms that the lower ground carpark (and stormwater easement) has no overland flow in the 1% AEP.

6. The current proposal of building over the stormwater drainage assets is not the only feasible solution for a reasonable development of the site. Just as the existing buildings are located outside of the drainage easement, the design of the mixed-use development can be reconfigured to avoid any encroachment into the drainage easement and provide an unimpeded flow path for floodwaters.

- It is possible that a mixed-use development concept for the site could locate buildings and car parking outside the drainage easement. The pros and cons of such an option were closely examined alongside the submitted concept design. Numerous factors led to selection of the concept design as preferred including variable site levels, elevation of adjoining streets, site access, car parking and loading arrangements, and the opportunity to elevate a large public plaza and thru site link at UG level above the stormwater flow path at LG level. Given the sound engineering considerations underpinning the previous Masters DA and the vastly superior overall development and public benefit outcome delivered by sensitively building over the drainage easement, the concept was selected as the preferred solution.

  The current scheme design avoids structural encroachment into the drainage easement and also provides an unimpeded flow path for flood waters and complies with no adverse impact to adjacent properties, refer to submitted flood reports as referenced in point 2 response.

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7. A site survey will be required to determine more accurately the location of the twin pipes and to establish the extents of the drainage easement.
- Site survey of the twin pipes was completed in February 2022 and included within the flood impact assessment, refer to survey drawings LTS 51250 002DT, which have been issued to Council.

8. A condition assessment and geotechnical investigation will be required to respectively assist in determining the current state of the drainage system within the site and establish any degradation of subsoil layers that could lead to failure of the drainage system.
- A condition assessment of the existing drainage system was completed in 2013 as part of the 'Masters' scheme with an updated condition survey completed in February 2022. Both reports confirm that the system is in very good condition with an expected lifetime of more than 50 years which is compatible with the development lifespan, and if maintenance or replacement is required at any point this is accommodated in the current development concept. Refer to TTW Pipe Condition Assessment, 6 July 2022 for further details. As the pipe has been shown to be in very good condition with no signs of failure, a geotechnical investigation will be completed and submitted to Council for review during the future Detailed DA submission stage and will confirm the condition and long-term stability of subsoil layers supporting the existing pipe system.

9. As the remaining life of the stormwater asset is less than the expected life of the proposed structure, reconstruction is preferred over retention or options to preserve and protect the existing pipes.
- As mentioned in point 8 response, the remaining life of the stormwater asset is compatible with the development lifespan. As such reconstruction of the existing system at such an early stage of it's lifespan is not cost effective or environmentally beneficial.

10. Council will consider the merit of decommissioning the existing stormwater pipes and realigning and replacing them with a channelized drainage system under the Lower Ground car parking constructed in a way that facilitates maintenance and repairs. For instance, these channels can be provided with removable grated lids that will allow easy monitoring and access and at the same time permit surcharging and ingress of flows into the system.
- Replacement of the existing pipes with a channelised system including removable grated lids (4m wide) will offer slightly more convenient maintenance access however, retention of the existing pipes in the post development condition will afford appropriate maintenance access via access chambers (at the location of existing maintenance pits) which is the same maintenance access that Council presently utilises to maintain the in-ground network. refer to *Maintenance & Construction Management Plan (Appendix D)* for further details.

  If Council agree that the existing pipes are in good condition and have adequate serviceability, replacing the pipes would be cost prohibitive to the proposed development. The existing twin DN1800 pipes run from Victoria Avenue to Cattai Creek with an approximate total length of 230m.

  Replacing the pipes with a channelised system for the length of approximately 100m across the site is not likely to offer more drainage capacity as the new system is to tie back to the existing twin pipes at the site eastern boundary during the short term.

  Replacing the existing pipes would not lead to an increase in drainage capacity at Victoria Avenue unless the replacement of the existing twin pipes is completed through downstream properties and up to the main discharge point at Cattai Creek as well.

11. The option of relocating or rerouting the stormwater pipes around the development can be explored provided the invert levels of the existing drainage system allow it. The new pipes will run south along Victoria Avenue and then eastwards along Carrington Road and then northwards along the site's eastern boundary to re-join with the original pipe alignment. The new pipes may be installed during construction of the below ground car parking level. Deep maintenance/inspection pits will be required and the rerouted pipes will need to be outside the zone of influence of the basement walls and associated foundation works. The design of the realigned stormwater pipes will be in accordance to relevant Australian Standards and Council design guidelines.
- Rerouting the existing stormwater pipes around the proposed development's footprint would result in the pipe system gradient becoming too flat, this would significantly decrease the pipe's hydraulic capacity and would likely lead to an adverse impact on upstream properties. The flatter pipe gradients would also require increased maintenance and this option is not recommended.

12. The design of the reconstructed or realigned drainage system is to be supported by appropriate detailed flood modelling that demonstrates the flood impacts are minimised and Council's design standards are

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met. Although TUFLOW is acceptable for flooding assessment of the site, DRAINS modelling should be undertaken to evaluate and design the stormwater drainage system. Ideally, the DRAINS model developed as part of the previous Masters Development should be used in this regard.

- Refer to point 11 response above, rerouting of the pipe system is not recommended due to pipe gradients and hydraulic capacity being reduced. DRAINS assessment was completed with the flooding modelling and has previously been submitted to Council for review.

13. Council prefers stormwater runoff from events up to and including the 1% AEP storm event be conveyed via underground stormwater system up to the site's boundary, possibly terminating at a surcharging pit. Increasing the conveyance capacity of the piped system will reduce the volume of runoff occurring as overland flows through the site. The amplification works can potentially be extended to the existing drainage system that runs through the neighbouring property and up to the Cattai Creek discharge point.

- As confirmed in the post development flood impact assessment, the existing underground pipe system conveys upstream flows in the 1% AEP with no surface or overland flow through the development site or existing council easement. The proposed additional inlet pits and minor pipes upgrade will improve inlet and conveyance in the stormwater system.

14. With reference to Council's The Hills DCP 2012 Part C Section 6, Flood Controlled Land:
    a. No development is to occur in or over a floodway area, a flowpath or a high hazard area (as defined in the Floodplain Development Manual) generated by flooding up to the 1% AEP flood level, unless justified by a site specific assessment.
        - As confirmed in the post development flood impact assessment, the existing underground pipe system conveys upstream flows in the 1% AEP with no surface or overland flow through the development site or existing council easement during this storm event.
    b. Garages or enclosed car parking must be protected from inundation by flood waters up to the 1% AEP flood level. Where 20 or more vehicles are potentially at risk, protection shall be provided to 1% AEP flood level plus 0.5m freeboard;
        - As confirmed in section 4.1 and 4.2 of the post development flood impact assessment, the existing underground pipe system conveys upstream flows in the 1% AEP with no surface or overland flow through the development site or existing council easement during this storm event. There is typically less than 100mm flood depth in car park area in the 0.2% AEP (1in500 year) flood event, and provides a siginficantly better results and lower flood hazard than the approved 'Masters' scheme that had 100mm depth of flow in the 1% AEP event. Basement levels will be protected by flood barriers with a top of barrier level above the PMF level.
    c. Where the level of the driveway providing access between the road and parking space is lower than 0.3m below 1% AEP flood level, the following condition must be satisfied:
        - When the flood levels reach the 1% AEP flood level, the depth of inundation on the driveway shall not exceed: the depth at the road; or the depth at the car parking space.
        - As confirmed in section 4.1 of the post development flood impact assessment, the maximum flood levels reach RL 85.09m AHD over the low point of Victoria Avenue. The driveway entrance to the Lower ground car park level is RL 85.30m and remains flood free in the 1% AEP
    d. A Site Flood Emergency Response Plan is required when elements of the development, including vehicular and pedestrian access are below the 1% AEP flood level plus 0.5m freeboard.
        - As confirmed in section 4.4 of the post development flood impact assessment, site-specific Flood Emergency Response Plan (FERP) covering the PMF event will be prepared by a suitably qualified specialist at the future Detailed DA stage and will consider the following:
            - NSW Government's Floodplain Development Manual, 2005,
            - NSW State Emergency Service (SES) guidelines and advice,
            - FloodSafe guidelines and the relative FloodSafe Tool Kits.
              Pedestrian and vehicle egress during an extreme flood event will be limited and a 'shelter in place' strategy will be adopted. Flood gates are to be provided for the proposed car parking lower basement area

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15. As cars and pedestrians could be present in the enclosed car parking level during a storm event and with the site being susceptible to flash floods, this proposal presents a high level of flood risk, comprising danger to life and damage to property. The maximum Depth x Velocity (DV) product of 0.4m2/s will be maintained where possible.
- As confirmed in section 4.1 of the post development flood impact assessment there is no flooding within the lower ground car park in the 1% AEP flood event, with low hazard experienced in the 0.2% (1in 500 year) AEP. For very rare storm events greater than the 0.2% AEP, evacuation from the basement and lower ground floor level is provided to upper levels within the building above the PMF level. The building will have sufficient safe refuge space for all building occupants above the PMF level.

16. Council will consider the merits of utilising a section of the Lower Ground Floor as an overland flowpath but the designated area should be clear of any obstruction at all times. This space will not be dedicated to car parking or storage and the spacing between columns above can be maximised. The configuration of the downstream end of the floodway needs to consider both building requirements (e.g. security, aesthetics) and hydraulic conveyance (i.e. blockage prevention).
- As confirmed in section 4.1 of the post development flood impact assessment there is no flooding within the lower ground car park in the 1% AEP flood event and very minor flow in the 0.2% (1in 500 year) AEP. This provides a lower flood risk solution to that previously proposed and approved as part of the 'Masters' DA scheme. A 40% blockage analysis has also been considered within the flood impact assessment. The upstream and downstream building façade of the lower ground level will have an open screen system with a 70-80% clear opening ratio which will allow the conveyance of overland flow for flood events greater than the 0.2% AEP event.

17. Carpark entries should not be located within overland flowpaths so that exiting of vehicles will always be possible even during a flood event. Relocating the carpark entry to Carrington Road should be considered.
- The car park will remain flood free in the 1% AEP event. Pedestrian and vehicle egress during an extreme flood event will be restricted and a 'shelter in place' strategy will be adopted as part of the FERP. For very rare storm events greater than the 0.2% AEP, evacuation from the basement and lower ground floor level is provided to upper levels within the building above the PMF level. The building will have sufficient safe refuge space for all building occupants above the PMF level.

18. The concept plans have indicated landscaping and structural elements that potentially obstruct or impact the movement of floodwaters from Victoria Avenue. Restricting the movement of overland flows to a section of the Lower Ground Level car parking means a narrower flow path for the floodwaters through the site relative to the existing scenario. The proposed development, therefore, presents changes in the flooding regime that will likely result in increases in flow velocities and flooding levels no only at this location but also in the adjoining properties.
- The proposed landscape and structural elements (stairs) have been included in the post development flood impact assessment and confirm that there is no adverse flood impact.

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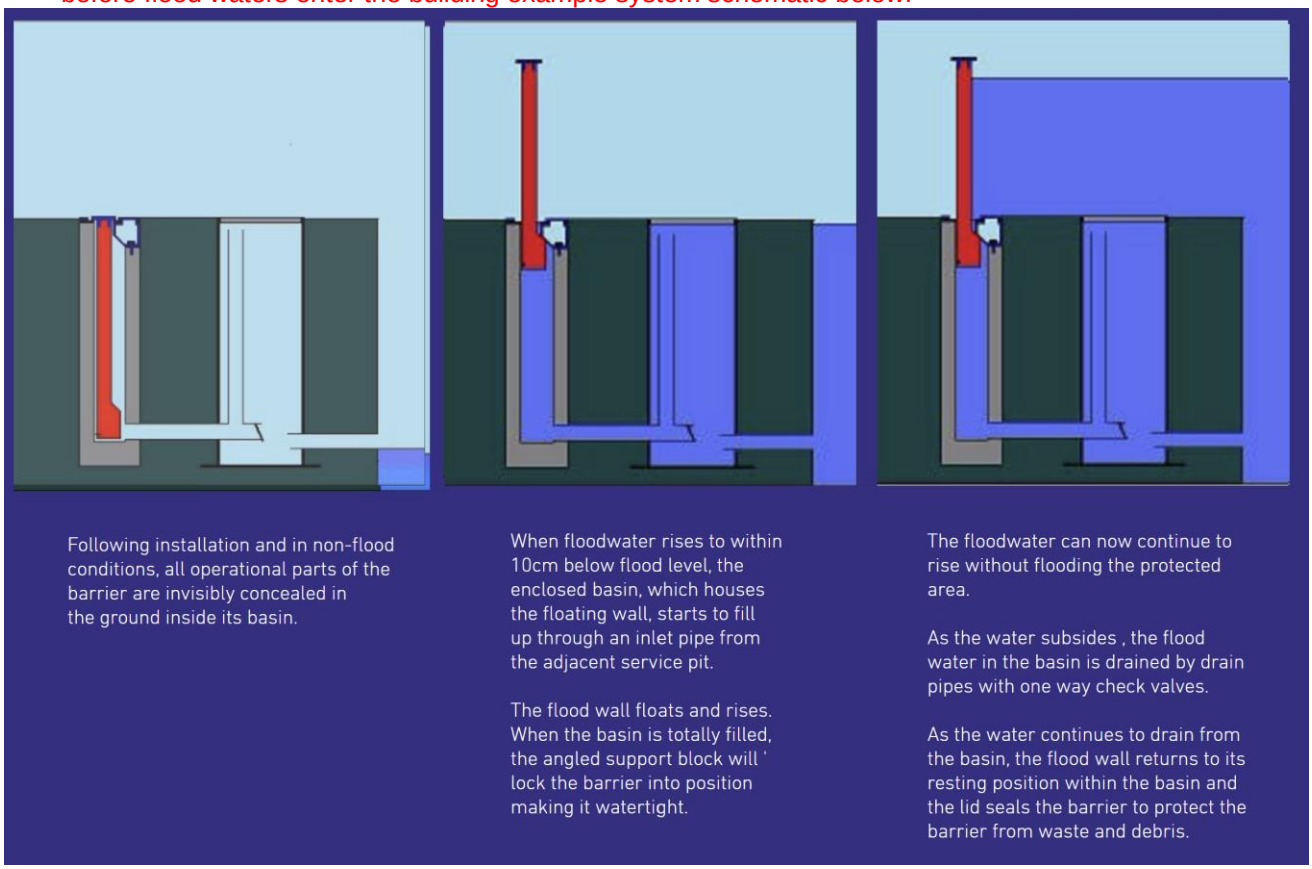
19. Flood gates to prevent ingress of floodwaters to lower levels are generally not supported. The effectiveness and reliability of a flood barrier are largely determined by how fast and dependable it protects the building from floodwaters. The gates needs to be shut in time before floodwaters enters the building. During flash flooding scenarios, there is limited time to deploy manually operated flood gates and demountable systems. Self-closing barriers are also subject to power outages, flat batteries and malfunctioning components. Ramps leading to lower levels can be relocated elsewhere so that they are outside of the overland flow path.

- The proposed flood barriers are proposed to protect against the PMF and would be self-closing hydraulically activated, with no manual input or electrical components required. The gates would close before flood waters enter the building example system schematic below:



20. The Site Flood Emergency Response Plan for the proposed development should relate to the land use and site conditions in conjunction with flood behaviour up to the 1% AEP flood level expected to be experienced at the site. The plan should consider the following specific actions:
    - Preparing for a flood;
    - Responding when a flood is likely;
    - Responding during a flood; and
    - Recovery after a flood

    The flood plan should be consistent with the relevant NSW SES flood readiness guides. A site specific flood emergency response plan is to be developed for implementation and be certified by a suitably qualified emergency management specialist, experienced in emergency overland flooding response if the proposal moves into the development stage.

- The development site will remain flood free in the 1% AEP however, a site-specific Flood Emergency Response Plan will be provided during the detailed development stage addressing the PMF event.

21. The 1% AEP flood extent and flood levels at Victoria Ave trapped low point (TLP) and across the site reported in TTW's Flood Impact Assessment (FIA) report are significantly different from those from Council's Urban Overland Flow Study (UOLFS). Predicted flood levels in the area are generally 500 mm lower. Excess runoff from west of Victoria Avenue will accumulate at the TLP but downstream site constraints do not allow the excess runoff to drain quickly. This phenomenon will cause damming up of the whole site. This 'bath tub' effect has been demonstrated by the UOLFS. The FIA report, however, has not established this and therefore has failed to deal with this issue.
    - This point has been fully addressed and approved with Council, refer to 21-23 Victoria Avenue, Castle Hill - Flood Modelling Clarification and Responses to Council Comments, TTW, 10 May 2022. This existing flood conditions and results within the report have also now been fully approved by Council

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22. Prior to undertaking a flood study, the consultant is to liaise with Council in regards to the modelling approach and parameters. Council will require a flood study report and the associated hydrologic and hydraulic modelling files for review purposes.
- This point has been fully addressed and agreed with Council, refer to 21-23 Victoria Avenue, Castle Hill - Flood Modelling Clarification and Responses to Council Comments, TTW, 10 May 2022

23. The Planning Proposal should consider and include water sensitive and urban design (WSUD) opportunities in its Public Domain and Landscape Design to reduce development impact and improve upon what currently exists.
- WSUD Measures are proposed as part of the proposed development that meet Council's required water quality and water quantity targets, refer TTW report; 21-23 Victoria Avenue, Castle Hill Stormwater Assessment.

24. The Planning Proposal needs to demonstrate the proposed mixed-use development will meet the required water quality objectives tabled below.

Pollutant	Average annual pollutant load reduction objective (%)
Gross pollutants (>5mm)	90
Total suspended solids	85
Total Phosphorus	65
Total Nitrogen	45

- WSUD Measures are proposed as part of the proposed development that meet Council's required water quality and water quantity targets, refer previously submitted report; 21-23 Victoria Avenue, Castle Hill Stormwater Assessment.

25. The THSC Stormwater and Waterways Design Requirements should be used in association with other relevant guidelines during the design process.
- The stormwater assessment submitted confirms that the design is in accordance with THSC Stormwater and Waterways Design Requirements along with the required Upper Parramatta River Catchment Trust (UPRCT) handbook as required.

Yours faithfully,
TAYLOR THOMSON WHITTING (NSW) PTY LTD

EIRIAN CRABBE
Associate Director

STEPHEN BRAIN
Technical Director

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Appendix B - Pipe Condition Assessment

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Structural
Civil
Traffic
Façade

19 July 2022 191928 CAAA

Eric Ruiz, Principal Coordinator-Stormwater & Waterways Management
The Hills Shire Council
Sent by email to jruiz@thehills.nsw.gov.au

21-23 Victoria Avenue, Castle Hill

Pipe Condition Assessment

Dear Eric and Team,

This report provides an overview of the detailed pipe assessment and exploratory CCTV investigation undertaken on the existing Council owned twin pipe system that runs through the development site.

The most recent CCTV exploratory detailed assessment was completed in February 2022 and confirms that the pipe condition remains in very good condition as anticipated. The are no pipe defects observed within the site however, the report identifies minor defects outside of the development site which are addressed in the following sections. These issues are considered as minor and do not materially impact the integrity of the pipes however, recommended remediations will ensure serviceability of the pipes will be maintained throughout the pipes lifespan as anticipated. Provided recommendations for pipe repairs could be considered as part of the overall development approval conditions. A copy of this report along with markups of the defects are included in the Appendix.

In addition to the recent CCTV Survey, the previously approved Development Application for the site (DA 1/2014/JP), prepared by Masters Home Improvement (dated 24 September 2013) included an exploratory CCTV investigation of the twin DN1800. As noted in the Henry & Hymas report (dated September 2013), the CCTV investigation concluded:

- The existing pipes are in excellent condition.
- The pipes are free of cracks, have sound joints, retain true grading, and are free of debris and blockages.
- The pipes have not been damaged by loading or settlement and would appear to be functioning as intended.
- Council have confirmed the pipes were constructed in the early 1980s

The Henry & Hymas report also notes that such pipes have a manufacturer specified design life of 100 years. Therefore, given the pipes have only been in service for 40 years, it is reasonable to expect up to 60 years of additional serviceability. This is compatible the lifespan of the proposed development on site.

1.0 Infiltration and sweating – Outside Development Site Boundary:

Infiltration and sweating defects have been detected in 20 locations along the stormwater pipe all of which are outside of the development site boundary. These issues are considered as minor damage/cracking. Attached below is a photo of the locations detected on the stormwater pipe.

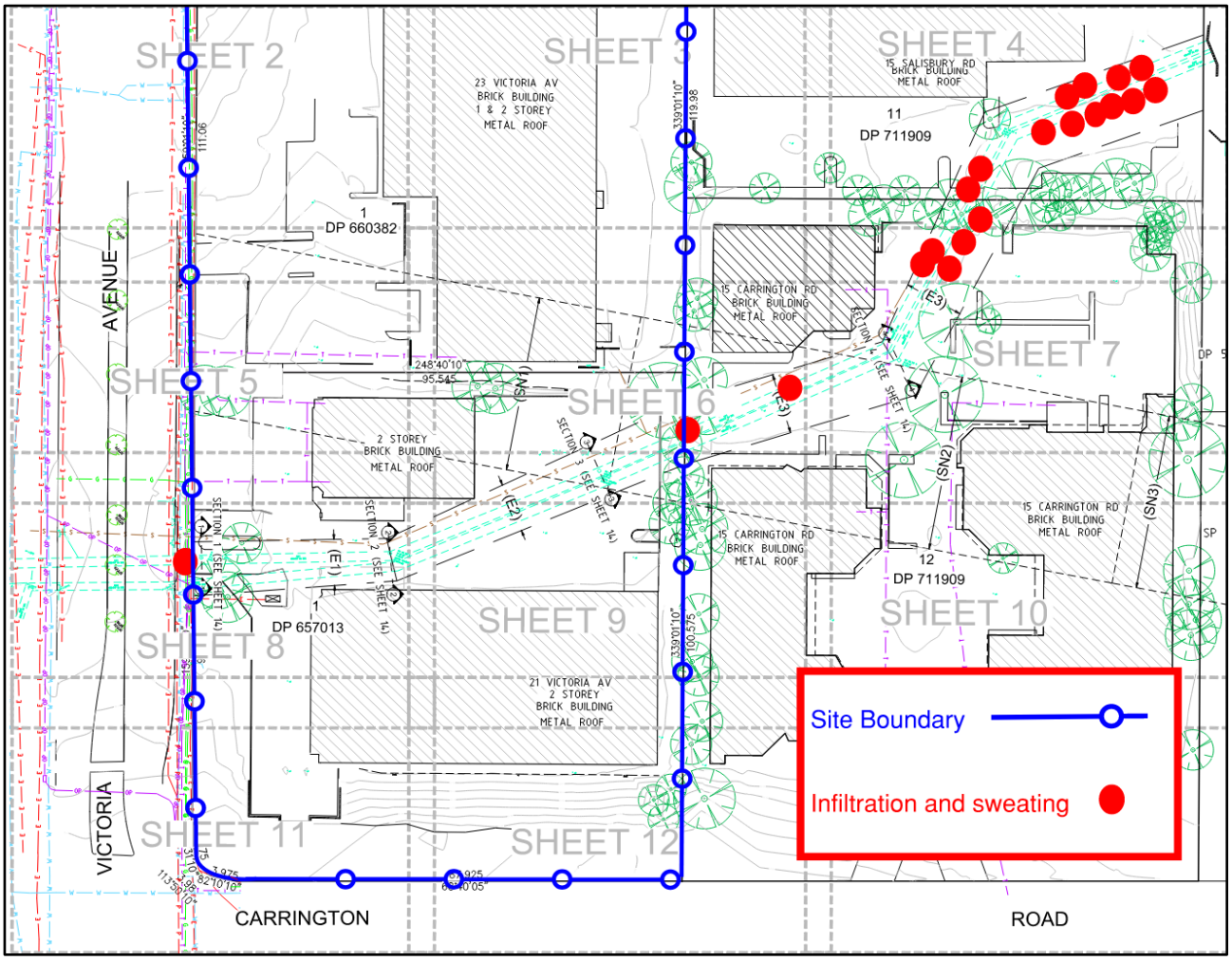

Figure 1. Infiltration and sweating

1.1 Suggested Solution.

Autogenous healing is suggested based on CCPA (Concrete Pipe Association of Australasia) recommendations. Self-healing method should close these minor damages over time and prevent damage to pipe reinforcement. Follow UP CCTV should be undertaken in subsequent years to verify.

Please see the appendix E (Infiltrations and Sweating Sheet) for more details.

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2.0 Circumferential Fractures, Breaking and Removed Aggregates – Outside Development Site Boundary

One occurrence of a circumferential fracture was found downstream of the development site as identified on figure 2.

One occurrence each of a breaking and removed aggregate occur upstream of the development site as identified on figure 3.

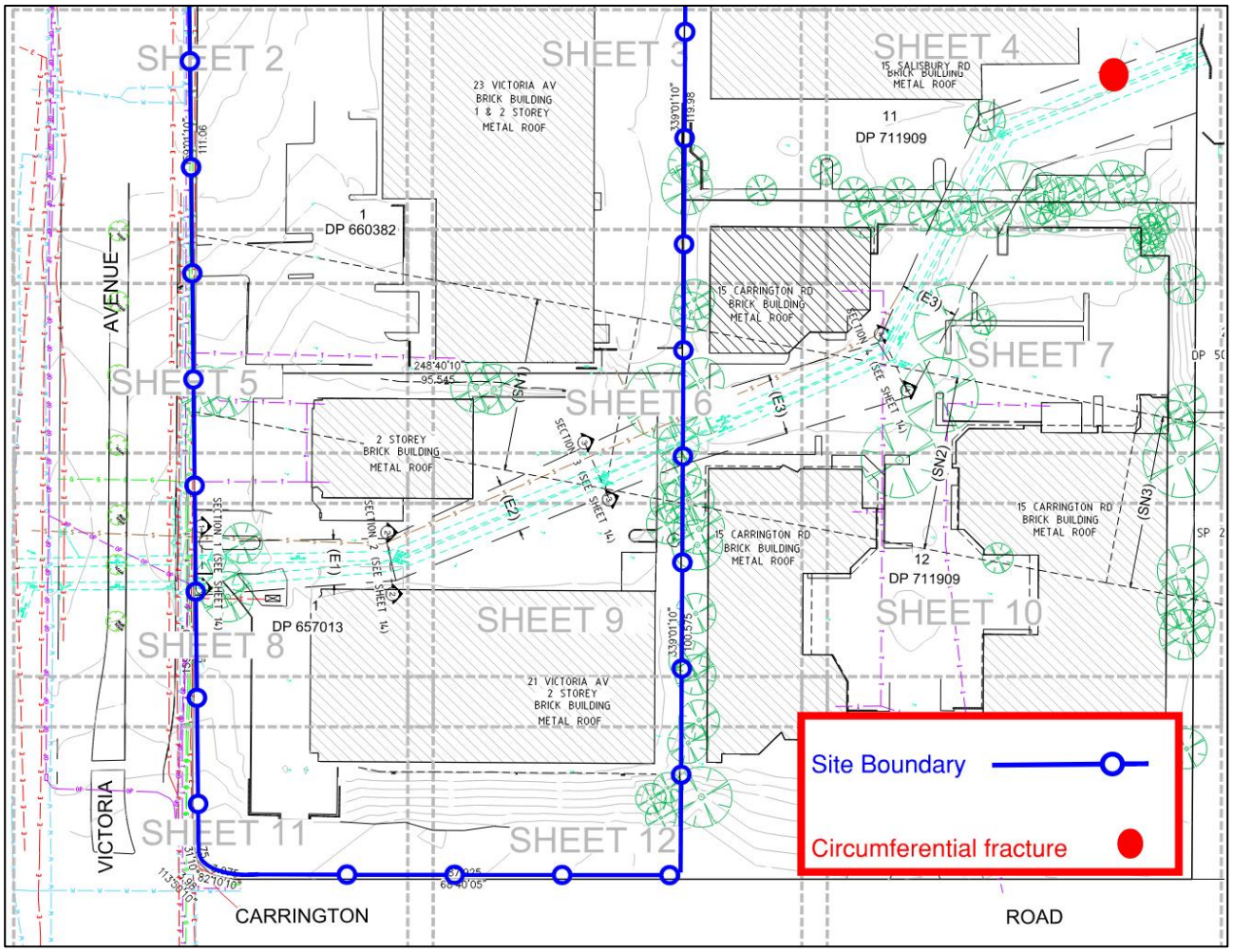

Figure 2. Circumferential Fractures

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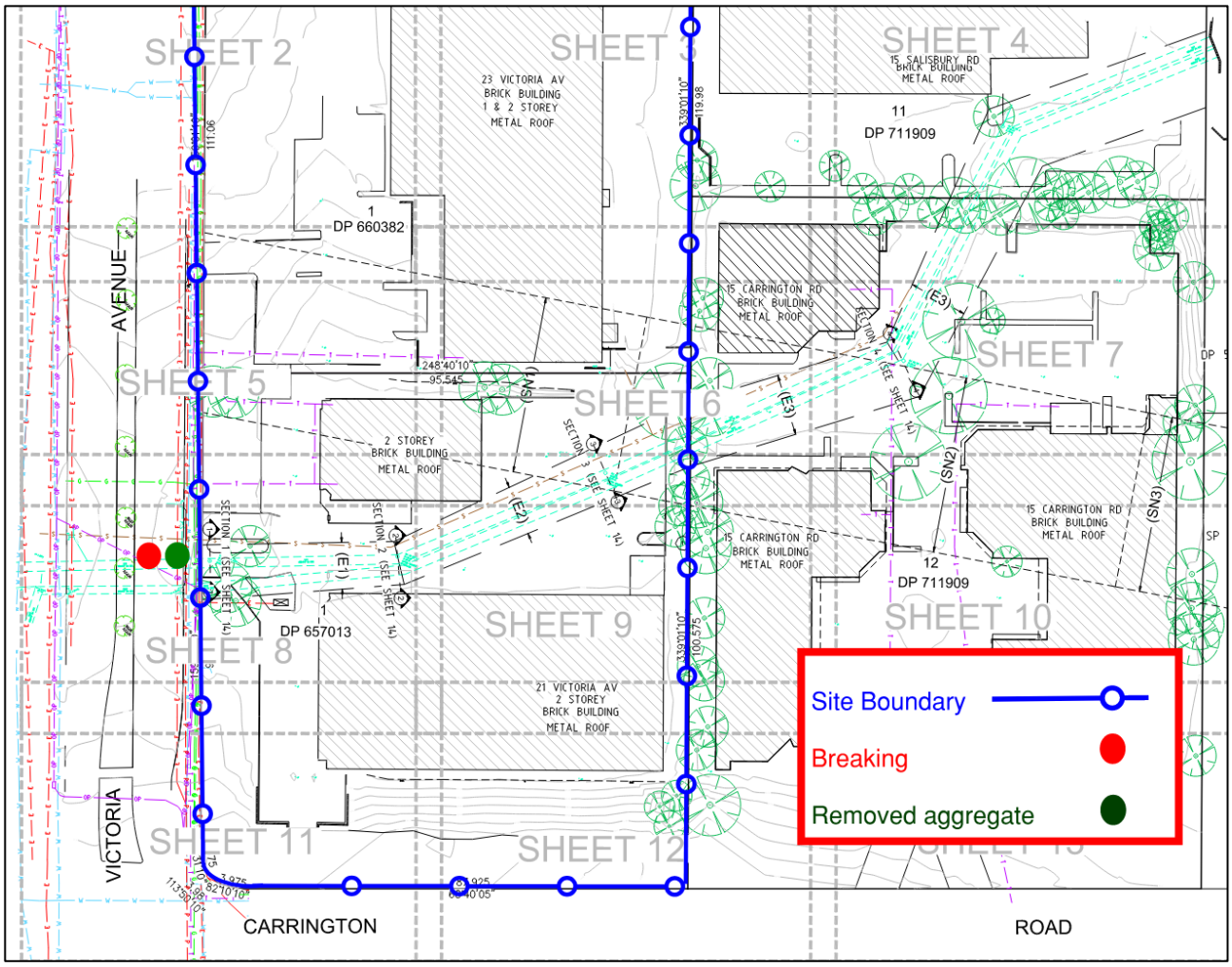

Figure 3. Breaking and removed aggregate

2.1 Suggested Solutions:

Circumferential fracture: As the pipe is large diameter, it is suggested to use epoxy injection/filling to fill the crack from internally and rely on calcification/autogenous healing. Seal and review in 12 months.

Breaking, removed aggregate: It is suggested that these small connections are rendered with an epoxy-based grout to prevent further corrosion of the reinforcement and long-term deterioration. Attached below is a photo of the detected locations on the stormwater pipe.

Please see the appendix E (Circumferential Fractures, Breaking Sheet) for more details.

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3.0 Open Connections

There are several connections that appear to be open with 100 to 300 mm diameter on the stormwater pipe, however these are also located outside the development site boundary, refer to figure 4.

Note: An open connection with 1050 mm diameter has been identified that needs further investigation. This pipe was not in the map provided in the CCTV report and can only be seen in the CCTV video file. Refer to figure 5.

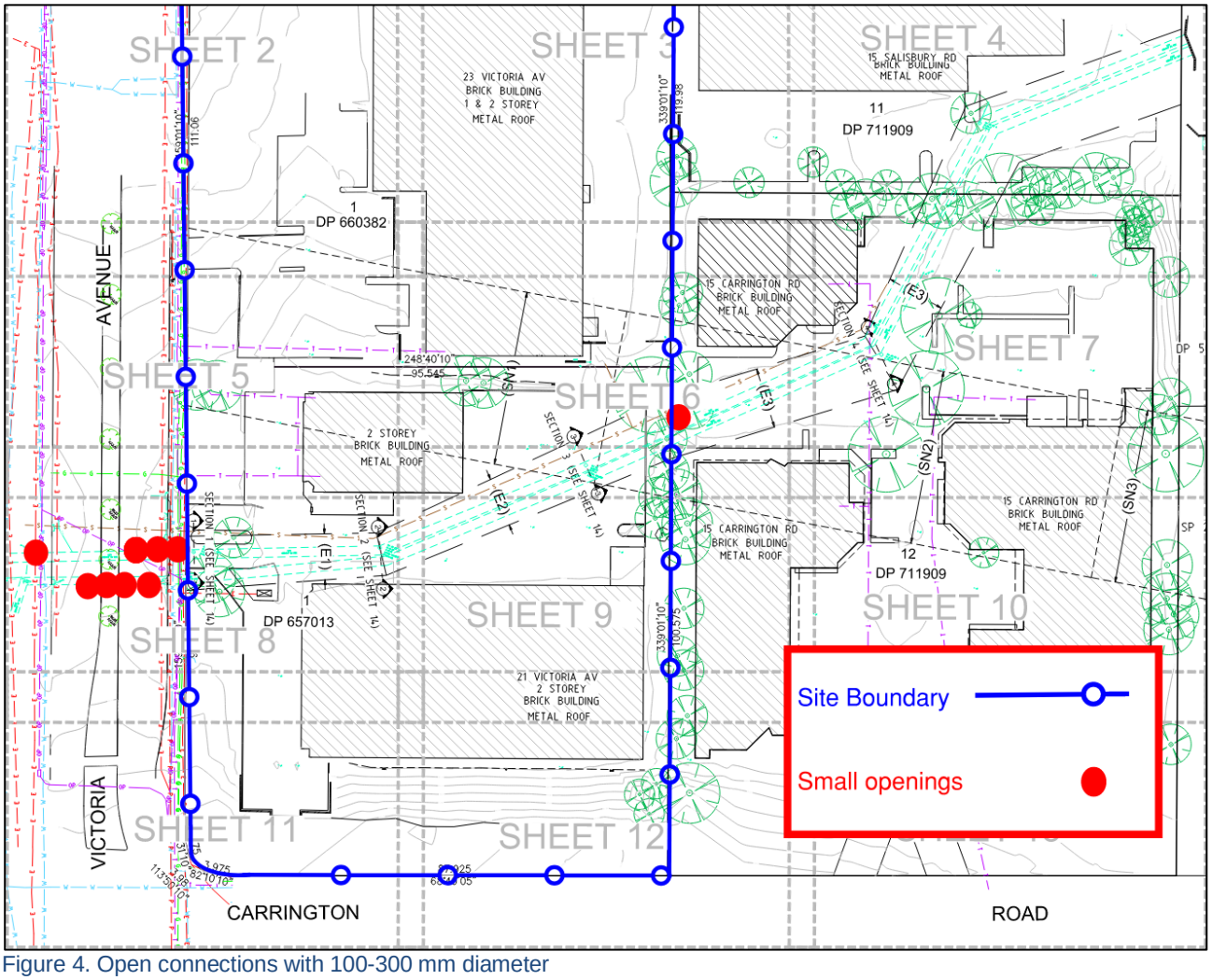

Figure 4. Open connections with 100-300 mm diameter

3.1 Suggested Solution:

For all the marked up small connections, it is suggested that they are rendered with an epoxy-based grout to prevent further corrosion of the reinforcement and long-term deterioration.

Please see the appendix E (Open Connections on Small Pipes <300mm dia Sheet) and (Open Connections on 1050mm Pipe) for more details.

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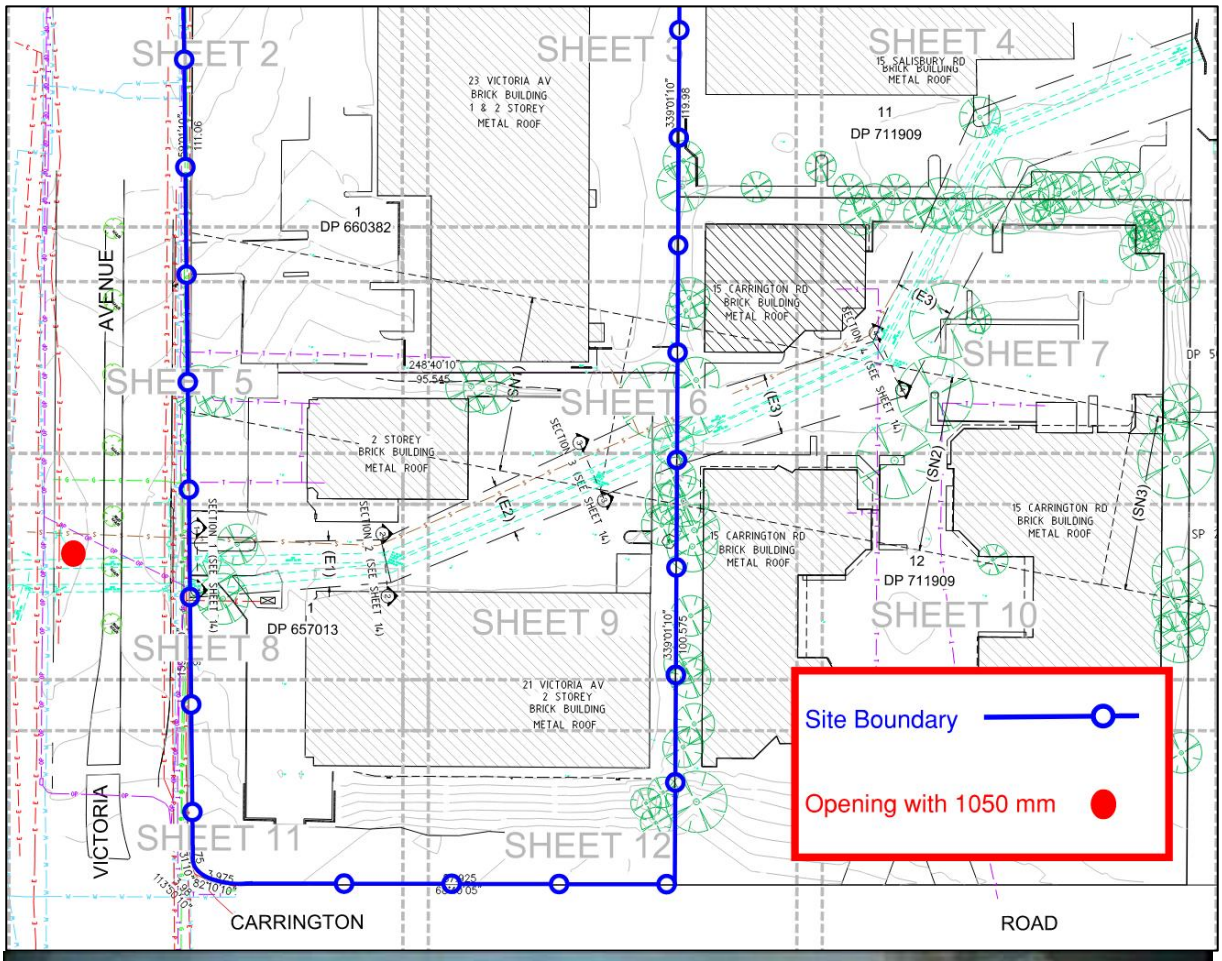

Figure 5. Open connections 1050 mm diameter

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4.0 Conclusion

The existing twin pipes are shown to be in very good condition with only minor defects found, all of which occur outside of the site boundary. The pipe remains suitable for long term continual use with ongoing inspection and maintenance. The minor defects as confirmed in the previous sections of this report are expected for the age and type of pipe construction and once rectified will not affect the integrity or lifespan of the asset which is compatible with the lifespan of the development.

Yours faithfully,
TAYLOR THOMSON WHITTING (NSW) PTY LTD

EIRIAN CRABBE
Associate Director

STEPHEN BRAIN
Technical Director

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Appendix C - Flood Emergency Response Plan

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27 July 2022 191928 CAAA

Eric Ruiz, Principal Coordinator-Stormwater & Waterways Management
The Hills Shire Council
Sent by email to jruiz@thehills.nsw.gov.au

21-23 Victoria Avenue, Castle Hill

Flood Emergency Response Plan

Dear Eric and Team,

This report provides a site-specific Flood Emergency Response Plan (FERP) covering the PMF event and makes recommendations to ensure that in the event of a flood at the site, risk to personal safety and the environment is appropriately managed. The plan provides strategic level advice and assumes that detailed design of various site controls will be undertaken prior to issue of construction certificate and implemented as part of the site's construction and on-going operation. The FERP has been prepared with reference to the following:

- NSW Government's Floodplain Development Manual, 2005,
- NSW State Emergency Service (SES) guidelines and advice,
- FloodSafe guidelines and the relative FloodSafe Tool Kits.

The FERP will also consider the proposed site conditions and land use including site access and egress, specifically addressing the following:

- Preparing for a flood
- Responding when a flood is likely
- Responding during a flood
- Recovery after a flood

A site-specific Flood Response Action Plan (FRAP) summarises the required flood emergency responses in both construction phase and occupation phase.

1.0 Preparation for Flood Response

1.1 Education

During the occupation phase, as part of the preparation for a flood event, all staff and site users on site will be made aware of the flood risk and the flood protocols & procedures (including their responsibilities) via briefing and signage. This will form part of the mandatory site inductions that all staff must undertake prior to gaining access to the site. A copy of this FERP will be made available to all staff, contractors, and future occupants. Completion of site induction and safety training is the responsibility of the site Management / Safety Officer.

1.2 Flood Emergency Kit

A Flood Emergency Kit must be available prior to a flood event taking place and regularly checked to ensure that supplies within the kit are sufficient and in working condition. This check should occur during each evacuation, and the kit should include:

- Radio with spare batteries
- Torch with spare batteries
- First aid kit and other medicines
- Waterproof bags
- A copy of this Flood Emergency Response Plan
- Emergency contact numbers.

This Emergency Kit should be stored in a waterproof container and is the responsibility of the Site Management during the occupation phase.

1.3 Flood Warnings and Notifications

The proposed building upper ground floor level is RL 90.70m which is 4m above the PMF level of 86.70m.

The proposed lower ground floor level entrance incorporates a crest level of 85.30m AHD which is 120mm above the peak 0.2% AEP flood level of 85.18m AHD at the Victoria Avenue low point, hence is majorly unaffected by flood events up to and including the 0.2% AEP event.

The proposed development will be affected by flooding caused by large-scale events greater than the 0.2% AEP flood event. Such large-scale flood events will be widely anticipated several days in advance. Site Management will be alerted to flood warnings via the following mechanisms:

BOM alerts and press releases:

Severe weather and thunderstorm warnings are issued by the Bureau of Meteorology (BOM) www.bom.gov.au. These warnings are continually updated with a description of the likely conditions (including predicted extreme rainfall depth).

Flood warnings are issued by the BOM when flooding is occurring or is expected to occur in a particular area. Warnings may include specific predictions of flood depths dependent on real-time rainfall and river level data. These warnings are distributed to Council, Police, and the relevant local SES, as well as being available on the BOM website through telephone weather warnings and radio broadcasts.

SES emergency alert telephone warning system:

SES will use a Standard Emergency Warning Signal (SEWS) to precede all Top Priority Flood Warnings and all Evacuation Warnings. Once activated, Evacuation Orders are broadcast over the radio stations and through the SES.

Flood Evacuation Order:

Flood Evacuation Order is a notification to the community, authorised by the SES, when the intent of an Incident Controller is to instruct a community to immediately evacuate in response to an imminent threat. It also advises where people should go and may advise which evacuation route to take.

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Visual Observation:

Site Management must visually monitor the flood levels on Victoria Avenue low point during severe rainfall events and initiate the flood response procedure if the flood levels over Victoria Avenue low point are likely raising above the crest level of the lower ground floor level entrance.

1.4 Installation of Flood Barriers

Flood gates will be provided to ensure retail areas in lower ground level and the lower ground lower basement openings are protected during large flood events up to the PMF. The flood gates are only expected to be triggered for storm events greater and the 0.2% AEP (1 in 500 Year ARI) when flood levels overtop the lower ground car park entrance at RL 85.30m. Location of proposed flood gates are shown in Figure 1.

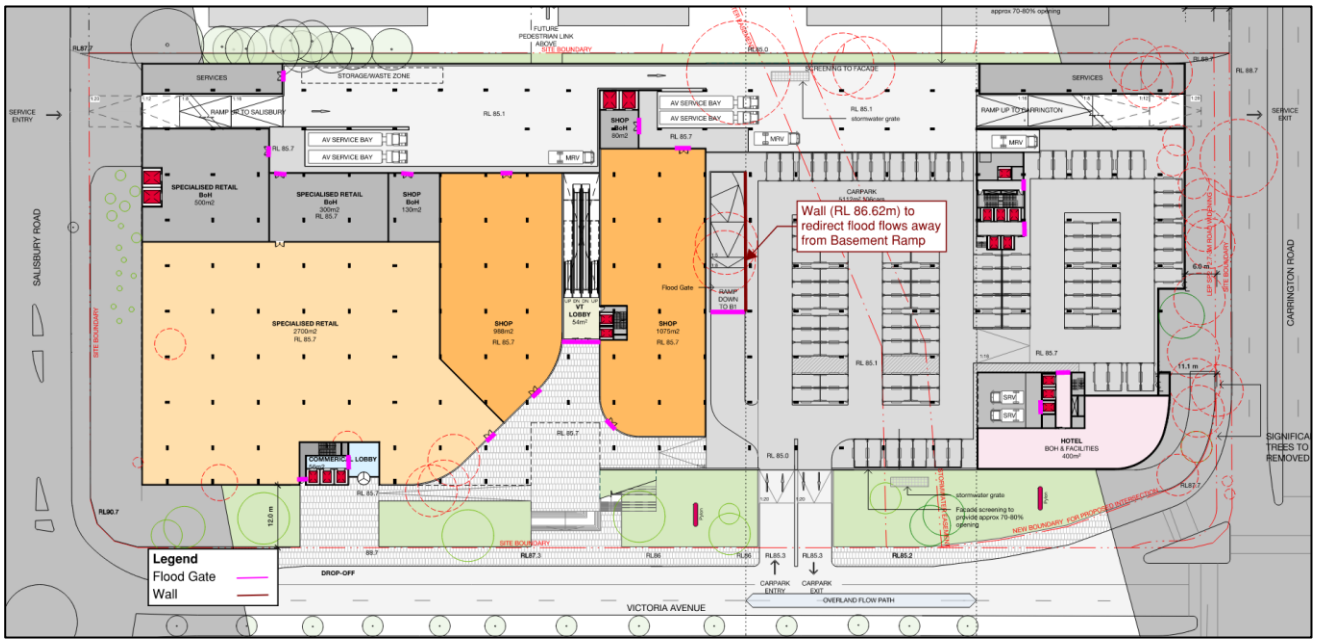

Figure 1 – Proposed Flood Barrier Locations (Lower Ground Level)

The flood barriers are proposed to protect against the PMF at locations shown in and would be self-closing hydraulically activated, with no manual input or electrical components required. The gates would close before flood waters enter the building with and example system shown in Figure 2 below. Further details of the flood gates, including operation and maintenance procedures, will be provided in detail design stage.

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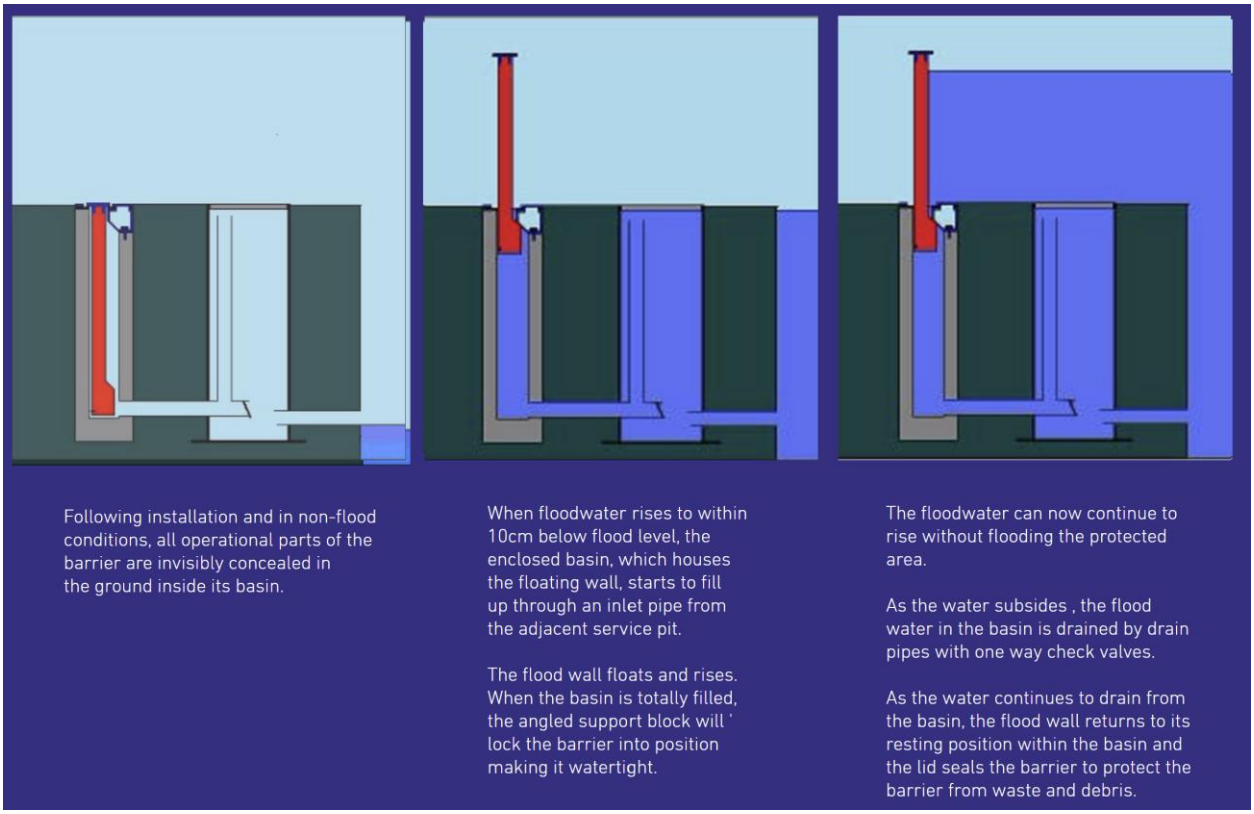

Figure 2 – Proposed Flood Barrier Schematic

1.5 Flood Inundation Time

The critical storm duration for the PMF peak flood levels at the site location is the 30-minute storm. Although Carrington Road (to the south) and Salisbury Road (to the north) remain low hazard during the PMF event, flood hazards over Victoria Avenue and across the flow path through the site would become high, shortly after the onset of the storm.

Due to the short interval from the onset of the flood to hazardous conditions over Victoria Avenue and across the flow path through the site, site users (as well as construction workers during the construction phase) must be warned to Stay clear of Victoria Avenue low point as well as the flow path through the site. It is expected that flood levels would recede within 90 minutes after the onset of the storm.

The site does not get isolated during flood events as Carrington Road (to the south) and Salisbury Road (to the north) are not majorly flood affected during the storms up to and including the PMF event, hence remain serviceable.

2.0 Flood Response Protocols

2.1 Emergency Assembly Point and Evacuation Routes

Carrington Road (to the south) and Salisbury Road (to the north) are not majorly flood affected during the storms up to and including the PMF event. Therefore, two Flood Emergency Assembly points at the northern site boundary (near Salisbury Road) and at the southern site boundary (near Carrington Road) have been proposed. Emergency Evacuation Routes and Assembly points are shown in Figure 3.

The site is subject to flash flooding with flood durations of less than 1.5 hour. Therefore, a shelter-in-place flood Management strategy is proposed for this site. During the construction phase, site workers will be directed to evacuate on foot to one of the assembly points and stay there until floodwaters recede. However, site users are also able to shelter-in-place on upper ground floor levels during the occupation phase.

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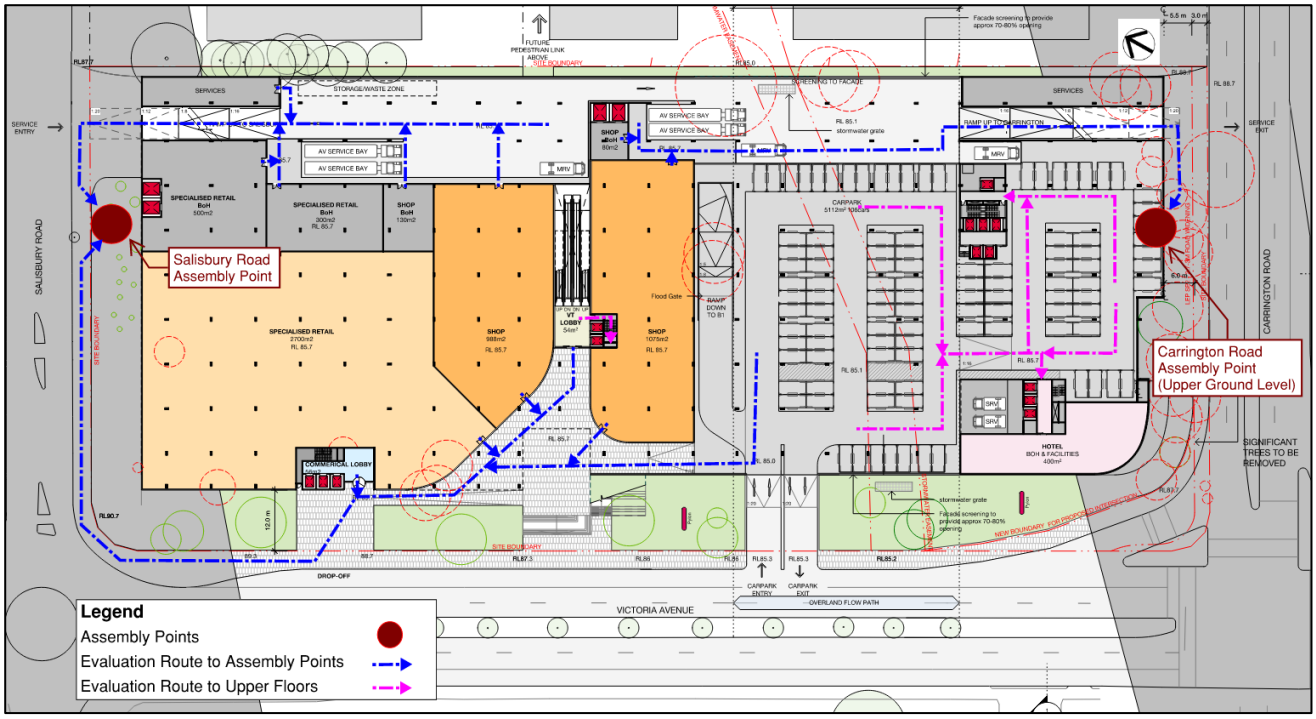

Figure 3 – Flood Emergency Assembly Point and Evacuation Routes from Lower Ground Floors

2.2 Emergency Contact Details

In the event of a severe flood, key contact details are included in Table 1 below.

Table 1 - Emergency Contact Details

Internal Contacts	
Emergency Coordinator	Phone Contact
Site Management	TBA
Safety Manager/First Aid Officer	TBA
External Contacts	
Service	Phone Contact
Police/Ambulance	000
State Emergency Services	132 500
Police – Castle Hill Police Station	(02) 9680 5399
Hospital – Lakeview Private Hospital	(02) 8624 5000

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3.0 Flood Response Action Plan (FRAP)

The site is subject to flash flooding with flood durations of less than 1.5 hour. Therefore, a 'shelter in place' flood management strategy is proposed for this site. The proposed upper floor levels will provide suitable space for shelter in a flood event greater than the 0.2% AEP event.

During construction phase, as part of the preparation for a flood event, all construction workers on site will be made aware of the flood risk, and the flood protocols & procedures for a safe site shutdown and evacuation (including their responsibilities) via briefing and signage. This will form part of the mandatory site inductions that all workers must undertake prior to gaining access to the site. A copy of this FRAP will be made available to all new construction staff, contractors and site visitors. Completion of site induction and safety training is the responsibility of the Site Management / Safety Officer.

It is recommended that evacuation drills be held at a minimum of every 6 months during construction phase to ensure all staff are aware of and familiar with their flood response actions, the sound of the alert and occupancy warning system, and the location of the assembly point.

WHEN A FLOOD WATCH IS ISSUED the following actions should be undertaken:

- Ensure the emergency kit is ready to use.
- Listen to the local radio station for updates on forecasted flood heights and timings.
- Call SES for an update and possible evacuation advice.
- Notify all staff and site users of the flood watch and assist availability of staff to assist with emergency actions if required.
- Ensure staff are familiar with the safe flood evacuation route.

WHEN A FLOOD WARNING IS ISSUED the following actions should be undertaken:

- Pedestrian and vehicle egress to basement car Park and lower ground level will be restricted.
- Alarm sounds and announcements will be issued to notify the people onsite to evacuate from the basement car Park and lower ground floor and move to either one of the assembly points (refer Section 2.1) or shelter-in-place on building's higher-level floors.
- Flood gate at the entrance ramp to the lower basement area will be automatically closed to redirect the floodwaters away from the lower basement opening.

3.1 Coordination of Flood Warnings and Orders

During the occupation phase, the site management will be responsible for monitoring information from the SES regarding flood events and will decide when to issue Flood Response Warnings and Orders for the site. The Flood Response Plan is shown in Table 2.

Shelter-in-place and wayfinding signage similar to Figure 4 must be installed at appropriate places throughout the site during the construction and occupation phases to identify the protocols clearly:

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Figure 4 – Typical Flood Evacuation Signage

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Table 2 - Flood Response Action Plan (FRAP)

Flood Warning and Notification Procedures	Key Actions
1) NSW State Emergency Service (SES), Local Council, or Bureau of Meteorology (BOM) issues an alert, advice or warning.	▪ Site Management / Safety officer to contact authorities to ascertain anticipated severity of a flood event. ▪ Notify all site workers and visitors and deliveries that a Flood alert is in place.
2) Regularly (hourly) check in with relevant authorities to monitor flood event and anticipated severity.	▪ If the flood event is not anticipated to impact the site, the Site Management is to continue hourly check-ins and postpone high risk activities.
	If a significant flood event is anticipated or has begun: **During the construction phase** ▪ Site Management is to implement emergency evacuation procedures which will form part of the mandatory site induction. ▪ All future site visits, deliveries and construction activities are postponed until all flood warnings are lifted. ▪ All site workers are to proceed to the muster points under the direction of the safety officer, until they receive notification that it is safe to return to site. ▪ Secure all plant, materials and equipment within the site and clear from Victoria Avenue low point as well as the existing flow path through the site. ▪ Site should be left secured with signage located explaining the site is closed due to a flood event. ▪ Close the entire site as quickly and safely as possible. **During the occupation phase** ▪ Site Management will instruct to restrict access to lower ground level and basement car park immediately in coordination with the site emergency response procedures. This may include an alert and warning message over the PA system confirming a major flood event. ▪ All site users are to proceed to the muster points under the direction of the Site Management or shelter-in-place on upper ground floors until they receive notification that it is safe to return to site. ▪ Ensure site users stay clear from Victoria Avenue low point by way of suitable signage and recurring announcements). ▪ Site Management is to follow any directions provided by the SES Incident controller.
3) The alert has been rescinded by the relevant authorities and any flood event that occurred has passed.	▪ Once it has been confirmed that the water level has reduced to a level that will not produce inundation, and if determined safe, the Incident Controller may announce the site can reopen – note the directions of police and the SES are to be followed at all times. ▪ Confirm floodwater has subsided below the ground level and that there is no ponding within the site. Flooded areas are to remain off limits until ponding has cleared. ▪ Site is to be inspected by the Site Management and Incident Controller if required. ▪ Once it is determined that the site is safe essential workers can return to verify that all plant and services are safe. ▪ Following completion of these checks site may reopen with all workers / site users returning to site.

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Yours faithfully,
TAYLOR THOMSON WHITTING (NSW) PTY LTD

EIRIAN CRABBE
Associate Director

STEPHEN BRAIN
Technical Director

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Appendix D - Maintenance and Construction Management Plan

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Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

19 July 2022 191928 CAAA

Eric Ruiz, Principal Coordinator-Stormwater & Waterways Management
The Hills Shire Council
Sent by email to jruiz@thehills.nsw.gov.au

21-23 Victoria Avenue, Castle Hill

Maintenance and Construction Management Plan

Dear Eric and Team,

This report provides an overview on the proposed structure concept design over / adjacent to the existing easement and outlines the future access, maintenance, and replacement procedure of the existing services within the easement boundary and under the proposed development.

As part of the stormwater management plan, the twin DN1800 pipes have been subject to an exploratory CCTV investigation completed in January 2022. Refer to the Pipe Condition Assessment in Appendix B for details. The CCTV investigation report (Appendix E) concluded:

- the existing pipes are in excellent condition.
- the pipes are free of cracks, have sound joints, retain true grading, and are free of debris and blockages.
- the pipes have not been damaged by loading or settlement and would appear to be functioning as intended.
- Council have confirmed the pipes were constructed in the early 1980s.

The Henry & Hymas report also notes that such pipes have a manufacturer specified design life of 100 years. Therefore, given the pipes have only been in service for 40 years, it is reasonable to expect up to 60 years of additional serviceability. Hence, the pipe lifespan is compatible with the proposed development.

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1.0 Proposed Structure Over / Adjacent to the Easement

The proposed development features a car park over the easement at lower ground level with finished floor level (FFL) of 85.20m AHD and the upper ground FFL of 90.70m AHD. With the slab thickness being approximately 1m (including the space required for utilities and/or drop ceiling), vertical clearance on the lower ground level within the easement area would be around 4.50m. This is in accordance with, and unchanged from, the previously approved Development Application for the site (DA 1/2014/JP).

Additionally:

- All load bearing structural elements will be located outside the existing stormwater easement to make pipe replacement works possible under post-development conditions.
- Foundation structures will also be out of the easement corridor and the zone of influence.
- continuous piling will be provided along the northern and southern easement boundaries within the proposed building to reduce the zone of influence.
- Concrete slabs will be designed over the easement across the car park with expansion joints that correspond to the easement extents to improve pavement removability in the event of future excavation. This will enable the slabs to be removed if required without interfering with adjacent slabs.
- Figure 1 shows indicative location of the columns at Lower Ground level. Figure 2 also shows typical location of the columns with relation to zone of influence for the easement.

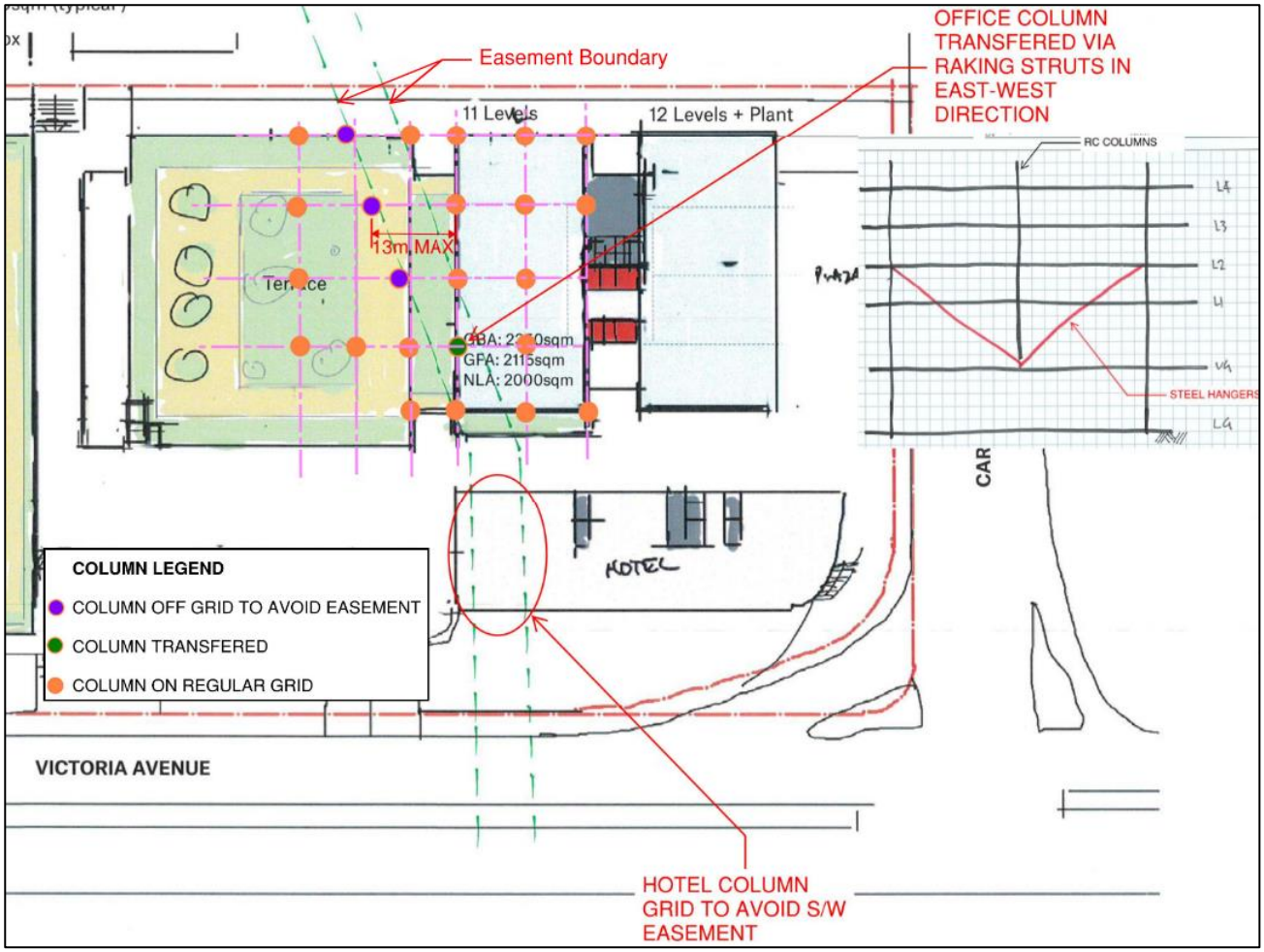

Figure 1 – Column Arrangement at Lower Ground Level (TBC)

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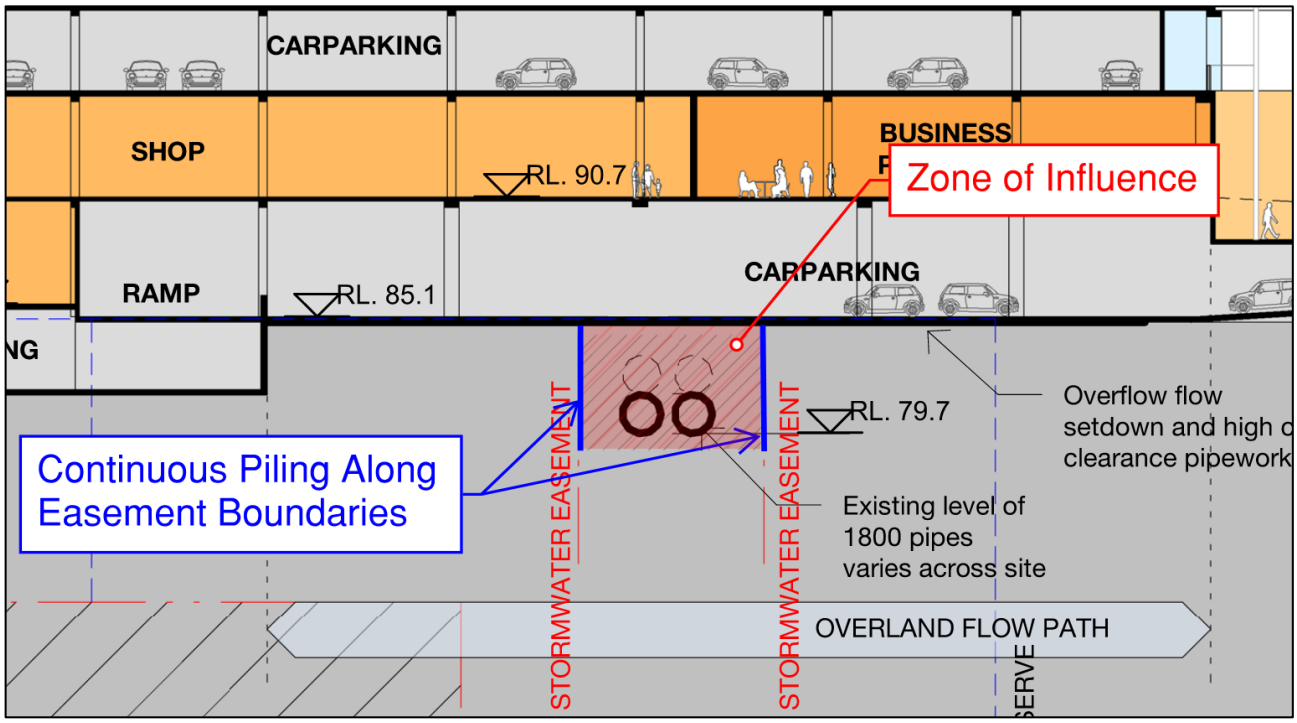

Figure 2 – Zone of Influence over the Easement – Typical section

1.1 Access & Maintenance

With reference to the maintainability of the existing drainage pipelines under post-development conditions:

- The existing access chambers to DN1800 pipes will be retained. The sealed cover access lids over the existing access chambers within the development boundary will be replaced with grated lids to allow better visual monitoring and access.
- Two additional access chambers to the twin DN1800 pipes with grated lids will be provided at locations as shown in Figure 3 to further facilitate access to the twin DN1800 pipes.

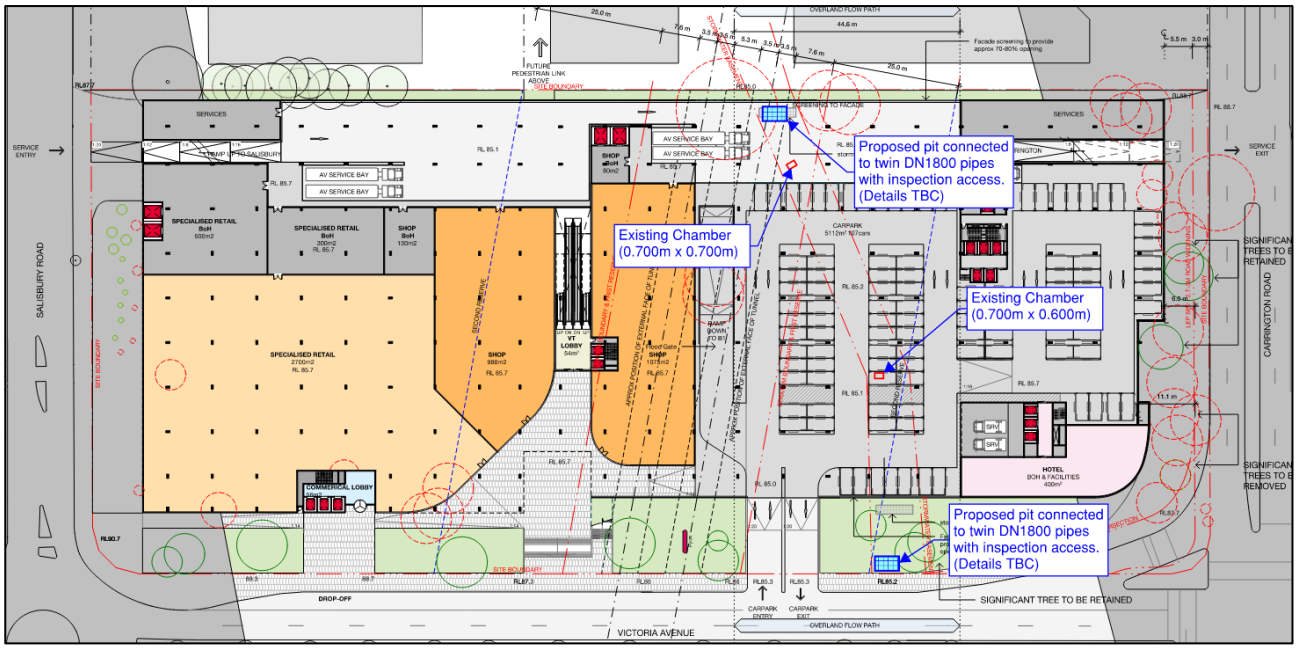

Figure 3 – Proposed and Existing Access Pits within the Site

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1.2 Replacement of the Pipes

The proposed building will provide an open area over the easement at lower ground level with vehicular access via Victoria Avenue.

During pipe replacement concrete slabs over the easement will be removed. A medium size excavator will be able dig out the soil to reach the defected pipes and replace them. For example, a Caterpillar M313 hydraulic excavator with a cab height of 2.81m and maximum digging depth of 5.24m would be capable of lifting a DN1800 concrete pipe as there would be sufficient height for the horizontal boom to operate as required. Alternatively, a truck mounted Hiab crane could be used to lift and / or lower the pipes within the clearances proposed.

Figure 4 illustrates the pipe replacement within the lower ground car park. Dimensions of working ranges of the required machinery are shown in Figure 5 to Figure 7.

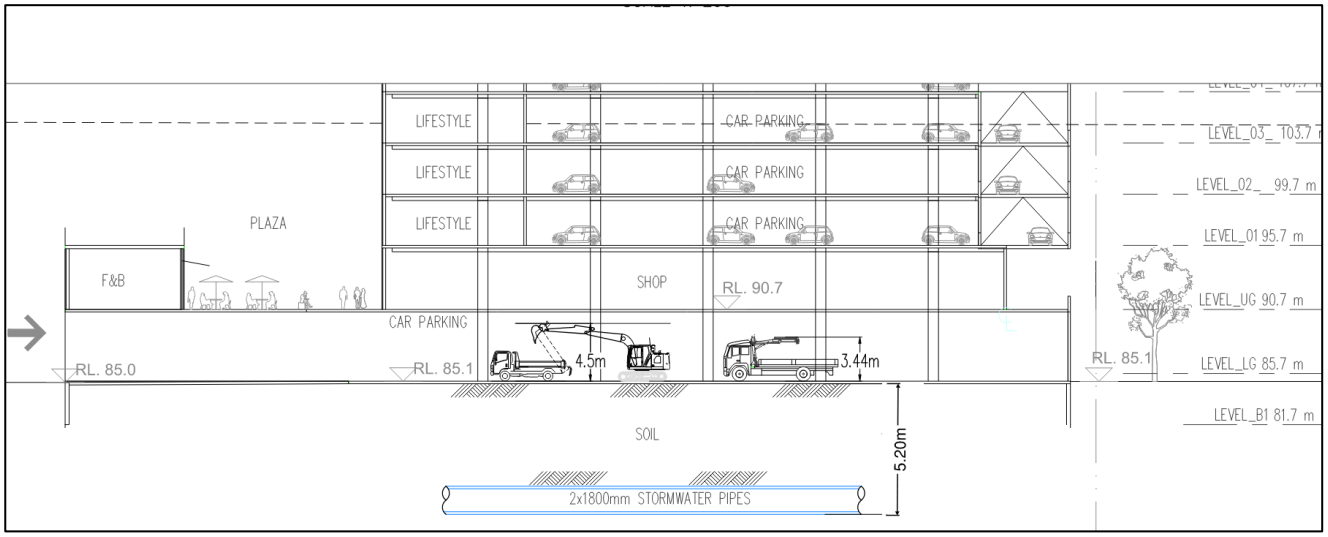

Figure 4 – Illustration of Working Machinery Over the Easement - Lower Ground Car Park

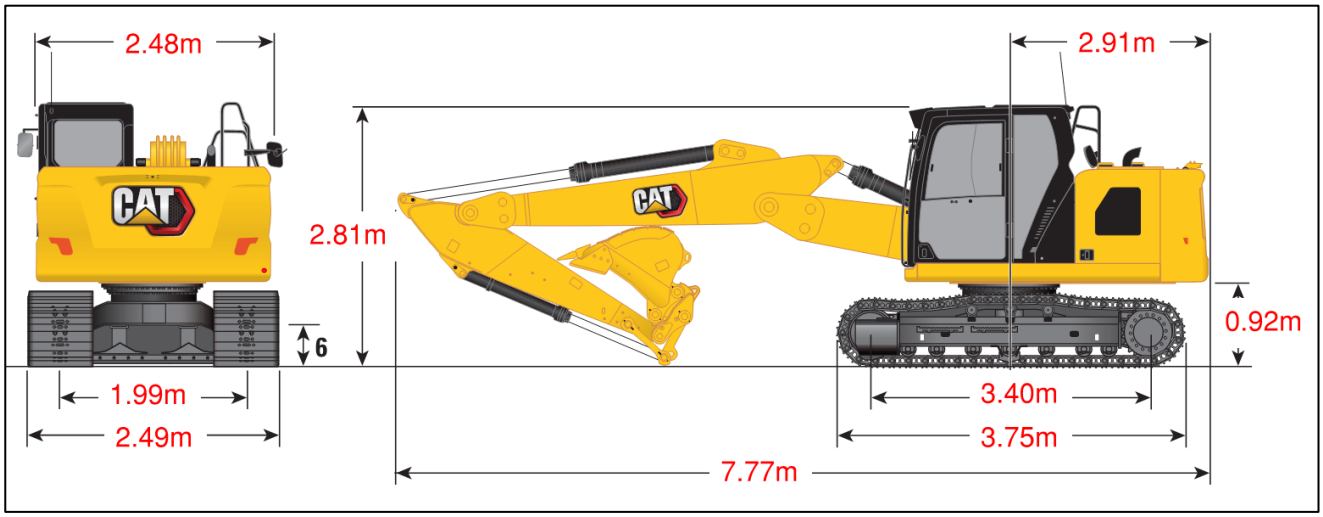

Figure 5 –Caterpillar M313 hydraulic excavator – Overall Dimensions

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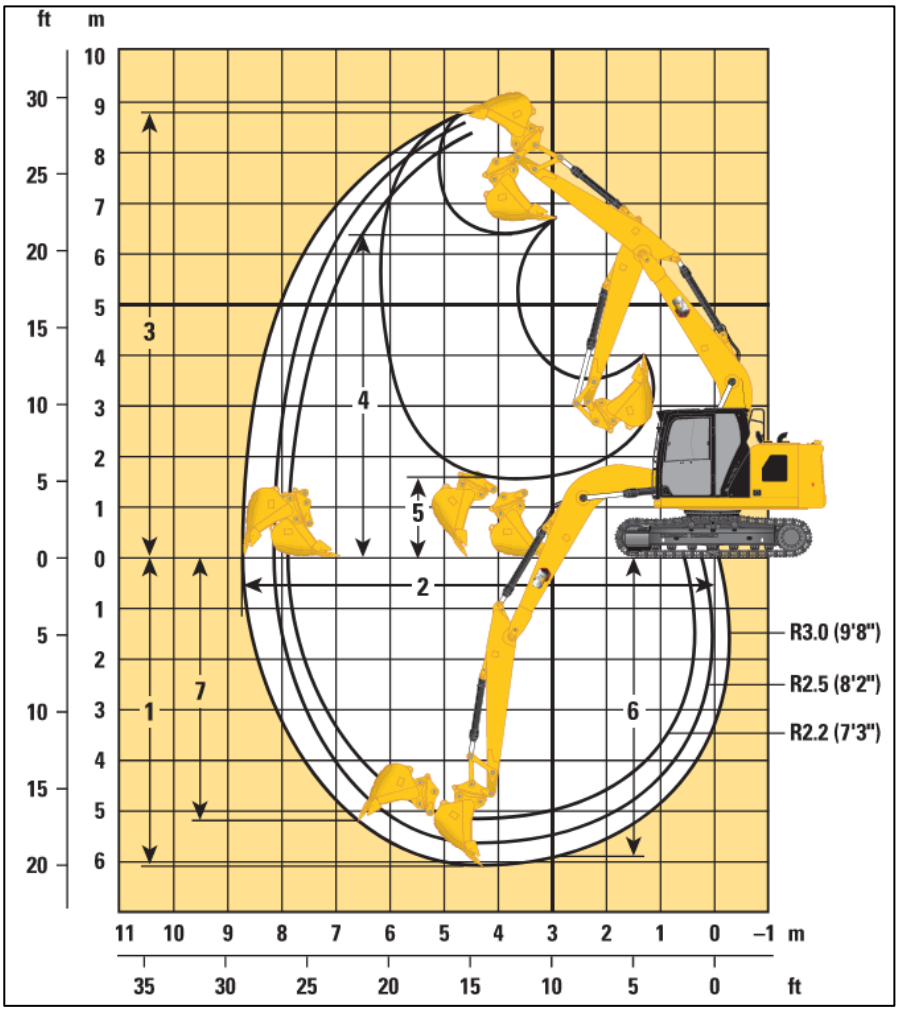

Figure 6 –Caterpillar M313 hydraulic excavator – Working Ranges

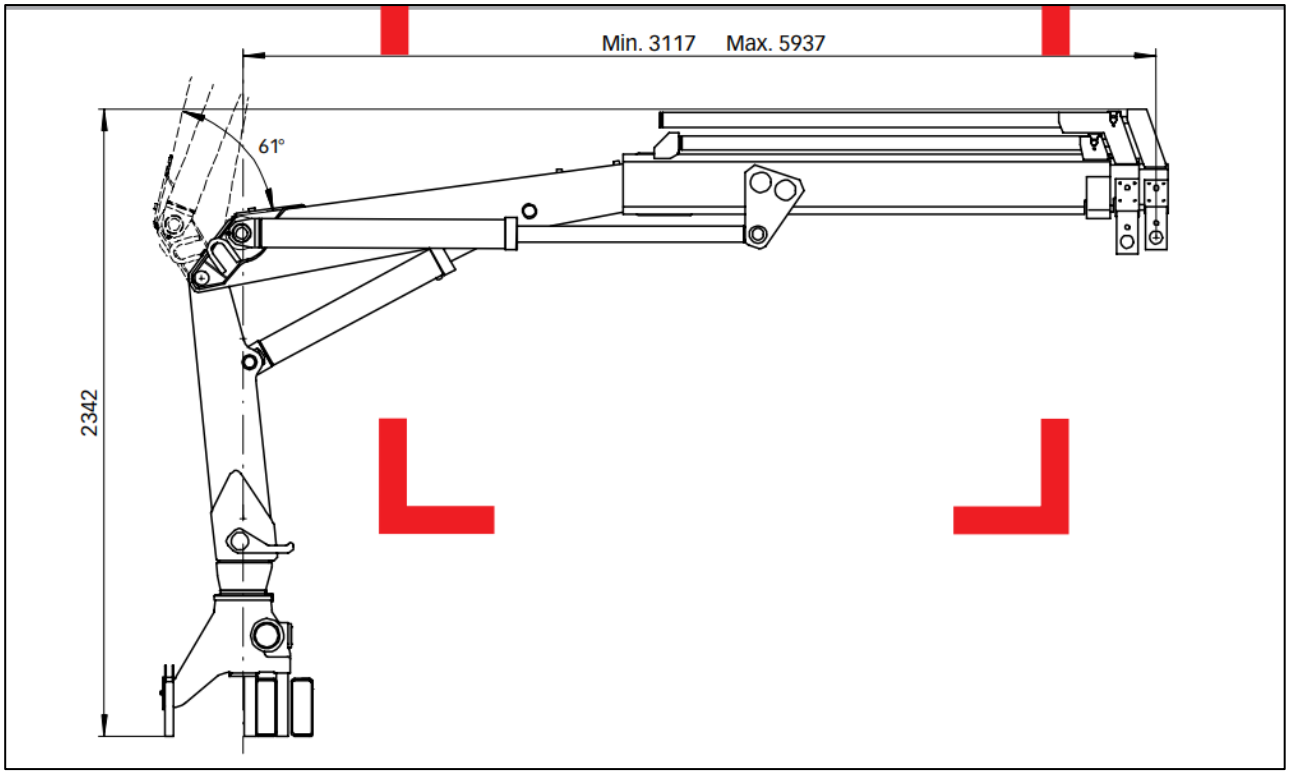

Figure 7 – Dimension of a HIAB 035 with 3.7 ton Lifting Capacity

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Yours faithfully,
TAYLOR THOMSON WHITTING (NSW) PTY LTD

EIRIAN CRABBE
Associate Director

STEPHEN BRAIN
Technical Director

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Appendix E - CCTV Survey Report and Defects Markup

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Solution for circumferential fracture:

As the pipe is large diameter, it is suggested to use **epoxy injection/filling** to fill the crack from internally and rely on calcification/autogenous healing. Seal and review in 12 months.

Circumferential fracture , width 2mm , from 7 to 10 o'clock, 23.96m from pit 6

Breaking, some pieces are missing , length of break 200 , from 8 to 9 o'clock, 11.49m from pit 3

Pieces of aggregate have been removed , at 1 o'clock, 7.01m from pit 3

Solution for breaking and removed aggregate:

For longevity of pipe life, it is suggested that these small connections are rendered with an **epoxy based grout** to prevent further corrosion of the reinforcement and long term deterioration.

Circumferential Fractures, Breaking and Removed Aggregates

LEGEND

BENCH MARK	▲
TELSTRA PIT	TEL
LIGHT (MOUNTED)	ELP
POWER POLE	PP
POWER POLE WITH LIGHT	PPL
GRATED INLET PIT	GIP
KERB INLET PIT	KIP
SEWER INSPECTION POINT	SIP
SEWER MANHOLE	SMH
STORMWATER MANHOLE	SWMH
STOP VALVE	SV
HYDRANT	HYD
WATER VALVE	WV
GAS VALVE	GAS
MONITOR WELL	MW
WATER METER	WM
BOTTOM OF WALL	BW
TOP OF WALL	TW
VEHICLE CROSSING	(VC)
PRAM CROSSING	(PC)
GAS	G
TELSTRA	T
OPTUS	OP
WATER	W
STORMWATER	SW
SEWER	S
ELECTRICITY (OVERHEAD)	P
ELECTRICITY (U'GROUND)	E

MGA TN APPROX 1°00'

NOTES

1. THE BOUNDARIES HAVE NOT BEEN MARKED ON GROUND
2. ALL AREAS AND DIMENSIONS HAVE BEEN COMPILED FROM PLANS MADE AVAILABLE BY NSW LAND REGISTRY SERVICES AND ARE SUBJECT TO FINAL SURVEY
3. ORIGIN OF LEVELS ON A.H.D. IS TAKEN FROM **SSM65435** R.L. **87.987** (A.H.D.) IN VICTORIA AVENUE
4. CONTOUR INTERVAL **0.5 m**
5. CONTOURS ARE INDICATIVE ONLY. ONLY SPOT LEVELS SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION
6. FLOOR LEVELS SHOWN ARE THRESHOLD LEVELS. NO INVESTIGATION OF INTERNAL FLOOR LEVELS HAS BEEN UNDERTAKEN
7. NO INVESTIGATION OF UNDERGROUND SERVICES HAS BEEN MADE. SERVICES HAVE BEEN PLOTTED FROM RELEVANT AUTHORITIES INFORMATION AND HAVE NOT BEEN SURVEYED. ALL RELEVANT AUTHORITIES SHOULD BE NOTIFIED PRIOR TO ANY EXCAVATION ON OR NEAR THE SITE
8. 8/.4/7 DENOTES TREE SPREAD OF 8m, TRUNK DIAMETER OF 0.4m & APPROX HEIGHT OF 7m
9. BEARINGS SHOWN ARE MGA (MAP GRID OF AUSTRALIA) ADD APPROX. 1°00' FOR TRUE NORTH
10. BUILDING LINEWORK AND ROOF INFORMATION IN LOT 1 IN DP657013 & LOT 1 IN DP660382 HAVE BEEN TAKEN FROM PLANS SUPPLIED BY CLIENT.
11. CONTOURS & TIN ON LAYERS 'contours by others' & 'DTM_by others' IN THE MODEL OVER PART OF LOT 1 IN DP660382 DERIVED FROM 2DIMENSIONAL SURVEY POINTS AND ADJACENT RL VALUES SHOWN ON PLAN BY G.J.ATKINS AND ASSOCIATES CONSULTING LAND SURVEYORS. REFERENCE 0782-2 DATED 10 DECEMBER 2007 SUPPLIED BY CLIENT.
12. THE LOCATION & EXTENT OF THE TWIN 1800ø STORMWATER PIPES SHOWN DASHED IS APPROXIMATE ONLY.

EASEMENTS

(E1) EASEMENT TO DRAIN WATER VARIABLE WIDTH (DP636051)
(E2) EASEMENT TO DRAIN WATER 8.5m WIDE (DP636051)
(E3) EASEMENT TO DRAIN WATER 12m WIDE, VARIABLE WIDTH & 14m WIDE (DP711909)

STRATUM NOTES

(SN1) EXCLUDES LAND BETWEEN RL48.9 (A.H.D) AND RL70.8(A.H.D) AND IS LOT 50 IN DP 1180975 BETWEEN THESE LEVELS
(SN2) EXCLUDES LAND BETWEEN RL49.8 (A.H.D) AND RL71.8(A.H.D) AND IS LOT 50 IN DP 11180975BETWEEN THESE LEVELS
(SN3) EXCLUDES LAND BETWEEN RL50.8 (A.H.D) AND RL72.8(A.H.D) AND IS LOT 50 IN DP 11180975 BETWEEN THESE LEVELS

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GDA2020

0 8 16 24 32 40

Dog Path: Set PL_DP660382 A1
Version: 1, Version Date: 11/08/2022

Revision	Date	Description	Reference
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F	00/00/00	–	00
E	00/00/00	–	00
D	00/00/00	–	00
C	00/00/00	–	00
B	00/00/00	–	00
A	00/00/00	–	00

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THIS IS THE PLAN REFERRED TO IN MY LETTER DATED:
.....
Registered Surveyor NSW

Client - SPG DEVELOPMENTS (MANAGER) PTY LTD
Drawing title
PLAN OF DETAIL AND LEVELS OVER PARTS OF LOT 1 IN DP657013, LOT 1 IN DP660382 & LOTS 11 & 12 IN DP711909 KNOWN AS 21-23 VICTORIA AVENUE & 15 CARRINGTON ROAD CASTLE HILL

datum AHD
site Area N/A
LGA THE HILLS SHIRE
reference number 51250 002DT
scale 1:400 @A1
date of survey 02/02/2022
SHEET 1 OF 14

Solution For all the marked up small connections:

For all the marked up small connections, it is suggested that they are rendered with an **epoxy-based grout** to prevent further corrosion of the reinforcement and long-term deterioration.

LEGEND

BENCH MARK	▲
TELSTRA PIT	TEL
LIGHT (MOUNTED)	ELP
POWER POLE	PP
POWER POLE WITH LIGHT	PPL
GRATED INLET PIT	GIP
KERB INLET PIT	KIP
SEWER INSPECTION POINT	SIP
SEWER MANHOLE	SMH
STORMWATER MANHOLE	SWMH
STOP VALVE	SV
HYDRANT	HYD
WATER VALVE	WV
GAS VALVE	GAS
MONITOR WELL	MW
WATER METER	WM
BOTTOM OF WALL	BW
TOP OF WALL	TW
VEHICLE CROSSING	(VC)
PRAM CROSSING	(PC)
GAS	G
TELSTRA	T
OPTUS	OP
WATER	W
STORMWATER	SW
SEWER	S
ELECTRICITY (OVERHEAD)	P
ELECTRICITY (U'GROUND)	E

MGA

TN

APPROX. 1°00'

NOTES

1. THE BOUNDARIES HAVE NOT BEEN MARKED ON GROUND
2. ALL AREAS AND DIMENSIONS HAVE BEEN COMPILED FROM PLANS MADE AVAILABLE BY NSW LAND REGISTRY SERVICES AND ARE SUBJECT TO FINAL SURVEY
3. ORIGIN OF LEVELS ON A.H.D. IS TAKEN FROM **SSM65435** R.L. **87.987** (A.H.D.) IN VICTORIA AVENUE
4. CONTOUR INTERVAL **0.5 m**
5. CONTOURS ARE INDICATIVE ONLY. ONLY SPOT LEVELS SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION
6. FLOOR LEVELS SHOWN ARE THRESHOLD LEVELS. NO INVESTIGATION OF INTERNAL FLOOR LEVELS HAS BEEN UNDERTAKEN
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12. THE LOCATION & EXTENT OF THE TWIN 1800ø STORMWATER PIPES SHOWN DASHED IS APPROXIMATE ONLY.

EASEMENTS

(E1) EASEMENT TO DRAIN WATER VARIABLE WIDTH (DP636051)
(E2) EASEMENT TO DRAIN WATER 8.5m WIDE (DP636051)
(E3) EASEMENT TO DRAIN WATER 12m WIDE, VARIABLE WIDTH & 14m WIDE (DP711909)

STRATUM NOTES

(SN1) EXCLUDES LAND BETWEEN RL48.9 (A.H.D) AND RL70.8(A.H.D) AND IS LOT 50 IN DP 1180975 BETWEEN THESE LEVELS
(SN2) EXCLUDES LAND BETWEEN RL49.8 (A.H.D) AND RL71.8(A.H.D) AND IS LOT 50 IN DP 11180975BETWEEN THESE LEVELS
(SN3) EXCLUDES LAND BETWEEN RL50.8 (A.H.D) AND RL72.8(A.H.D) AND IS LOT 50 IN DP 11180975 BETWEEN THESE LEVELS

Open connection, diameter 50mm , at 3 o'clock, 11.50m from pit 3

Open connection , diameter 100mm , at 10 o'clock, 31.29m from pit 3

Open connection, diameter 100, at 12 o'clock, 11.45m from pit 3

Open connection, diameter 100mm , at 12 o'clock, Reo is covering opening of the connection, 9.94m from pit 3

Open connection, diameter 100mm , at 12 o'clock, 9.01m from pit 3

Open connection, diameter 50mm, width 50mm, at 9 o'clock, 3.58 from pit 3

Open connection, diameter 225mm , at 3 o'clock, 7.01m from pit 3

Open connection, diameter 100mm, at 2 o'clock, 4.30m from pit 3

Open connection, diameter 300mm, at 2 o'clock, 40.01m from pit 5

31.29 m
11.50 m
7.01 m
4.30 m
3.58 m
9.01 m
9.94 m
11.45 m
40.01 m

SHEET 2
SHEET 3
SHEET 4
SHEET 5
SHEET 6
SHEET 7
SHEET 8
SHEET 9
SHEET 10
SHEET 11
SHEET 12
SHEET 13

AVENUE
VICTORIA
CARRINGTON
ROAD

1
DP 660382

1
DP 657013

2
DP 505589

12
DP 711909

SP 21054

15 SALISBURY RD
BRICK BUILDING
METAL ROOF

15 CARRINGTON RD
BRICK BUILDING
METAL ROOF

2 STOREY
BRICK BUILDING
METAL ROOF

21 VICTORIA AV
2 STOREY
BRICK BUILDING
METAL ROOF

15 CARRINGTON RD
BRICK BUILDING
METAL ROOF

15 CARRINGTON RD
BRICK BUILDING
METAL ROOF

159°01'10" 111.06
248°40'10" 95.545
339°01'10" 100.575
87.925
68°40'05"
311°10'" 3.975
113°50'10" 2.98
82°10'10"

(E1) (E2) (E3) (SN1) (SN2) (SN3)

SECTION 1 (SEE SHEET 14)
SECTION 2 (SEE SHEET 14)
SECTION 3 (SEE SHEET 14)
SECTION 4 (SEE SHEET 14)

Open Connections on Small Pipes <300mm dia

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GDA2020

0 8 16 24 32 40

Document Set ID: DP66[illegible] A1
Version: 1, Version Date: 11/08/2022

Revision	Date	Description	Reference
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F	00/00/00	–	00
E	00/00/00	–	00
D	00/00/00	–	00
C	00/00/00	–	00
B	00/00/00	–	00
A	00/00/00	–	00

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THIS IS THE PLAN REFERRED TO IN MY LETTER DATED:

.....
Registered Surveyor NSW

Client - SPG DEVELOPMENTS (MANAGER) PTY LTD

Drawing title
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datum	AHD
site Area	N/A
LGA	THE HILLS SHIRE
reference number	51250 002DT
scale	1:400 @A1
date of survey	02/02/2022
SHEET	1
OF	14

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		18/02/2022	11	2 LEFT

Photo: 095129_18022022_A.JPG, Media No:: LTS LOCKLEY, _0, 00:03:11
24m, Connection, good workmanship, connection appears to be open, diameter 1050mm , at 3 o'clock

MONITOR WELL	MW
WATER METER	WM
BOTTOM OF WALL	BW
TOP OF WALL	TW
VEHICLE CROSSING	(VC)
PRAM CROSSING	(PC)
GAS	G
TELSTRA	T
OPTUS	OP
WATER	W
STORMWATER	SW
SEWER	S
ELECTRICITY (OVERHEAD)	P
ELECTRICITY (U'GROUND)	E

Open connection , diameter 1050mm , at 3 o'clock, 24.00 meter from pit 3

Solution for the 1050 pipe connection:

Epoxy grout on all exposed pipe surfaces to smooth and prevent corrosion of pipe reinforcing.

SHEET 2 SHEET 3 SHEET 4 SHEET 5 SHEET 6 SHEET 7 SHEET 10 SHEET 11 SHEET 12 SHEET 13

23 VICTORIA AV
BRICK BUILDING
1 & 2 STOREY
METAL ROOF

1
DP 660382

15 SALISBURY RD
BRICK BUILDING
METAL ROOF

11
DP 711909

15 CARRINGTON RD
BRICK BUILDING
METAL ROOF

2
DP 505589

SP 21054

12
DP 711909

2 STOREY
BRICK BUILDING
METAL ROOF

VICTORIA AVENUE

159°01'10" 111.06

339°01'10" 119.98

339°01'10" 100.575

248°40'10" 95.545

24.00 m

SECTION 1 (SEE SHEET 14)
SECTION 2 (SEE SHEET 14)
SECTION 3 (SEE SHEET 14)
SECTION 4 (SEE SHEET 14)

(E1) (E2) (E3) (SN) (SN2) (SN3)

311°10" 3.975
113°50'10" 2.98
82°10'10"

87.925
68°40'05"

CARRINGTON ROAD

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(E2) EASEMENT TO DRAIN WATER 8.5m WIDE (DP636051)
(E3) EASEMENT TO DRAIN WATER 12m WIDE, VARIABLE WIDTH & 14m WIDE (DP711909)

STRATUM NOTES
(SN1) EXCLUDES LAND BETWEEN RL48.9 (A.H.D) AND RL70.8(A.H.D) AND IS LOT 50 IN DP 1180975 BETWEEN THESE LEVELS
(SN2) EXCLUDES LAND BETWEEN RL49.8 (A.H.D) AND RL71.8(A.H.D) AND IS LOT 50 IN DP 11180975BETWEEN THESE LEVELS
(SN3) EXCLUDES LAND BETWEEN RL50.8 (A.H.D) AND RL72.8(A.H.D) AND IS LOT 50 IN DP 11180975 BETWEEN THESE LEVELS

Open Connections on 1050mm Pipe

DIAL BEFORE YOU DIG www.1100.com.au

GDA2020

0 8 16 24 32 40

Document Set ID: DP664[illegible] A1
Version: 1, Version Date: 11/08/2022

Revision	Date	Description	Reference
H	00/00/00 –		00
G	00/00/00 –		00
F	00/00/00 –		00
E	00/00/00 –		00
D	00/00/00 –		00
C	00/00/00 –		00
B	00/00/00 –		00
A	00/00/00 –		00

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THIS IS THE PLAN REFERRED TO IN MY LETTER DATED:

.....
Registered Surveyor NSW

Client - SPG DEVELOPMENTS (MANAGER) PTY LTD

Drawing title
PLAN OF DETAIL AND LEVELS OVER PARTS OF LOT 1 IN DP657013, LOT 1 IN DP660382 & LOTS 11 & 12 IN DP711909 KNOWN AS 21-23 VICTORIA AVENUE & 15 CARRINGTON ROAD CASTLE HILLL

datum	AHD
site Area	N/A
LGA	THE HILLS SHIRE
reference number	51250 002DT
scale	1:400 @A1
date of survey	02/02/2022
SHEET	1
OF	14

City :

Sydneywide Environmental Services
40 edward st
Riverstone
Tel: 0417924993
Website:
Email: sydwide@bigpond.com

/ Main sections / Inspection: 1

Project name	Project Number:	Responsible:	Date:
LTS LOCKLEY, VICTORIA AVE CCT			**18/02/2022**

No.	Start MH	End MH	Date	Location/Street	Tape No.	Material	m	(m)
1	5	6	18/02/2022	CARRINGTON RD		Reinforced concrete	47.17	**47.11**
2	6	7	18/02/2022	CARRINGTON RD		Reinforced concrete	39.91	**39.30**
3	5	6	18/02/2022	CARRINGTON RD		Reinforced concrete	46.75	**46.15**
4	6	7	18/02/2022	CARRINGTON RD		Reinforced concrete	40.21	**39.60**
5	4	5	18/02/2022	CARRINGTON RD		Reinforced concrete	105.19	**104.58**
6	3	4	18/02/2022	CARRINGTON RD		Reinforced concrete	41.83	**41.23**
7	2	3	18/02/2022	CARRINGTON RD		Reinforced concrete	20.51	20.51
8	1	2	18/02/2022	CARRINGTON RD		Reinforced concrete	5.09	**4.49**
9	4	5	18/02/2022	CARRINGTON RD		Reinforced concrete	104.89	**104.29**
10	3	4	18/02/2022	CARRINGTON RD		Reinforced concrete	36.44	**35.84**
11	2	3	18/02/2022	CARRINGTON RD		Reinforced concrete	33.71	**33.11**
12	1	2	18/02/2022	CARRINGTON RD		Reinforced concrete	9.96	**9.36**

Pipe size: CIRCULAR 1800 = 531.66 m (525.57 m)

All sections = 531.66 m (525.57 m)

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Sydneywide Environmental Services
40 edward st
Riverstone
Tel.: 0417924993
Website:
Email sydwide@bigpond.com

Inspection summary / Inspection: 1

Project Name:	Project number:	Date:	Contact:	
LTS LOCKLEY, VICTORIA AVE CCTV 18 02 22		18/02/2022		

Please find per enclosure the inspection report

Total Length of sewer network	**531.66 m**
Inspected Length of sewer network	**525.57 m**
Not inspected Length of sewer network	**6.09 m**
Total Length of house connections (satellite)	**0.00 m**
Inspected Length of house connections (satellite)	**0.00 m**
Not inspected Length of house connections (satellite)	**0.00 m**
Number of Sections	**12**
Number of house connections	**0**
Number of Photos	**31**

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Inspection Summary / Inspection: 1

Date:	Responsible:			
18/02/2022				

Sewer Reference:	5 LEFT	Section length:	47.17 m
Section Numer:	1	Pipe length:	
Start node:	5	Material	Reinforced concrete
End node:	6	Shape:	Circular

5	**0.06**	STMH	Start node, maintenance hole, Nodename: 5	
	19.00	IS	Infiltration, sweating , from 1 to 4 o'clock	; 0
	20.53	IS	Infiltration, sweating , from 9 to 3 o'clock	; 0
	35.32	IS	Infiltration, sweating , at 12 o'clock	; 0
	38.48	IS	Infiltration, sweating , from 2 to 5 o'clock	; 0
6	**47.17**	FHMH	Finish node, maintenance hole, Nodename: 6	

Sewer Reference:	6 LEFT	Section length:	39.91 m
Section Numer:	2	Pipe length:	
Start node:	6	Material	Reinforced concrete
End node:	7	Shape:	Circular

6	**0.61**	STGP	Start node, grated inlet pit, Nodename: 6	
	0.61	WLC	Water level, clear flow (the invert is visible), depth 5%	
	13.87	IS	Infiltration, sweating , from 12 to 12 o'clock	; 0
	18.16	IS	Infiltration, sweating , from 6 to 12 o'clock	; 0
	25.23	IS	Infiltration, sweating , from 12 to 6 o'clock	; 0
	27.73	IS	Infiltration, sweating , from 12 to 6 o'clock	; 0
7	**39.91**	FHO	Finish node, outfall or culvert headwall, Nodename: 7	

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Inspection Summary / Inspection: 1

Date:	Responsible:			
18/02/2022				

Sewer Reference:	5 RIGHT	Section length:	46.75 m
Section Numer:	3	Pipe length:	
Start node:	5	Material	Reinforced concrete
End node:	6	Shape:	Circular

5	**0.60**	STGP	Start node, grated inlet pit, Nodename: 5	
	0.60	WLC	Water level, clear flow (the invert is visible), depth 5%	
	15.34	GC	UNMARKED PIT. (5.1)	
	20.67	IS	Infiltration, sweating , at 12 o'clock	; 0
	26.85	IS	Infiltration, sweating , from 7 to 10 o'clock	; 0
	31.09	IS	Infiltration, sweating , from 1 to 6 o'clock	; 0
6	**46.75**	FHMH	Finish node, maintenance hole, Nodename: 6	

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Inspection Summary / Inspection: 1

Date:	Responsible:			
18/02/2022				

Sewer Reference:	6 RIGHT	Section length:	40.21 m
Section Numer:	4	Pipe length:	
Start node:	6	Material	Reinforced concrete
End node:	7	Shape:	Circular

6	0.61	STGP	Start node, grated inlet pit, Nodename: 6	
	0.61	WLC	Water level, clear flow (the invert is visible), depth 5%	
	6.41	IS	Infiltration, sweating , from 7 to 9 o'clock	; 0
	12.80	IS	Infiltration, sweating , from 12 to 12 o'clock	; 0
	17.06	IS	Infiltration, sweating , from 12 to 12 o'clock	; 0
	19.77	IS	Infiltration, sweating , from 12 to 12 o'clock	; 0
	23.96	FC	Circumferential fracture , width 2mm , from 7 to 10 o'clock	8;
	25.99	IS	Infiltration, sweating , from 12 to 12 o'clock	; 0
	27.66	IS	Infiltration, sweating , from 12 to 12 o'clock	; 0
7	40.21	FHO	Finish node, outfall or culvert headwall, Nodename: 7	

Sewer Reference:	4 RIGHT	Section length:	105.19 m
Section Numer:	5	Pipe length:	
Start node:	4	Material	Reinforced concrete
End node:	5	Shape:	Circular

5	0.61	STMH	Start node, maintenance hole, Nodename: 4
	0.61	WLC	Water level, clear flow (the invert is visible), depth 5%
4	105.19	FHZ	Finish node, Nodename: 5, CLOSED PIT

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Inspection Summary / Inspection: 1

Date:	Responsible:			
18/02/2022				

Sewer Reference:	3 RIGHT	Section length:	41.83 m
Section Numer:	6	Pipe length:	
Start node:	3	Material	Reinforced concrete
End node:	4	Shape:	Circular

4	0.60	STZ	Start node, Nodename: 3, CLOSED PIT ```
	0.60	WLC	Water level, clear flow (the invert is visible), depth 5%
3	41.83	FHGP	Finish node, grated inlet pit, Nodename: 4

Sewer Reference:	2 RIGHT	Section length:	20.51 m
Section Numer:	7	Pipe length:	
Start node:	2	Material	Reinforced concrete
End node:	3	Shape:	Circular

3	0.61	STGP	Start node, grated inlet pit, Nodename: 2
	0.64	WLC	Water level, clear flow (the invert is visible), depth 5%
	3.58	CNGO	Connection, good workmanship, connection appears to be open, diameter 50mm, width 50mm, at 9 o'clock
	9.01	CNGO	Connection, good workmanship, connection appears to be open, diameter 100mm , at 12 o'clock
	9.94	CNGO	Connection, good workmanship, connection appears to be open, diameter 100mm , at 12 o'clock
	9.94	GC	REO IS COVERING OPENING OF THE CONNECTION
	11.45	CNGO	Connection, good workmanship, connection appears to be open, diameter 100mm , at 12 o'clock
2	20.51	FHGP	Finish node, grated inlet pit, Nodename: 3

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Inspection Summary / Inspection: 1

Date:	Responsible:			
18/02/2022				

Sewer Reference:	1 RIGHT	Section length:	5.09 m
Section Numer:	8	Pipe length:	
Start node:	1	Material	Reinforced concrete
End node:	2	Shape:	Circular

2	0.60	STGP	Start node, grated inlet pit, Nodename: 2	
	0.60	WLC	Water level, clear flow (the invert is visible), depth 5%	
1	5.09	FHZ	Finish node, Nodename: 1, CLOSED PIT	

Sewer Reference:	4 LEFT	Section length:	104.89 m
Section Numer:	9	Pipe length:	
Start node:	4	Material	Reinforced concrete
End node:	5	Shape:	Circular

5	0.60	WLC	Water level, clear flow (the invert is visible)	
	19.18	IS	Infiltration, sweating , from 2 to 5 o'clock	; 0
	40.01	CNGO	Connection, good workmanship, connection appears to be open, diameter 300mm , at 2 o'clock	
	40.01	IS	Infiltration, sweating , at 2 o'clock	; 0
	59.96	GC	APPEARS TO BE LARGE INSPECTION HOLE	
4	104.89	FHMH	Finish node, maintenance hole, Nodename: 4	

Sewer Reference:	3 LEFT	Section length:	36.44 m
Section Numer:	10	Pipe length:	
Start node:	3	Material	Reinforced concrete
End node:	4	Shape:	Circular

3	0.60	STGP	Start node, grated inlet pit, Nodename: 3
	0.60	WLC	Water level, clear flow (the invert is visible), depth 0%
4	36.44	FHMH	Finish node, maintenance hole, Nodename: 4

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Version: 1, Version Date: 11/08/2022

Inspection Summary / Inspection: 1

Date:	Responsible:			
18/02/2022				

Sewer Reference:	2 LEFT	Section length:	33.71 m
Section Numer:	11	Pipe length:	
Start node:	2	Material	Reinforced concrete
End node:	3	Shape:	Circular

3	**0.60**	STGP	Start node, grated inlet pit, Nodename: 3	
	0.60	WLC	Water level, clear flow (the invert is visible), depth 5%	
	4.30	CNGO	Connection, good workmanship, connection appears to be open, diameter 100mm , at 2 o'clock	
	4.30	IS	Infiltration, sweating , at 2 o'clock	; 0
	7.01	CNGO	Connection, good workmanship, connection appears to be open, diameter 225mm , at 3 o'clock	
	7.01	SAM	Pieces of aggregate have been removed , at 1 o'clock	40;
	11.49	BM	Breaking, some pieces are missing , length of break 200 , from 8 to 9 o'clock	60;
	11.50	CNGO	Connection, good workmanship, connection appears to be open, diameter 50mm , at 3 o'clock	
	24.00	CNGO	Connection, good workmanship, connection appears to be open, diameter 1050mm , at 3 o'clock	
	31.29	CNGO	Connection, good workmanship, connection appears to be open, diameter 100mm , at 10 o'clock	
2	**33.71**	FHGP	Finish node, grated inlet pit, Nodename: 2	

Sewer Reference:	1 LEFT	Section length:	9.96 m
Section Numer:	12	Pipe length:	
Start node:	1	Material	Reinforced concrete
End node:	2	Shape:	Circular

2	**0.60**	STGP	Start node, grated inlet pit, Nodename: 2	
	0.60	WLC	Water level, clear flow (the invert is visible), depth 5%	
1	**9.96**	FHZ	Finish node, Nodename: 1, END OF WORKS	

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Sydneywide Environmental Services
40 edward st
Riverstone
Tel: 0417924993

Email: sydwide@bigpond.com

WSA assessment / Inspection: 1

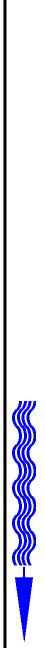
Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**1**	**5 LEFT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**WSA 05-2008 2.2**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**5**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**downstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**6**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**47.17 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:375 **Position** **Observation**



0.06 Start node, maintenance hole, Nodename: 5

19 m

20.53 m

19.00 Infiltration, sweating , from 1 to 4 o'clock

20.53 Infiltration, sweating , from 9 to 3 o'clock

35.32 m

35.32 Infiltration, sweating , at 12 o'clock

38.48 Infiltration, sweating , from 2 to 5 o'clock

38.48 m

47.17 Finish node, maintenance hole, Nodename: 6

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	**0**	**0**	**0**	**1**	**4**	**0**	**0**	**0**	**1**

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Sydneywide Environmental Services
40 edward st
Riverstone
Tel: 0417924993
Website:
Email: sydwide@bigpond.com

Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**1**	**5 LEFT**

Photo: 075134_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:30
19m, Infiltration, sweating , from 1 to 4 o'clock

Photo: 075222_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:02:13
20.53m, Infiltration, sweating , from 9 to 3 o'clock

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Version: 1, Version Date: 11/08/2022

Sydneywide Environmental Services
40 edward st
Riverstone
Tel: 0417924993
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Email: sydwide@bigpond.com

Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**1**	**5 LEFT**

Photo: 075327_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:03:11
35.32m, Infiltration, sweating , at 12 o'clock

Photo: 075414_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:03:46
38.48m, Infiltration, sweating , from 2 to 5 o'clock

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Sydneywide Environmental Services
40 edward st
Riverstone
Tel: 0417924993

Email: sydwide@bigpond.com

WSA assessment / Inspection: 1

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**2**	**6 LEFT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**WSA 05-2008 2.2**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**6**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**downstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**7**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**39.91 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:315	Position	Observation
6		
	0.61	Start node, grated inlet pit, Nodename: 6
	0.61	Water level, clear flow (the invert is visible), depth 5%
	13.87	Infiltration, sweating , from 12 to 12 o'clock
	18.16	Infiltration, sweating , from 6 to 12 o'clock
	25.23	Infiltration, sweating , from 12 to 6 o'clock
	27.73	Infiltration, sweating , from 12 to 6 o'clock
	39.91	Finish node, outfall or culvert headwall, Nodename: 7
7		

13.87 m

13.87 m

18.16 m

27.73 m

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	**0**	**0**	**0**	**1**	**4**	**0**	**0**	**0**	**1**

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Sydneywide Environmental Services
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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**2**	**6 LEFT**

Photo: 075845_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:07
13.87m, Infiltration, sweating , from 12 to 12 o'clock

Photo: 075851_18022022_B.JPG, Media No:: LTS LOCKLEY,_0, 00:01:07
13.87m, Infiltration, sweating , from 12 to 12 o'clock

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**2**	**6 LEFT**

Photo: 075920_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:37
18.16m, Infiltration, sweating , from 6 to 12 o'clock

Photo: 080015_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:02:21
27.73m, Infiltration, sweating , from 12 to 6 o'clock

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Sydneywide Environmental Services
40 edward st
Riverstone
Tel: 0417924993

Email: sydwide@bigpond.com

WSA assessment / Inspection: 1

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**3**	**5 RIGHT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**WSA 05-2008 2.2**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**5**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**downstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**6**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**46.75 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:375 Position	Observation
5	
0.60	Start node, grated inlet pit, Nodename: 5
0.60	Water level, clear flow (the invert is visible), depth 5%
15.34	UNMARKED PIT. (5.1)
20.67	Infiltration, sweating , at 12 o'clock
26.85	Infiltration, sweating , from 7 to 10 o'clock
31.09	Infiltration, sweating , from 1 to 6 o'clock
46.75	Finish node, maintenance hole, Nodename: 6
6	

15.34 m

26.85 m

31.09 m

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	**0**	**0**	**0**	**1**	**3**	**0**	**0**	**0**	**1**

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Sydneywide Environmental Services
40 edward st
Riverstone
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Email: sydwide@bigpond.com

Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**3**	**5 RIGHT**

Photo: 081416_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:12
15.34m, UNMARKED PIT. (5.1) / UNMARKED PIT. (5.1)

Photo: 081521_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:58
26.85m, Infiltration, sweating , from 7 to 10 o'clock

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**3**	**5 RIGHT**

Photo: 081554_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:02:21
31.09m, Infiltration, sweating , from 1 to 6 o'clock

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022

Sydneywide Environmental Services
40 edward st
Riverstone
Tel: 0417924993

Email: sydwide@bigpond.com

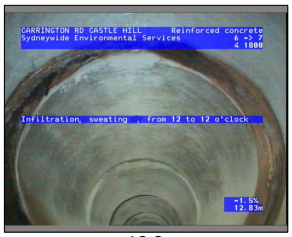
WSA assessment / Inspection: 1

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**4**	**6 RIGHT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**WSA 05-2008 2.2**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**6**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**downstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**7**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**40.21 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:330 Position	Observation	
6		
0.61	Start node, grated inlet pit, Nodename: 6	
0.61	Water level, clear flow (the invert is visible), depth 5%	
6.41	Infiltration, sweating , from 7 to 9 o'clock	 6.41 m
12.80	Infiltration, sweating , from 12 to 12 o'clock	 12.8 m
17.06	Infiltration, sweating , from 12 to 12 o'clock	
19.77	Infiltration, sweating , from 12 to 12 o'clock	 17.06 m
23.96	Circumferential fracture , width 2mm , from 7 to 10 o'clock	
25.99	Infiltration, sweating , from 12 to 12 o'clock	 19.77 m
27.66	Infiltration, sweating , from 12 to 12 o'clock	
40.21	Finish node, outfall or culvert headwall, Nodename: 7	 23.96 m
7		

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
1	**8**	**0.2**	**8**	**2**	**6**	**0**	**0**	**0**	**1**

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Sydneywide Environmental Services
40 edward st
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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**4**	**6 RIGHT**

Photo: 081936_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:00:39
6.41m, Infiltration, sweating , from 7 to 9 o'clock

Photo: 082006_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:06
12.8m, Infiltration, sweating , from 12 to 12 o'clock

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**4**	**6 RIGHT**

Photo: 082026_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:24
17.06m, Infiltration, sweating , from 12 to 12 o'clock

Photo: 082041_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:35
19.77m, Infiltration, sweating , from 12 to 12 o'clock

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**4**	**6 RIGHT**

Photo: 082125_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:02:03
23.96m, Circumferential fracture , width 2mm , from 7 to 10 o'clock

Photo: 082506_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:02:25
25.99m, Infiltration, sweating , from 12 to 12 o'clock

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**4**	**6 RIGHT**

Photo: 082521_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:02:38
27.66m, Infiltration, sweating , from 12 to 12 o'clock

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WSA assessment / Inspection: 1

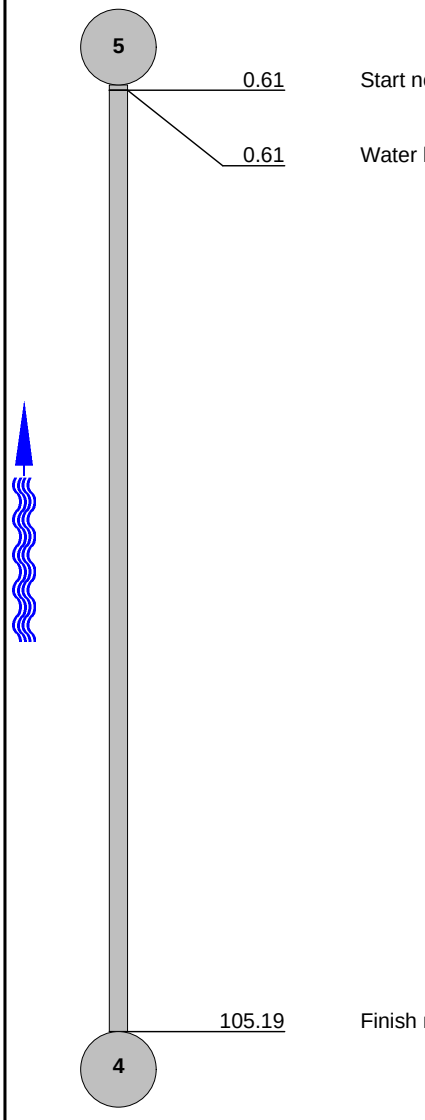
Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**5**	**4 RIGHT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**WSA 05-2008 2.2**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**4**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**upstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**5**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**105.19 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:840	Position	Observation
	0.61	Start node, maintenance hole, Nodename: 4
	0.61	Water level, clear flow (the invert is visible), depth 5%
	105.19	Finish node, Nodename: 5, CLOSED PIT



STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

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WSA assessment / Inspection: 1

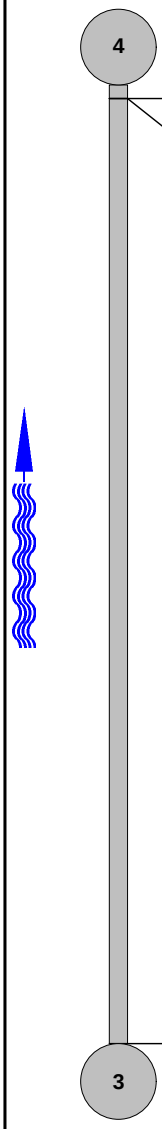
Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**6**	**3 RIGHT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**WSA 05-2008 2.2**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**3**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**upstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**4**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**41.83 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:330	Position	Observation
	0.60	Start node, Nodename: 3, CLOSED PIT ```
	0.60	Water level, clear flow (the invert is visible), depth 5%
	41.83	Finish node, grated inlet pit, Nodename: 4



STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

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WSA assessment / Inspection: 1

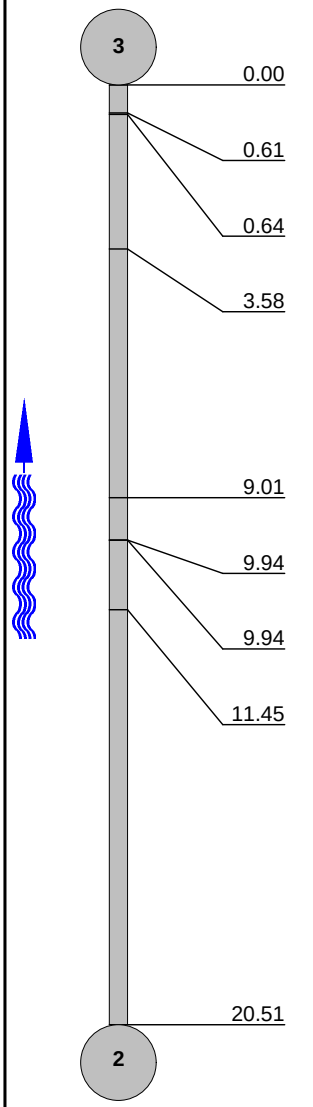
Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**7**	**2 RIGHT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**%**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**2**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**upstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**3**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**20.51 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:165 **Position** **Observation**



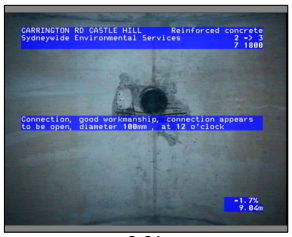
0.00

0.61 Start node, grated inlet pit, Nodename: 2

0.64 Water level, clear flow (the invert is visible), depth 5%

3.58 Connection, good workmanship, connection appears to be open, diameter 50mm, width 50mm, at 9 o'clock

3.58 m



9.01 m

9.01 Connection, good workmanship, connection appears to be open, diameter 100mm , at 12 o'clock

9.94 Connection, good workmanship, connection appears to be open, diameter 100mm , at 12 o'clock

9.94 REO IS COVERING OPENING OF THE CONNECTION

11.45 Connection, good workmanship, connection appears to be open, diameter 100mm , at 12 o'clock

20.51 Finish node, grated inlet pit, Nodename: 3

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**7**	**2 RIGHT**

Photo: 085944_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:00:25
3.58m, Connection, good workmanship, connection appears to be open, diameter 50mm, width 50mm, at 9 o'clock

Photo: 090020_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:00:53
9.01m, Connection, good workmanship, connection appears to be open, diameter 100mm , at 12 o'clock

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WSA assessment / Inspection: 1

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**8**	**1 RIGHT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**WSA 05-2008 2.2**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**1**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**upstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**2**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**5.09 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:50	Position	Observation
	0.60	Start node, grated inlet pit, Nodename: 2
	0.60	Water level, clear flow (the invert is visible), depth 5%
	5.09	Finish node, Nodename: 1, CLOSED PIT

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

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WSA assessment / Inspection: 1

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**9**	**4 LEFT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**WSA 05-2008 2.2**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**4**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**upstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**5**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**104.89 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:840	Position	Observation
5		
	0.60	Water level, clear flow (the invert is visible)
	19.18	Infiltration, sweating , from 2 to 5 o'clock
	40.01	Connection, good workmanship, connection appears to be open, diameter 300mm , at 2 o'clock
	40.01	Infiltration, sweating , at 2 o'clock
	59.96	APPEARS TO BE LARGE INSPECTION HOLE
	104.89	Finish node, maintenance hole, Nodename: 4
4		

19.18 m

40.01 m

40.01 m

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	**0**	**0**	**0**	**1**	**2**	**0**	**0**	**0**	**1**

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**9**	**4 LEFT**

Photo: 093357_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:00:58
19.18m, Infiltration, sweating , from 2 to 5 o'clock

Photo: 093503_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:58
40.01m, Connection, good workmanship, connection appears to be open, diameter 300mm , at 2 o'clock

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**9**	**4 LEFT**

Photo: 093513_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:02:02
40.01m, Infiltration, sweating , at 2 o'clock

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WSA assessment / Inspection: 1

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**10**	**3 LEFT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**WSA 05-2008 2.2**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**3**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**downstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**4**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**36.44 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:300	Position	Observation
3		
	0.60	Start node, grated inlet pit, Nodename: 3
	0.60	Water level, clear flow (the invert is visible), depth 0%
	36.44	Finish node, maintenance hole, Nodename: 4
4		

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

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WSA assessment / Inspection: 1

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**11**	**2 LEFT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**%**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**2**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**upstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**3**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**33.71 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:270 Position	Observation	
3		
0.60	Start node, grated inlet pit, Nodename: 3	
0.60	Water level, clear flow (the invert is visible), depth 5%	
4.30	Connection, good workmanship, connection appears to be open, diameter 100mm , at 2 o'clock	 4.3 m
4.30	Infiltration, sweating , at 2 o'clock	 4.3 m
7.01	Connection, good workmanship, connection appears to be open, diameter 225mm , at 3 o'clock	
7.01	Pieces of aggregate have been removed , at 1 o'clock	 7.01 m
11.49	Breaking, some pieces are missing , length of break 200 , from 8 to 9 o'clock	 7.01 m
11.50	Connection, good workmanship, connection appears to be open, diameter 50mm , at 3 o'clock	
24.00	Connection, good workmanship, connection appears to be open, diameter 1050mm , at 3 o'clock	
31.29	Connection, good workmanship, connection appears to be open, diameter 100mm , at 10 o'clock	 11.49 m
33.71	Finish node, grated inlet pit, Nodename: 2	
2		

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
2	**60**	**2.97**	**100**	**5**	**1**	**0**	**0**	**0**	**1**

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**11**	**2 LEFT**

Photo: 094745_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:00:38
4.3m, Connection, good workmanship, connection appears to be open, diameter 100mm , at 2 o'clock

Photo: 094754_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:00:42
4.3m, Infiltration, sweating , at 2 o'clock

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**11**	**2 LEFT**

Photo: 094830_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:05
7.01m, Connection, good workmanship, connection appears to be open, diameter 225mm , at 3 o'clock

Photo: 094859_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:15
7.01m, Pieces of aggregate have been removed , at 1 o'clock

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**11**	**2 LEFT**

Photo: 094946_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:01:50
11.49m, Breaking, some pieces are missing , length of break 200 , from 8 to 9 o'clock

Photo: 095021_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:02:07
11.5m, Connection, good workmanship, connection appears to be open, diameter 50mm , at 3 o'clock

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Inspection Pictures / Inspection: 1

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
CARRINGTON RD		**18/02/2022**	**11**	**2 LEFT**

Photo: 095129_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:03:11
24m, Connection, good workmanship, connection appears to be open, diameter 1050mm , at 3 o'clock

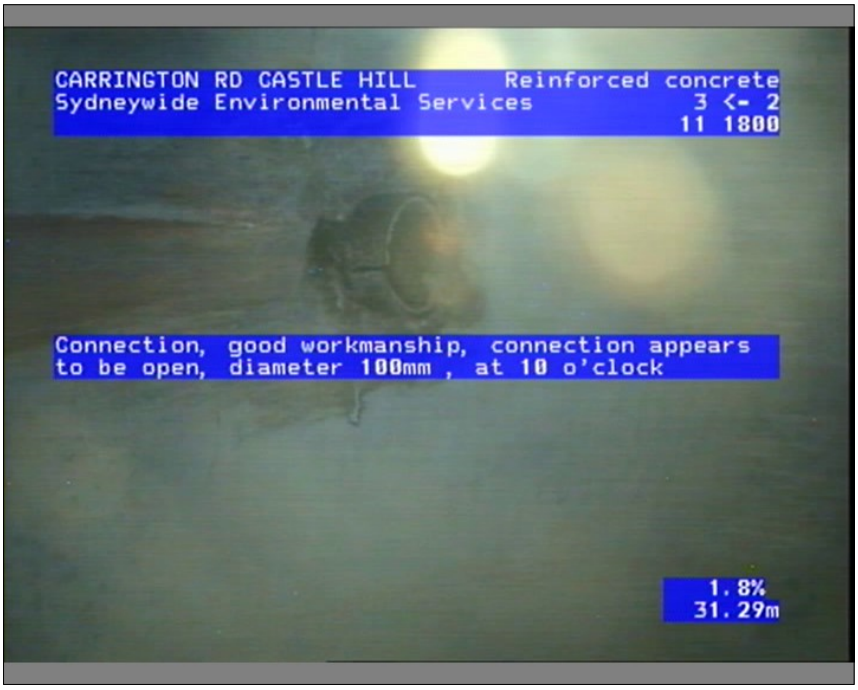

Photo: 095214_18022022_A.JPG, Media No:: LTS LOCKLEY,_0, 00:03:49
31.29m, Connection, good workmanship, connection appears to be open, diameter 100mm , at 10 o'clock

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WSA assessment / Inspection: 1

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
18/02/2022		**LTS LOCKLEY**	**CRAIG PICKUP 1**	**12**	**1 LEFT**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
07:33:56	**not cleaned**	**WSA 05-2008 2.2**	**Pipeline inside Start Nod**		**Television Camera**

Town:		Catchment:		US MH:	**1**
Suburb:	**CASTLE HILL**	Asset Owner:	**LTS LOCKLEY**	Survey Dir:	**upstream**
Street:	**CARRINGTON RD**	Weather.:	**Dry**	DS MH:	**2**
Asset Location	**Light road**	Flow control		Inspect Lenght :	**9.96 m**

Purpose of inspection :	**Routine Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Stormwater drain**	Width:	
		Pipe Material:	**Reinforced concrete**

Remarks :

1:90	Position	Observation
	0.60	Start node, grated inlet pit, Nodename: 2
	0.60	Water level, clear flow (the invert is visible), depth 5%
	9.96	Finish node, Nodename: 1, END OF WORKS

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

Document Set ID: 20266482
Version: 1, Version Date: 11/08/2022