NSW Health Infrastructure

Children's Hospital Westmead Multistorey Car Park

Flood Impact Assessment

CHW-ARP-CV-RP-MP-91-XX013

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Job number 271985

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Abbreviations

1D	One-dimensional
2D	Two-dimensional
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AR&R	Australian Rainfall & Runoff
ARI	Average Recurrence Interval
BoM	Bureau of Meteorology
CASB	Central Acute Services Building
CHW	Children's Hospital Westmead
CoPC	City of Parramatta Council
CMRI	Children's Medical Research Institute
DCP	Development Control Plan
DTM	Digital Terrain Model
DEM	Digital Elevation Model
FDM	Floodplain Development Manual
FFL	Finished Floor Level
FPL	Flood Planning Level
HAC	Health Administration Corporation
HI	NSW Health Infrastructure
HPC	Heavy Parallelised Computing
IFD	Intensity-Frequency-Duration
LEP	Local Environmental Plan
LGA	Local Government Area
LHD	Local Health District
LiDAR	Light Detection and Ranging
m AHD	metres Australian Height Datum (AHD)
m/s	metres per second. Unit used to describe the velocity of floodwater
m^3/s	Cubic metres per second. Unit measurement of river flows

MSCP	Multi Storey Car Park
OSD	On Site Detention
PLR	Parramatta Light Rail
PSB	Paediatric Services Building
PMF	Probable Maximum Flood
RMH	Ronald McDonald House
SCHN	Sydney Children's Hospitals Network
SES	State Emergency Service
SGS	Sub-Grid Sampling
SSDA	State Significant Development Application
WSLHD	Western Sydney Local Health District

Reliance Statement

The sole purpose of this report, flood models and the associated services performed by Arup is to undertake the assessment of flood risk to the Multistorey Car Park development in compliance with, and adherence to, applicable planning controls including the Secretary's Environmental Assessment Requirements (SEARS).This work was carried out in accordance with the scope of services set out in the contract (HI9361CIV) between Arup and Health Infrastructure (HI).

In preparing this report and associated flood models, Arup has relied upon, and assumed to be accurate, information (or confirmation of the absence thereof) provided by HI and from other sources, such as City of Parramatta Council (CoPC). Except as otherwise stated in the report, Arup has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Arup derived the data used in this study from information sourced from HI and the public domain at the time or times outlined in the report. The assumptions and limitations associated with the data are:

- The currency, reliability and accuracy of the datasets as well as suitability for their intended use are documented in the accompanying metadata, reports or drawings; and
- It is assumed that care and due diligence have been observed by the source agencies in developing the datasets in accordance with the relevant standards.

Any changes or impacts to the catchment and its associated environment following the issue of this report and model may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report.

Arup has prepared this report and associated flood models in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and with reference to applicable standards, guidelines, procedures and practices at the date of issue of this report and flood model. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made with regards to the data, observations and findings expressed in the report, to the extent permitted by law.

All flood models, whether numerical, analytical or physical, rely on a set of assumptions and requirements to accurately simulate the flow conditions. As no model will provide an exact representation of the complexity of the actual flow, it is important to understand these assumptions, as they form the limitations of that method. Ignoring or violating these assumptions and limitations or failing to critically analyse the model will produce inaccurate results.

No responsibility is accepted by Arup for use of any part of this report in any other context. This modelling data has been prepared on behalf of, and for the exclusive use of HI, and is subject to, and issued in accordance with, the provisions of the contract between Arup and HI. Arup accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

1 Executive Summary

Arup have been commissioned by NSW Health Infrastructure (HI) to undertake a Flood Impact Assessment for the proposed design of the Multistorey Car Park (MSCP) as part of the Children's Hospital Westmead (CHW) Stage 2 redevelopment works. This Flood Impact Assessment describes the pre- and post-development flooding conditions and presents the proposed flood risk management strategy while demonstrating compliance to the Secretary's Environmental Assessment Requirements (SEARs) for the development.

A hydraulic model was developed using TUFLOW modelling software to assess the proposed development for the 10% AEP, 1% AEP, 0.5% AEP, 0.2% AEP and Probable Maximum Flood (PMF) storm events. This has been undertaken by developing a site specific flood model using work previously completed for Central Acute Services Building (CASB) and for Parramatta Light Rail (PLR). This assessment considers potential flood impact from both riverine flooding (i.e. from Toongabbie Creek and Upper Parramatta River) and overland flow flooding within the extents of the Westmead Health Precinct.

Analysis of the MSCP pre-development conditions reveal site flooding conditions consisting of both overland and river flooding around Redbank Road, Labyrinth Way and the Lodge (old Ronald McDonald House; RMH) and predominantly overland flows for the northern areas of the existing CHW building/south of the MSCP development.

Analysis of the post-development conditions reveals site flooding conditions will experience afflux for both the overland and river events around the development site, including the northern areas of the CHW building. The afflux for the flood events (with the exception of the PMF river event) are generally localised impacts limited to within the extents of the Westmead Health Precinct. For the PMF extreme river event with an estimated probability of 1 in 10 million, afflux extends outside of the site extents. However, these impacts are generally in areas where significant flood depths already occur under existing conditions, and they constitute a 2% (or less) increase in flood depth.

Our proposed approach to flood risk management for the site is as follows:

- The lowest floor levels of the car park are higher than the expected 1% AEP plus 0.5 m freeboard across the site. In addition, vehicle and pedestrian entryways into the building from the external ground level will be managed by internal ramping/stairs to mitigate water ingress into the car park levels of the building;
- A flood emergency management strategy will be further developed in consultation with the Sydney Children's Hospital Network (SCHN); and
- Further design development and operational management of critical servicing infrastructure (i.e. electrical) will be undertaken in detailed design stages of the project to ensure adequate operation of hospital services in the event of a flood.

As sensitivity analysis, the 0.5% AEP and 0.2% AEP events have been modelled as proxy for the climate change scenarios compared to the 1% AEP event. It was found that the rainfall increase did not significantly increase overland flows, however the riverine events experience increased flooding particularly for Redbank Road and Labyrinth Way. A full pipe blockage scenario has also been modelled which saw significant increase in peak flood levels for trapped low points such as the northern area of the CHW and existing CHW loading dock. Nevertheless, the post-development afflux for this scenario generally remains similar for most areas driven by surface runoff. The MSCP entryways are still above the 1% AEP level plus 0.5 m freeboard under the full pipe blockage scenario.

A hydraulic assessment was also undertaken to confirm a direct stormwater connection from the MSCP development into the existing stormwater network as the stormwater strategy, without the need for on-site detention. The assessment demonstrated that this approach enables the discharge of site flows to Toongabbie Creek prior to the peak river flood event. In addition, discharging the development site flows in this manner would not have significant impacts to the downstream stormwater networks.

We have reviewed several flood event scenarios as required under the SEARs and consider that the outcomes are adequate for the development and do not significantly impact the flood conditions of the surrounding developments and areas. The proposed PMF river event illustrates impacts within the development site and surrounding areas. However, it is assessed to be of low risk provided the improbability of the event, the low degree of afflux and the fact that these areas are already flooded.

The flood emergency management strategy shall be developed in consultation with the Sydney Children's Hospital Networks (SCHN) and the relevant authorities while coordinating with existing strategies in place. Based on the site conditions, a shelter-in-place strategy would be recommended. In addition, critical infrastructure shall be designed to be protected or managed as to not disrupt building services in the event of a flood.

The next steps and further work required include:

- Further detailed design of the MSCP development;
- Updated flood modelling to demonstrate impact of MSCP as design progresses; and
- Consultation with SCHN on developing the site specific flood emergency management plan and coordination with the wider Westmead Health Precinct emergency management plan.

2 Project Introduction

2.1 Purpose of Report

This purpose of this report is to document the Flood Impact Assessment and demonstrate compliance with the SEARs for the proposed MSCP development as part of the CHW Stage 2 project.

2.2 Overview of Proposed Development

The MSCP project consists of a new multi-deck car park located on the site of the old Ronald McDonald House to the north of the campus. The proposed site is bounded by Labyrinth Way to the north and east and Redbank Road to the west. South of the site is the existing Children's Hospital at Westmead (CHW) building.

A locality plan showing the location of the proposed MSCP development is indicated in Figure 1.

Figure 1- MSCP Locality Plan (NSW Six Maps, 2020)

The proposed development under this SSDA is a Multi Storey Car Park (MSCP) accommodating both staff and visitor car parking to be located on Labyrinth Way, on the site of the old Ronald McDonald House (The Lodge).

The scope of proposed works includes:

- Demolition of The Lodge;
- Construction of a new MSCP with approximately 8 car parking storeys, which is equivalent to the height of 5 storeys of the hospital:
    - Facilitating car parking spaces for staff and visitors;
    - Vehicular access from Labyrinth Way and / or Redbank Road; and
    - A split-level approach to the MSCP to respond to the natural ground level.
- Ancillary retail facilities;
- Road works:
    - Realignment of Redbank Road with vehicular access connection to MSCP;
- Tree removal; and
- Associated landscape works.

The MSCP is being designed to be constructed in a single stage yet car parking will be staged operationally to come on-line with parking demand across the Precinct:

- The first stage of car parking operation would provide replacement car parking for the demolished P17 car park. There would be no net increase of parking on site under this stage.
- The second stage of car parking operation to serve the growth in hospital activity associated with the future PSB (subject to a separate SSDA) would only come on-line operationally with the PSB SSDA consent becoming operational, specifically at occupation. This would provide growth of around 280 additional spaces in line with hospital activity projections until 2031.

3 Assessment Requirements

3.1 Secretary's Environmental Assessment Requirements (SEARs)

The Department of Planning, Industry and Environment has issued Secretary's Environmental Assessment Requirements (SEARs) for the proposed development under the application number SSD-10434896. This report has been prepared with consideration given to the SEARs as follows:

Table 1 - SEARs for flooding and stormwater drainage

SEAR	Where Addressed

16. Stormwater Drainage
• Provide:
  • a preliminary stormwater management plan for the development that:
  • is prepared by a suitably qualified person in consultation with Council and any other relevant drainage authority.
  • details the proposed drainage design for the site including on-site detention facilities, water quality measures and the nominated discharge point.
  • demonstrates compliance with Council or other drainage authority requirements.
  • stormwater plans detailing the proposed methods of drainage without impacting on the downstream properties
• Where drainage infrastructure works are required that would be handed over to Council, provide full hydraulic details and detailed plans and specifications of proposed works that have been prepared in consultation with Council and comply with Council's relevant standards.
	Section 7.1.1 and Appendix B
	There are no drainage infrastructure works that are required to be handed over to CoPC.

17. Flooding • Identify any flood risk on-site in consultation with Council and having regard to the most recent flood studies for the project area and the potential effects of climate change, sea level rise and an increase in rainfall intensity. • Assess the impacts of the development, including any changes to flood risk on-site or off-site, the 1 in 10 year, 1 in 100 year flood levels and the probable maximum flood, or an equivalent extreme event and detail design solutions to mitigate flood risk where required. • Include details of the developments flood risk emergency management, contingency measures, evacuation and access arrangements.	Sections 6.2 and 7 Section 7 Section 7.7

3.2 City of Parramatta Council

The development site is situated within the City of Parramatta Council (CoPC) Local Government Area (LGA). From both historical experience and the predictions of current flood studies, Parramatta is an area known to be at risk of flooding, principally as a function of Toongabbie Creek and Parramatta River.

CoPC provided a response to the SEARs and, as a consequence of the known flood risks, they indicated they will review this flood impact assessment and the overall project in detail during the EIS stage of this SSDA.

The flood assessment and stormwater strategy were presented in a meeting with CoPC and HI on 1 February, 2021. CoPC was generally in support of the strategy and outcomes presented. Refer to Appendix D for the meeting minutes and presentation slides.

4 Flood Model Development

The following sections provide an overview of the Westmead Health Precinct model development.

The primary focus of the model is to determine the existing flood conditions for both riverine and overland flow flooding around the MSCP site, and the subsequent impact (if any) around the development. Additionally, the model informs on the hydraulic assessment of the stormwater infrastructure and on the proposed stormwater management strategy.

4.1 Input Information for Model

The 1D/2D TUFLOW flood model was built using information collated from various sources including works previously undertaken in the Westmead Health Precinct, adjacent works (by others) and recent information. Having collated and assessed all of the information available, where multiple sources exist, the information which was considered to be of the highest level of accuracy / reliability was used in constructing the model. The input information for the model is as follows:

- City of Parramatta Council flood map (dated 11/05/2016) and Parramatta River MIKE11 model;
- CASB flood report and model (by Arup; ref: CASB-ARP-CV-RT-0004; dated 22 June 2016);
- PLR Hawkesbury Road works flood model, survey, as-built and other relevant design documentation (dated 2019);
- PLR North Parramatta TUFLOW model
- LTS survey of CHW (ref: 32572 088DT; rev: E; Dated 18/12/2020); and
- Online Pipe CCTV of existing stormwater assets at CHW and Redbank Road (Dated January 2021).

4.2 Modelling Assumptions and Limitations

The following are assumptions and limitations pertaining to the flood modelling approach adopted:

- Australian Rainfall & Runoff 87 (AR&R87) approach has been adopted, which is consistent with previous flood modelling undertaken for CASB and PLR, as well as the CoPC flood results used for model validation. It is understood that CoPC is currently preparing a new Parramatta River flood study based on the recently published AR&R2019 guidelines, though experience from adjacent catchments, i.e. Parramatta CBD, indicated that the AR&R87 approach yields more conservative flood estimates;
- All buildings in the hydraulic model are represented as blockages, meaning that stormwater cannot flow through these areas. This provides a more

conservative representation of the velocities and depths of overland flows which may occur across the site;

- A range of storm durations has been modelled from 10 minutes to 12 hours and the critical storm durations within the extents of the Westmead Health Precinct are as follows:

Table 2: Critical storm duration (minute) applicable to MSCP site

Event Return Period	**Critical Storm Duration (Overland Flow Flooding)**	**Critical Storm Duration (Riverine Flooding)**
10% AEP, 1% AEP	15, 25, 90, 120	540
0.5% AEP, 0.2% AEP	15, 30	540
PMF	15, 30, 60	180

- For the majority of the hydraulic model extents, stormwater run-off is applied as "rainfall on grid" (i.e. applied directly to the digital terrain model). Where a direct building connection to the underground stormwater systems are identified, a DRAINS hydrologic model was established to generate the runoff hydrograph for the building roof catchment for direct application to the pipes;
- Coincidental riverine and overland flow flooding have been assumed which is a conservative approach, i.e. 1% AEP local rainfall occurring at the same time as a 1% AEP tailwater condition at Toongabbie Creek and Parramatta River;
- River inflow/tailwater boundary conditions have been derived from the CoPC Parramatta River MIKE11 model and the PLR North Parramatta TUFLOW model;
- Majority of the model setup and assumptions including those related to the grid size (i.e. 2 m for the Digital Elevation Model), model extent, initial water level, Toongabbie Creek/Parramatta River bathymetry, bridge form loss coefficients and levels, surface roughness, initial and continuing losses have been reviewed and retained from the PLR flood model;
- Model assumes blockage factors for pits, i.e. 20% for on-grade pits and 50% for sag pits. A sensitivity test has also been undertaken assessing a full pipe blockage scenario of the stormwater networks to determine the worst-case scenario for flood risk;
- Existing OSD storage tanks/basins incorporated do not simulate orifice control devices as TUFLOW software is not appropriate for this purpose;
- Details of the CHW Ronald McDonald House (RMH) detention basin are unknown. Any throttling, orifice control and surcharge of this basin is assumed to be due to the 750mm outlet being a throttle;
- It is assumed that the existing and proposed bridges crossing Toongabbie Creek and Parramatta River are able to withstand all flood events including the PMF; and

- The entrance threshold levels of all buildings across the Westmead Precinct are not known, and it is not the intention of this MSCP impact assessment to report on these.

TUFLOW version 2020-10-AA Single Precision with HPC (Heavy Parallelised Computing) and SGS (Sub-Grid Sampling) capabilities has been used for the flood modelling herein. Validation of the flood modelling results to ascertain the model suitability for use in the assessment is discussed in Section 6.2.

5 Pre-development Site Conditions

The following sections describe the site layout and stormwater network for the pre-development site conditions.
Refer to Appendix A Figure M.S.1 for the flood model set up plan showing the information used for the Westmead Health Precinct.

5.1 Site Layout

The northwest edge of the site is bounded by Redbank Road and a bridge while Labyrinth Way borders the north and east perimeter of the site. Both roads are two-lanes and north of these roads is Toongabbie Creek.

Adjacent developments include the new Ronald McDonald House in the northeast, Cumberland Hospital in the southeast and the CHW building to the south.

The existing site contains an on-grade car park (which is also an access to the adjacent CHW building), the existing Lodge (old Ronald McDonald House) and various landscape elements including childrens playgrounds.

The site general falls from the south to the north toward Toongabbie Creek. The lowest area of the site is at a localised low point north of the site on Labyrinth Way.

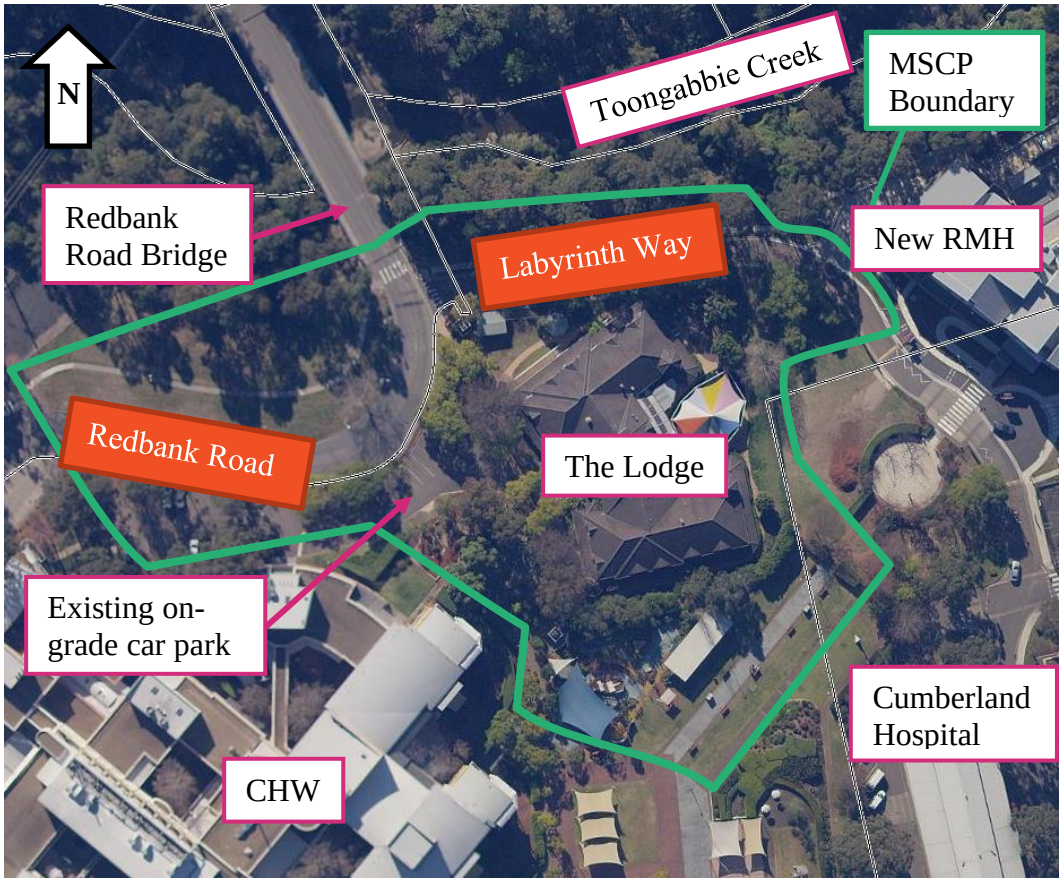


Figure 2 – Existing MSCP site plan

5.2 Stormwater

Within the MSCP development site there is existing stormwater infrastructure in the form of an extensive pit and pipe network which serves the Children's Hospital, the Lodge (old Ronald McDonald House) and the public domain areas in between the two buildings. Surface water (runoff) is collected by inlet pits which convey flows into in-ground drainage pipes. Similarly, gutters and downpipes convey roof water runoff into the in-ground drainage networks.

There are two large stormwater trunk lines within the MSCP development site as shown in Figure 3. The pink stormwater trunk line with its associated easement is owned by Health Administration Corporation (HAC) while the orange stormwater trunk line is owned by CoPC. It is estimated that the majority of the existing Lodge site drains into the pink stormwater trunk line.

The first stormwater trunk line (pink) crosses underneath the CHW (∅1200). Upon clearing the eastern side of the CHW, the pipe bends in a southeast direction (∅1200) before bending again to continue in a north-easterly direction towards the new Ronald McDonald House (∅1500) and reducing in size before discharging to Parramatta River. The reduction in pipe size causes the line to surcharge via specially designed surcharge pits. Water which surcharges from this line is detained in an above ground basin. It is estimated that this basin provides approximately 3,500 m³ of storage capacity. Due to the size of this detention

basin, it is assumed that the basin has been sized for multiple areas within the Westmead Health Precinct.

The second stormwater trunk line (orange) runs along the eastern side of the existing RMH building. The pipe is estimated to be ∅825 in size. After the pipe crosses Labyrinth Way, the pipe discharges into Toongabbie Creek.

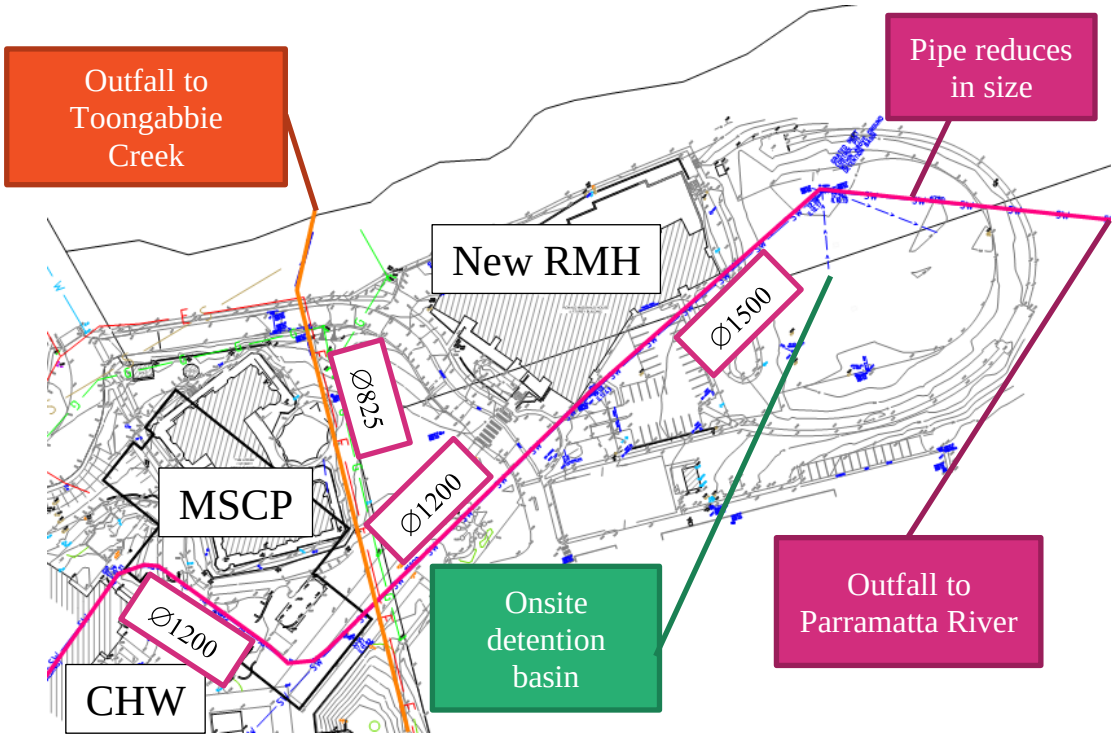


Figure 3 - Existing Stormwater Infrastructure

6 Pre-Development Flooding Conditions

The following sections describe the pre-development flooding conditions. Refer to Appendix A for the existing case flood results maps.

The MSCP site is impacted by both riverine and overland flood events.

Referring to Figure 4, overland flow flooding around the MSCP site is caused by the following:

- Local catchment runoff including the northern CHW area;
- Redbank Road acting as an overland flow path; and
- Labyrinth Way acting as an overland flow path.

There is a trapped low point on Labyrinth way north of the MSCP site which is drained by the ∅825/∅1050 trunk stormwater main.

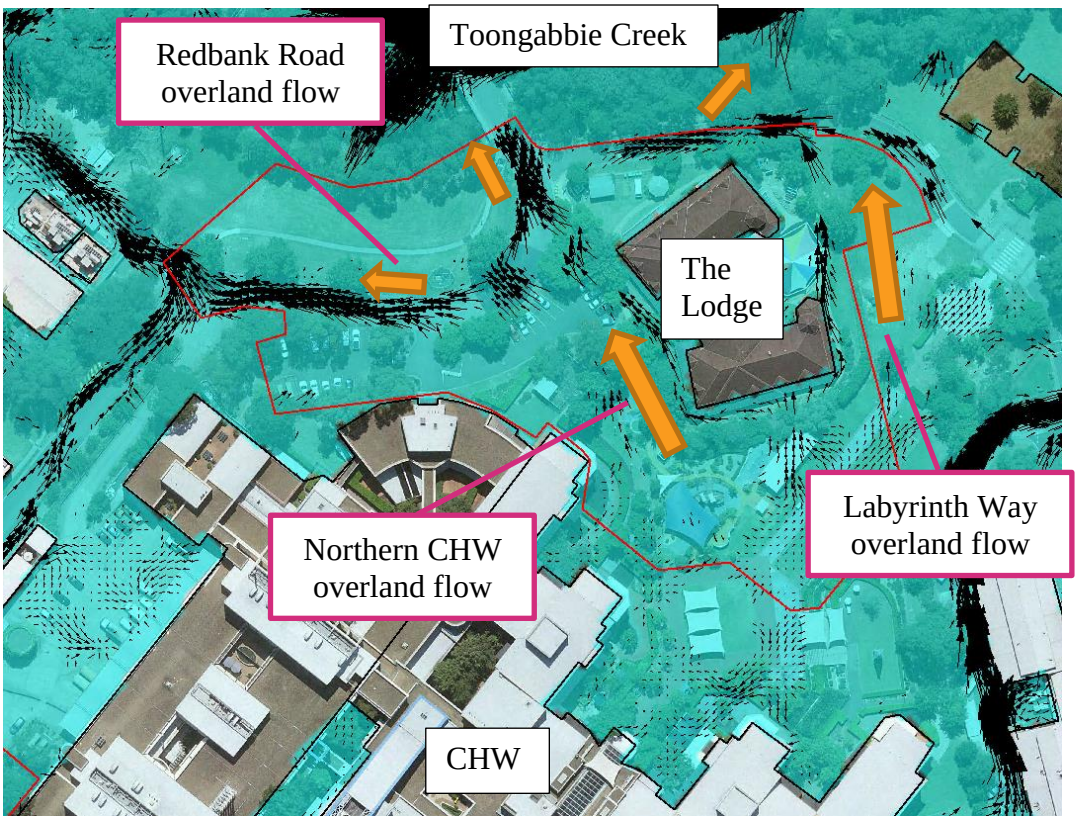


Figure 4 – Overland Flow Flooding affecting the MSCP Site

For major riverine flood events like the 1% AEP and above, the Toongabbie Creek and Parramatta riverine flows would overtop the banks and encroach onto the MSCP site. In the PMF event, the riverine floodwaters would flow around the MSCP site as well as up to the northern edges of the existing CHW building (Refer to Figure 5).

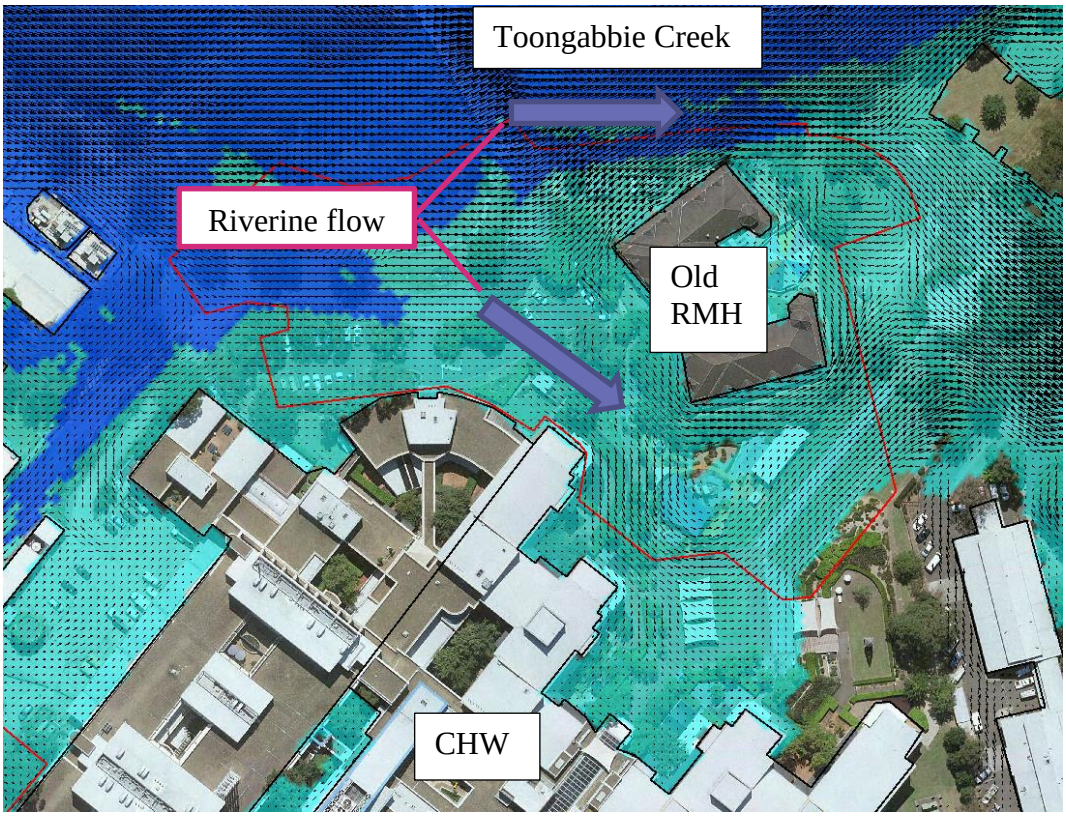


Figure 5 – Riverine Flooding affecting the MSCP Site (Dark Blue – 1% AEP flood extent, Light Blue – PMF extent)

6.1 Pre-Development Flood Modelling Results

The following sections describe the flood affectation for the site in detail for both overland flow and Toongabbie Creek riverine flooding.

6.1.1 10% AEP Event

The 10% AEP event results indicate overland flow flooding within the site as follows:

Redbank Road

- (Overland) Sheet flow in the order of 0.12 m depth or less along the road carriageway; and
- (River) Generally flood free from riverine flooding for this event.

Labyrinth Way

- (Overland) Up to 0.15 m flood depth at the trapped low point north of the Lodge; and
- (River) Generally flood free from riverine flooding for this event.

Existing On-grade Car Park

- (Overland and river) Generally flood free with minor shallow ponding spots.

Existing Lodge

- (Overland) Localised ponding of up to 0.16 m depth along the west, south and east edges of the building;
- (Overland) Up to 0.16 m ponding depth around the south and southeast landscape and children playground areas; and
- (River) Generally flood free from riverine flooding for this event.

CHW Building (North Frontage)

- (Overland) Up to 0.22 m ponding depth outside the north building entryway and external areas; and
- (River) Generally flood free from riverine flooding for this event.

6.1.2 1% AEP Existing Flood

The 1% AEP event results indicate both overland flow and river flooding within the site as follows:

Redbank Road

- (Overland) Sheet flow in the order of 0.14 m depth or less along the road carriageway; and
- (River) Riverine flows overtop the banks and encroach onto Redbank Road and the bridge abutment. Up to 0.3 m flood depth can be expected at the bridge abutment and above 0.8 m flood depth at the west side of the road.

Labyrinth Way

- (Overland) Up to 0.2 m flood depth at the trapped low point north of the Lodge building; and
- (River) Riverine flows overtop the banks and encroach onto the bridge abutment and Labyrinth Way. Flood depth in excess of 0.4 m can be expected at the trapped low point.

Existing On-grade Car Park

- (Overland and river) Generally flood free with minor shallow ponding spots.

Existing Lodge

- (Overland) Localised ponding of up to 0.18 m depth along the west, south and east edges of the building;
- (Overland) Up to 0.19 m ponding depth around the south and southeast landscape and children playground areas; and
- (River) Generally flood free from riverine flooding for this event.

CHW Building (North Frontage)

- (Overland) Up to 0.25 m ponding depth outside the north building entryway and external areas; and
- (River) Generally flood free from riverine flooding for this event.

6.1.3 PMF Event

The PMF event results indicate both overland flow and river flooding within the site as follows:

Redbank Road

- (Overland) Flow along the road stretching from the bridge abutment to the west side of the road with flood depth reaching 1.0 m; and
- (River) Riverine flows overtop the banks and flow onto Redbank Road, with flood depth in excess of 5.0 m.

Labyrinth Way

- (Overland) In excess of 0.5 m flood depth at the trapped low point north of the Lodge building; and
- (River) Riverine flows overtop the banks and flow onto Labyrinth Way, with flood depth in excess of 5.0 m.

Existing On-grade Car Park

- (Overland) Car park entrance becomes inundated with localised ponding of up to 0.04 m depth; and
- (River flooding) Riverine flows overtop the banks and flow onto the car park area, with flood depth in excess of 4.5 m at the car park entrance.

Existing Lodge

- (Overland) Localised ponding in excess of 0.3 m depth along the west, south and east edges of the building;
- (Overland) Up to 0.38 m ponding depth around the south and southeast landscape and children playground areas;
- (River) Flood depth in excess of 3.0 m flood depth surrounding existing building; and
- (River) Flood depth in excess of 1.0 m depth around the south and southeast landscape and children playground areas.

CHW Building (North Frontage)

- (Overland) Up to 0.4 m ponding depth outside the north building entryway and external areas; and
- (River) Up to 0.9 m depth near the north building entryway and external areas.

6.1.4 Pre-Development Flood Hazard

Pre-development flood hazards have been determined for the 1% AEP and PMF events, based on the hazard category recommended by the AR&R2019 guidelines. These guidelines provide a classification of six categories (H1 to H6) and the classification is shown below in Figure 6. These classifications use a combination of flood depth and flood velocity to derive a classification which defines the general vulnerabilities of associated with that hazard category.

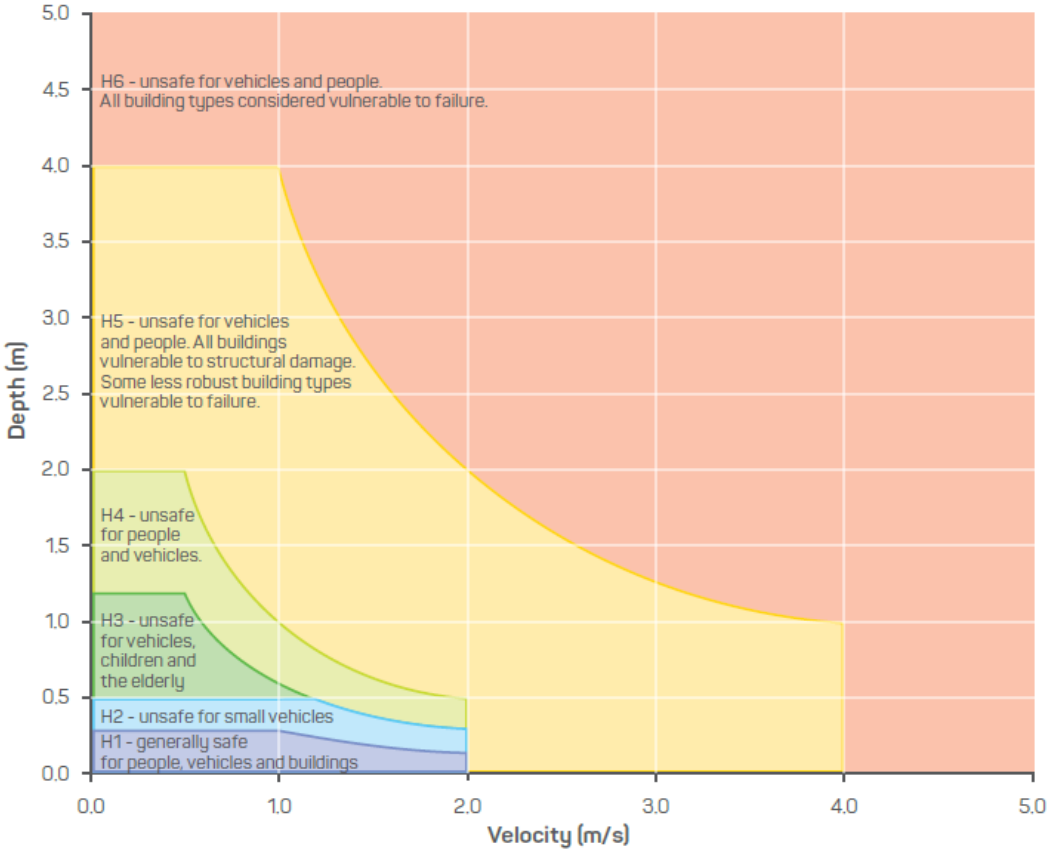


Figure 6 - Flood Hazard Categories based on AR&R2019 guidelines

Notable areas of flood hazard are as follows:

- 1% AEP events:
  - (Overland) Generally H1 hazard for the overland flow flooding for the Lodge site and its surrounds, which is safe flow conditions for people and vehicles; and
  - (River) Up to H2 hazard (i.e. unsafe for small vehicles) can be found within the 1% AEP flood extent on Labyrinth Way and H3 hazard (i.e. unsafe for vehicles, children and the elderly) for the west side of Redbank Road.
- PMF events:
  - (Overland) Generally H1 and H2 hazard for the overland flow flooding for the Lodge site and its surrounds, but up to H3 hazard at the Labyrinth Way low point and the west side of Redbank Road, which is unsafe flow

conditions for vehicles, children and the elderly. Highly localised hazard of up to H5 (i.e. unsafe for vehicles and people, and buildings vulnerable to damage) can be found on the north-west corner of the existing Lodge building; and

- (River) Generally H5 and H6 hazard for the riverine flooding around the existing Lodge building, which is flow conditions unsafe for vehicles and people, and buildings vulnerable to damage. Hazard ratings decrease to H3 for the higher grounds such as the CHW northern entryway, which is flows conditions unsafe for vehicles, children and the elderly.

6.2 CoPC Information

The peak flood levels documented in the CoPC flood map (refer to Appendix C) have been compared against peak flood levels derived from the flood modelling herein for the existing riverine flood scenario, and they are found to correlate well (Refer to Figure 7). It should be noted that the CoPC flood map is based on results from the MIKE11 Parramatta River model, which is a 1D model and does not capture recent topographical changes in the catchment.

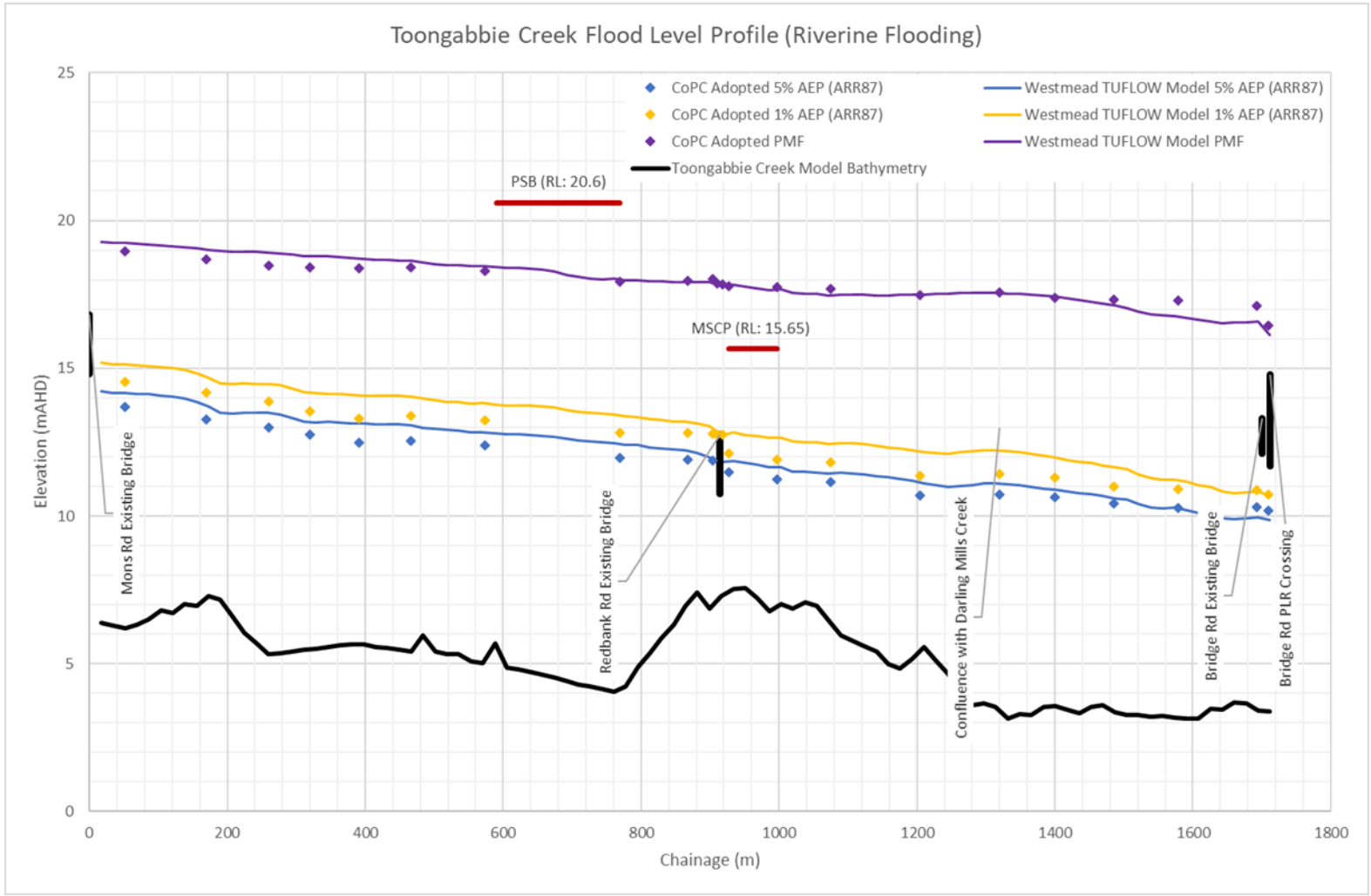
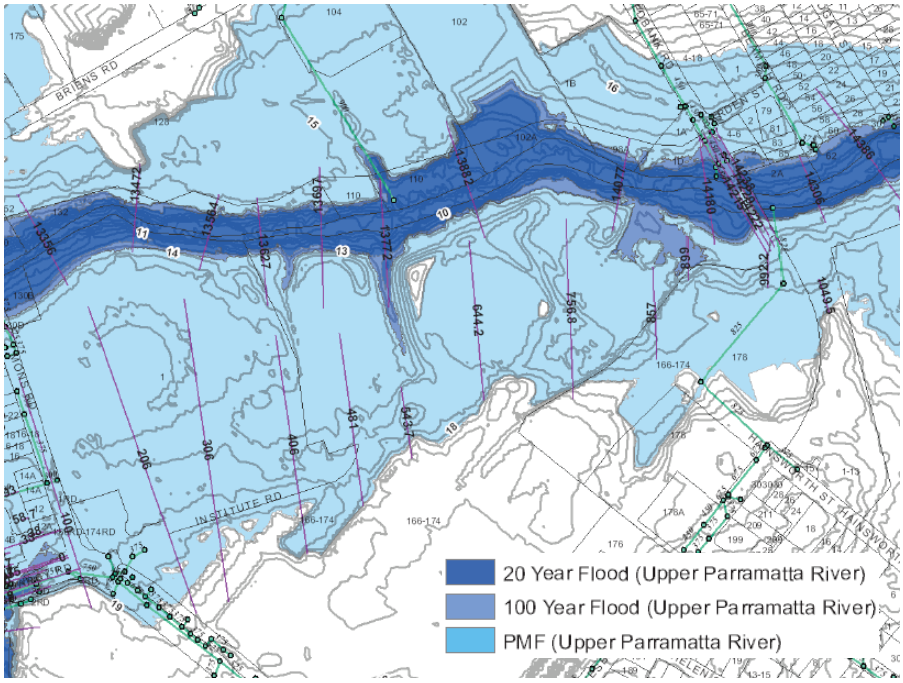


Figure 7 – Toongabbie Creek Longitudinal Profile

A comparison of the flood extents has also been undertaken and shown as Figure 8. The extents generally match up well other than for locations whereby new development has taken place.



CoPC Flood Map

Westmead TUFLOW Flood Extent (Dark Blue – 1% AEP, Light Blue – PMF)

Figure 8 – Flood Extent Comparison

CoPC also provides a publicly available flood hazard map for riverine flooding on their council website. This map indicates that the MSCP building location is in a low risk area and portions of the Redbank Road realignment are within high/medium risk areas as shown in Figure 9.

The coloured shading indicate the following flood risk:

- Yellow = low flood risk area; affected from the 1% AEP up to the PMF
- Orange = medium flood risk area; medium and low hazard up to the 1% AEP event
- Red = high flood risk area; high hazard up to the 1% AEP
- Everywhere else = not expected to experience river flooding

A low flood risk area is defined by Council to be an area which is only affected in events greater than the 1% AEP (annual exceedance probability) event.

In accordance with Council's DCP Table 2.4.2.1.2, car parks are permitted to be constructed in low flood risk areas if the development meets the condition that floor levels are "equal to or greater than the 1% AEP flood level plus freeboard". Freeboard in this context equals an additional height of 0.5 m.

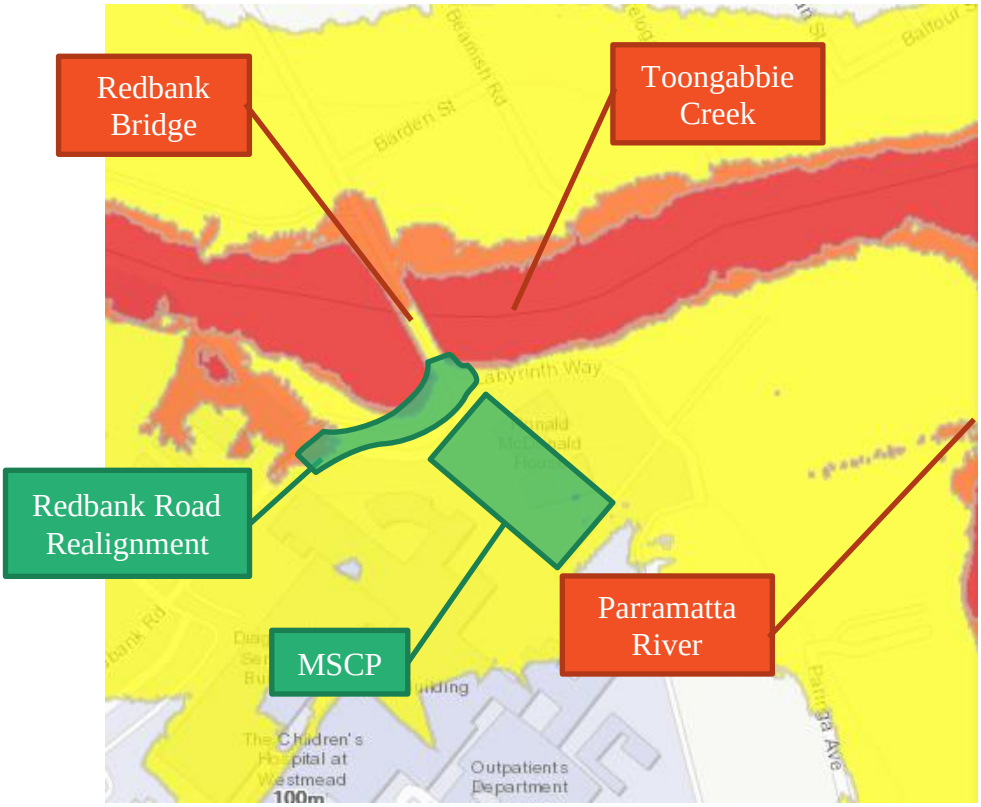


Figure 9 - City of Parramatta Council Flood Risk Mapping (information from https://www.cityofparramatta.nsw.gov.au/recreation-environment/floodsmart-parramatta/know-your-flood-risk dated 25 May 2020)

It may be noted that this CoPC flood risk map is an estimate only and may not necessarily be updated with the latest information. The flood model undertaken as

part of this flood impact assessment would be considered a higher level of accuracy for the purposes of assessing flood hazard for the MSCP site.

The development site is within the Western Sydney Local Health District (WSLHD) and SCHN land and design development is being undertaken with the relevant health authorities to manage flood risk, not only for the development but also the surrounding areas.

6.3 Notable Areas Impacted by Flooding

The following areas within the wider Westmead Health Precinct are also noted to be impacted by flooding in the pre-development conditions (refer to Figure 10):

- CHW plant rooms along KR Lane;
- Forecourt area (entry into PSB);
- CHW north entryway;
- North substation; and
- Footpath around perimeter of CHW building.

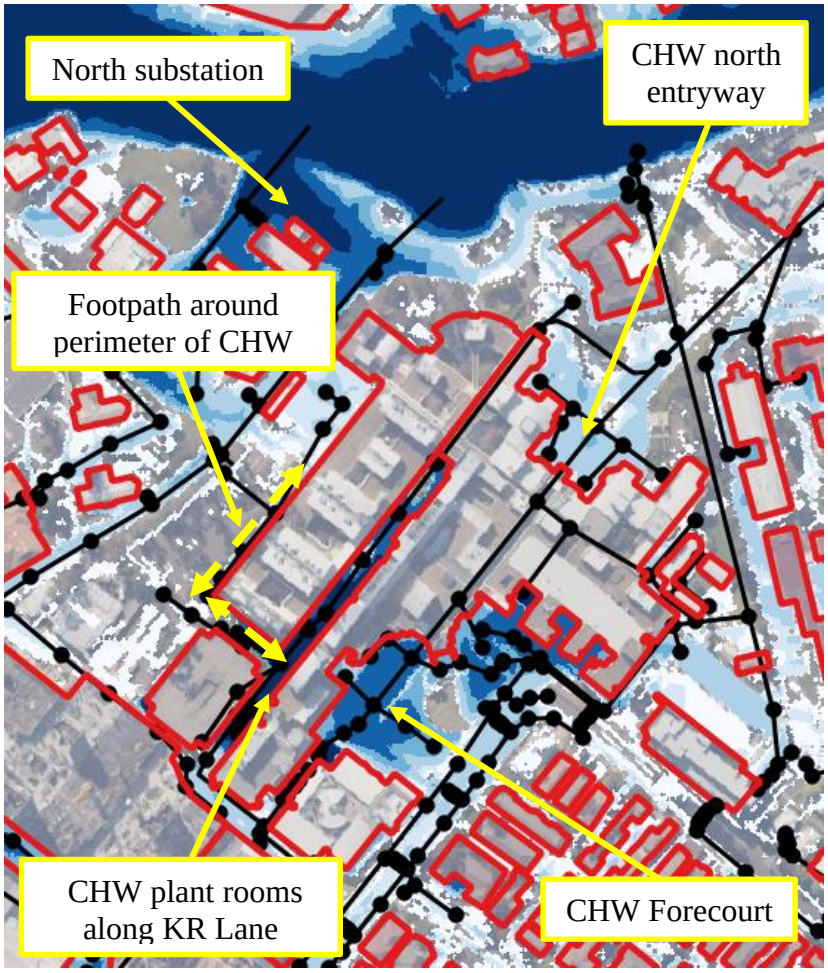


Figure 10 - Notable areas subject to existing flooding (PMF overland event in background)

7 Post-Development Flooding Conditions

7.1 Proposed MSCP Development Strategy

The stormwater drainage scheme and preliminary grading scheme (as designed by Arup at the schematic design stage) have been incorporated in the TUFLOW model under the post-development scenario.

The MSCP civil design includes the new building footprint extents, Redbank Road realignment and external areas of the proposed building.

An overview of this proposed stormwater network and preliminary grading that was used for the flood impact assessment and described below is presented in Appendix B.

7.1.1 Proposed Stormwater System

The stormwater strategy is a direct connection from the development site into the local existing (HI owned) stormwater network (i.e. no inclusion of on-site detention). Refer to Appendix B for the proposed MSCP stormwater management plan.

The proposed stormwater system has been designed to maintain the existing natural catchment areas for discharges.

The proposed stormwater system for the site has effectively been designed to manage three (3) main catchment areas, namely:

1. West areas of the Redbank Road realignment, car park entryway ramp and existing car park which connects to the existing ∅750 trunk main (owned by HAC) along Redbank Road and discharges directly into Toongabbie Creek upstream of the Redbank Road Bridge;
2. The MSCP building extents, a portion of the exitway ramp, the south pedestrian ramps and external landscape areas (west, south and portions of the east areas) which connects to the existing ∅1200 trunk stormwater main (owned by HAC) running along the west and southern edges of the proposed building. This trunk main leads to the existing detention basin (near RMH) before discharging to Toongabbie Creek downstream of where Toongabbie Creek and Darling Mills Creek converge; and
3. The east areas of the Redbank Road realignment, Labyrinth Way, the lower portion of the exitway ramp and east landscape areas drain to the ∅825 trunk main (owned by CoPC) at Labyrinth Way and discharges into Toongabbie Creek downstream of Redbank Road Bridge. The surface run-off drain to existing inlet pits, mimics the existing surface runoff conditions, and does not require a new connection to the Council drainage network.

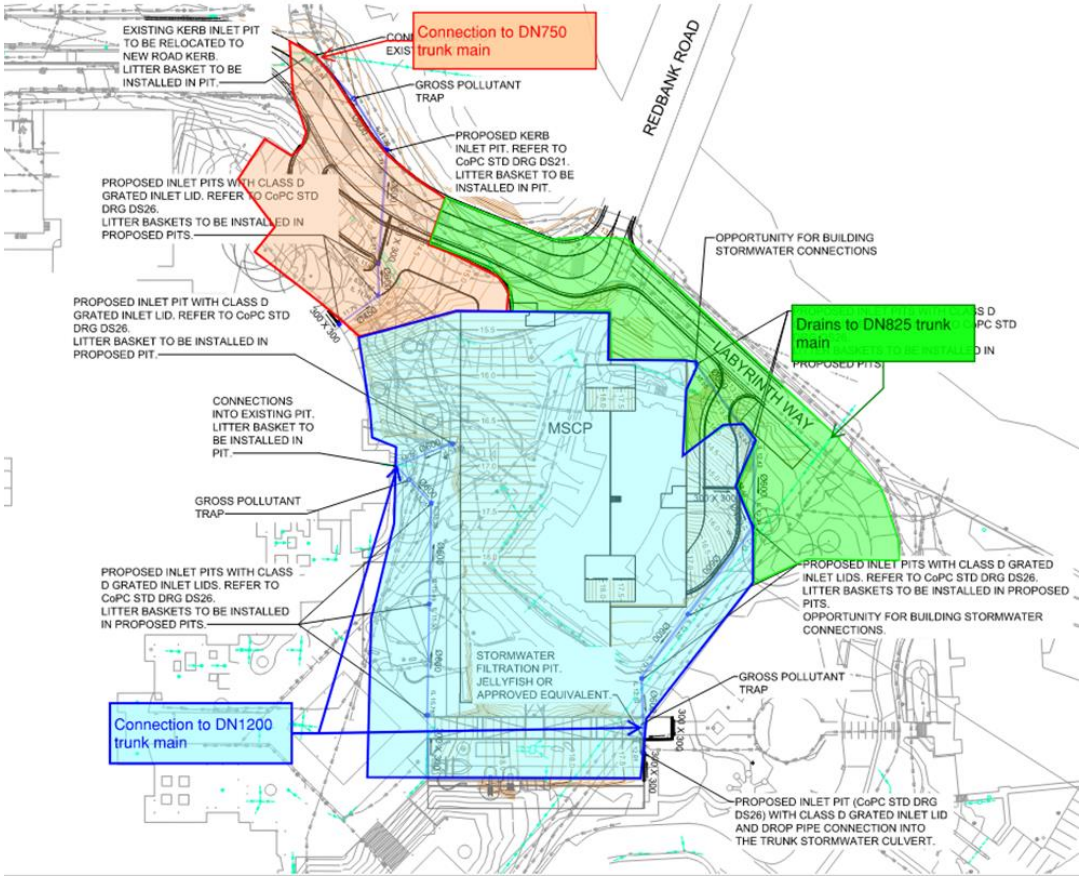


Figure 11- MSCP Stormwater strategy

As mentioned previously, the majority of the existing site is estimated to be draining to the ∅1200 trunk main and the intent generally matches the existing conditions by maintaining the same connection. In addition, we avoided connecting into the existing ∅825 stormwater trunk main running along the east side of the proposed building as it is understood this trunk main accommodates the flows from the PLR works along Hawkesbury Road and does not have capacity for additional flows.

Based on hydraulic and flooding analysis, the proposed stormwater strategy is assessed to be suitable for the site because it:

- Does not have significant impacts to the existing stormwater network or flooding conditions; and
- Intends to discharge site flows into Toongabbie Creek prior to the creek peak flow event (6 to 7 hours).

Refer to Figure 12 for the river flow hydrograph and Figure 13 illustrating the site flow discharge difference between pre and post development at the RMH outlet to Toongabbie Creek.

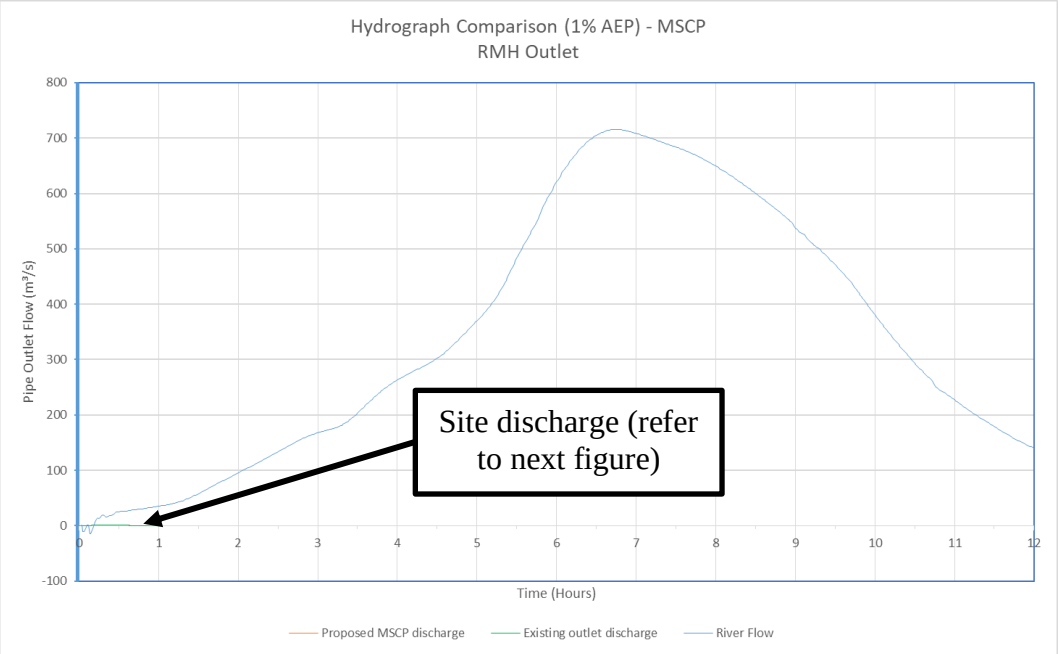


Figure 12 - River flow hydrograph

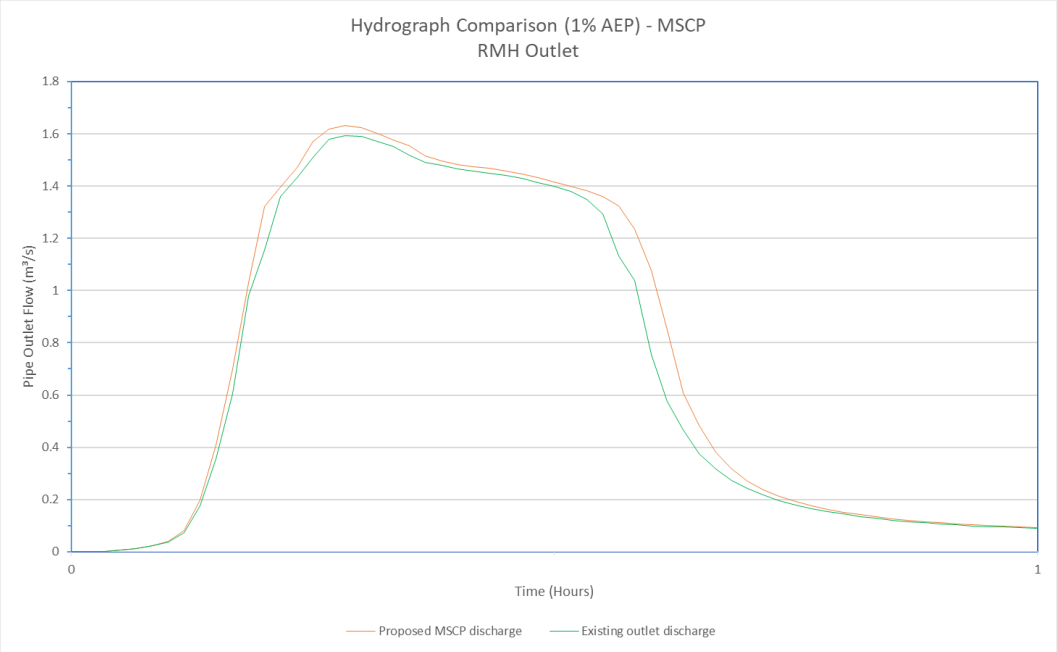


Figure 13 - Site Discharge flow hydrograph

7.1.2 Proposed External Grading / Levels

Preliminary grading was undertaken to create a digital terrain model (DTM) for the proposed site. The extent of grading was limited to areas as indicated below in Figure 14.

An overview of the proposed grading is as follows:

- Redbank Road realignment – the road realignment design either cuts down from existing levels or matches into existing levels;

- MSCP building footprint – the lowest floor level is raised from existing levels. The perimeter of the building will either contain retaining walls or batters to meet the existing ground level;
- MSCP entry ramp – will cut into existing levels when connecting to Redbank Road and be in fill when interfacing with the entry level of the MSCP;
- MSCP exitway ramp - will cut into existing levels when connecting to Labyrinth Way and be in fill when interfacing with the exit level of the MSCP; and
- South pedestrian access ramps – will be in fill in order to interface with the entry level of the MSCP.

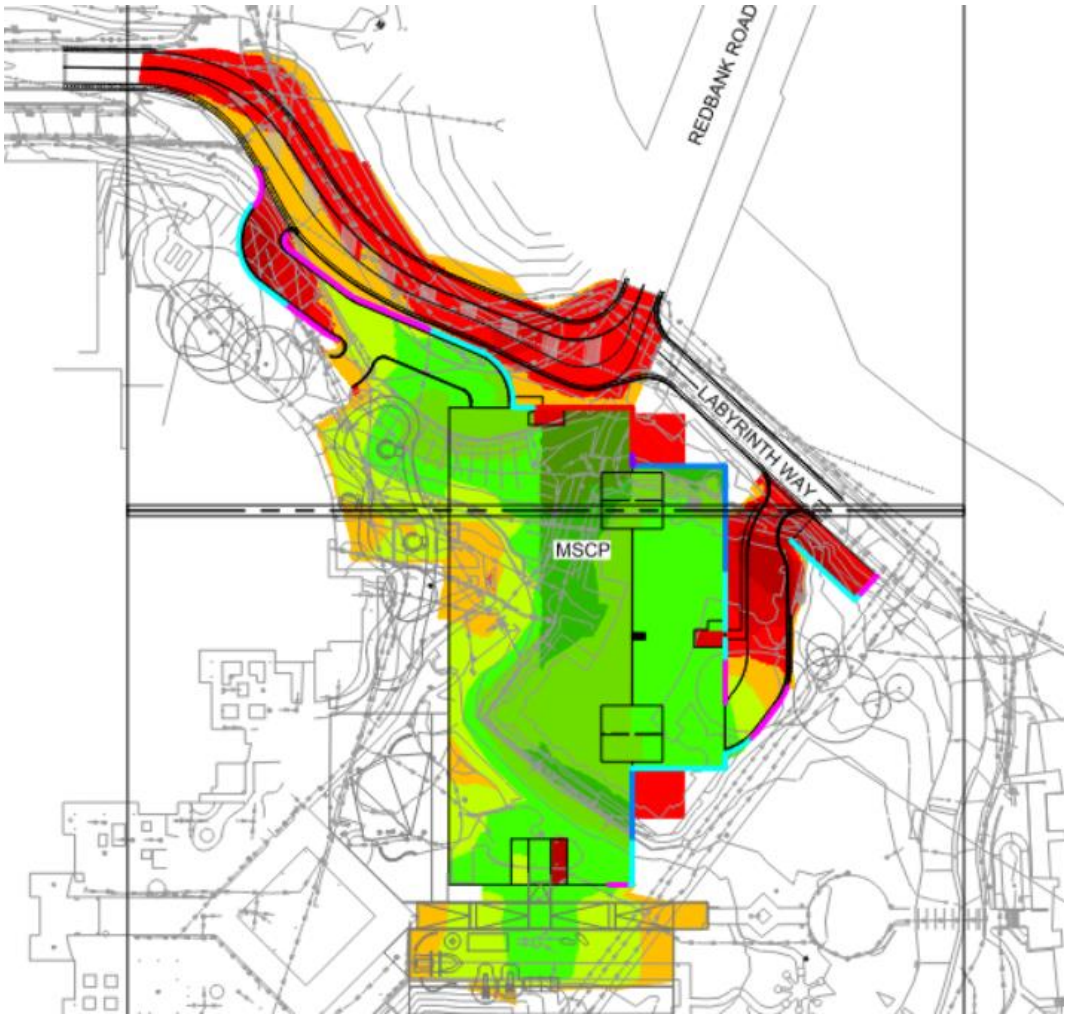


Figure 14 - Proposed MSCP earthworks plan (red/orange indicate cut; greens indicate fill)

7.2 Proposed Model Development and Limitations

A list of the key assumptions and limitations of the model developed for the proposed case scenario is as follows:

- The proposed MSCP building is represented as blockage, meaning that stormwater cannot flow through the building. This provides a more

conservative representation of the building and its obstructive effects on flow velocities and depths which may occur across the site;

- The lowest MSCP building finished floor levels range from 15.65 m to 18.85 m. Any building entryway requirement for ramping up to a suitable threshold determined by this impact assessment, is assumed to be provided within the building footprint; and
- Proposed design scenario assumes the same pit blockage factor as the existing case for a like-for-like assessment.

7.3 Post-Development Flood Modelling Results

The following sections describe the post-development flooding conditions for both overland flow and Toongabbie Creek riverine flooding. Refer to Appendix A for the proposed case flood results maps.

The MSCP site is impacted by both riverine and overland flood events.

7.3.1 10% AEP Event

The 10% event results indicate flooding within the site to be primarily from overland flows as follows:

Realigned Redbank Road

- (Overland) Sheet flow up to 0.16 m depth (slight increase) along the realigned road carriageway; and
- (River) Generally flood free from riverine flooding for this event (unchanged).

Labyrinth Way

- (Overland) Up to 0.14 m flood depth (slight decrease) at the trapped low point north of the MSCP; and
- (River) Generally flood free from riverine flooding for this event (unchanged).

Existing On-grade Car Park and Loading Dock

- (Overland) Up to 0.07 m depth (increase) at the existing CHW building loading dock due to a trapped low point from the entryway and MSCP embankment; and
- (River) Generally flood free from riverine flooding for this event (unchanged).

MSCP Building

- (Overland) Localised ponding of up to 0.19 m depth (increase) along the west, south and east edges of the building site;
- (Overland) Up to 0.16 m (unchanged) ponding depth around the south and southeast landscape and children playground areas; and
- (River) Generally flood free from riverine flooding for this event (unchanged).

CHW Building (North Frontage)

- (Overland) Up to 0.22 m ponding depth (unchanged) outside the north building entryway and external areas; and
- (River) Generally flood free from riverine flooding for this event (unchanged).

7.3.2 1% AEP Event

The 1% AEP event results indicate both overland flow and river flooding within the site as follows:

Realigned Redbank Road

- (Overland) Sheet flow up to 0.18 m depth (slight increase) along the realigned road carriageway; and
- (River) Riverine flows overtop the banks and encroach onto Redbank Road and the bridge abutment. Up to 0.3 m flood depth can be expected at the bridge abutment and above 0.8 m flood depth at the west side of the road (unchanged).

Labyrinth Way

- (Overland) Up to 0.27 m flood depth (increase) at the trapped low point north of the MSCP; and
- (River) Riverine flows overtop the banks and encroach onto the bridge abutment and Labyrinth Way. Flood depth up to 0.38 m (slight decrease) can be expected at the trapped low point.

Existing On-grade Car Park and Loading Dock

- (Overland) Up to 0.08 m depth (increase) at the existing CHW building loading dock due to a trapped low point from the entryway and MSCP embankment; and
- (River) Generally flood free from riverine flooding for this event (unchanged).

MSCP Building

- (Overland) Localised ponding of up to 0.2 m depth (increase) along the west, south and east edges of the building;
- (Overland) Up to 0.19 m ponding depth (unchanged) around the south and southeast landscape and children playground areas; and
- (River) Generally flood free from riverine flooding for this event (unchanged).

CHW Building (North Frontage)

- (Overland) Up to 0.25 m ponding depth (unchanged) outside the north building entryway and external areas; and
- (River) Generally flood free from riverine flooding for this event (unchanged).

7.3.3 PMF Event

The PMF event results indicate both overland flow and river flooding within the site as follows:

Realigned Redbank Road

- (Overland) Flow along the realigned road stretching from the bridge abutment to the west side of the road with flood depth reaching 1.0 m (unchanged); and
- (River) Riverine flows overtop the banks and flow onto Redbank Road, with flood depth in excess of 5.0 m (unchanged).

Labyrinth Way

- (Overland) Up to 0.5 m flood depth at the trapped low point north of the MSCP (unchanged); and
- (River) Riverine flows overtop the banks and flow onto Labyrinth Way, with flood depth in excess of 5.0 m (unchanged).

Existing On-grade Car Park and Loading Dock

- (Overland) Up to 0.8 m depth (increase) at the existing CHW building loading dock due to a trapped low point from the entryway and MSCP embankment; and
- (River flooding) Riverine flows overtop the banks and flow onto the new ramp, with flood depth in excess of 5.0 m at the ramp entrance (increase).

MSCP Building

- (Overland) Localised ponding in excess of 0.5 m depth (increase) along the west, south and east edges of the building;
- (Overland) Up to 0.41 m ponding depth (slight increase) around the south and southeast landscape and children playground areas;
- (River) Flood depth in excess of 3.0 m flood depth surrounding existing building (unchanged); and
- (River) Flood depth in excess of 1.0 m depth (unchanged) around the south and southeast landscape and children playground areas.

CHW Building (North Frontage)

- (Overland) Up to 0.44 m ponding depth (slight increase) outside the north building entryway and external areas; and
- (River) Up to 1.0 m depth (increase) near the north building entryway and external areas.

7.3.4 Post-Development Flood Hazard

Post development flood hazards have also been determined for the 1% AEP and PMF events, based on the hazard category recommended by the AR&R2019 guidelines.

Notable areas of flood hazard are as follows:

- 1% AEP events:
  - (Overland) Generally H1 hazard (unchanged) for the overland flow flooding for the MSCP site and its surrounds, which is safe flow conditions for people and vehicles; and
  - (River) Up to H2 hazard (i.e. unsafe for small vehicles) can be found within the 1% AEP flood extent on Labyrinth Way and H3 hazard (i.e. unsafe for vehicles, children and the elderly) for the west side of Redbank Road (unchanged).
- PMF events:
  - (Overland) Generally H1 and H2 hazard (unchanged) for the overland flow flooding for the MSCP site and its surrounds, but up to H3 hazard (unchanged) at the CHW Loading Dock low point, Labyrinth Way low point and the west side of Redbank Road, which is unsafe flow conditions for vehicles, children and the elderly. Highly localised hazard of up to H5 (i.e. unsafe for vehicles and people, and buildings vulnerable to damage) can be found along the north perimeter of the CHW building (increase); and
  - (River) Generally H5 and H6 hazard (unchanged) for the riverine flooding on the north-western edge of the MSCP building, which is flow conditions unsafe for vehicles and people, and buildings vulnerable to damage. Hazard ratings decrease to H3 for the higher grounds such as the CHW northern entryway, which is flows conditions unsafe for vehicles, children and the elderly (unchanged).

7.4 Flood Impacts

The following sections describe flood impacts the proposed development will have compared to the pre-development conditions. Refer to Appendix A for the afflux flood results maps.

7.4.1 Changes to Flooding Behaviour

<u>10% AEP Flood Event</u>

- Realigned Redbank Road (Overland): Generally a reduction in peak flood levels along the realigned Redbank Road, with the exception of a 0.48 m afflux on the northern footpath due to grading changes;
- Labyrinth Way (Overland): Up to 0.09 m afflux along the road, which is localised along the northern edge of MSCP;

- Existing On-grade Car Park and Loading Dock (Overland): Over 0.05 m afflux outside the existing CHW building loading dock entryway. This is due to this area becoming a trapped low point from the MSCP entryway ramp and landscape embankment. It may also be noted the afflux depths here are also a function of the ground level rising;
- Building extents (Overland): Over 1.0 m afflux on the west, south and east areas of the building due primarily to surface levels changes. Despite the afflux, the flood depths surround the MSCP building are generally shallow;
- CHW northern areas (Overland): Over 0.1 m afflux along the northern areas of the building near the loading dock due primarily to surface levels changes. There is no significant impact at the main entryway to CHW; and
- No significant impacts were found for the riverine flood event.

1% AEP Flood Event

- Realigned Redbank Road (Overland): Generally a reduction in peak flood levels along the realigned Redbank Road, with the exception of a 0.48 m afflux on the northern footpath due to grading changes;
- Labyrinth Way (Overland): Up to 0.23 m afflux along the road, which is localised along the northern edge of MSCP;
- Existing On-grade Car Park and Loading Dock (Overland): Over 0.05 m afflux outside the existing CHW building loading dock entryway. This is due to this area becoming a trapped low point from the MSCP entryway ramp and landscape embankment. The afflux depths here are also a function of the ground level rising;
- Building extents (Overland): Over 1.0 m afflux on the west, south and east areas of the building due primarily to surface levels changes. Despite the afflux, the flood depths surround the MSCP building are generally shallow;
- CHW northern areas (Overland): Over 0.1 m afflux along the northern areas of the building near the loading dock due primarily to surface levels changes. There is no significant impact at the main entryway to CHW; and
- No significant impacts were found for the riverine flood event other than localised afflux up to 0.07 m on Labyrinth Way along the northern edge of MSCP.

PMF Overland Flow Flood Event

- Realigned Redbank Road: Up to 0.15 m afflux on the northern footpath of the realigned road due to grading changes;
- Labyrinth Way: Up to 0.17 m afflux along the road, which is localised along the northern edge of MSCP;
- Existing On-grade Car Park and Loading Dock: Over 0.5 m afflux outside the existing CHW building loading dock entryway. This is due to this area becoming a trapped low point from the MSCP entryway ramp and landscape embankment. It may also be noted the afflux depths here are also a function of the ground level rising;

- Building extents: Over 1.0 m afflux on the west, south and east areas of the building due primarily to surface levels changes; and
- CHW northern areas: Over 0.4 m afflux along the northern areas of the building near the loading dock due primarily to surface levels changes. Afflux of 0.03 m was found outside the main entryway to CHW.

PMF River Flood Event

The PMF river flood afflux results for the post-development scenario indicate impacts to areas outside of the MSCP site as follows:

- Areas north of Toongabbie Creek: from 0.015 m to 0.03 m afflux. Some of these areas were already flooded in excess of 2 m depth in the existing scenario;
- Toongabbie Creek: from 0.015 m to 0.03 m afflux. The creek flood depth reaches more than 10 m in the existing scenario;
- Upstream areas of CHW precinct: from 0.015 m to 0.035 m afflux. Some of these areas were already flooded in excess of 3 m depth in the existing scenario; and
- Northern areas of the CHW building: up to 0.1 m afflux. This area was already flooded up to 1.0 m depth in the existing scenario.

It may be noted the PMF in this assessment would be considered as an extreme event with an estimated return period of 1 in 10 million years. Development guidelines typically only consider PMF for emergency planning purposes and do not require the design to accommodate for it as it would be impractical. In addition, the 0.2% AEP event results (1 in 500 AEP) indicate afflux impacts locally to the MSCP site and not to the same extent as the PMF. Therefore, the afflux impact as indicated in the PMF would only be expected to occur for events closer to the PMF than the 0.2% AEP event.

The PMF afflux impacts are assessed as the following two considerations:

1. CoPC land including Toongabbie Creek and areas north of the creek:
    a. The afflux impacts may be considered low risk for CoPC because the additional afflux would be 2% (or less) of the existing flood depths (up to 2 m) already being experienced in these areas.
2. HI land – The afflux impacts would be considered as follows:
    a. The HI areas upstream of the MSCP experience afflux of 2% (or less) of the existing flood depths (up to 3 m) in these areas. Therefore the afflux impacts in these areas would be considered low risk.
    b. The northern areas of the CHW building experience additional afflux of up to 10% of the existing flood depths (up to 1.0 m). This afflux may be assessed in the detailed design of the MSCP.

Flood Hazards

- Generally minimal changes to flood hazards as discussed in Section 7.3.4.

7.5 Flood Immunity / Thresholds

An analysis of the proposed building entryway thresholds and floor levels have been assessed against the flood level as summarized in Figure 15 and Table 3.

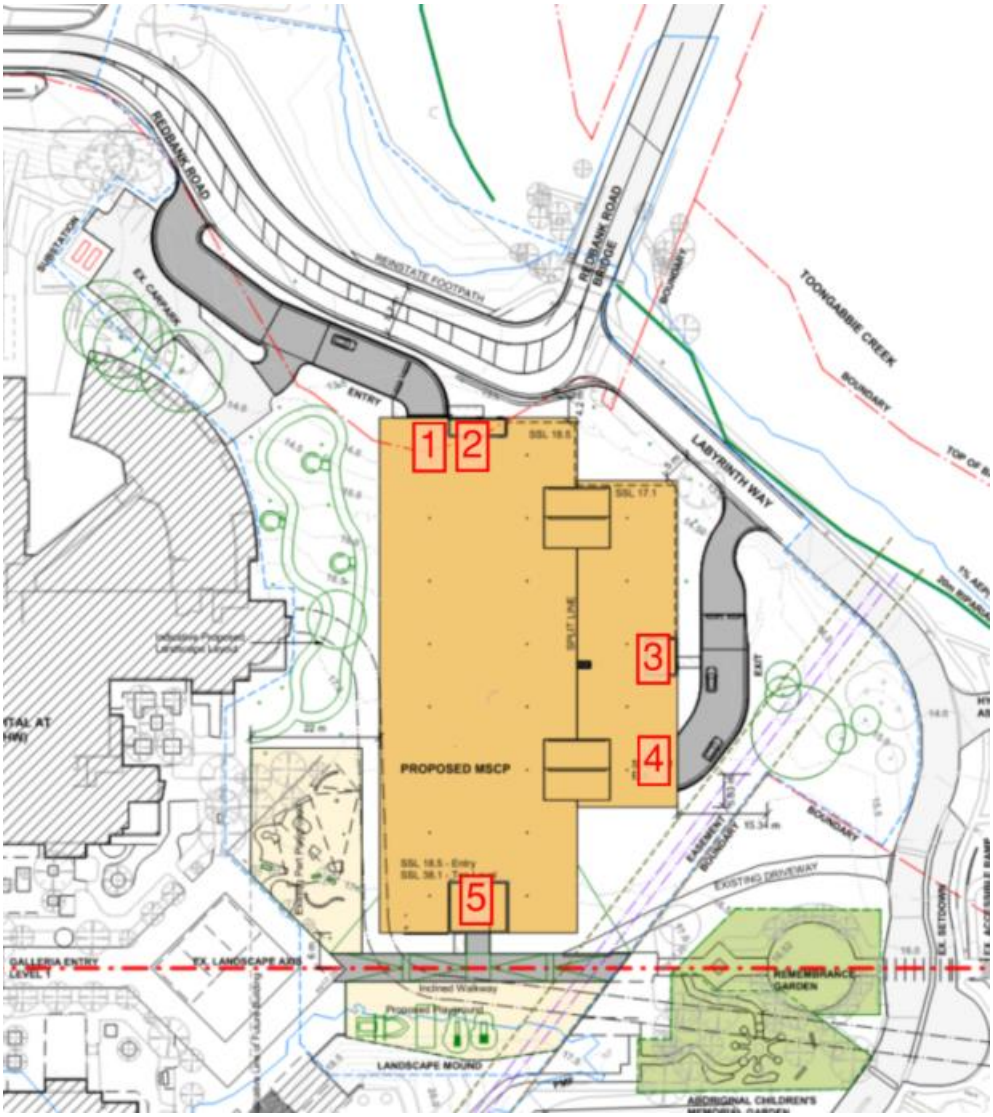


Figure 15 – MSCP floor level and entryway plan (source: BLP proposed site plan dated 15/01/2021)

Table 3 - Proposed floor/entryway threshold levels

Location	FFL/Threshold (m AHD)	1% (m AHD)	PMF (m AHD)	Comments
1 – MSCP entryway ramp	15.65 (top of ramp)	13.52 (overland; within Redbank Road realignment)	15.33 (overland) 18.01 (river)	Above 1% AEP + 500mm freeboard and PMF
2 – Fire Stairs	13.75 (entryway RL)	13.28 (river; within Redbank Road realignment)	13.78 (overland) 18.00 (river)	Building stairs internally ascend to RL 18.85 m, i.e. above 1% AEP + 500mm freeboard and PMF
3 – Fire Stairs	15.70 (entryway RL)	12.96 (overland: within Labyrinth Way) 12.85 (river; within Labyrinth Way)	17.63 (river)	Above 1% AEP + 500mm freeboard, and building stairs internally ascend to RL 17.45 m
4 – MSCP exitway ramp	17.45 (top of ramp)		17.65 (river)	Above 1% AEP + 500mm freeboard
5 – Lobby entryway	18.85 (entryway RL)	18.33 (overland outside of ramp extents)	-	Above 1% AEP + 500mm freeboard

The results show that the lowest floor levels of the MSCP are above the riverine and overland 1% AEP level plus 0.5 m freeboard. Some of the entryways into the building internally ramp/rise to the lowest floor level within the building.

While the floor levels are below the PMF event, due to the MSCP being within close proximity to Toongabbie Creek, it would not be feasible to raise the MSCP significantly in order to clear the PMF levels without causing flooding impacts. It is also noted the MSCP would not be considered as a sensitive use facility and would not be required to have protection up to the PMF level. Therefore, protection up to 1% AEP plus 0.5 m freeboard would be considered acceptable.

As the design progresses for the MSCP building, proposed portals and vents should be raised to the level above the 1% AEP plus 0.5 m freeboard at that location.

7.6 Sensitivity Analysis

The following modelling scenarios were also undertaken as a sensitivity analysis to assess the effects of climate change and pipe blockage on the flood model results as well as flooding impacts.

7.6.1 Climate Change

Climate change assessment was undertaken utilising the 0.5% and 0.2% AEP events as proxy, assessing the effects of increased rainfall intensity and elevated tailwater conditions (due to the increase rainfall) on the flood risks for the MSCP

site. Sea level rise has not been modelled herein as it primarily affects the tidal areas downstream of the Parramatta CBD (draft Parramatta River Flood Study by Cardno, 2019). Refer to Appendix A for the 0.2% AEP climate change flood results maps.

The sensitivity of the peak flood levels to climate change is presented in Table 4, with the comparison locations shown in Figure 16. The results show that the peak flood levels around the MSCP site which are primarily driven by overland flow flooding (#1, #2, #3, #6 and #8) do not significantly increase from the 1% AEP to the 0.5% AEP and 0.2% AEP events. However, peak flood levels on Redbank Road and Labyrinth Way which are influenced by riverine flooding (#4, #5, #7 and #9) would increase by up to 0.2 m for the 0.5% AEP event and 0.55 m for the 0.2% AEP event. In terms of post-development afflux, the major change in peak flood levels observed for some locations (#1, #2 and #7) is driven by the surface grading changes. Compared to the 1% AEP, the same afflux behaviour is observed for the 0.5% and 0.2% AEP events. For the other locations, the afflux is generally within the tolerance of the limits of the model accuracy, i.e. ± 0.01 m, except for the CHW loading dock (#6).

Table 4 – Sensitivity of Flood Levels to Climate Change

Location (Refer Figure 16)	Pre-Development Peak Flood Levels (m AHD)			Post-Development Peak Flood Levels (m AHD)			Post-Development Afflux (m)		
	1% AEP	0.5% AEP	0.2% AEP	1% AEP	0.5% AEP	0.2% AEP	1% AEP	0.5% AEP	0.2% AEP
1 – MSCP West	16.70	16.70	16.71	16.88	16.88	16.88	+0.18	+0.17	+0.17
2 – MSCP New Ramp	17.31	17.30	17.31	18.30	18.30	18.30	+0.99	+1.00	+1.00
3 – CHW Walkway	17.31	17.30	17.31	17.30	17.30	17.31	-0.01	-	-
4 – Redbank Road Bridge Approach	13.22	13.40	13.70	13.23	13.39	13.70	-	-0.01	-
5 – Labyrinth Way Low Point	12.87	13.07	13.42	12.86	13.06	13.39	-0.01	-0.01	-0.03
6 – CHW Loading Dock	13.84	13.84	13.84	13.85	13.86	13.86	+0.02	+0.02	+0.02
7 – Existing On-grade Car Park Entrance	13.33	13.49	13.78	14.38	14.38	14.38	+1.05	+0.89	+0.61
8 – CHW Northern Entry	17.26	17.26	17.27	17.26	17.26	17.27	-	-	-
9 – MSCP New Ramp Entry	13.29	13.48	13.76	13.29	13.49	13.76	-	+0.01	-

Figure 16 - Flood Level Comparison Locations

7.6.2 Pipe Blockage

Modelling of the 1% AEP events was undertaken for a fully blocked stormwater system as considered from the CoPC engineering design guidelines. Comparison of the flood levels between the no pipe blockage and full pipe blockage scenarios is presented in Table 5, with the comparison locations shown in Figure 16.

The results show that for trapped low points such as the CHW northern area (#8) and the CHW loading dock under post-development conditions (#6) which are drained primarily by the stormwater system, the peak flood levels increase significantly under the full pipe blockage scenario. For areas driven mainly by flood conveyance such as Redbank Road, the blockage of the stormwater system has less influence on the local flood levels.

In terms of afflux, the post-development impacts on peak flood levels are generally similar between the no pipe blockage and full pipe blockage scenarios except for the west of the MSCP (#1) and CHW loading dock (#6) which are areas drained primarily by the stormwater network.

Table 5 – Sensitivity of 1% AEP Flood Levels to Pipe Blockage Assumption

Location (Refer Figure 16)	Pre-Development Peak Flood Levels (m AHD)		Post-Development Peak Flood Levels (m AHD)		Post-Development Afflux (m)	
	No Pipe Blockage	100% Pipe Blockage	No Pipe Blockage	100% Pipe Blockage	No Pipe Blockage	100% Pipe Blockage
1 – MSCP West	16.70	16.75	16.88	17.09	+0.18	+0.34
2 – MSCP New Ramp	17.31	17.31	18.30	18.30	+0.99	+0.99
3 – CHW Walkway	17.31	17.32	17.30	17.35	-0.01	+0.03
4 – Redbank Road Bridge Approach	13.22	13.23	13.23	13.23	-	-
5 – Labyrinth Way Low Point	12.87	12.89	12.86	12.88	-0.01	-
6 – CHW Loading Dock	13.84	13.84	13.85	14.43	+0.02	+0.59
7 – Existing On-grade Car Park Entrance	13.33	13.34	14.38	14.40	+1.05	+1.06
8 – CHW Northern Entry	17.26	17.34	17.26	17.35	-	+0.01
9 – MSCP New Ramp Entry	13.29	13.30	13.29	13.30	-	-

This analysis shows that the MSCP entryways are still above the 1% AEP level plus 0.5 m freeboard under the full pipe blockage scenario (based on peak flood levels estimated for #2, #4 and #5).

Although it has been demonstrated that the proposed MSCP finished floor levels still have flood immunity in this event, it should be noted that a blocked stormwater system will result in an increase in flood depths in and around the proposed MSCP site.

It is recommended that an Operation & Maintenance (O&M) Plan for the proposed MSCP site drainage system is implemented and existing downstream stormwater assets are also maintained to ensure adequate performance of the stormwater network.

7.7 Emergency Management Strategy

There is a flood emergency management strategy in place for the Westmead Health Precinct by the SCHN which is coordinated with other relevant authorities including (and not limited to) NSW Health, NSW Police, Transport NSW, State Emergency Service (SES) and the Bureau of Meteorology (BoM).

SCHN shall be consulted for the proposed MSCP development to not only develop the flood emergency management strategy specific for the site, but to also coordinate the management plan with the overall Westmead Health Precinct plans. The intent is to not make any significant changes to the existing management plans, but to maintain/coordinate with the plans already in place and outline any specific elements that require to be changed.

Subject to consultations with SCHN, a summary of flood emergency management strategies for the MSCP site are recommended as follows:

- Establish with SCHN whether a shelter-in-place (evacuation to higher levels of the building) or an off-site evacuation approach would be most suitable considering the current management plans;
- Evacuation routes (locations of stairs/ramps and muster points), signage, warning systems (alarms and PA systems) and CCTV surveillance are to be considered as part of the building management plans;
- Details of how the Building Management System (BMS) is linked with FloodSmart Parramatta;
- Further design and management of critical infrastructure to not disrupt the building services (such as electrical substations, switchboards, back-up power generators or any other critical plant equipment) in the event of a flood. This can include design of the servicing elements to be above the flood levels or consideration for back-up equipment to provide service for a given duration until the main element may resume; and
- Post-flood event actions including inspections and maintenance activities.

8 Recommendations and Further Work

This flood impact assessment has been undertaken at schematic design stage, and as such, Arup have assessed the flooding and stormwater management requirements for the development design. Key outcomes are as follows:

- The proposed lowest finished floor levels of the MSCP building provides flood immunity for the 1% AEP plus 0.5 m freeboard;
- The proposed building design, stormwater scheme and grading strategy for the development do not significantly impact the existing conditions flood behaviour beyond the project boundary for events up to and including the 0.2% AEP;
- The proposed case PMF riverine event illustrates impacts within the development site and areas outside of the site extents. However, these impacts are generally in areas where significant flood depths already occur in the existing scenario, and they constitute a 2% (or less) increase in flood depth;
- Flood impacts adjacent the northern areas of the CHW building require further consideration in the detailed design of the MSCP.
- Flood hazard for the 1% AEP event is low. However, the PMF event hazard is high for the MSCP site and its surround. It is recommended that either a shelter-in-place (evacuation to higher levels of the MSCP) or an off-site evacuation approach be explored as part of the flood emergency management strategy;
- The climate change sensitivity analysis found that afflux behaviour observed for the site under post-development conditions is similar to the 1% AEP. The rise in riverine flood as a result of climate change would impact primarily the low lying areas like Redbank Road and Labyrinth Way; and
- There are impacts from the pipe blockage sensitivity analysis, especially for trapped low points which primarily drain to stormwater trunk main. Therefore it is recommended to maintain and clean stormwater assets to ensure adequate performance of the stormwater network; and

Arup proposes several further key design recommendations and next steps as follows:

- Further design development of MSCP in consultation with Architect as the design progresses;
- Updated flood modelling to demonstrate impact of MSCP and existing CHW building as the development design progresses; and
- Consultation with SCHN on developing the flood emergency management plan and coordination with the wider Westmead Health Precinct management plan.

Appendix A

Flood Maps

Legend

- Model Extent
- Site Boundary
- Proposed Building
- Information received from Parramatta Light Rail
- Information from CASB Flood Model
- Information provided by LTS Lockley Survey
- Pits
- OSD Tanks
- Nodes for Input Hydrograph
- Existing DRAINS Subcatchments

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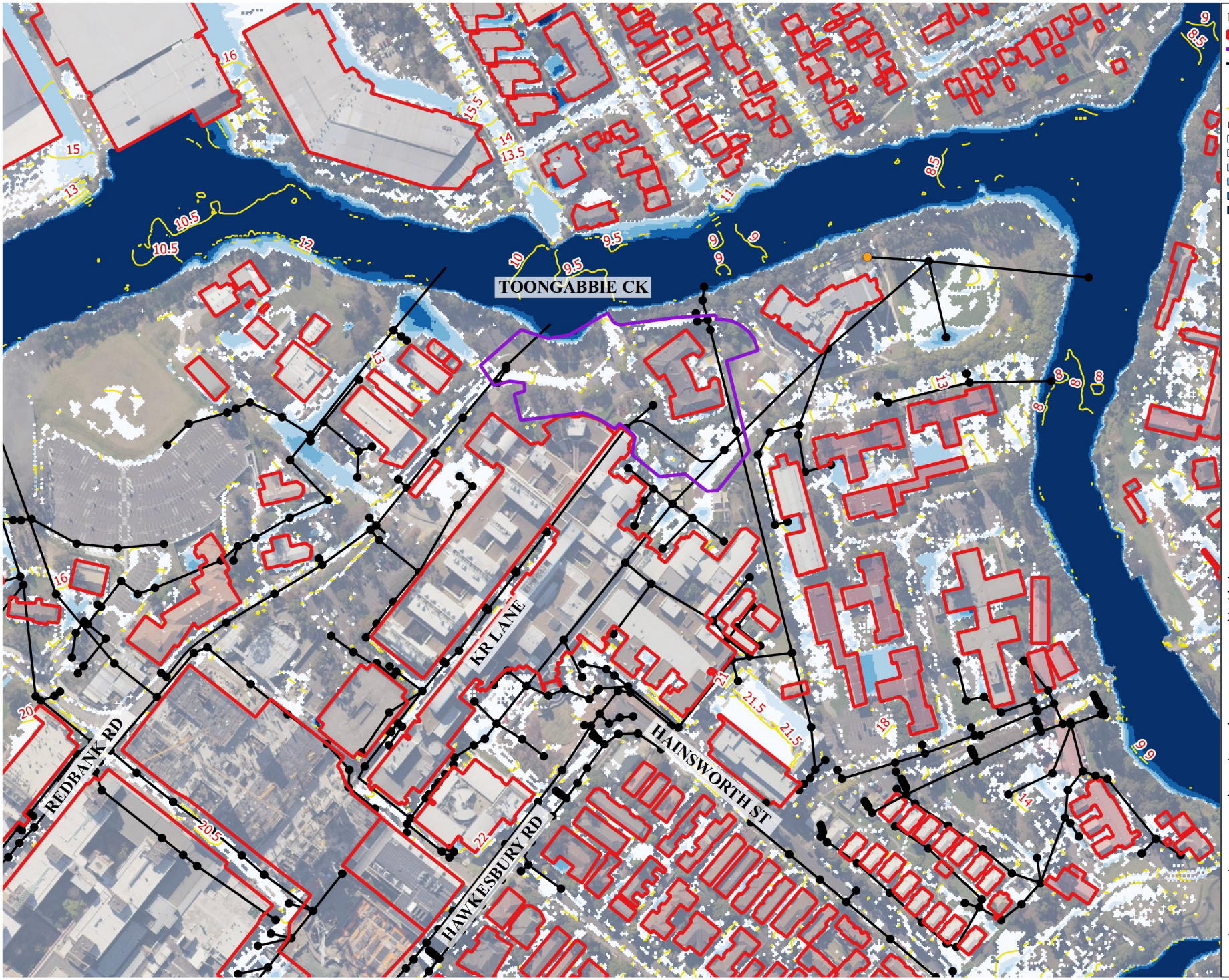
25 0 25 50 m

Scale at A3 1:5,000

Figure No. M.S.1
Flood Model Setup Plan

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

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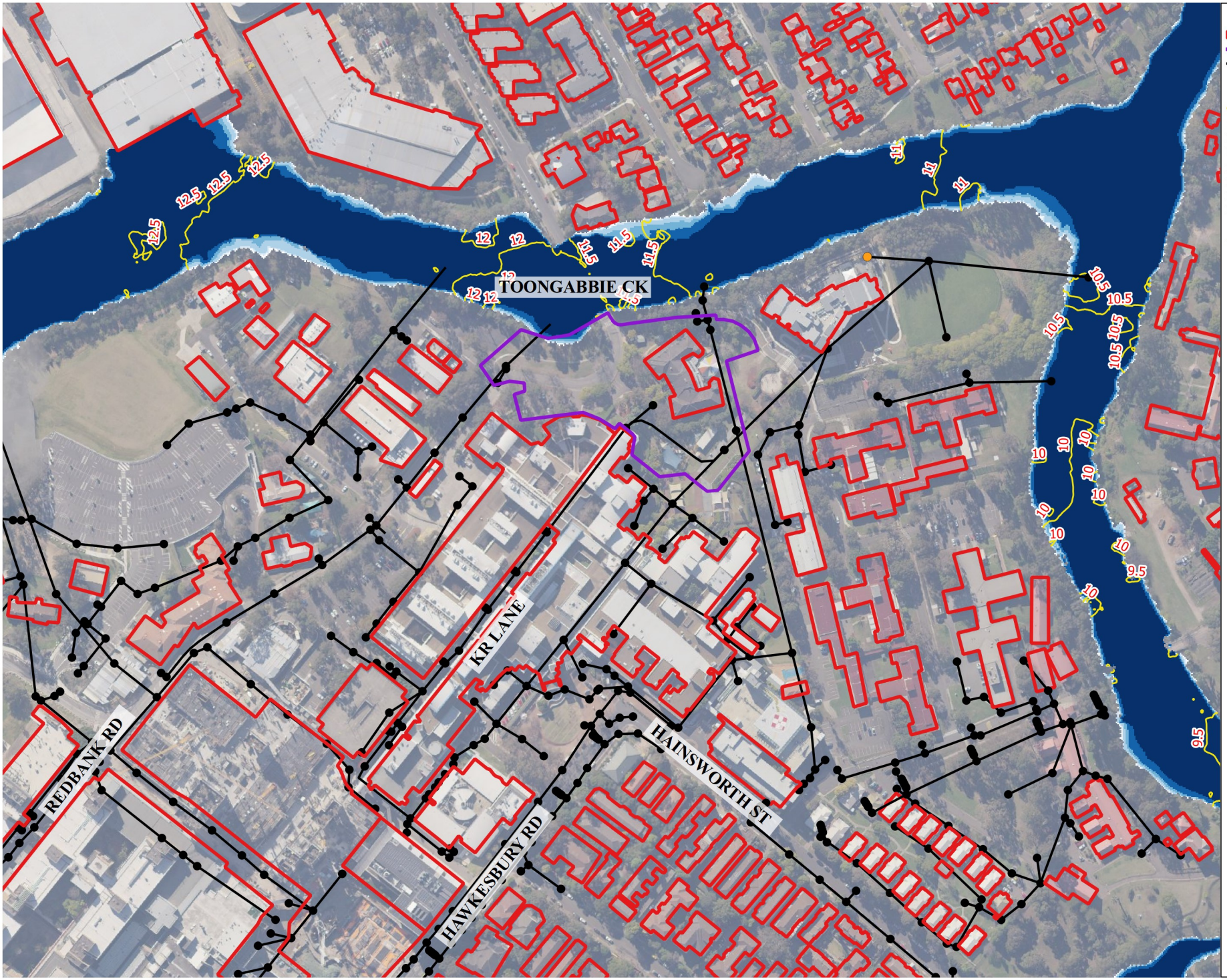
Scale at A3 1:2,500

Figure No. E.D.1
Existing Case 10% AEP Overland Flooding Peak Flood Depths and Levels

Job No.
271985

Figure Status
For SSDA



Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Notes:

1. The riverine flooding shown excludes local catchment runoff

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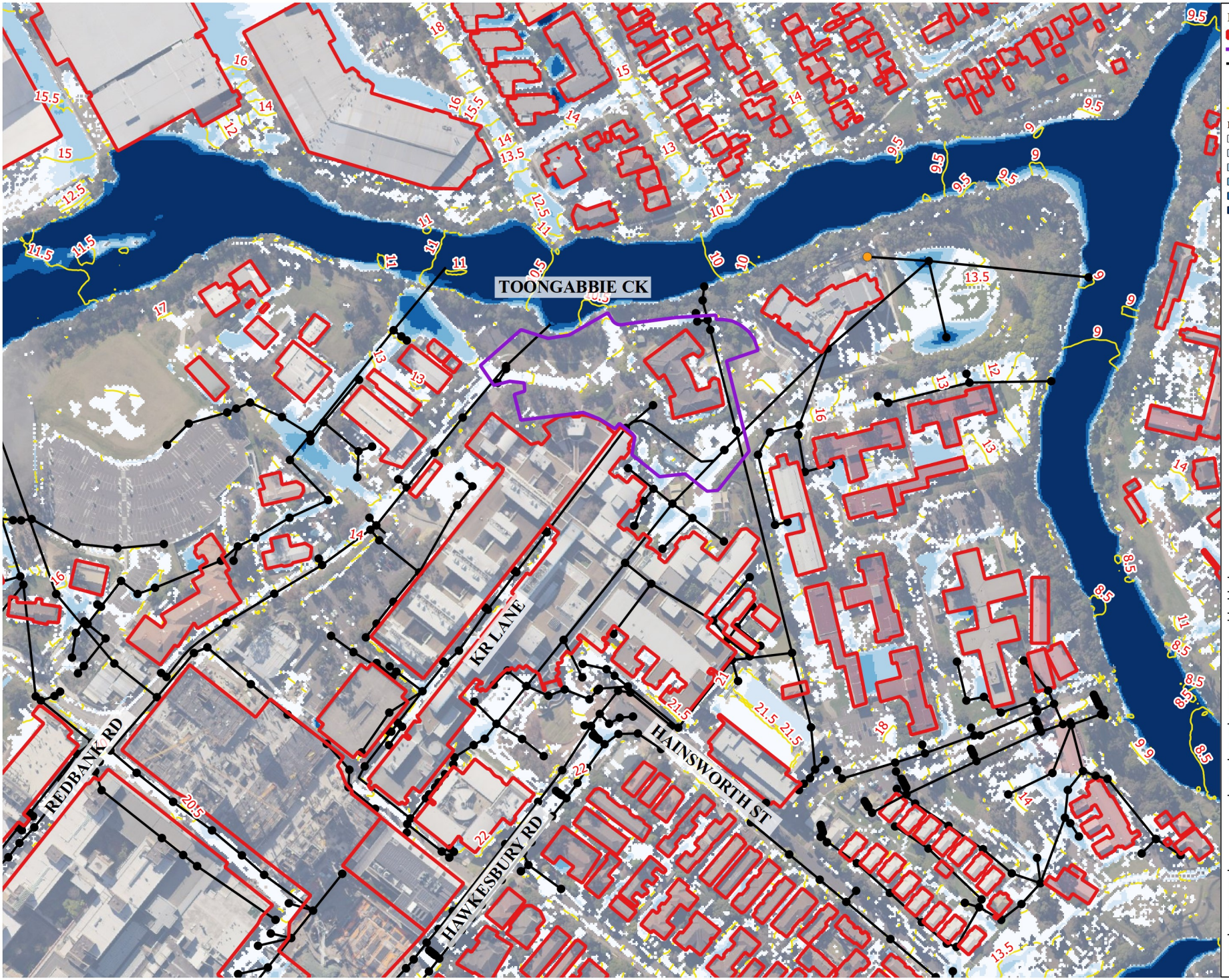
Scale at A3 1:2,500

Figure No. E.D.2
Existing Case 10% AEP
Riverine Flooding
Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

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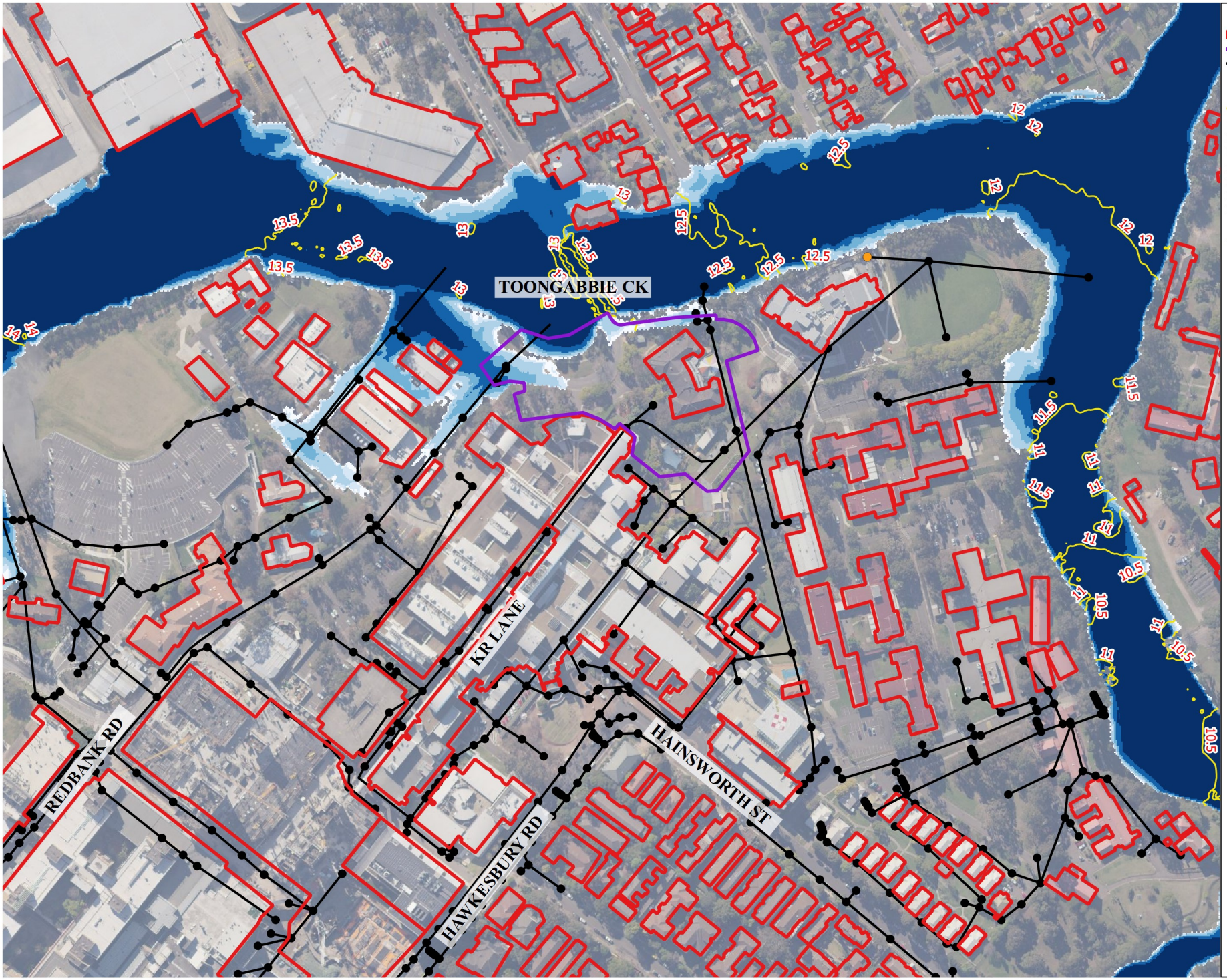
Scale at A3 1:2,500

Figure No. E.D.3
Existing Case 1% AEP Overland Flooding Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Notes:
1. The riverine flooding shown excludes local catchment runoff

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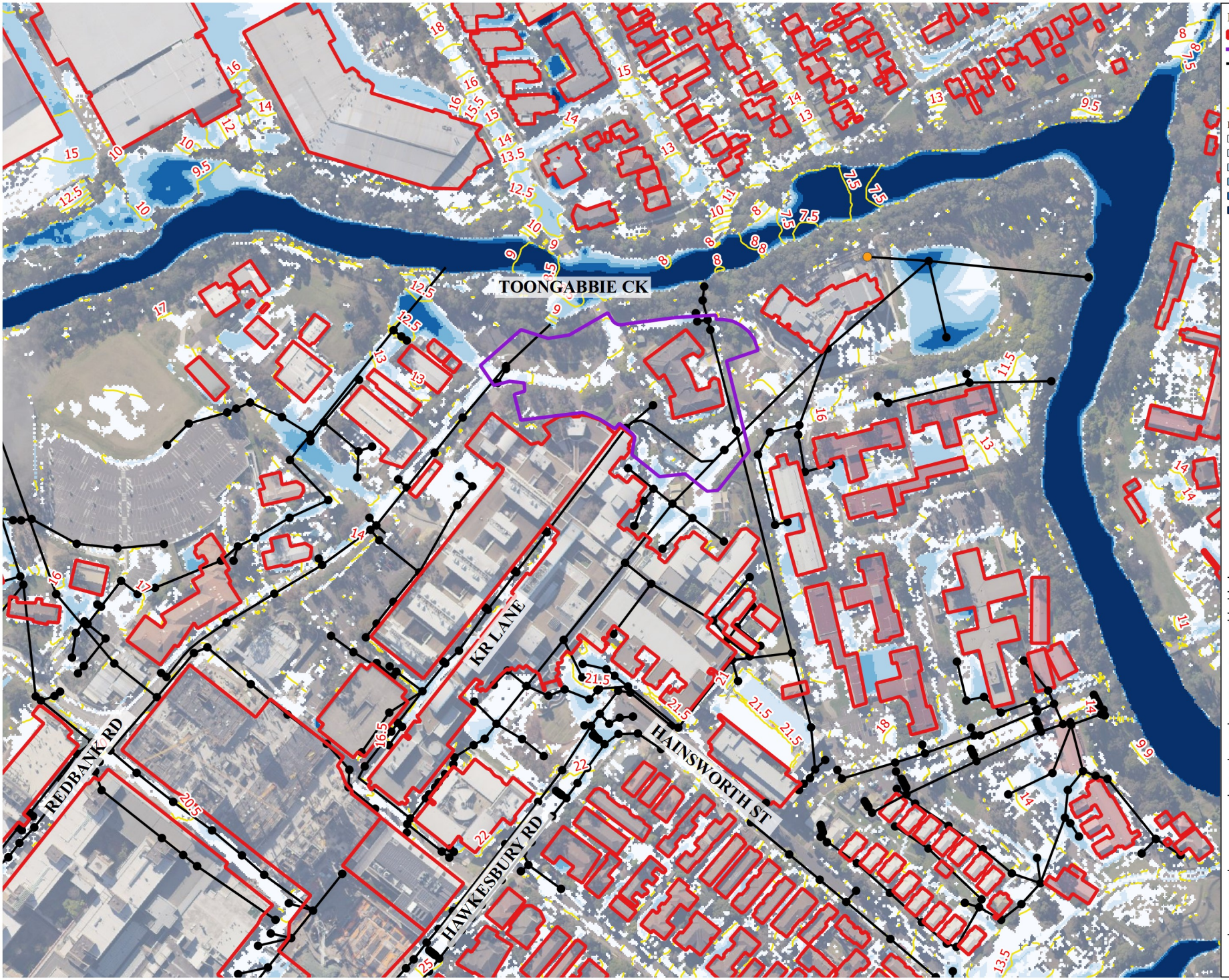
Scale at A3 1:2,500

Figure No. E.D.4
Existing Case 1% AEP Riverine Flooding
Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

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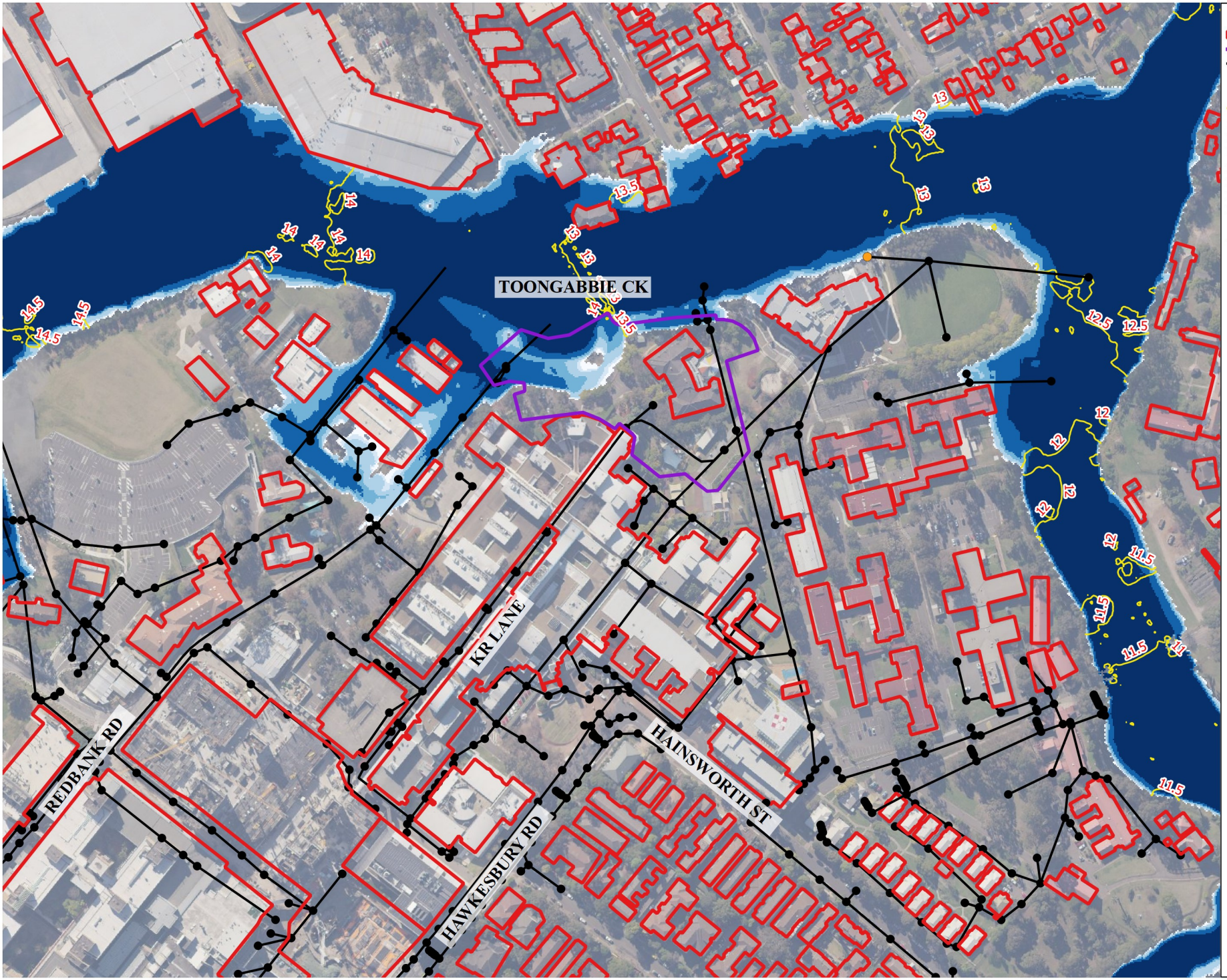
Scale at A3 1:2,500

Figure No. E.D.5
Existing Case 0.2% AEP Overland Flooding Peak Flood Depths and Levels

Job No.
271985

Figure Status
For SSDA



Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Notes:
1. The riverine flooding shown excludes local catchment runoff

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Scale at A3 1:2,500

Figure No. E.D.6
Existing Case 0.2% AEP Riverine Flooding Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**

Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Issue	Date	By	Chkd	Appd
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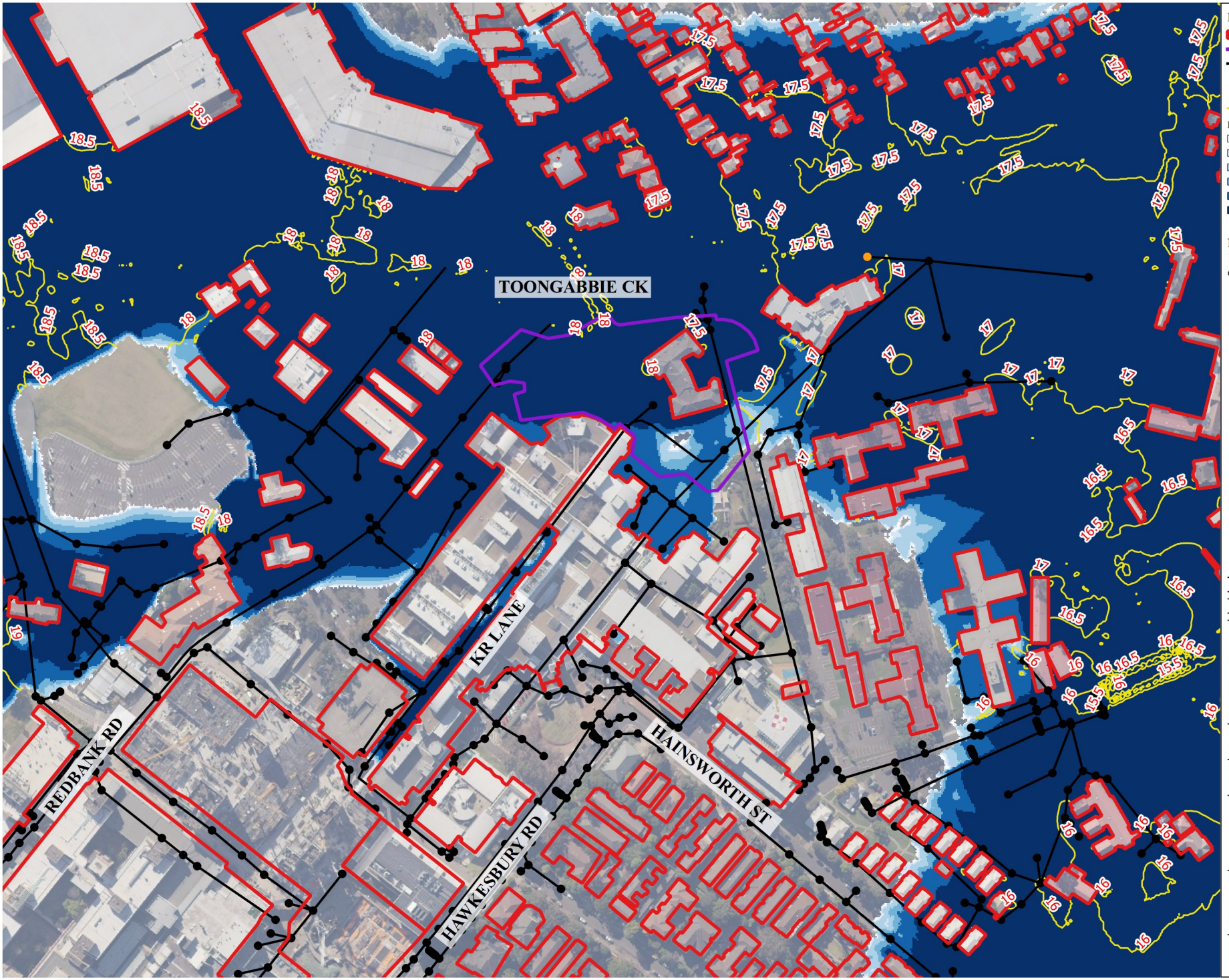
Scale at A3 1:2,500

Figure No. E.D.7
Existing Case PMF Overland Flooding
Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Notes:

1. The riverine flooding shown excludes local catchment runoff

Issue	Date	By	Chkd	Appd
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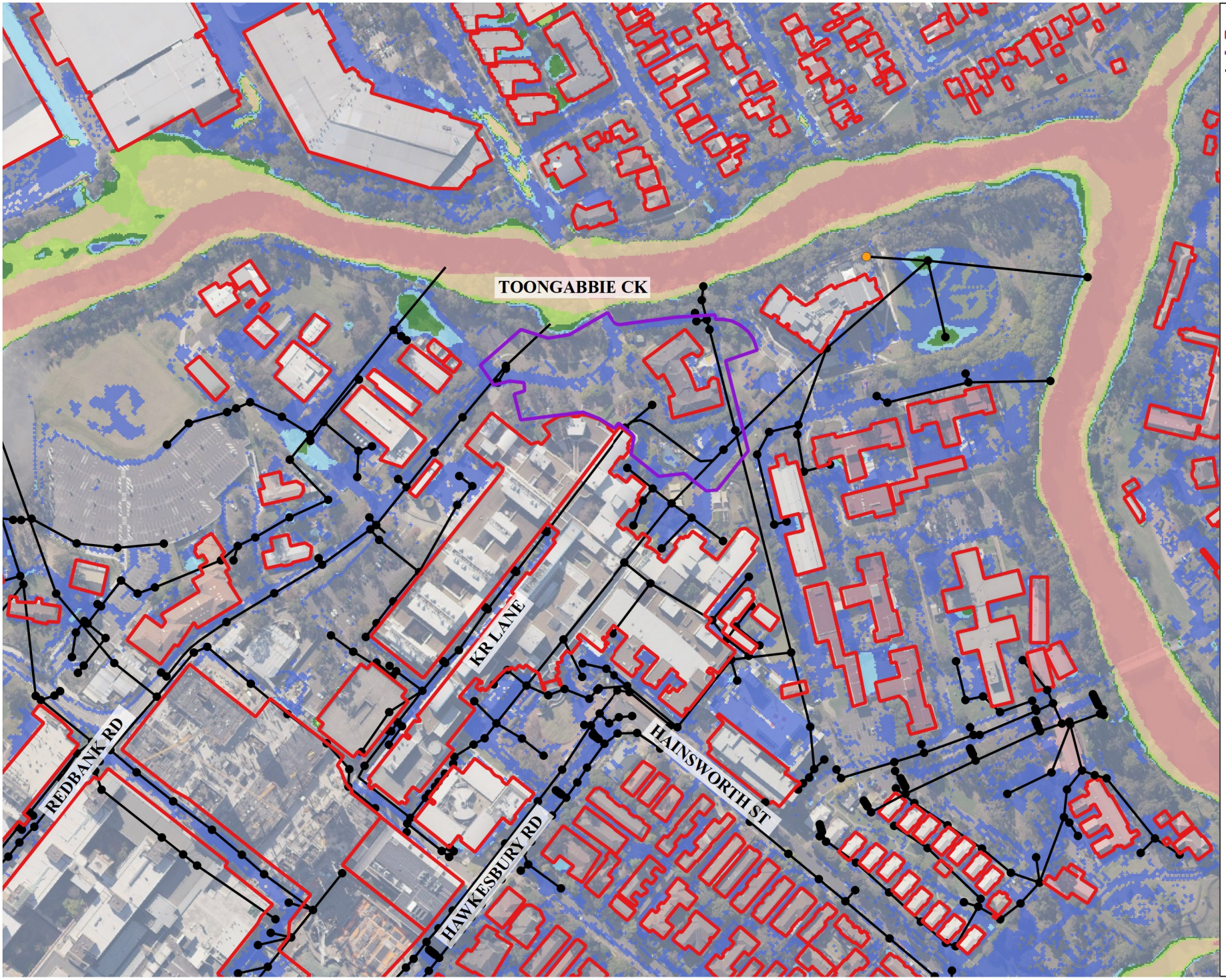
Scale at A3 1:2,500

Figure No. E.D.8
Existing Case PMF Riverine Flooding
Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD

Flood Hazard Category

- H1 - Relatively benign flow conditions.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for all vehicles, children and the elderly.
- H4 - Unsafe for all people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

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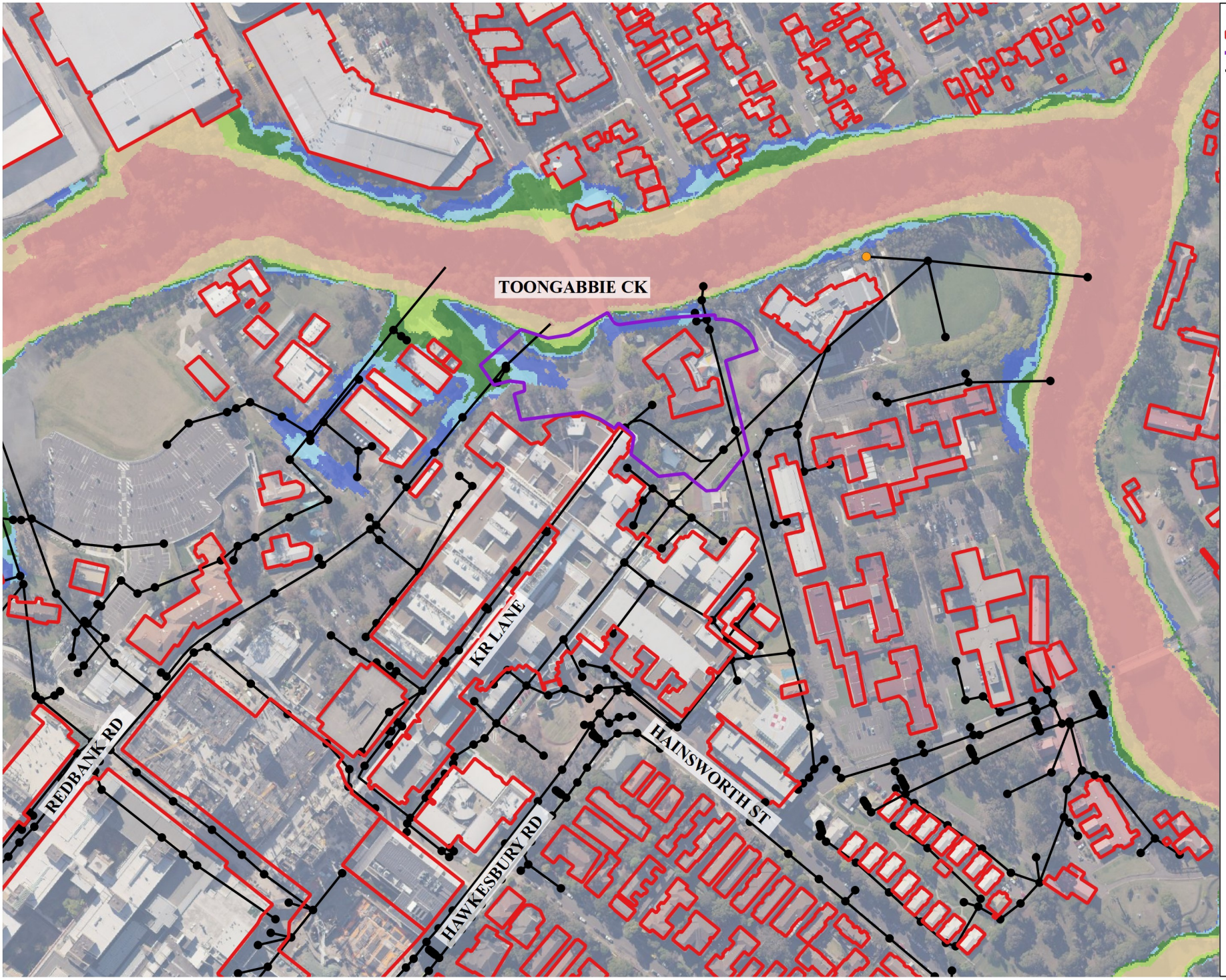
25 0 25 50 m

Scale at A3 1:2,500

Figure No. E.H.1
Existing Case 1% AEP Overland Flooding Hazard

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD

Flood Hazard Category

- H1 - Relatively benign flow conditions.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for all vehicles, children and the elderly.
- H4 - Unsafe for all people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

Notes:
1. The riverine flooding shown excludes local catchment runoff

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Scale at A3 1:2,500

Figure No. E.H.2
Existing Case 1% AEP Riverine Flooding Hazard

Job No.	Figure Status
271985	**For SSDA**

Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD

Flood Hazard Category

- H1 - Relatively benign flow conditions.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for all vehicles, children and the elderly.
- H4 - Unsafe for all people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

Issue	Date	By	Chkd	Appd
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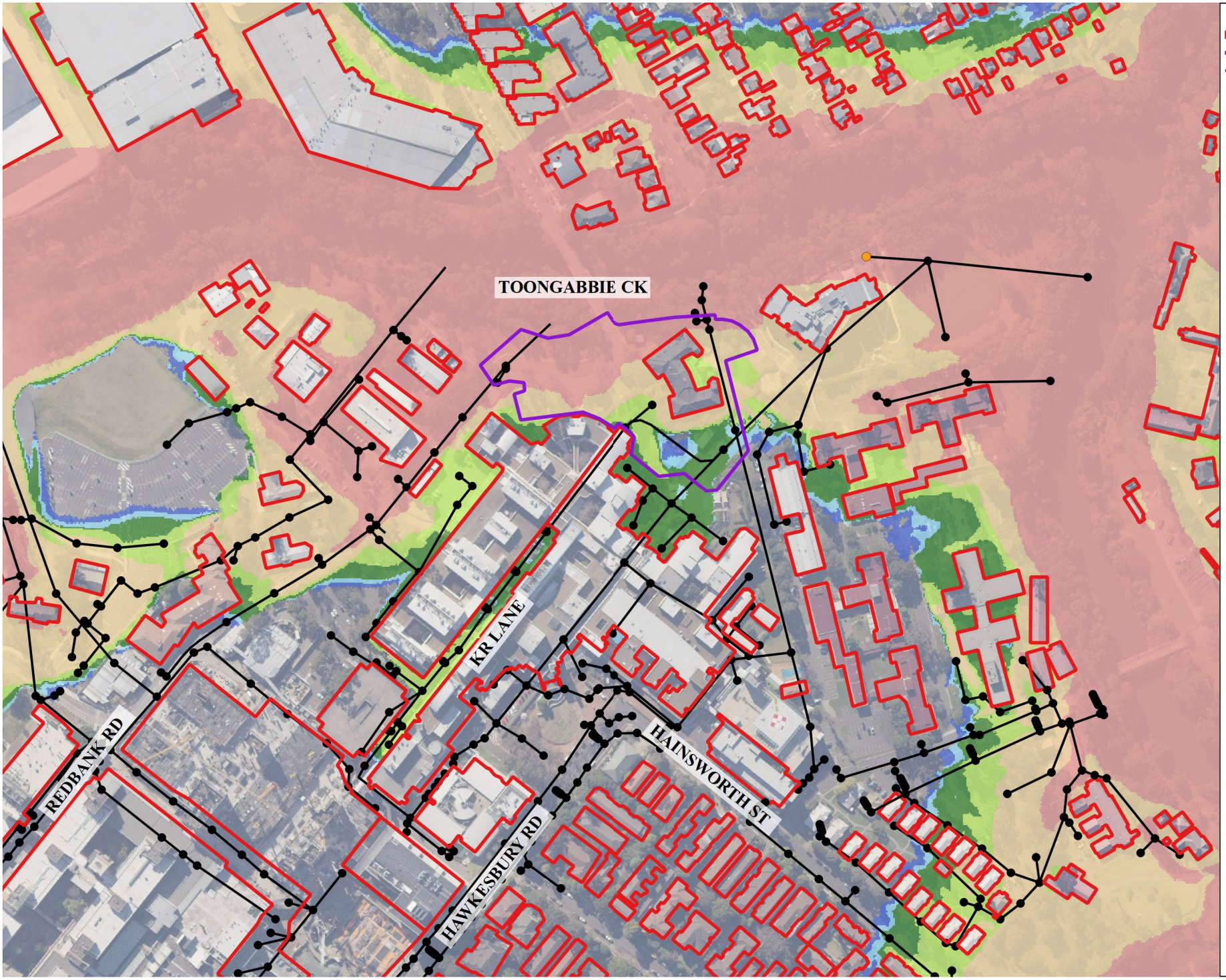
25 0 25 50 m

Scale at A3 1:2,500

Figure No. E.H.3
Existing Case PMF Overland Flooding Hazard

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD

Flood Hazard Category

- H1 - Relatively benign flow conditions.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for all vehicles, children and the elderly.
- H4 - Unsafe for all people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

Notes:
1. The riverine flooding shown excludes local catchment runoff

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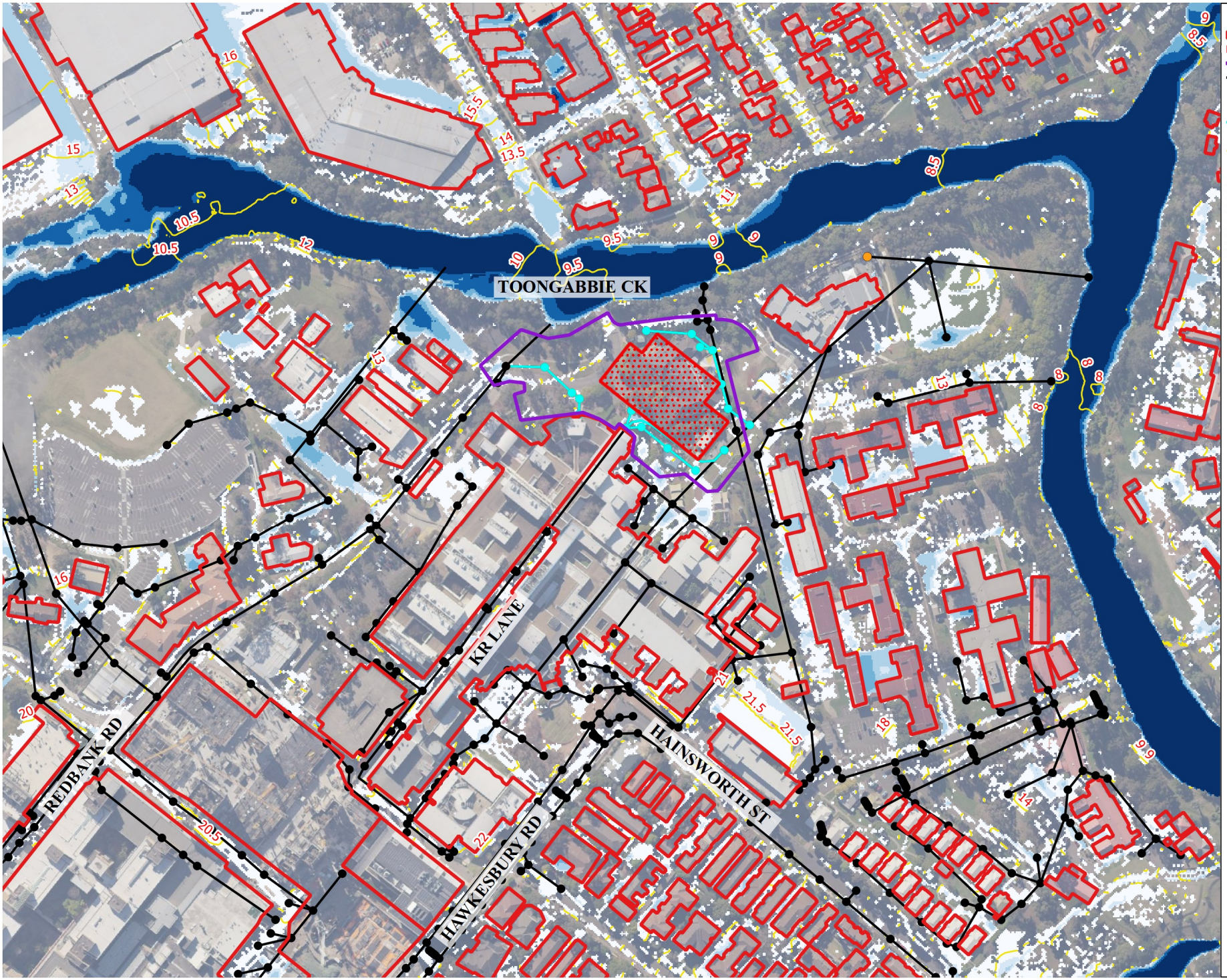
25 0 25 50 m

Scale at A3 1:2,500

Figure No. E.H.4
Existing Case PMF Riverine Flooding Hazard

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Issue	Date	By	Chkd	Appd
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Job Title
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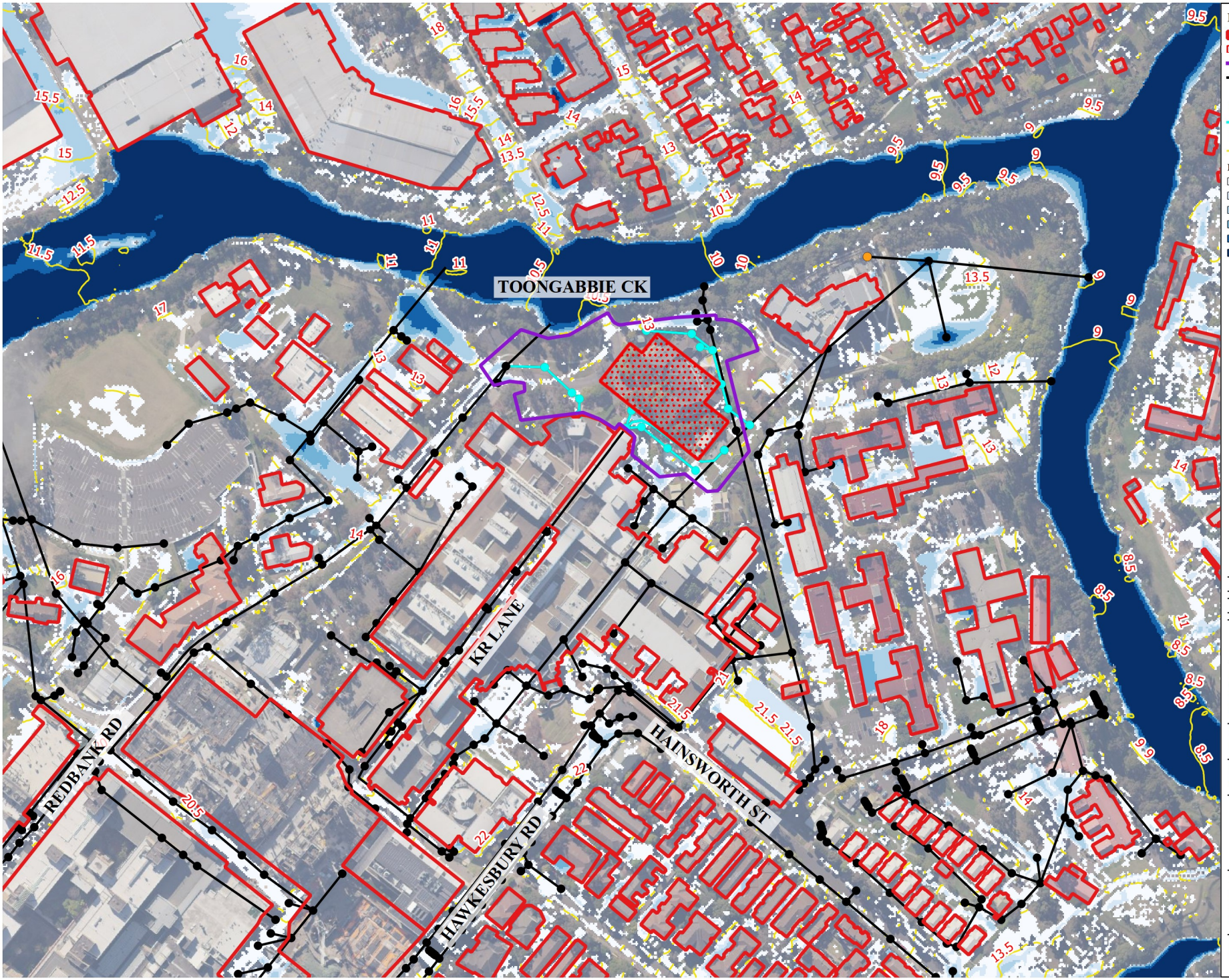
Scale at A3 1:2,500

Figure No. P.D.1

MSCP Proposed Case 10% AEP Overland Flooding Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Issue	Date	By	Chkd	Appd
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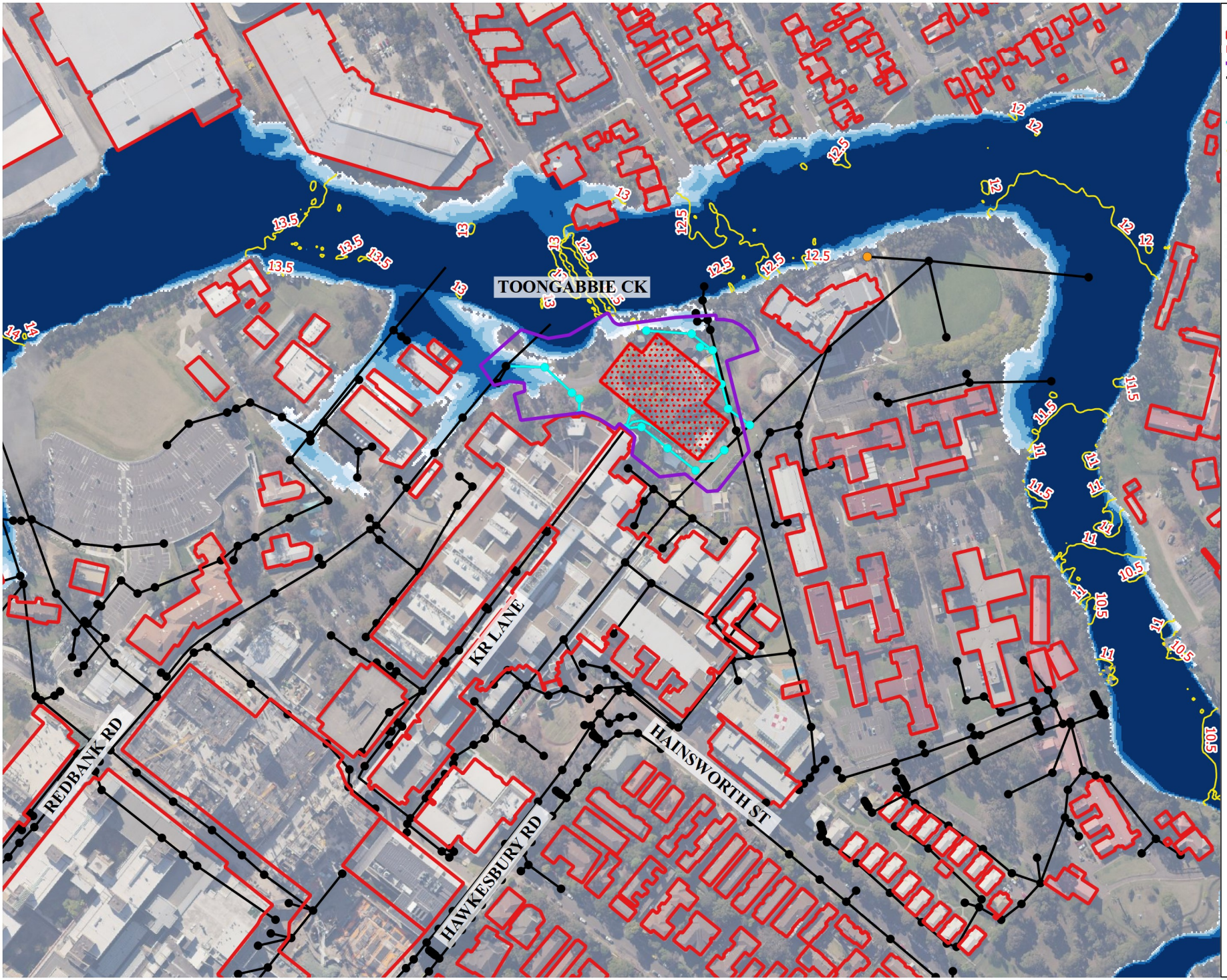
Scale at A3 1:2,500

Figure No. P.D.2
MSCP Proposed Case 1% AEP Overland Flooding Peak Flood Depths and Levels

Job No.
271985

Figure Status
For SSDA



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Notes:
1. The riverine flooding shown excludes local catchment runoff

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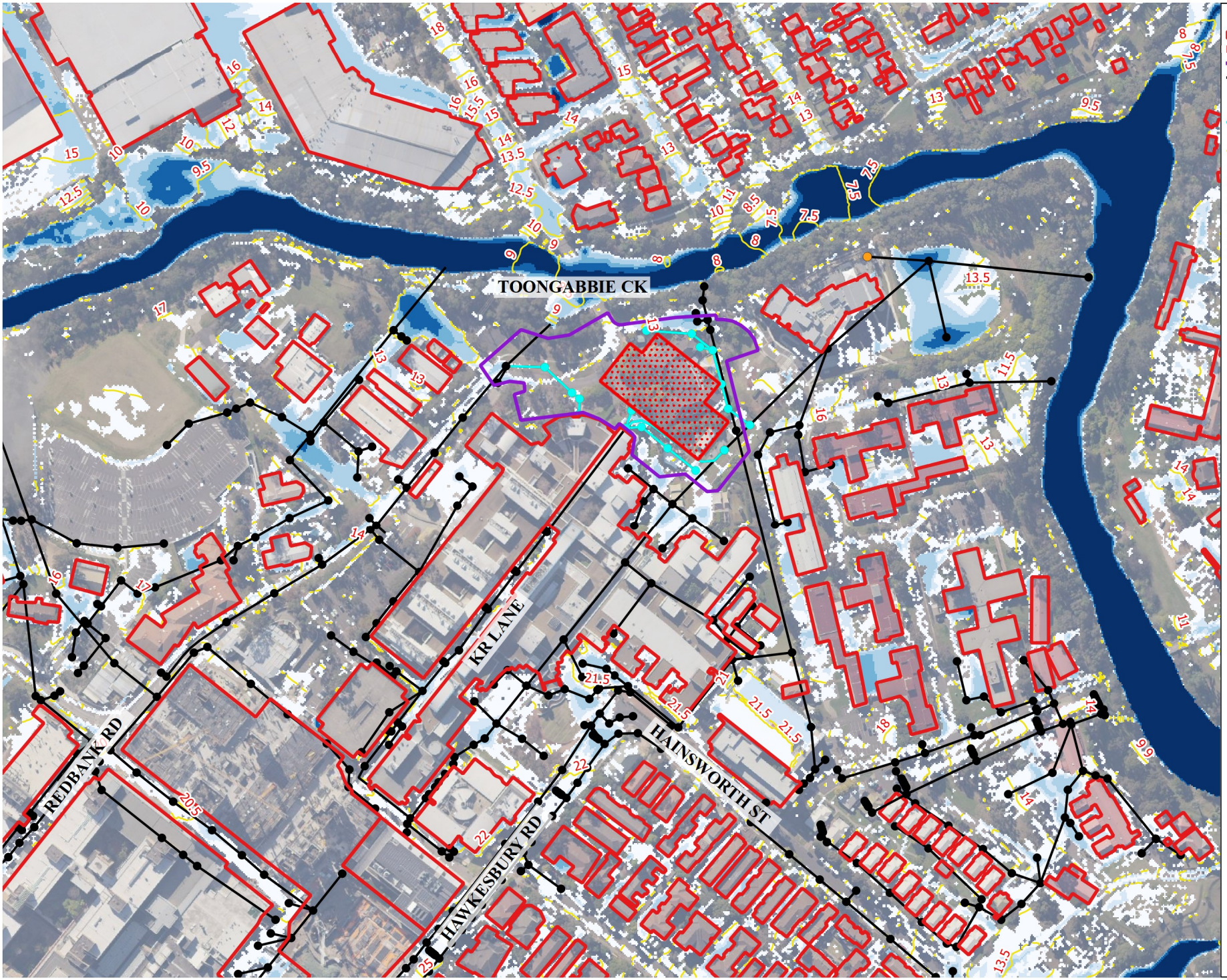
25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.D.3
MSCP Proposed Case 1% AEP Riverine Flooding Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Issue	Date	By	Chkd	Appd
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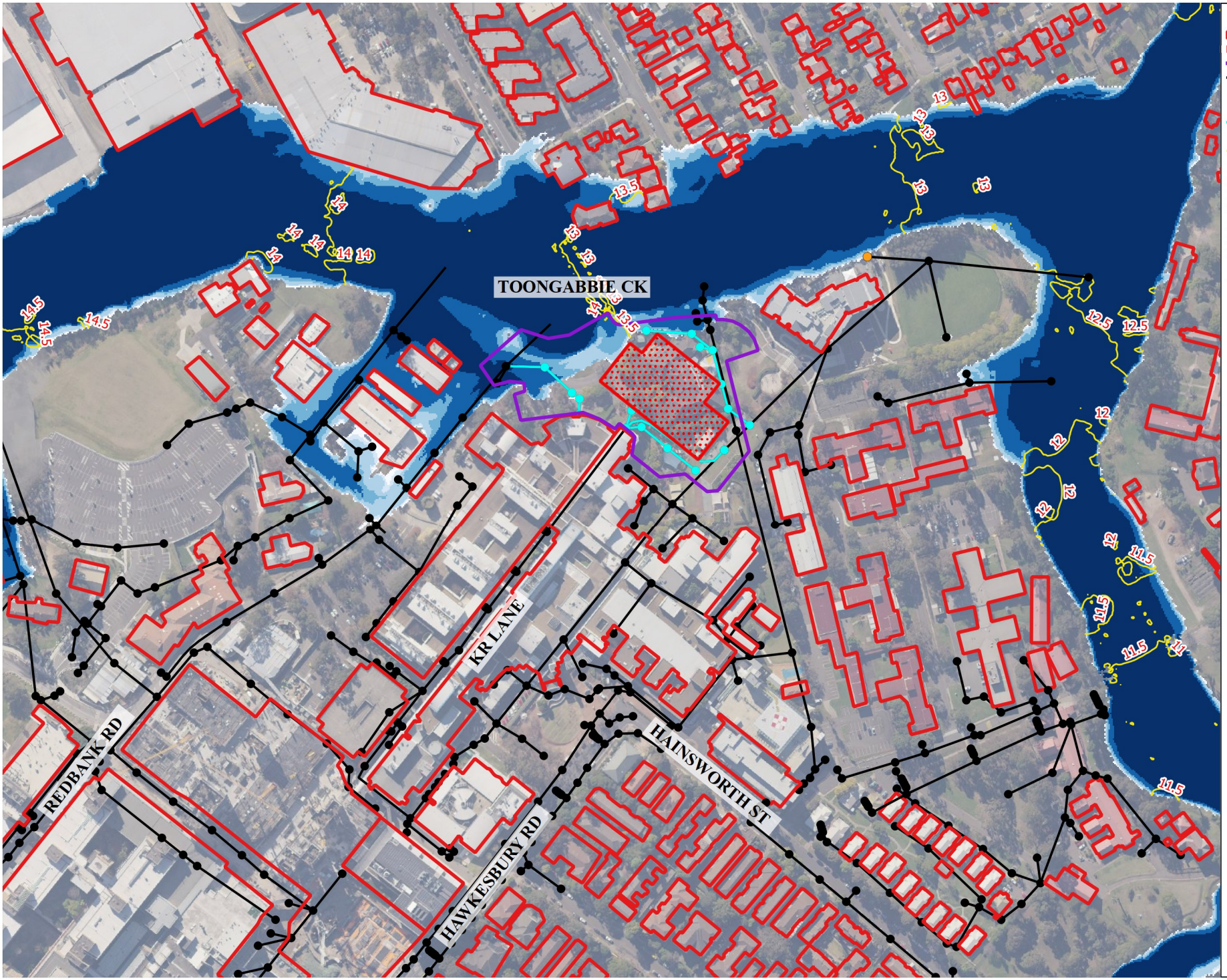
25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.D.4
MSCP Proposed Case 0.2% AEP Overland Flooding Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Notes:

1. The riverine flooding shown excludes local catchment runoff

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

ARUP

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151 Clarence Street
Sydney NSW 2000
Tel +61 (2) 9320 9320
www.arup.com

Client
Health Infrastructure

Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.D.5

MSCP Proposed Case 0.2% AEP Riverine Flooding Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**

Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

ARUP

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Sydney NSW 2000
Tel +61 (2) 9320 9320
www.arup.com

Client
Health Infrastructure

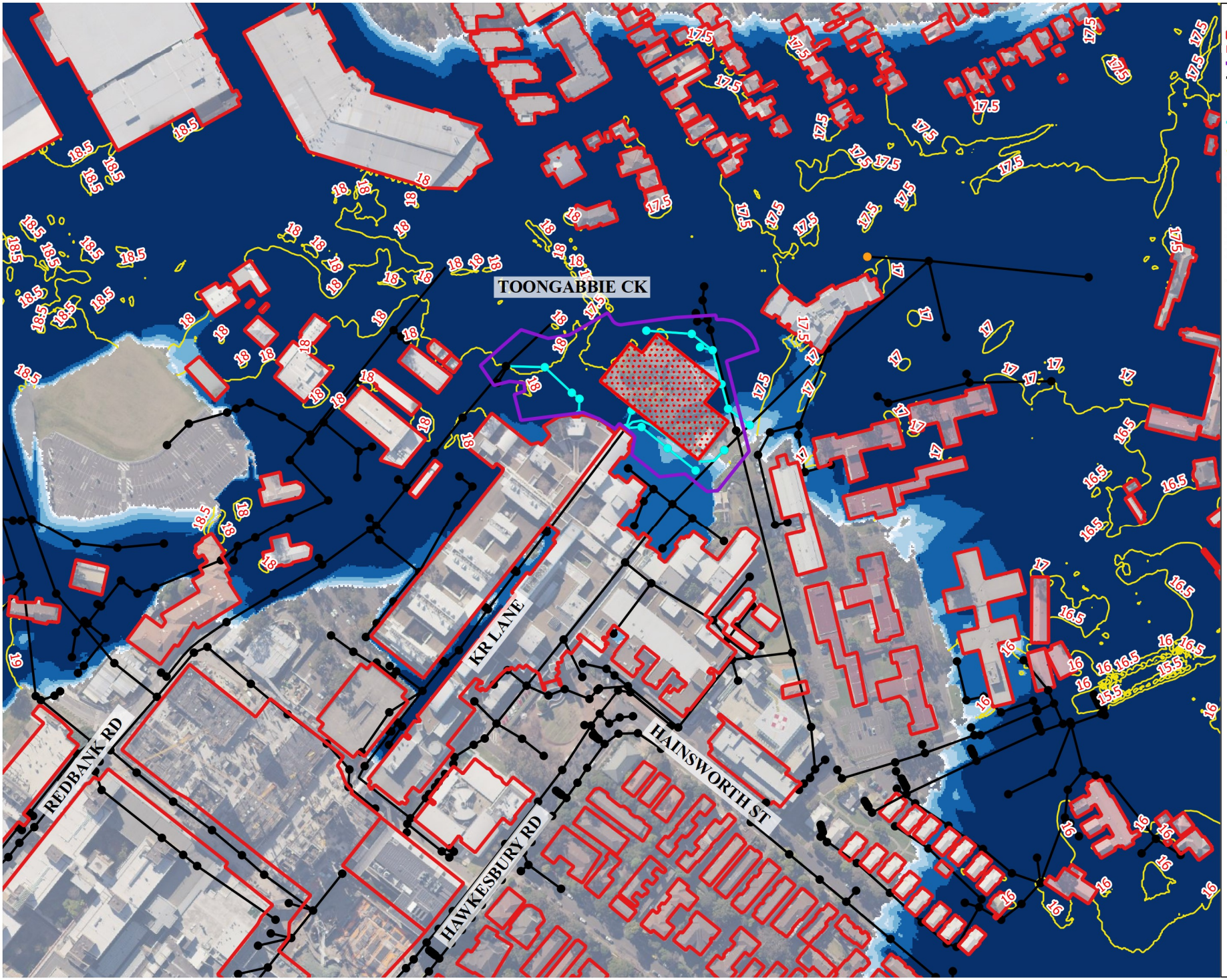
Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.D.6
MSCP Proposed Case PMF
Overland Flooding
Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits
- Flood Level Contours (mAHD)

Peak Flood Depths (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Notes:

1. The riverine flooding shown excludes local catchment runoff

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

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Level 5, Barrack Place
151 Clarence Street
Sydney NSW 2000
Tel +61 (2) 9320 9320
www.arup.com

Client
Health Infrastructure

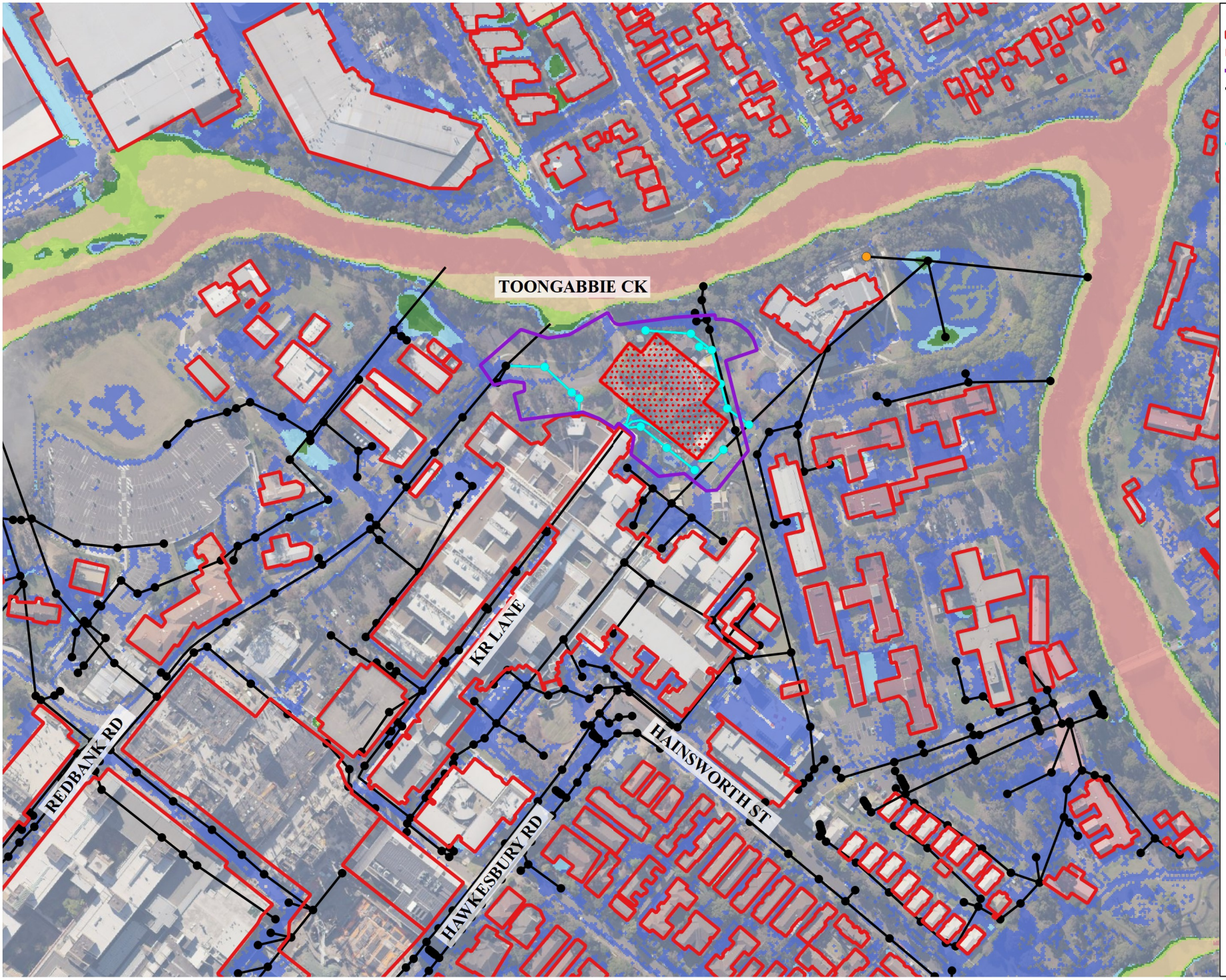
Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.D.7
MSCP Proposed Case PMF
Riverine Flooding
Peak Flood Depths and Levels

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits

Flood Hazard Category

- H1 - Relatively benign flow conditions.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for all vehicles, children and the elderly.
- H4 - Unsafe for all people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

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Tel +61 (2) 9320 9320
www.arup.com

Client
Health Infrastructure

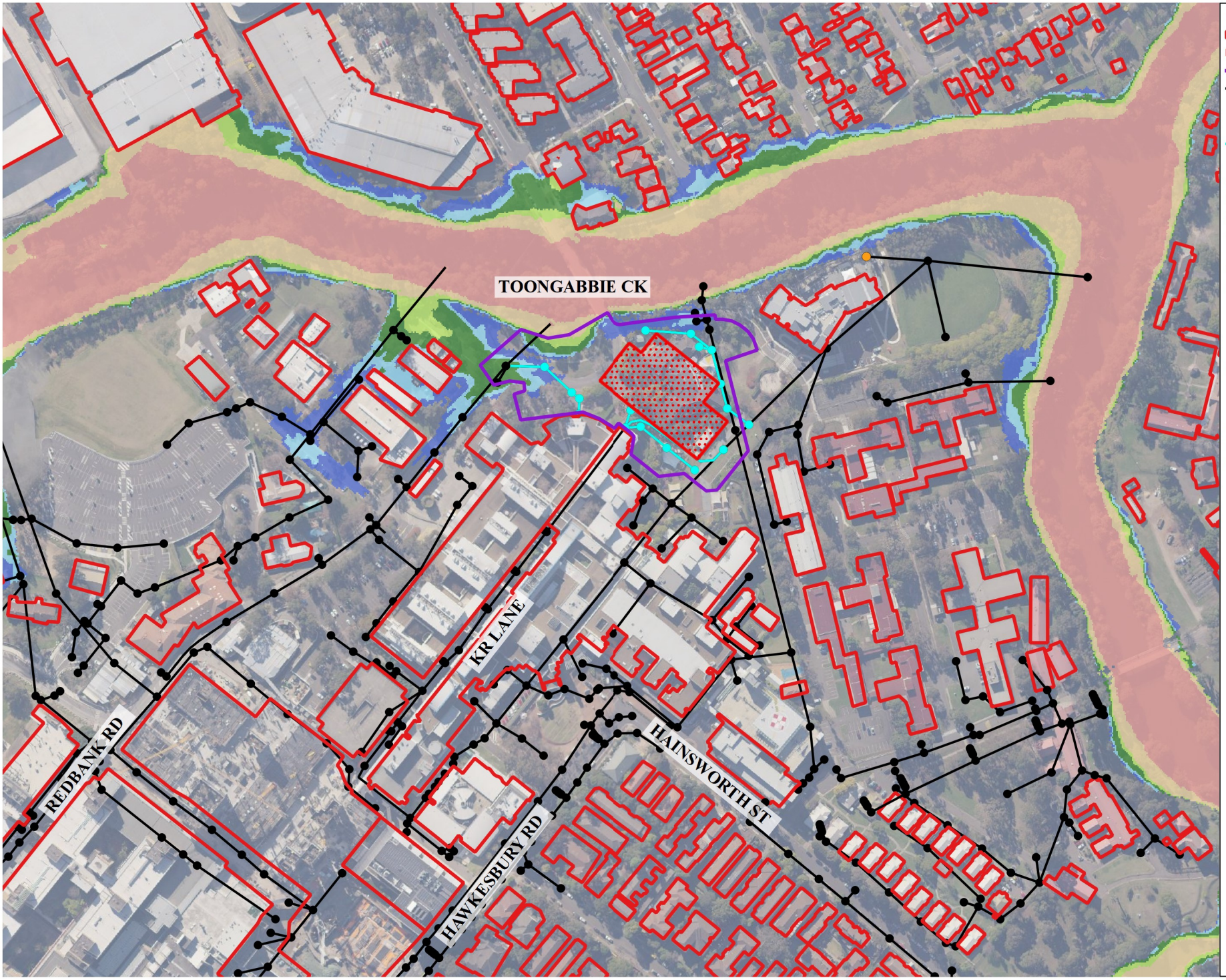
Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.H.1
MSCP Proposed Case 1% AEP Overland Flooding Hazard

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits

Flood Hazard Category

- H1 - Relatively benign flow conditions.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for all vehicles, children and the elderly.
- H4 - Unsafe for all people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

Notes:
1. The riverine flooding shown excludes local catchment runoff

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

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www.arup.com

Client
Health Infrastructure

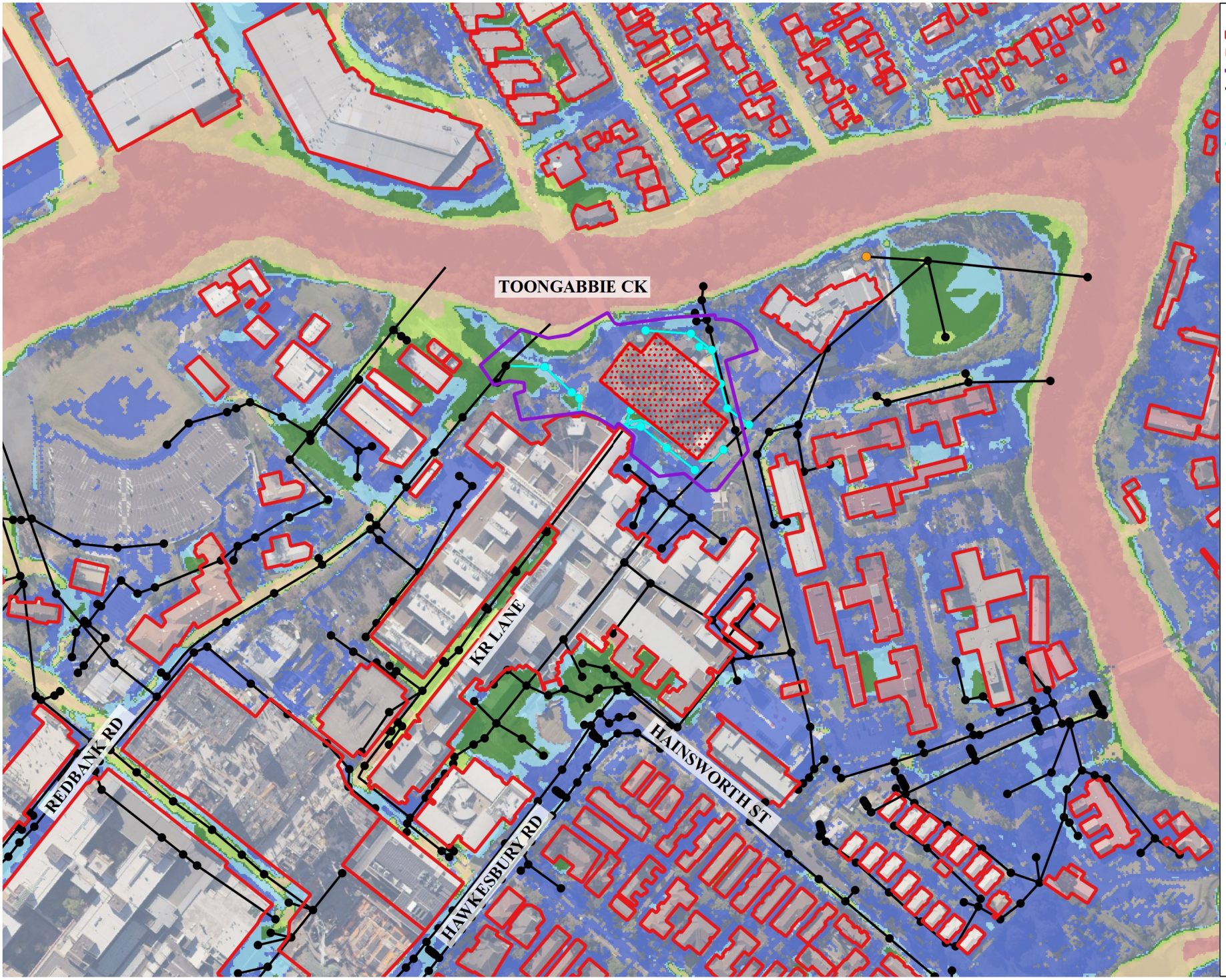
Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.H.2
MSCP Proposed Case 1% AEP Riverine Flooding Hazard

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits

Flood Hazard Category

- H1 - Relatively benign flow conditions.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for all vehicles, children and the elderly.
- H4 - Unsafe for all people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

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Client
Health Infrastructure

Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.H.3
MSCP Proposed Case PMF Overland Flooding Hazard

Job No.	Figure Status
271985	**For SSDA**

Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits

Flood Hazard Category

- H1 - Relatively benign flow conditions.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for all vehicles, children and the elderly.
- H4 - Unsafe for all people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

Notes:
1. The riverine flooding shown excludes local catchment runoff

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

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www.arup.com

Client
Health Infrastructure

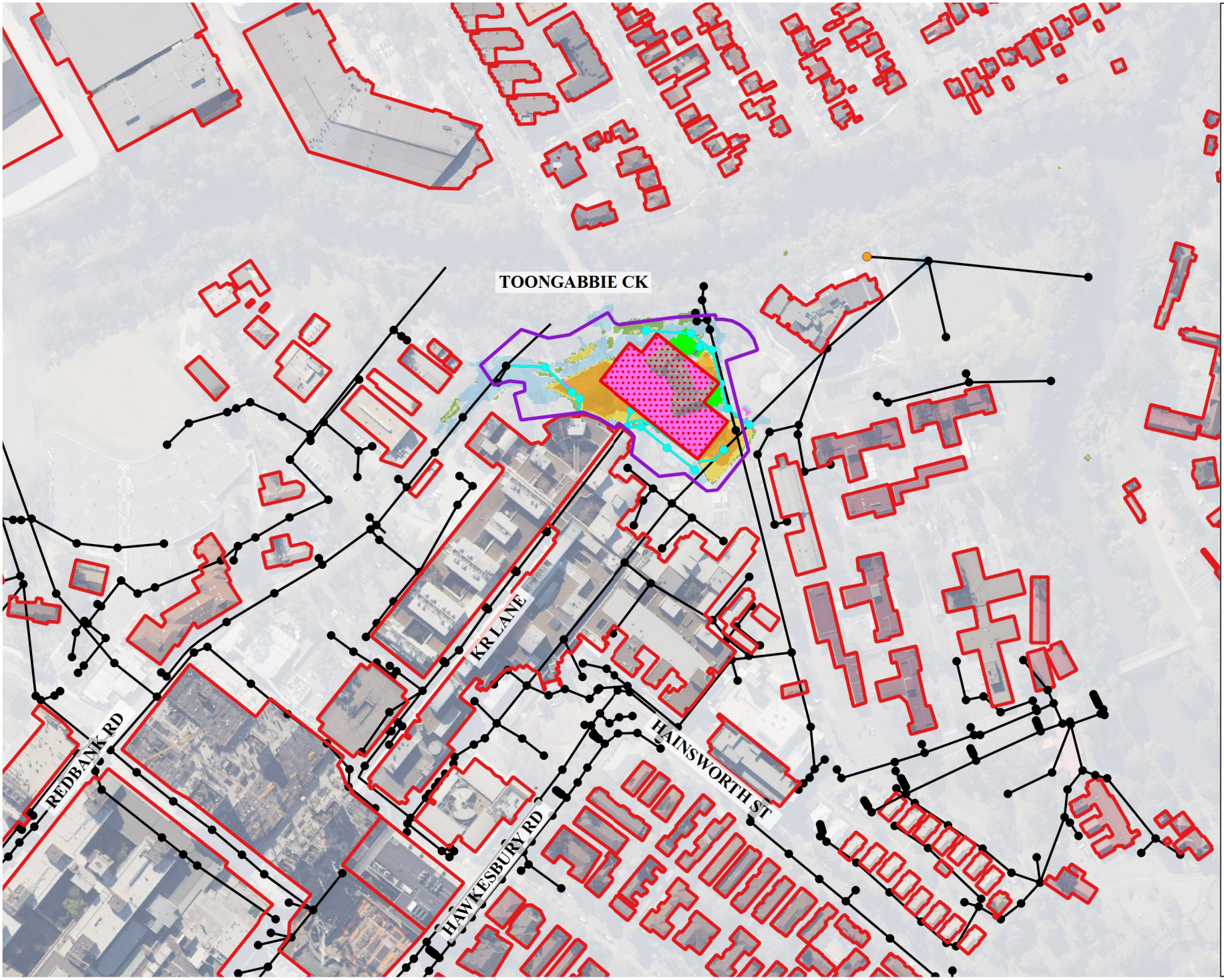
Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.H.4
MSCP Proposed Case PMF Riverine Flooding Hazard

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits

Change in Flood Level (m)

- <= -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.5
- > 0.5
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

1. This figure has been produced by comparing the proposed development flooding levels presented in Figure P.D.1 with the levels as presented in Figure E.D.1. Flooding impacts report changes in peak flood levels (mAHD). Note this is not the same as peak water depth.

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

ARUP

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Tel +61 (2) 9320 9320
www.arup.com

Client
Health Infrastructure

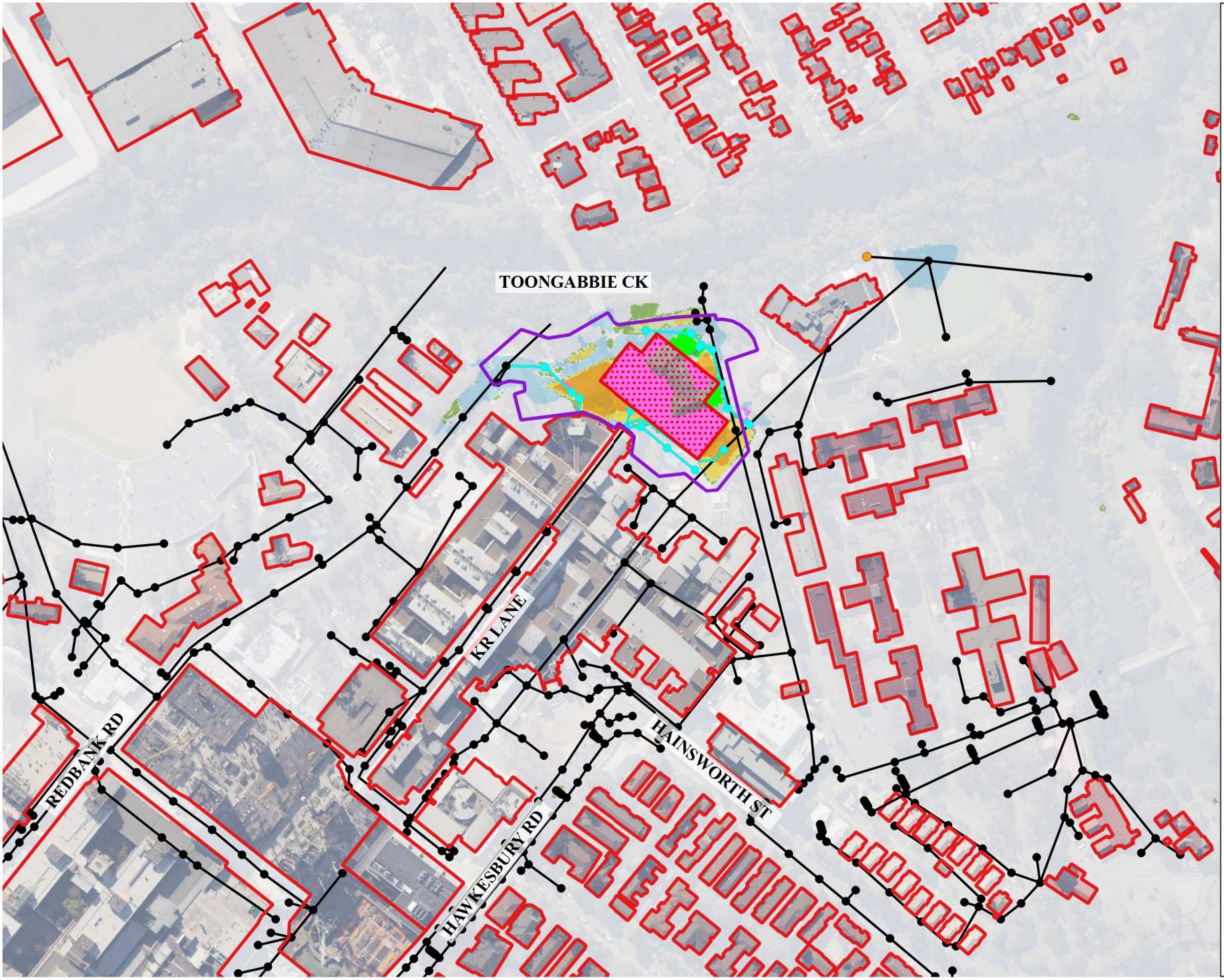
Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.A.1
MSCP Proposed Case 10% AEP Overland Flooding Afflux

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits

Change in Flood Level (m)

- <= -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.5
- > 0.5
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

1. This figure has been produced by comparing the proposed development flooding levels presented in Figure P.D.2 with the levels as presented in Figure E.D.3. Flooding impacts report changes in peak flood levels (mAHD). Note this is not the same as peak water depth.

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

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Client
Health Infrastructure

Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.A.2
MSCP Proposed Case 1% AEP Overland Flooding Afflux

Job No.	Figure Status
271985	**For SSDA**

Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits

Change in Flood Level (m)

- <= -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.5
- > 0.5
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

1. This figure has been produced by comparing the proposed development flooding levels presented in Figure P.D.3 with the levels as presented in Figure E.D.4. Flooding impacts report changes in peak flood levels (mAHD). Note this is not the same as peak water depth.

2. The riverine flooding shown excludes local catchment runoff

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

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Level 5, Barrack Place
151 Clarence Street
Sydney NSW 2000
Tel +61 (2) 9320 9320
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Client
Health Infrastructure

Job Title
Children's Hospital Westmead Stage 2

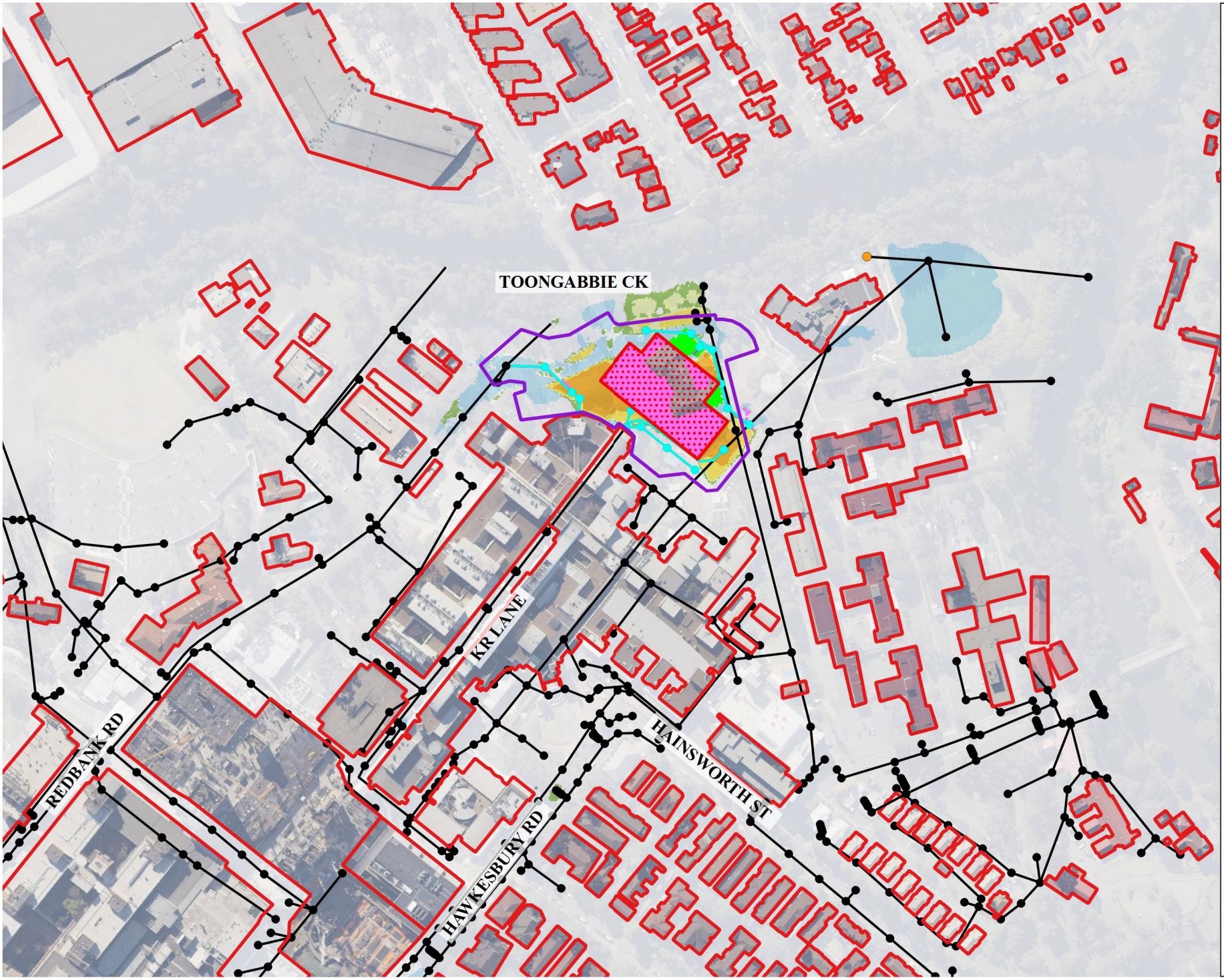
25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.A.3
MSCP Proposed Case 1% AEP Riverine Flooding Afflux

Job No.
271985

Figure Status
For SSDA



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits

Change in Flood Level (m)

- <= -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.5
- > 0.5
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

1. This figure has been produced by comparing the proposed development flooding levels presented in Figure P.D.4 with the levels as presented in Figure E.D.5. Flooding impacts report changes in peak flood levels (mAHD). Note this is not the same as peak water depth.

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

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Client
Health Infrastructure

Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.A.4
MSCP Proposed Case 0.2% AEP Overland Flooding Afflux

Job No.	Figure Status
271985	**For SSDA**

Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits

Change in Flood Level (m)

- <= -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.5
- > 0.5
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

1. This figure has been produced by comparing the proposed development flooding levels presented in Figure P.D.5 with the levels as presented in Figure E.D.6. Flooding impacts report changes in peak flood levels (mAHD). Note this is not the same as peak water depth.

2. The riverine flooding shown excludes local catchment runoff

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

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Client
Health Infrastructure

Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.A.5
MSCP Proposed Case 0.2% AEP Riverine Flooding Afflux

Job No.	Figure Status
271985	**For SSDA**

Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits

Change in Flood Level (m)

- <= -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.5
- > 0.5
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

1. This figure has been produced by comparing the proposed development flooding levels presented in Figure P.D.6 with the levels as presented in Figure E.D.7. Flooding impacts report changes in peak flood levels (mAHD). Note this is not the same as peak water depth.

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

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Client
Health Infrastructure

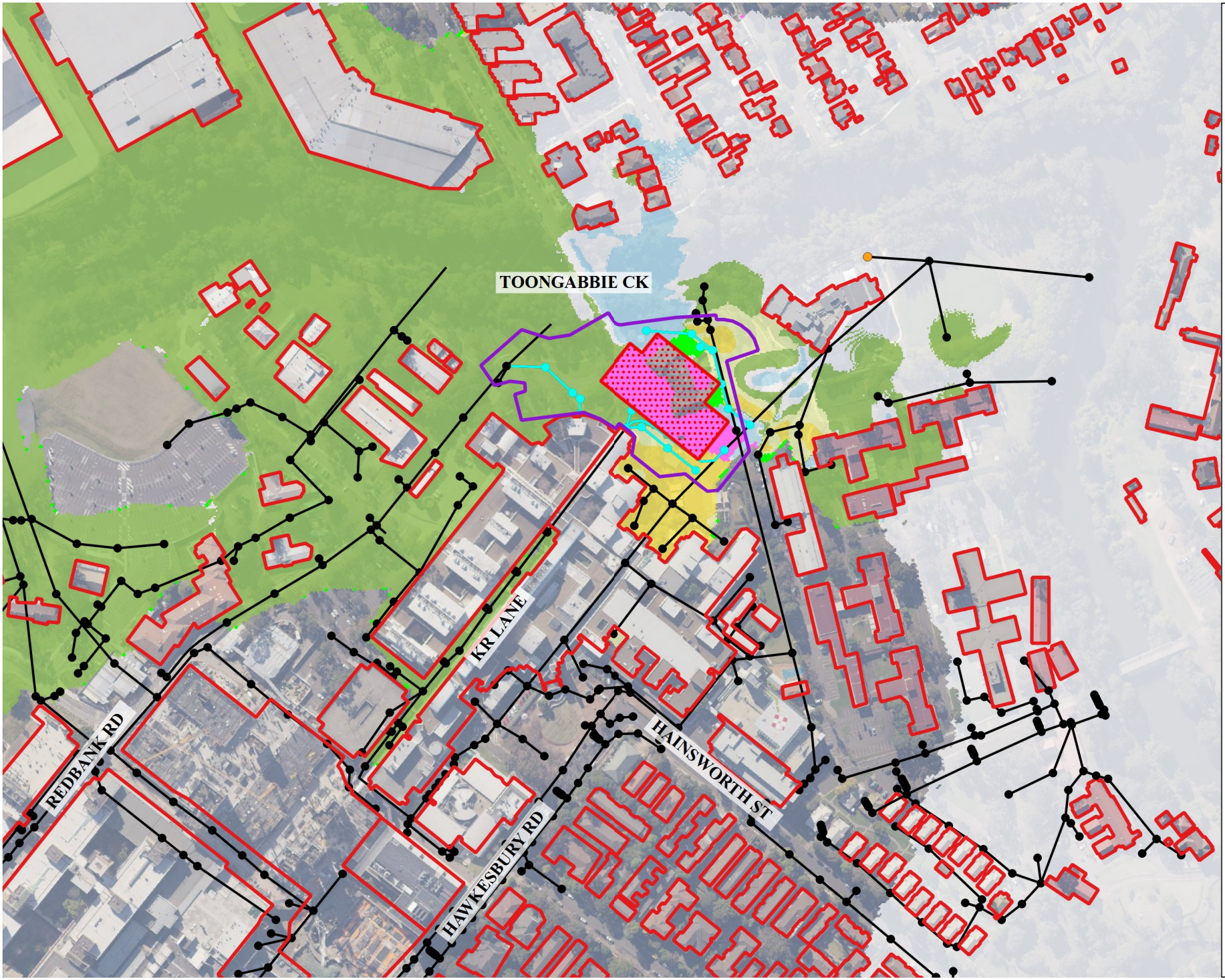
Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

Scale at A3 1:2,500

Figure No. P.A.6
MSCP Proposed Case PMF Overland Flooding Afflux

Job No.	Figure Status
271985	**For SSDA**



Legend

- Buildings
- Proposed Building
- Site Boundary
- Existing Pipes
- Existing Pits
- Existing OSD
- Proposed Pipes
- Proposed Pits

Change in Flood Level (m)

- <= -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.5
- > 0.5
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

1. This figure has been produced by comparing the proposed development flooding levels presented in Figure P.D.7 with the levels as presented in Figure E.D.8. Flooding impacts report changes in peak flood levels (mAHD). Note this is not the same as peak water depth.

2. The riverine flooding shown excludes local catchment runoff

Issue	Date	By	Chkd	Appd
1	12-02-2021	JC	NC	TT

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Sydney NSW 2000
Tel +61 (2) 9320 9320
www.arup.com

Client
Health Infrastructure

Job Title
Children's Hospital Westmead Stage 2

25 0 25 50 m

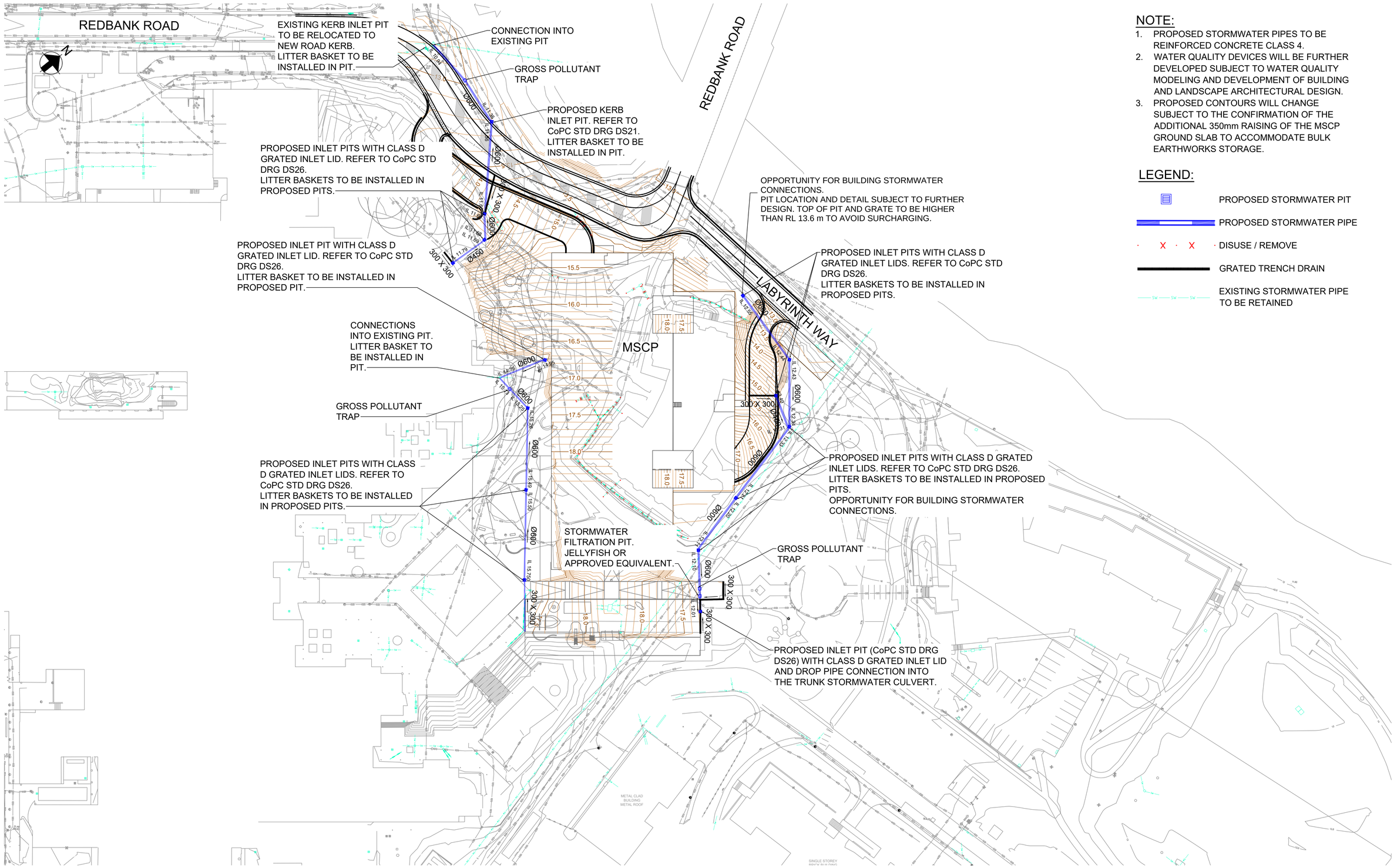
Scale at A3 1:2,500

Figure No. P.A.7
MSCP Proposed Case PMF Riverine Flooding Afflux

Job No.	Figure Status
271985	**For SSDA**

Appendix B

Stormwater Management Plan



NOTE:

1. PROPOSED STORMWATER PIPES TO BE REINFORCED CONCRETE CLASS 4.
2. WATER QUALITY DEVICES WILL BE FURTHER DEVELOPED SUBJECT TO WATER QUALITY MODELING AND DEVELOPMENT OF BUILDING AND LANDSCAPE ARCHITECTURAL DESIGN.
3. PROPOSED CONTOURS WILL CHANGE SUBJECT TO THE CONFIRMATION OF THE ADDITIONAL 350mm RAISING OF THE MSCP GROUND SLAB TO ACCOMMODATE BULK EARTHWORKS STORAGE.

LEGEND:

- PROPOSED STORMWATER PIT
- PROPOSED STORMWATER PIPE
- DISUSE / REMOVE
- GRATED TRENCH DRAIN
- EXISTING STORMWATER PIPE TO BE RETAINED

NOT FOR CONSTRUCTION

Scales

0 10 20m

A1 / A3
1:500 / 1:1000

Design Model Version
Xref ..\d0515556\X-ARU-PGL-SU-CADASTRAL.dwg

Do not scale

Issue	Date	By	Chkd	Appd

Issue	Date	By	Chkd	Appd

Issue	Date	By	Chkd	Appd
3	11.02.21	DJ	TT	BH
	SCHEMATIC DESIGN UPDATE			
2	18.12.20	JC	TT	BH
	100% SCHEMATIC DESIGN			
1	27.11.20	JC	TT	BH
	DRAFT ISSUE FOR COST PLAN			

Client
NSW GOVERNMENT Health Infrastructure

Engineering Certification (CEng)
Name: .....
Signature: ..... Date: .....

Job Title
CHILDREN'S HOSPITAL WESTMEAD
STAGE 2
MULTI-STOREY CAR PARK
SCHEMATIC DESIGN

Scale at A1 1:500m

Discipline Civil

ARUP
Arup, Level 5, 151 Clarence St
Sydney, NSW, 2000
Tel +61 (02) 9320 9320 Fax +61 (02) 9320 9321
www.arup.com

CONSULT AUSTRALIA
Member Firm
Arup Pty Ltd
ABN 18 000 966 165

Drawing Title
DRAINAGE
MSCP
OVERALL PLAN

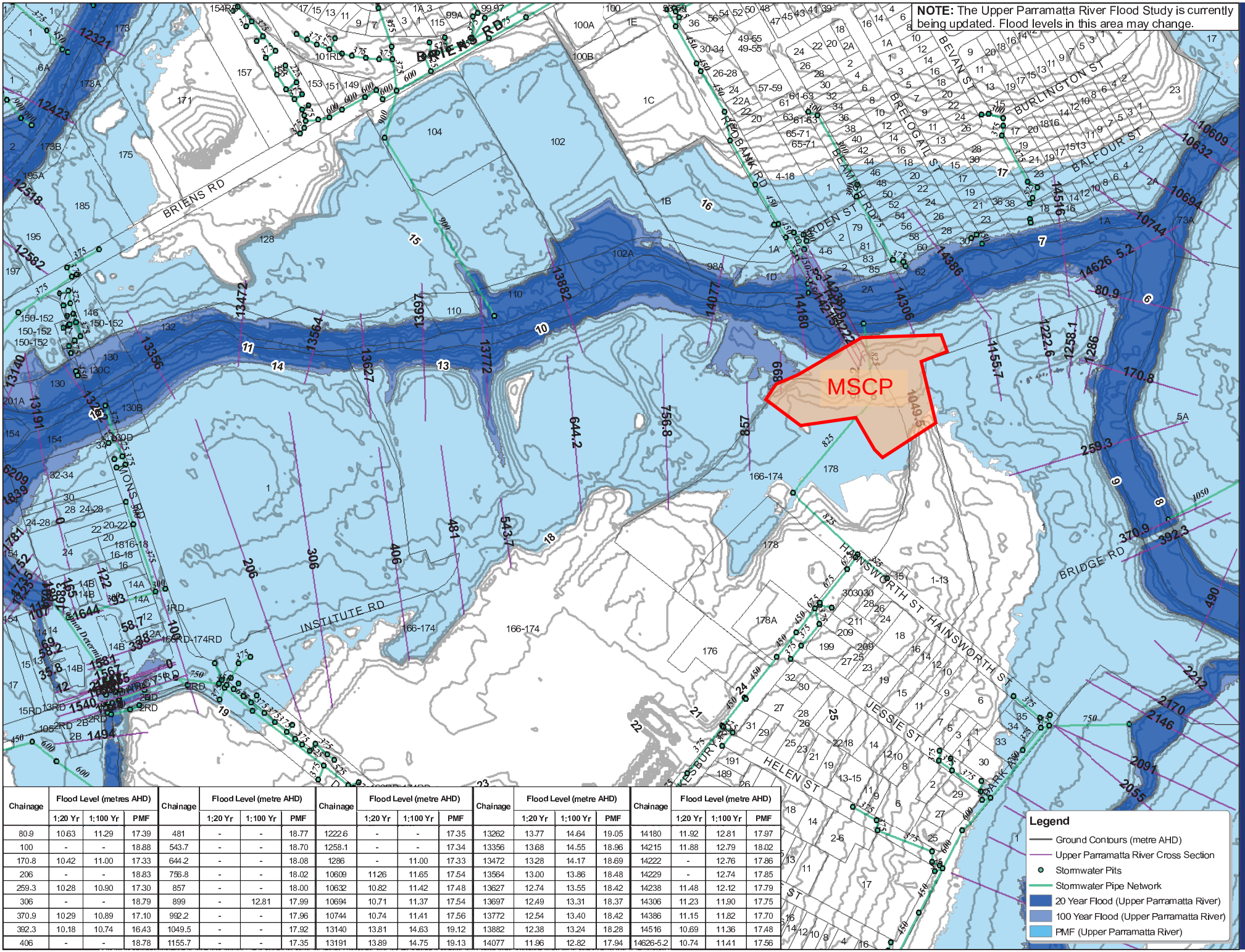
Drawing Status
SCHEMATIC DESIGN

Job No	Drawing No	Issue
271985-00	CHW-ARP-CV-DG-MP-00-XX630	3

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

Appendix C

CoPC Flood Map



Parramatta City Council Flood Map

DISCLAIMER: Flood levels and flood extent lines are based on current information held by Council. Council does not accept responsibility for the accuracy of this Information. Any pipe sizes and location of pits and pipe lines should be confirmed by site investigation.
The flood levels provided are only an approximate guide and have been derived using the current computer simulated model.
The information provided on this document is presented in good faith. It is the responsibility of each individual using this information to undertake their own checks and confirm this information prior to its use.
Parramatta City Council, its agents and employees are not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement, or advice referred to above.

Printed 11/05/2016

Chainage	Flood Level (metres AHD)			Chainage	Flood Level (metre AHD)			Chainage	Flood Level (metre AHD)			Chainage	Flood Level (metre AHD)			Chainage	Flood Level (metre AHD)		
	1:20 Yr	1:100 Yr	PMF		1:20 Yr	1:100 Yr	PMF		1:20 Yr	1:100 Yr	PMF		1:20 Yr	1:100 Yr	PMF		1:20 Yr	1:100 Yr	PMF
80.9	10.63	11.29	17.39	481	-	-	18.77	1222.6	-	-	17.35	13262	13.77	14.64	19.05	14180	11.92	12.81	17.97
100	-	-	18.88	543.7	-	-	18.70	1258.1	-	-	17.34	13356	13.68	14.55	18.96	14215	11.88	12.79	18.02
170.8	10.42	11.00	17.33	644.2	-	-	18.08	1286	-	11.00	17.33	13472	13.28	14.17	18.69	14222	-	12.76	17.86
206	-	-	18.83	756.8	-	-	18.02	10609	11.26	11.65	17.54	13564	13.00	13.86	18.48	14229	-	12.74	17.85
259.3	10.28	10.90	17.30	857	-	-	18.00	10632	10.82	11.42	17.48	13627	12.74	13.55	18.42	14238	11.48	12.12	17.79
306	-	-	18.79	899	-	12.81	17.99	10694	10.71	11.37	17.54	13697	12.49	13.31	18.37	14306	11.23	11.90	17.75
370.9	10.29	10.89	17.10	992.2	-	-	17.96	10744	10.74	11.41	17.56	13772	12.54	13.40	18.42	14386	11.15	11.82	17.70
392.3	10.18	10.74	16.43	1049.5	-	-	17.92	13140	13.81	14.63	19.12	13882	12.38	13.24	18.28	14516	10.69	11.36	17.48
406	-	-	18.78	1155.7	-	-	17.35	13191	13.89	14.75	19.13	14077	11.96	12.82	17.94	14626-5.2	10.74	11.41	17.56

Appendix D

Flood Assessment and Stormwater Strategy Presentation and Meeting Minutes

Meeting Minutes

The Children's Hospital Westmead Stage 2 – Health Infrastructure / Parramatta Council Meeting

Meeting No.: 04

Date/Time: 1 February 2021 Start: 11:30am End: 12:30 pm

Venue: Video Conference

Attendance

Name		Organisation	Role
Caleb Teh	CT	Health Infrastructure	Project Director
Jim Tsom	JT	City of Parramatta Council	Catchment Development
Paul Clarke	PC	City of Parramatta Council	Catchment Development
Brian Hetherington	BH	Arup	Civil Engineer
Terrence Tang	TT	Arup	Civil Engineer
Nathan Cheah	NC	Arup	Civil Engineer
Hanan Hussaini	HH	PwC	Project Manager
Mary Sakr	MS	PwC	Project Manager

Item	Topic - Actions	Action	By
1.0	**Apologies and Introductions**		
1.1	Apologies and introductions noted.	Note	-
1.2	PwC noted the purpose of the session is to review the stormwater and flood mapping for the Westmead Health Precinct , prior to the EIS submission for the Paediatric Services Building (PSB) and Multi Storey Car Park (MSCP) as previously requested by CoPC.	Note	-
2.0	**Flood and Stormwater Strategy**		
2.1	Arup presented the stormwater and flood strategy for the PSB and MSCP (Attachment 1).	Note	-
2.2	Arup confirmed that the PSB and MSCP are proposed to be connected to private stormwater lines to eliminate the impact on the CoPC assets.	Note	-
2.3	CoPC noted that the overland flow-path will impact the existing CHW fire egress pedestrian pathway and recommended the review of the velocity and depth in that location.	Note	-
2.4	Arup noted the stormwater strategy includes direct connections into the existing stormwater network to discharge flow before river peak. Arup noted that the current site conditions are marginally impacted and therefore there is no requirement for an OSD tank. CoPC was generally in support, although queried the regulation of water quality. Arup to investigate as design progresses.	Note	-
3.0	**Other Items**		
3.1	Nil to report.	Note	-
4.0	**Next Meeting**		
4.1	To be confirmed.	Note	-

Attachments:

- **Attachment 1: Presentation**

Attachment 1: Presentation

CHW Stage 2 - Stormwater and Flood Risk Management

Agenda:

1. Children's Hospital Stage 2 Redevelopment overview and site appreciation
2. Outline the work that has been done since
3. Existing flood/stormwater conditions
4. Paediatric Services Building (PSB) Schematic Design
    - Proposed design
    - Development flood/stormwater assessment
    - Summary and next steps
5. Multistorey Car Park (MSCP) Schematic Design
    - Proposed design
    - Development flood/stormwater assessment
    - Summary and next steps

CHW Stage 2 – Stormwater and Flood Risk Management

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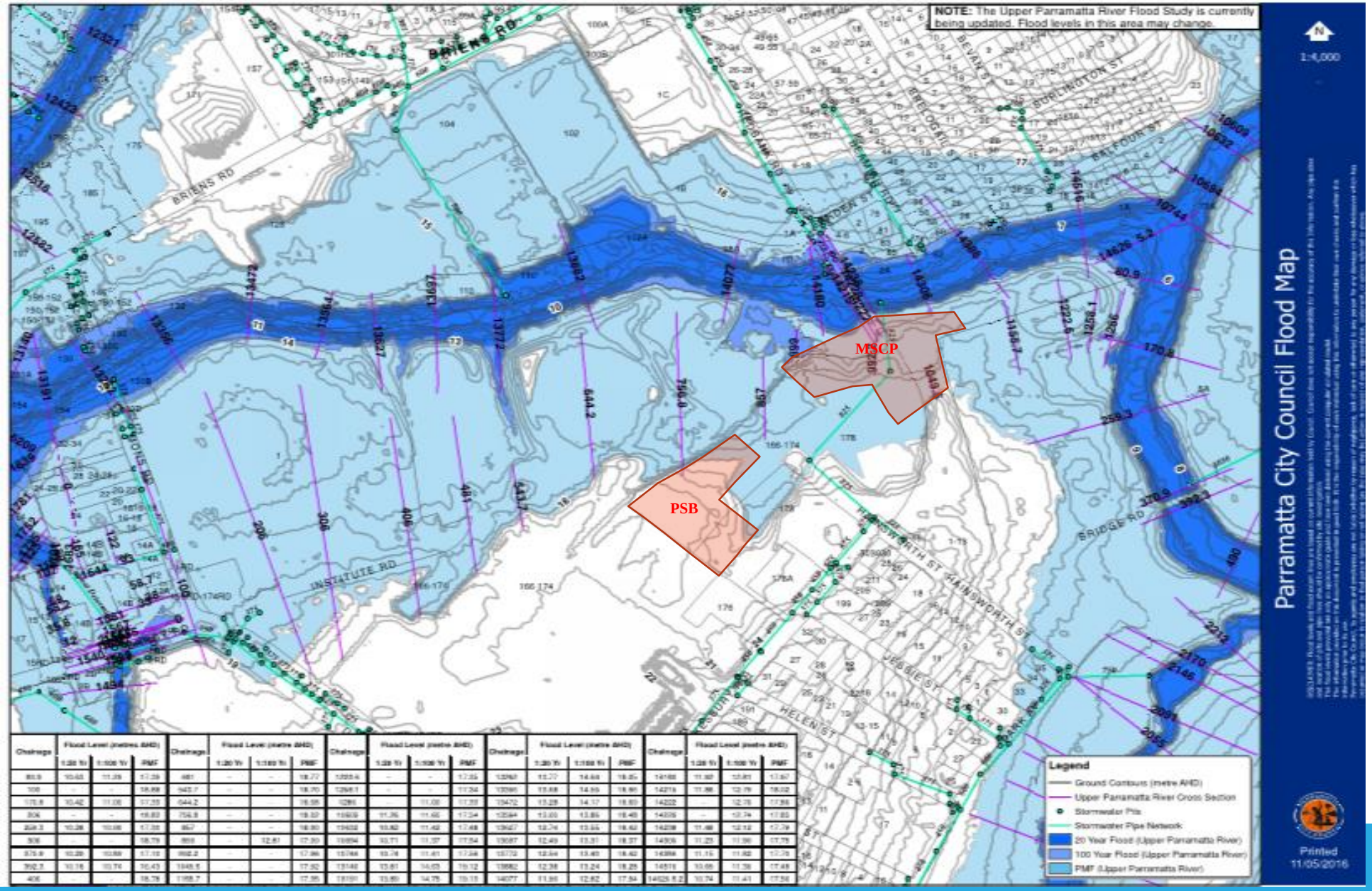
CHW Stage 2 – Stormwater and Flood Risk Management

Work Done:

- CASB Arup flood model (2017) (purple)
- PLR flood model (2019) (blue)
- PSB and MSCP site survey information (green)
- Arup combined the above information and created combined river and overland models

CHW Stage 2 – Stormwater and Flood Risk Management



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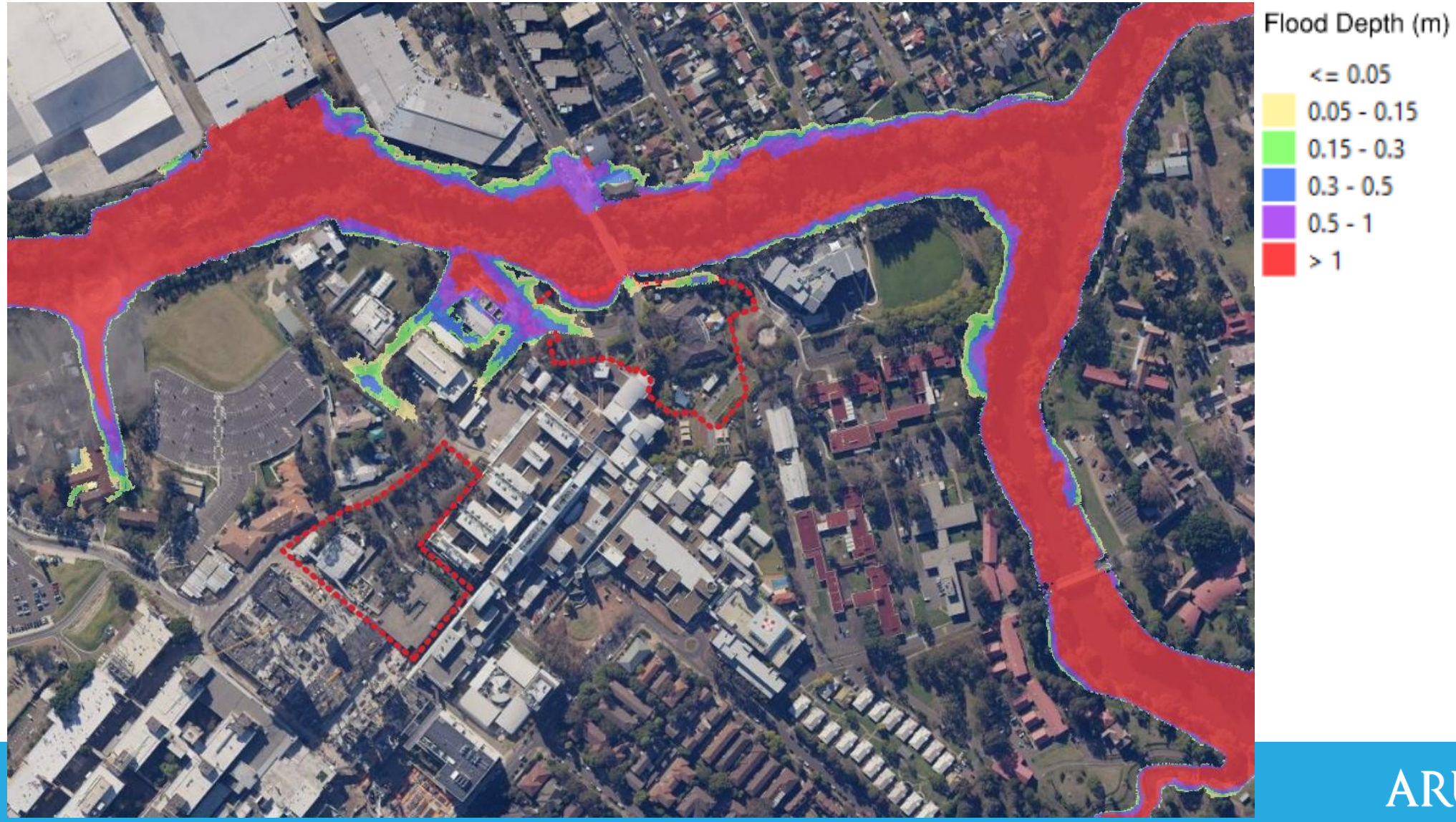
CHW Stage 2 – Stormwater and Flood Risk Management

Existing conditions - 1% AEP Overland

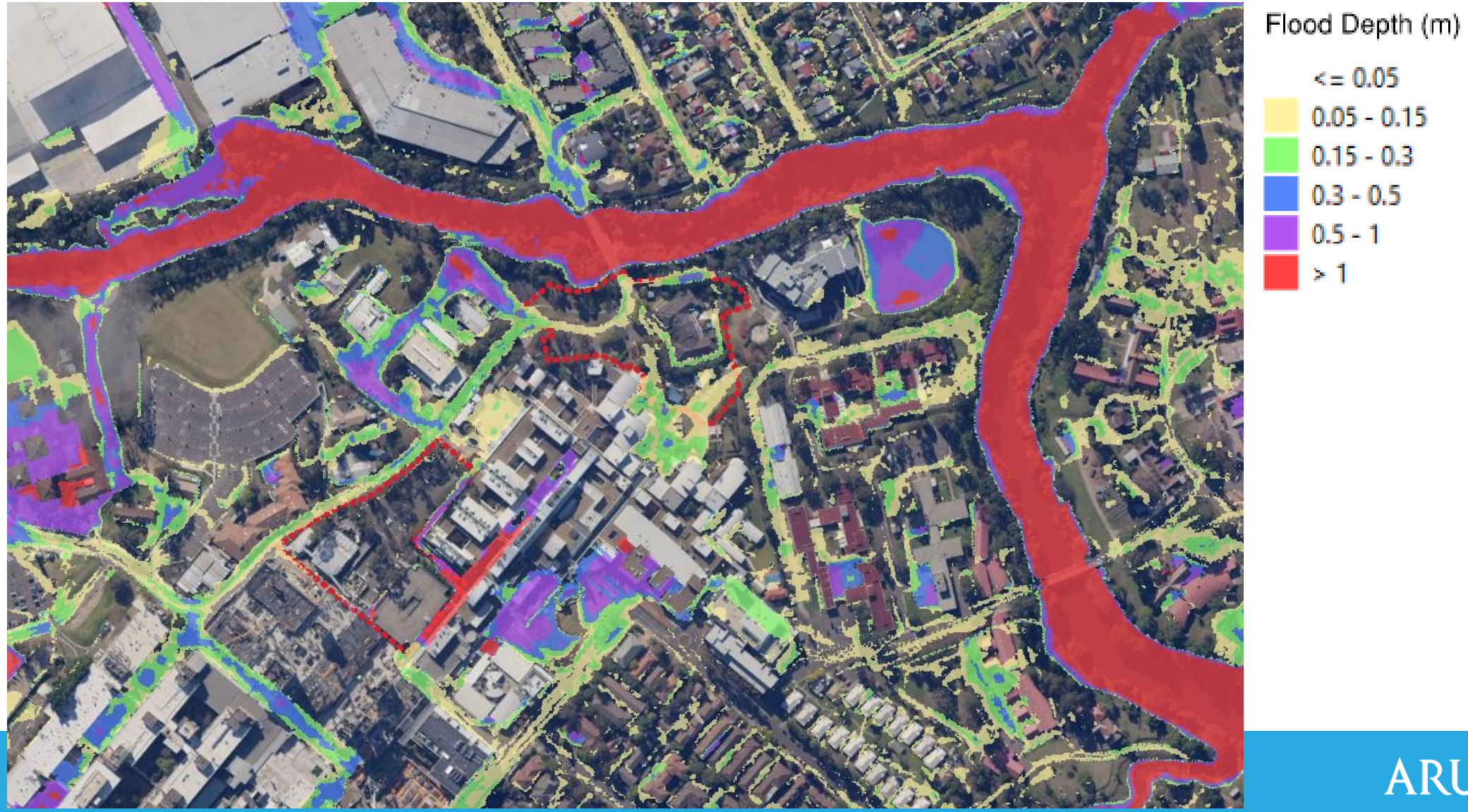
CHW Stage 2 – Stormwater and Flood Risk Management

Existing conditions - 1% AEP River



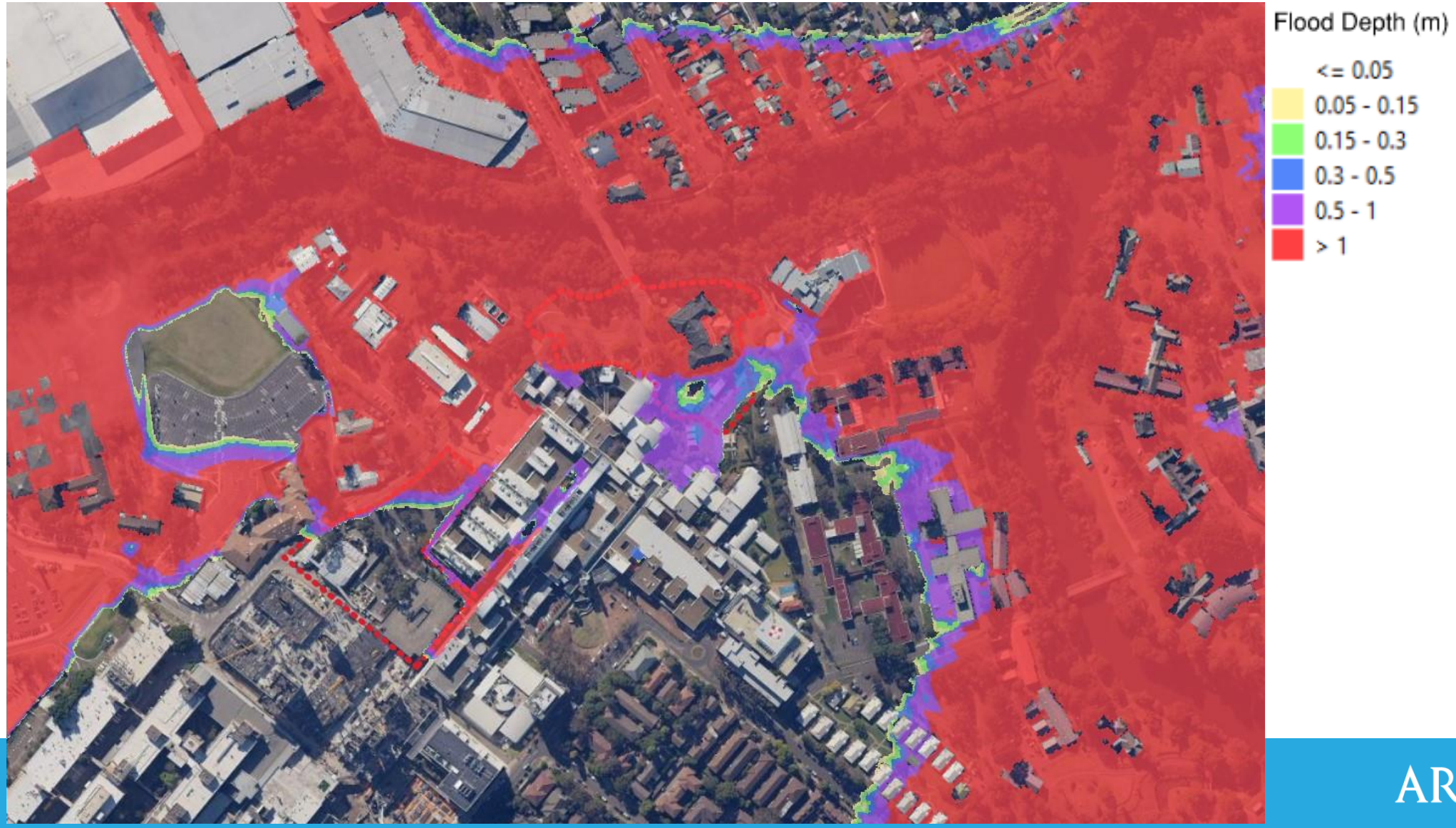
CHW Stage 2 – Stormwater and Flood Risk Management

Existing conditions – PMF Overland (30 mins)



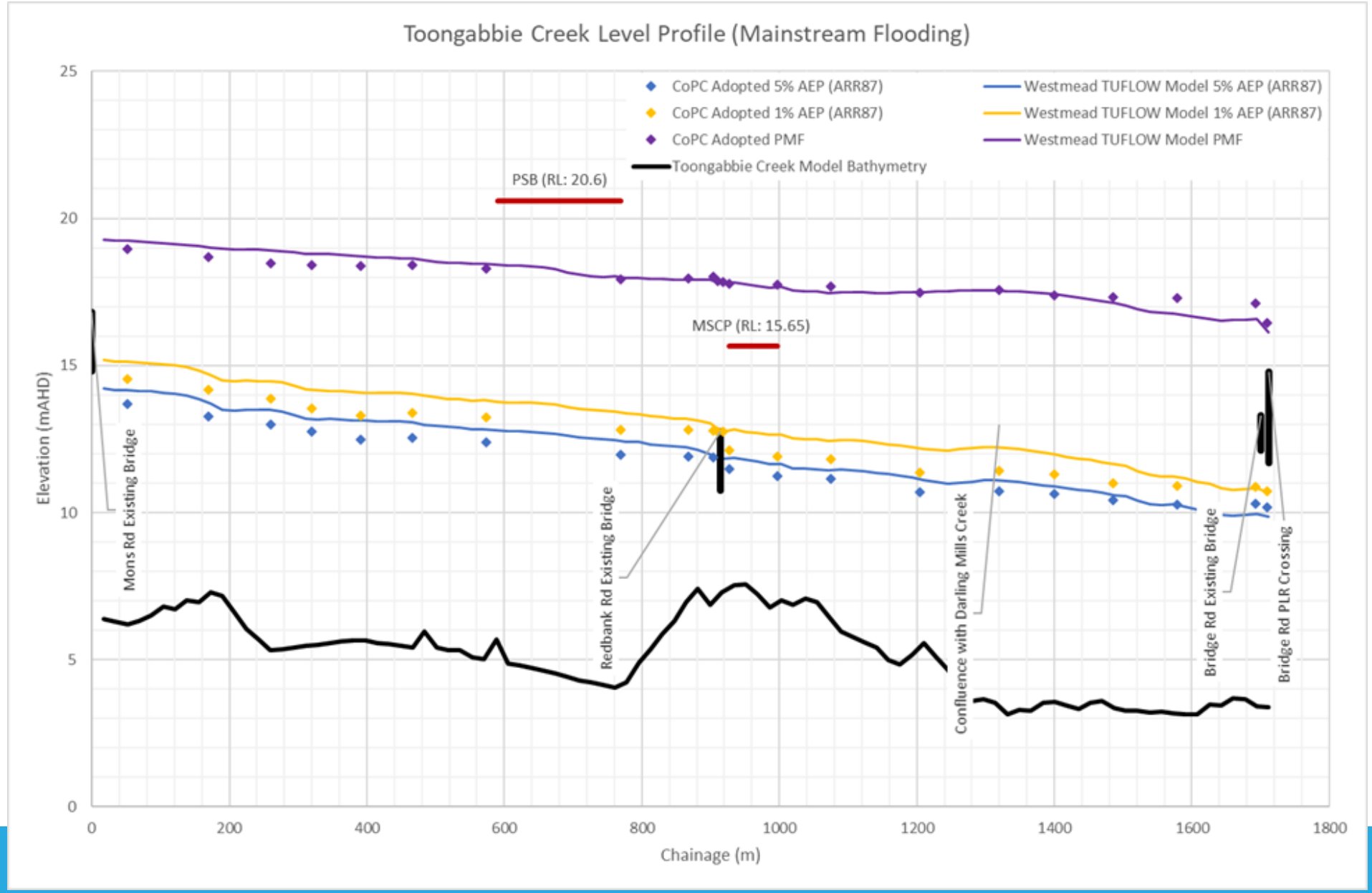
CHW Stage 2 – Stormwater and Flood Risk Management

Existing conditions – PMF River (3 hours)



CHW Stage 2 – Stormwater and Flood Risk Management

Calibration



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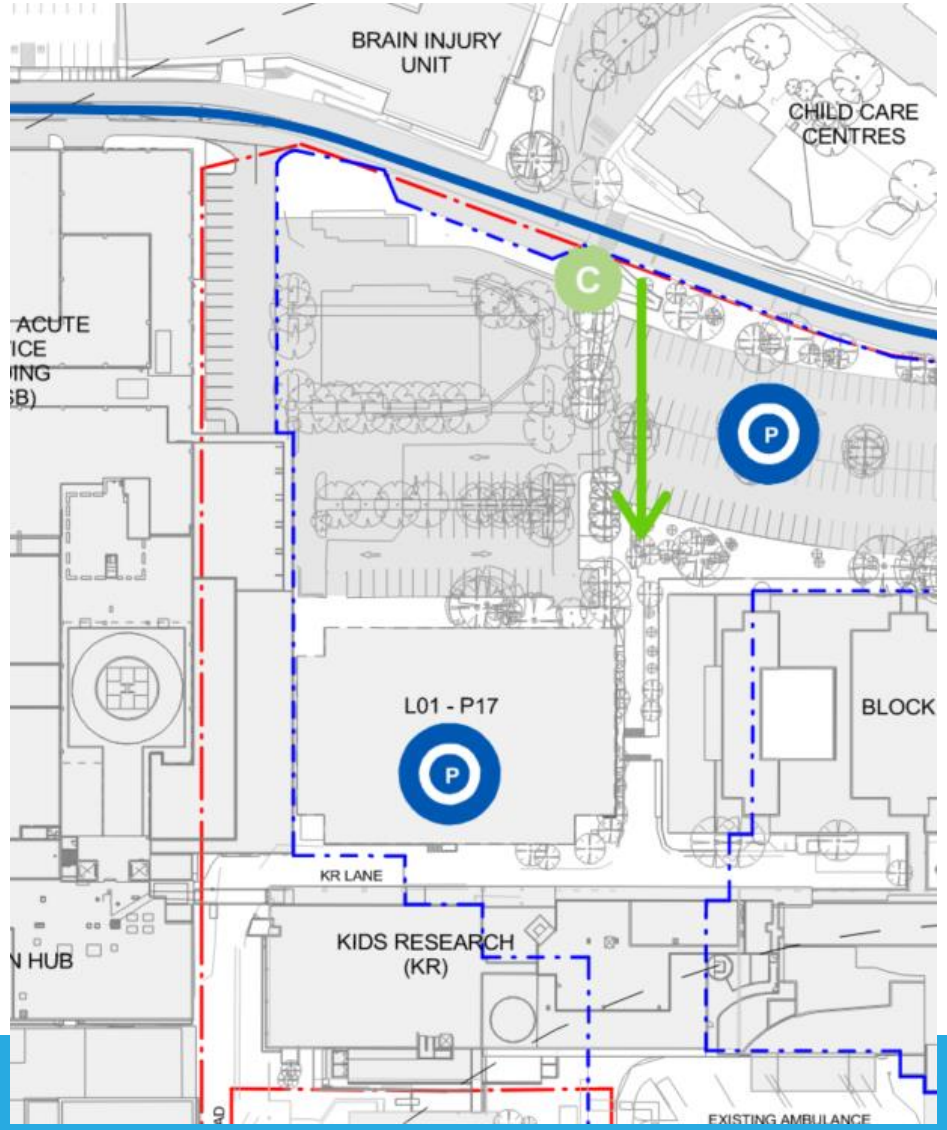
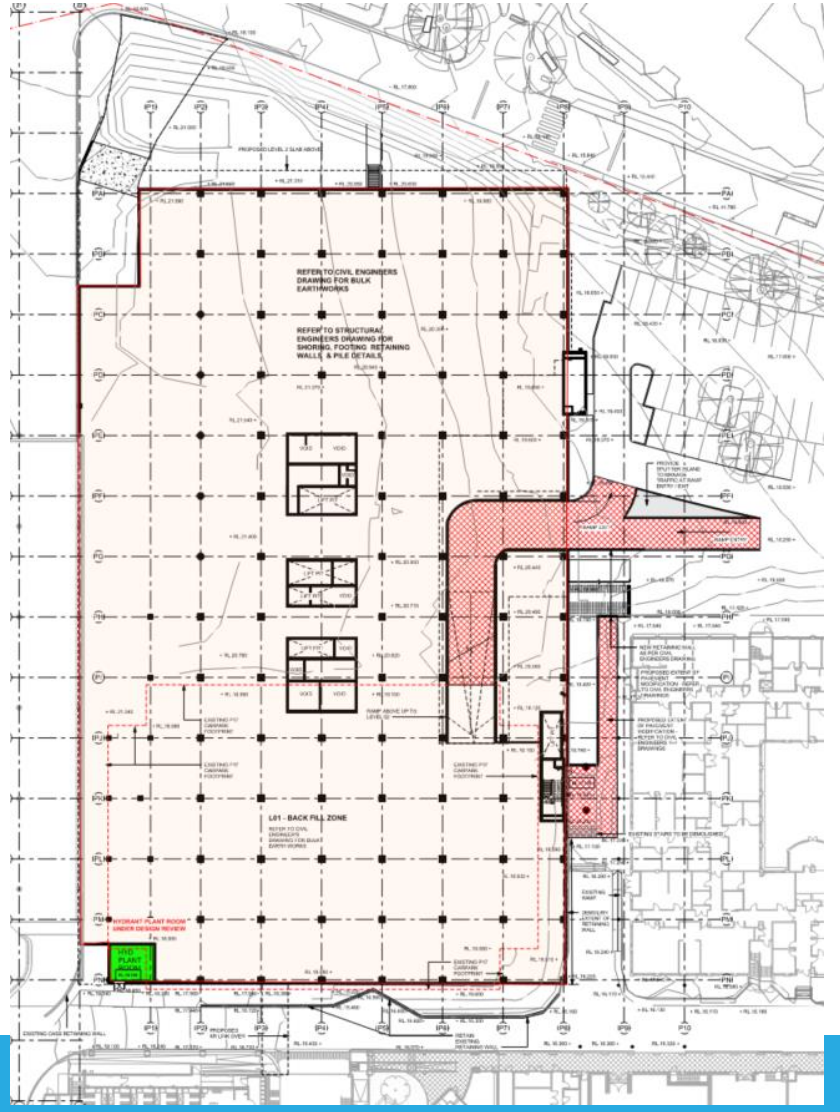
PSB – Stormwater and Flood Risk Management

Existing Site



Proposed Architectural Design



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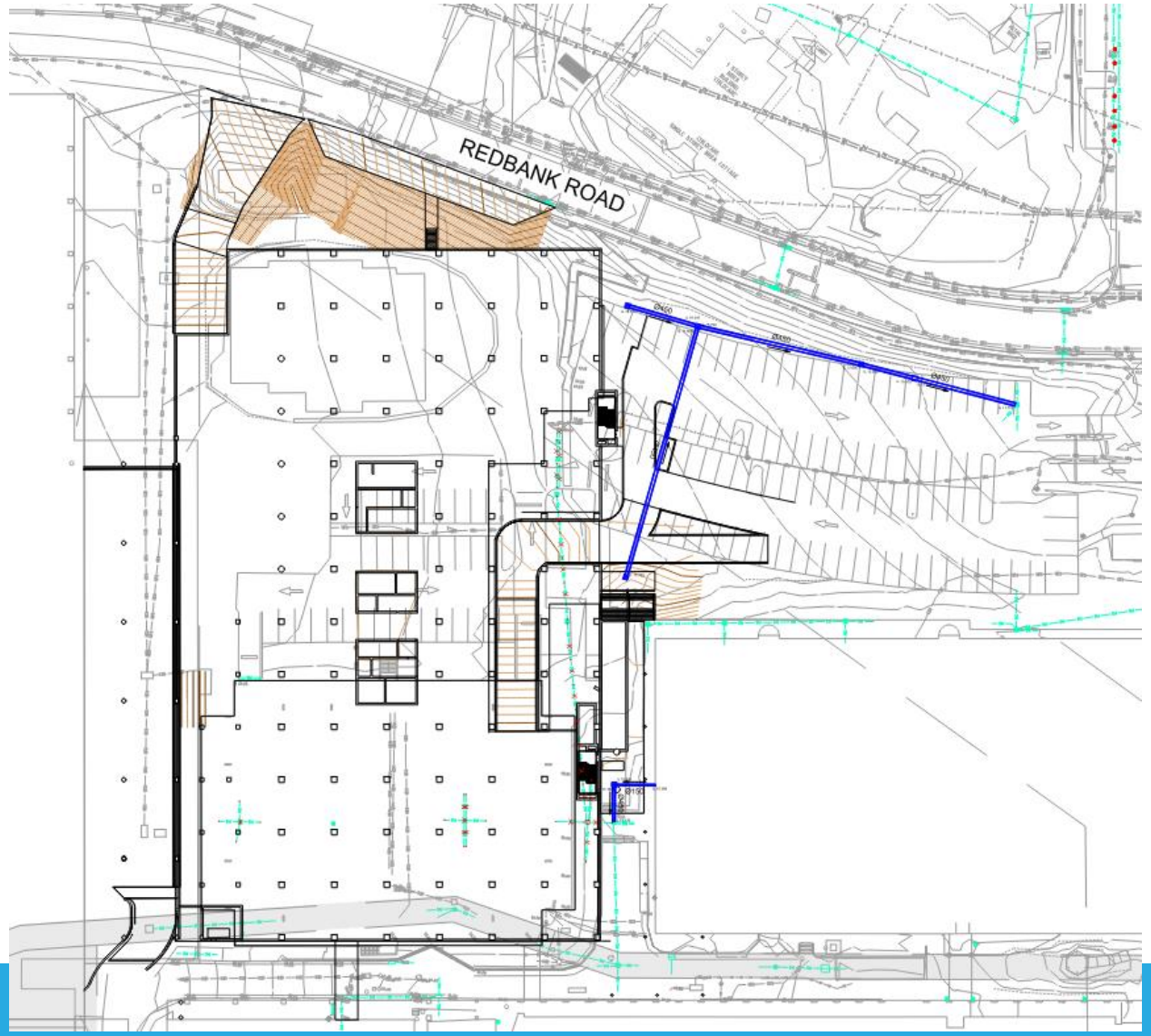
PSB – Stormwater and Flood Risk Management

Proposed Stormwater Strategy

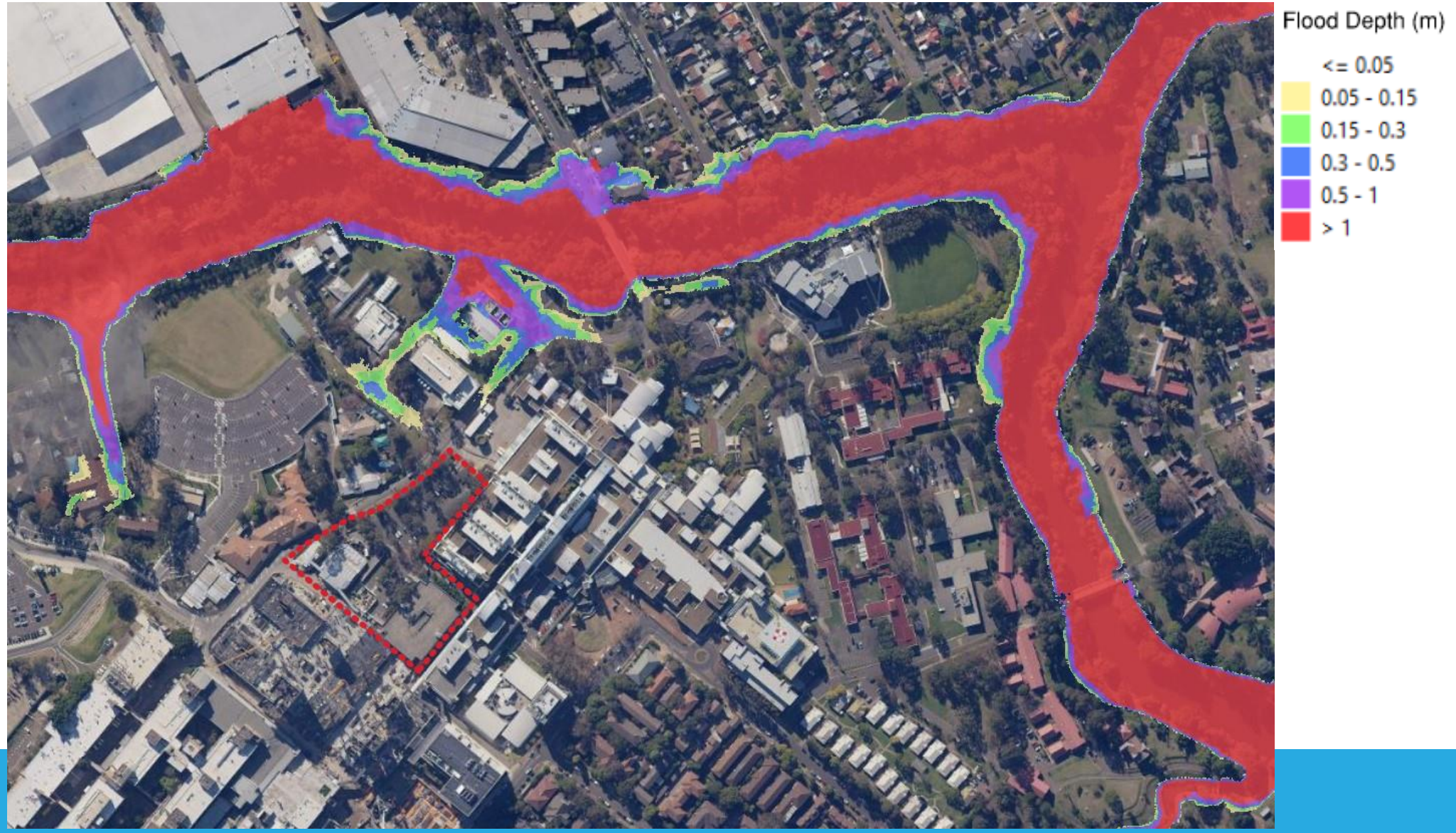


PSB – Stormwater and Flood Risk Management

Proposed design flood results – 1% AEP Overland

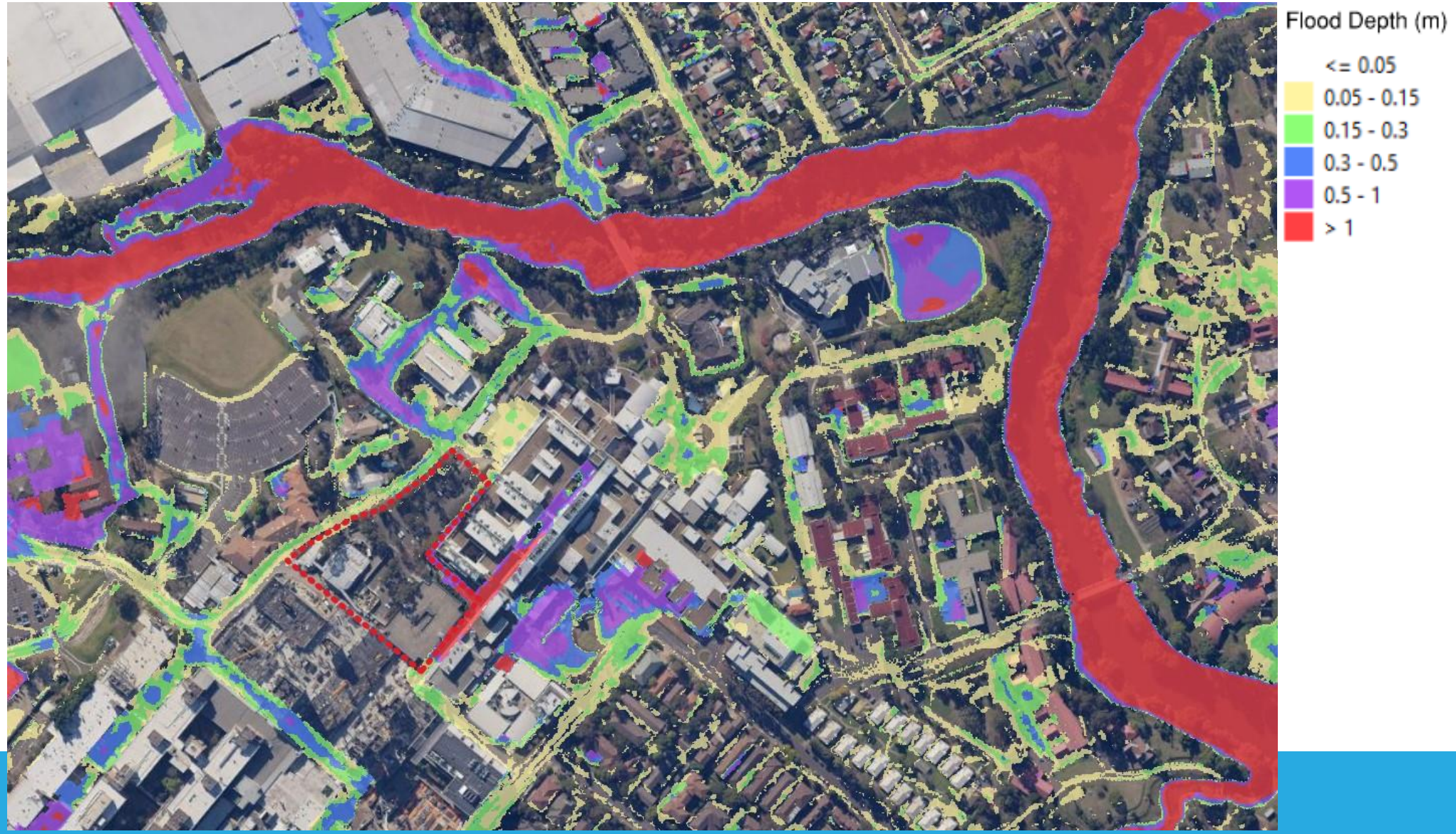
PSB – Stormwater and Flood Risk Management

Proposed design flood results – 1% AEP River



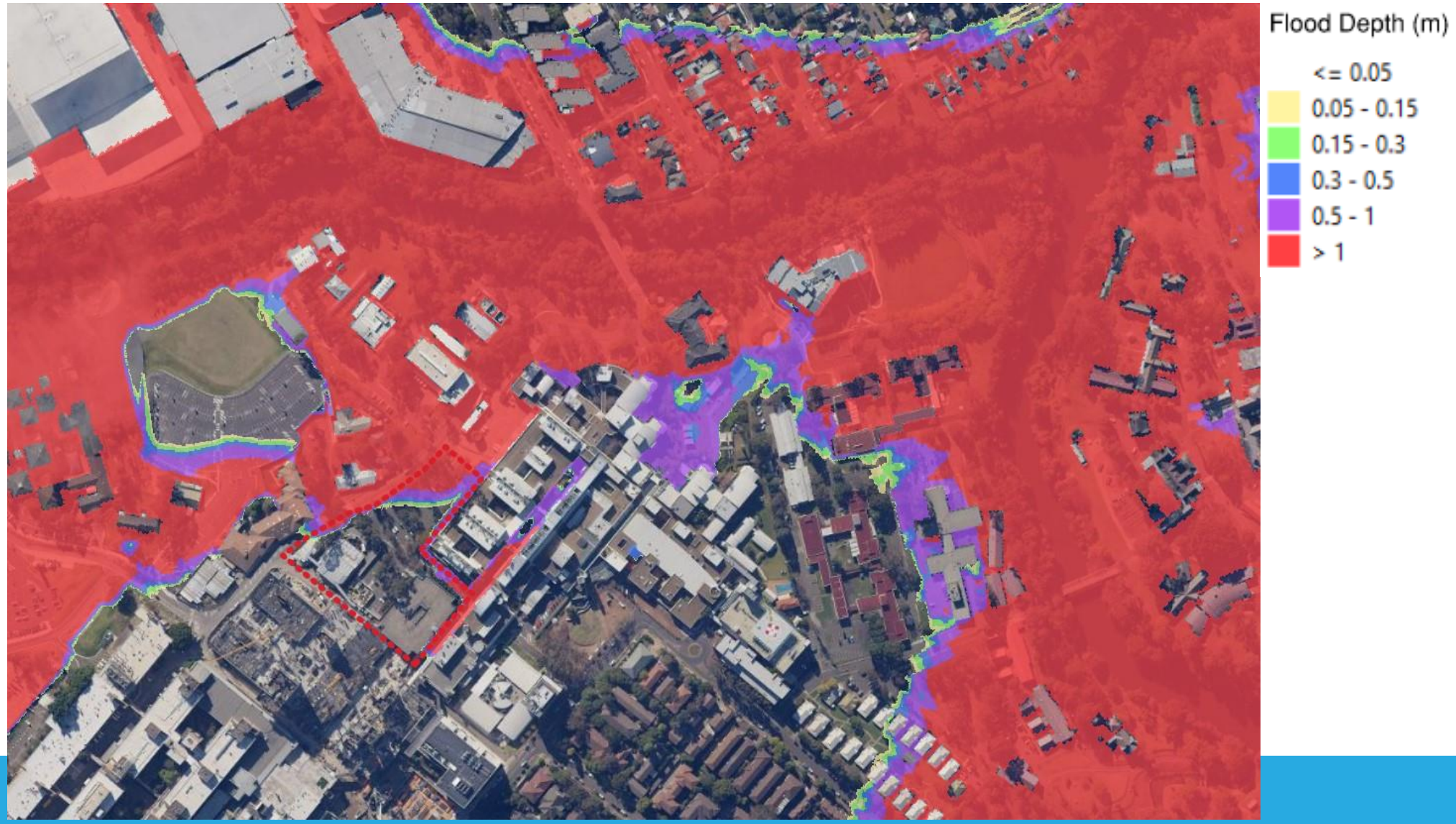
PSB – Stormwater and Flood Risk Management

Proposed design flood results – PMF Overland



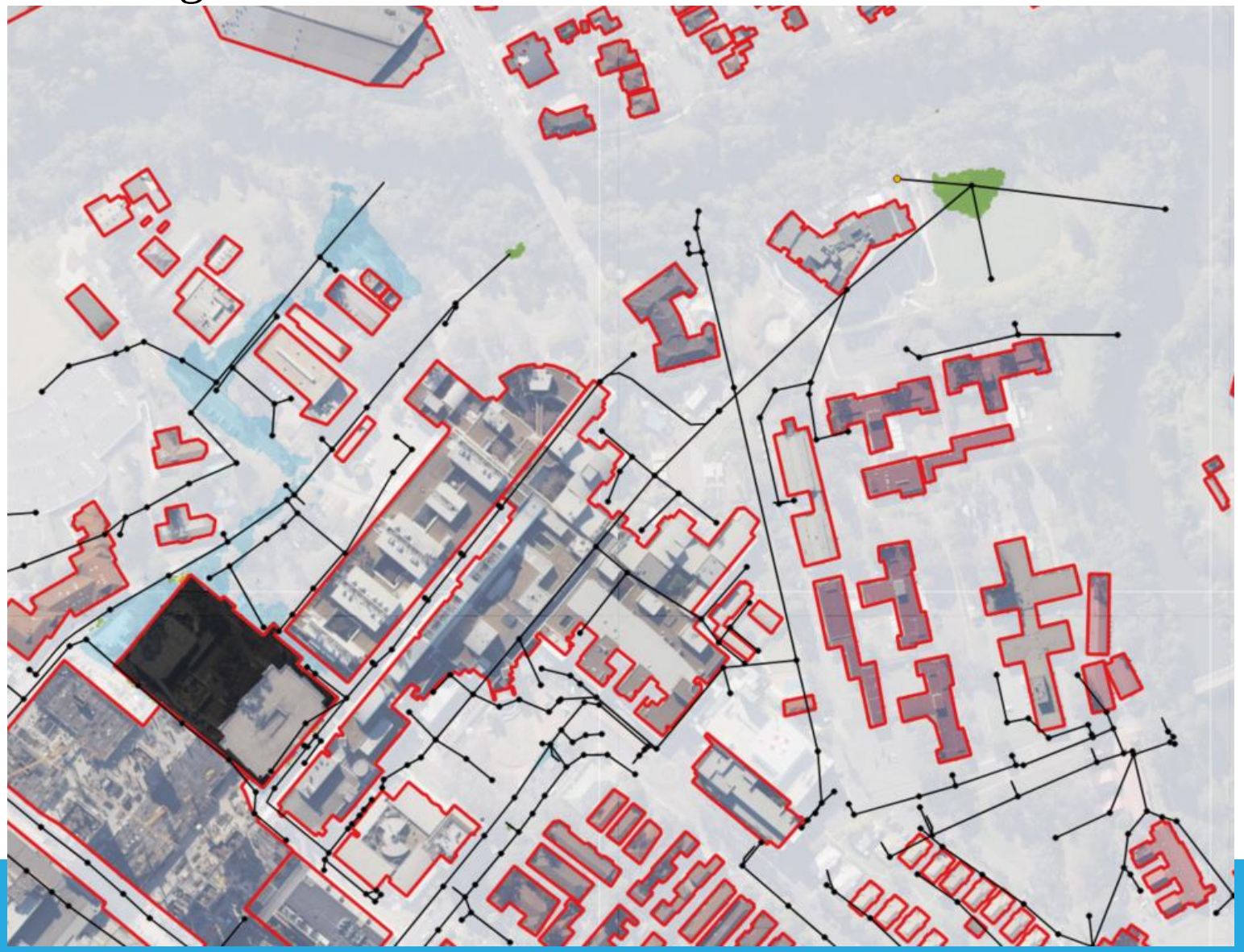
PSB – Stormwater and Flood Risk Management

Proposed design flood results – PMF River



PSB – Stormwater and Flood Risk Management

Proposed design flood results - 1% AEP Afflux Overland

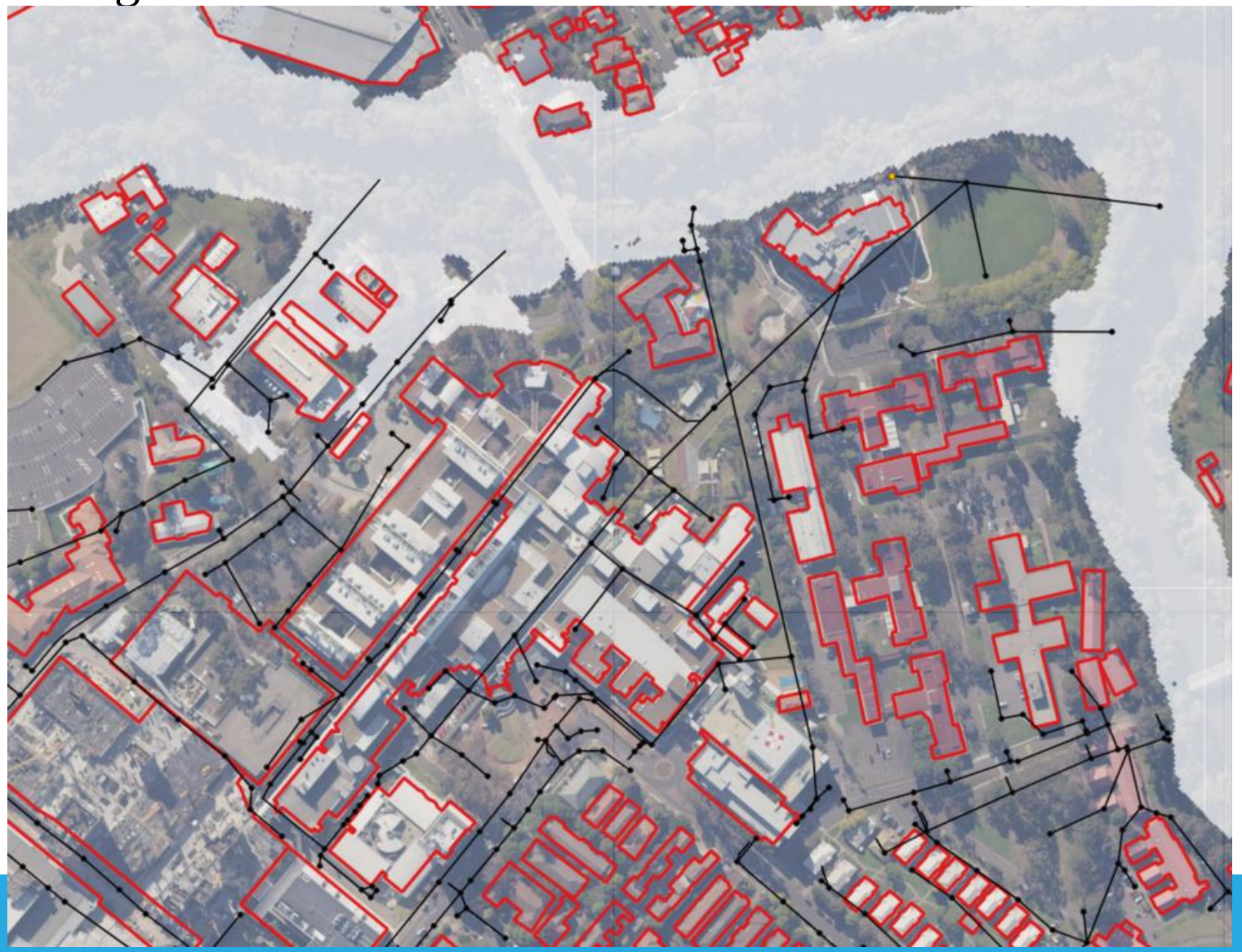


Flood Level Increase (mAHD)

- <= -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.2
- > 0.2
- No longer flooded
- Newly flooded

PSB – Stormwater and Flood Risk Management

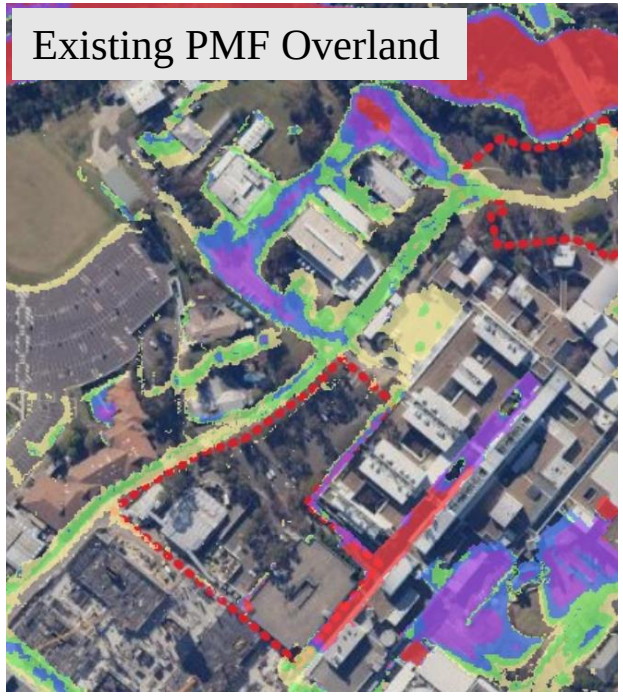
Proposed design flood results – 1% AEP Afflux River



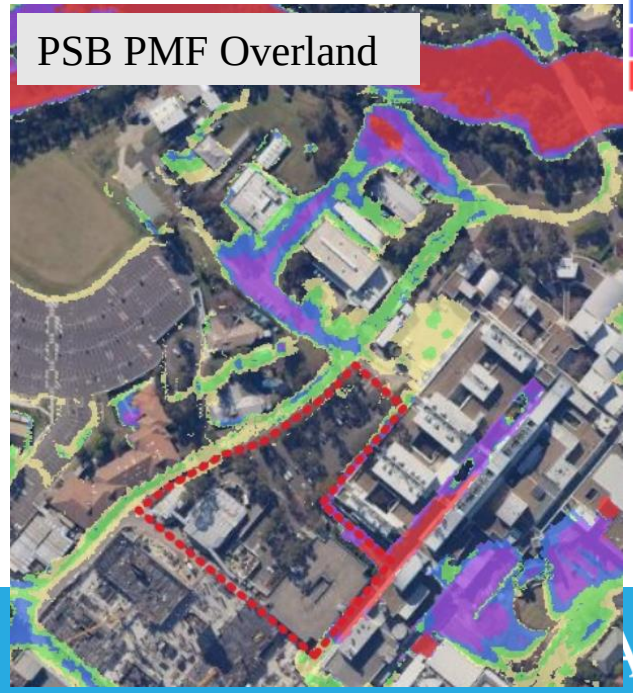
PSB – Stormwater and Flood Risk Management

Proposed design flood results - PMF Afflux Overland

Existing PMF Overland



PSB PMF Overland



Flood Depth (m)
<= 0.05
0.05 - 0.15
0.15 - 0.3
0.3 - 0.5
0.5 - 1
> 1

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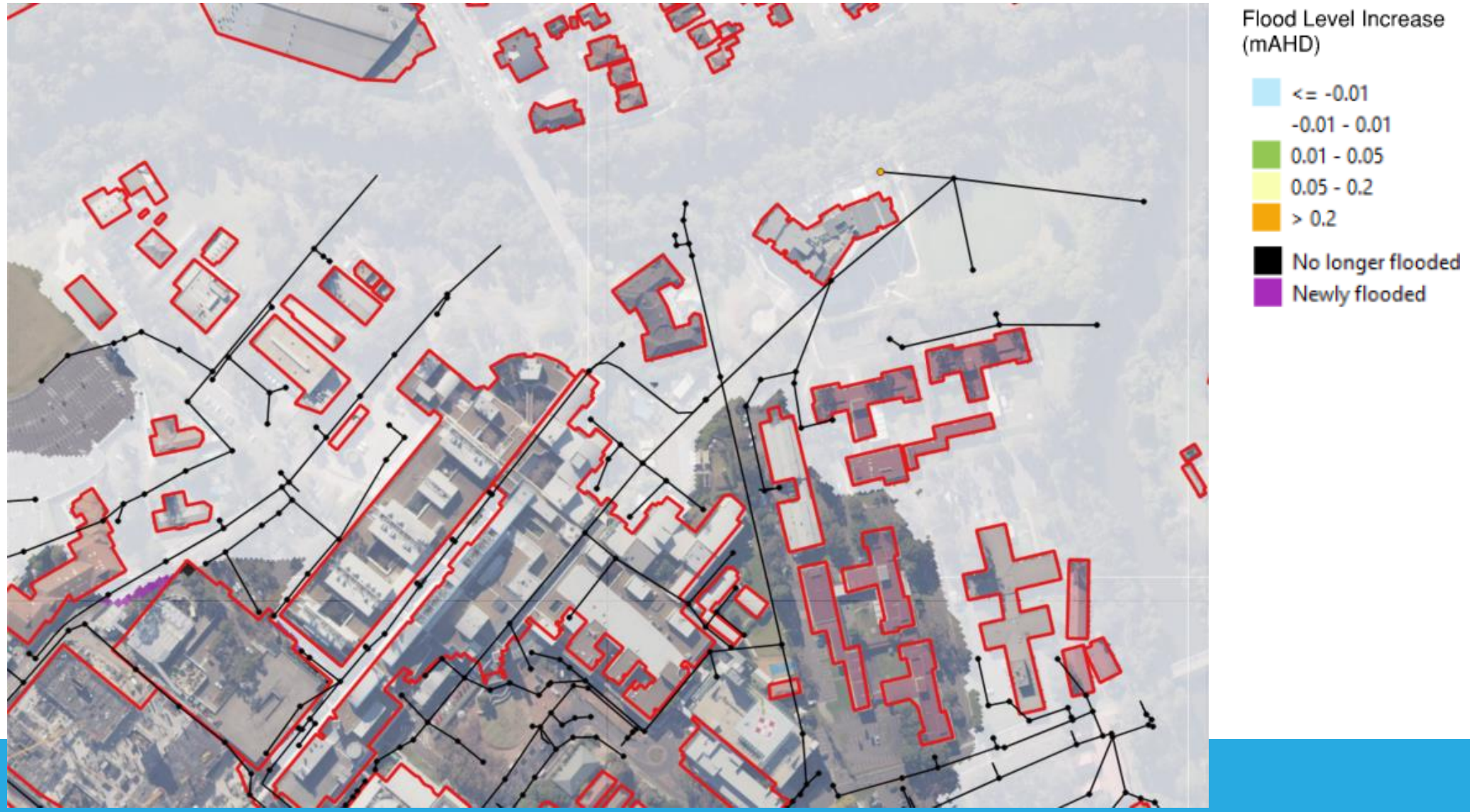
PSB – Stormwater and Flood Risk Management

Proposed design flood results – PMF Afflux River



PSB – Stormwater and Flood Risk Management

Proposed flood levels and building thresholds

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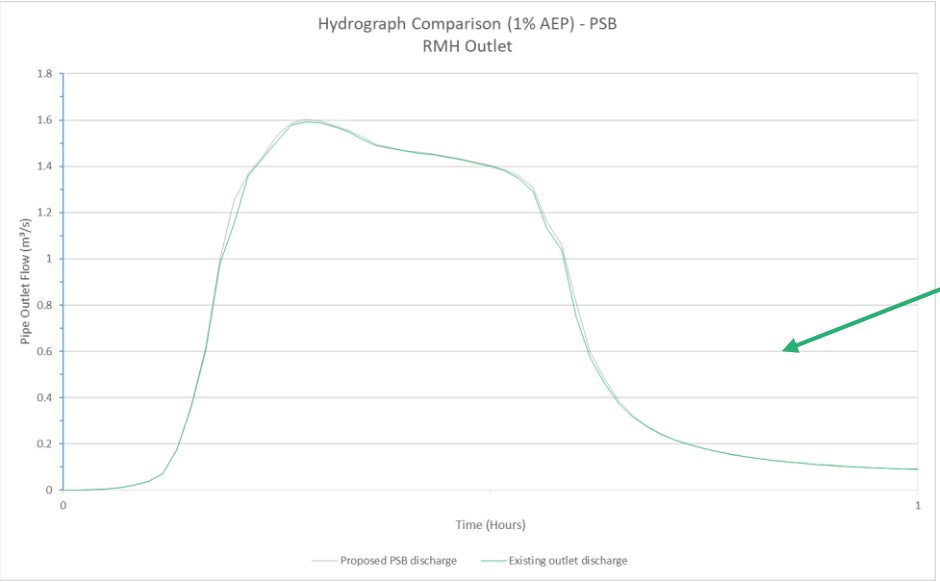
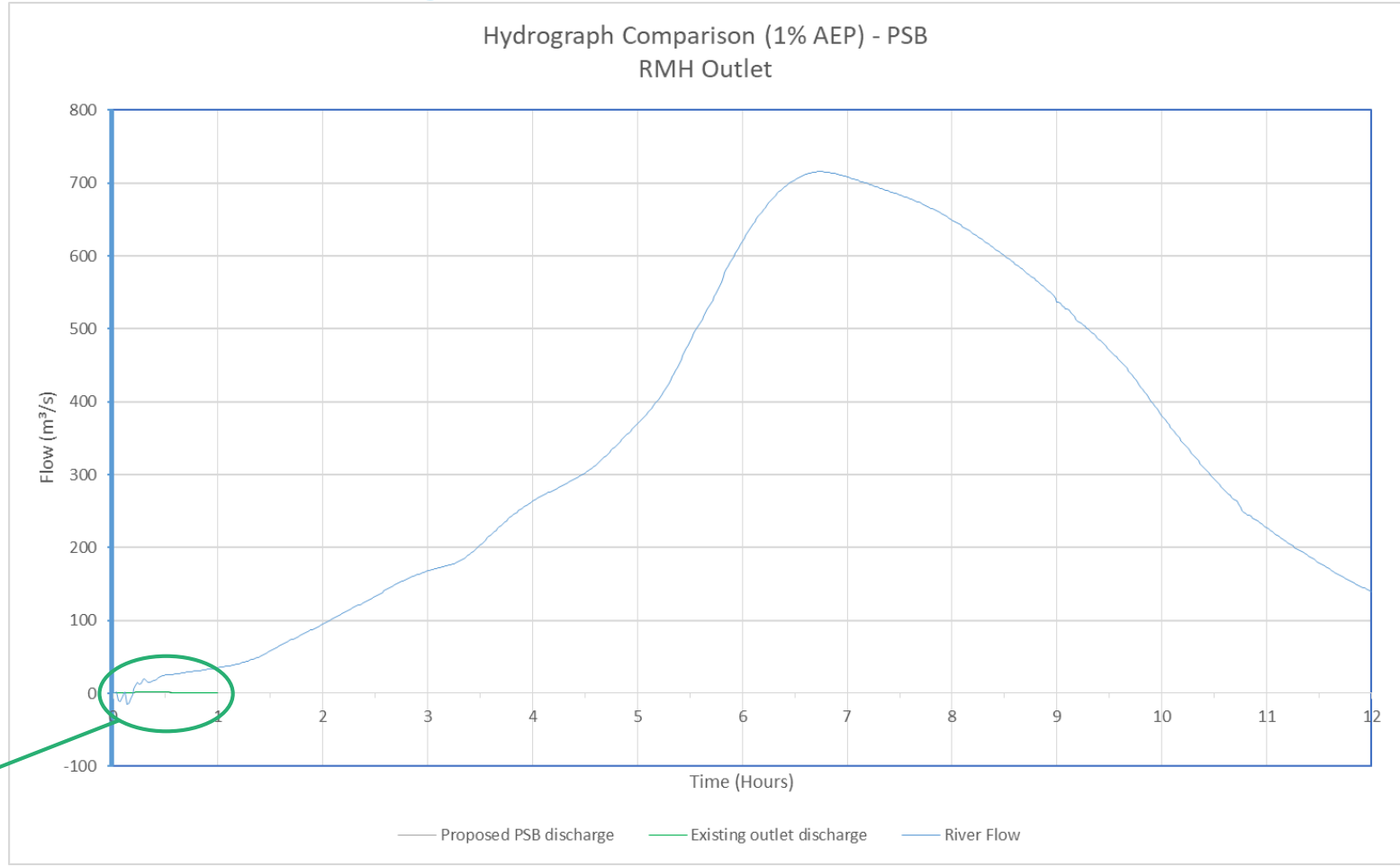
PSB – Stormwater and Flood Risk Management

Downstream outlet assessment





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PSB – Stormwater and Flood Risk Management

PSB summary:

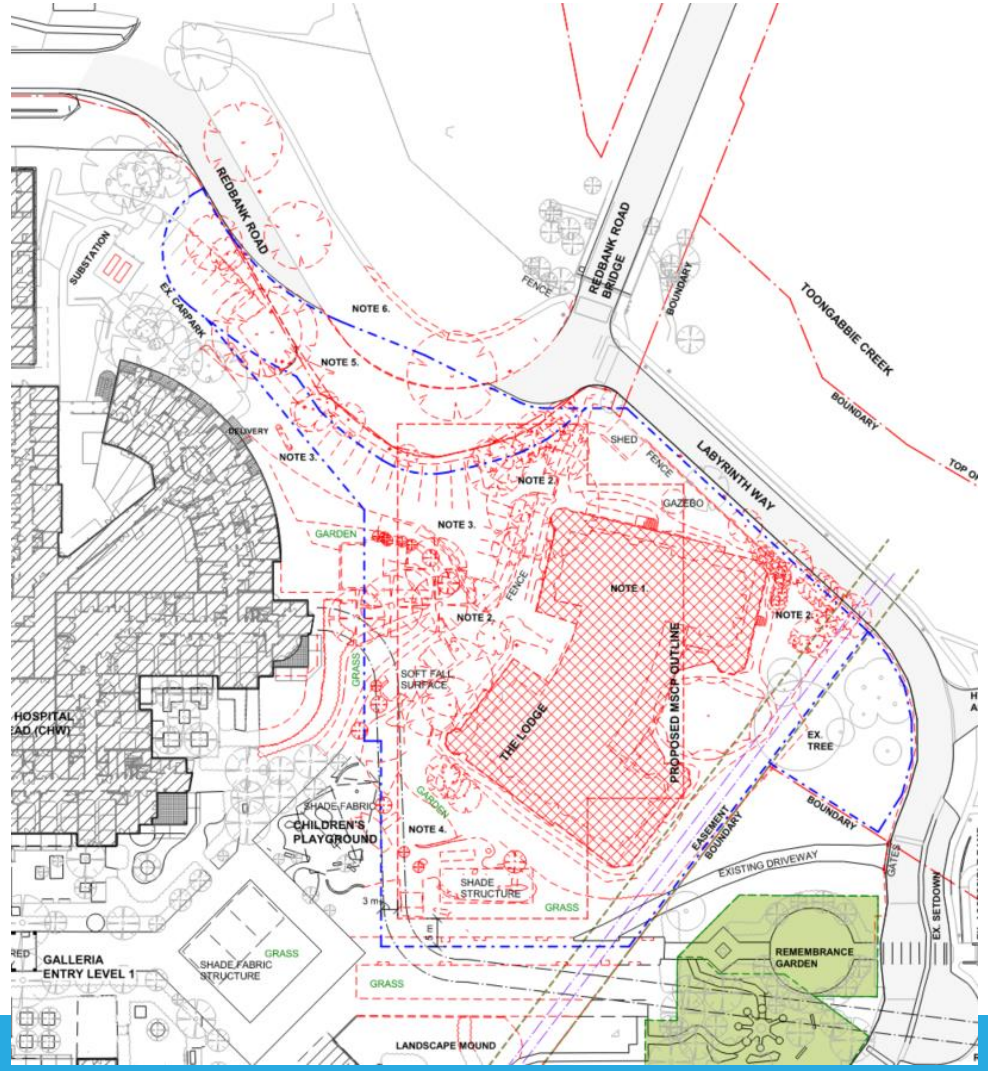
- Direct stormwater connections into the existing stormwater network to discharge flows before river peak.
- Generally no significant flood impacts nearby areas.

Next steps:

- Existing CHW forecourt modelled, but further design development required for proposed CHW forecourt and PSB entryway threshold.

MSCP – Stormwater and Flood Risk Management

Existing Site



Proposed design

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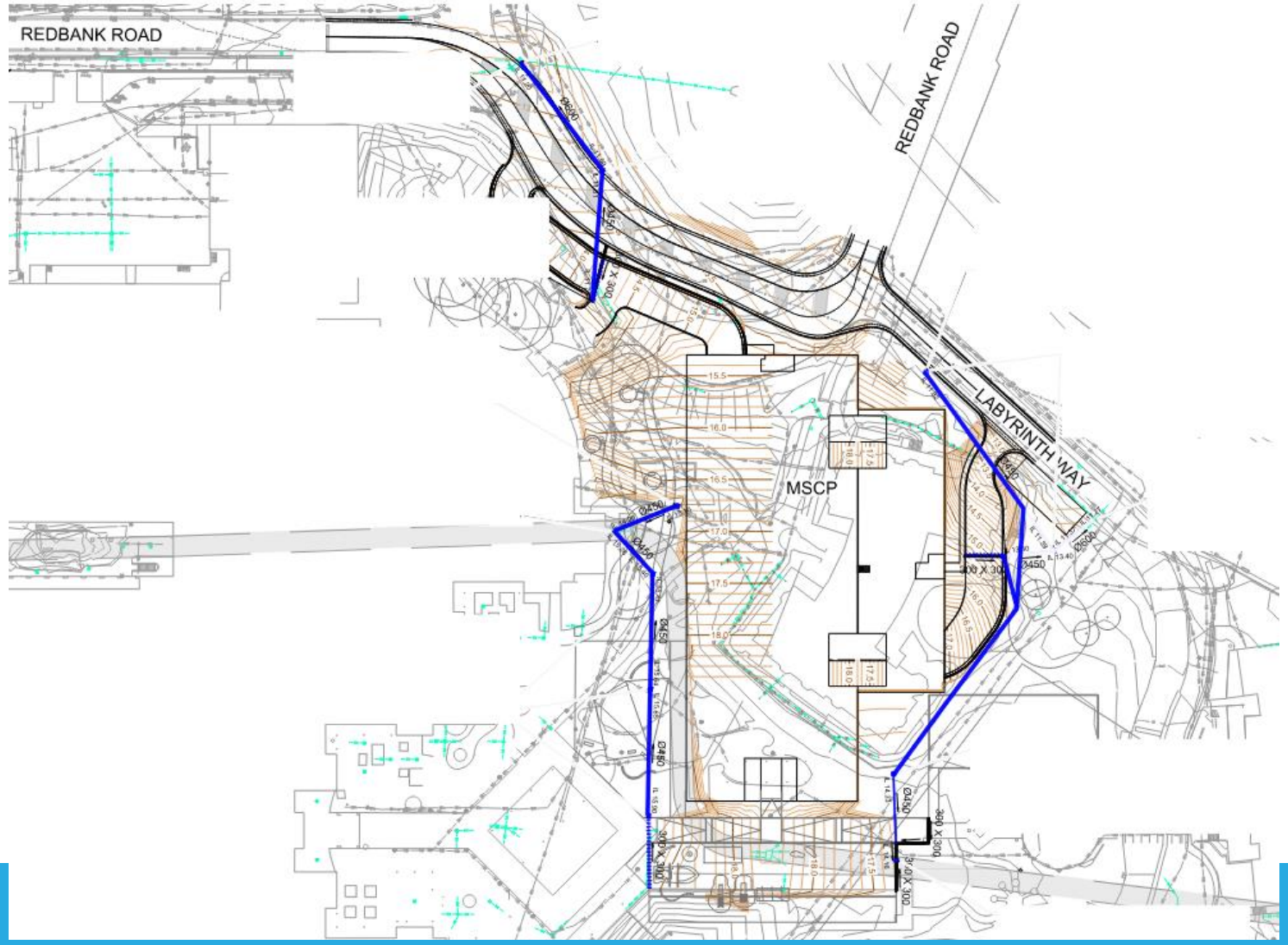
MSCP – Stormwater and Flood Risk Management

Proposed Stormwater Strategy

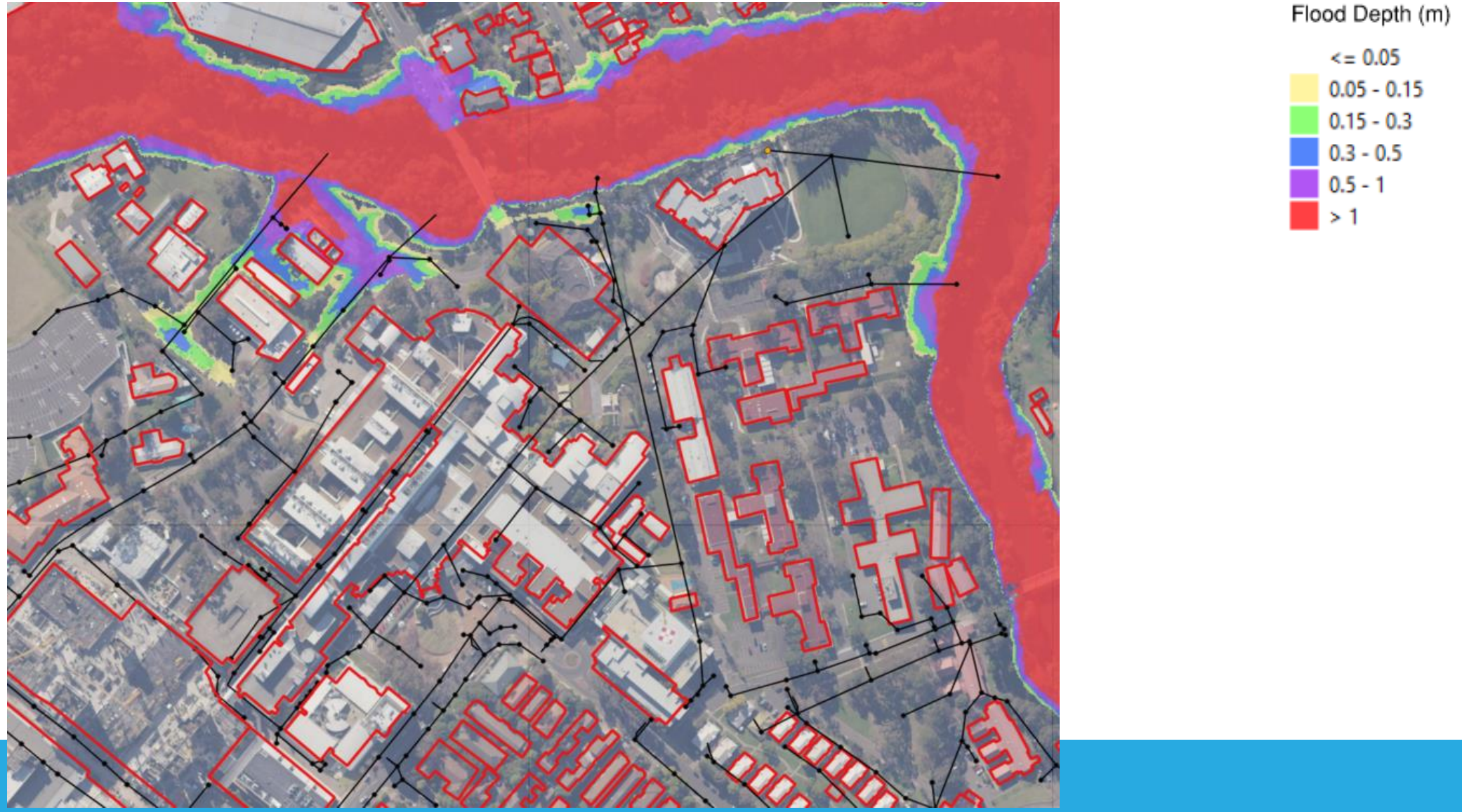


MSCP – Stormwater and Flood Risk Management

Proposed design flood results – 1% AEP Overland

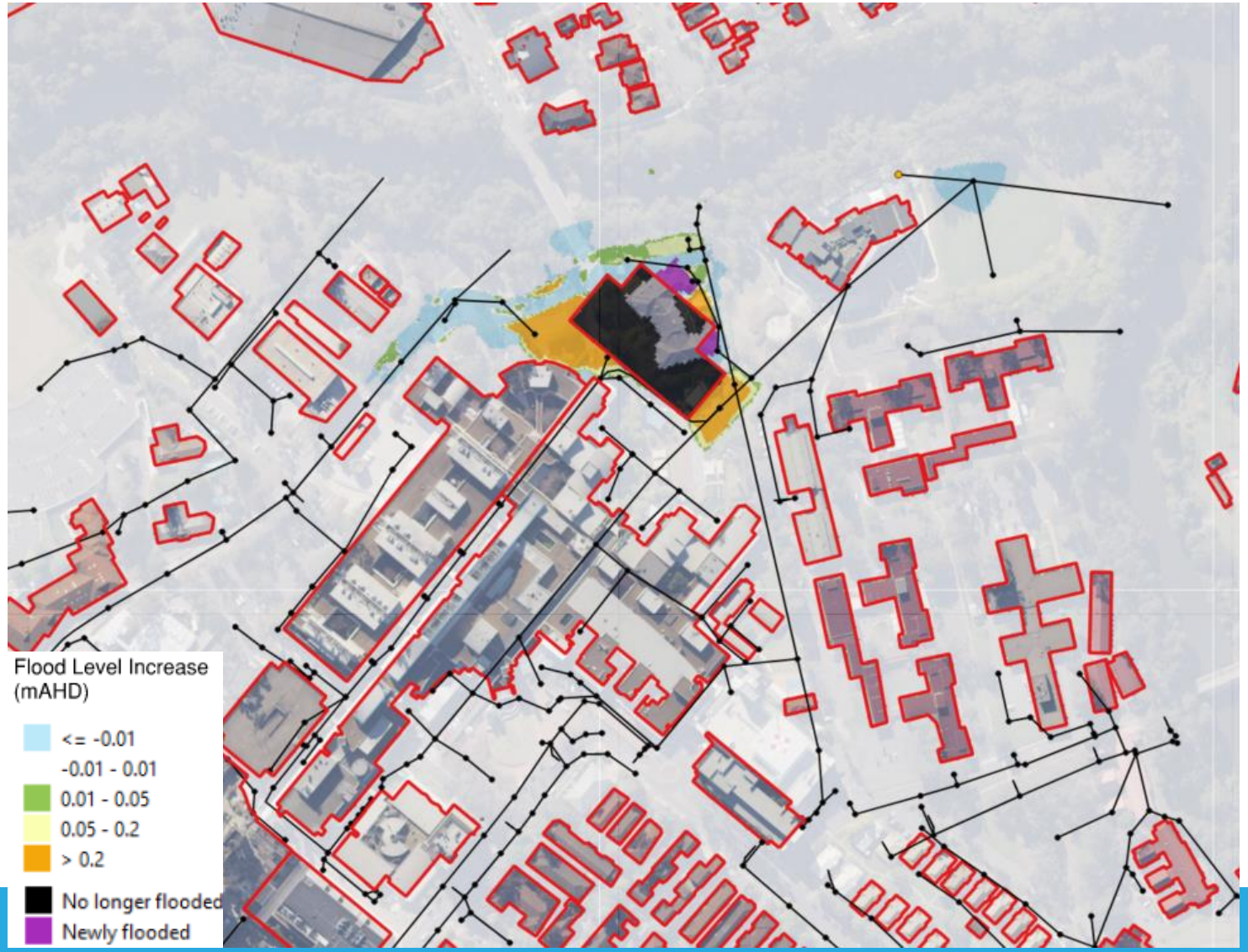
MSCP – Stormwater and Flood Risk Management

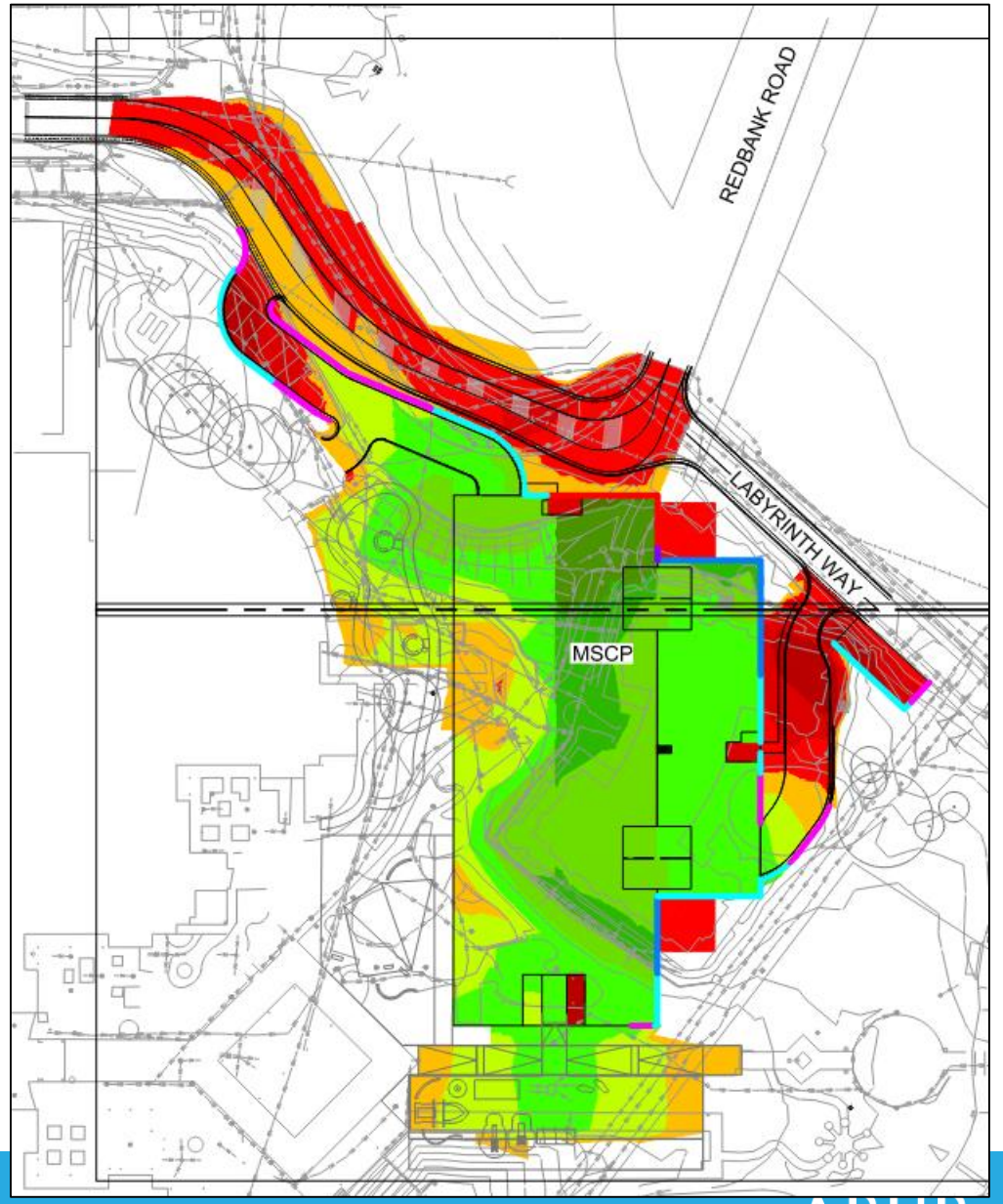
Proposed design flood results – 1% AEP River



MSCP – Stormwater and Flood Risk Management

Proposed design flood results - 1% AEP Afflux Overland





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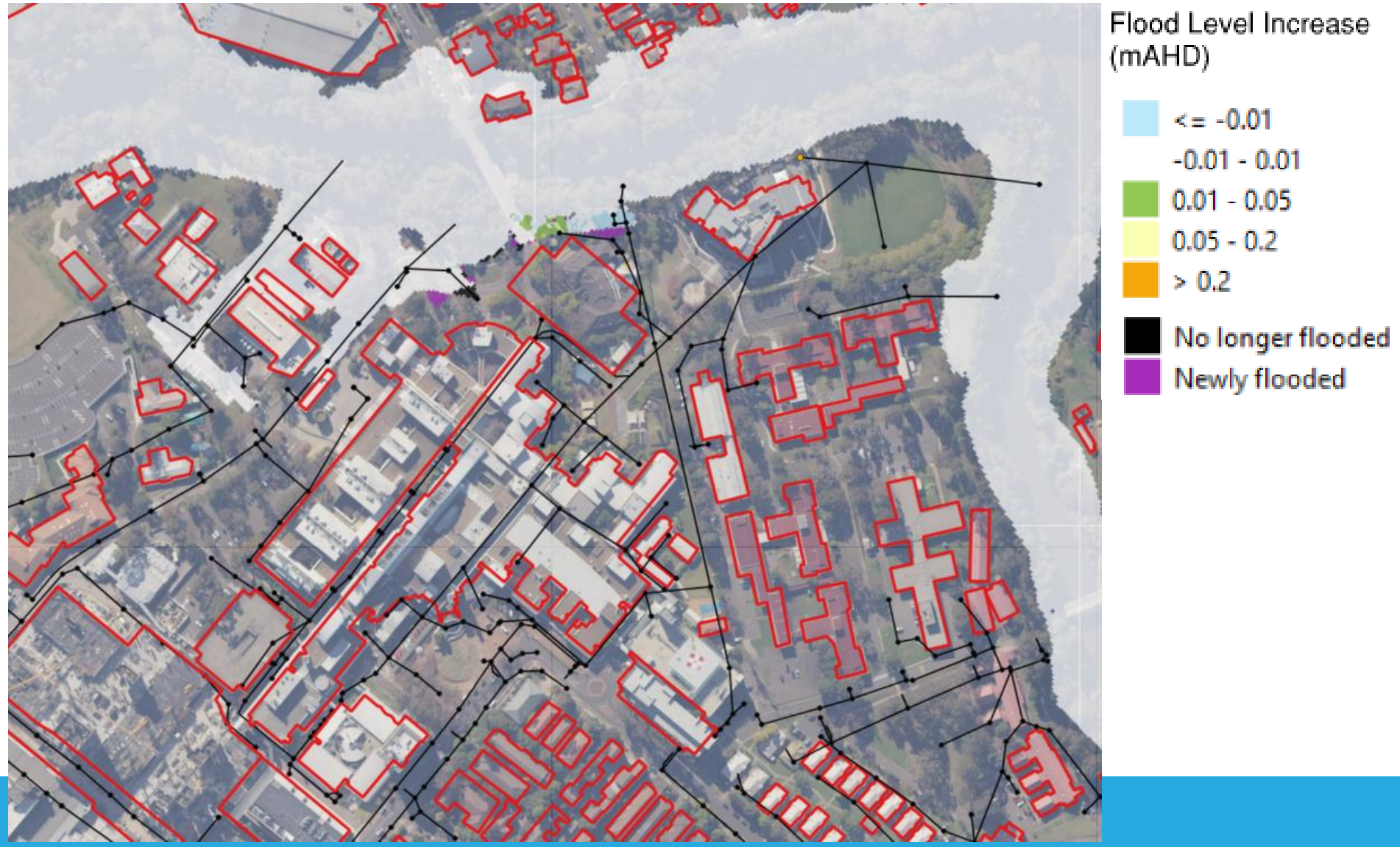
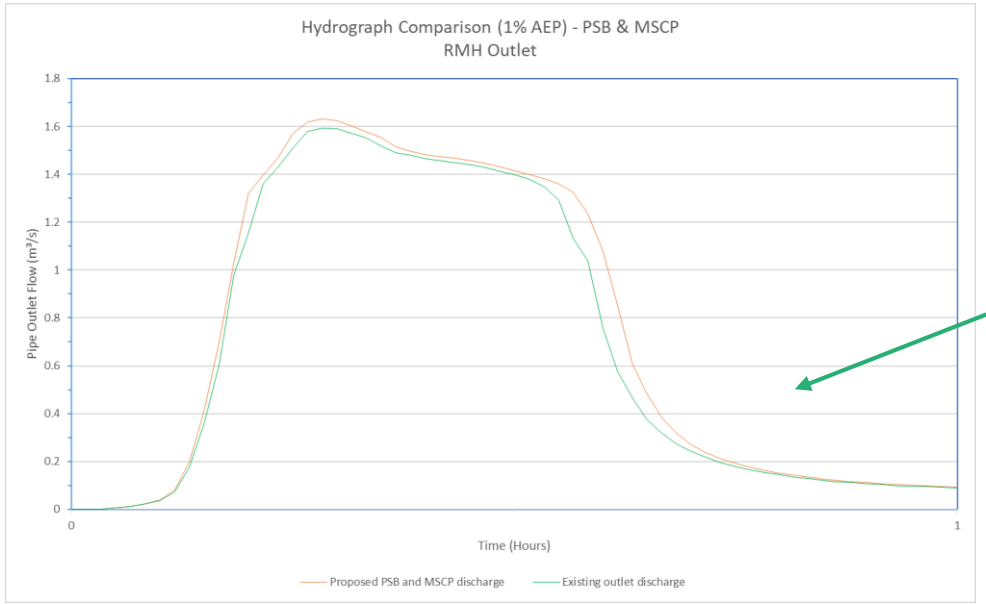
MSCP – Stormwater and Flood Risk Management

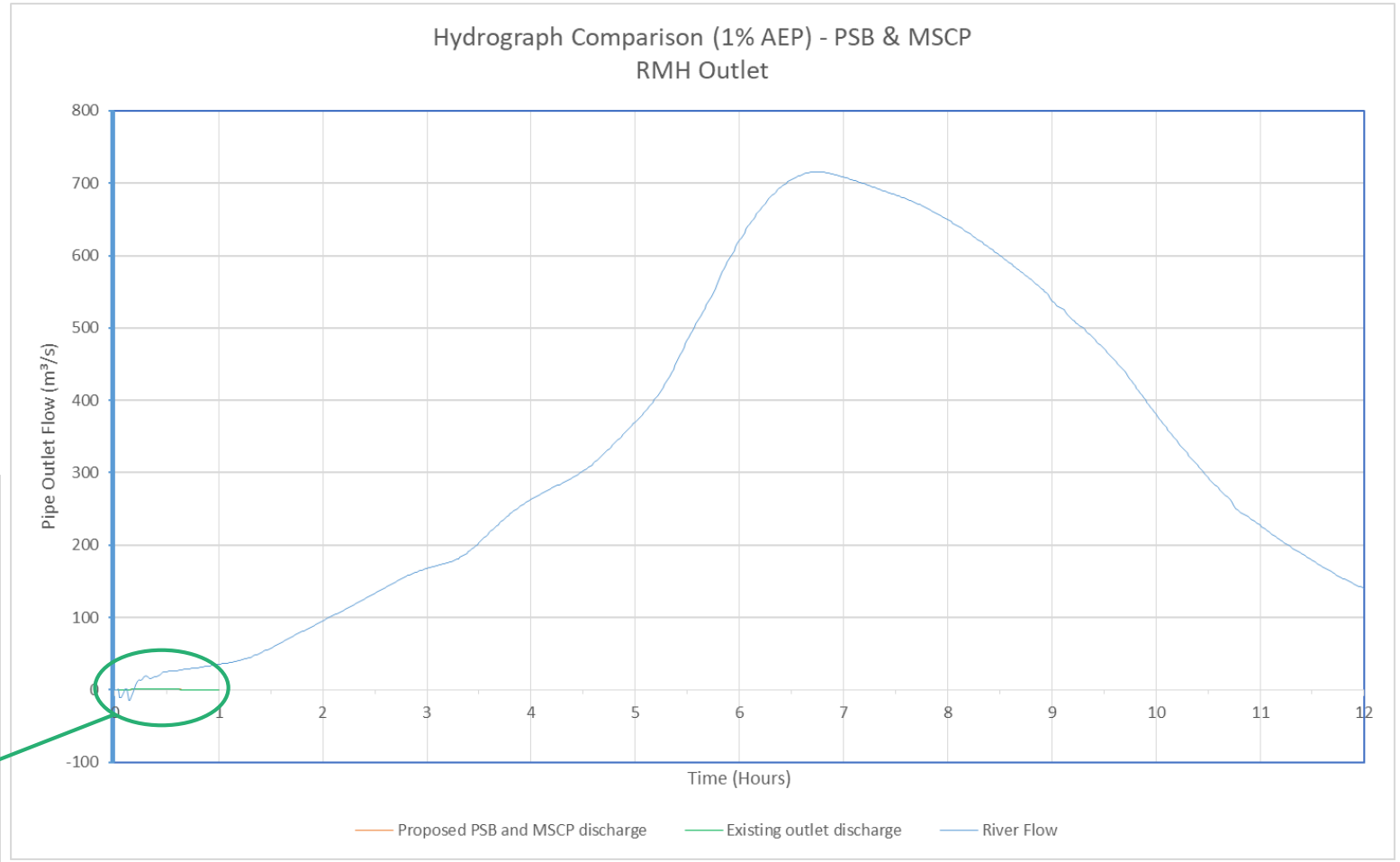
Proposed design flood results – 1% AEP Afflux River



MSCP – Stormwater and Flood Risk Management

Downstream outlet assessment





MSCP – Stormwater and Flood Risk Management

MSCP summary:

- Direct stormwater connection into the existing stormwater network to discharge flows before river peak.
- Afflux due to raising of proposed levels.

Next steps:

- Further MSCP design development to external battering and stormwater infrastructure to reduce afflux to adjacent CHW building.
- Further modelling of PMF and climate change events.