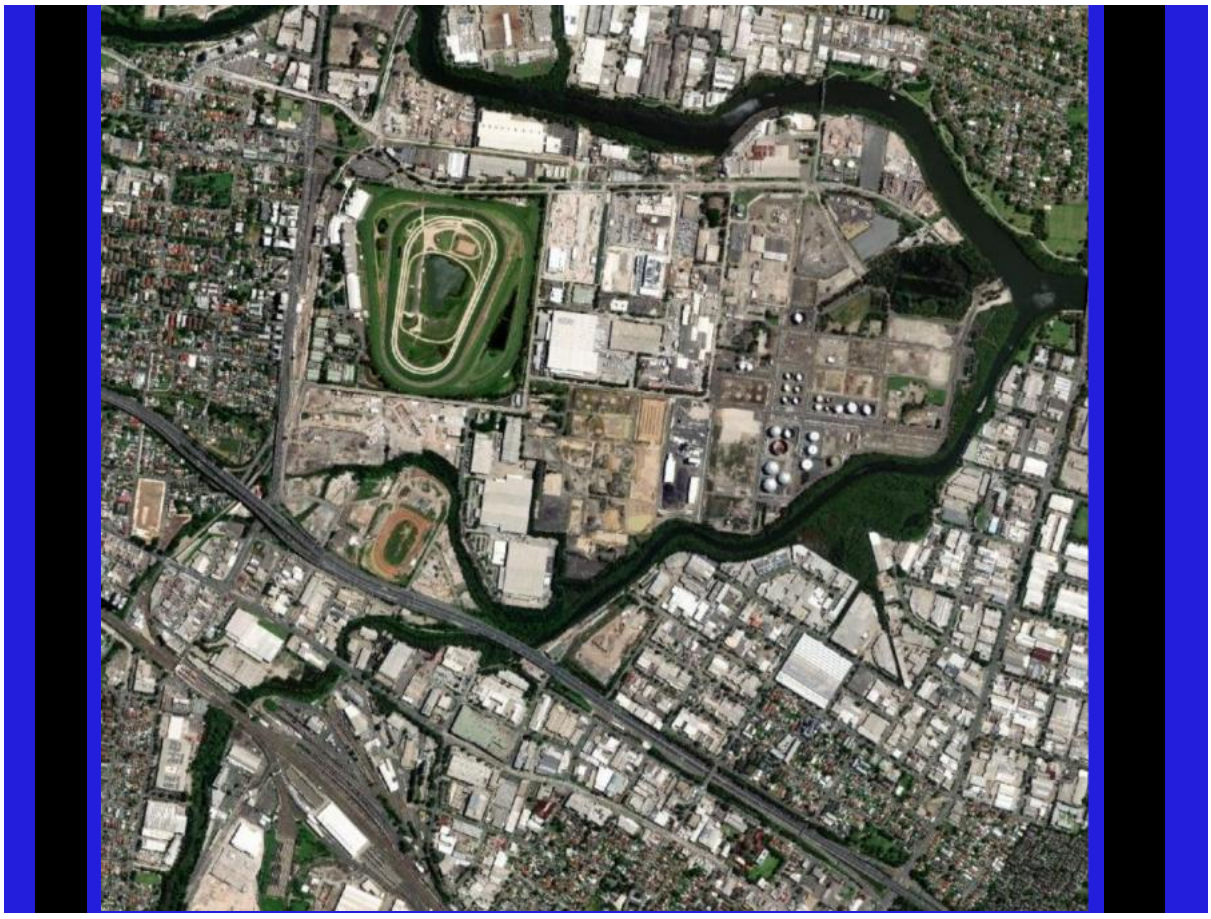
# Flood Assessment Report

Greater Parramatta and Olympic Peninsula Water Cycle Management Project

Prepared for Sydney Water
February 2026



# Flood Assessment Report

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# Executive summary

Sydney Water is proposing to build and operate a new water resource recovery facility (WRRF) at Camellia-Rosehill. The new WRRF is needed to provide additional wastewater capacity to support growth across the northern suburbs of Sydney, and in the Greater Parramatta and Olympic Peninsula (GPOP) growth corridor. The WRRF and associated infrastructure together form the GPOP Water Cycle Management (WCM) project (the project).

The main elements of the project include:

- a new WRRF at Camellia-Rosehill to treat wastewater to produce advanced treated water
- upgrades to the existing pumping station at Camellia
- a new wastewater transfer pipeline from Camellia pumping station to the WRRF
- a new and repurposed brine pipeline to transfer brine from the WRRF to the Northern Suburbs Ocean Outfall Sewer (NSOOS)
- a new river release pipeline to transfer advanced treated water from the WRRF to a release structure in Parramatta River at Meadowbank.

This Flood Assessment Report has been prepared to identify and assess the potential flood impacts related to the construction and operation of the project and propose management measures to assist with mitigating impacts to flood risk. This assessment has been undertaken based on numerical modelling of flooding and the changes to flood behaviour due to elements of the project, and qualitative assessment of potential impacts based on other available flood information and studies. A range of flood events including the 10%, 5% and 1% AEP and the 50% of PMF and PMF events have been assessed. The 1% annual exceedance probability (AEP) climate change flood events have also been assessed and while the RCP4.5 (year 2150) event is a focus, the RC8.5 (year 2150) event has also been assessed for completeness.

This report has been prepared to support the environmental impact statement (EIS) for the project.

**Consultation with agencies and stakeholders**

This assessment has been prepared in consultation with relevant stakeholders, including Conservation Programs, Heritage and Regulation Group (DCCEEW), Department of Planning, Housing and Industry (Infrastructure Assessments and State led Rezoning), State Emergency Services, City of Parramatta and Ryde Councils, Sydney Metro, neighbouring properties and others.

**Background on WRRF site**

The Camellia-Rosehill WRRF site is the main project component of the GPOP WCM Project that is relevant to the flooding assessment due to the potential interaction with flood flows. The site historically formed part of the Clyde Refinery, operated by Viva Energy.

Sydney Water acquired the WRRF site in 2024, following subdivision of the Western Area of the Clyde Refinery site. For the acquired site, Sydney Water undertook site environmental works to raise part of the site with up to 1.7 m of natural material to reduce ongoing risks of exposure from residual contaminated soils and to assist with maintaining flood immunity of the site. A separate flood impact assessment was undertaken for those works.

The context for this current flood assessment is:

- Base case: Part of the site has been raised with 1.7 m natural fill material as a part of initial site environmental management works.
- Design case: WRRF site with completed Project.

**Existing flood environment**

Potential sources of flooding at the Camellia-Rosehill WRRF site include Duck River and local catchment flooding in events up to the 1% AEP flood, with the Parramatta River causing regional flooding and affecting the WRRF site in extreme events including the PMF. The Camellia pumping station is primarily affected by Parramatta River flooding. The brine pipeline, transfer pipeline and river release pipeline are affected by the Parramatta River flooding in addition to tributary flooding including from Vineyard Creek, Claycliff Creek, Duck River, Haslams Creek, Smalls Creek and Charity Creek as well as local flooding.

Existing flooding depths in key locations on and around the Camellia-Rosehill WRRF site are described below.

*WRRF site*

- On the WRRF site itself, there is limited flooding in events up to and including the flood frequency analysis (FFA) 1% annual exceedance probability (AEP) event in the Base case. A minor overflow occurs from flooding in Unwin Street in the FFA 1% AEP event with depths of less than 0.1 metres (m) in the reserved overland flow path along the site western boundary. In the FFA 1% AEP representative concentration pathways (RCP) 4.5 and RCP 8.5 scenarios, this overland flow path is activated with flow depths of up to 0.3 m and 0.5 m, respectively.

  In the 50% of probable maximum flood (PMF) and PMF events, the reserved overland flow path has depths of up to 1.5 m and 2.5 m, respectively. The floodway through the site experiences depths of up to 1.6 m in the PMF event.

- On Devon Street, flood depths are around 0.52 m in the 5% and 10% AEP events, and 0.56 m in the FFA 1% AEP event. Flood depths are up to 0.58 m in the FFA 1% AEP RCP 8.5 scenario. Flood depths are up to 0.8 m and 2.0 m in the 50% of PMF and PMF events, respectively.

  On Unwin Street, predicted flood depths are less than 0.1 m in the 5% and 10% AEP events, and 0.2 m in the FFA 1% AEP event. Flood depths are up to 0.33 m in the FFA 1% AEP RCP 8.5 scenario. Flood depths are up to 0.9 m and 2.3 m in the 50% of PMF and PMF events, respectively.

- The Sydney Metro site between Unwin Street and Duck Creek is flood-free in up to and including the FFA 1% AEP event, apart from the flood detention basin where depths are about 2.5 m. Overland flows from Unwin Street occur in the FFA 1% AEP climate change events. Inundation depths are up to 1 m in the 50% of PMF event and up to 2 m in the PMF.

- On the Downer Rosehill Sustainable Road Resource Centre to the east of the site, flood depths are around 0.6 m in the 5% and 10% AEP events, and 0.7 m in the FFA 1% AEP event. Flooding is a result of overland flows in these events.

  Flood depths are up to 0.8 m and 2.8 m in the 50% of PMF and PMF events, respectively, due to mainstream flooding from Duck River.

- On the property to the south of the site (Property 1), flood depths in the FFA 1% AEP event are up to 1.5 m within low-lying drainage and riparian areas as a result of Duck River flooding. Flooding depths vary from 0.8 – 2.7 m in the 50% of PMF event and 2.5 - 4 m in the PMF event.

- Property 2 on the northern side of the Devon Street sag point is raised about 2.5 m above street level and is above the PMF inundation of Devon Street.

- The property on the corner of Devon Street and Durham Street (Property 3) is affected by local overland flooding in the 10% AEP event to depths of 0.8 m and up to 1 m in the FFA 1% AEP event.

*Camellia pumping station*

The Camellia pumping station site is outside of the FFA 1% AEP flood extent, except for localised flood depths to 0.5 m at the northern boundary of the site. It is inundated in the 50% of PMF event to depths of 2 m. In the PMF, flood depths on the site are typically 4 – 5 m.

*Brine and transfer pipelines*

The brine pipeline between Camellia pumping station and the NSOOS repurposes a section of an existing unused wastewater pipeline. This section will be relined so it is suitable for transfer of brine. Key flooding areas that the pipeline crosses under include:

- Vineyard Creek, where existing 1% AEP flood depths exceed 1.5 m
- Parramatta River, where normal tidal water depths exceed 4 m.

The brine and transfer pipelines between Camellia pumping station and new WRRF would consist of new underground pipelines. Key flooding areas that the pipelines would cross under include:

- Existing flooding areas around Grand Avenue and James Ruse Drive, where flooding from Claycliff Creek exceeds 2 m in the 1% AEP event
- Existing ponds in Rosehill Gardens Racecourse where the 1% AEP flood depths are 1.8 m.

*River release pipeline*

The river release pipeline, between the new WRRF and the river release structure at Meadowbank, would pass under the following key flooding areas:

- Narawang Wetlands, where existing 1% AEP flood depths exceed 3 m
- Flood ponding areas due to Haslams Creek flooding adjacent to UrbnSurf, with depths of 2 m in the 1% AEP event.
- Parramatta River, where normal tidal water depths exceed 4 m.
- Meadowbank Park, with flood depths on overbank areas adjacent to Smalls Creek and Charity Creek of 0.5 – 1 m in the 1% AEP event.
- Overland flooding is also expected to occur along the river release pipeline alignment through Silverwater. No flood studies have been completed to date in this area and hence the flood depths during storm events are not defined.

**Flood impacts of the project during operation**

Key flood maps are provided in Figure ES-1 to Figure ES-6 flood levels and depths and change in flood levels for the PMF and flood frequency analysis (FFA)-reconciled 1% AEP events for comparison of Base and Design case flooding behaviour. Flood mapping for the full range of assessed flood events is provided in Appendix B and Appendix D.

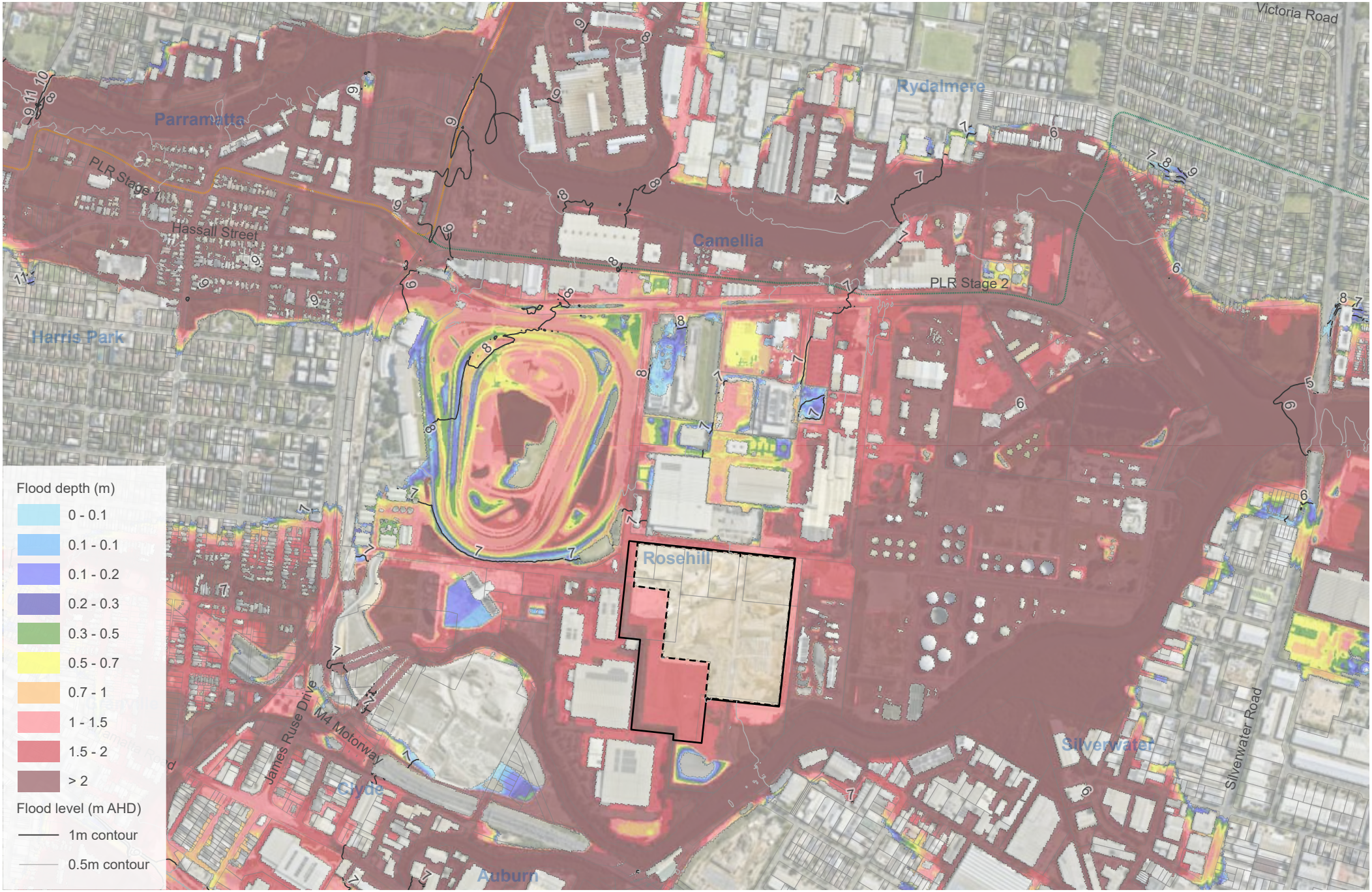



**Figure ES-1** Base Case Flood Level and Depth PMF Event

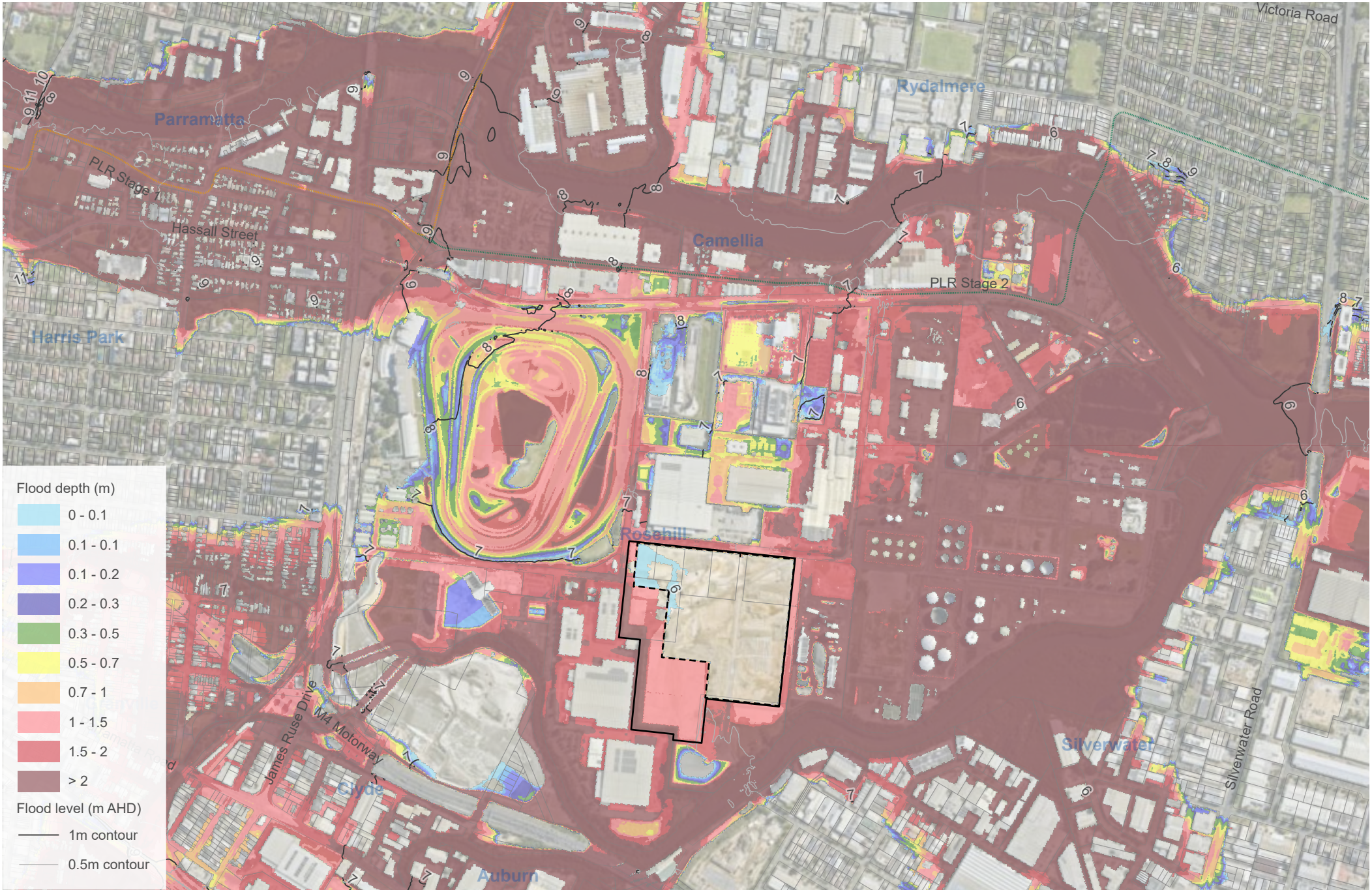
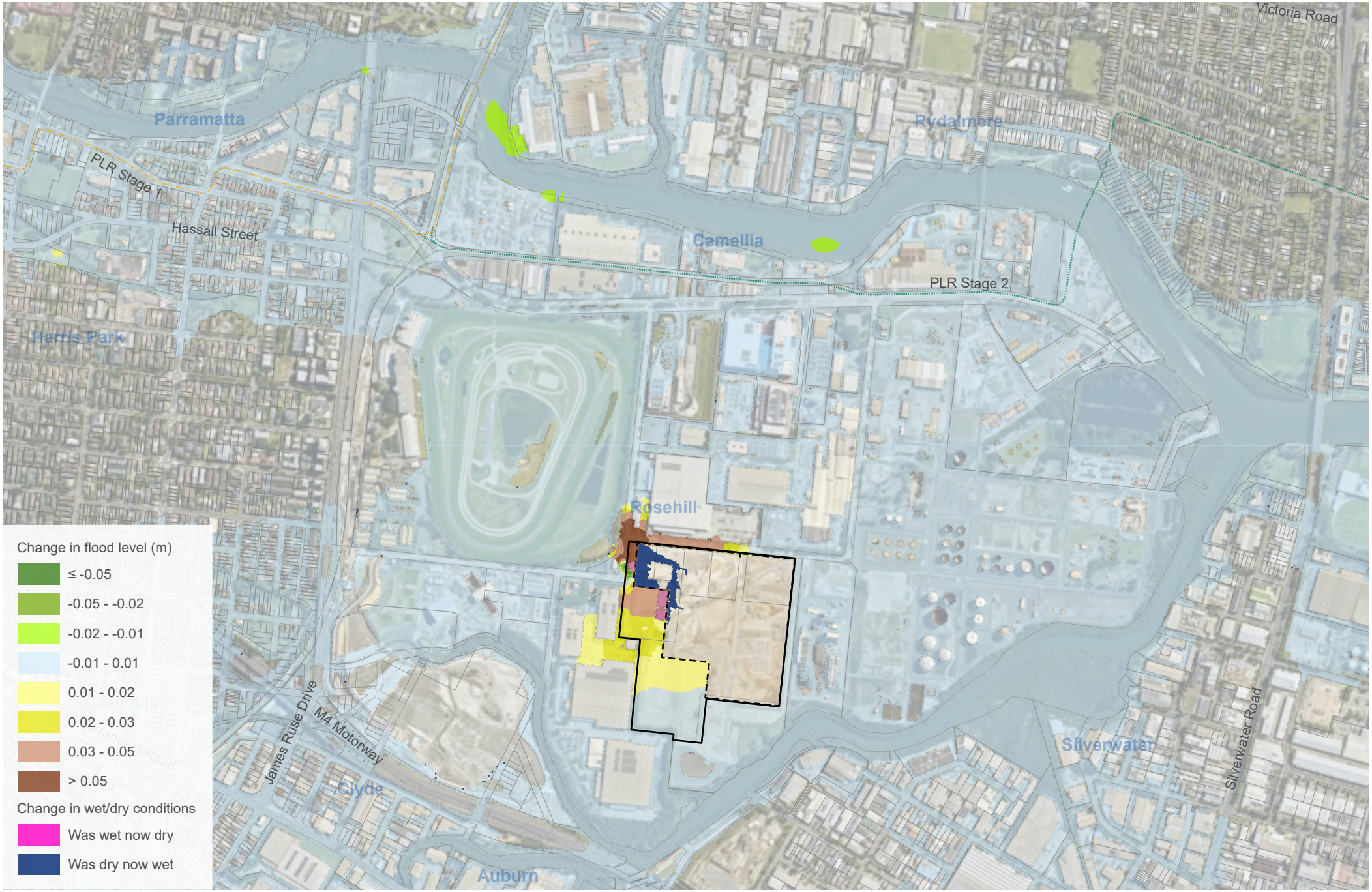



**Figure ES-2** Design Case Flood Level and Depth - PMF Event




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

**Figure ES-3** Change in Flood Level - Design versus Base Case PMF Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N

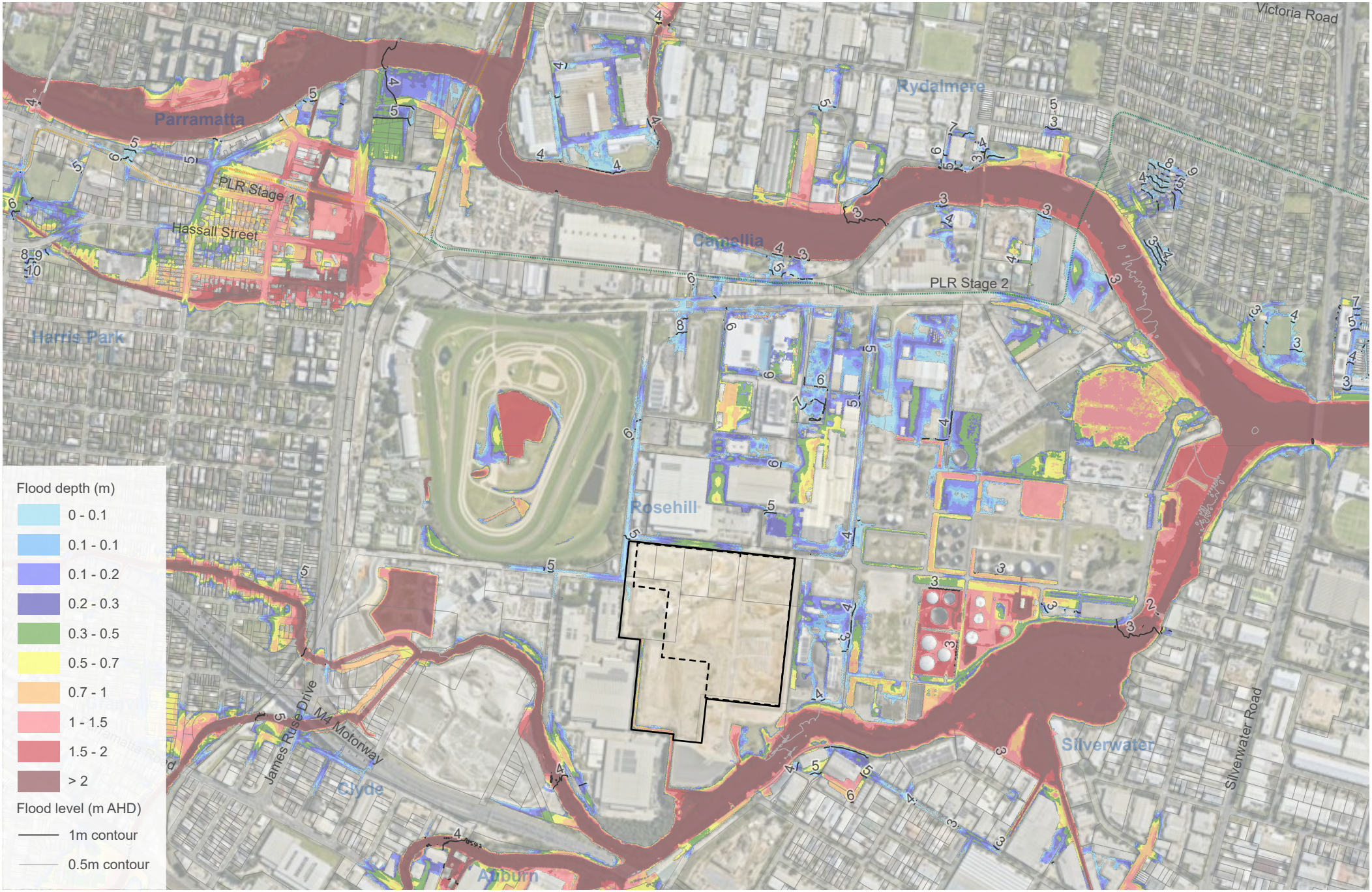
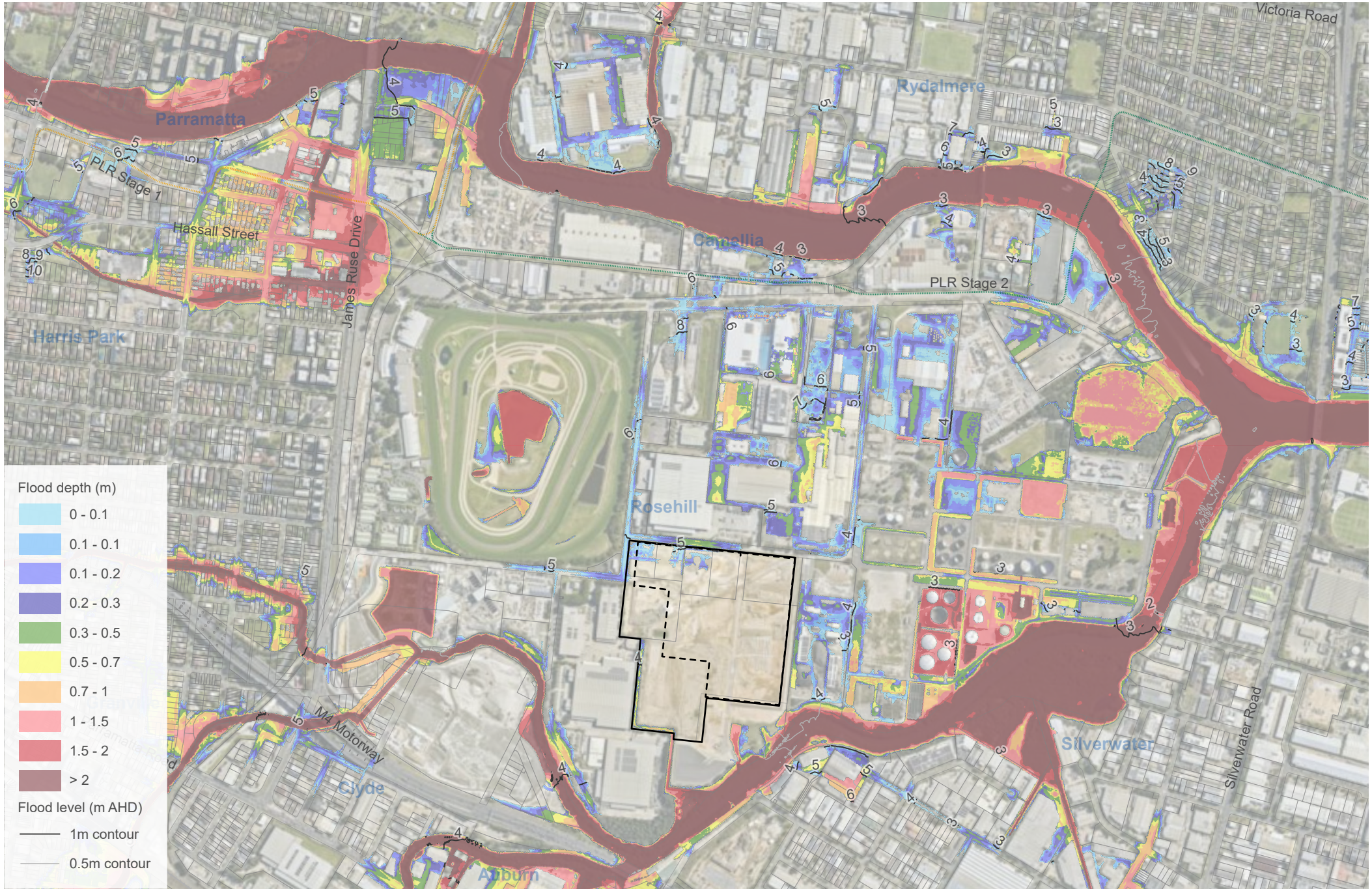



**Figure ES-4** Base Case Flood Level and Depth FFA 1% AEP Event




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

**Figure ES-5** Design Case Flood Level and Depth - FFA 1% AEP Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N


Camellia-Rosehill WRRF site

Site filling outline

Cadastre

**Figure ES-6** Change in Flood Level - Design versus Base Case FFA 1% AEP Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

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A summary of the flood impact assessment is provided below:

- Impacts to flood levels, depths, extent, velocity, flood hazard and duration of inundation resulting from project operation are generally predicted to be negligible to minor in all flood events up to and including the PMF. This includes effects on flooding resulting from the WRRF, Camellia pumping station, brine and transfer pipelines and the large majority of the river release pipeline. There would generally be minimal changes to built form and terrain at these sites to result in changes to flood behaviour. Maximum increase in flood levels around the WRRF would be +0.05 m in the PMF event with the project, while there would be reductions in flood levels of -0.05 m in Devon Street and -0.08 m in Unwin Street due to additional drainage infrastructure with the project.
- Given the negligible to minor effects of the project operation on flood depths, extents, hazard and duration of inundation, the impacts to external properties, infrastructure and social and economic costs of existing flooding are also generally expected to be minor.
- There may be changes to flood behaviour resulting from the aerial crossings of the river release pipeline over Smalls Creek and Charity Creek in Meadowbank Park, with potential for increases in flood depths and levels in the yards of adjacent residential apartment properties. The design and potential for changes to flood behaviour would be reviewed following further design development at detailed design.

**Flood impacts of the project during construction**

- Construction activities which may result in flooding impacts include stockpiling of spoil and materials, site levelling/regrading, trenching and tunnelling for pipeline construction, and aerial crossings for pipelines. These activities may cause obstruction or redirection of flood flows, resulting in flooding impacts to adjacent areas.
- Construction impacts are generally expected to be minor. There are several construction compounds located within high flood hazard areas where the risk of flood impacts to the construction site and of impacts resulting from construction activities is increased. Refer to Table ES-1 for management measures at the identified construction sites with increased risk of flood impacts.

**Sensitivity assessment and cumulative flood impacts**

- The cumulative impacts due to the combined effects of other proposed developments are generally unlikely, or expected to be minor and localised.
- Following the Camellia-Rosehill Place Strategy, additional precinct planning will be undertaken by DPHI. Sydney Water has provided the flood model to DPHI and potential flood impacts from the Camellia-Rosehill WRRF can be incorporated into future plans as needed. It is expected that the WRRF would have only minor contribution to any cumulative flood impacts.

**Climate change impacts**

- The impact of increased flooding due to climate change is expected to be negligible to minor for the WRRF. Key areas of the WRRF site are situated at least 0.5 m above the FFA 1% AEP climate change (RCP8.5 2150) flood level.
- At Camellia pumping station, the FFA 1% AEP flood level would increase by 0.8 m as a result of climate change. The site would change from being flood-free in the current climate FFA 1% AEP event to being inundated during the FFA 1% AEP climate change (RCP4.5 2150) event to depths of 0.2 – 1.0 m. The pump station upgrade will involve improvement to existing flood protection measures and new electrical installations will be designed with consideration of RCP4.5 2150 flood immunity and Sydney Water will continue to manage potential flooding impacts at the pump station. This will be undertaken separately from the GPOP WCM project.

### Management measures

Table ES-1 outlines the proposed flooding management measures for the project.

**Table ES-1 Flooding management measures**

| ID | Management measure | Applicable area |
|---|---|---|
| **Construction** | | |
| FL1 | A flood management plan will be prepared as part of the Construction Environmental Management Plan (CEMP) for the proposed construction works that will describe the processes for flood preparedness, materials management, weather monitoring, flood incident management and site management during construction. Flood incident management measures should be prepared in consultation with NSW SES and relevant local councils. | All construction areas |
| FL2 | Maintain existing hydraulic capacity where practicable for activities that may impact existing drainage systems during construction. | All |
| FL3 | Plan excavation of open trenches and microtunnelling/HDD to avoid potential flooding impacts to people and property, including:<br>▪ Planning excavation to avoid periods of forecast heavy rain<br>▪ Backfilling excavations promptly.<br>▪ Microtunnelling/HDD entry and exit points should be protected from floodwater entry, where possible. | All |
| FL4 | Plan construction activities to locate spoil stockpiles in areas which are not subject to frequent inundation by floodwater. | All.<br>Focus on C7, C8, C10, C13, C16, C19, C22, C24, C28. |
| FL5 | Plan construction activities to locate construction facilities outside high flood hazard areas on a 1% AEP flood, where possible. | All.<br>Focus on C7, C8, C10, C13, C16, C19, C22, C24, C28. |
| **Operation** | | |
| FL6 | The design of the proposed aerial crossings of Smalls Creek and Charity Creek will be reviewed during detailed design. If required, the design of the aerial crossings will be refined to minimise the potential flood impacts. | Aerial crossings |
| FL7 | Prepare and implement a flood management plan for the operation of the WRRF which will describe the procedures for planning and responding to a flood event. Early evacuation preparedness will be implemented in favour of sheltering in place. | WRRF |

# Contents

## Appendices



## Tables

## Figures

# Acronyms and abbreviations

| Term | Meaning |
|---|---|
| 1D | One-dimensional |
| 2D | Two-dimensional |
| Afflux | Increase in flood level as a result of obstruction to flow. |
| AHD | Australian Height Datum. A common national surface level datum approximately corresponding to mean sea level. |
| AEP | Annual Exceedance Probability. The probability that an event of a given size will be equalled or exceeded in a given year. In this study AEP has been used consistently to define the probability of occurrence of flooding. |
| Construction ancillary facilities | Temporary facilities during construction that include, but are not limited to, construction work areas, sediment basins, material stockpile and laydown areas, parking, maintenance workshops and offices, and construction compounds. |
| ARI | Average Recurrence Interval. The inverse of the AEP expressed as a return period. For instance, the 1% AEP is equivalent to the 100-year ARI event. |
| ARR | Australian Rainfall and Runoff. Guidelines prepared by the Institute of Engineers Australia for the estimation of design floods. Reference is made to the 1987 or the 2019 versions of ARR, as specified. |
| ARR 2019 Version 4.1 | Australian Rainfall and Runoff released in 2019. |
| ARR 2019 Version 4.2 | Australian Rainfall and Runoff released in 2024. |
| Base case | Development conditions prior to the Project being in place.<br>In the context of the Camellia-Rosehill WRRF, comprises the WRRF site following completion of the partial site raising (see below) and prior to construction of the permanent site works as described in Table 1-1. |
| BoM | Bureau of Meteorology |
| Catchment | The land area draining through the mainstream, as well as tributary streams, to a particular site. It always relates to an area above a specific location. |
| CEMP | Construction Environmental Management Plan. A site-specific plan developed for the construction phase to ensure that all contractors and sub-contractors comply with the environmental conditions of approval and that the environmental risks are properly managed. |
| Conveyance | The transport of flood water downstream. |
| CoP | City of Parramatta Council |
| CoR | City of Ryde Council |
| DCCEEW | NSW Department of Climate Change, Energy, the Environment and Water, includes the Conservation Programs, Heritage and Regulation Group. |
| DEM | Digital elevation model |

| Term | Meaning |
|---|---|
| Design case | Development conditions with the Project in place. This would be the operational state of the project.<br>In the context of the Camellia-Rosehill WRRF, comprises the WRRF site following completion of the permanent site works as described in Table 1-1 on the partially raised site. |
| DFE | Defined Flood Event |
| DPHI | NSW Department of Planning, Housing and Infrastructure |
| Discharge | The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second ($m^3/s$). Discharge is different from speed or velocity of flow, which is a measure of how fast the water is moving for example, metres per second (m/s). |
| EIS | Environmental impact statement |
| FFA | Flood frequency analysis |
| FIRA | Flood impact and risk assessment |
| Flood | Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami. |
| Flood fringe areas | The remaining area of flood prone land after floodway and flood storage areas have been defined. |
| Flood hazard | A flood that has the potential to cause harm or conditions with the potential to result in loss of life, injury and economic loss. |
| Flood liable/ flood prone land | Is synonymous with flood prone land i.e. land susceptibility to flooding by the probable maximum flood event. Note that the term flooding liable land covers the whole floodplain, not just that part below the flood planning level (see flood planning area). |
| Floodplain | Area of land which is subject to inundation by floods up to and including the probable maximum flood event, that is flood prone land. |
| Flood planning area (FPA) | The flood planning area is the area within which developments may be subject to flood related development controls. The flood planning area is calculated as the area lower than the flood planning level. |
| Flood planning level (FPL) | The combination of the flood level from the DFE and freeboard selected for floodplain risk management purposes. |
| Flood storage areas | Those parts of the floodplain that are important for the temporary storage of floodwaters during passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas. |
| Floodway areas | Those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels. |

| Term | Meaning |
|---|---|
| Freeboard | Provides reasonable certainty that the risk exposure selected in deciding on a particular flood chosen as the basis for the flood planning level is actually provided. It is a factor of safety typically used in relation to the setting of floor levels, levee crest levels, etc. Freeboard is included in the flood planning level. |
| FRMP | Floodplain Risk Management Plan |
| FRMS | Floodplain Risk Management Study |
| FRMSP | Floodplain Risk Management Study and Plan |
| GDA | Geodetic Datum of Australia |
| GIS | Geographic Information System |
| ha | Hectare |
| HDD | Horizontal directional drilling |
| HPC | Highly Parallelised Compute scheme in the TUFLOW flood hydraulic modelling software. |
| HWSS | High Water Spring Solstice tide |
| Hydraulics | The study of water flow in waterways; in particular, the evaluation of flow parameters such as water level and velocity. |
| Hydrology | The study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods. |
| IFD | Intensity Frequency Duration. Describes rainfall in terms of intensity (typically mm/hr), frequency (e.g. ARI) and duration of the storm. |
| IPCC | Intergovernmental Panel on Climate Change |
| km | Kilometres |
| $km^2$ | Square kilometres |
| LEP | Local environmental plan |
| LGA | Local government area |
| LiDAR | Light Detection and Ranging |
| Local overland flooding | Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam. |
| MGA | Map Grid of Australia. Geographic projection system. |
| mm | Millimetres |
| m/s | metres per second. Unit used to describe the velocity of floodwaters. |
| $m^3/s$ | Cubic metres per second or "cumecs". A unit of measurement of creek or river flows or discharges. It is the rate of flow of water measured in terms of volume per unit time. 1 $m^3/s$ is equal to 86.4 ML/day. |
| ML/day | Megalitres per day. A unit for measurement of flows or discharges. |
| Mainstream flooding | Inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam. |
| MSF | Sydney Metro West Clyde Maintenance and Stabling Facility |

| Term | Meaning |
|---|---|
| NSOOS | Northern Suburbs Ocean Outfall Sewer |
| OEH | Former NSW Office of Environment and Heritage |
| Overland flow path | The path that floodwaters can follow as they are conveyed towards the main flow channel or if they leave the confines of the main flow channel. Overland flow paths can occur through private property or along roads. |
| PLR | Parramatta Light Rail |
| PMF | Probable maximum flood. The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The probable maximum flood defines the extent of flood prone land, that is, the floodplain. |
| PMP | Probable maximum precipitation. The PMP is the greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to probable maximum flood estimation. |
| Pre-site raising case | In the context of the Camellia-Rosehill WRRF, comprises the site conditions upon acquisition of the WRRF site by Sydney Water (terrain based on 2024 LiDAR survey and with no permanent structures). |
| RCP | Representative Concentration Pathways. Scenarios used in climate modelling to project future greenhouse gas concentrations and their impact on the climate |
| REF | Review of Environmental Factors |
| RMS | Former NSW Roads and Maritime Services |
| (The) project | Greater Parramatta and Olympic Peninsula (GPOP) Water Cycle Management project |
| SEARs | Secretary's environmental assessment requirements |
| SES | NSW State Emergency Service |
| SOPA | Sydney Olympic Park Authority |
| SSD | State Significant Development |
| SSI | State significant infrastructure |
| TfNSW | Transport for NSW |
| TUFLOW | TUFLOW is a computer program which is used to simulate free-surface flow for flood and tidal wave propagation. It provides coupled 1D and 2D hydraulic solutions using a powerful and robust computation. The engine has seamless interfacing with GIS and is widely used across Australia. |
| WRRF | Water resource recovery facility |
| WBNM | Watershed Bound Network Model. WBNM is an event based hydrologic model and calculates flood hydrographs from storm rainfall information. |

**Terminology between ARI and AEP**

In accordance with ARR 2019 Version 4.2, AEP is the probability of an event being equalled or exceeded within a year and may be expressed as either a percentage (%) or 1 in X (where X is number of years). For example, a 1% AEP event or 1 in 100 AEP has a 1% chance of being equalled or exceeded in any year.

Average Recurrence Interval (ARI) was a term used previously to define the probability of design flood events (ARR, 1987) and was defined as the average period between occurrences equalling or exceeding a given value. The use of terms such as “recurrence interval” and “return period” are no longer recommended as they imply that a given event magnitude is only exceeded at regular intervals such as every 100 years. The term ARI has only been applied when referencing documents developed prior to the release of ARR 2019 Version 4.2.

# 1. Introduction

## 1.1 Project overview

Sydney Water is proposing to build and operate a new water resource recovery facility (WRRF) at Camellia-Rosehill. The new WRRF is needed to provide additional wastewater capacity to support growth across the northern suburbs of Sydney, and in the Greater Parramatta and Olympic Peninsula (GPOP) growth corridor. The WRRF and associated infrastructure together form the GPOP Water Cycle Management project (the project).

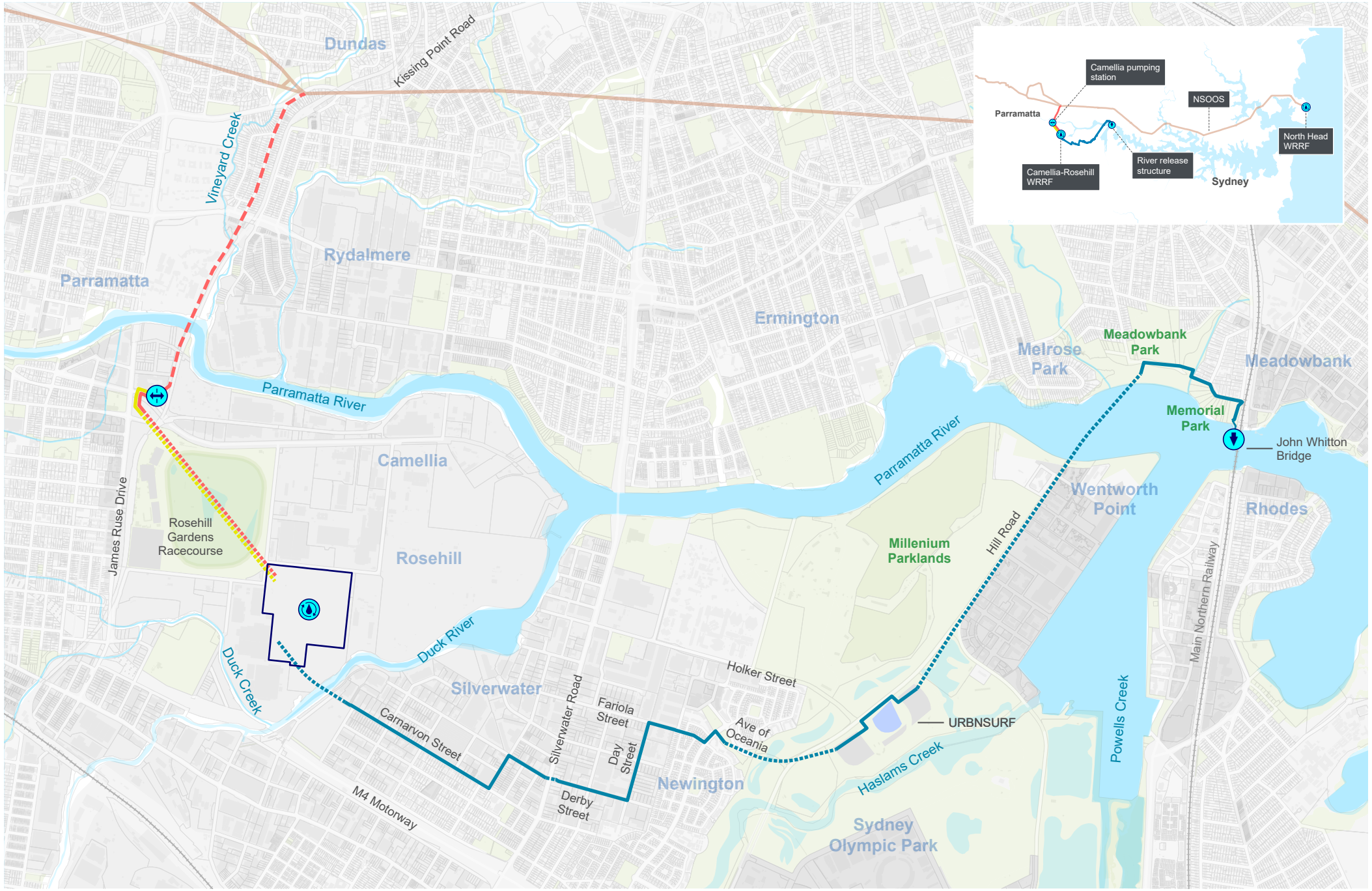
The additional growth would place pressure on the existing northern suburbs wastewater network, which includes the Northern Suburbs Ocean Outfall Sewer (NSOOS) and the North Head WRRF. These critical assets provide wastewater services to around 1.7 million people, and with current growth projections would reach capacity by 2031.

The GPOP WCM project has been designed to be efficient, sustainable, and cost effective for the community, as well as resilient and adaptable for future water uses.

The main elements of the project include:

- a new WRRF at Camellia-Rosehill to treat wastewater to produce advanced treated water
- upgrades to the existing pumping station at Camellia
- a new wastewater transfer pipeline from Camellia pumping station to the WRRF
- a new and repurposed brine pipeline to transfer brine from the WRRF to the NSOOS
- a new river release pipeline to transfer advanced treated water from the WRRF to a release structure in Parramatta River at Meadowbank.

The location of main elements of the project is provided on Figure 1-1. Further details of each component of the project are provided in Table 1-1. The project is State significant infrastructure and Sydney Water is preparing an Environmental Impact Statement (EIS) to support an application to the Minister for Planning and Public Spaces.




Camellia-Rosehill WRRF
Camellia pumping station
River release structure

Proposed pipelines
Brine pipeline
Transfer pipeline
River release pipeline

Pipeline construction method
Open trench
Trenchless
Relining

Northern Suburbs Ocean Outfall Sewer (NSOOS)
Railway

**Figure 1-1** Project overview

0 500 1000 1500 m

Data sources: State of NSW (Spatial Services), NSW Department of Planning and Environment
Basemap: MetroMap 2025
Scale: 1:27,500 @ A4
GDA2020 MGA Zone 56

N

**Table 1-1. Project description**

| Project Component | Detailed Description |
|---|---|
| WRRF | The WRRF would have capacity to treat 70 megalitres per day (ML/d). The WRRF would produce advance treated water to minimise impacts on receiving waterways. The reverse osmosis (RO) treatment process within the WRRF would generate brine as a by-product.<br>The main components of the WRRF include:<br>▪ inlet works<br>▪ primary, secondary and tertiary wastewater treatment process units<br>▪ advanced treatment processes involving reverse osmosis<br>▪ disinfection systems<br>▪ biosolids handling facilities<br>▪ odour control facilities.<br>The WRRF would require a range of process infrastructure such as tanks, bioreactors and digestors. The operation of the WRRF would also require ancillary facilities such as an administration building and associated car park, chemical storage and stormwater infrastructure.<br>The WRRF site would be designed to operate in up to the 1% AEP event. Many of the components are designed to be run autonomously for a period of time. |
| Camellia pumping station upgrades | The existing Camellia pumping station would be upgraded to divert wastewater to the WRRF. Upgrades would include the installation of new pumps to deliver wastewater flows to the new WRRF while remaining pumps would pump excess existing flows and brine produced by the WRRF to the NSOOS via existing pressure mains. New connections would be installed to divert the wastewater into the transfer pipeline. The existing site sheds would be replaced with a new electrical switch room along the eastern boundary of the site. |
| Transfer pipeline | The transfer pipeline is about 2.2 kilometres in length and would transfer wastewater from the Camellia pumping station to the WRRF. |
| Brine pipeline | The brine pipeline is about 5.2 kilometres in length and would transfer brine from the WRRF to the NSOOS for treatment and offshore discharge at North Head WRRF. A new pipeline would be constructed between the WRRF and Camellia pumping station, along the same alignment as the transfer pipeline. Between the Camellia pumping station and the NSOOS the brine pipeline would repurpose an existing pipeline. |
| River release pipeline and release structure | The river release pipeline is about 7.6 kilometres in length commencing at the WRRF and within the suburbs of Silverwater, Newington, Sydney Olympic Park and Meadowbank. The river release pipeline would discharge advanced treated water into the Parramatta River at Meadowbank.<br>Above ground infrastructure includes two concrete bridge-style aerial crossings over minor waterways in Meadowbank Park, and an approximately 8 metre high barometric loop located near the existing toilet block in Memorial Park.<br>The river release structure involves eight smaller pipelines that extend out underneath the sandstone sea wall and along the riverbed of the Parramatta River. The pipelines would vary in length, with the longest extending about 130 m. Diffusers would release water to enable mixing. |
| Land ownership and location | The WRRF would be located on Sydney Water owned property at the intersection of Colquhoun and Devon Street, Rosehill (Lot 1, Deposited Plan 1308385). The WRRF site comprises an area of 21.41 hectares (ha) (see Figure 1-1) and is located within the City of Parramatta Local Government Area (LGA).<br>Upgrades to the existing sewage pumping station at Camellia are also located on Sydney Water property within the City of Parramatta LGA.<br>Pipeline alignments are generally within the road corridor, Council or Crown land or Sydney Water easements, except for the transfer and brine pipelines beneath Rosehill Gardens Racecourse. |

| Project Component | Detailed Description |
|---|---|
| Construction activities | Key activities for construction of the WRRF will include:<br>▪ site establishment<br>▪ delivery of materials<br>▪ earthworks<br>▪ civil works<br>▪ structure construction<br>▪ installation of mechanical and electrical plant and equipment<br>▪ landscaping and rehabilitation<br>▪ commissioning.<br>The new sections of pipelines from the WRRF to Camellia pumping station and the river release location, would be constructed using a combination of trenching and horizontal directional drilling techniques. Between Camellia pumping station and the NSOOS, the existing rising main would be relined and repurposed to form part of the brine pipeline.<br>The upgrade of Camellia pumping station would include augmentation of underground infrastructure, installation of pumps, and upgrade of power supply. |
| Construction program | Construction of the project would commence in 2028 with a duration of around 36 months. Operation is planned to commence in 2031. |

## 1.2 Overview of flooding assessment

### 1.2.1 Approach

This Flood Assessment Report documents the approach, inputs and outcomes of the flooding assessment for the project. It is broadly comprised of the following streams of assessment:

- Flood modelling assessment of the new Camellia-Rosehill WRRF
  - Quantitative flood modelling analysis of the WRRF for existing and developed (operation) cases, including flood impacts, given the scale of the site development
  - While the flood modelling is primarily focussed on mainstream flooding in Parramatta River, Duck River, Duck Creek and A'Becketts Creek due to flood exposure of the new WRRF in extreme flood events including the probable maximum flood (PMF), the modelling also accounts for overland flooding around the WRRF site.
- Qualitative assessment of potential flood impacts resulting from, and flood risk posed to, the project infrastructure elements external to the WRRF, including:
  - Camellia pumping station
  - Brine pipeline, transfer pipeline, river release pipeline and associated surface works
  - Operation and construction phase flood impacts and risk are considered
  - The minor scale of these works posed onto the flooding behaviour permits a qualitative assessment.
- Qualitative assessment of construction phase impacts.
- Qualitative assessment of cumulative impacts with other approved and proposed development.

### 1.2.2 Definition of WRRF development conditions

The Camellia-Rosehill WRRF site is the main project component of the GPOP WCM Project that is relevant to the flooding assessment due to the potential interaction with flood flows. The site historically formed the part of the Clyde Refinery, which originally comprised of an approximately 140 ha area on the Camellia Peninsula.

The eastern area of the Clyde Refinery is currently operated by Viva Energy in the area to the north-east of the WRRF site. The Western Area was subject to partial remediation and subdivision (AECOM, 2022).

Sydney Water acquired the WRRF site in 2024. The WRRF site when acquired included initial filling and regrading of the vacant site surface. Other properties forming part of the Western Area include the Downer Sustainable Road Resource Centre site located immediately east of the WRRF site.

Sydney Water raised the site with up to 1.7 m of natural material to reduce ongoing risks of exposure from residual contaminated soils and to raise the site above the 1% AEP flood level. The works proposed were part of site environmental management works at the WRRF site and were assessed in a Review of Environmental Factors (REF), which included a flood impact assessment. The REF was determined by Sydney Water in October 2024.

The initially assessed footprint for site raising in the REF comprised the large majority of the WRRF site. An Amendment REF is being prepared (as of August 2025), including updated flood modelling and impact assessment, based on a revised and condensed footprint to be raised, with inclusion of a floodway on the western portion of the site for the purposes of flood flow management and flood impact mitigation in up to and including the probable maximum flood (PMF) event.

On the basis of the historic development context of the WRRF site described above, the development conditions on the site for the purposes of this flood assessment are as follows:

- Base case conditions for flood assessment: comprises the site following completion of the partial site raising (undertaken as a part of initial site management works) and prior to construction of the permanent site works as described in Table 1-1.
- Design case conditions for flood assessment: comprises the WRRF site following completion of the permanent site works as described in Table 1-1 on the partially raised site. This would be the operational state of the project.

The floodway reserved for conveyance of up to the PMF event flows in the western portion of the WRRF site in the Base and Design cases accommodates the short and medium term design capacity of the WRRF of 70 ML/day up to about 2050. When expansion of the WRRF is needed, use of the floodway area may be required. At that future stage, Sydney Water will reassess flooding for the proposed expansion/changes to the site and with regard to Camellia – Rosehill precinct flooding, which will have undergone significant changes due to redevelopment of the precinct, and seek appropriate approvals at the time.

### 1.2.3 Consideration of Precinct redevelopment

The Department of Planning, Housing and Infrastructure ("DPHI") finalised the Camellia-Rosehill Place Strategy (the Place Strategy) in 2022. That is, that a coordinated and strategic approach was needed to consider changes to land use, address remediation, transport challenges, land use conflict through the preparation of a Place Strategy.

This GPOP WCM flood assessment has been undertaken recognising that the Camellia-Rosehill Place Strategy is yet to be implemented through a rezoning. However, Sydney Water will provide DPHI with design information on the GPOP WCM project to allow consideration of how the project will align with the Camellia-Rosehill Place Strategy.

## 1.3 Flood assessment requirements

### 1.3.1 SEARs

Sydney Water were issued with Secretary's Environmental Assessment Requirements (SEARs) in September 2024. The SEARs relating to this assessment, and where these requirements are addressed in this report are outlined in Table 1-2. The context of these SEARs, in relation to flooding, are in consideration of the following desired performance outcomes:

- The project minimises adverse impacts on existing flooding characteristics.
- Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure.

A separate climate change assessment report has been prepared to address the SEARs related to climate change risk. Outcomes from this flooding assessment have been used to inform the relevant aspects of that climate change risk assessment.

**Table 1-2. Secretary's Environmental Assessment Requirements – Flooding**

| Secretary's Environmental Assessment Requirements | Where addressed |
|---|---|
| 1. Changes to flood behaviour during construction and operation for a full range of flood events up to the probable maximum flood (taking into account sea level rise and storm intensity due to climate change) must be assessed (and modelled) including*: | |
| (a) time to onset, duration, depth, velocity and hydraulic hazard of any flooding | Section 5.2 |
| (b) any detrimental increases in the potential flood affectation of other properties, assets and infrastructure | Section 6.2, Section 7 |
| (c) consistency (or inconsistency) with applicable Council floodplain risk management plans | Section 6.2.12 |
| (d) compatibility with the flood hazard of the land | Section 6.2.8, Section 7.5. |
| (e) compatibility with the hydraulic functions of flow conveyance in flood ways and storage areas of the land | Section 6.2.8, Section 7.5. |
| (f) downstream velocity and scour potential | Section 6.2.2 |
| (g) impacts the development may have upon existing community emergency management arrangements for flooding. These matters must be discussed with the State Emergency Services and Council | Section 6.2.11. Consultation discussed in Section 4.4. |
| (h) any impacts the development may have on the social and economic costs to the community as consequence of flooding. | Section 6.2.10, Section 7.6. |
| (i) an independent peer-review, with the findings detailed in the EIS, including how any recommendations and findings have been addressed. | Appendix F |
| (j) Impact on existing development consents that apply to the site. | Section 6.2.9 |
| 2. Flood management objectives and outcomes must be clearly identified and substantiated to address the characteristics of the environment and relevant legislative, management and guidance requirements. | Section 4.2.6, Section 10.2 |
| 3. A flood impact and risk assessment (FIRA), prepared in accordance with relevant guidelines, and having regard to advice provided by Biodiversity, Conservation and Science Group. | This report. |

* Flood modelling is to be undertaken by a suitably qualified engineer consistent with Council's requirements and Australian Rainfall and Runoff. Flood behaviour includes flood volume, extent, depth, level, velocity, duration, rate of rise, flood function and hazard. Impacts of flooding include changes to flood behaviour and risks to the community including emergency management response for the community.

### 1.3.2 Agency requirements

In support of seeking the Secretary's Environmental Assessment Requirements, the relevant requirements from Department of Climate Change, Energy, the Environment and Water (DCCEEW) are summarised in Table 1-3. Other relevant agency comments are summarised in Appendix F.

**Table 1-3. Agency requirements – DCCEEW – Flooding**

| Agency Requirements | Where addressed |
|---|---|
| 6. The EIS must include a flood impact and risk assessment (FIRA). As a minimum the FIRA must*: | This report. |
| Consider the relevant provisions of the NSW Flood Risk Management Manual and toolkit, and existing council and government studies, information and requirements. | Section 4.2 |
| Identify and describe existing flood behaviour and flood constraints on the site and its surrounding areas for the full range of events, including 5% AEP, 1% AEP, 0.5% AEP or 0.2% AEP and 1 in 2,000 AEP flood and PMF events and provide an assessment of the compatibility of the development and its users with flood behaviour. This may require flood modelling where existing flood information is not available. | Refer to Section 4.4.1 for agreed flood events for assessment.<br>Refer to Section 2.3 and Section 5.2 for existing flood behaviour.<br>Refer to Section 5.1 for details of the flood modelling.<br>Refer to Section 6.2 and 7 for assessment of compatibility of the project with the flooding conditions. |
| Determine and describe changes in post development flood behaviour, impacts of flooding on existing community and on the development and its future community for full range of events, 5% AEP, 1% AEP, 0.5% AEP or 0.2% AEP flood and PMF events. This will typically require flood modelling. | Section 6.2 and 7. |
| Consider impacts of climate change due to any increase in rainfall intensities. The 0.5% AEP or 0.2% AEP events can be used to provide an understanding of the scale of change of flood behaviour relative to the 1% AEP event. | Section 6.4.1 |
| Propose and assess the effectiveness of management measures including development controls required to minimise the impacts and risks of flooding to the development and its users and existing community. | Section 10.4. |

Refer to Appendix F for additional relevant requirements from other agencies.

## 1.4 Report structure

This report is structured according to the following sections:

Section 1 Outlines the key elements of the project and the structure of this report (this section)

Section 2 Background: Description of the site, catchment description and flooding behaviour

Section 3 Available information: Description of the available data including data sources

Section 4 Flood related requirements: Outline of the statutory context, including applicable legislation and planning policies and guidelines. Policy and planning setting, assessment criteria and stakeholder consultation.

Section 5 Base case modelling and analysis - WRRF: Description of the hydrologic and hydraulic modelling development for existing conditions for the WRRF

Section 6 Design case modelling and analysis - WRRF: Description of the hydrologic and hydraulic modelling development for existing conditions for the WRRF, including flood impact assessment. Sensitivity assessments of the climate change flood impact assessment.

Section 7 Flood impact assessment of other GPOP WCM infrastructure: Qualitative impact assessment of the Camellia pumping station, brine pipeline, transfer pipeline and river release pipeline.

Section 8 Construction phase assessment. Assessment of potential construction phase flood impact

| | |
|---|---|
| Section 9 | Cumulative flood impacts: Assessment of expected flood impacts of the WRRF combined with other approved/proposed developments in the study area. |
| Section 10 | Key flooding issues and risks to be managed and mitigation measures recommended for both construction and operation phases to address residual flooding impacts |
| Section 11 | References. |
| Appendices | Appendix A – Hydrologic inputs<br>Appendix B – Flood mapping – Base case<br>Appendix C – Project design information<br>Appendix D – Flood mapping – Design case<br>Appendix E – Flood mapping – Sensitivity assessments<br>Appendix F - Independent peer review. |

# 2. Background

## 2.1 Study area

The WRRF site is located within the Camellia-Rosehill industrial precinct, to the north of Duck River and to the east of the M4 Western Motorway Bridge. The site is surrounded by nearby industrial and commercial land use and is slightly downstream of the confluence of Duck River, Duck Creek and A'Becketts Creek. The site is bounded by Devon Street to the north, Colquhoun Street and Unwin Street along the northern end of its western boundary, an existing drainage easement including a drainage channel along its western boundary that drains to Duck River, an area of elevated land and then Duck River to its south and undeveloped land and industrial land use properties to its east. Notable properties and developments in the vicinity of the WRRF site include:

- Downer Rosehill Sustainable Road Resource Centre to its east, as mentioned above
- "Property 1" to the south
- "Property 2" to the north of Devon Street sag point, bounded by Colquhoun Street
- "Property 3" on north side of the eastern end of Devon Street, bounded by Durham Street
- "Property 4" industrial estate immediately to the west
- Metro West Clyde stabling and maintenance facility (currently under construction) to the west
- Rosehill Gardens Racecourse to the north-west.

These are shown in Figure 2-1.

The section of the existing wastewater pipeline being repurposed (and relined) as part of this project for brine transfer starts with its connection to the NSOOS under Kissing Point Road, Dundas, and runs south through a residential area under Rippon Avenue and then under Victoria Road, Rydalmere. The existing pipeline then passes under Vineyard Creek and through the Western Sydney University Parramatta campus adjacent to the Parramatta Light Rail Carlingford Line. Subsequently, it crosses under the Parramatta River and then through former and current industrial properties before reaching the Camellia pumping station site.

Camellia pumping station is located 250 m from the southern bank of the Parramatta River, situated between the Parramatta Light Rail (Stage 1) to its south and east and adjacent to the Rosehill Gardens light rail stop, and James Ruse Drive to its west. Surrounding properties are of industrial land use, with Rosehill Gardens Racecourse about 250 m to the south.

From Camellia pumping station, the brine pipeline (new section) runs parallel with the transfer pipeline south-east under Rosehill Gardens Racecourse before reaching the WRRF site.

From the WRRF site, the river release pipeline crosses under Duck River to the south of the site and passes through industrial properties in Silverwater to the east of the WRRF site, before passing through residential areas, reconstructed wetland areas offline from Haslams Creek (Narawang Wetlands) and the UrbnSurf wave park adjacent to Haslams Creek and in Wentworth Point. It then crosses underneath the Parramatta River and passes through recreational open space areas and crossings of Smalls Creek and Charity Creek in Meadowbank on the northern side of Parramatta River before entering the Parramatta River via a river release structure, just west of John Whitton Bridge.

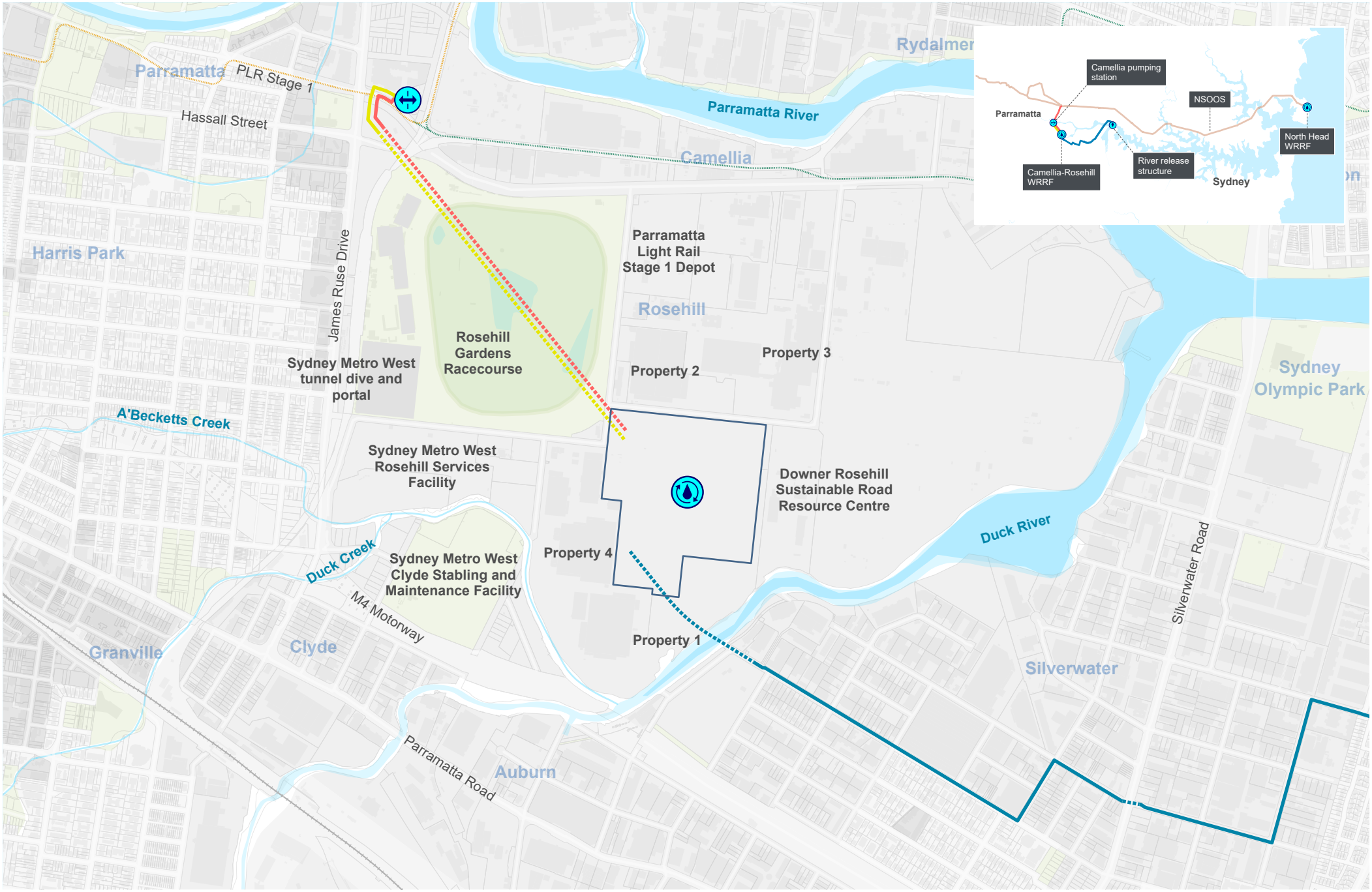
## 2.2 Catchment description

### 2.2.1 Duck River catchment

The WRRF site is located in the Duck River catchment which is a part of the broader Parramatta River catchment shown in Figure 2-2. Duck Creek and A'Becketts Creek sub-catchments sit within the overall Duck River catchment. The catchment areas of the three waterways draining to the vicinity of the site include:

- Duck River sub-catchment: 25 $km^2$ upstream of Duck Creek confluence
- Duck Creek and sub-catchment: 9 $km^2$ upstream of Duck Creek confluence
- A'Becketts Creek sub-catchment: 7 $km^2$.

These sub-catchments are shown on Figure 2-3.




Camellia-Rosehill WRRF
Camellia pumping station

Proposed pipelines
Brine pipeline
Transfer pipeline

Proposed River Release Pipeline
Proposed River Release Pipeline - Open trench
Proposed River Release Pipeline - Trenchless

Railway
Parramatta Light Rail Stage 1 (EIS)
Parramatta Light Rail Stage 2 (EIS)

**Figure 2-1** Site Locality

0 200 400 600 m

Data sources: State of NSW (Spatial Services), NSW Department of Planning and Environment
Basemap: MetroMap 2025

Scale: 1:15,000 @ A4
GDA2020 MGA Zone 56

N

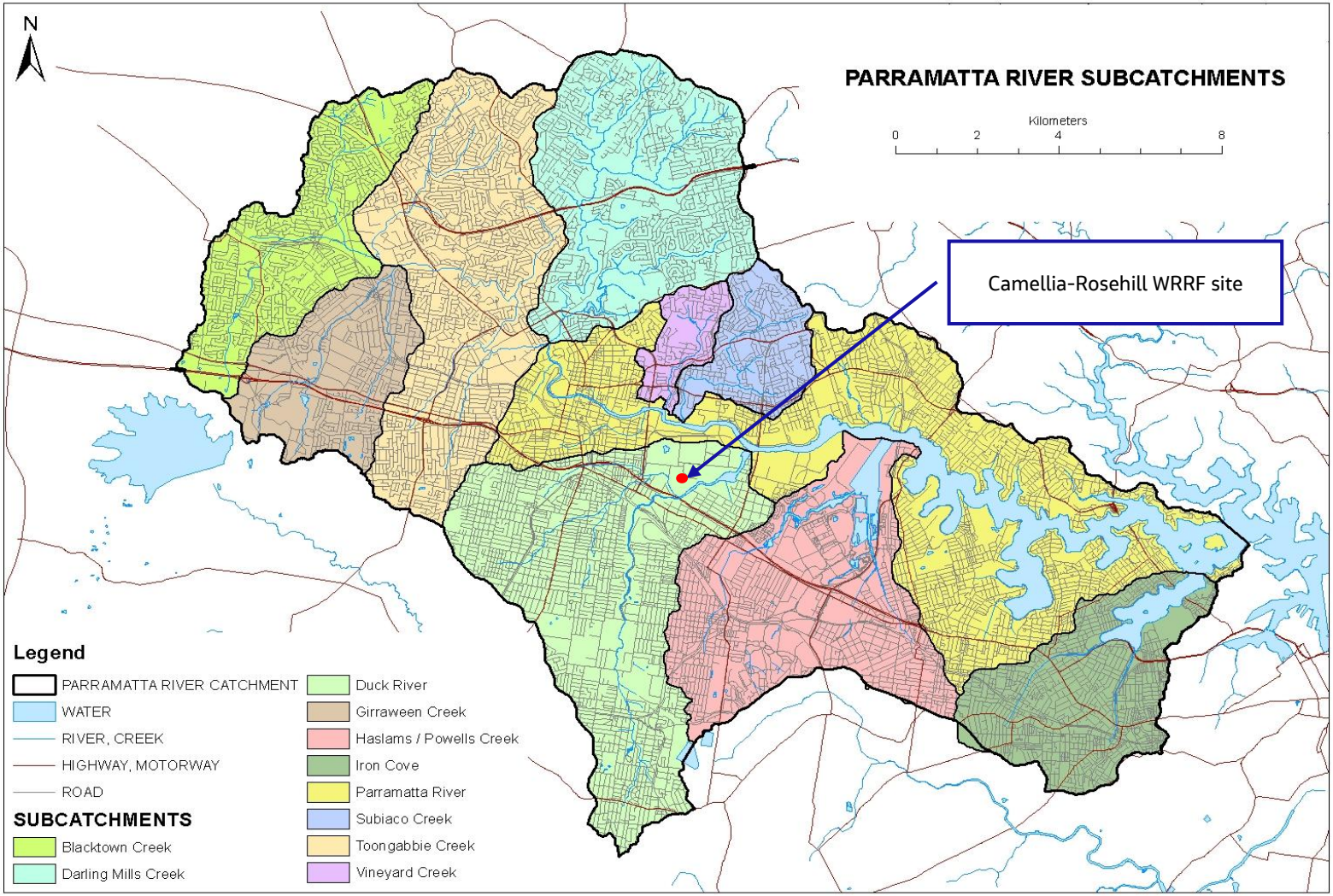



**Figure 2-2. Parramatta River sub-catchments and location of the project site.**

Figure source: www.parramattariver.org.au

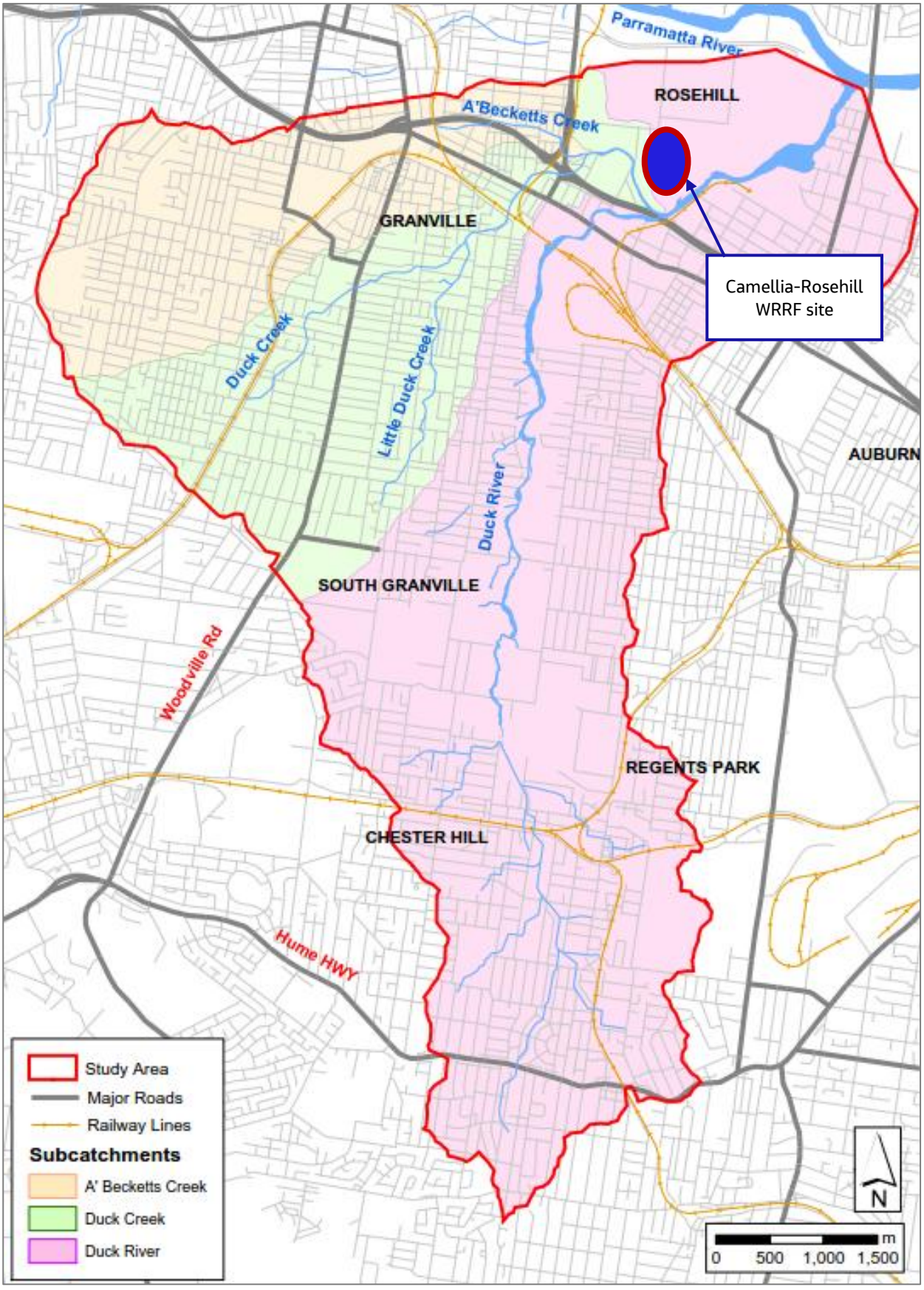



**Figure 2-3. Duck River, Duck Creek and A'Becketts Creek sub-catchments**

Source: WMAwater, 2012

Each of the sub-catchments are highly urbanised with a mix of residential, commercial, industrial and other urban land uses, and also contains areas of parklands, reserves and vegetation.

The watercourses in the vicinity of the WRRF are unlined and generally in a degraded state. The main channels are vegetated to varying extents with mangroves, particularly in the section around the Duck River/Duck Creek confluence. In other sections the vegetation is a mix of mangroves and invasive species. The channels are in places deeply incised, with steep banks as a result of the highly modified urban catchment flow regimes. Each of the watercourses in the vicinity of the WRRF site are tidal.

Upstream of James Ruse Drive, Duck Creek and A'Becketts Creek are formalised channels with a concrete-lined base and formed grassed, landscaped or otherwise lined banks. Duck River continues for some distance upstream of the M4 Motorway as an unlined channel.

There are numerous existing waterway crossings and hydraulic structures over the watercourses in the vicinity of the WRRF site, including:

- On Duck River: M4 Motorway, Parramatta Road and T1 Main Western Line.
- On Duck Creek: Kay Street, M4 Motorway and on/off ramps, James Ruse Drive, now closed T6 Carlingford line, Parramatta Road and T1 Main Western Line and a number of footbridges.
- On A'Becketts Creek: Unwin Street, James Ruse Drive and on ramp, RMS Granville Depot accessway bridge and now closed T6 Carlingford line. Other crossings away from the site up to the T1 Main Western Line crossing include Arthur Street, Alfred Street, Good Street, footbridges near Harris Street and Wigram Street at the railway crossing itself.

The M4 Motorway and James Ruse Drive both cross the watercourses and floodplain on viaduct.

### 2.2.2 Parramatta River catchment

The Parramatta River has its confluence with Duck River about 2 km downstream of the WRRF site. The catchment area upstream of the confluence is about 128 km$^2$ and is comprised of the following main tributaries (excluding the Duck River catchment):

- Blacktown Creek
- Girraween Creek
- Toongabbie Creek
- Darling Mills Creek
- Subiaco Creek
- Vineyard Creek.

The catchment extends to the north to the suburbs of Castle Hill, Norwest and Bella Vista, and west to Kings Langley, Seven Hills and Blacktown. The catchment is highly urbanised with a mix of residential, commercial, industrial and other urban land uses, and also contains areas of parklands, reserves and vegetation. Significant areas of bushland are situated along Toongabbie Creek, Darling Mills Creek, around Lake Parramatta and Hunts Creek and in the upper reaches of Vineyard Creek.

### 2.2.3 Haslams Creek catchment

The river release pipeline downstream of the WRRF passes through the Haslams Creek catchment. Haslams Creek drains an urbanised catchment area of about 17 km$^2$. Land use within the catchment is mostly residential with pockets of industrial and commercial land use while the south-eastern portion of the catchment also includes a portion of the Rockwood Cemetery. The lower parts of the catchment include

sections of the Sydney Olympic Park precinct. The watercourse is mostly concrete lined and becomes natural and estuarine downstream of the Great Western Highway. The lower sections are mainly comprised of open space and environmentally sensitive and conservation areas.

The trunk drainage system for the catchment includes various stormwater channels and pipe networks which discharge into Haslams Creek. The main creek channel and the various tributary stormwater channels are all lined. Some parts of the trunk drainage system, including Haslams Creek, are under the control of Sydney Water while other parts of the system are under the control of City of Parramatta (CoP) Council.

### 2.2.4 Meadowbank Park catchments

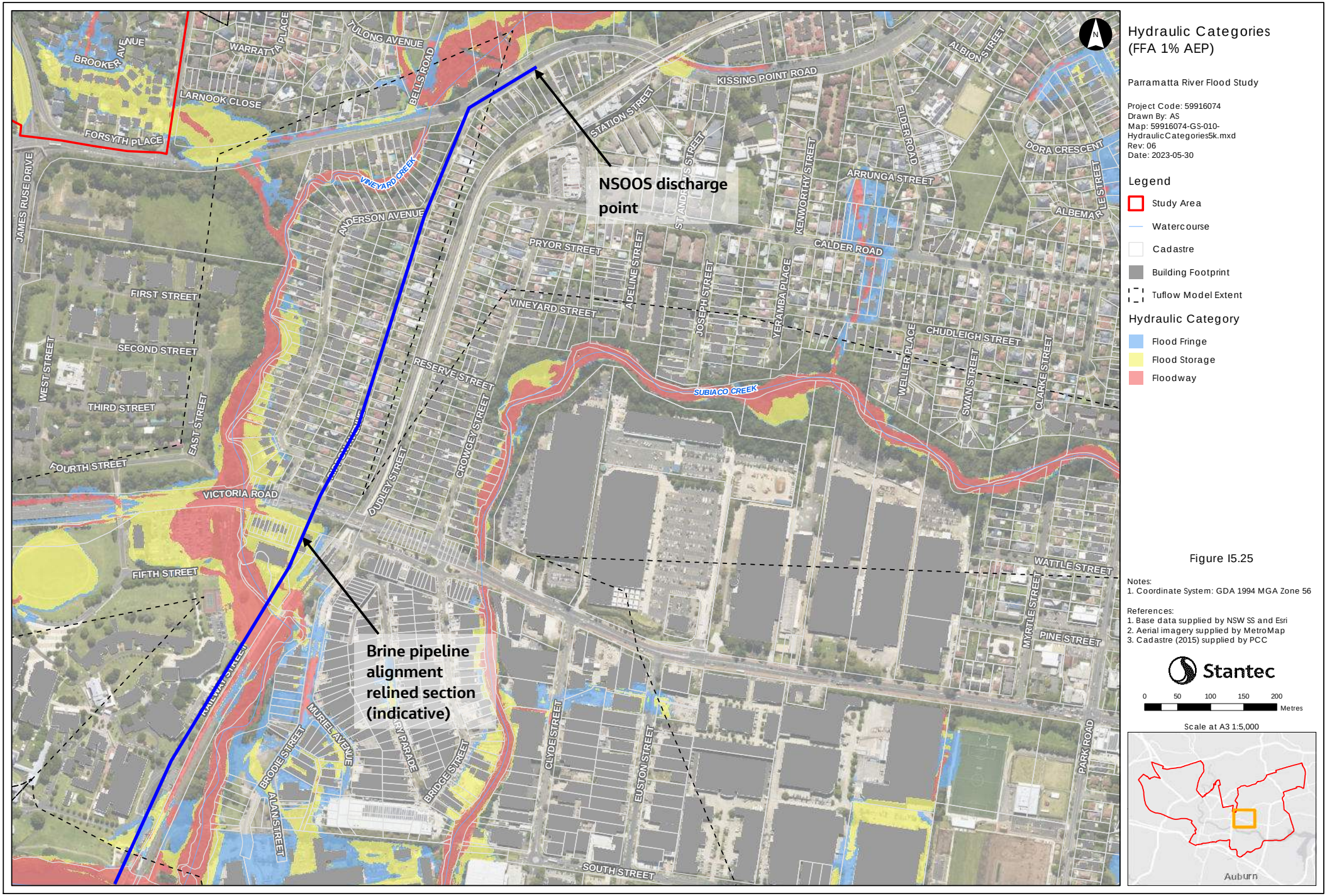
After crossing under the Parramatta River from Wentworth Point, the river release pipeline passes through Meadowbank Park and along the edges of adjacent residential areas in Meadowbank, before the advanced treated water is released to the Parramatta River near John Whitton Bridge. Several local catchments drain through Meadowbank Park, including Archer Creek (2.86 $km^2$ catchment area), Smalls Creek (Denistone catchment; 2.15 $km^2$) and Charity Creek (2.47 $km^2$). These creeks pass through Meadowbank Park in concrete lined channels. Local overland flows also occur in the vicinity of the Project works.

## 2.3 Known flood behaviour

Information on flood behaviour sourced from available flood studies, which are described in Section 3.1, is summarised in this section for the various sections of the GPOP WCM project area.

### 2.3.1 Brine pipeline north of Parramatta River

Along the repurposed and relined section of the brine pipeline to the north of Parramatta River, starting from the NSOOS connection at Kissing Point Road, Dundas, flooding occurs along Vineyard Creek due to flows from that sub-catchment. In the 1% AEP event floodway areas and high flood hazard areas occur in the vicinity of the Project, affecting the sag point in Victoria Road and Railway Street, with active overland flows occurring between Railway Street and the Parramatta Light Rail (Stage 1) line (Stantec, 2024). There is a small area of flood storage to the west of the light rail bridge in open space on the northern bank of the Parramatta River. The CoP flood hazard mapping with the repurposed and relined section of the brine pipeline route is shown on Figure 2-4 along this section of the project.




## Hydraulic Categories (FFA 1% AEP)

Parramatta River Flood Study

Project Code: 59916074
Drawn By: AS
Map: 59916074-GS-010-HydraulicCategories5k.mxd
Rev: 06
Date: 2023-05-30

### Legend

- Study Area
- Watercourse
- Cadastre
- Building Footprint
- Tuflow Model Extent

### Hydraulic Category

- Flood Fringe
- Flood Storage
- Floodway

Figure I5.25

Notes:
1. Coordinate System: GDA 1994 MGA Zone 56

References:
1. Base data supplied by NSW SS and Esri
2. Aerial imagery supplied by MetroMap
3. Cadastre (2015) supplied by PCC

Stantec

0 50 100 150 200 Metres

Scale at A3 1:5,000





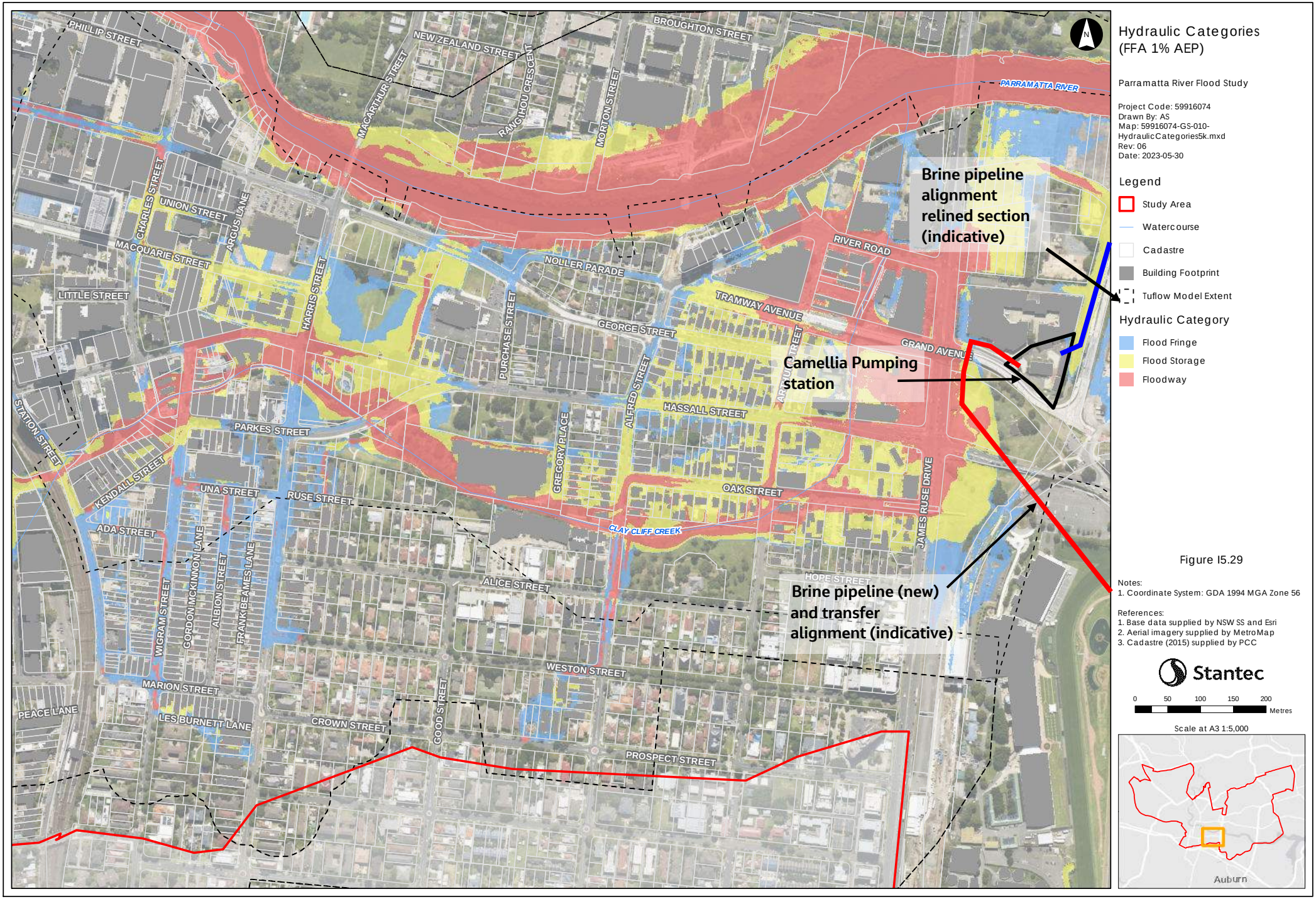

*Source: Parramatta River Flood Study (Stantec, 2024)*

**Figure 2-4. Flood hazard mapping in 1% AEP event along brine pipeline route (NSOOS to Victoria Road).**

### 2.3.2 Brine pipeline, transfer pipeline and Camellia pumping station between Parramatta River and WRRF

Around Camellia pumping station there are floodway and flood storage areas in the 1% AEP event to the west of the site due to flooding from Claycliff Creek, affecting parts of Grand Avenue North, River Road West and James Ruse Drive. To the east of the site there is a small area of flood storage, adjacent to the Parramatta Light Rail (Stage 1) line. The pumping station site itself is not flooded in the 1% AEP event (Stantec, 2024). Refer to Figure 2-5 and Figure 2-6 (Source: Parramatta River Flood Study (Stantec, 2024) with GPOP WCM project pipeline route overlay).

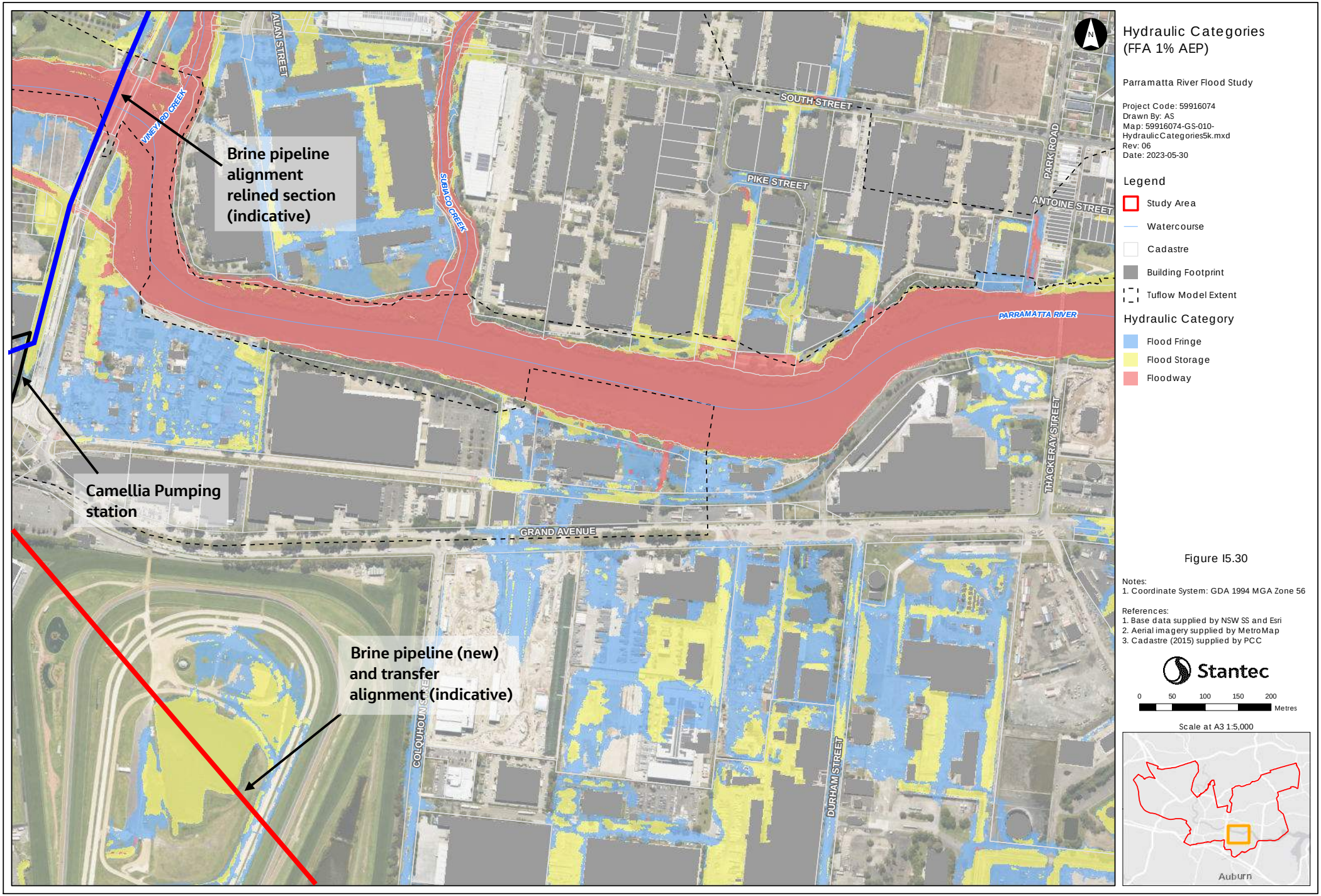
Between Camellia pumping station and the Camellia-Rosehill WRRF, the brine (new section) and transfer pipelines pass under Rosehill Gardens Racecourse. The racecourse is located on historically low-lying drainage areas and as a result there currently are ponding areas which are mapped as flood storage zones in the 1% AEP event (Stantec, 2024).






*Source: Parramatta River Flood Study (Stantec, 2024)*

**Figure 2-5.Flood hazard mapping in 1% AEP event along brine pipeline route (Victoria Road to Parramatta River).**






*Source: Parramatta River Flood Study (Stantec, 2024)*

**Figure 2-6.Flood hazard mapping in 1% AEP event along brine and transfer pipeline routes (Parramatta River to Rosehill Gardens Racecourse).**

Peak flooding in the vicinity of the Camellia-Rosehill WRRF site is a combination of:

- mainstream flooding from Parramatta River
- mainstream flooding from Duck Creek, A'Becketts Creek and Duck River
- overland flooding from local stormwater runoff.

Mainstream flooding is the result of flood flows from the main catchments causing water levels to rise out of the waterways and inundating the adjacent floodplains. The flooding in these waterways may also interact with and be influenced by flooding in the Parramatta River, which in turn may be influenced by downstream tidal effects and elevated ocean levels, although these coastal influences are not overly significant in the vicinity of the WRRF site, as the catchment flooding influences are predominant.

Flooding from Duck River and Duck Creek in rare events such as the 1% AEP event does not reach sufficiently high flood levels to break out of the watercourse and significantly affect the Camellia-Rosehill WRRF site. The flood extent is restricted to only affecting the southern fringes and along the existing stormwater channel on the site western boundary.

Modelling by CoP Council indicates that during extreme flood events such as the PMF, there is significant breakout of floodwater from the watercourses. Flooding in the Parramatta River breaks out around Parramatta and Camellia and then flows across the floodplain in a south and south-easterly direction through Rosehill where it then meets floodwaters breaking out from A'Becketts Creek and Duck Creek downstream of James Ruse Drive and which flow in a west-to-east direction. These combined floodplain flows reach the Camellia-Rosehill WRRF site and then continue eastward around the northern side of the site or in a south-easterly direction around the western and southern sides of the site. Both flow paths join Duck River or the Parramatta River to the east of the site. Refer to Figure 2-7.

Overland flooding may contribute to flooding at the Camellia-Rosehill WRRF site. Overland flooding results from local runoff into surface flow paths including roads, causing inundation of areas as it drains to the receiving watercourses. It can also occur in low points formed in roads including Colquhoun Street/Unwin Street corner, with flooding occurring when the local drainage system capacity is exceeded.

### 2.3.3 River release pipeline east of Camellia-Rosehill WRRF

To the east of Camellia-Rosehill WRRF, the river release pipeline passes underneath Duck River and through an industrial area in Silverwater, under Carnarvon Street, Derby Street, Vore Street, Day Street North, Farioli Street, Comaneci Street and into Pierre de Coubertin Park. This route is mostly above the 1% AEP flood from Duck River and is denoted as mainly flood storage in the PMF (Stantec, 2024). Overland flooding is not defined in available previous flood studies in this area and flood mapping is not available.

After Pierre de Coubertin Park, the river release pipeline passes under Avenue of Oceania and the Narawang Wetlands, which are situated offline to the main Haslams Creek channel, and into the car park to the south of the UrbnSurf wave park adjacent to Haslams Creek. The pipeline passes around UrbnSurf and then passes under Wentworth Point. The Narawang Wetlands include permanent wetland waterbodies and it is expected that the Wetlands would become further inundated during rare and extreme flood events as floodwaters break out from Haslams Creek and flow through the wetland network. Refer to Figure 2-8.

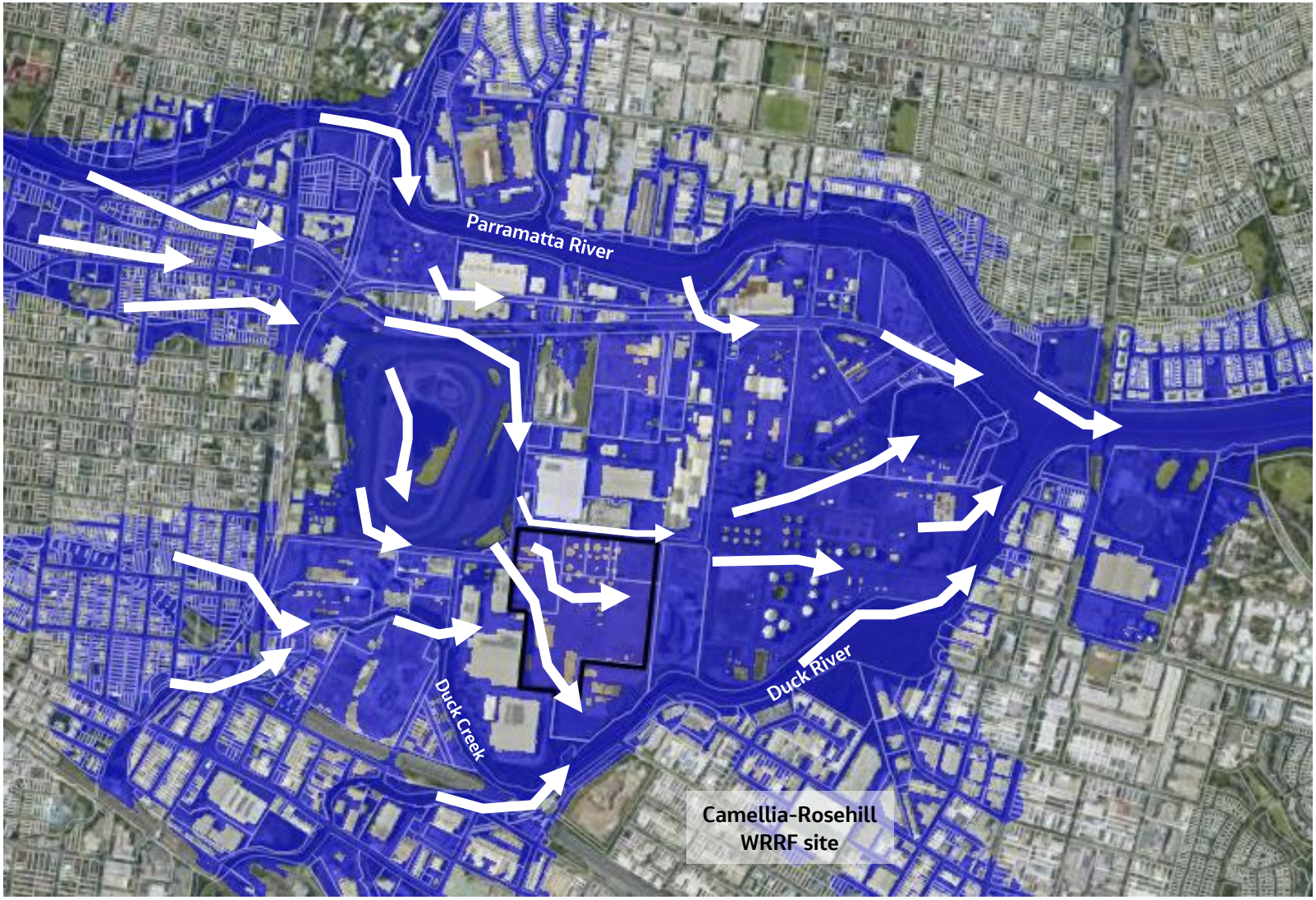



**Figure 2-7. PMF extent and flow patterns around WRRF site.**

Source: Parramatta River Flood Study (Stantec, 2024) model output (no site raising works in place)

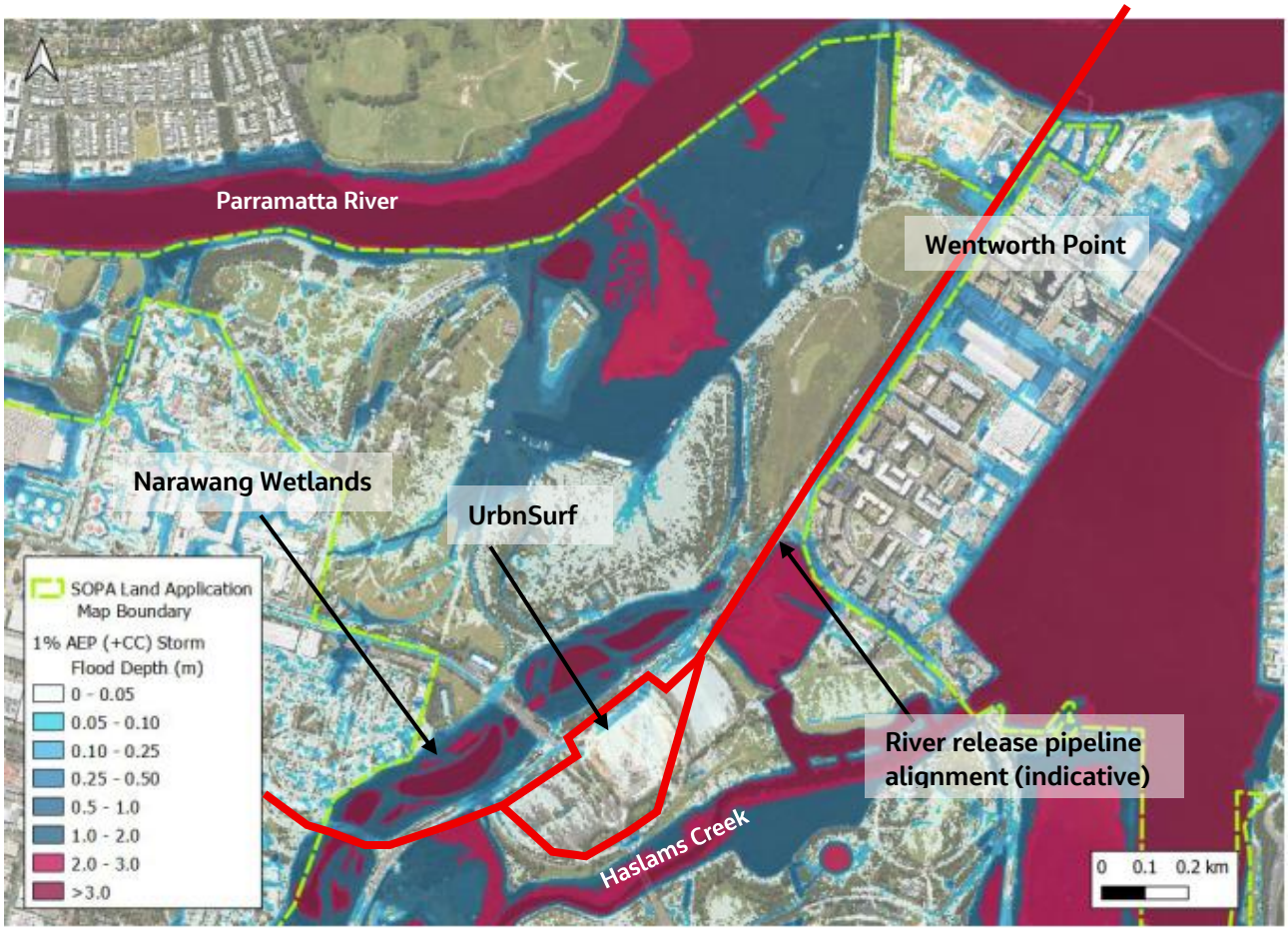



**Figure 2-8. SOPA Masterplan 2050 Newington area – Existing case – 1% AEP with climate change.**

Source: Sydney Olympic Park Master Plan 2050 - Flooding Assessment Report (Mott MacDonald, 2024) with GPOP WCM project pipeline route overlay

The river release pipeline crosses the Parramatta River and passes through Meadowbank Park. The Project area experiences flooding from Smalls Creek and Charity Creek channels as well as in the overbank areas adjacent to the creeks (WMAwater, 2023), with flood depths on overbank areas within the park of 0.5 – 1 m in the 1% AEP event. Refer to Figure 2-9.

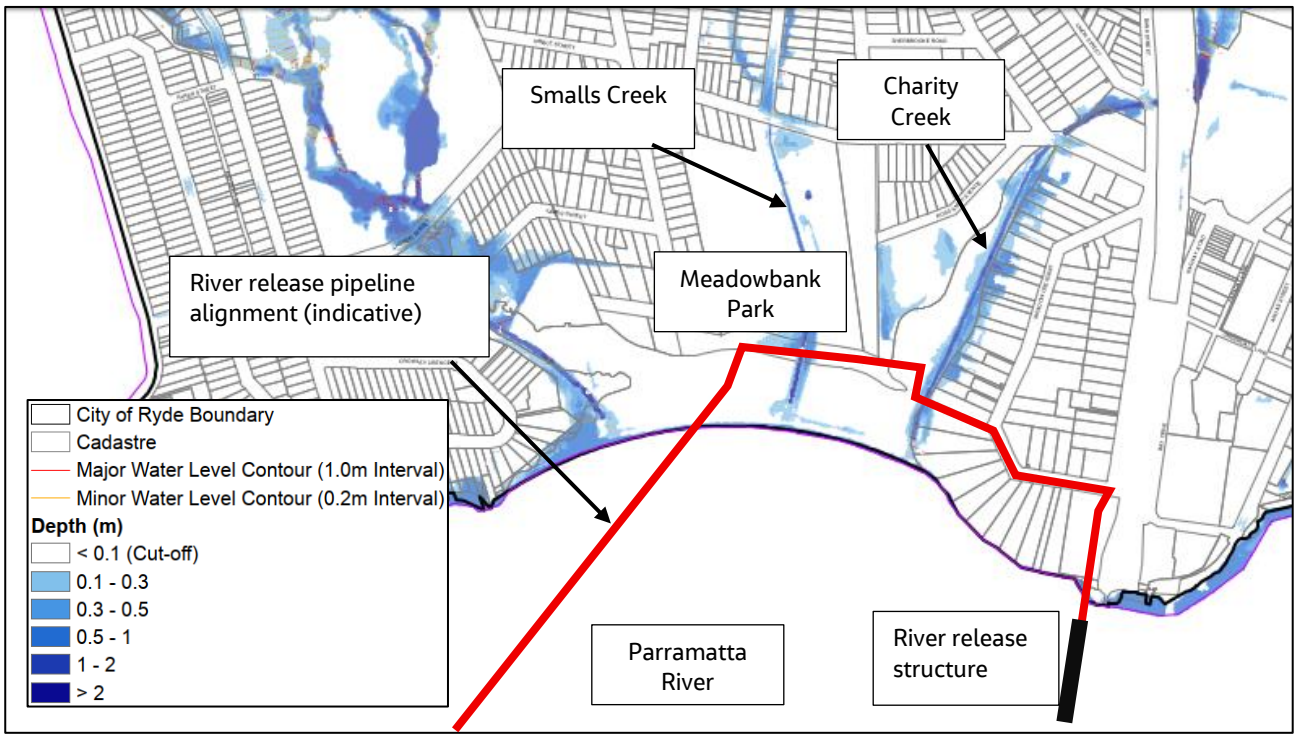



**Figure 2-9. Flood depth mapping in 1% AEP event around Meadowbank Park. with GPOP WCM project pipeline route overlay**

Source: WMAwater, 2023

## 2.4 Flood history

Data on historical floods is generally limited. Stantec (2024) indicates that historical flooding in the Parramatta River catchment occurred in 1898, 1914, 1956, 1961, 1967, 1969, 1974, 1975, 1986, 1988, 1990, 1991, 1998 and more recently in 2015 and 2016. The largest of these occurred in 1889 and 1914 when the catchment was relatively undeveloped.

Marsden Street Weir gauge (213004) provides the longest continuous data set of water level data from 1979 to present. The largest event in the period of recorded water level occurred in April 1988, with a recorded peak flood level of 7.866 m AHD and estimated flow of 688.5 $m^3/s$. The 1889 and 1914 flood events had estimated peak flood levels of 8.19 m AHD and 7.60 m AHD, respectively (Stantec, 2024).

While understood to be relatively large magnitude floods, an annual exceedance probability cannot be estimated for these events due to paucity of flood level and discharge data in addition to constant and significant changes in catchment characteristics from ongoing urbanization and flood mitigation.

Minor flooding in the Parramatta River occurred in 2015, 2016 and March 2019, resulting in overflows over the Charles Street weir at the upstream tidal extremity of the Lower Parramatta River. These events were relatively small in magnitude and are not expected to have affected the WRRF site.

Major flooding most recently occurred in the Parramatta River in February 2020 and March 2021 when floodwaters broke the banks of the river and inundated the site of the Parramatta Powerhouse Museum site. The 2021 flood event was estimated to be a 5% AEP flood event (*Parramatta River breaks its banks, flooding Powerhouse Museum site*, https://www.smh.com.au/national/parramatta-river-breaks-its-banks-flooding-powerhouse-museum-site-20210320-p57ci5.html).

Overland flooding occurred in the vicinity of the WRRF site as recently as February 2019 as a result of intense localised storms and rainfall, with flooding of James Ruse Drive and other roads in Rosehill and Camellia.

# 3. Available information

## 3.1 Relevant flooding studies and reports

There are a number of previous flooding studies and reports that have been prepared for the Parramatta River and Duck River catchments. The following previous studies are of most relevance to this assessment.

### 3.1.1 Parramatta River Flood Study (Stantec, 2024)

City of Parramatta Council (CoP) engaged Stantec to update the flood study of the Parramatta River. Flood information in the City of Parramatta LGA has been developed through several previous flood studies undertaken at various times through the 1990's and 2000's. Due to changes in the catchment and advances in modelling software and techniques, Council decided to undertake an updated Parramatta River Flood Study to assist in floodplain management, structural works, planning, development control and emergency management in the Parramatta LGA.

The primary objective of the Flood Study is to model the flood behaviour in the Study Area under existing conditions and address possible future variations due to climate change. The development of a detailed flood model will help guide future development in the catchment. The Flood Study will also provide the preparatory groundwork required to undertake a Floodplain Risk Management Study and a Floodplain Risk Management Plan with particular emphasis to implement potential flood mitigation solutions for the Westmead Biomedical Precinct and the Parramatta CBD and other areas within the flood study area.

The flood study involved the development of seven separate TUFLOW hydraulic models covering the main watercourses, tributaries and overland flow areas in Parramatta LGA. The Mainstream model, which includes Parramatta River and Toongabbie Creek, is most relevant to this current study. Model terrain was based on LiDAR dated 2013 and watercourse bathymetric survey, with a model grid of 2 m interval. The Mainstream model extends from downstream of McCoy Park detention basin on Toongabbie Creek in Seven Hills down to John Whitton Bridge (Ryde Bridge), between Putney and Rhodes on the Parramatta River.

A single XP-RAFTS hydrologic model was developed firstly by combining existing hydrologic models into one large model representing the entire Parramatta River catchment and updating the model to reflect present day catchment conditions. The hydrology model was then calibrated and validated to historic flood events that occurred in April 1988, April 2015, and June 2016. The 1% AEP flood flows were also reconciled to match the flood frequency analysis at Marsden Street weir river gauge by factoring up the design rainfall depth to fit the FFA 1% AEP flow. Once calibrated, the hydrology model was used to produce flow hydrographs for design flood events which were used as inputs for the hydraulic model.

The calibrated and validated hydraulic models were used to simulate a range of design flood events (1% FFA-reconciled event, 2%, 5%, 10% and 20% Annual Exceedance Probability (AEP) events) and the Probable Maximum Flood (PMF) along the Parramatta River/Toongabbie Creek main channel and the tributaries and overland flow areas within the Study Area. The design events were based on ARR 2019 (Version 4.1) design rainfall, temporal patterns and hydrologic guidelines, noting that only one selected temporal pattern was provided for each storm event.

Climate change assessment was undertaken based on the interim climate change rainfall growth factors in ARR 2019 (Version 4.1) and sea level rise, for the years 2050, 2090 and 2150 for RCP 4.5 and 8.5 climate change scenarios.

Outputs from the flood modelling were analysed to prepare mapping of flood depths/levels, flood hazard, hydraulic categories (floodway, flood fringe, flood storage) and flood risk precincts. Emergency response categorisation and flood planning constraints categorisation mapping was also prepared for key flood risk locations, including Camellia north of Grand Avenue (excludes the WRRF site) and Parramatta CBD.

The Mainstream TUFLOW flood model and XP-RAFTS hydrologic model were provided by CoP for this study.

### 3.1.2 Hydrologic Model Conversion for Parramatta River Catchment (WMAwater, 2019)

CoP engaged WMAwater to convert the previously established XP-RAFTS model of the Parramatta River catchment to WBNM hydrologic model platform. The existing XP-RAFTS hydrologic model (over 1600 nodes) is a highly complex model with limited documentation available of the development of the model. Reasons for the conversion included requiring a special software license to open and run such a large model, difficulties in setting up the model for new storm event configurations, and the now-discontinued technical support and maintenance of the XP-RAFTS software by the product vendor.

The WBNM model simplified the sub-catchment layout (reduced to about 1200 model nodes) and included calibration of the model.

The XP-RAFTS model outputs are still utilised in CoP's flood study TUFLOW model, although the WBNM model outputs could be utilised for future updates of the flood study.

The converted WBNM Parramatta River catchment hydrologic model was provided by CoP for this study. The use of this model for assessing long duration PMF events was discussed with DCCEEW and DPHI.

### 3.1.3 Camellia-Rosehill Rezoning flooding assessments

Precinct planning is currently ongoing, led by DPHI. This includes flooding assessments of proposed future redevelopment of the Camellia-Rosehill Precinct, with coordination undertaken with various future land holders in the Precinct (including Sydney Water) to consider the future land uses and landforms in the precinct planning flood assessment and their potential effects on flood behaviour. Both this GPOP WCM flooding study and the DPHI studies are using the CoP TUFLOW model of the Parramatta River as a common basis for assessment.

### 3.1.4 Clyde Stabling and Maintenance Facility – Flooding and Hydrology Report (GLC, 2023)

This report was prepared by SMEC-GHD Design Joint Venture on behalf of Gamuda Laing O'Rourke Consortium (GLC) for Sydney Metro for the Clyde Stabling and Maintenance Facility (MSF) as part of the Sydney Metro West project detailed design. This report covers the Stage 3 submission of flooding and hydrology undertaken for the Clyde MSF.

The TUFLOW model and associated inputs for events and durations assessed in the report were provided by Sydney Water for use on this current project. The model was based on the previous Reference Design flood modelling, developed independently from the CoP flood modelling. The Clyde MSF TUFLOW model is based on 2019 LiDAR with a 2 m model grid, with ARR 1987 hydrology and design rainfall. Inflow hydrographs were generated in an XP-RAFTS model for catchment inflows and a DRAINS model for MSF stormwater flows.

Key flood-related design elements of the Clyde Stabling and Maintenance Facility include:

- MSF filled platform on the site of the former Parramatta Speedway site, located on the confluence of Duck River and Duck Creek and to the east of James Ruse Drive. Required design flood protection level above PMF in year 2100, based on ARR 2019 (Version 4.1).
- Water conveyance structures – large bridge structures for transverse crossing of Duck Creek and A'Becketts Creek under the MSF filled platform.
- Offline flood detention basin on northern side to Duck Creek to offset loss of floodplain storage due to MSF filling.
- A flood relief culvert under rail line entrance to MSF, connecting to detention basin.

- Clyde dive structure - Metro rail dive from the MSF to the main line tunnel. Required design flood protection level for dive threshold above PMF in year 2100, based on ARR 2019 (Version 4.1).
- Rosehill services facility - Including a tunnel shaft over the main line tunnel on the northern bank of Duck Creek. Required design flood protection level above PMF in year 2100, based on ARR 2019 (Version 4.1).

Design flood events assessed included the 50%, 20%, 10%, 5%, 2%, 1%, 0.5%, 0.2%, 0.1% and 0.05% AEP events and PMF event. The Duck River PMF and Parramatta River PMF events were simulated separately. Flood impacts due to the project were estimated at around 0.1 – 0.2 m in the Duck River PMF in various locations. There were typically reductions in flood levels in other flood events.

The Stage 4/Issued-For-Construction phase design report and updated TUFLOW model were not available for this current study at the time of writing this report. The MSF layout within the TUFLOW model extent is shown on Figure 3-1. The locations and layout of major hydraulic structures are indicated on Figure 3-2.


**Figure 3-1. Metro West Clyde Maintenance and Stabling Facility layout, main line and TUFLOW model extent.**

Source: Figure 2 in GLC (2023)


**Figure 3-2. Metro West Clyde Maintenance and Stabling Facility major hydraulic structures**

Source: Figure 3 in GLC (2023)

### 3.1.5 Lower Parramatta River Floodplain Risk Management Study and Plan (SKM, 2005)

This study defined flooding behaviour using a 1D MIKE11 hydraulic model of the Parramatta River and main tributaries, with the flood modelling mapping and outputs used to define design flood levels and behaviour, flood risk precincts and identify flooding risk in the study area. A range of works-based flood mitigation options were tested in the flood model and objectively evaluated to formulate a prioritised list of recommended works. Planning and property modification measures were assessed and recommended to achieve improvements to flood planning and development controls for the Parramatta local government area.

The FRMP included a number of provisions and recommendations relating to flood modification measures, including construction of a detention basing at Ollie Webb Reserve on Clay Cliff Creek, and a range of property modification measures such as review of land use zonings and development controls which are implemented through the LEP and DCP.

The flood modelling and mapping in the 2005 FRMSP has largely been superseded by the recent flood assessments undertaken by CoP in the Parramatta River Flood Study (Stantec, 2024). The FRMSP is also expected to be updated in the near future following on from the 2024 flood study, although the provisions forthcoming from the 2005 FRMSP are still relevant to flood planning and development in the study area.

### 3.1.6 City of Ryde Flood Harmonisation Study – Flood Study Update (WMAwater, 2023)

City of Ryde (CoR) undertook a flood harmonisation study across all 14 catchments within the Ryde Local Government Area (LGA). The study includes a comprehensive update to the four Flood Studies (FS) and Floodplain Risk Management Study and Plans (FRMS&P) for each catchment across the LGA, which were

completed over the course of over 10 years up to 2015. Recent and ongoing urban development within the LGA and changes to hydrologic and engineering guidance necessitated the update to the flood studies for consistency with latest engineering practice.

Catchments of relevance to the GPOP Project are the Parramatta River sub-catchments, including Archer Creek, Smalls Creek and Charity Creek. The study included updating the DRAINS hydrologic models and TUFLOW hydraulic models for these sub-catchments with ARR 2019 (Version 4.1) design rainfall and losses, updates to model topography to 2019 ground LiDAR survey and urban development conditions, and calibration to historic flood events. Flood depth and extent mapping was published for the 1% AEP event and PMF event for the entire study area.

The flood models from the CoR study were not available for this assessment.

### 3.1.7 Parramatta River – Ryde Sub-catchments Floodplain Risk Management Study and Plan (SKM, 2015)

Ryde LGA encompasses an area of 40.7km$^2$ in northern Sydney covering a number of catchments draining to the Parramatta River and the Lane Cove River. The area of focus for this study includes five catchments in the southern part of the LGA, draining to the Parramatta River. Patterns of urbanisation and associated construction of drainage infrastructure dating back to as early as the 1930's, have resulted in a number of watercourses being piped and development occurring in sometimes unsuitable locations, putting this development at risk of flooding during heavy rainfall events. Such flooding occurred in 1984, 1986, 1988 (twice), 1989 (twice) and 1990, leading to widespread flooding and damage to properties.

A number of major drainage improvement projects have been completed in the study area prior to the study to alleviate the flooding problems. The storm events in May 1998 and April 2003 caused significant problems but not to the extent as those in the late 1980's due to the drainage upgrades. However, there were numerous locations where existing development may be at risk from flooding.

The CoR commissioned SKM to undertake a Floodplain Risk Management Study and Plan (FRMSP) for five catchments with a total area of 12.7km$^2$. The FRMSP can be used by CoR and other stakeholders to reduce the impact of flooding on the community and assist in managing future development of the area. The main purpose of the FRMSP is to identify and compare various floodplain risk management options, in addition to identifying appropriate non-structural management measures such as those related to flood planning, development controls and emergency management.

A total of seven mitigation works options and one for property flood-proofing were recommended for implementation in the FRMSP, none of which are located in the vicinity of the GPOP WCM project, located primarily within Meadowbank Park and surrounds.

### 3.1.8 Sydney Olympic Park Master Plan 2050 - Flooding Assessment Report (Mott MacDonald, 2024)

A flood risk and impact assessment was prepared to support the Sydney Olympic Park Master Plan 2050 (Master Plan 2050). This report summarises the existing conditions and future development conditions based on the development of detailed hydraulic modelling, with a focus on overland flow and management of stormwater and flood risk generally. The study utilised a hydraulic model (TUFLOW) and hydrologic model (DRAINS) pair to perform flooding assessment of the precinct covering the urbanised areas and along the watercourses and naturalised pond systems on approach to Parramatta River.

The 5%, 1%, 1% AEP with climate change and PMF events were assessed for the existing and Masterplan 2050 conditions. Limited flood mapping is publicly available. The available mapping was used in this study to inform the construction (refer Section 8.2) and operation phase flood assessments (refer Section 7.4) for the river release pipeline.

## 3.2 Flooding studies currently in progress

There are a number of studies currently in progress in the study area. As such, flood mapping and other information is not yet available at the time of writing:

- Draft Haslams Creek Flood Study. Currently at Stage 1 Data Collection phase, being undertaken by CoP.
- A'Becketts Creek Flood Study. Currently in progress, being undertaken by CoP.
- Duck River, Duck Creek and A'Becketts Creek Catchment Areas Overland Flood Study. Current study phase is post-community consultation of the Draft Study which is being undertaken by Cumberland City Council. Appears to cover overland flow areas which are not directly affected by the GPOP WCM Project.
- Parramatta River Floodplain Risk Management Study and Plan. This is a future study following the completion of the Parramatta River Flood Study (Stantec, 2024) and will investigate and identify appropriate flood mitigation actions that can be delivered to reduce or resolve flooding in areas with a high flood risk. Existing planning and development controls related to flooding may be updated as a part of this study.

## 3.3 Local flood plans

The Parramatta LGA Flood Emergency Sub-Plan (SES, 2021) is a sub-plan of the NSW State Flood Plan (SES, 2018a) and the Parramatta Local Emergency Management Plan (EMPLAN), is authorised under the State Emergency and Rescue Management Act 1989 (NSW) and the State Emergency Service Act 1989 (NSW). It covers all aspects of flood emergency management including prevention, preparation, response, and recovery, with a primary focus on protecting and preserving life, including the establishment of flood warning systems, issuing community warnings, and coordinating evacuations.

The purpose of the Sub-Plan is to set out the multi-agency arrangements for the emergency management of flooding in the Parramatta LGA. Roles and responsibilities for agencies including regional and local SES, Police, Council, Fire and Rescue NSW, BOM, Transport for NSW, WaterNSW, DPHI etc. and operators of facilities (schools, pre-schools, caravan parks) community groups and community members, among others, and pre-, during and post-flood procedures are defined.

# 4. Flood related requirements

## 4.1 Relevant legislation

### 4.1.1 State legislation

#### 4.1.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act and the Environmental Planning and Assessment Regulation 2021 (the Regulation) provide the framework for development assessment in NSW. The EP&A Act and the Regulation include provisions to ensure that the potential environmental impacts of a development are considered in the decision-making process before proceeding to construction.

#### 4.1.1.2 Local Planning Directions

Local planning directions are enabled via section 9.1(2) of the EP&A Act. Local planning direction 4.1 aims to ensure that development on flood-prone land aligns with the relevant policies and guidelines, including:

- The NSW Government's Flood Prone Land Policy;
- The principles of the NSW Flood Risk Management Manual (2023b);
- Considering flooding in land use planning guideline 2021; and
- Any adopted flood study prepared in accordance with the aforementioned Flood Risk Management Manual.

Local planning direction 4.1 outlines requirements for a planning proposal which should incorporate provisions consistent with the NSW Flood Prone Land Policy, the Floodplain Risk Management Manual (2023b) principles, the Considering flooding in land use planning guideline (2021), and any adopted flood study or floodplain risk management plan.

Inconsistency with this direction may be acceptable if supported by a floodplain risk management study/plan, a council-adopted flood study, an accepted flood and risk impact assessment, or if the inconsistent provisions are of minor significance as determined by the planning authority.

## 4.2 Relevant policies and guidelines

### 4.2.1 NSW Flood Risk Management Manual (DPE, 2023b) and Flood Prone Land Policy

The NSW Flood Risk Management Manual (the "Manual") guides local government and industry in managing flood risks effectively. It focuses on developing and implementing sustainable strategies for human activities on floodplains, considering social, economic, ecological, and cultural factors along with community aspirations.

The NSW Flood Prone Land Policy is produced in the opening sections of the Manual. Its purpose is to reduce the impact of flooding on individual owners and occupiers of flood-prone property and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible. In doing so, community resilience to flooding is improved. Achieving this involves:

- using a merit-based approach in preparing and implementing flood risk management (FRM) plans to address riverine and local overland flooding

- reducing the impact of flooding and flood liability on existing developed areas identified in FRM plans through flood mitigation works and measures including ongoing emergency management (EM) measures, the raising of houses where appropriate and by development controls
- adopting a merit-based approach for all development decisions in the floodplain, taking into account social, economic and ecological factors, as well as flooding considerations
- limiting the potential for flood losses in all areas proposed for development or redevelopment by the application of ecologically sensitive planning and development controls.

The policy recognises that flood prone land is a valuable resource and that development applications and proposals for rezoning of flood prone land should be the subject of careful assessment which incorporates consideration of local circumstances.

The project recognises existing users of the floodplain and the existing flooding risks that apply to these users. Consideration has been made in the design development of the project to minimise impacts as a result of the project and hence minimising increases in private and public losses resulting from floods. In doing so, the project is being carried out in compliance with the provisions in the Manual and the NSW Flood Prone Land Policy.

### 4.2.2 Australian Rainfall and Runoff: A Guide to Flood Estimation

Australian Rainfall and Runoff (ARR) is a national guideline document, data and software suite that is the primary guideline used for the estimation of design flood characteristics in Australia. ARR 2019 is the 4th edition (Version 4.1) of ARR, after the 1st edition was released by Engineers Australia in 1958. This edition is published and supported by the Commonwealth of Australia and is an update to the ARR 2016. Geoscience Australia supports ARR as part of its role to provide authoritative, independent information and advice to the Australian Government and other stakeholders to support risk mitigation and community resilience.

ARR is pivotal to the safety and sustainability of Australian infrastructure, communities and the environment. It is an important component in the provision of reliable and robust estimates of flood risk. Consistent use of ARR ensures that development does not occur in high-risk areas and that infrastructure is appropriately designed.

Key aspects of hydrology and flood estimation covered in ARR include:

- Book 1 - Scope and Philosophy
- Book 2 - Rainfall Estimation
- Book 3 - Peak Flow Estimation
- Book 4 - Catchment Simulation for Design Flood Estimation
- Book 5 - Flood Hydrograph Estimation
- Book 6 - Flood Hydraulics
- Book 7 - Application of Catchment Modelling Systems
- Book 8 - Estimation of Very Rare to Extreme Floods
- Book 9 - Runoff in Urban Areas.

The initial release of ARR 2019 (Version 4.1) included updates to design rainfall and hydrologic guidelines developed from renewed analysis of rainfall and streamflow data across Australia for estimation of design flooding. additionally, guidance on climate change factors and PMF considerations were updated from previous versions to reflect contemporary practice and differences required for use in dam studies and floodplain management. Of relevance, the interim climate change factors were prescribed at the time of publishing to be applicable up to and including the 1% AEP flood event for flood impact assessment studies, subject to further research findings into the climate change effects on extreme floods.

An update of the guideline was published as ARR 2019 (Version 4.2) in August 2024, with the key update being to climate change guidance to reflect best practice and most recent knowledge as of 2024 as per the Intergovernmental Panel on Climate Change (IPCC) 6. This included revised climate change factors for Australia which are markedly greater in increment compared to those in ARR 2019 Version 4.1, and with their application to be made in all events up to and including the PMF.

### 4.2.3 Planning Circular PS 24-001

Planning circular PS 24-001 "Update on addressing flood risk in planning decisions" outlines existing flood-related planning policies and provides further information and advice on their application in planning. The circular also provides updates on flood-related policy initiatives underway, including action taken in response to the 2022 NSW Flood Inquiry. It supplements Planning Circular PS 21-006 "Considering flooding in land use planning: guidance and statutory requirements".

Through the circular, DPHI recommends that planning authorities apply a risk-based approach to the assessment of flood-affected proposals, including planning proposals, local and regional development applications, State significant development applications and State significant infrastructure applications. This risk-based approach should take into account the flood risk profile of each proposal which considers the flood characteristics for the location, the nature and type of development and any impacts on the existing community and surrounding properties. Matters to consider when determining the flood risk profile should include:

- whether the proposal is in a high-risk catchment
- the location of the proposal in relation to flood behaviour and constraints including:
  - floodway, flood storage area or flood fringe area
  - the hazard vulnerability classification of the land
  - frequency of inundation
- whether the proposal provides for safe occupation and efficient and effective evacuation in flood events and how it is to be achieved
- in high-risk catchments, whether the proposal is likely to result in a significant increase to the risk to life in other parts of the catchment in a PMF event
- any known evacuation constraints such as the flood emergency response classification for the area and available warning times (including rate of rise and when the evacuation route is cut off by floodwater)
- whether the proposal is for a sensitive or hazardous land use, or other higher risk uses and what mitigation strategies (if any) are proposed to reduce any identified risks
- whether there may be adverse flooding impacts on surrounding properties
- potential impacts of cut and fill and other building works on flood behaviour
- ability of proposed development to withstand flood impacts.

The above matters should be considered across a range of flood scenarios for high-risk proposals. The typical events examined may include the 10% AEP, 5% AEP, 1% AEP, 0.5% or 0.2% AEP, the PMF event, and in relation to the flood planning level (if available).

Consistent with the NSW Flood Inquiry, extreme flood events such as the 0.05% or 0.02% AEP should also be considered, particularly for higher risk proposals and when setting flood planning levels to support land use planning. The impacts of climate change on future flood frequency and levels should also be considered.

The preparation of this Flooding Assessment Report is consistent with the above relevant requirements outlined in PS 24-001.

### 4.2.4 Practical Consideration of Climate Change

Practical Consideration of Climate Change (DECC, 2007) is a floodplain risk management guideline that aims to assist in floodplain risk management. It describes the impacts of climate change and the associated ramifications upon the vulnerability of floodplain risk management and mitigation options. This guideline was considered in the modelling of climate change flooding scenarios.

### 4.2.5 Floodplain Risk Management Guideline: Incorporating sea level rise benchmarks in flood risk assessments

The Floodplain Risk Management Guide: Incorporating sea level rise benchmarks in flood risk assessments (DECCW, 2010) provides advice on approaches that can be used to incorporate sea level rise benchmarks into flood risk assessments for waterways in NSW. This guideline was considered in the modelling of climate change flooding scenarios.

### 4.2.6 Shelter in place guideline for flash flooding

This guideline, prepared by DPHI (2024), aims to assist consent authorities to undertake site specific, risk-based assessment to assess if shelter in place is a suitable emergency management strategy for development proposed in flash flood environments. This is achieved by balancing the merits, risks, and impacts of a proposal. The guideline also aims to inform considerations about whether appropriate measures are in place to limit potential flash flood related impacts on affected proposals and public safety.

Shelter in place is the internal movement of a building's occupants to an area within the building above the probable maximum flood (PMF) level before their property becomes inundated by flood waters. Shelter in place is not a design or safety solution free from risk. When considering shelter in place, secondary risks such as the impact of a flood on people's access to water and electricity, the availability of food, management of medical emergencies, building fire and their health and well-being should also be addressed.

Flash flooding is "flooding that occurs within 6 hours of the precipitating weather event, and often involves rapid water level changes and flood water velocity". This includes overland, creek and riverine flooding sources. Flash flooding can be more dangerous than long duration flooding. This is largely due to the rapid changes in velocities and depths of water, and very short or minimal warning time providing limited opportunity for communities to respond to a flood threat in an appropriate and timely manner.

The guideline describes evacuation off-site as the primary emergency management strategy for flooding in NSW. Generally, the most appropriate primary emergency management strategy is self-evacuation of people off-site to an area not affected by flooding, as detailed in the NSW State Flood Plan and Local Flood Plans, although the guideline acknowledges that there may be limitations to evacuation off-site, including constraints on existing evacuation routes due to large population under evacuation and flood-affectation of the routes.

The guideline provides a checklist of considerations for sheltering in place. These would be considered during development of a flood management plan for staffed portions of the GPOP WCM project, although as initially recommended by the guidelines and in consultation with SES (refer Section 4.4.4), an early evacuation strategy will be prioritised. Refer to 10.4 for proposed management measures for the project.

## 4.3 Design criteria and performance outcomes

The following design criteria and performance outcomes are relevant to the GPOP WCM Project.

- Electrical assets associated with the Project would be designed to be located outside of the 1% AEP flood level.

- Parts of the WRRF site would be raised with natural material to reduce interaction with existing contamination and place critical infrastructure above the 1% AEP flood level
- Minimise increases in flood levels due to permanent infrastructure during flood events up to and including the 1% AEP event, which will consider climate change impacts. Minimise increases in flood levels due to temporary infrastructure during flood events up to and including the 5% AEP event. No specific criteria relating to flood impacts are recommended in the Flood Risk Management Manual (DPE, 2023b). Appropriate threshold levels for flooding impacts may vary depending on the catchment setting and presence and nature of existing development in the vicinity of the project site. The following flood level increase thresholds are referred to for assessment of the flood level impacts:
  - Buildings: 10 mm if flooded above floor
  - Buildings/Open space: 50 mm if buildings not flooded above floor.
- Potential flood impacts to sensitive receivers including Sydney Metro West would be considered for flood events up to and including the PMF.
- Durations of inundation not increased by more than 1 hour in up to and including the 1% AEP event
- No additional private properties would be affected by flooding up to and including the 1% AEP flood event due to permanent infrastructure
- Dedicated evacuation routes would not be adversely impacted in flood events up to and including the PMF
- Facilitate improvements to flooding in the Precinct with appropriate design provisions and proposed drainage infrastructure, where possible.
- The potential for soil erosion and scouring is reduced for events up to and including the 1% AEP event.

## 4.4 Stakeholder consultation

A range of stakeholder consultation was undertaken which formed the requirements and basis for this flood impact and risk assessment.

### 4.4.1 DCCEEW Conservation Programs, Heritage and Regulation Group

Consultation meetings were held in January and May 2025 between DCCEEW, DPHI and Sydney Water, with key outcomes and items from the meetings summarised below:

- Assessment of flooding impacts of the Camellia-Rosehill WRRF site have been conducted via a Review of Environmental Factors (REF), investigating the change in flood behaviour between pre-existing site conditions (circa July 2024) and the interim Base case (site partly raised) condition. The natural material fill is required to contain pre-existing contaminated soils.
- This EIS would assess the change to flooding behaviour and flood impacts from the interim partly raised site condition to the operational phase (Design case) of the site.
  - The EIS baseline would not include the Camellia-Rosehill rezoning and areas of infill, given there is still uncertainty remaining about the details and timing of this process.
  - It was noted that given the potential flood impacts of site raising have been assessed and determined through the REF, the flooding impacts using the site partly raised condition as the base case and implementation of the WRRF treatment works and structures in the design case is sufficient for the EIS assessment.
- The different flood models for the catchment area and their availability was considered. The final preference was that the CoP Parramatta River Flood Study TUFLOW model (Stantec, 2024) would be adopted and updated/extended using elements from the Sydney Metro Clyde MSF model (GLC, 2023)

and other data provided by DPHI from the Camellia-Rosehill rezoning flood assessments, with additional survey data.

- It was agreed that the EIS flood assessment would be undertaken based on hydrology guidance in ARR 2019 (Version 4.1).
- Some flood events hydrologic inflow data was not available within the adopted TUFLOW flood model. Hence it was agreed that the following flood events would be assessed utilising the available information:
  - 10% AEP
  - 5% AEP
  - 1% AEP (flood frequency analysis-reconciled flows)
  - 50% of PMF, as an interim flood event between the 1% AEP and PMF events. The 50% of PMF event inflow hydrographs were provided within the TUFLOW model and it is understood that these were derived by CoP by simulating 50% of the probable maximum precipitation (PMP) rainfall intensities within the XP-RAFTS hydrology model of the Parramatta River catchment.
  - PMF short duration (up to 6 hours duration) based upon the Generalised Short Duration Method (GSDM) for PMP events (BoM, 2003).
  - PMF long duration (24 hour and longer duration). To be estimated using BoM Generalised Southeast Australia Method for Probable Maximum Precipitation (BoM, 2006) and simulated in the updated WBNM hydrologic model (WMAwater, 2019). For assessment of durations of isolation of the WRRF site.
  - 1% AEP climate change events for the year 2150 for emission scenarios RCP 4.5. RCP 8.5 has also been provided for completeness.

### 4.4.2 City of Parramatta Council

Consultation with CoP Council in February 2025 included discussion of proposed use of previously available flood models, and extension of the Parramatta River model upstream on Duck River and Duck Creek based on the Sydney Metro model. Modelling of the Camellia Rosehill rezoning was also discussed, with the rezoning to be excluded from the Base case and Design case modelling, and to be assessed only as a sensitivity scenario of future development.

### 4.4.3 Sydney Metro

Sydney Metro have been consulted throughout the GPOP WCM project on flood related matters, including on the site raising REF, their hydrologic assessment basis for flood protection and design, and predicted flooding impacts at the Clyde MSF site resulting from the GPOP WCM project.

### 4.4.4 SES

A meeting was held with SES, DCCEEW and DPHI in September 2025 which included discussion of the nature of the GPOP project and the operations on the WRRF site. Existing flood behaviour on and around the WRRF was described in addition to the development of the site including flood immunity of the facilities. Feedback was provided confirming that the flood model results (as presented in this report) were in accordance with the agencies' expectations of how the surrounding road network would function during the storm events.

Key advice and recommendations from SES included:

- SES do not support strategies that require driving or walking through floodwaters, and preferred general policy is early evacuation over sheltering in place.
- The regional flood behaviour affecting Camellia-Rosehill peninsula is characterised by flash flooding that responds quickly to rainfall events, and there is no forewarning of the magnitude of flood event prior to

or during the rainfall event. This requires the emergency response plan to consider the full range of flood event magnitudes.

- Warning alert systems are limited for the peninsula:
  - There are no Bureau of Meteorology (BOM) flood warning gauges for Parramatta River or Duck River in these locations.
  - The Council Parramatta Flood Smart Warning System does not currently cover the Camellia-Rosehill peninsula.
  - BOM Flood Watch, Severe Weather Warning and Severe Thunderstorm Warning products are available (text, email or phone warnings are issued)
- There are existing road access constraints during flood events which would hinder evacuation once flooding has commenced.

Based on the above, SES recommend operational process includes staff remaining weather aware, and evacuating early - prior to the start of flooding, so that staff are not on site for high risk days/times. These issues are to be considered in the flood management measures identified in the EIS.

# 5. Base case modelling and analysis – Camellia-Rosehill WRRF

## 5.1 Existing flood modelling

### 5.1.1 Hydraulic model setup

For this flood impact and risk assessment the CoP Parramatta River Flood Study TUFLOW model (Stantec, 2024) was adopted as the basis for the flood modelling. In summary, key updates to the model included:

- Extension of the model up Duck River, Duck Creek and A'Beckett's Creek with channel, bridge/culvert and materials layer geometry elements extracted from the Sydney Metro TUFLOW model (GLC, 2023). The CoP model extended only to around the M4 Motorway on Duck River and Duck Creek and to James Ruse Drive on A'Becketts Creek, which was not expected to be sufficiently extensive in area for this assessment.
- Building footprints in the extended model domain were represented as inactive model cell areas using spatial layers from Sydney Water.
- Bathymetry in the Parramatta River and Duck River was retained from the CoP model. Channel modifications on Duck Creek and A'Becketts Creek were represented based on the Sydney Metro model.
- Inflow boundaries in the extended model area were defined as total and local inflow locations based on XP-RAFTS hydrologic model sub-catchment area mapping in Stantec (2024).
- Updated terrain data with 2019 LiDAR of the Sydney Region. The CoP model is based on 2013 LiDAR.
- Representation of Sydney Metro Clyde MSF and Rosehill Services Facility based on details in the Sydney Metro TUFLOW model for Stage 3 detailed design (GLC, 2023). Key elements include the MSF filled embankment and rail embankment, tunnel dive area, finished ground surface to the north of Duck Creek, major transverse drainage structures on Duck Creek, A'Becketts Creek and floodplain crossing under James Ruse Drive and flood detention basin on northern side of Duck Creek. Various road overbridges in the Clyde site were also represented. Refer to Section 3.1.4 for further description.
- Representation of Parramatta Light Rail Stage 2 based on Camellia-Rosehill flood assessment modelling provided by DPHI, including new bridge crossing of Parramatta River near the eastern end of Grand Avenue, Camellia.
- Inclusion of project drone LiDAR survey captured in May 2025 for the WRRF site and surrounds in Camellia and Rosehill. This includes current day ground surface on the Downer Rosehill Sustainable Road Resource Centre to the east and Property 1 to the south of the WRRF, which have undergone landform change since the 2019 LiDAR data capture.

The updated TUFLOW model extent and inflow boundary locations are shown on Figure 5-1. The CoP TUFLOW extent is also shown for comparison. The CoP model geographic projection of GDA 1994 MGA Zone 56 was retained and relevant files from other source models were reprojected as required. The model was run in TUFLOW 2020-10-AA-iSP-w64 in Highly Parallelise Compute (HPC) scheme.

### 5.1.2 Topography

The model topography in the WRRF site and surrounds for the Base case is shown on Figure 5-2 comprising:

- Base terrain consisting of 2019 Sydney LiDAR and 2025 project drone survey of Camellia – Rosehill. Ground levels along bank of existing stormwater channel and western boundary are based on this data. Flow path preserving pre-raising ground surface levels retained along western boundary of site for overflows from Unwin Street in flood events including 1% AEP event.
- Site subgrade across entire site, surface elevations vary 4.8 – 5.1 m AHD approx.
- Site management filling layer 1.7m height, surface elevations vary 6.6 – 6.8 m AHD approx.
- Floodway area reserved in the western portion of the site for conveyance of flood flows in up to the PMF event. Initial filling on subgrade through floodway area in west of site approx. 0.1 m height.

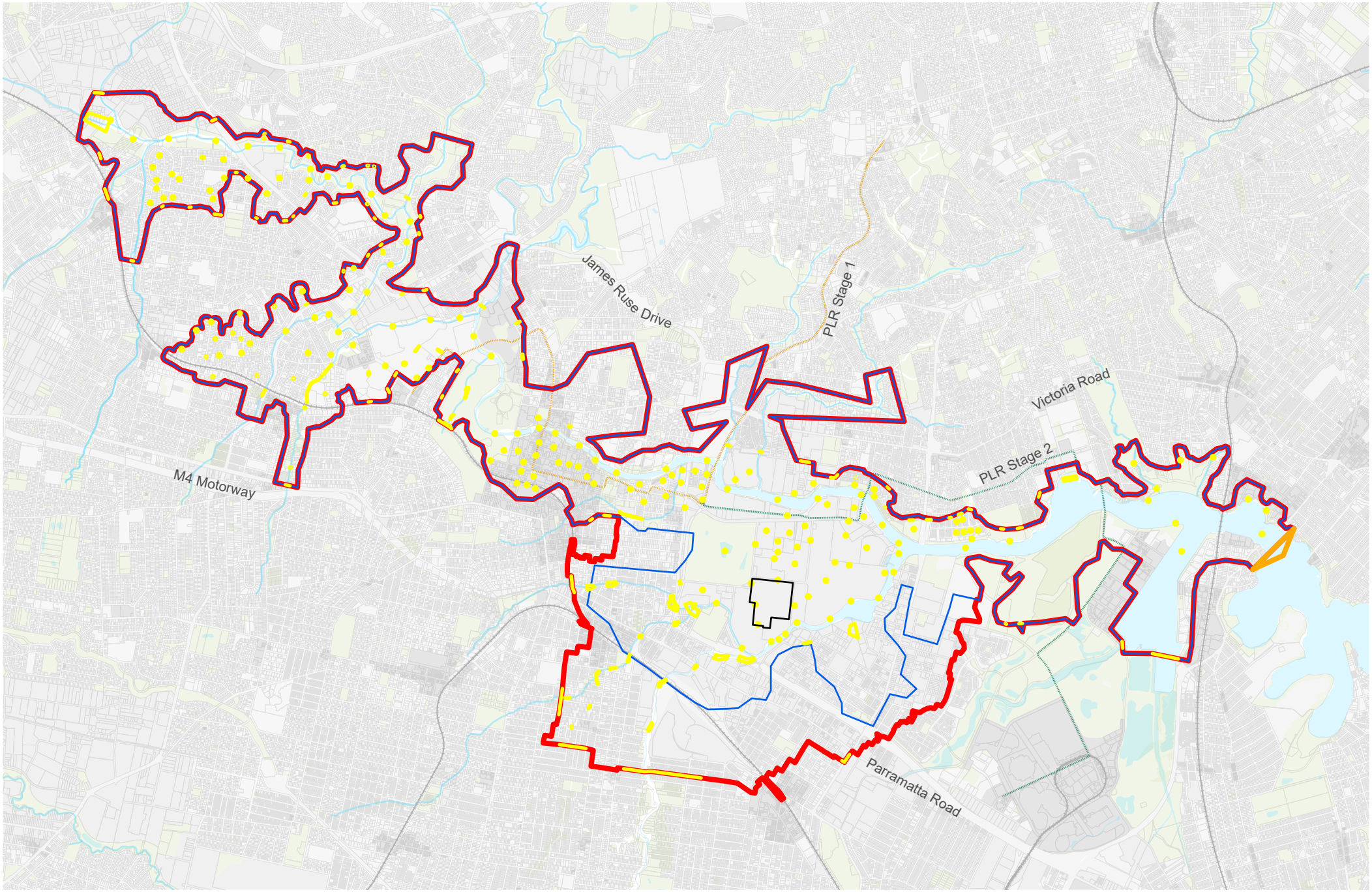



**Figure 5-1** TUFLOW Model Extent and Boundary

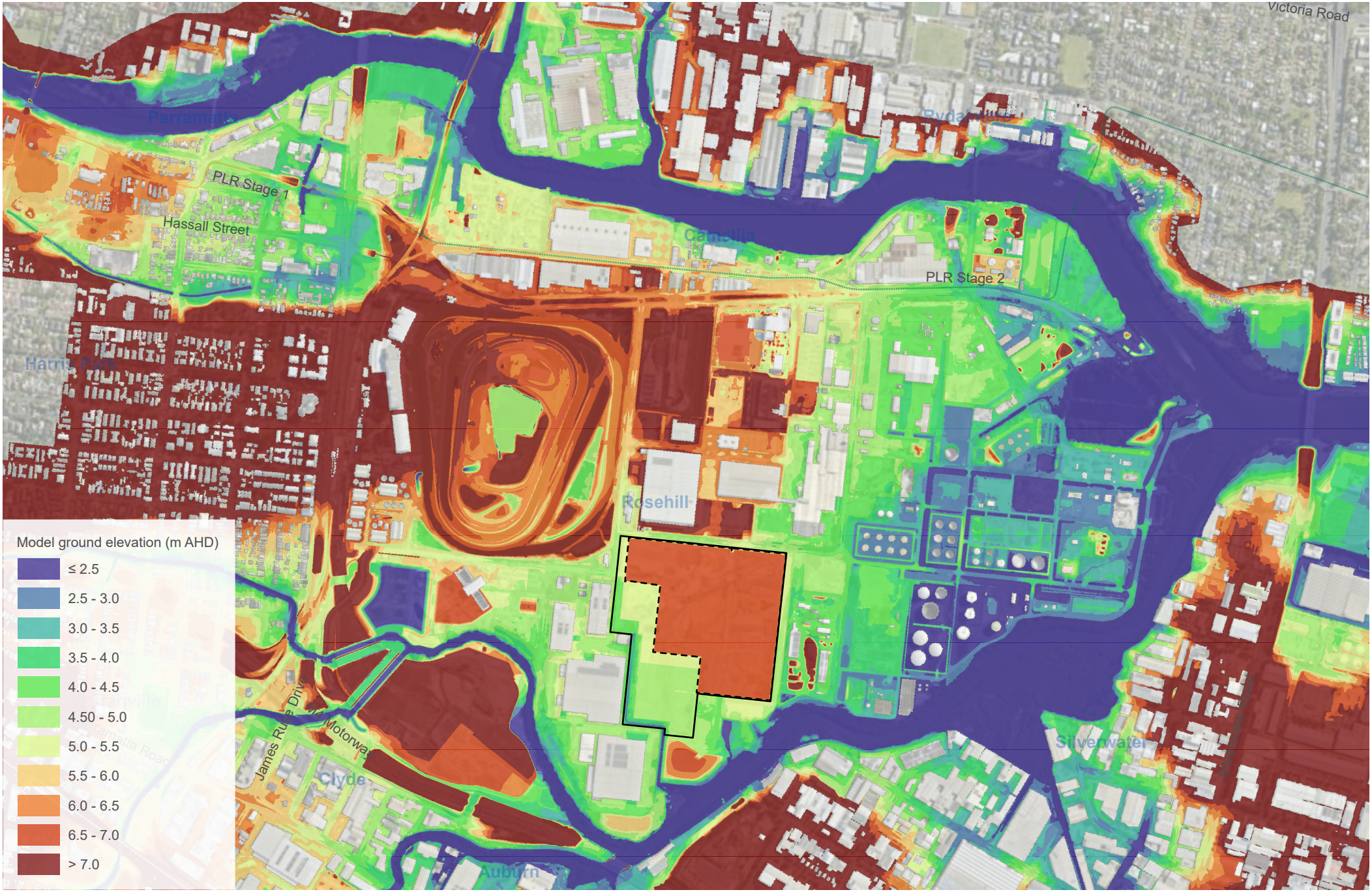



**Figure 5-2** TUFLOW Model Topography around WRRF Site - Base case

### 5.1.3 Land use materials

The TUFLOW land use materials and Manning's n hydraulic roughness was generally retained from the CoP model, with areas in the extended model domain in this study represented based on the materials layer from the Sydney Metro model, with some adaptation to obtain consistency across the model.

The adopted materials Manning's n values are tabulated on Table 5-1. The materials in the vicinity of the WRRF site are mapped on Figure 5-3.

**Table 5-1. TUFLOW materials Manning's n values**

| ID | Manning's n | Description |
|---|---|---|
| 1 | 0.02 | Watercourse – Parramatta River, Duck River, Duck Creek |
| 2 | 0.08 | Low Density Industrial -corresponding Council LEP Zone: General Industrial IN1 |
| 3 | 0.1 | Moderate Industrial, substantial building with little permeability - corresponding Council LEP Zone: Light Industrial IN2 |
| 4 | 0.2 | High Industrial substantial building with almost no permeability -corresponding Council LEP Zone: Heavy Industrial IN3 |
| 5 | 0.06 | Channel banks, moderate vegetation, WRRF riverbed armouring |
| 6 | 0.08 | Channel banks, dense vegetation |
| 7 | 0.04 | Low Density Residential (excluding building polygons) - corresponding Council LEP Zone: Low Density Residential R2, or Industrial areas with some trees and green space excluding building polygons |
| 8 | 0.04 | Medium Density Residential (excluding building polygons) - corresponding Council LEP Zone: Medium Density Residential R3, or Industrial areas with some trees and green space excluding building polygons |
| 9 | 0.04 | High Density Residential (excluding building polygons) - corresponding Council LEP Zone: High Density Residential R4, or Industrial areas with some trees and green space excluding building polygons |
| 10 | 0.1 | High Density Development - corresponding Council LEP Zone: Neighbourhood Centre B1 |
| 11 | 0.1 | High Density Development - corresponding Council LEP Zone: Local Centre B2 |
| 12 | 0.1 | High Density Development - corresponding Council LEP Zone: No Description B3 |
| 13 | 0.1 | High Density Development - corresponding Council LEP Zone: Mixed Use B4 |
| 14 | 0.1 | High Density Development - corresponding Council LEP Zone: Business Development B5 |
| 15 | 0.1 | High Density Development - corresponding Council LEP Zone: Enterprise Corridor B6 |
| 16 | 0.04 | Parks, grass and some trees - corresponding Council LEP Zone: Public Recreation RE1 & RE2 |
| 17 | 0.015 | Concrete channel |
| 18 | 0.1 | High Density Development - corresponding Council LEP Zone: Special Activities SP1 |
| 19 | 0.1 | High Density Development - corresponding Council LEP Zone: Infrastructure SP2 |
| 20 | 0.035 | Maintained grass channel - corresponding Council LEP Zone: Natural Waterways W1 |
| 21 | 0.04 | Vegetated Creek, Channel or waterway (some light vegetation) - corresponding Council LEP Zone: Recreational Waterways W2 |
| 22 | 0.02 | Roads |
| 23 | 0.03 | Smooth paved ground, carparks |
| 24 | 0.1 | Industrial site - paved ground with low density structures |
| 25 | 0.045 | Grass with medium density trees |

| ID | Manning's n | Description |
|---|---|---|
| 26 | 0.035 | Grass only; main culvert |
| 27 | 0.07 | Dense Trees with under brushes |
| 28 | 0.05 | WRRF roughness for man-made creeks |
| 30 | 0.1 | Building footprints with depth-varying roughness. Manning's 'n' of 0.015 applied to depths less than 50 mm and Manning's 'n' of 0.1 applied to depths greater than 50 mm. |
| 32 | 0.04 | Rail |
| 33 | 0.035 | GPOP dirt surface - existing |
| 34 | 0.02 | GPOP concrete surface - design |
| 35 | 0.045 | GPOP floodway design case - native grasses |
| 36 | 0.05 | GPOP solar array over native grass. Solar panel posts 200mm diameter, 9m spacing panels above flood level |
| 77 | 0.07 | Sydney Metro model: Low Density Residential - corresponding Council LEP Zone: Low Density Residential R2 |
| 88 | 0.09 | Sydney Metro model: Medium Density Residential - corresponding Council LEP Zone: Medium Density Residential R3; WRRF heavy density vegetation |
| 99 | 0.1 | Sydney Metro model: High Density Residential - corresponding Council LEP Zone: High Density Residential R4 |
| 100 | 0.04 | Default Material (sets the material to Parks) |

* Materials types and manning's n values retained from Parramatta River Flood Study (Stantec, 2024) and Sydney Metro Clyde Stabling and Maintenance Facility hydrology study (GLC, 2023) TUFLOW models.

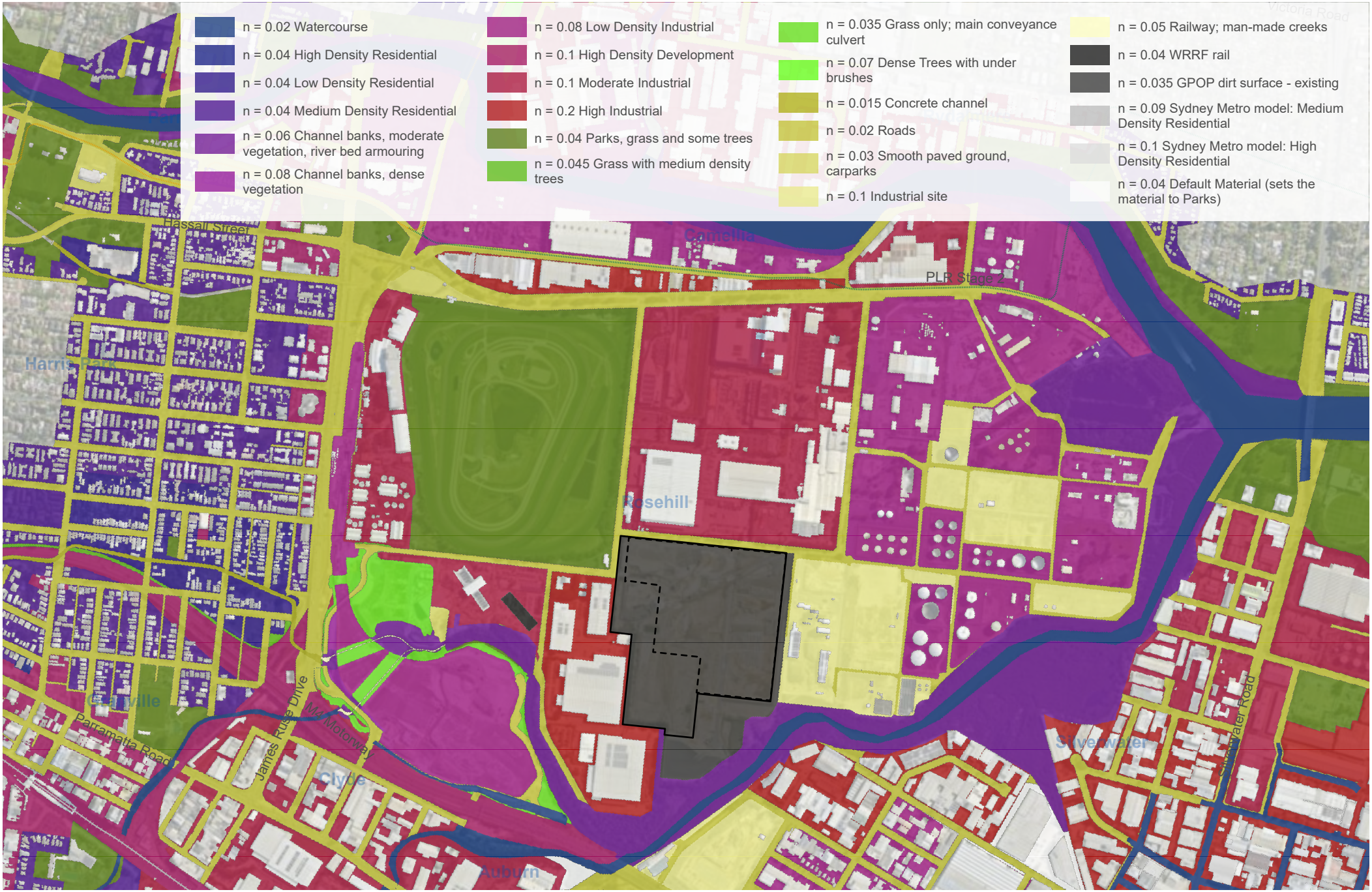



**Figure 5-3** TUFLOW Material Roughness - Base case

### 5.1.4 Stormwater drainage

Stormwater drainage networks represented in the CoP TUFLOW model were retained in the GPOP TUFLOW model. In the vicinity of the Camellia-Rosehill WRRF, it was observed that a number of existing drainage network lines in Devon Street, Colquhoun Street and Unwin Street were not represented in the CoP model and hence were supplemented with drainage network elements from the Sydney Metro model. These additional stormwater features are based on surveyed and non-surveyed information (GLC, 2023) and have been confirmed on aerial imagery. The modelled stormwater drainage around the WRRF site is shown on Figure 5-4.

Site drainage within the Sydney Metro sites were not represented as the assessment focus is primarily on mainstream flooding in Duck Creek and A'Becketts Creek, since the WRRF site is not affected by local stormwater flows within the Sydney Metro sites. Similarly, the local stormwater networks in the extended model areas in Duck River, Duck Creek and A'Becketts Creek catchment areas were typically not represented due to focus on mainstream flooding.

### 5.1.5 Cell size and timestep

The CoP model grid resolution of 2 m was retained for simulation of flood events up to the FFA 1% AEP climate change events. The model grid was updated to 4 m resolution for the 50% of PMF and PMF events, which provided more stable flood behaviour simulation than the 2 m grid during these extreme events with high flows in deep river channel bathymetry.

The TUFLOW model was run with a dynamic timestep using the TUFLOW HPC scheme. The modelling in this study was run in TUFLOW version 2020-10-AA-iSP-w64 for consistency with the CoP study.

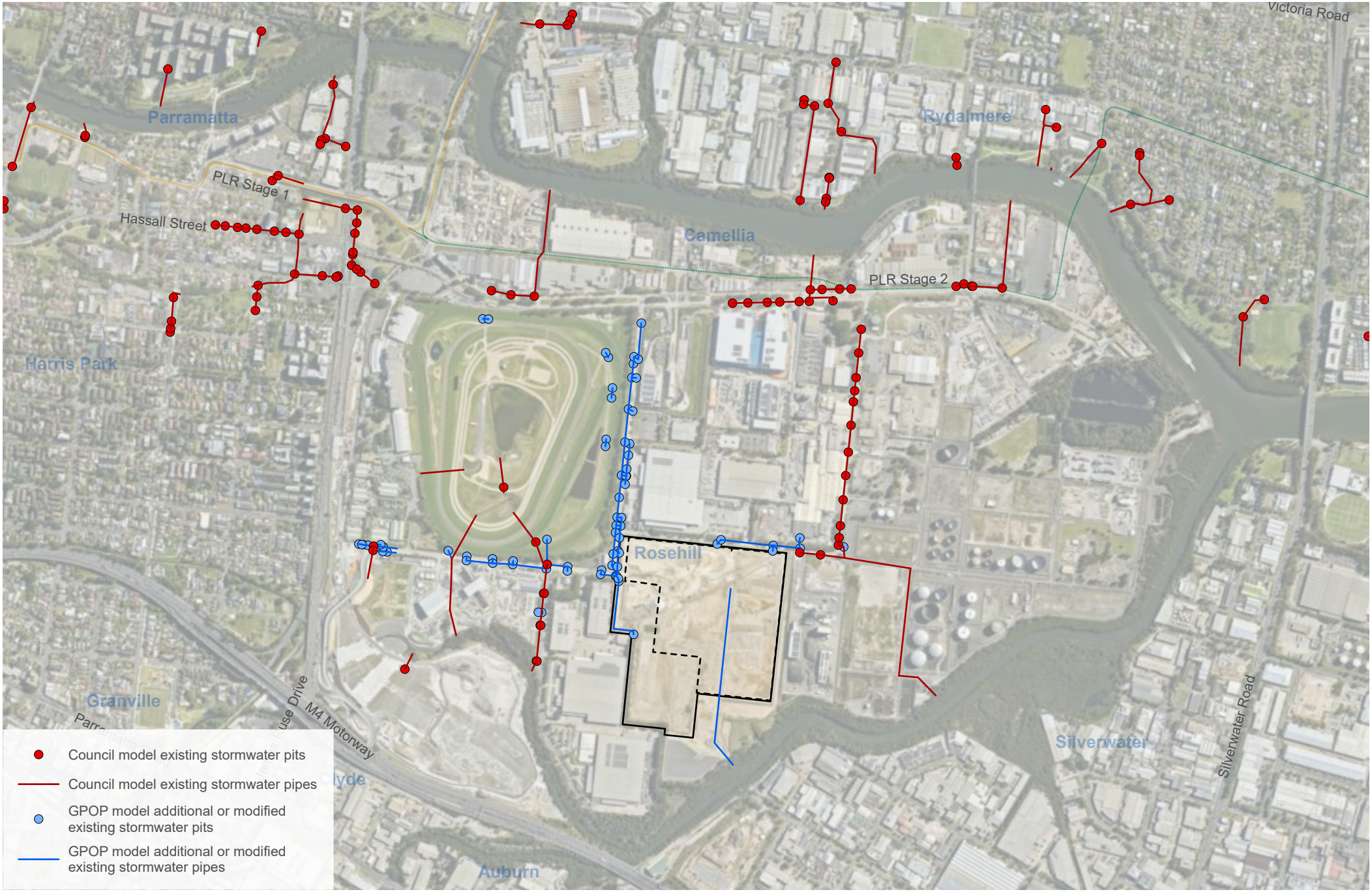



**Figure 5-4** TUFLOW Drainage around WRRF Site - Base case

### 5.1.6 Design events assessed

Design events were assessed primarily using inflow hydrographs built-in to the CoP TUFLOW model (Stantec, 2024).

Inflows for the 24, 36-, 48-, 72- and 96-hour storm duration PMF events were derived using the converted Parramatta River catchment WBNM hydrologic model (WMAwater, 2019). Design probable maximum precipitation (PMP) rainfall depths for the catchment were defined based on the Bureau of Meteorology Generalised Southeast Australia Method for Probable Maximum Precipitation (BoM, 2006). Note that these long-duration PMF events have been simulated only for the Design case to assess durations of isolation at the Camellia-Rosehill WRRF.

**Table 5-2. Matrix of Design Events Assessed**

| Storm duration | PMF | 50% of PMF | FFA 1% AEP | 5% AEP | 10% AEP | FFA 1% AEP RCP4.5 2150 | FFA 1% AEP RCP8.5 2150 |
|---|---|---|---|---|---|---|---|
| 15 min | | V | | | | | |
| 30 min | V | | V[†] | V | | V[††] | V[††] |
| 45 min | V | V | | | | | |
| 1 hour | V | V | V[†] | V | V | V[††] | V[††] |
| 2 hour | V | V | V | V | V | V | V |
| 3 hour | V | V | | | | | |
| 4 hour | V | V | | | | | |
| 5 hour | V | V | | | | | |
| 6 hour | V | V | V | V | V | V | V |
| 9 hour | | | | | V | | |
| 12 hour | | | V | V | | V | V |
| 24 hour | V[†††] | | | | | | |
| 36 hour | V[†††] | | | | | | |
| 48 hour | V[†††] | | | | | | |
| 72 hour | V[†††] | | | | | | |
| 96 hour | V[†††] | | | | | | |

[†]Factored up the 1% AEP inflow from the Parramatta River Flood Study by 35% as a proxy

[††]Factored up and extrapolated the 1% AEP inflow from the Parramatta River Flood Study by ARR 2019 interim, with climate change factors, to year 2150: an 11.50% inflow increase for RCP4.5 and a 28.5% inflow increase for RCP8.5.

[†††]Inflows derived using the converted Parramatta River catchment WBNM hydrologic model (WMAwater, 2019) and Generalised Southeast Australia Method for Probable Maximum Precipitation (BoM, 2006). Only simulated for the Design case.

### 5.1.7 Tailwater conditions

The tailwater levels were retained from the CoP TUFLOW modelling and are summarised in Table 5-3.

**Table 5-3. Adopted tailwater conditions**

| Event | Tailwater condition |
|---|---|
| PMF<br>50% of PMF | Constant 1% AEP Tide = 1.42 m AHD |
| FFA 1% AEP | Constant 5% AEP Tide = 1.34 m AHD |
| 5% AEP<br>10% AEP | Constant Annual Average HWSS Level = 0.995 m AHD |
| FFA 1% AEP RCP4.5 2150<br>FFA 1% AEP RCP8.5 2150 | Constant 5% AEP Tide (1.34 m AHD) + 1.5 m sea level rise = 2.84 m AHD. |

### 5.1.8 Model validation

The updated GPOP model results were compared to the results from re-runs of the CoP modelling. Long sections of maximum flood levels along Duck River and along Parramatta River (up to Charles Street Weir) are presented on Figure 5-5 and Figure 5-6, respectively, for the FFA 1% AEP and PMF events.

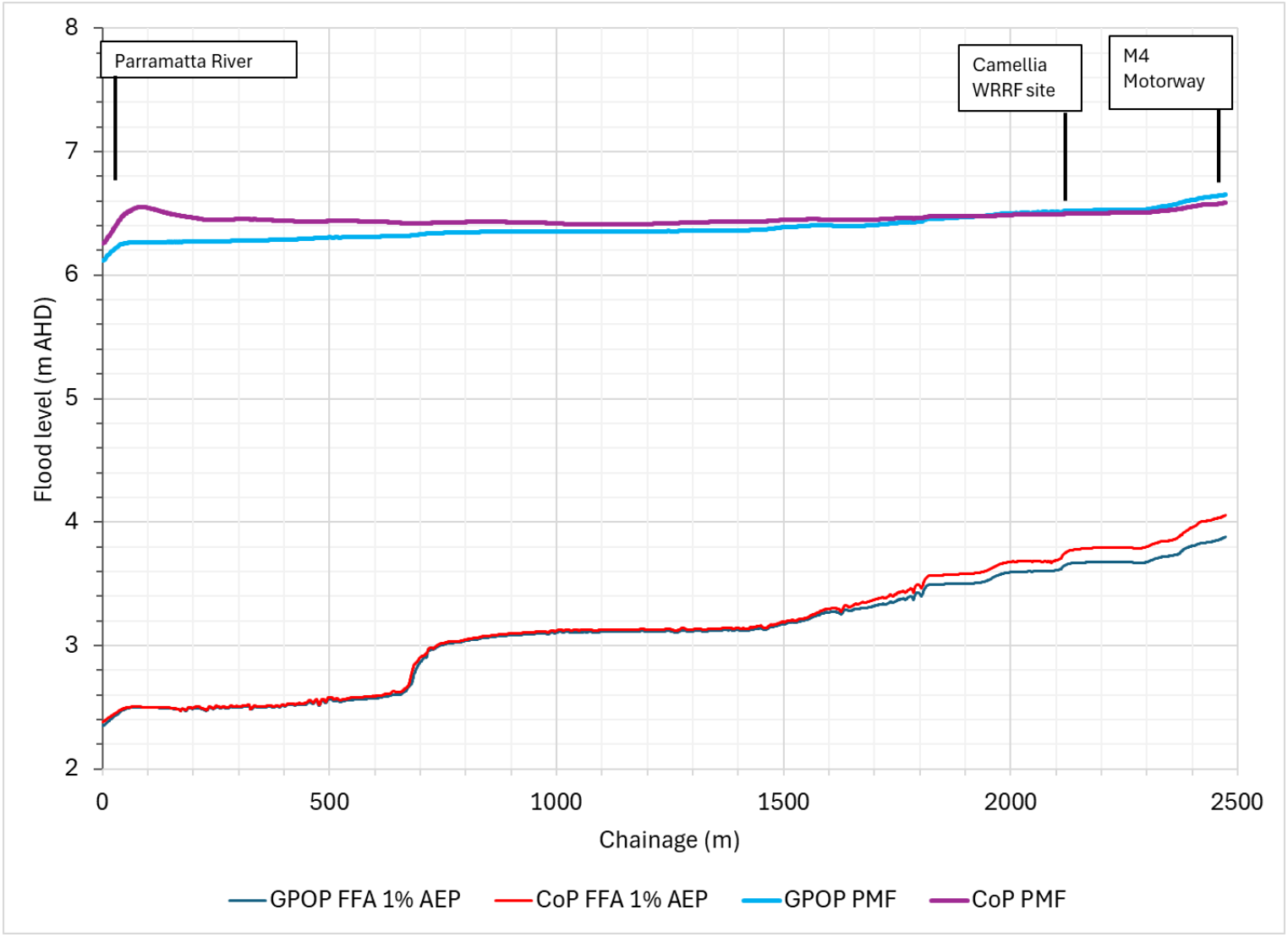



**Figure 5-5. Flood level long section – Duck River – FFA_1% AEP and PMF**

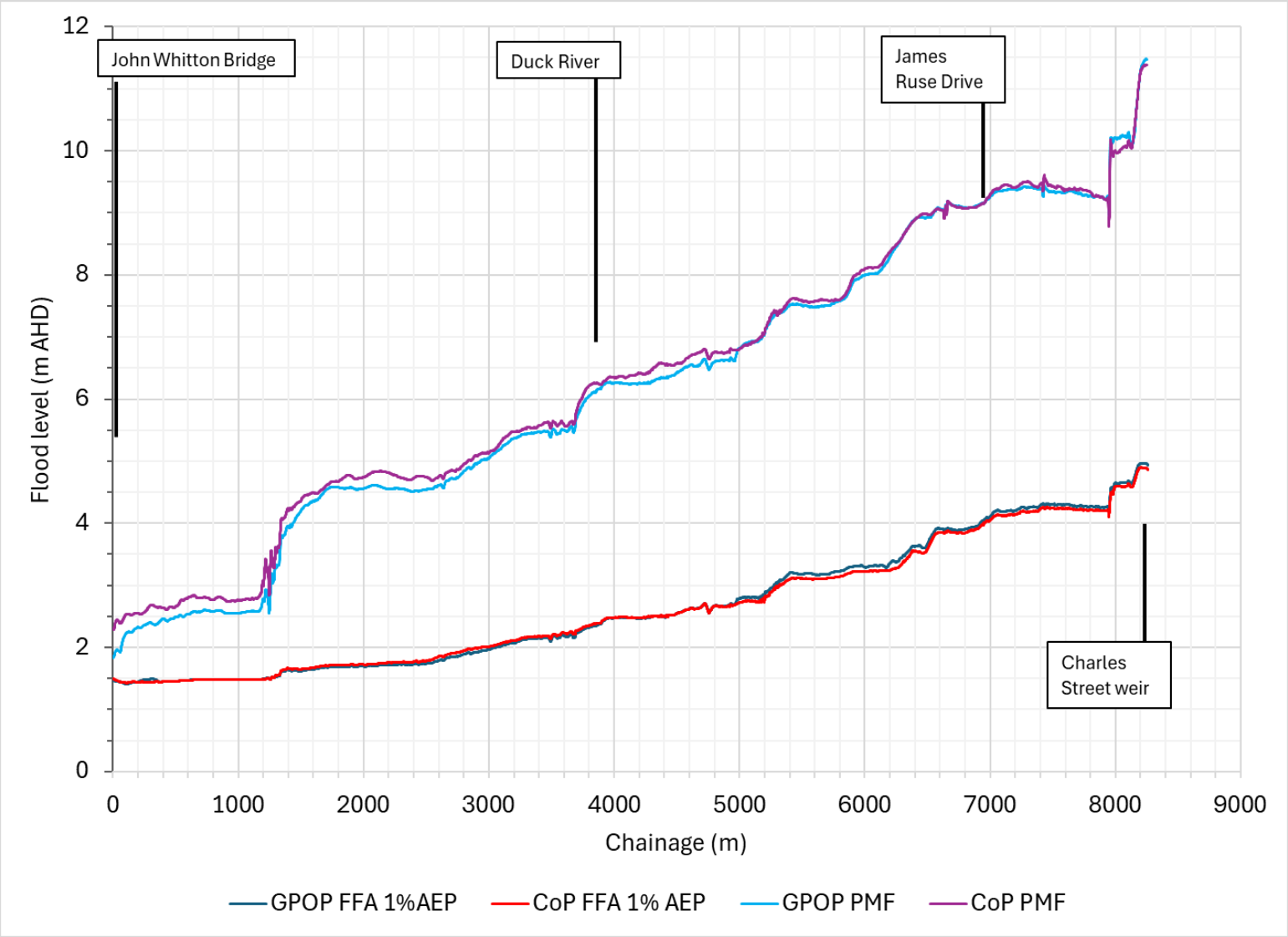



**Figure 5-6. Flood level long section – Parramatta River – FFA_1% AEP and PMF**

Variance in peak flood levels is observed to occur on the upper part of the Duck River long section on Figure 5-5 with GPOP modeled FFA 1% AEP flood levels about 0.1 m lower than CoP modelled levels at the Canellia-Rosehill WRRF site, and about 0.18 m around the M4 Motorway. This is attributed to the GPOP model domain being extended up Duck River, Duck Creek and A'Becketts Creek in anticipation of potential changes in flood level due to the project. The model extension accounts for increased flood storage in the GPOP TUFLOW model, compared to the CoP model where the Duck River and Duck Creek inflows from the XP-RAFTS hydrology model are input in the vicintiy of the M4 Motorway. Figure 5-7 and Figure 5-8 compare the TUFLOW modelled flow hydrographs in the FFA 1% AEP and PMF events in Duck River downstream of Duck Creek, showing the attenuation of the flows due to the accounted flood storage. Other factors contributing to variances in flood levels along Duck River include the updated base LiDAR dates from 2013 to 2019 and the effects on flood conveyance and storage with the Metro West project at Clyde, which is included in the GPOP model and not in the CoP model.

The FFA 1% AEP flood levels in the Parramatta River are consistent (+/- 0.05m) between the GPOP model and the CoP model.

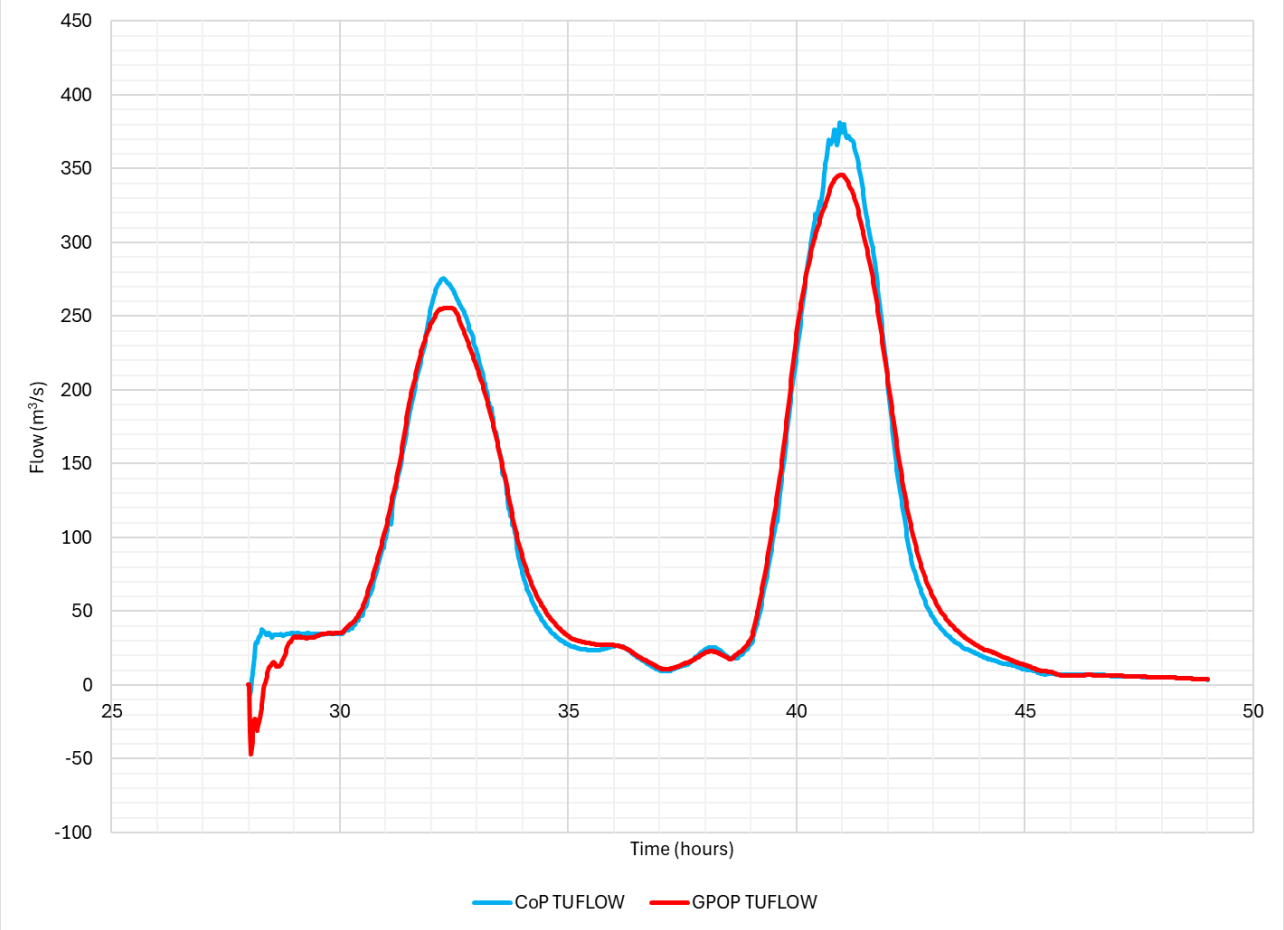



**Figure 5-7. Comparison of 1% AEP 12 hour event flows – Duck River downstream of Duck Creek junction**

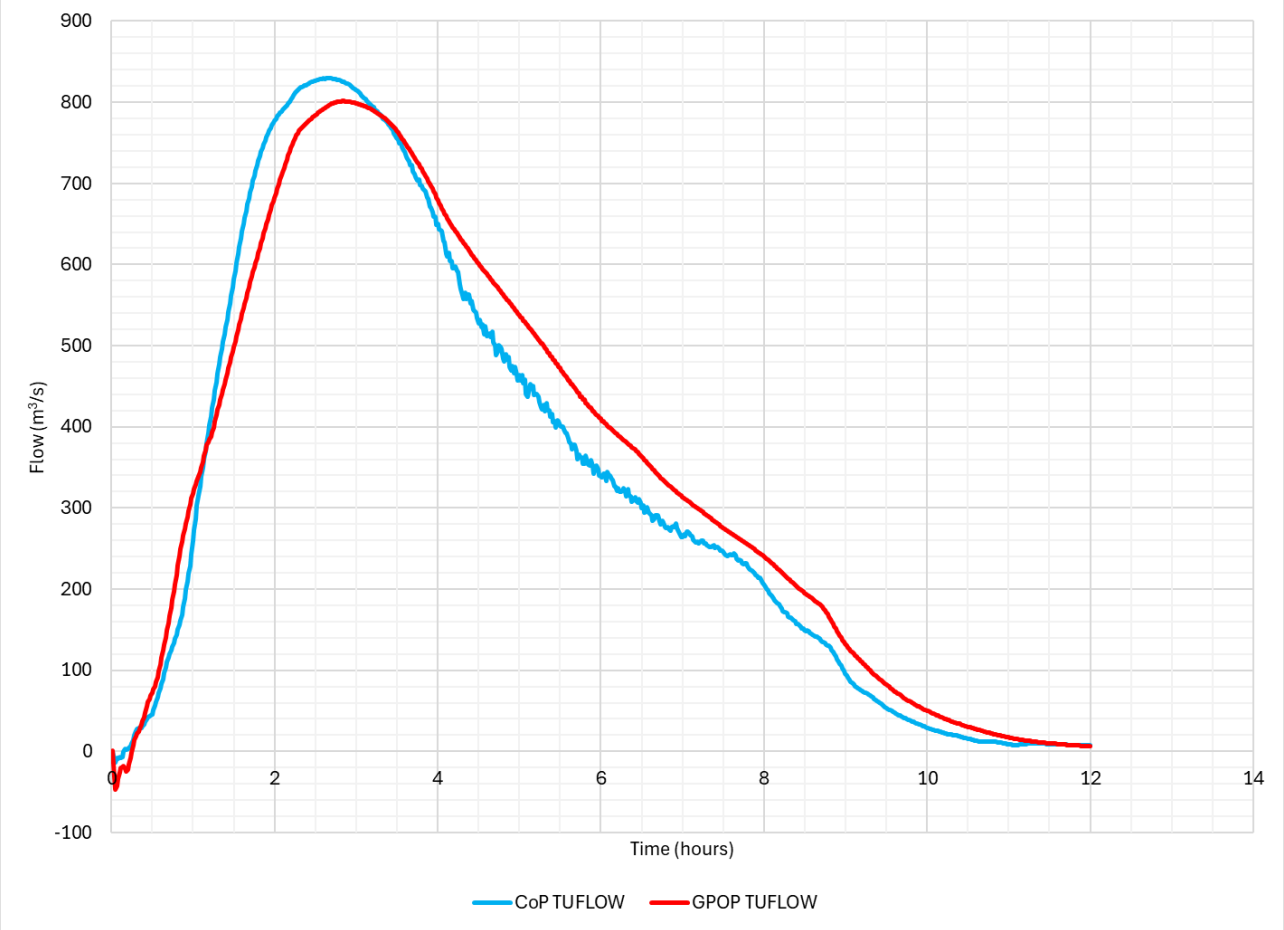



**Figure 5-8. Comparison of PMF 5 hour event flows – Duck River downstream of Duck Creek junction**

The PMF levels in the GPOP and CoP modelling are similar (+/- 0.05 m) around the Camellia-Rosehill WRRF site and M4 Motoroway on Figure 5-5, although the variance is increased at the lower parts of Duck River and is also reflected in the Parramatta River on Figure 5-6. This is attributed to model flow oscillations (model instabilities) in the CoP model in the PMF particularly in the lower sections of the Parramatta River as a result of that model's configuration for the swift and deep flows in the river during the PMF. Figure 5-9 compares the GPOP and CoP flow hydrographs in the Parramatta River, upstream of Wentworth Point, in the PMF. The peaks of the flow oscillations in the CoP model contribute to anomalous high peak flood levels and occur throughout the lower Parramatta River in the model.

In summary, while there are variances in flood levels predicted by the GPOP flood modelling compared to the CoP flood model, these variances can be explained by representation of floodplain storage in the extended GPOP model and improved model configuration to mitigate modelled flow oscillations during 50% of PMF and PMF event simulations. At the WRRF site, the GPOP modelled flood levels are similar to those predicted by the CoP model and hence the model is considered appropriate for the flood impact assessment.

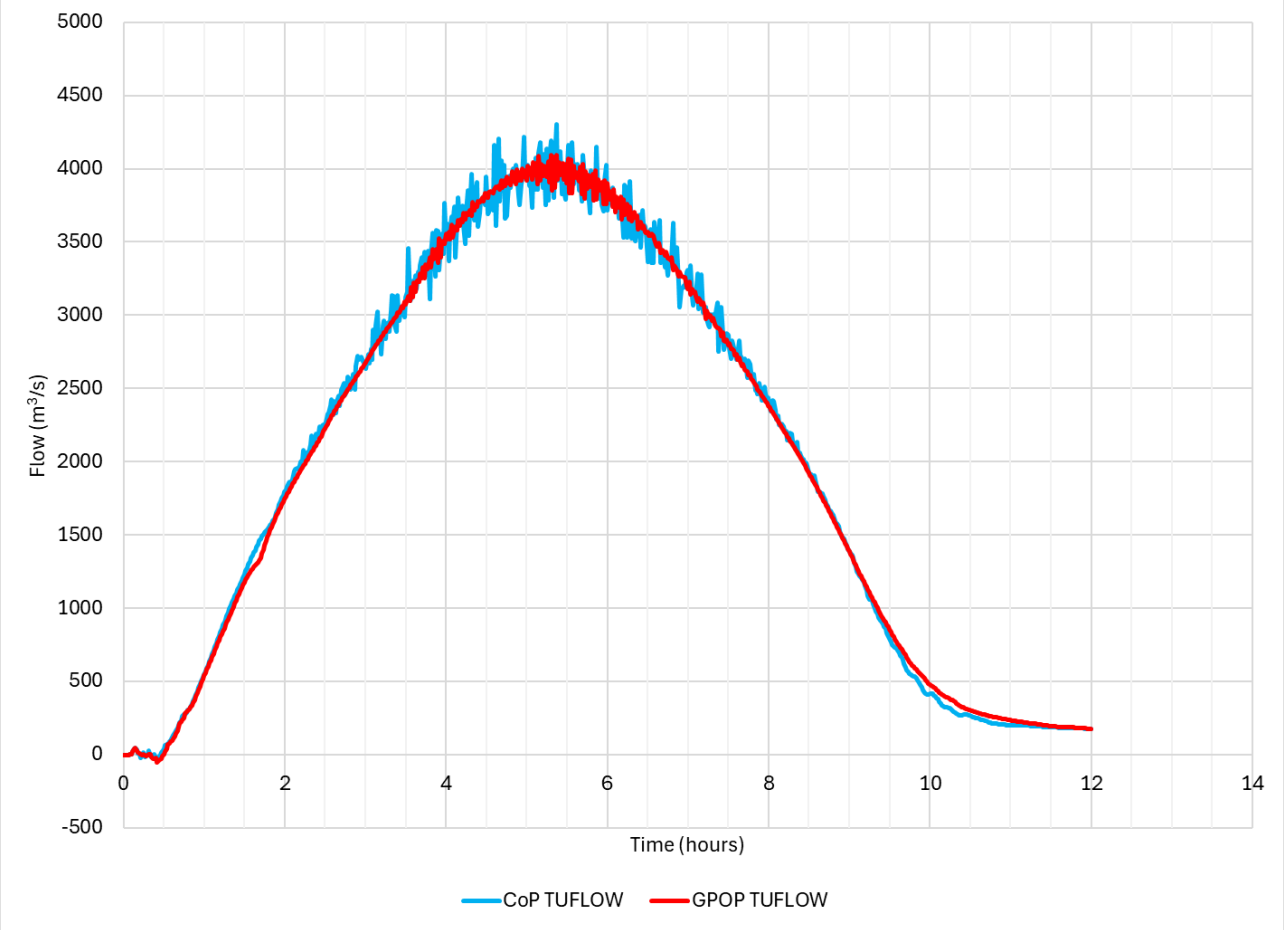



**Figure 5-9. Comparison of PMF 5 hour event flows – Parramatta River upstream of Wentworth Point**

## 5.2 Base case flooding conditions

### 5.2.1 Summary of flood behaviour at WRRF site

The WRRF site is generally not affected by mainstream or overland flooding in up to and including the FFA 1% AEP event. Floodwaters in Duck River during the FFA 1% AEP event rise to levels of 3.5 – 3.7m AHD adjacent to the site but only extend onto the fringes of the south-eastern corner of the site in addition to backwater flooding up the existing stormwater channel on the western boundary of the site. Local overland flooding which is generated in the catchment areas to the north and west of the site accumulate in Devon Street, Colquhoun Street and Unwin Street, with limited overflow onto the reserved overland flow path on the western side of the site.

During the PMF event, as described in Section 2.3.2, floodwaters breaking out from the Parramatta River around Parramatta and Rosehill flow in a south and south-easterly direction towards the WRRF site through Rosehill Racecourse Gardens and along Colquhoun Street where it then meets floodwaters breaking out from A'Becketts Creek and Duck Creek downstream of James Ruse Drive and which flow in a west-to-east direction. Once reaching the site the PMF floodwaters flow in Devon Street along the northern side of the site and through the WRRF floodway in the western portion of the site. These floodwaters re-enter Duck River and Parramatta River to the south and east of the site. In the Base case, the top of the site filled embankment is above the PMF level.

### 5.2.2 Flood depths and levels

Flood depths and levels are mapped for the Base case and are presented in Figure B-1 to B-7 in Appendix B for the PMF, 50% of PMF, FFA 1% AEP, 5% AEP and 10% AEP events, and climate change FFA 1% AEP RCP4.5 (year 2150) and RCP8.5 (year 2150) events, respectively.

For events up to and including the FFA 1% AEP, flooding is largely contained within the channel banks of the Parramatta River, Duck River, Duck Creek and other tributaries, with the majority of flooding occurring through overland flow. Mainstream flooding largely affects some low-lying foreshore areas, but flood extents along the mainstream change dramatically when flow is out of bank in events rarer than the 5% AEP. Overbank flooding occurs in the 1% AEP event on Duck River upstream of the M4 Motorway, Duck Creek and A'Becketts Creek. A large area of inundation also occurs in Rosehill on and to the west of James Ruse Drive along Claycliff Creek and its overbank areas.

The PMF affects large areas of the Parramatta River and Duck River floodplain, with almost all of the Camellia – Rosehill Peninsula to the east of James Ruse Drive inundated.

Existing flooding depths in key locations on and around the Camellia-Rosehill WRRF site are described below:

- On the Camellia-Rosehill WRRF site itself, there is no to limited flooding in events up to and including the FFA 1% AEP event in the Base case. A minor overflow occurs from flooding in Unwin Street in the FFA 1% AEP event with depths of less than 0.1 m in the reserved overland flow path along the site western boundary. In the FFA 1% AEP RCP 4.5 and RCP 8.5 scenarios, this overland flow path is activated with flow depths of up to 0.3 m and 0.5 m, respectively.

  In the 50% of PMF and PMF events, the reserved overland flow path has depths of up to 1.5 m and 2.5 m, respectively. The floodway through the site experiences depths of up to 1.6 m in the PMF event.

- On Devon Street, flood depths are around 0.52 m in the 5% and 10% AEP events, and 0.56 m in the FFA 1% AEP event. Flood depths are up to 0.58 m in the FFA 1% AEP RCP 8.5 scenario. Flood depths are up to 0.8 m and 2.0 m in the 50% of PMF and PMF events, respectively.

  On Unwin Street, predicted flood depths are less than 0.1 m in the 5% and 10% AEP events, and 0.2 m in the FFA 1% AEP event. Flood depths are up to 0.33 m in the FFA 1% AEP RCP 8.5 scenario. Flood depths are up to 0.9 m and 2.3 m in the 50% of PMF and PMF events, respectively.

- The Sydney Metro site between Unwin Street and Duck Creek is flood-free in up to and including the FFA 1% AEP event, apart from the flood detention basin where depths are about 2.5 m. Overland flows from Unwin Street occur in the FFA 1% AEP climate change events. Inundation depths are up to 1 m in the 50% of PMF event and up to 2 m in the PMF.

- On the Downer Rosehill Sustainable Road Resource Centre to the east of the site, flood depths are around 0.6 m in the 5% and 10% AEP events, and 0.7 m in the FFA 1% AEP event. Flood depths are up to 0.75 m in the FFA 1% AEP RCP 8.5 scenario. Flooding is a result of overland flows in these events

  Flood depths are up to 0.8 m and 2.8 m in the 50% of PMF and PMF events, respectively, due to mainstream flooding from Duck River.

- On the property to the south of the site, flood depths in the FFA 1% AEP event are up to 1.5 m within low-lying drainage and riparian areas as a result of Duck River flooding. These depths increase to 2.0 m and 2.2 m in the FFA 1% AEP RCP 4.5 and RCP 8.5 scenarios, respectively, with some floodwater breaking out onto developable parts of the property.

  The parts of Property 1 above the low-lying riparian areas are affected by 50% of PMF and PMF flood event inundation, to depths of 0.8 m and 2.5 m, respectively.

- The property on the northern side of the Devon Street sag point is raised about 2.5 m above street level and is above the PMF inundation of Devon Street.

- The property on the corner of Devon Street and Durham Street is affected by local overland flooding in the 10% AEP event to depths of 0.8 m and up to 1 m in the FFA 1% AEP event.

Flood levels on the Camellia-Rosehill WRRF site reach a maximum of 6.76 m AHD in the PMF event, at the north-western corner of the site. The top of the site filled embankment has an elevation of 6.83 m AHD, hence the site filled embankment is above the PMF and is not inundated. The maximum flood levels on the WRRF site in the 50% of PMF event and FFA 1% AEP event are 5.39 m AHD and 4.99 m AHD, respectively.

### 5.2.3 Flow velocities

Flow velocities are mapped for the Base case and are presented in Figure B-8 to B-14 in Appendix B for the PMF, 50% of PMF, FFA 1% AEP, 5% AEP and 10% AEP events, and FFA 1% AEP RCP4.5 (year 2150) and RCP8.5 (year 2150) events, respectively.

Flow velocities in the FFA 1% AEP event are generally between 2 to 4 m/s within the Parramatta River and up to 2 to 3 m/s in Duck River and Duck Creek. Overland flow velocities in the vicinity of the site are generally limited to less than 1 m/s, with isolated locations experiencing up to 2 m/s velocities. Flow velocities in the existing stormwater channel on the western boundary of the site are up to 1 m/s.

Flow velocities in the PMF generally vary from 2 to 4 m/s in the Upper Parramatta River and from 4 to 6 m/s in the Lower Parramatta River. Flow velocities in Duck River and Duck Creek are generally up to 3.5 m/s. In the vicinity of the site, most overland flow velocities are expected to be limited to less than 2 m/s, with few localised roadway flows up to 4 m/s. Velocities in the floodway on the WRRF site range from 0.5 to 2 m/s. On adjacent properties, flow velocities are typically 0.5 to 1.0 m/s on Property 1 and 0.5 to 2 m/s on the Sydney Metro property to the north of Duck Creek.

### 5.2.4 Flood hazard

The flood hazard mapping for the Base case is presented in Figure B-15 to B-21 in Appendix B for the PMF, 50% of PMF, FFA 1% AEP, 5% AEP and 10% AEP events, and FFA 1% AEP RCP4.5 (year 2150) and RCP8.5 (year 2150) events, respectively.

The mapping has been prepared based on the guidelines in ARR 2019 Version 4.1 (Book 6: Flood Hydraulics, Section 7.2.7) and the Flood Risk Management Guide 2023. The classification is still based on depth and velocity but utilises six categories based on the stability of children, adults, the elderly and vehicles in flood waters. This hazard classification is consistent with that adopted in the Parramatta River Flood Study (Stantec, 2024). The flood hazard categories are summarised below and shown graphically on Figure 5-10.

- H1 – Generally safe for people, vehicles and buildings;
- H2 – Unsafe for small vehicles;
- H3 - Unsafe for vehicles, children and the elderly;
- H4 - Unsafe for people and vehicles;
- H5 - Unsafe for people and vehicles. Buildings require special engineering design and construction; and
- H6 – Unsafe for people or vehicles. All buildings types considered vulnerable to failure.

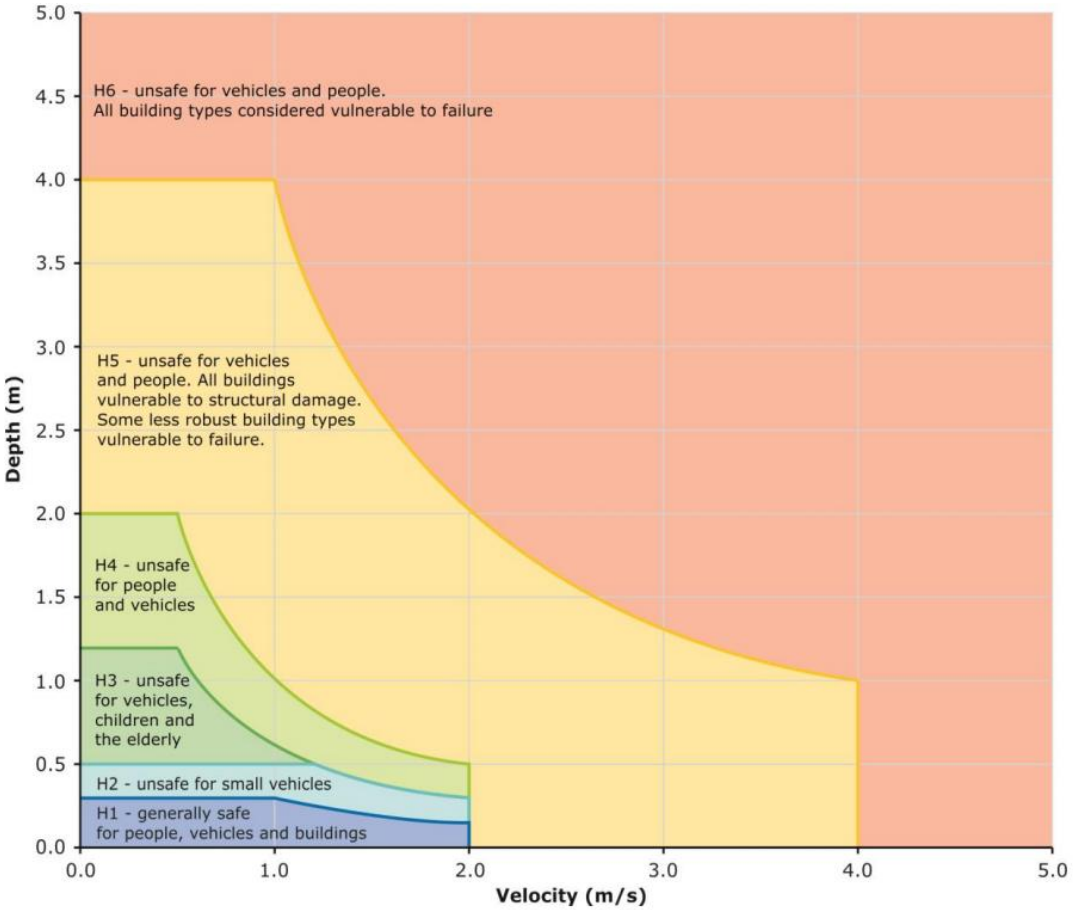



**Figure 5-10. General flood hazard vulnerability curves, ARR 2019 (Version 4.1)**

Flood hazard in the Parramatta River and other watercourses is typically H5 – H6 in the FFA 1% AEP event due to the high depths in these permanent watercourses. A key area of flooding is located in Rosehill near James Ruse Drive and along Claycliff Creek, where the FFA 1% AEP flood hazard is H4 – H5 in this trapped low point caused by higher topography to its north, along the southern side of the Parramatta River. In the PMF event, areas of H5 and H6 flood hazard emanating from the Parramatta River are extensive and include the Rosehill – Claycliff Creek area and the Parramatta CBD.

In the vicinity of the site, the flood hazard in the FFA 1% AEP event is typically H5 – H6 in Duck River, Duck Creek and A'Becketts Creek, grading down to H1 – H3 on their banks. Overland flows in Devon Street, Unwin Street and other streets are typically H1, with areas of H2 and localised H3 in sag points with deeper depths of ponding. Local overland flooding on Property 2 and the Downer property range from H1 to H3, depending on the depth of ponding. On the WRRF site, there is a localised patch of H1 flood hazard near Unwin Street. Flood hazard in the existing stormwater channel is typically H3 – H4.

In the PMF, the H5 – H6 flood hazard areas are extensive outward from Duck River and Duck Creek. The flood hazard rating in Devon Street, Colquhoun Street and Unwin Street are typically H5 and up to H6 due to relatively high flood depths and velocities in active flow areas. Property flooding around the WRRF site is typically up to H5. Flood flows in the WRRF site floodway are H4 – H5.

### 5.2.5 Hydraulic categories

Hydraulic category mapping for the Base case is presented in Figure B-22 to B-26 in Appendix B for the PMF, 50% of PMF and FFA 1% AEP events, and FFA 1% AEP RCP4.5 (year 2150) and RCP8.5 (year 2150) events, respectively.

The mapping has been prepared according to the hydraulic criteria adopted in the Parramatta River Flood Study (Stantec, 2024). The three flood hydraulic categories identified in the Flood Risk Management Manual (DPE, 2023b) are:

- Floodway, where the main body of flow occurs and blockage could cause redirection of flows. Generally characterised by relatively high flow rates; depths and velocities;
- Flood storage, characterised by deep areas of floodwater and low flow velocities. Floodplain filling of these areas can cause adverse impacts to flood levels in adjacent areas; and
- Flood fringe, areas of the floodplain characterised by shallow flows at low velocity.

**Table 5-4. Hydraulic Categories Criteria**

| Hydraulic Category | Criteria |
|---|---|
| Floodway | As a minimum, the floodway was assumed to follow the creek line from bank to bank. In addition, the following depth and velocity criteria were used to define a floodway:<br>▪ Velocity x Depth product must be greater than 0.25 $m^2/s$ and velocity must be greater than 0.25 m/s<br>OR,<br>▪ Velocity is greater than 1 m/s. |
| Flood Storage | ▪ Depth greater than 0.2m<br>▪ Not classified as floodway |
| Flood Fringe | Area within the flood extent for each AEP flood event outside the Floodway and Flood Storage areas. |

The hydraulic categories mapping shows that the WRRF site has no floodway or flood storage areas in the FFA 1% AEP event outside of the reserved overland flow path and the existing stormwater channel on the western site boundary. There are existing localised areas of flood storage in Devon Street and on the Downer property to the east.

The hydraulic category areas in the FFA 1% AEP climate change (RCP4.5 and RCP8.5 2150) events are similar to the FFA 1% AEP event, with expansions of the flood storage and flood fringe areas evident on the mapping in the vicinity of the site.

The 50% of PMF event shows further expansions of the flood storage and flood fringe areas compared to the more frequent flood events. A corridor of floodway hydraulic category becomes established in Unwin Street, which continues down through the reserved overland flow path on the WRRF site's western boundary and into the existing stormwater channel, then continuing to discharge to Duck River.

In the PMF event, floodway zones are prevalent in and around the WRRF site. The floodway-categorised flows are contained within the reserved floodway flow path through the western portion of the WRRF site.

#### 5.2.5.1 Comparison to City of Parramatta flood mapping

The Base case FFA 1% AEP event hydraulic categories mapping from this study is compared to that published by CoP in the Parramatta River Flood Study (Stantec, 2024) on Figure 5-11 and Figure 5-12. Differences in the extents of flood storage and flood fringe areas are observed on the Camellia-Rosehill WRRF site:

- The CoP mapping shows extensive flood storage areas and flood fringe areas on the WRRF site. This is due to CoP modelling utilising 2013 LiDAR data, which represented the previous refinery features on the site at that time, with areas of ponding and flood storage zones within bunded areas.
- Additionally, the site elevations were previously lower than Devon Street and once floodwaters overtopped the road verge, they could readily flow through the site.
- The Base case terrain for the site includes the capping and regrading of the site surface, raising the ground surface above Devon Street and above the FFA 1% AEP (and also above the PMF) flood level.

- Overland flooding in Devon Street, Colquhoun Street and Unwin Street is also predicted to be less extensive than in the CoP modelling, as the GPOP WCM modelling includes a number of branches of existing stormwater networks which were not represented in the CoP modelling.
- Differences in the hydraulic category mapping are also present on the Sydney Metro West site due primarily to recent changes in land use and terrain.
- Elsewhere, the GPOP WCM hydraulic category mapping is generally consistent with the CoP mapping in the FFA 1% AEP event.

It is noted that the PMF hydraulic categories mapped in this study are not consistent with the mapping in the CoP's Parramatta River Flood Study (Stantec, 2024), which shows a lower prevalence of floodway areas around the WRRF site. Review of the CoP mapping suggests that the velocity and velocity-depth product criteria are not adequately applied in the floodway zone definition.

The GPOP WCM hydraulic categories mapping appropriately represents the predicted flooding conditions on and around the WRRF site given the use of contemporary terrain information and stormwater network data.

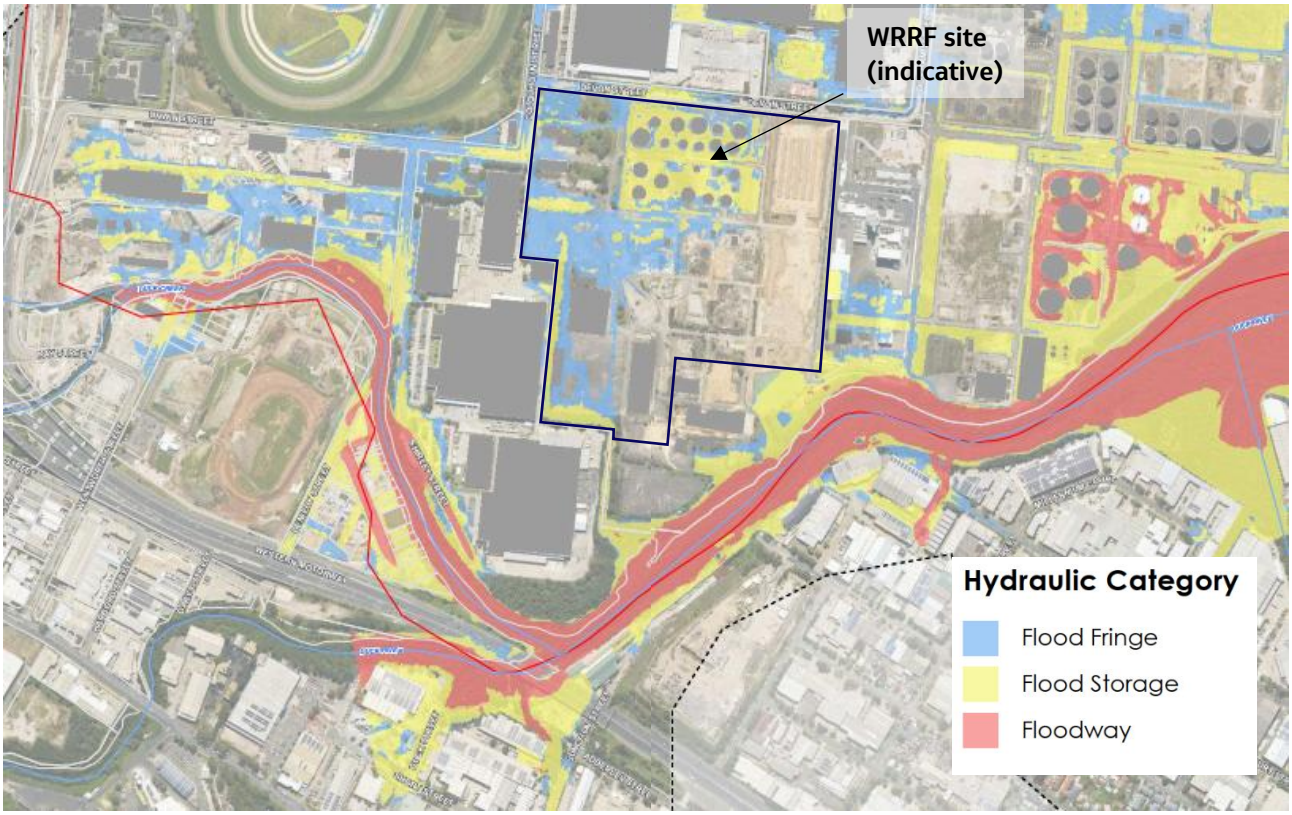



**Figure 5-11. Hydraulic categories mapping – City of Parramatta Council – FFA 1% AEP**

Source: Parramatta River Flood Study (Stantec, 2024)

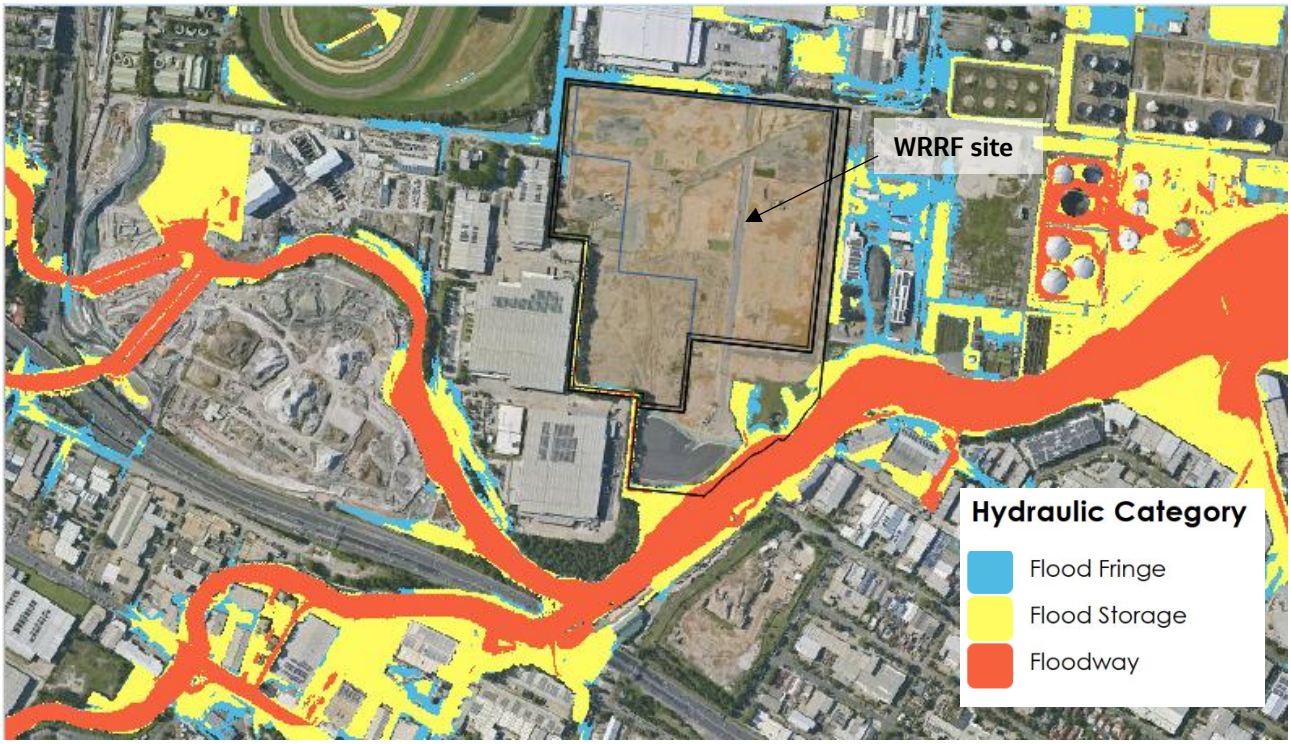



**Figure 5-12. Hydraulic categories mapping – GPOP WCM modelling (Base case) – FFA 1% AEP**

### 5.2.6 Flood risk precincts

The flood risk precincts have been mapped for the Base case on Figure B-27 in Appendix B according to the categorisation criteria provided by CoP and adopted in Parramatta River Flood Study (Stantec, 2024). The categorisation is described in Table 5-5.

**Table 5-5. Flood risk precinct categorisation**

| Flood Risk Precinct | Common Description | Technical Description |
|---|---|---|
| High Risk Area | ▪ Frequent flooding is common<br>▪ Near the main river and creeks where water flows during a flood, including overflow from drainage<br>▪ This area will see the fastest flowing and deepest water and cause a significant risk to life. | High hazard flood area within the FFA 1% AEP flood extent |
| Medium Risk Area | ▪ Frequent flooding will be rare<br>▪ Where the flood water goes once the creek/river areas overflow<br>▪ In rare floods these areas have the potential for deep and fast flowing water. | Medium and low hazard flood area within the FFA 1% AEP flood extent |
| Low Risk Area | ▪ Flooding is extremely rare<br>▪ Generally, away from the river or creek and higher up<br>▪ If a flood affects these areas it will cover a large area with dangerous water in many places. | Area from the FFA 1% AEP flood extent up to the PMF extent |
| Everywhere Else | Not expected to flood but there still could be local incidents of water running off the land and of street drainage not coping with rainfall amounts. | Area outside the Probable Maximum Flood. There may still be isolated impacts from local overland flow. |

"High", Medium" and "Low" flood hazard are defined based on the previous NSW Floodplain Development Manual (NSW Government, 2005), which has since been superseded by the Flood Risk Management Manual (DPE, 2023b). Hazard categorisation is illustrated graphically on Figure 5-13.

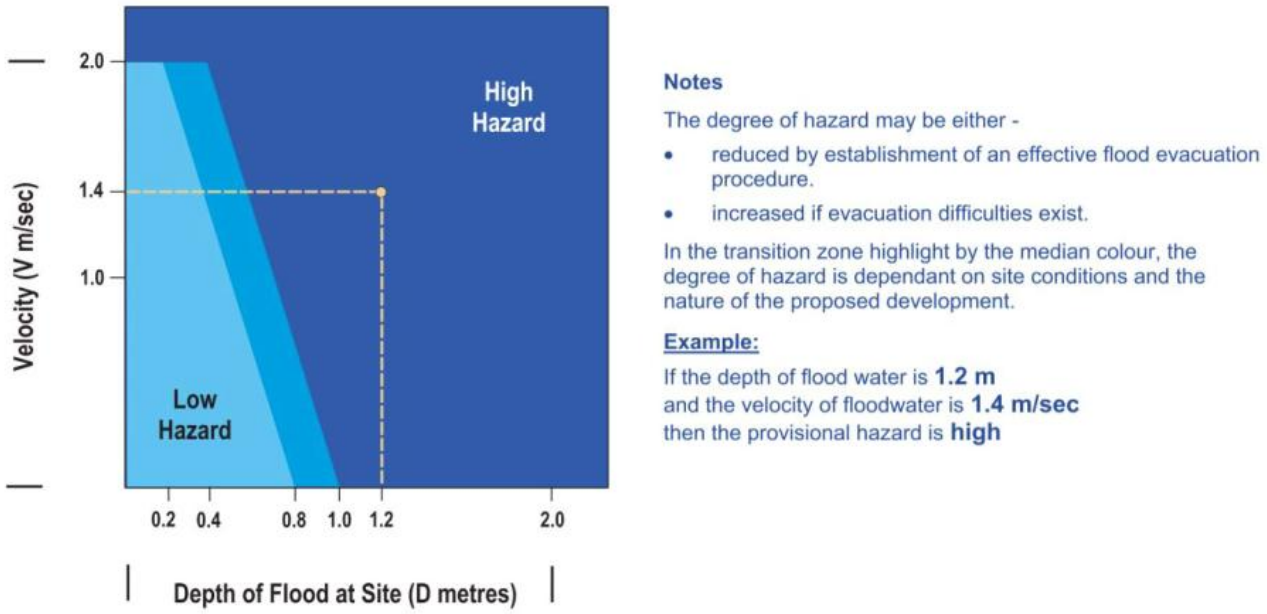



**Figure 5-13. Flood hazard categorisation – Floodplain Development Manual (2005)**

The WRRF site and immediate surrounds are mapped as Medium and Low Risk Precinct areas, reflecting the generally low hazard FFA 1% AEP flooding conditions and the extensive PMF inundation on the site and across the Camellia and Rosehill area in general. There is localised High Risk Precinct in the existing stormwater channel on the site western boundary, indicating high flow depths and velocities in that drainage channel.

### 5.2.7 Flooding of key evacuation routes

Key evacuation routes are expected to include Grand Avenue, James Ruse Drive and the M4 Motorway, as confirmed with SES (refer Section 4.4.4). However, there are existing flooding constraints on local roads leading to these main routes and the main routes are also affected by flooding. The intersection area of Grand Avenue and James Ruse Drive is a significant evacuation route flooding constraint with depths of flooding in the 10% AEP event exceeding 1.5 m.

Grand Avenue would experience overland flooding at road sag points between Colquhoun Street and Durham Street to depths of 0.2 m in the 10% AEP event and 0.35 m in the FFA 1% AEP event.

The M4 Motorway is elevated above the PMF on a viaduct within the flood model domain and hence is considered flood-free in the modelled area. However, access to the M4 Motorway from Camellia-Rosehill is limited due to flooding of local roads.

The modelling confirms that local road and main evacuation routes would quickly become cut by flooding during storm events, highlighting the need for early evacuation from the Camellia-Rosehill Precinct in response to a flood.

# 6. Design case modelling and analysis – Camellia-Rosehill WRRF

## 6.1 Proposed development flood modelling

Updates to the flood model to represent the proposed development on the Camellia-Rosehill WRRF site are summarised in Table 6-1. Relevant design drawings of the Project are provided in Appendix C. For flood impact assessment outside of the WRRF site, refer to Section 7.

**Table 6-1. Updates for Design case flood model for Camellia-Rosehill WRRF flood impact assessment**

| Element | Description of model update |
|---|---|
| Camellia-Rosehill WRRF treatment plant works | Blocked structures using TUFLOW 2d_code objects. Manning's n = 0.02 for paved surfaces and access roads. |
| Camellia-Rosehill WRRF Admin building off Unwin Street | Raised building with undercroft car parking area allowing flood flow conveyance. Modelled using TUFLOW layered flow constriction (2d_lfcsh) objects with 15% blockage factor. Solid walls along parts of undercroft perimeter modelled using 2d_zsh lines. Access ramp around outside of building perimeter to first floor modelled using TUFLOW layered flow constriction (2d_lfcsh) object. Lift shaft and utility rooms modelled as blocked obstructions using TUFLOW 2d_zsh objects. |
| Floodway surface | Raised additional 0.2 m above Base case condition with topsoil for floodway planting (total 0.3 m raising above engineered subgrade surface). Manning's n = 0.045 for planting of native grasses. |
| Potential solar area | Solar panels mounted on poles above PMF level (approx. 2 m height). Panels retract to horizontal position during non-operational time (e.g. flood). Poles 200 mm diameter at 9 m spacing. Modelled with Manning's n = 0.05 (assuming native grass cover plus poles). |
| Drainage infrastructure | 600 mm diameter pipe (polypropylene) with headwall inlet through filled embankment toe at Devon Street sag point, draining to stormwater line and channel on western side of site. Manning's n = 0.011. Site stormwater network not represented.<br><br>An alternative overland flow path solution was considered for supplementing Devon Street sag drainage, however, was found to be infeasible due to existing underground utilities constraints and project space requirements. |

### 6.1.1 Topography

The model topography in the Camellia-Rosehill WRRF site and surrounds for the Design case is shown on Figure 6-1.

### 6.1.2 Design features and drainage

The design features of the Project, including buildings and structures, potential solar area and proposed drainage are shown on Figure 6-2.

### 6.1.3 Land use materials

The TUFLOW materials in the vicinity of the Camellia-Rosehill WRRF site for the Design case is mapped on Figure 6-3.

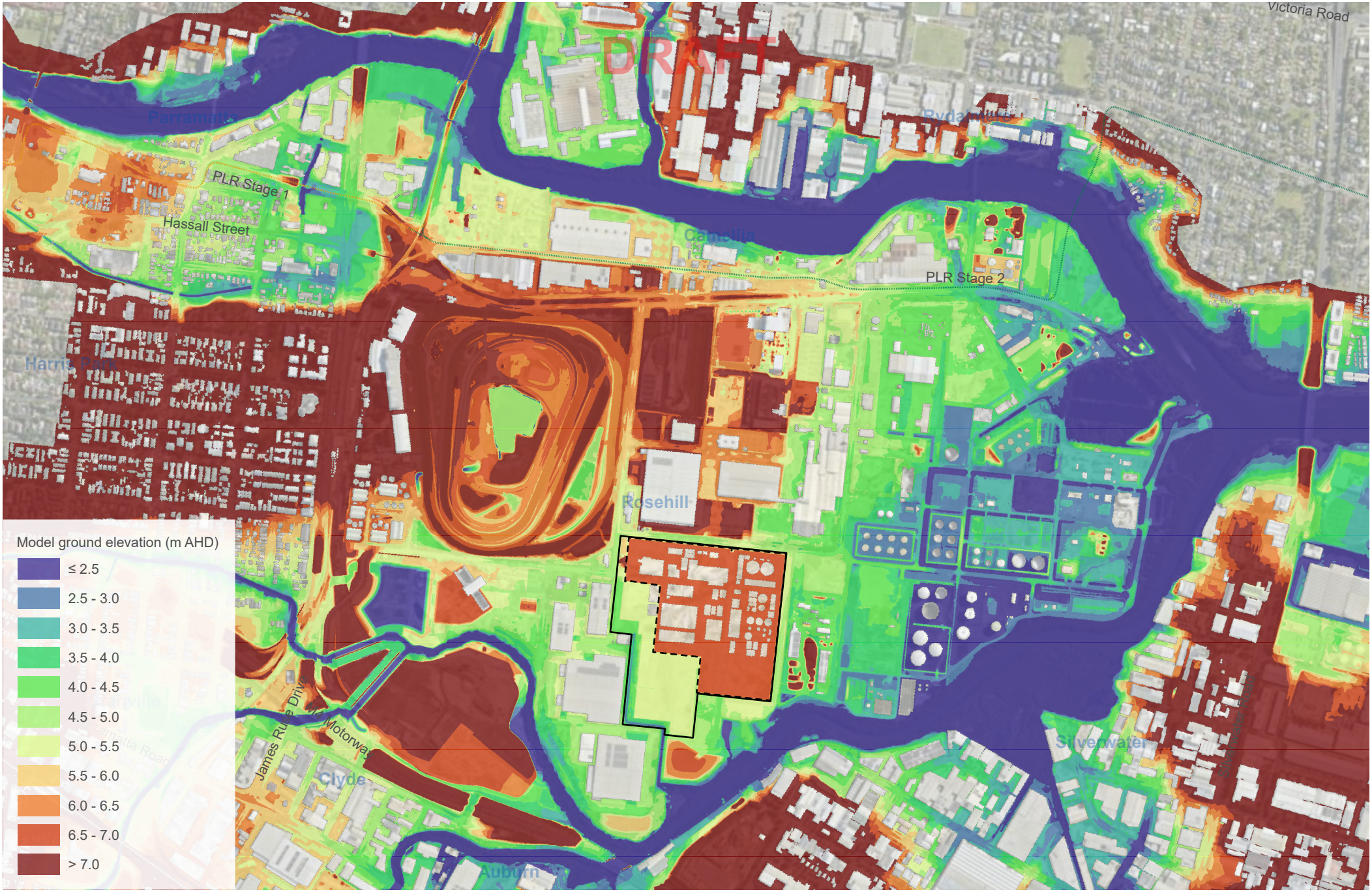



**Figure 6-1** TUFLOW Model Topography - Design case

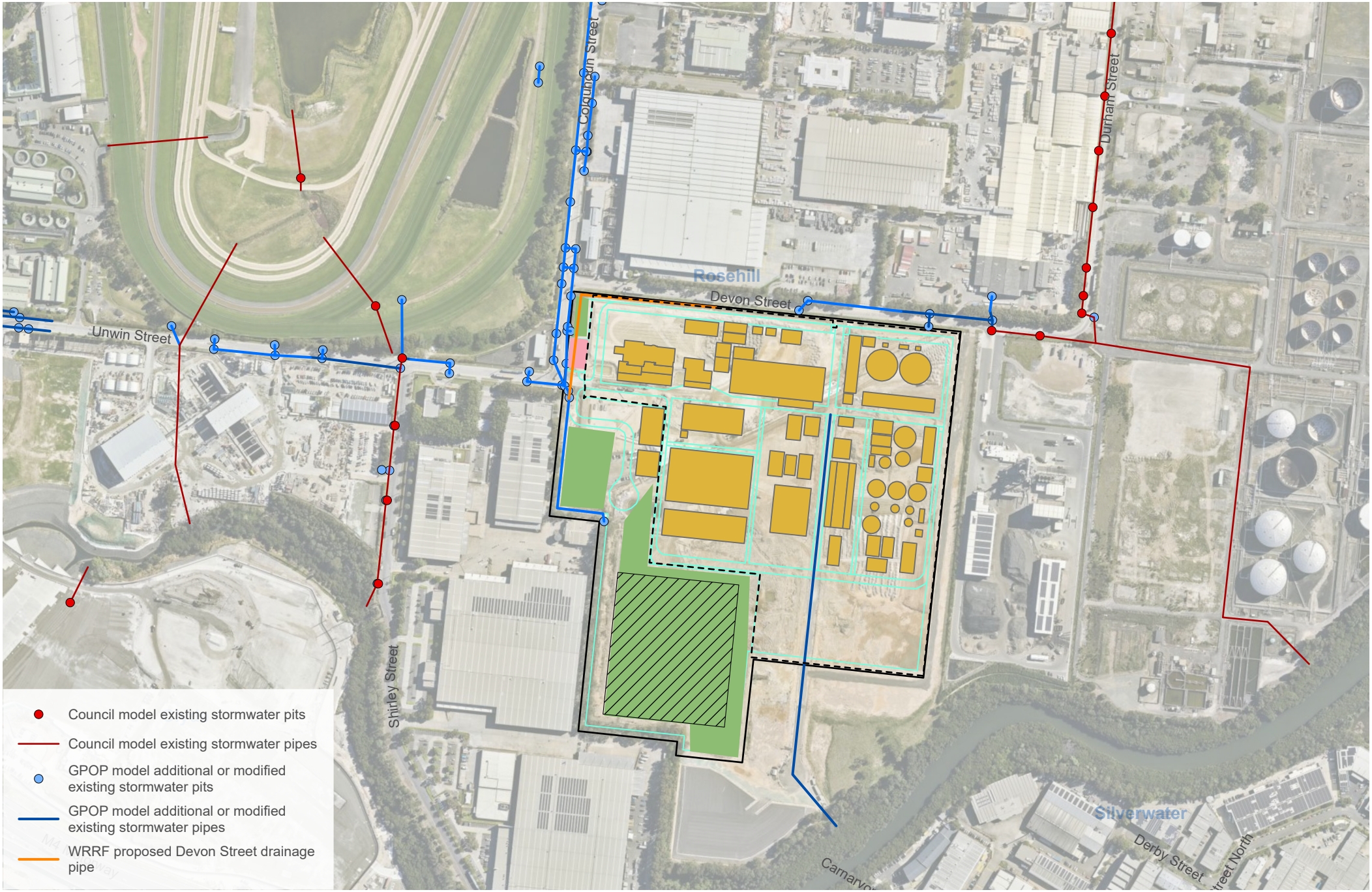



**Figure 6-2** TUFLOW Design case design features

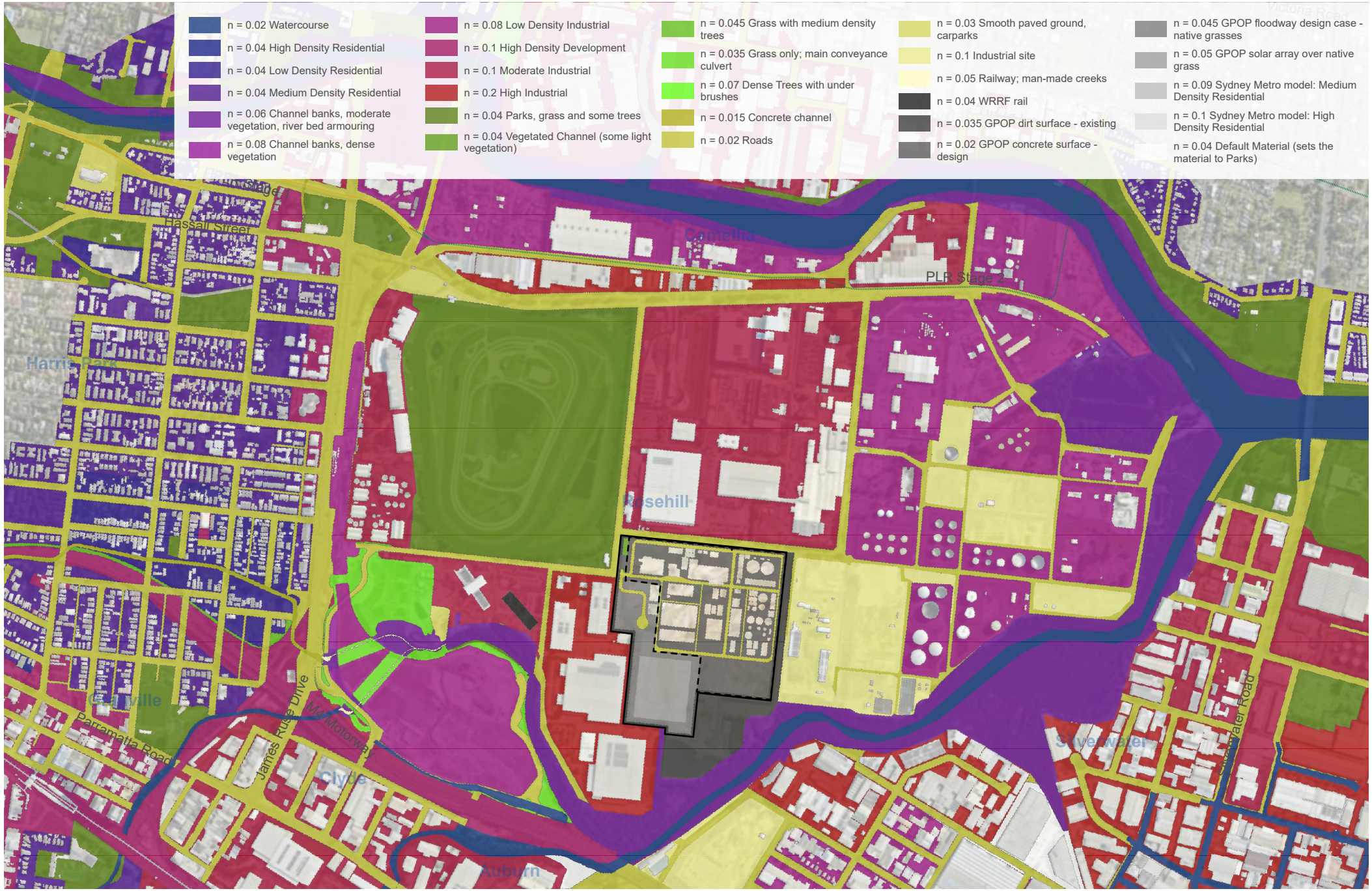



**Figure 6-3** TUFLOW Material Roughness - Design case

## 6.2 Flood impacts of the proposed development - Operation

### 6.2.1 Change in flood levels

Mapping which describes the change in flood level from the Base case to the Design case, is provided on Figures D-1 to D-7 in Appendix D.

There are negligible increases in flood levels in the 10%, 5% and FFA 1% AEP events on floodplain and watercourse areas as a result of the project. There are reductions in flood levels of -0.05 m to -0.08 m in Devon Street, Colquhoun Street and Unwin Street as a result of the additional drainage capacity provided by the project.

In the FFA 1% AEP climate change (RCP4.5 and 8.5 2150) events, there are similarly negligible increases in flood levels on properties adjacent to the WRRF site. There are reductions in flood levels of -0.05 m in Devon Street, Colquhoun Street and Unwin Street and up to -0.01 m decrease on Property 4 to the west. The mapping shows changes in flood levels of +/- 0.015 m in the watercourses in addition to localised drainage and wetland areas and adjoining parts of industrial properties at the eastern end of the Camellia Peninsula, at the junction of Duck River and Parramatta River. These are negligible impacts given the nature of the land use.

The FFA 1% AEP climate change (RCP4.5 and 8.5 2150) event flood impact mapping also displays spurious changes in flood levels in the Parramatta River and lower Duck River of +/-0.02m, located a significant distance from the site. These are a result of underlying model instabilities and flow oscillations during high flow events. Given their distance from the WRRF site, they do not affect the site and are not associated with the flood impacts from the site.

In the 50% of PMF event, there are increases in flood levels of 0.01 – 0.02 m on Property 4. In the PMF there are increases in flood levels of 0.02 – 0.03 m on Property 4 and 0.04 – 0.07 m increase in flood levels in Devon Street and Colquhoun Street and adjoining properties, including Property 2 and the substation on the corner of Devon Street and Colquhoun Street. These are considered minor impacts given the rarity of these flood events, the depths of flooding (up to 1.7 m depth in the PMF on the substation site) and the nature of the land use. There are negligible changes in flood levels elsewhere in the 50% of PMF and PMF events.

### 6.2.2 Velocity changes

Mapping of the change in velocity from the Base case to the Design case, is provided on Figures D-8 to D-14 in Appendix D.

In the 10%, 5%, FFA 1% AEP and the FFA 1% AEP climate change (RCP4.5 and 8.5 2150) events, there are generally negligible changes in flow velocities (less than +/- 0.1 m/s change) on the floodplain and properties outside the site and in watercourses. There are localised increases in velocities of +0.3 m/s in the roadways of Devon Street, Colquhoun Street and Unwin Street due to reduced flood depths in these streets, allowing street flows to remain elevated in the areas where the flood extents retracted and the tailwater level reduced. This is an acceptable increase in the velocities given they occur in the roadway. In the FFA 1% AEP climate change (RCP8.5 2150) event, there are increases in velocities in the overland flow path on the western boundary of the WRRF site of +0.3 m/s, although flow velocities remain below 1 m/s.

In the 50% of PMF, similar to the more frequent events, there are generally negligible changes in flow velocities (less than +/- 0.1 m/s change) on the floodplain and properties outside the site and in watercourses. There are localised increases in velocities of up to +0.5 m/s in the roadway of Devon Street, although velocities remain below 1 m/s.

In the PMF, there are generally negligible changes in flow velocities (less than +/- 0.1 m/s change) on the floodplain and properties outside the site, with exception of localised velocity increases on Rosehill Gardens Racecourse property and a substation, both at the corner of Colquhoun Street and Unwin Street. In this

location, velocities would increase by up to +0.5 m/s, with velocities of up to 2 m/s on paved surfaces and 1.5 m/s on grassed surfaces. These are considered minor impacts given the rarity of these flood events, the depths of flooding (up to 1.7 m depth in the PMF on the substation site) and the nature of the land use.

### 6.2.3 Changes to flood hazard mapping

The flood hazard rating of flow conditions is dictated by the combination of flood depths and flow velocity. Given the negligible to minor changes in flood levels/depths, extents and flow velocities in the Design case, any changes to flood hazard rating in all assessed flood events could be expected to be negligible.

### 6.2.4 Changes to hydraulic categories

The flood hydraulic categorisation is dictated by the combination of flood depths and flow velocity. Given the negligible to minor changes in flood levels/depths, extents and flow velocities in the Design case, any changes to hydraulic categorisation in all assessed flood events could be expected to be negligible.

### 6.2.5 Changes to flood risk precincts

The flood risk precinct categorisation is dictated by the flood hazard in the FFA 1% AEP event and the flood extent in the PMF. Given the negligible to minor changes in flood levels/depths, extents and flow velocities in the Design case, any changes to flood risk precincts could be expected to be negligible.

### 6.2.6 Timing of flooding

Water level hydrographs (plots of water level varying with time) were sampled at a number of key locations for the Base case and Design case to assess the timing of onset of flooding and review changes to the timing and duration of flooding. The hydrographs are plotted for the FFA 1% AEP, the 50% of PMF and PMF events. Key locations are shown on Figure 6-4 and include:

1. Devon Street sag point
2. Unwin Street sag point
3. Property 1 low point
4. Metro West site
5. Rosehill Gardens Racecourse
6. Durham Street sag point
7. Colquhoun Street sag point
8. Grand Avenue local sag point
9. James Ruse Drive and Grand Avenue intersection.

The hydrographs indicate that onset of flooding is typically rapid, with flooding around the WRRF site rising within 2 – 4 hours of the start of the storm event and 1 – 2 hours in the 50% of PMF and the PMF events. This confirms the SES' recommendation for early evacuation of the WRRF site upon onset of a storm and flooding event.

The hydrographs show that there is negligible increase, if any, in the duration of flooding at these locations. There are reduced peak flood depths and durations of flooding at Devon Street (Location 1) and Unwin Street (Location 2) in the Design case.


**Figure 6-4. Flood level hydrograph comparison locations**

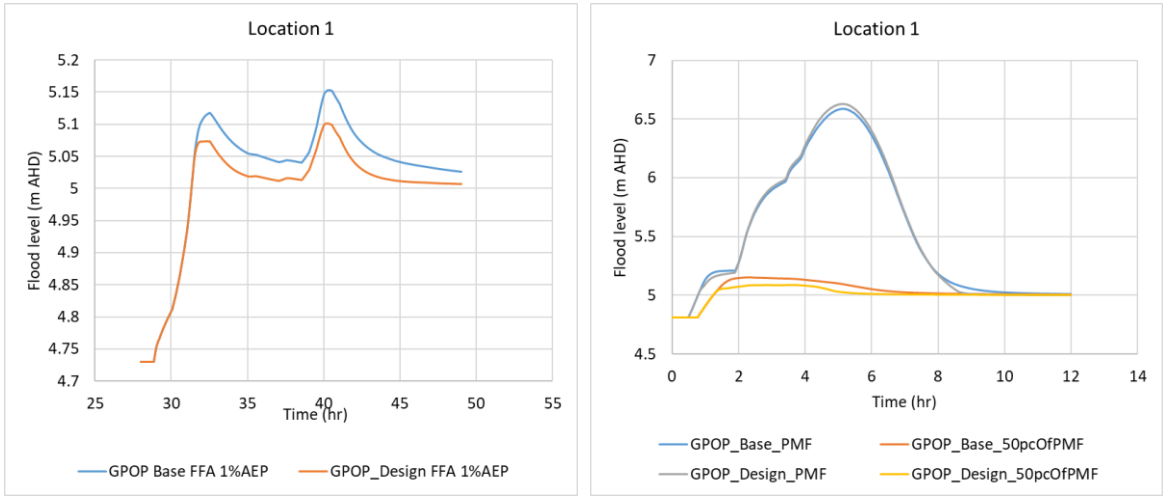



**Figure 6-5. Flood level hydrograph comparisons – Base case and Design case – Location 1 (Devon St sag)**

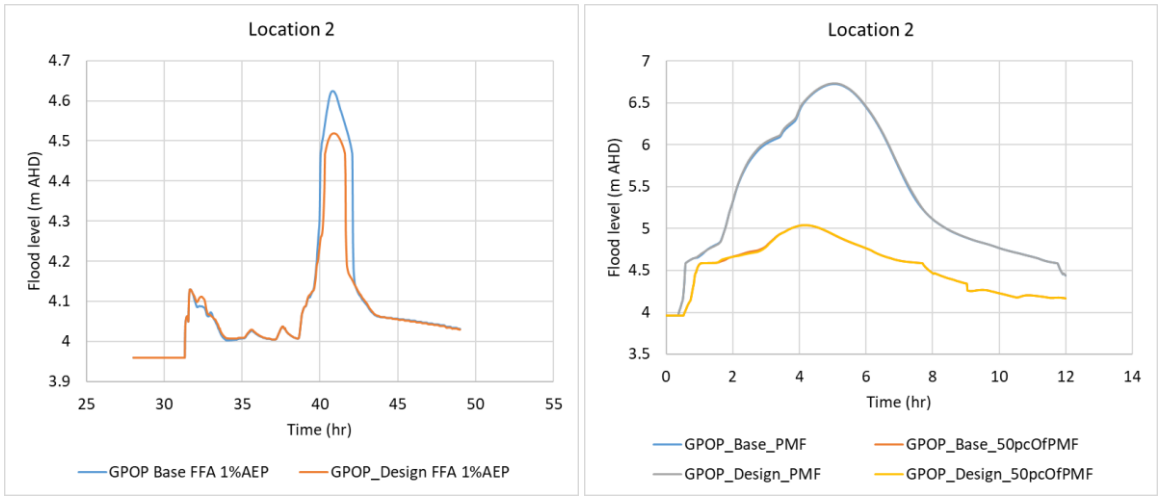



**Figure 6-6. Flood level hydrograph comparisons – Base case and Design case – Location 2 (Unwin St sag)**

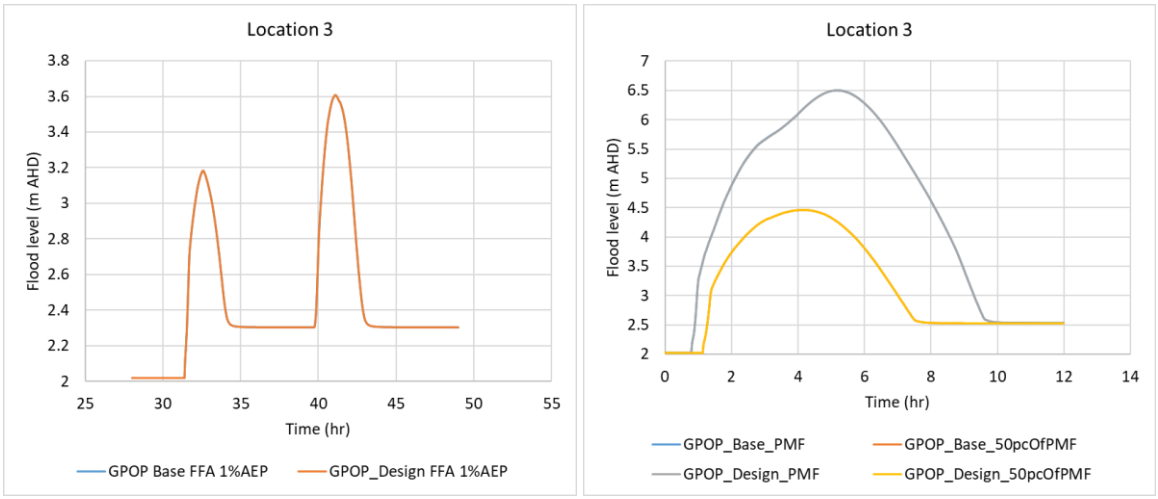



**Figure 6-7. Flood level hydrograph comparisons – Base case and Design case – Location 3 (Property 1 low point)**

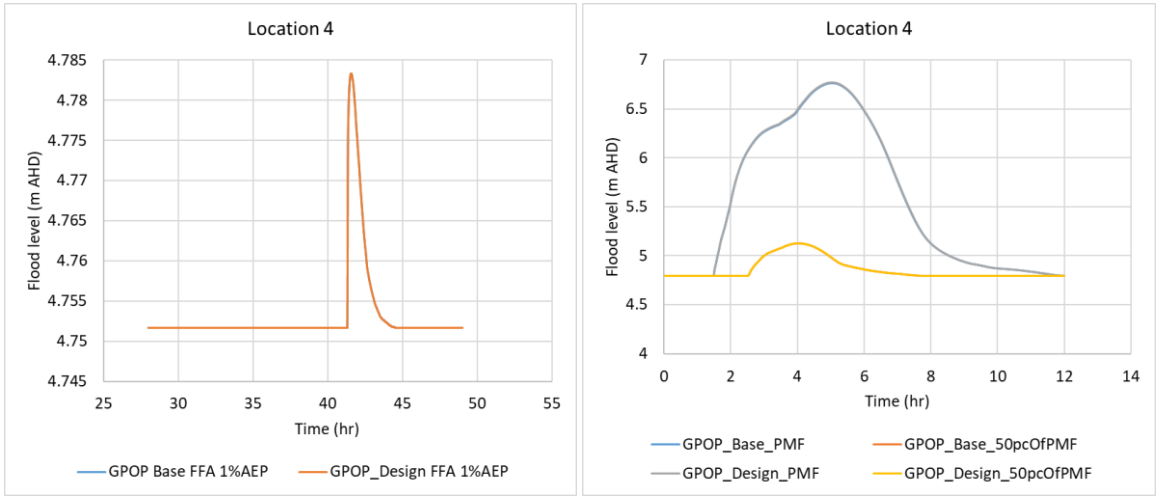



**Figure 6-8. Flood level hydrograph comparisons – Base case and Design case – Location 4 (Sydney Metro West site)**

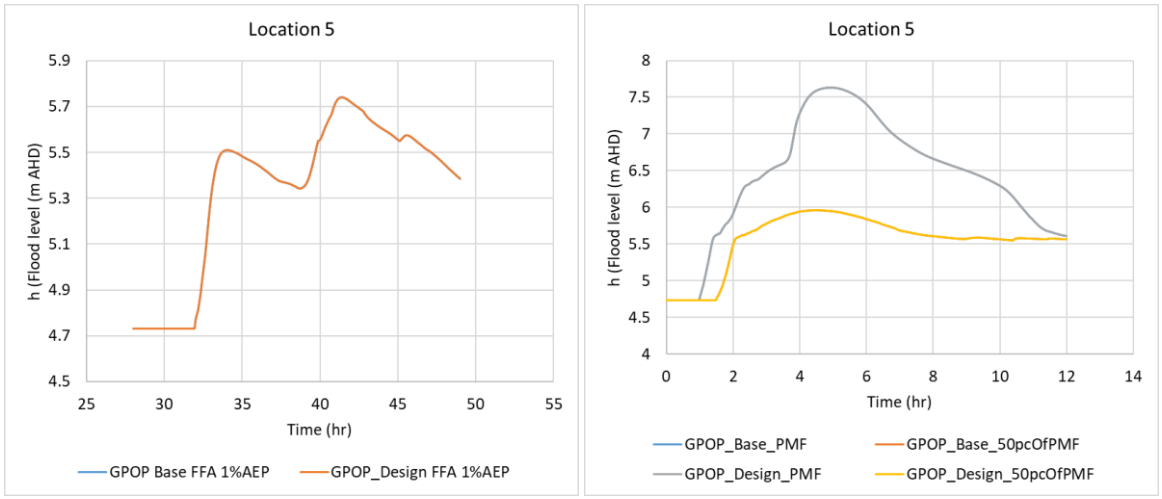



**Figure 6-9. Flood level hydrograph comparisons – Base case and Design case – Location 5 (Rosehill Gardens Racecourse)**

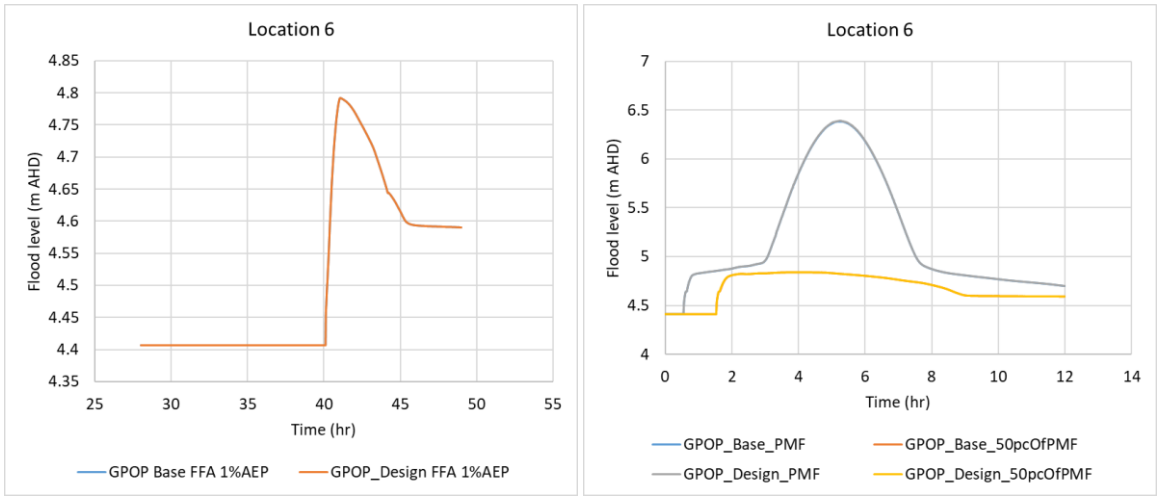



**Figure 6-10. Flood level hydrograph comparisons – Base case and Design case – Location 6 (Durham Street sag point)**

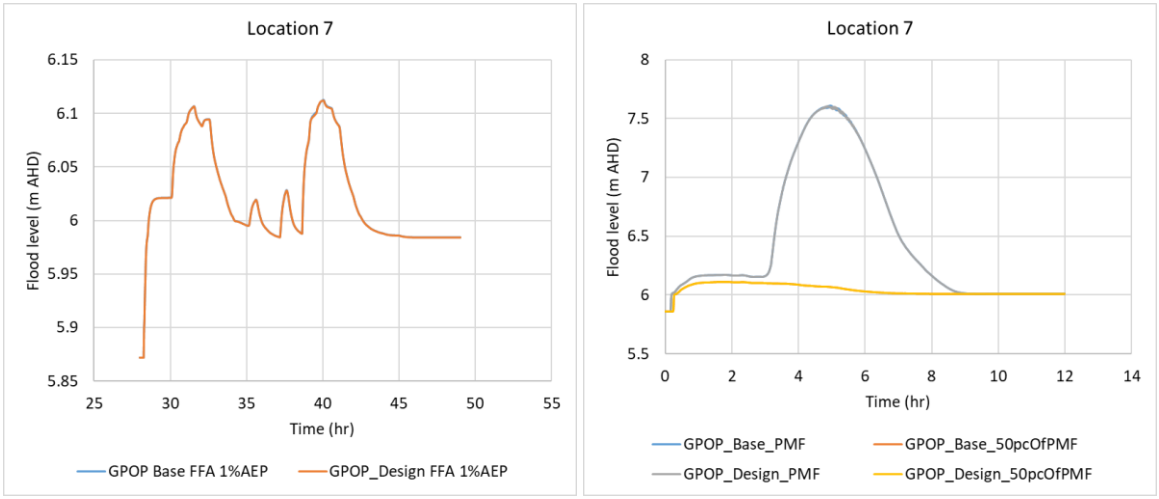



**Figure 6-11. Flood level hydrograph comparisons – Base case and Design case – Location 7 (Colquhoun Street sag point)**

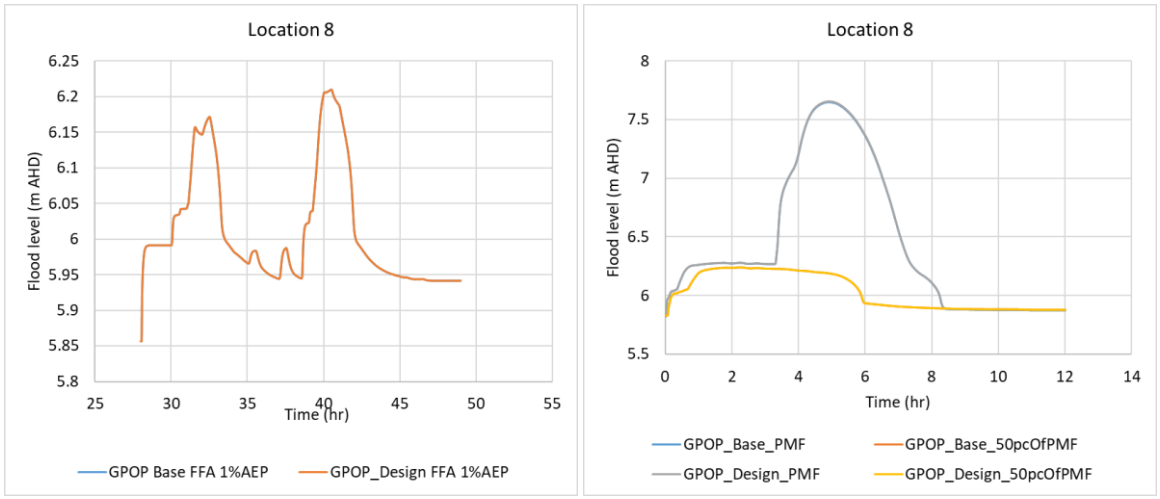



**Figure 6-12. Flood level hydrograph comparisons – Base case and Design case – Location 8 (Grand Avenue local sag point)**

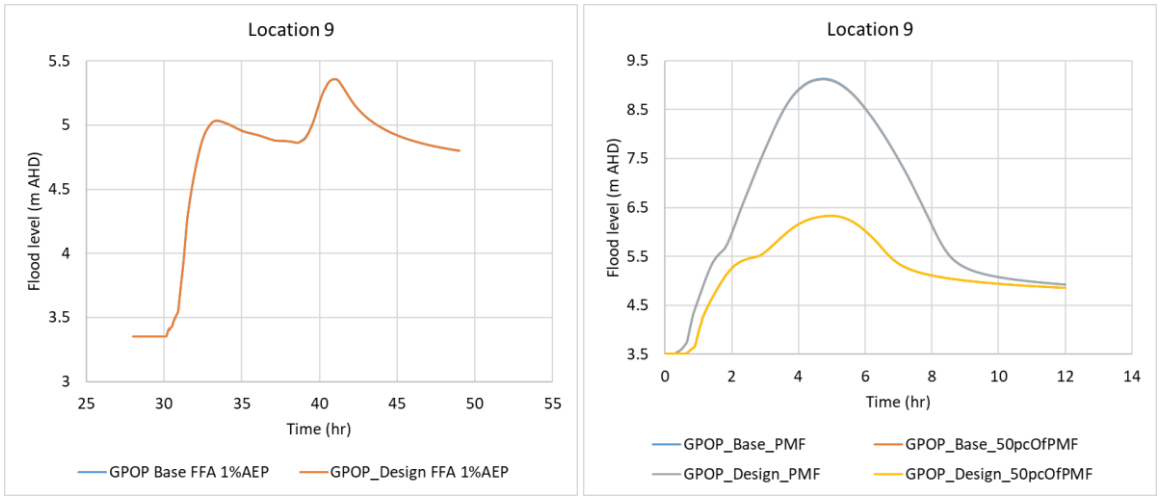



**Figure 6-13. Flood level hydrograph comparisons – Base case and Design case – Location 9 (James Ruse Drive and Grande Avenue intersection)**

### 6.2.7 Impact of flooding on the project

Peak flood levels in the Design case at the north-western corner of the site are summarised in Table 6-2. This part of the site has the maximum flood levels and potential for flooding of the Administration building and site filled embankment.

**Table 6-2. Peak Design case flood levels on Camellia-Rosehill WRRF site**

| Flood event | Level/flood level (m AHD) |
|---|---|
| FFA 1% AEP | 5.10 |
| FFA 1% AEP climate change RCP8.5 2150 | 5.12 |
| PMF | 6.84 |
| Top of site filled embankment finished level | 6.83 |
| Administration building first floor level | 8.35 |

The flood modelling undertaken for the Camellia-Rosehill WRRF demonstrates that the site is above the FFA 1% AEP flood level with RCP8.5 2150 climate change scenario for areas outside the reserved overland flow path along the western site boundary. Project works within the floodway area and on the site filled embankment would be 0.5 m above the FFA 1% AEP climate change (RCP8.5 2150) flood level due to the proposed site grading. Electrical works on the ground floor/undercroft car park in the Administration building would need to be situated about 0.3 m above the ground surface, which is considered achievable, to maintain 0.5 m freeboard above the 1% AEP climate change flood level in Colquhoun Street. The first floor of the Administration building is above the 1% AEP climate change flood level with 0.5 m freeboard. Therefore, the required flood immunity for the Camellia-Rosehill WRRF is achieved, or can readily be achieved with further detailed design, under the Design case conditions.

In the Design case, the PMF level is slightly above the site filled embankment finished level, with shallow overtopping flows to 0.01m depth. While there is no design requirement for the site to be above the PMF, the large majority of the site at ground level is flood-free.

### 6.2.8 Compatibility with the hydraulic functions of flow conveyance in flood ways and storage areas of the land

This study shows that the Camellia-Rosehill WRRF site is flood-free in the FFA 1% AEP event outside of reserved overland flow paths and the existing stormwater channel, with absence of floodway or flood storage areas on the Base case site (refer Section 5.2.5 for discussion on the Base case).

The hydraulic category mapping for the PMF shows areas of floodway and flood storage categories through and around the Camellia-Rosehill WRRF site. Preliminary flood assessments and modelling guided the WRRF site filled embankment footprint to be minimised and for provision of a PMF floodway flow path through the western portion of the site. This floodway is maintained in the Design case. The flood modelling assessment has shown minimal flood impacts of the WRRF design in up to including the PMF, when Design case flood behaviour benchmarked against Base case flooding. This demonstrates that the WRRF design appropriately considers the development of the site with respect to floodway and flood storage areas, and hence is considered compatible with the flood hydraulic functions of the site and surrounds.

### 6.2.9 Impacts to properties and infrastructure

Given the negligible increases in flood levels shown, and therefore flood extents, on the flood impact mapping in Appendix D in the Design case, the impact of the project on property flooding, including properties adjacent to the WRRF site, and infrastructure flooding, including to Sydney Metro West, due to the project could be expected to be negligible.

The Camellia-Rosehill WRRF site is subject to existing approvals including proposed site raising which is part of site environmental management works and was assessed in a Review of Environmental Factors (REF), which included a flood impact assessment. This current flood impact and risk assessment accounts for the site raising in the flood modelling and shows negligible to minor flooding impacts. Hence, there are negligible impacts on the existing approvals of the site.

### 6.2.10 Impacts on the social and economic costs to the community

Given the negligible increases in flood levels in the Design case compared to the Base case, the incremental social and economic costs due to the project is expected to be minor.

### 6.2.11 Impacts to emergency management

Given the negligible increases in flood levels and duration of flooding at key locations in the Design case compared to the Base case, the impact due to the project to existing emergency management arrangements of the Camellia – Rosehill Precinct, including to key evacuation routes, is expected to be minor.

On GPOP WCM sites, the project would place an increased population, consisting of approximately 10 WRRF staff, in an area with existing flood evacuation constraints. A flood management plan will be developed for the operation of the WRRF site including procedures for early evacuation of the site in the event of a flood, refer to management measures in Section 10.4.

### 6.2.12 Compatibility with existing floodplain risk management plans

The Camellia-Rosehill WRRF site is within the area covered by City of Parramatta's Lower Parramatta River Floodplain Risk Management Study and Plan (SKM, 2005), refer to Section 3.1.5. No inconsistencies of the WRRF design compared to the FRMSP were identified, including to policy and planning controls such as required freeboard above 1% AEP flood level for habitable floors. Further, no flood mitigation works as recommended by the FRMSP are affected by the project.

Flood modelling assessment has also shown minimal flood impacts of the WRRF design in up to including the PMF, when Design case flood behaviour benchmarked against Base case flooding. This demonstrates that the WRRF design appropriately considers the development of the site with respect to floodway and flood storage areas.

## 6.3 Potential durations of isolation of the site

The potential isolation of the Camellia-Rosehill WRRF site during extreme flood events was reviewed based on simulation of the long duration PMF events. Storm event catchment inflow hydrographs for 24-hour to 96-hour duration events were assessed using BoM's Generalised Southeast Australia Method (BoM, 2006) and simulation in CoP's WBNM hydrology model of the Parramatta River catchment (refer Section 3.1.2) and then in the TUFLOW hydraulic model for the GPOP WCM project. While the 5 hour duration PMF storm event results in maximum flood levels at the Camellia-Rosehill WRRF, the long duration PMF events have the potential to result in extended periods of isolation of the site.

The PMF flood levels versus time are plotted on Figure 6-14 at the WRRF site entrance on Colquhoun Street at Unwin Street, which is near the Unwin Street sag point. The site filled embankment level and Administration building floor level are also indicated. Note that the peak flooding on the site itself is slightly higher than in Colquhoun Street and reaches just above the site filled embankment to an overtopping depth of 0.01 m.

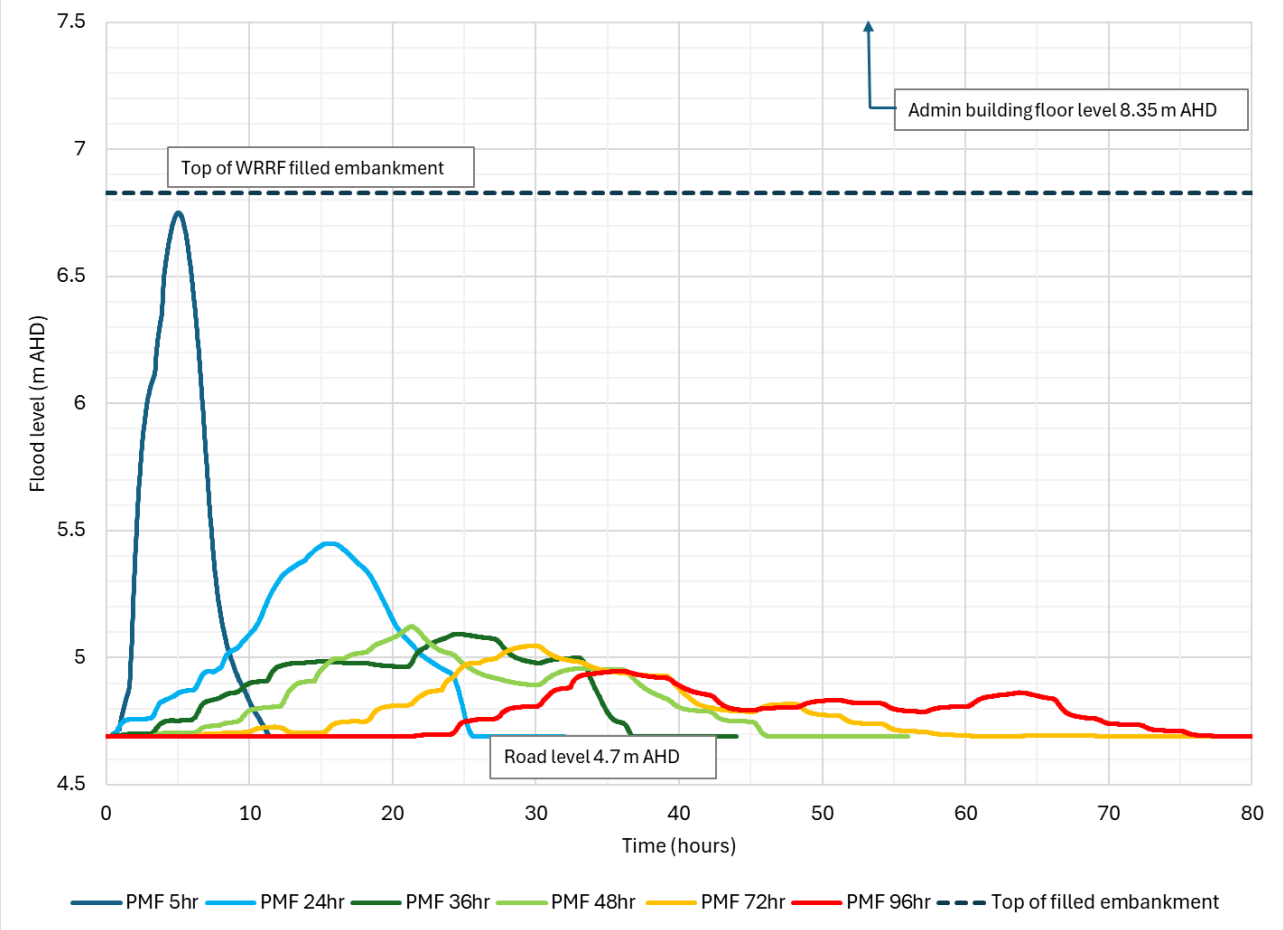



**Figure 6-14. Flood level versus time, PMF events – Design case Colquhoun Street at Unwin Street**

Flood depths under 0.3 m (corresponding to flood level under 5 m AHD at Colquhoun Street) could be considered as low H1 flood hazard and remain trafficable, assuming flow velocities below 1 m/s (refer to Section 5.2.4 for flood hazard description). The duration of flood depth exceeding 0.3 m in Colquhoun Street for the PMF events is summarised in Table 6-3.

**Table 6-3. Duration of inundation greater than 0.3 m depth during PMF events – Design case Colquhoun Street at Unwin Street**

| PMF event duration | Duration of flooding exceeding 0.3 m depth (hours) |
|---|---|
| 5 hour duration | 7.0 |
| 24 hour duration | 14.0 |
| 36 hour duration | 7.1 |
| 48 hour duration | 7.8 |
| 72 hour duration | 4.3 |
| 96 hour duration | 0.0 |

It is observed that vehicle access to and from the Camellia-Rosehill WRRF site would be cut due to flooding in Colquhoun Street at Unwin Street by 7 hours in the critical 5 hour storm duration PMF event, and up to 14 hours in the 24 hour storm duration PMF event. Note that the top of the filled embankment would be almost entirely flood-free in the PMF event with localised shallow (0.01 m depth) inundation in the western portion of the site, and the Administration building floor level is elevated above the PMF flood level. There may be flood evacuation constraints at a precinct scale in roads away from the site. A flood management plan

for the WRRF site would be prepared which would include defining flood emergency protocols, refer to management measures in Section 10.4.

Regionally, key evacuation routes including James Ruse Drive at Grand Avenue in Rosehill would become cut by flooding during frequent flood events (including the 10% AEP event and more frequent) and early during the flood events. Durations of flooding would be extensive, as indicated by the water level hydrographs on Figure 6-13. This highlights the importance of early evacuation of the WRRF site during a flood event.

The Camellia-Rosehill WRRF site would be designed to operate in up to the 1% AEP event. Many of the components are designed to run autonomously for a period of time. This would enable early evacuation of the WRRF operating staff during potential flooding events.

## 6.4 Sensitivity assessments

### 6.4.1 Impact of climate change

Mapping showing the change in flood level in the FFA 1% AEP event due to climate change is shown on Figure E-1 and E-2 for the RCP4.5 2150 and RCP8.5 2150 climate change scenarios, which incorporate both increased rainfall and flood flows and sea level rise for the year 2150 in the Design case.

Climate change predictions are made based on modelling changes to temperature and rainfall in global climate models for various RCPs, which consider projected increases in greenhouse gas concentrations. These projections are based on research by the Intergovernmental Panel on Climate Change (IPCC) and were refined for the Australian region. Stantec (2024) developed hydrologic and hydraulic modelling that is used in this study for RCP4.5 and RCP8.5 scenarios based on the guidance of ARR2019 Version 4.1 (Ball et al., 2019). As described in Section 5.1.7, a 1.5 m sea level rise increment for the year 2150 was applied to the climate change flood modelling scenarios. The increase in design rainfall in the year 2150 adopted for estimating climate change-increased flood flows are:

- RCP4.5 2150: +11.5% increase in rainfall
- RCP8.5 2150: +28.5% increase in rainfall.

Compared to the existing climate 1% AEP event, flood levels in the RCP4.5 2150 climate change scenario increase by 0.5 – 0.6 m in Duck River, with similar flood level increases in the existing stormwater channel on the site western boundary. Increases in flood levels and depths in Devon Street are about 0.01 m and 0.13 m in Unwin Street. There are increases in flood extent on the Camellia-Rosehill WRRF site compared to the existing climate scenario, which are contained in the reserved overland flow path on the western site boundary.

Compared to the existing climate 1% AEP event, flood levels in the RCP8.5 2150 climate change scenario increase by 0.7 – 0.75 m in Duck River, and 0.6 – 0.7 m in the existing stormwater channel on the site western boundary. Increases in flood levels and depths in Devon Street are about 0.01 m and 0.2 m in Unwin Street. There are increases in flood extent on the WRRF site compared to the existing climate scenario. The increases in extent are larger than in the RCP4.5 2150 scenario and which are contained in the reserved overland flow path on the western site boundary.

As discussed in Section 6.2.7, key areas of the WRRF site are situated at least 0.5 m above the FFA 1% AEP climate change (RCP8.5 2150) flood level.

### 6.4.2 Rosehill – Camellia rezoning masterplan cumulative impacts

Project design details of the Camellia-Rosehill WRRF were provided to DPHI for use in future modelling assessment of combined GPOP WCM and Precinct flooding effects.

# 7. Flood impact assessment of other GPOP WCM infrastructure (operation)

## 7.1 Camellia pumping station

The upgrade to Camellia pumping station would involve the installation of a new switchroom and transformer building, with an approximately 10 m x 8.4 m expansion of building footprint area compared to the existing transformer building. Modification of the dry well floor will also be undertaken, with the removal of 1.6 m thick concrete flooring, approx. 220 $m^3$ volume. There will also be new underground pipeline and power conduits installed. The existing and proposed layout is shown on Figure 7-1 and in Appendix C.

The pumping station site is outside of the FFA 1% AEP flood extent, except for localised flood depths to 0.5 m at the northern boundary of the site, and is inundated in the 50% of PMF event. Flood depths of 2 m would occur in the 50% of PMF event. In the PMF, flood depths on the site are typically 4 – 5 m. Flow velocities around the pumping station are up to about 1 m/s in the PMF. Inundation extents and existing flow behaviour is shown on Figure 7-1, indicating no major floodway flow paths are being significantly obstructed by the proposed pumping station upgrade.

Given the small extension of existing building footprint, limited flood interaction in the FFA 1% AEP event and existing widespread and deep flooding in the 50% PMF event and rarer, the minor scale of the proposed upgrade of the existing pumping station posed onto the flooding behaviour permits a qualitative assessment, and the impact of the upgrade on flooding is expected to be minor.

In the future climate change (RCP4.5 2150) scenario the peak FFA 1% AEP flood levels would be increased by 0.8 m at the pumping station compared to the existing climate, and the site would change from being flood-free in the current climate FFA 1% AEP event to being covered by the flood extent. Water depths above ground surface would be 0.2 – 1.0 m at the Design case pumping station facilities in the FFA 1% AEP RCP4.5 2150 climate change scenario. The pump station upgrade will involve improvement to existing flood protection measures and new electrical installations will be designed with consideration of RCP4.5 2150 flood immunity and Sydney Water will continue to manage potential flooding impacts at the pump station. This will be undertaken separately from the GPOP WCM project.

## 7.2 Brine pipeline (relined section)

The brine pipeline between Camellia pumping station and the NSOOS repurposes an existing unused wastewater pipeline. This section will be relined so it is suitable for transfer of the more corrosive brine. Key flooding areas that the pipeline crosses under include:

- Vineyard Creek, where existing 1% AEP flood depths exceed 1.5 m
- Parramatta River, where normal tidal water depths exceed 4 m.

Since there are no above ground works, there are no flood impacts expected from operation of these elements of the project.

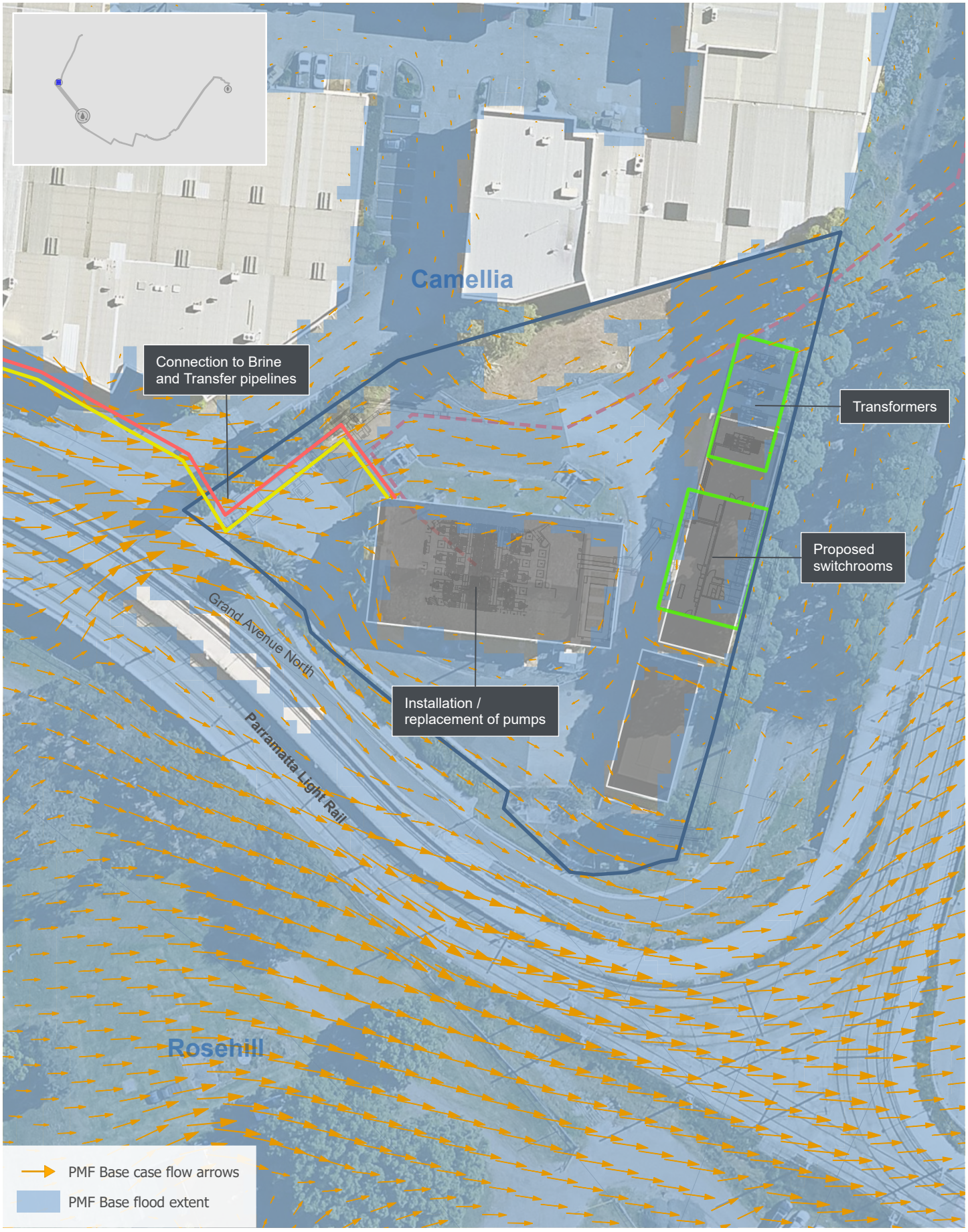



**Figure 7-1** Camellia pumping station – Existing and proposed building footprints and flow behaviour

## 7.3 Brine pipeline and transfer pipeline

The brine and transfer pipelines between the Camellia pumping station and WRRF would consist of underground pipelines. Air valves and inspection pits will be located below ground level along the pipelines. Key flooding areas that the pipelines would cross under include:

- Existing flooding areas around Grand Avenue and James Ruse Drive, where flooding from Claycliff Creek exceeds 2 m in the 1% AEP event
- Existing ponds in Rosehill Gardens Racecourse where the 1% AEP flood depths are 1.8 m.

Since there are no above ground works, there are no flood impacts expected from operation of these elements of the project.

## 7.4 River release pipeline

The river release pipeline, between the WRRF and the river release structure at the Parramatta River at Meadowbank, would pass under the following key flooding areas:

- Narawang Wetlands, where existing 1% AEP flood depths exceed 3 m.
- Flood ponding areas due to Haslams Creek flooding adjacent to UrbnSurf, with depths of 2 m in the 1% AEP event.
- Parramatta River. Normal tidal water depths exceed 4 m.
- Meadowbank Park, with flood depths on overbank areas adjacent to Smalls Creek and Charity Creek of 0.5 – 1 m in the 1% AEP event.
- Overland flooding is also expected to occur along the river release pipeline alignment through Silverwater. No flood studies have been completed to date in this area and hence the flood depths during storm events are not defined.

The river release pipeline will largely consist of underground pipelines, air valves and scour valves. No flood impacts are expected as a result of these elements.

The river release pipeline will also include two aerial crossings within the rectangular concrete channels of Smalls Creek and Charity Creek. An existing footbridge is situated at the Smalls Creek crossing location and it is proposed to reconstruct the bridge to accommodate the pipeline aerial crossing. The channel is approximately 2 m deep and the pipeline crossing consists of twin 0.61m diameter pipes. The existing footbridge is shown on Figure 7-2.

**Figure 7-2: Existing footbridge crossing of Smalls Creek**

There is the potential for resulting flood impacts upstream of the reconstructed footbridge and pipe crossing, although the magnitude of impacts depend on the combined nature of the reconstructed footbridge and pipeline crossing in comparison to the flow obstruction posed by the existing bridge. Maintaining the existing clearance of the reconstructed crossing above the channel would minimise any flood impacts. It is expected that only open space and sports fields would be affected by any flood impacts.

An aerial crossing of Charity Creek is also proposed, although there is no existing footbridge and hence the pipeline crossing may potentially pose a new flow obstruction in the creek channel. There is a risk of increases in flood levels and depths on the yards and ground level areas of adjacent medium density residential blocks, noting that garages and lobby areas only are likely to be affected and the habitable floors are above ground level. An elevated crossing above the channel banks would minimise potential flood impacts.

For both aerial crossings, as their design is further progressed in the future detailed design stage, the design review will confirm if there are no changes to existing flooding conditions Refer to Section 10.4 for management measures.

A barometric loop would be housed in a structure about 10m high (about two-storey) on the river release pipeline alignment at Meadow Crescent. The structure is not located in an area affected by mainstream and overland flooding, hence no flood impacts are expected.

The river release structure would be located on the bed of the Parramatta River, with approximately 300 mm diameter pipes and anchoring structures sitting up to about 0.6 m above the river bed. Given the 200 m width of the river, the deep permanent depth of the river at this location and the low profile of the release structure compared to the cross section of the river, the flood impacts resulting from the structure are expected to be negligible.

## 7.5 Compatibility with the hydraulic functions of flow conveyance in flood ways and storage areas of the land

Camellia pumping station, the brine pipeline, transfer pipeline and river release pipelines in the operation phase are generally compatible with the flood hydraulic function in the project area. The pipelines are mostly underground and do not interact with flooding. Above-ground project elements including the Camellia pumping station and barometric loop are located in low risk flood areas or are not flood-affected, respectively.

The river release pipeline aerial crossings of Smalls Creek and Charity Creek are over floodway areas and have the potential to impact on flow conveyance in these creeks. As their design is further progressed in the future detailed design stage, the design review will confirm no changes to existing flooding conditions or impacts to hydraulic function.

## 7.6 Property, infrastructure, social and economic impacts

Given minimal flood exposure on Camellia pumping station and the brine, transfer and river release pipelines, the potential flood impacts to property and infrastructure and social and economic aspects is generally expected to be minor.

During detailed design, the river release pipeline routes and aerial crossings designs will be progressed and assessed so they do not alter existing flood conditions.

# 8. Construction phase flood impact assessment

## 8.1 Potential flood risks at construction work areas

### 8.1.1 Camellia-Rosehill WRRF

The main construction activities (and sub-activities) with the potential to cause flooding impacts include, but are not limited to:

- Site establishment/levelling
- Establishment of construction compounds, laydown areas and ancillary facilities
- Stockpiling of soils and materials

The flood modelling indicates a generally low risk of flood impact to construction works on the Camellia-Rosehill WRRF site. There is overall low exposure to flooding in events up to and including the 50% of PMF event, while only some of the site would be flooded in the PMF as the raised area of site would remain flood-free.

Further detail on the potential impacts and mitigation measures is provided in Section 10.4.

**Earthworks**

Whilst establishment of construction compounds, laydown areas and ancillary facilities will occur in already cleared land, minor earthworks are likely to be required. Earthworks are likely to include:

- Levelling (expected to be minimal)
- Construction of hardstand areas
- Stockpiling of sediment and topsoil for works associated with the Camellia-Rosehill WRRF and landscaping
- Stockpiling of excess spoil generated during construction of the WRRF.

The inundation of the earthworks by floodwater has the potential to cause the scouring of disturbed surfaces and the transport of sediment and construction materials into the receiving drainage lines and waterways.

It would therefore be necessary to plan, implement and maintain measures that are aimed at managing the diversion of floodwater either through or around the construction areas. A broad outline of potential mitigation measures is provided in Section 10.4.

**Stockpiling of topsoil**

Excavated topsoil and imported fill would need to be stockpiled prior to being reused on the Project or transferred. Stockpiles of raw materials or spoil would be located as close as practical to the work area and appropriate environmental management measures would be implemented to minimise impacts on receiving waters from erosion and sedimentation.

Blockage of flow paths by stockpiles would also reduce flood flow conveyance and result in increased flood depths and redistribution of flows in adjacent areas. While the site is at low risk from flooding and is mostly flood-free in up to and including the 50% of PMF event, blockage of floodway flows in the PMF could result in flooding impacts to properties including Sydney Metro to the west of the site. Stockpiles should therefore be placed in areas adjacent to the floodway which are outside of active flow zones.

Stockpiles located on the floodplain can also lead to significant quantities of material being washed into the receiving drainage lines and waterways.

The locations within each construction work area and ancillary facility where materials would be stored would be subject to detailed design and construction planning.

Stockpile management during project construction would be detailed in the Construction Soil and Water Management Plan (CSWMP) and include locating stockpiles away from overland paths and providing stabilisation, watering and covering of stockpiles where necessary.

### 8.1.2 Camellia pumping station

Construction activities at Camellia pumping station include:

- Brine and transfer pipeline connection using open trenching technique.
- Demolition of existing transformer building and site shed.
- Construction of new switchroom and transformer building. Approximately 10 m x 8.4 m expansion of building footprint area compared to existing transformer building.
- Dry well floor modification – removal of 1.6 m thick concrete flooring, approx. 220 $m^3$ volume.
- Power conduits trenching and conduit installation.

The pumping station site is outside of the FFA 1% AEP flood extent except for localised flood depths to 0.5 m at the northern boundary of the site and is inundated in the 50% of PMF event to a depth of 2 m. Construction materials would be handled and stored primarily at nearby construction compounds. Trenching impacts are expected to be as per pipeline construction, refer to Section 8.1.3.

### 8.1.3 Pipeline construction

Pipeline construction for the project will involve the following methods:

- Brine pipeline between NSOOS and Camellia pumping station: relining of existing pipeline
- Brine pipeline and transfer pipeline between Camellia pumping station and WRRF: mostly horizontal directional drilling, localised trenching
- River release pipeline between WRRF and river release structure at Meadowbank: horizontal directional drilling, trenching.
- Construction is required within the Parramatta River at Meadowbank for the river release structure.

The extents of the pipeline construction methods are shown on the project description on Figure 1-1.

Installation of the pipeline via relining and horizontal directional drilling would be mostly underground with no surface disturbance except at section ends where surface work sites would be required.

Trenching will involve mostly below ground works with the ground surface broken to lay the pipeline in an open trench.

The main construction activities (and sub-activities) with the potential to cause flooding impacts include, but are not limited to:

- Temporary construction compounds and laydown areas
- Trenching
- Stockpiling
- Tunnelling
- Aerial crossings.

The abovementioned works have the potential to impact on flood behaviour along the pipeline routes and adjacent areas if not properly managed. Potential impacts from these works are discussed in Table 8-1.

**Construction compounds and material laydown areas**

There would be approximately 30 construction compounds proposed for the construction of the GPOP WCM pipelines. Construction compounds will be established in open space areas, existing car parking areas, currently vacant lots (predominantly industrial zone) and in selected road corridors. The compounds will be used for a variety of purposes including:

- Temporary buildings such as offices and meeting rooms, amenities and first aid facilities.
- Stockpiling for construction materials and stockpiling/sorting of waste material prior to disposal or reuse.
- Storage of site equipment, including bunded storage for any chemicals such as fuel.
- Tunnelling including the launch and receival points for sections of drilled pipeline construction, other activities associated with drillings such as the drill rig, spoil management and pipe placement.

A number of these compound sites are located near watercourses or are in the floodplain and are at risk from flooding. Other sites are not within watercourse floodplain areas but may be within overland flow areas.

**Trenching**

Open trenches have the potential to redistribute flood flow and result in flooding of new areas which are not usually flooded. Section 10.4 provides a summary of potential measures to manage these impacts.

**Stockpiling**

The construction of the pipelines would generate spoil, some of which would need to be temporarily stored in stockpile areas for reuse on site or otherwise disposed of. It would also be necessary to temporarily store imported construction materials.

As noted in Section 8.1.1, stockpiles located on the floodplain have the potential to obstruct floodwater and alter flooding patterns. Inundation of stockpile areas by floodwater can also lead to significant quantities of material being washed into the receiving drainage lines and waterways. The locations within each construction work area and ancillary facility where materials would be stored would be subject to detailed design and construction planning.

**HDD/trenchless construction methods**

Horizontal directional drilling and trenchless construction methods have the potential to re-distribute flood flow and result in flooding of new areas which are not usually flooded if floodwaters enter the tunnel and are conveyed to other areas, although potential impacts would be limited due to the relatively small size of HDD portals.

**Aerial crossings**

The project involves construction of two above ground aerial crossings along the river release pipeline alignment, over Smalls Creek and Charity Creek. Both crossings will be open span design above (at the top of) these rectangular concrete channels with no piers proposed within the channels.

Temporary access paths would be required to move machinery and materials to construction areas for each aerial crossings. Given the relatively narrow width of the channels (approximately 6 m width) it is not expected that the channels would need to be partially blocked with temporary work platforms for cranes within the channel. Some construction stages may require partial demolition of the channel lining.

**River release structure**

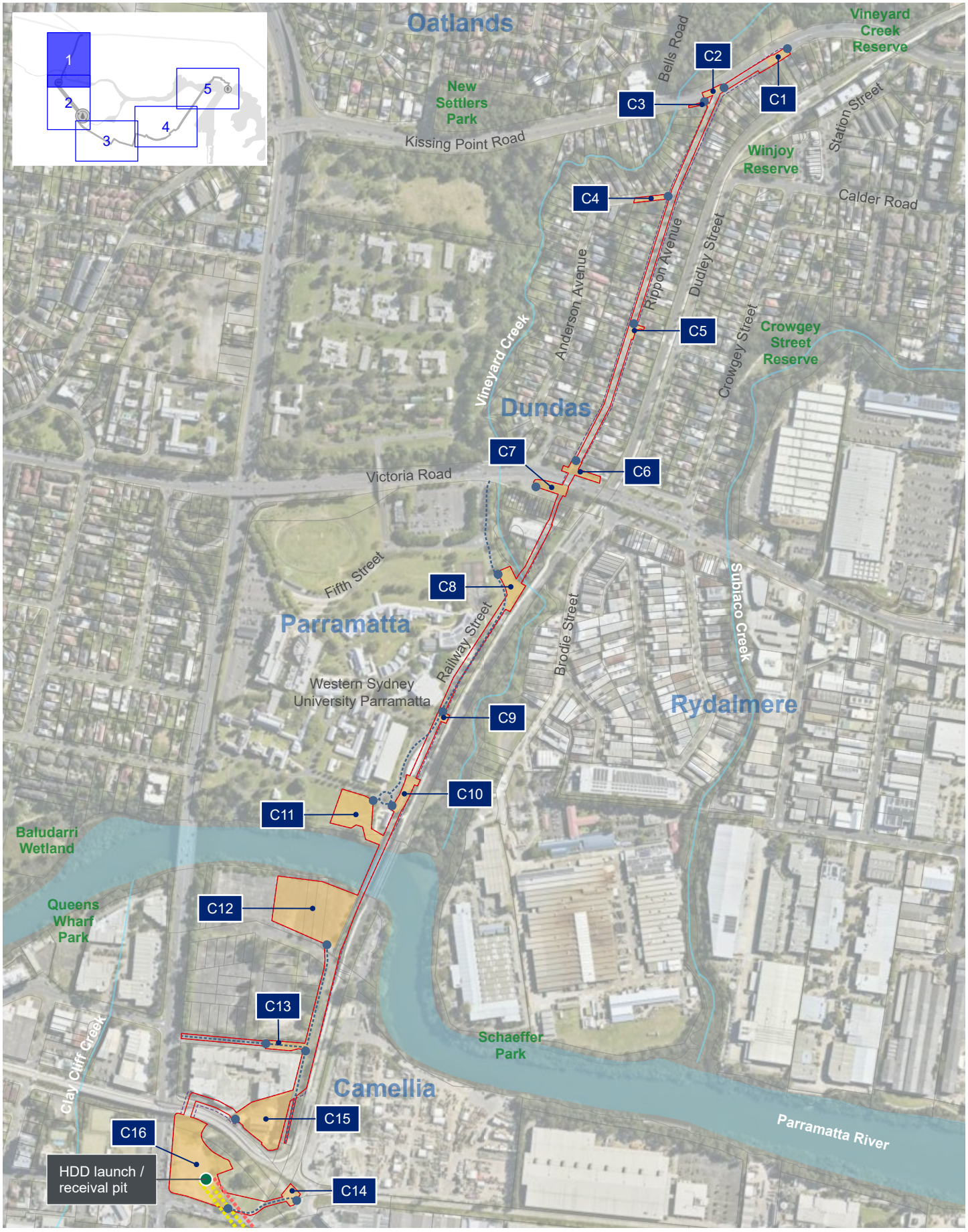
Construction of the river release structure will involve on-water placement of pipelines and diffuser elements onto the bed of the Parramatta River from a work barge. Dry bed construction site approaches using caissons or coffer dams etc. would also likely be employed along the pipeline within a short distance (within approximately 8 m) from the shoreline, which is expected to have negligible effects on river flood flow

behaviour. Construction materials and equipment would be handled and stored primarily at nearby construction compounds.

## 8.2 Potential construction flood impacts

Construction sites are shown on Figure 8-1 . The potential construction flood impacts are described in Table 8-1. A qualitative assessment of the impacts was undertaken with consideration of the nature of the flooding at the sites and likely construction activities. Details of site grading, stockpile locations and other construction activities on construction compounds are not confirmed, hence the construction activities were not modelled in the flood model. Where the sites are outside the GPOP WCM TUFLOW model extent, flood mapping from the following studies have been reviewed to assess potential impacts:

- Parramatta River Flood Study (Stantec, 2024)
- Sydney Olympic Park Master Plan 2050 - Flooding Assessment Report (Mott MacDonald, 2024)
- City of Ryde Flood Harmonisation Study – Flood Study Update (WMAwater, 2023).



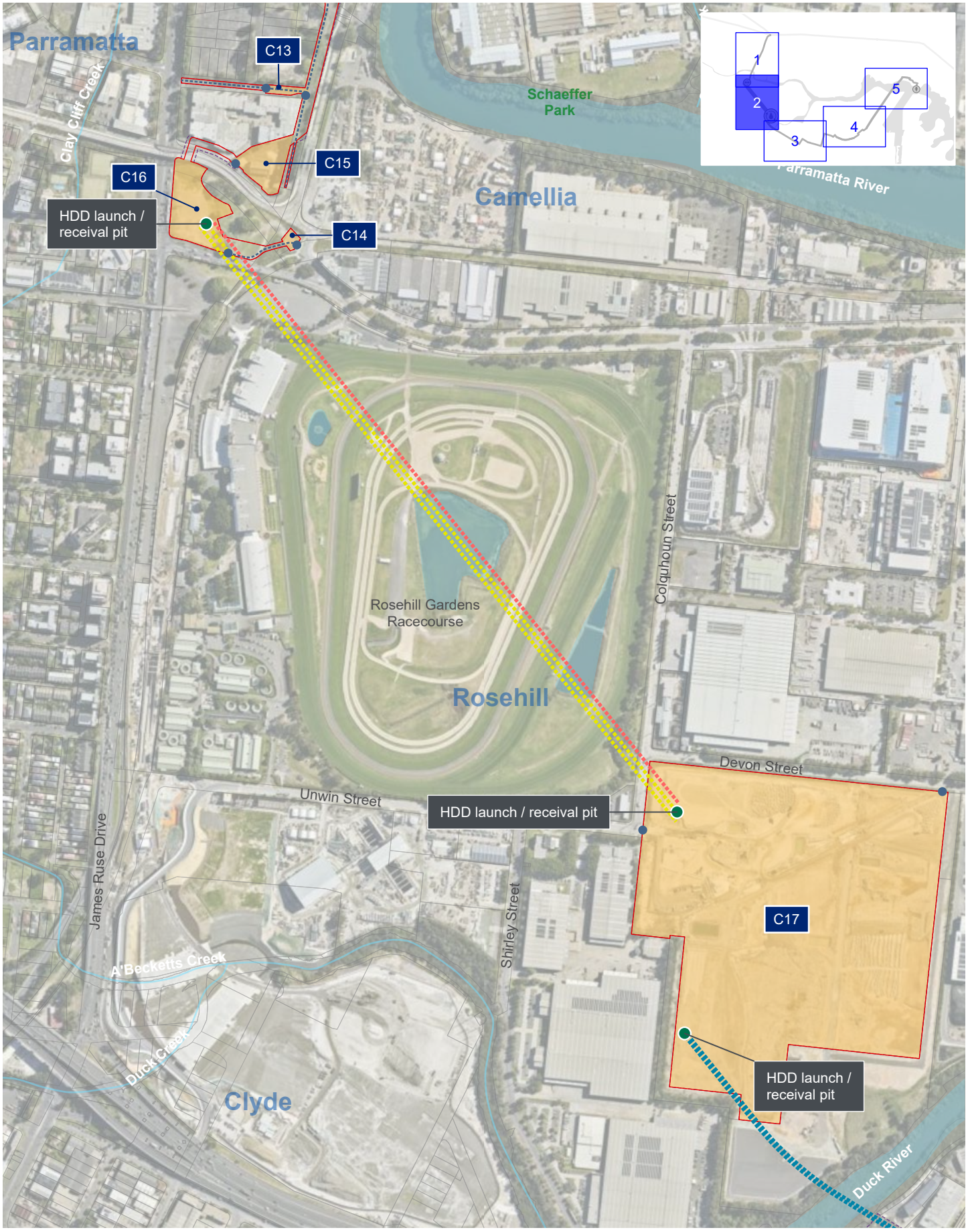

Impact area (IA)
Impact assessment area (IAA)
Proposed Transfer Pipeline - Trenchless
Proposed Brine Pipeline - Trenchless
HDD launch / receival pit
Indicative compound access
Indicative compound access routes
Indicative construction compounds

**Figure 8-1** Project impact area including indicative construction compounds

Sheet 1 of 5 0 100 200 300 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025
Scale: 1:8,000 @ A4
GDA2020 MGA Zone 56

N



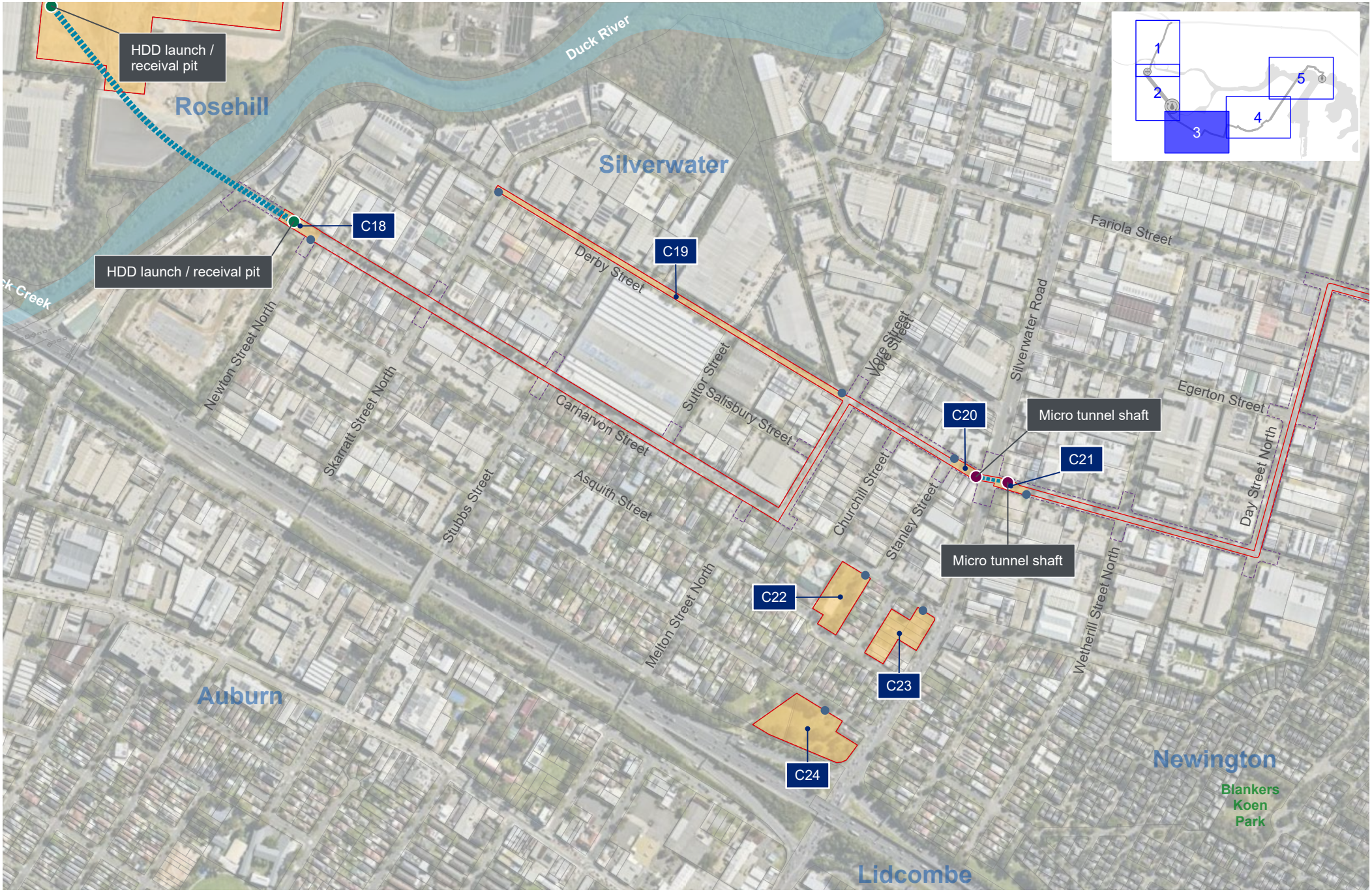

Impact area (IA)
Impact assessment area (IAA)
Proposed Transfer Pipeline - Trenchless
Proposed Brine Pipeline - Trenchless
Proposed River Release Pipeline - Trenchless
HDD launch / receival pit
Indicative compound access
Indicative compound access routes
Indicative construction compounds

**Figure 8-1** Project impact area including indicative construction compounds

Sheet 2 of 5 0 100 200 300 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025
Scale: 1:8,000 @ A4
GDA2020 MGA Zone 56

N




Impact area (IA)
Impact assessment area (IAA)
Proposed River Release Pipeline - Trenchless
HDD launch / receival pit
Micro tunnel shaft
Indicative compound access
Indicative construction compounds

**Figure 8-1** Project impact area including indicative construction compounds

Sheet 3 of 5

0 100 200 300 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:8,000 @ A4
GDA2020 MGA Zone 56

N


Impact area (IA)
Impact assessment area (IAA)
Proposed River Release Pipeline - Trenchless
HDD launch / receival pit
Indicative compound access
Indicative construction compounds

**Figure 8-1** Project impact area including indicative construction compounds

Sheet 4 of 5

0 100 200 300 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:8,000 @ A4
GDA2020 MGA Zone 56

N


Impact area (IA)
Impact assessment area (IAA)
Proposed River Release Pipeline - Trenchless
HDD launch / receival pit
Indicative compound access
Indicative compound access routes
Indicative construction compounds
Indicative Parramatta River construction area

**Figure 8-1** Project impact area including indicative construction compounds

Sheet 5 of 5

0 100 200 300 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:8,000 @ A4
GDA2020 MGA Zone 56

N

**Table 8-1. Potential construction impacts**

| Construction work area | Construction ancillary facilities / other areas | Flooding Threshold[1] | Proposed construction activities[2] | | | | | Description of existing flood behaviour | Potential impacts of construction activities on flood behaviour without mitigation |
|---|---|---|---|---|---|---|---|---|---|
| | | | Site facilities[3] | Material storage and stockpiling[4] | Earthworks/Pipe works[5] | Barometric loop | Other | | |
| Pipe relining | General construction method throughout alignment | 20% AEP | | | | | ✓ | Not affected by flooding between Kissing Point Road and Victoria Road.<br>Access pit locations are affected by mainstream and local flooding in 20% AEP event between Victoria Road and Parramatta River. Depths typically 0.3 – 0.5 m with max depth at access pit at/near construction site C8 adjacent to Vineyard Creek.<br>Access pit locations are affected by mainstream and local flooding in 20% AEP event between Parramatta River and Camellia pumping station. Depths typically 0.3 m in the 20% AEP event. | Flooding may impact relining activities at pipe access pits at various locations. In particular, those in the vicinity of compound site C8 immediately adjacent to Vineyard Creek. |
| Trenching | General construction method throughout alignment | Varies | | ✓ | ✓ | | | The proposed alignment includes lengths of trenching that are located within floodplains and could be subject to mainstream flooding. The trenching also intersects major overland flow paths and drainage channels Key locations are outlined below:<br>▪ Near Camellia pumping station: 10% AEP flooding 1 - 2 m depth<br>▪ Carnarvon Street between Stubbs Street and Suttor Street, Silverwater: Overland flow sag point<br>▪ Derby Street at Vore Street, Silverwater t: major overland flow path<br>▪ Derby Street east of Silverwater Road, Silverwater: local overland flow path in road<br>▪ Meadowbank Park: crossings of trunk drainage channels of Smalls Creek and Charity Creek.<br>All trench locations may be affected by stormwater drainage and local overland flows/flooding. | Flood impact to trench construction is likely during small storm events. This may redirect flows within the catchment, resulting in potential increases in flood depths or new areas of flooding around the locations where the redirected flows discharge back to the surface.<br>Incremental impacts of open trenching around Camellia pumping station on flood flow redistribution and flood depths are expected to be minor due to the short length of open trenching proposed in this area and pre-existing high depths of flooding. |
| HDD (Micro-tunnelling) | General construction method throughout alignment | Varies | | ✓ | ✓ | | | HDD is proposed along the pipeline alignment in a number of sections:<br>▪ Near Camellia pumping station to WRRF: north end exposed to 10% AEP flooding over 1 m depth. Southern end not flooded.<br>▪ WRRF to Carnarvon Street, Silverwater: Northern end flooded in PMF to 1.5 m depth. Southern end not affected by mainstream flooding.<br>▪ Derby Street under Silverwater Road, Silverwater: eastern and western ends affected by mainstream PMF 1 – 2 m depth.<br>▪ Newington to UrbnSurf south: Limited existing flood mapping available, appears to be outside 1% AEP mainstream flood extent.<br>▪ UrbanSurf north: Limited existing flood mapping available, appears to be outside 1% AEP mainstream flood extent at south and ends. Affected by 50% of PMF to 0.2 m depth at north end.<br>▪ All end points may be affected by stormwater drainage and local overland flows/flooding. | Risk of flood impact at the microtunnel launch and exit sites. Risk of redistribution of flows through tunnels to other parts of catchment, resulting in potential increases in flood depths or new areas of flooding around the locations where the redirected flows discharge back to the surface. |
| Barometric Loop | Located in Meadowbank | N/A | | | | ✓ | | Barometric loop proposed on Bank Street/ Meadow Crescent. Located along a high point with only minor local stormwater catchment. | Very low risk of flood impact during construction due to being located at a high point. |
| Construction Compounds | C1 | PMF | | | ✓ | | | Flood overtopping from Vineyard Creek over Kissing Point Road, affecting site to depths approx. 1 m in PMF. | Low risk of mainstream flooding due to elevation above creek. Potential for overland flows in roadway being redirected by construction activities onto adjacent residential properties. |

| Construction work area | Construction ancillary facilities / other areas | Flooding Threshold[1] | Proposed construction activities[2] | | | | | Description of existing flood behaviour | Potential impacts of construction activities on flood behaviour without mitigation |
|---|---|---|---|---|---|---|---|---|---|
| | | | Site facilities[3] | Material storage and stockpiling[4] | Earthworks/Pipe works[5] | Barometric loop | Other | | |
| Construction Compounds | C2 | PMF | | ✓ | ✓ | | | Flood overtopping from Vineyard Creek over Kissing Point Road, affecting site to depths approx. 0.5 m in PMF. | Low risk of mainstream flooding due to elevation above creek. Potential for overland flows in roadway being redirected by construction activities onto adjacent residential properties. |
| Construction Compounds | C3 | PMF | | ✓ | | | | Flood overtopping from Vineyard Creek over Kissing Point Road, affecting site to depths approx. 0.5-1 m in PMF. | Low risk of mainstream flooding due to elevation above creek. Potential for overland flows in roadway being redirected by construction activities onto adjacent residential properties. |
| Construction Compounds | C4 | Nil | | ✓ | ✓ | | | Not affected by mainstream flooding | Flood impacts not expected. |
| Construction Compounds | C5 | Nil | | ✓ | ✓ | | | Not affected by mainstream flooding | Flood impacts not expected. |
| Construction Compounds | C6 | PMF | | ✓ | ✓ | | | Fringe of flood extent affecting site to depths of approx. 0.5 – 0.7 m in PMF. | Minimal flood impact likely. |
| Construction Compounds | C7 | 20% AEP | ✓ | ✓ | ✓ | | | Fringe flooding affecting site to depths of 0.3 m in 20% AEP event, 0.5 – 0.7 m in 1% AEP event. | Potential minor impacts from filling of flood storage area if stockpiles are placed in flood areas. |
| Construction Compounds | C8 | 20% AEP | | | ✓ | | | Site is located immediately next to Vineyard Creek, likely in active flow zone. Affected by depths greater than 1.5 m in the 20% AEP event and larger. | Stockpiles could obstruct active flows and redirect flows, with potential increases in flood levels to adjacent areas – mostly open space.<br>Potential for localised scouring of natural surface. Stockpiles themselves may be eroded by flood flows. Site facilities likely to be flood-impacted. |
| Construction Compounds | C9 | Nil | | | ✓ | | | Not affected by flooding | No flood impacts expected. |
| Construction Compounds | C10 | 20% AEP | | ✓ | ✓ | | | Site is in a local low point and affected by flood ponding to 0.3 m depth in the 20% AEP event | Potential minor impacts from filling of flood storage area and redirection of overland flows if stockpiles are placed in flood areas. |
| Construction Compounds | C11 | 1% AEP | ✓ | ✓ | ✓ | | | Site is mostly outside 1% AEP flood extent except for small low-lying portion on riverbank with depths of 1 m. Site PMF depths 2 – 4 m. | Minimal flood impact likely. |
| Construction Compounds | C12 | 5% AEP | ✓ | ✓ | ✓ | | | Fringe flooding less than 0.1 m in 5% AEP event. Most of the site is flooded in the 1% AEP event with depths of 0.1 – 0.3 m. Not an active flow area. | Minimal flood impact likely due to shallow fringe flooding of the Parramatta River in the 1% AEP event. |
| Construction Compounds | C13 | 20% AEP | | ✓ | ✓ | | | Local flooding to depths of 0.5 m in the 20% AEP event. Not an active flow area. | Potential minor impacts from filling of flood storage area if stockpiles are placed in flood areas. |
| Construction Compounds | C14 | PMF | ✓ | | | | | Depths exceeding 2 m in the PMF. | Minimal flood impact likely. |
| Construction Compounds | C15 (Camellia pumping station) | >1% AEP | ✓ | ✓ | ✓ | | ✓ | Mostly flood-free in the 1% AEP except for northern corner of site with depths of 0.5 m. Flood depths of 2 m in the 50% PMF event. | Minimal flood impact likely given the nature of construction activities at the Camellia pumping station site. |
| Construction Compounds | C16 | <20% AEP | | ✓ | ✓ | | | Half of the site is inundated to over 1.5m depth in the 20% AEP event. | Potential for minor to moderate flood impacts depending on degree of site filling and stockpiling. |
| Construction Compounds | C17 (WRRF) | PMF | ✓ | ✓ | ✓ | | | Mostly flood-free on floodway in 50% PMF and smaller events. Flood depths 1.5 – 2.5 m in the PMF in the floodway. Flood-free in PMF on site filled embankment. | Minimal/nil flood impact likely in events up to and including PMF, if floodway active flow area is not obstructed by stockpiles. |
| Construction Compounds | C18 | Nil | | | ✓ | | | Not affected by mainstream flooding. | Minimal/nil flood impact likely. |
| Construction Compounds | C19 | 1% AEP | | | ✓ | | | Flood depths to 0.7 m in 1% AEP mainstream flood. Crosses local overland flow path. | Potential to obstruct local overland flood flows with redistribution of flows onto adjacent properties resulting in potential increases in flood depths or new areas of flooding. |
| Construction Compounds | C20 | 50% of PMF | | | ✓ | | | Flood depths to 0.7 m in 50% of PMF mainstream flood. Located in local overland flow path in Derby Street (modelling of overland flooding not available). | Minimal impacts to mainstream flooding expected. Potential to obstruct local overland flood flows with redistribution of flows onto adjacent properties resulting in potential increases in flood depths or new areas of flooding. |

| Construction work area | Construction ancillary facilities / other areas | Flooding Threshold[1] | Proposed construction activities[2] | | | | | Description of existing flood behaviour | Potential impacts of construction activities on flood behaviour without mitigation |
|---|---|---|---|---|---|---|---|---|---|
| | | | Site facilities[3] | Material storage and stockpiling[4] | Earthworks/Pipe works[5] | Barometric loop | Other | | |
| Construction Compounds | C21 | PMF | | | ✓ | | | Flood depths to 1.7 m in PMF mainstream flood. Located in local overland flow path in Derby Street (modelling of overland flooding not available). | Minimal impacts to mainstream flooding expected. Potential to obstruct local overland flood flows with redistribution of flows onto adjacent properties resulting in potential increases in flood depths or new areas of flooding. |
| Construction Compounds | C22 | Minor events | ✓ | ✓ | | | | Site is located within major overland flow path with trunk drainage channel passing through site. Overland flood modelling not available.<br>Affected by mainstream PMF event with depths exceeding 2 m. | Potential of material flood impacts to adjacent properties due to obstruction and redirection of major overland flows resulting in potential increases in flood depths or new areas of flooding. |
| Construction Compounds | C23 | PMF | ✓ | ✓ | | | | Fringe flooding in mainstream PMF event with depths to 0.3 m. | Minimal flood impacts likely. |
| Construction Compounds | C24 | Minor events | ✓ | ✓ | | | | Site is located within major overland flow path with trunk drainage channel passing through site. Overland flood modelling not available.<br>Affected by mainstream PMF event with depths exceeding 1 m. | Potential of material flood impacts to adjacent properties due to obstruction and redirection of major overland flows resulting in potential increases in flood depths or new areas of flooding. |
| Construction Compounds | C25 | Nil | | ✓ | ✓ | | | Outside of available modelling area but located on high ground. Not expected to be affected by flooding. | No flood impacts expected. |
| Construction Compounds | C26 | PMF? | | ✓ | ✓ | | | Outside of mapped 1% AEP flood extent. May be affected by PMF fringe flooding from Haslams Creek although flood mapping not publicly available. | Minimal flood impacts likely. |
| Construction Compounds | C27 | PMF? | ✓ | ✓ | ✓ | | | Local flooding/stormwater in 1% AEP event possible. May be affected by PMF fringe flooding from Haslams Creek although flood mapping not publicly available. | Minimal flood impacts likely |
| Construction Compounds | C28 | 1% AEP | ✓ | ✓ | ✓ | | | Flood depths in 1% AEP event to 1 m in overbank areas. Site includes crossing of Smalls Creek and Charity Creek. | Potential flood impacts due to blockage of flows at Smalls Creek and Charity Creek crossings with trench pipeline laying method. Flood impacts and redistribution of flow onto residential properties along Charity Creek resulting in potential increases in flood depths or new areas of flooding. |
| Construction Compounds | C29 | PMF | ✓ | ✓ | ✓ | | | Mainstream flooding affects southern end of site to depths of 0.3 m. Site is located on hillside and away from overland flow paths. | Negligible flood impacts expected. |
| Construction Compounds | C30 | 10% AEP | ✓ | ✓ | ✓ | | ✓ | Site is in intertidal zone and riverside car park. Car park areas affected by depths of up to 0.5 m along low-lying edge of site. | Negligible flood impacts expected. |
| Construction Compounds | C31 | 1% AEP | ✓ | ✓ | ✓ | | | Site is in intertidal zone and riverside car park. Car park areas affected by depths of up to 0.5 m along low-lying edge of site in 1% AEP event.<br>Construction site also includes on-water areas for installation of river release structure. | Negligible flood impacts expected. |

Notes:

1 The assessed threshold of flooding is based on the existing case.

2 Refer to Section 8.1 for a description of flood risks associated with each construction activity.

3 Site facilities include site offices, staff amenities, stores and laydown, workshops and parking.

4 Spoil management includes stockpiling and treatment of excavated material.

5 Earthworks includes construction of road and drainage works.

6 Barometric loop includes supporting structure of loop

### 8.2.1 Construction impacts on the social and economic costs to the community

There is potential for increased costs to the community borne by flooding impacts caused from construction activities, such as by obstructing and redirecting overland flows by temporary stockpiles, trenching and piping works resulting in increased flooding depths in adjacent properties, if undertaken without appropriate mitigation. Construction planning is to include implementing appropriate measures to minimise the risk of resulting flood impacts, particularly in construction areas which intersect main flow paths and with private properties within the vicinity. Refer to Section 10.4 for the proposed management measures.

### 8.2.2 Construction impacts to emergency management

The main emergency access routes in the vicinity of construction sites include Grand Avenue, James Ruse Drive and Silverwater Road.

Construction site C16 adjoins the intersection of Grand Avenue and James Ruse Drive. There is potential for minor to moderate increases in flood depths in the area depending on degree of site filling and stockpiling on the site, which can be minimised with management measures such as placing stockpiles outside of flood areas.

The Grand Avenue and James Ruse Drive intersection is already flood-affected in frequent flood events during which vehicle access is likely to be cut. The construction activities are expected to cause only minor or negligible increases in flood levels during the frequent events. Implementing management measures will minimise impacts to flood depths and durations in larger events. Therefore, with management measures in place, the impact to existing emergency access at Grand Avenue and James Ruse Drive is expected to be minor.

Two microtunnelling construction sites (C20, C21) would be located at either side of Silverwater Road at Derby Street. There is potential for construction activities (e.g. temporary stockpiles) to redirect overland flows at this location, although the overland flows are expected to be relatively minor only and disruption to trafficability of Silverwater Road by overland flows in the construction phase is not expected to be worsened compared to the base case. Therefore the impact to existing emergency access on Silverwater Road in the construction phase is expected to be minor.

On GPOP WCM sites, the project would place an increased population, consisting of approximately 10 WRRF staff, in an area with existing flood evacuation constraints. A flood management plan will be developed for the operation of the WRRF site including procedures for early evacuation of the site in the event of a flood, refer to management measures in Section 10.4.

# 9. Cumulative flood impacts

A qualitative assessment of the potential cumulative flood impacts of the GPOP WCM project with other proposed development has been undertaken. Cumulative impacts could occur as a result of other proposed developments interacting with the changed flood flow conditions caused by the project. For example, blockage of flow paths by the project or cumulative loss of floodplain storage. The proximity of other proposed development to the project would increase the magnitude, extent and likelihood of cumulative impacts.

As discussed in Section 6.2, the flooding impacts resulting from the project are expected to be generally minor and localised. The cumulative impacts due to the combined effects of other proposed developments are generally unlikely or expected to be minor and localised. Flood impacts from the Camellia – Rosehill rezoning masterplan, in combination with the Camellia-Rosehill WRRF, are currently being assessed by DPHI. It is expected that the WRRF would have only minor contribution to any cumulative flood impacts.

A review of approved and proposed developments and development projects in the vicinity of the project is provided in Table 9-1 and shown on Figure 9-1. Those within about 1 km of the project are discussed for potential cumulative flood impacts.

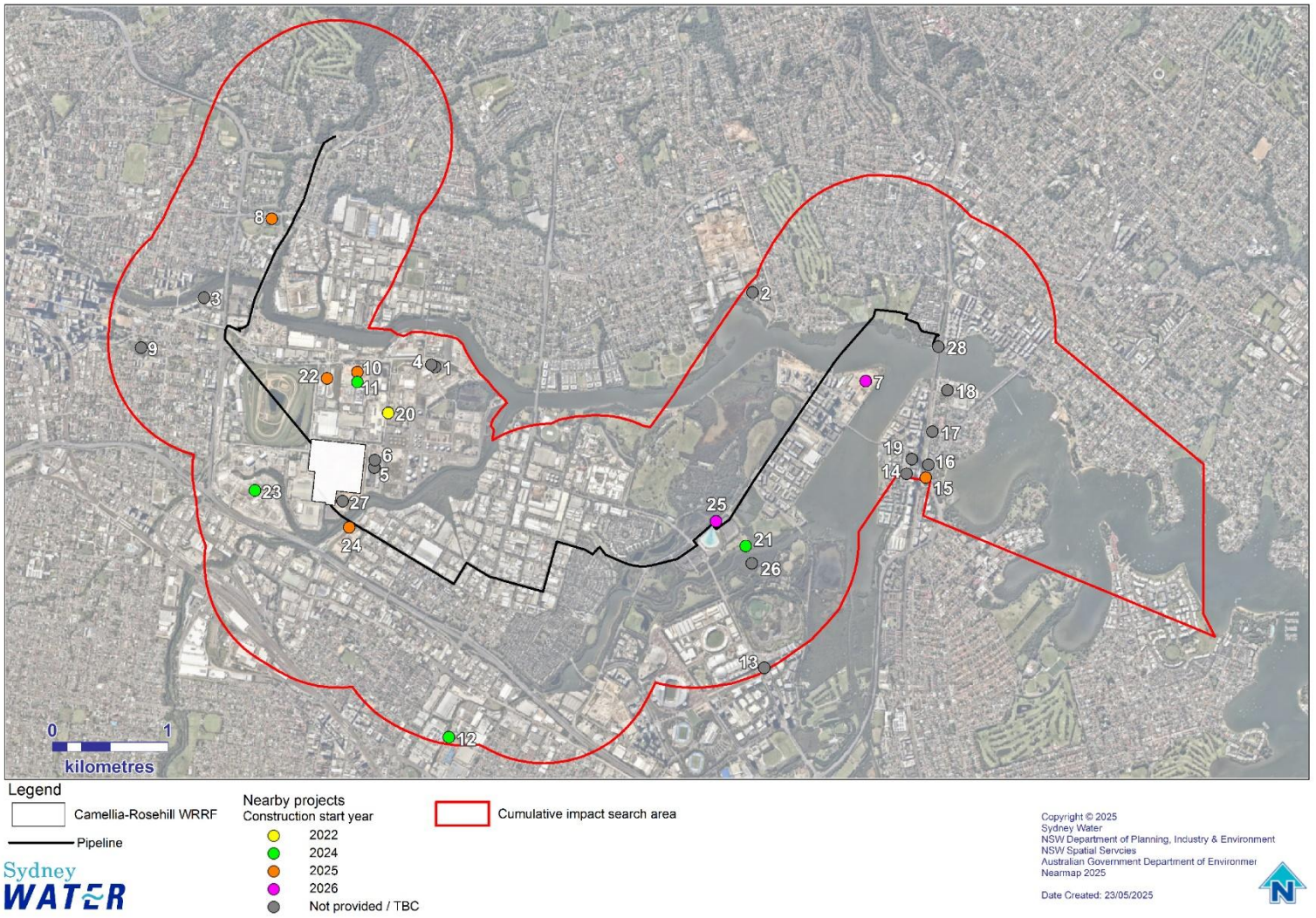



**Figure 9-1. Approved developments in cumulative impact assessment**

**Table 9-1. Cumulative flood impacts – Flood-relevant developments**

| Map ID | Project ID | LGA | Project name | Address | Distance from project | Description of project | Cumulative flood impacts |
|---|---|---|---|---|---|---|---|
| 1 | SSD-77870968 | City of Parramatta | Rosehill Resource Recovery Facility | 12A Grand Avenue Rosehill NSW 2142 | 0.85 km | Construction and operation of a resource recovery facility (RRF) and concrete batching plant. The RRF has a proposed capacity of 250,000 tonnes per annum. The concrete batching plant is anticipated to produce 250,000 tonnes per annum of concrete | No cumulative flood impacts expected.<br>Similar to current land use. Flood impact assessment not yet completed.<br>The GPOP project is not predicted to result in any flood impacts in this area for accumulation. |
| 4 | SSD-65654458 | City of Parramatta | SAMI - Camellia - Bitumen Plant Redevelopment | 12 Grand Avenue, Camellia | 0.8 km | Redevelopment of an existing bitumen storage and processing facility, with ancillary office and laboratory to service operations on the site. | No cumulative flood impacts expected.<br>Similar to current land use. Flood impact assessment not yet completed.<br>The GPOP project is not predicted to result in any flood impacts in this area for accumulation. |
| 6 | SSD-10459-Mod-4 | City of Parramatta | Mod 4 - DSRRC throughput increase | 6//DP1271928 | Directly adjacent to WRRF (east) | Downer proposes to modify the consent to enable an increase in annual RAP processing from 250,000 to 375,000 tonnes per annum | No cumulative flood impacts expected.<br>Similar to current land use. No change to levels of work on site that would affect previous flood assessment undertaken.<br>The GPOP WCM project is not predicted to result in any flood impacts in this area for accumulation. |
| 20 | N/A | N/A | Camellia-Rosehill Place Strategy | Camellia Precinct | Overlaps with the project | The place strategy is a 20-year plan for the renewal of Camellia-Rosehill including a new town centre and enhanced entertainment precinct, new urban services precinct and land retained for heavy industry – all supported by improved transport connections and new public open spaces. | Flood impacts from the Camellia – Rosehill rezoning masterplan, in combination with the Camellia-Rosehill WRRF, are currently being assessed by DPHI. It is expected that the WRRF would have only minor contribution to any cumulative flood impacts |
| 21 | N/A | N/A | SOPA Master Plan | Sydney Olympic Park | Overlaps with the project | Master Plan 2050 proposes to deliver a total of up to 13,000 homes, 32,000 jobs, 5 to 10 percent affordable housing, new hotel accommodation, more space for education and health, new community sports and leisure centres, a new library and community hub, a new cultural centre, 2 new school education sites, 7 new public spaces, 4 new sports fields and over 10 playgrounds. | Outside the WRRF flood modelling domain.<br>No expected GPOP WCM operational phase impacts due to river release pipeline – no above-ground permanent works.<br>No cumulative impacts expected. |
| 22 | SSI-10035 | City of Parramatta | Parramatta Light Rail Stage 2 | Various lots | Overlaps with the project | Construction and operation of an approx. ten-kilometre two-way light rail line connecting Stage 1 and the Parramatta CBD to Sydney Olympic Park via Camellia, Rydalmere, Ermington, Melrose Park and Wentworth Point. | PLR Stage 2 is incorporated into the Camellia-Rosehill WRRF flood modelling for both Base and Design cases.<br>The GPOP WCM project is not predicted to result in any flood impacts interaction or accumulation with PLR 2. No cumulative impacts expected. |
| 23 | SSI-22765520 | Cumberland | Sydney Metro West - Rail infrastructure, stations, precincts and operations (Stage 3) | Various lots including Clyde Stabling depot (Unwin Street) | <1km | Application for major civil construction (consisting of tunnel fit-out, station building and fit-out) and operation of the line between Westmead and Sydney CBD. | Stage 1 of the Sydney Metro West project (Concept and major civil construction work) for Clyde stabling and maintenance facility and Rosehill services facility is incorporated into the Camellia-Rosehill WRRF flood modelling for both Base and Design cases. No cumulative impacts of the GPOP WCM project with the Sydney Metro West Stage 3 works at Clyde and Rosehill are expected as the Camellia-Rosehill WRRF and GPOP WCM flood impacts do not extend to the Metro site for interaction or accumulation.<br>Sydney Metro West Stage 3 works at Parramatta and Westmead Station sites are within the WRRF flood model domain. No cumulative impacts with GPOP WCM project are expected as the WRRF and GPOP flood impacts do not extend to these Metro sites for interaction or accumulation.<br>All other Sydney Metro West Stage 3 sites (Clyde MSF, Rosehill services facility, Rosehill tunnel dive and portal) are within the GPOP assessment area and have been considered in Section 5.1.1 of this report. |
| 24 | N/A | City of Parramatta | Duck River Nature Trail | Various lots | Overlaps with the project | To be delivered in three stages, generous new boardwalks and pedestrian and cyclist paths along the eastern edge of Duck River, will create access to the foreshore and enhance the quality of the riverside landscapes. | No flood assessment undertaken for this project, however, flood impacts are expected to be negligible due to the nature of the project. Further, the GPOP WCM project is not predicted to result in any flood impacts in this area.<br>No cumulative flood impacts with GPOP WCM project expected. |

| Map ID | Project ID | LGA | Project name | Address | Distance from project | Description of project | Cumulative flood impacts |
|---|---|---|---|---|---|---|---|
| 25 | N/A | City of Parramatta | Hill Road Project | Hill Road from Wentworth Point to Lidcombe, between Burroway Road to Haslams Marker (John Ian wing Parade) | Overlaps with the project | No details available. | No details available for cumulative flood impact assessment. |
| 26 | N/A | TBC | Placeholder: SOPA RW Networks | TBC | TBC | No details available. | No details available for cumulative flood impact assessment. |
| 27 | SSD-10459-Mod-5 (TBC)-4 | City of Parramatta | Central Sydney Industrial Estate SSD 10459 Mod 5 | 6//DP1271928 | Directly adjacent to WRRF (east and south) | This relates to the residual land from Sydney Water's acquisition of the site. Potential subdivision and development of industrial lots. | No details available for cumulative flood impact assessment, however, location of this project in the vicinity of the WRRF may interact with PMF flows and result in flooding impacts.<br>No cumulative impacts expected in the 1% AEP event due to limited flood exposure of this site and Camellia-Rosehill WRRF site. |
| 28 | N/A | City of Ryde | Meadowbank Bridge Remediation | Meadowbank Bridge (John Whitton Bridge) | Adjacent to/ overlaps with the project (near river release structure construction) | Transport for NSW will repair and upgrade the heritage-listed Meadowbank bridge to maintain this vital pedestrian and cyclist corridor across the Parramatta River. | No cumulative flood impacts expected due to nature of works and siting above the PMF. |

# 10. Key issues and risks to be managed

## 10.1 Summary of flood impacts

A summary of the flood impact assessment is provided below:

- Impacts to flood levels, depths, extent, velocity, flood hazard and duration of inundation resulting from the project operation phase are generally predicted to be minor in all flood events up to and including the PMF in addition to 1% AEP climate change flood events. This includes effects on flooding resulting from the Camellia-Rosehill WRRF, Camellia pumping station, brine and transfer pipelines and the large majority of the river release pipeline.
- There may be changes to flood behaviour resulting from the aerial crossings of the river release pipeline over Smalls Creek and Charity Creek in Meadowbank Park, with potential increases in flood depths and levels, unless the design of the aerial crossings are above existing levels. For both aerial crossings, as their design is further progressed in the future detailed design stage, the design review will confirm if there are no changes to existing flooding conditions
- The impacts to flooding conditions at the project works due to increased rainfall, flood flows and sea level rise with climate change are expected to be minor. Key areas of the Camellia-Rosehill WRRF site are situated at least 0.5 m above the FFA 1% AEP climate change (RCP8.5 2150) flood level.
- Construction impacts are generally expected to be minor. There are several construction compounds located within high flood hazard areas where the risk of flood impacts to the construction site and of impacts resulting from construction activities is increased.
- The cumulative impacts due to the combined effects of other proposed developments are generally unlikely, or expected to be minor and localised. Flood impacts from the Camellia – Rosehill rezoning masterplan, in combination with the Camellia-Rosehill WRRF, are currently being assessed by DPHI. It is expected that the WRRF would have only minor contribution to any cumulative flood impacts.

## 10.2 Project design objectives compliance

The compliance with achieving the project design objectives is summarised in Table 10-1.

**Table 10-1. Project design objectives compliance**

| Condition | Comment on compliance |
|---|---|
| Electrical assets associated with the Project would be designed to be located outside of the 1% AEP flood level. | Expected to be compliant. The Camellia-Rosehill WRRF is largely outside of the 1% AEP extent. Camellia pumping station is outside the 1% AEP extent.<br>Refer to management measures in Section 10.4 for further consideration. |
| Parts of the Camellia-Rosehill WRRF site would be raised with natural material to reduce interaction with existing contamination and place critical infrastructure above the 1% AEP flood area. | Compliant. |
| Minimise increases in flood levels due to permanent infrastructure during flood events up to and including the 1% AEP event, which will include allowances for climate change impacts. Target flood level increase thresholds:<br>▪ Buildings: 10 mm if flooded above floor<br>▪ Buildings/Open space: 50 mm if buildings not flooded above floor. | Expected to be compliant. Flood impacts resulting from the WRRF in the 1% AEP event (existing climate and with climate change) are less than 10 mm. Refer to Section 6.2.1 and Section 7.Flood impacts resulting from river release pipeline to be confirmed at detailed design. Refer to management measures in Section 10.4 for further consideration. |

| Condition | Comment on compliance |
|---|---|
| Minimise increases in flood levels due to temporary infrastructure during flood events up to and including the 5% AEP event. | Expected to be compliant. Refer to management measures in Section 10.4 for further consideration. |
| Potential flood impacts to sensitive receivers including Sydney Metro West would be considered for flood events up to and including the PMF. | Compliant. Refer Section 6.2.9. |
| Durations of inundation not increased by more than 1 hour in up to and including the 1% AEP event. | Compliant. Refer to Section 6.2.6. |
| No additional private properties would be affected by flooding up to and including the 1% AEP flood event due to permanent infrastructure. | Expected to be compliant. Flood impacts resulting from the Camellia-Rosehill WRRF in the 1% AEP event (existing climate and with climate change) are less than 10 mm. Refer to Section<br>Flood impacts resulting from river release pipeline to be confirmed at detailed design. Refer to management measures in Section 10.4 for further consideration. |
| Dedicated evacuation routes would not be adversely impacted in flood events up to and including the PMF | Compliant. Refer to Section 6.2.11. |
| Facilitate improvements to flooding in the Precinct with appropriate design provisions and proposed drainage infrastructure, where possible. | Compliant. Section 6.2.1 describes reductions in flood depths in Devon Street resulting from proposed drainage infrastructure at the Camellia-Rosehill WRRF. |
| The potential for soil erosion and scouring is reduced for events up to and including the 1% AEP event. | Compliant. Refer to Section 6.2.2. |

## 10.3 Climate change impacts

The risk of increased flood impacts and exposure with future climate change is negligible to minor for the Camellia-Rosehill WRRF. The flooding assessment of climate change impacts to flooding indicates that the future 1% AEP flooding (with climate change) would be contained within reserved drainage flow paths on the WRRF and the site filled embankment and Administration building habitable floor levels would be elevated above the FFA 1% AEP climate change flood level.

There is risk of increased flood exposure at Camellia pumping station, with the FFA 1% AEP flood level increasing by 0.8 m from the existing climate scenario to the RCP4.5 2150 scenario. Water depths above ground surface of 0.2 – 1.0 m would occur at the Design case pumping station facilities in the FFA 1% AEP climate change (RCP4.5 2150) scenario. The pump station upgrade will involve improvement to existing flood protection measures and new electrical installations will be designed with consideration of RCP4.5 2150 flood immunity and Sydney Water will continue to manage potential flooding impacts at the pump station. This will be undertaken separately from the GPOP WCM project.

## 10.4 Management measures

The mitigation and management measures described in Table 10-2 have been identified to address the potential flood impacts of the Project.

**Table 10-2 Flooding management measures**

| ID | Management measure | Applicable area |
|---|---|---|
| **Construction** | | |
| FL1 | A flood management plan will be prepared as part of the Construction Environmental Management Plan (CEMP) for the proposed construction works that will describe the processes for flood preparedness, materials management, weather monitoring, flood incident management and site management during construction. Flood incident management measures should be prepared in consultation with NSW SES and relevant local councils. | All construction areas |
| FL2 | Maintain existing hydraulic capacity where practicable for activities that may impact existing drainage systems during construction. | All |
| FL3 | Plan excavation of open trenches and microtunnelling/HDD to avoid potential flooding impacts to people and property, including:<br>▪ Planning excavation to avoid periods of forecast heavy rain<br>▪ Backfilling excavations promptly.<br>▪ Microtunnelling/HDD entry and exit points should be protected from floodwater entry, where possible. | All |
| FL4 | Plan construction activities to locate spoil stockpiles in areas which are not subject to frequent inundation by floodwater. | All.<br>Focus on C7, C8, C10, C13, C16, C19, C22, C24, C28. |
| FL5 | Plan construction activities to locate construction facilities outside high flood hazard areas on a 1% AEP flood, where possible. | All.<br>Focus on C7, C8, C10, C13, C16, C19, C22, C24, C28. |
| **Operation** | | |
| FL6 | The design of the proposed aerial crossings of Smalls Creek and Charity Creek will be reviewed during detailed design. If required, the design of the aerial crossings will be refined to minimise the potential flood impacts. | Aerial crossings |
| FL7 | Prepare and implement a flood management plan for the operation of the WRRF which will describe the procedures for planning and responding to a flood event. Early evacuation preparedness will be implemented in favour of sheltering in place. | WRRF |

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WMAwater (2023) Flood Harmonisation Study – Flood Study Update. Prepared for City of Ryde.

# Appendix A. Hydrologic outcomes

**Table A-1. Design flood event flows – TUFLOW model – Base case**

| Location | Flood event | | | | | | |
|---|---|---|---|---|---|---|---|
| | 10% AEP | 5% AEP | FFA 1% AEP | FFA 1% AEP RCP4.5 2150 | FFA 1% AEP RCP8.5 2150 | 50% of PMF | PMF |
| Parramatta River U/S Parramatta Stadium | 379.1 | 467.1 | 738.0 | 817.1 | 925.3 | 1568.6 | 3424.3 |
| Parramatta River at Charles Street weir | 388.0 | 482.7 | 741.9 | 807.1 | 910.8 | 1557.5 | 3230.5 |
| Parramatta River at Parramatta Light Rail Carlingford Line bridge | 390.1 | 489.9 | 769.8 | 827.8 | 920.8 | 1408.7 | 1975.3 |
| Parramatta River at Silverwater Road bridge | 578.2 | 726.9 | 1152.5 | 1288.8 | 1428.6 | 2136.1 | 3991.2 |
| Parramatta River U/S Wentworth Point | 595.1 | 738.5 | 1133.5 | 1316.0 | 1473.3 | 2010.7 | 4056.0 |
| A'Becketts Creek D/S Good Street | 36.4 | 43.3 | 77.7 | 88.4 | 105.4 | 197.9 | 453.3 |
| Duck Creek U/S Duck River junction | 72.1 | 81.8 | 141.5 | 154.6 | 171.1 | 232.7 | 386.8 |
| Duck River U/S M4 Motorway | 88.4 | 115.2 | 209.0 | 233.2 | 260.9 | 338.7 | 672.8 |
| Duck River floodplain flow west of WRRF | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 18.5 | 168.1 |
| Duck River D/S Duck Creek junction | 158.0 | 196.2 | 345.9 | 378.8 | 422.4 | 567.4 | 936.2 |

# Appendix B. Flood mapping – Base case

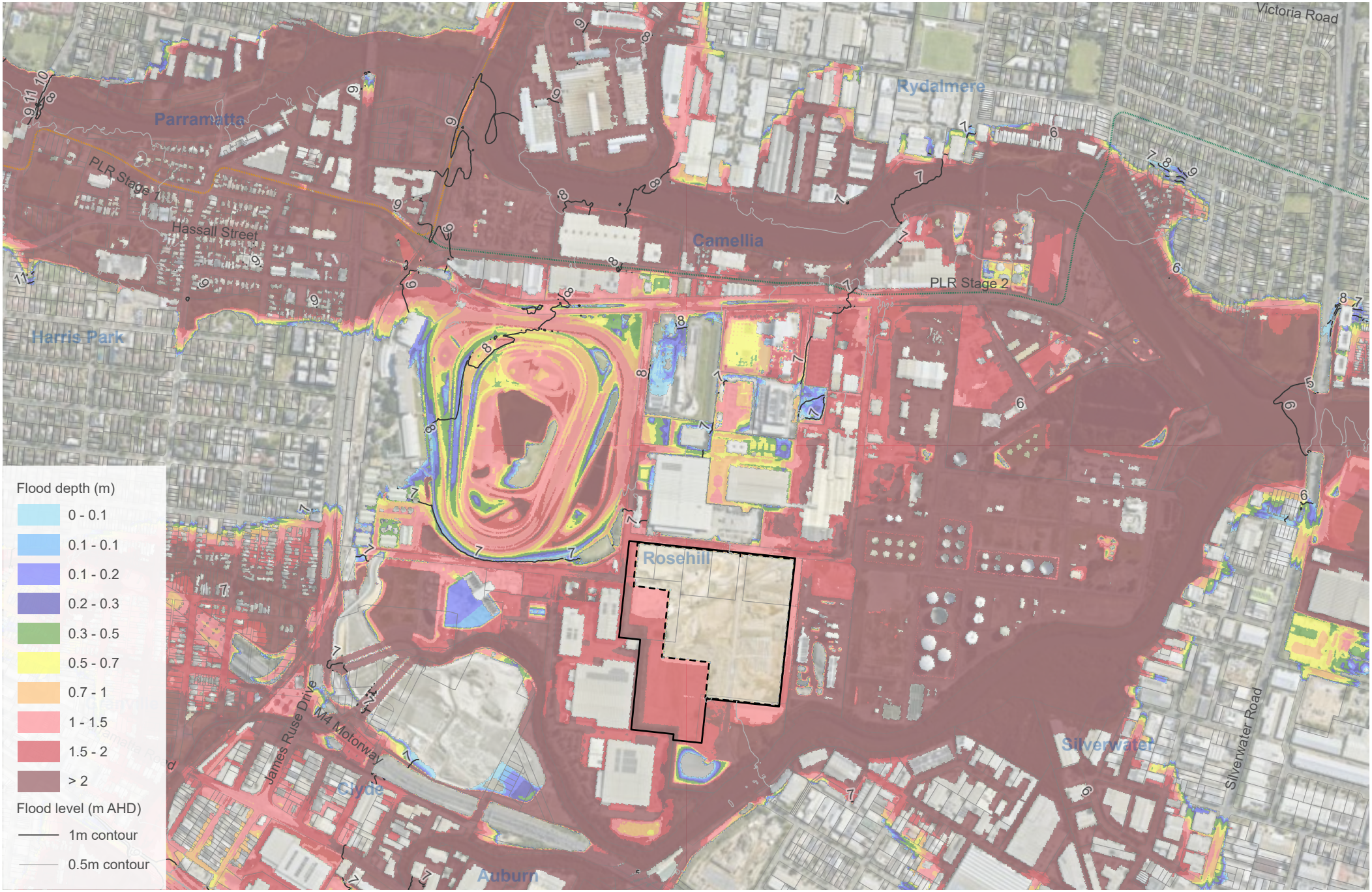



**Figure B-1** Base Case Flood Level and Depth PMF Event

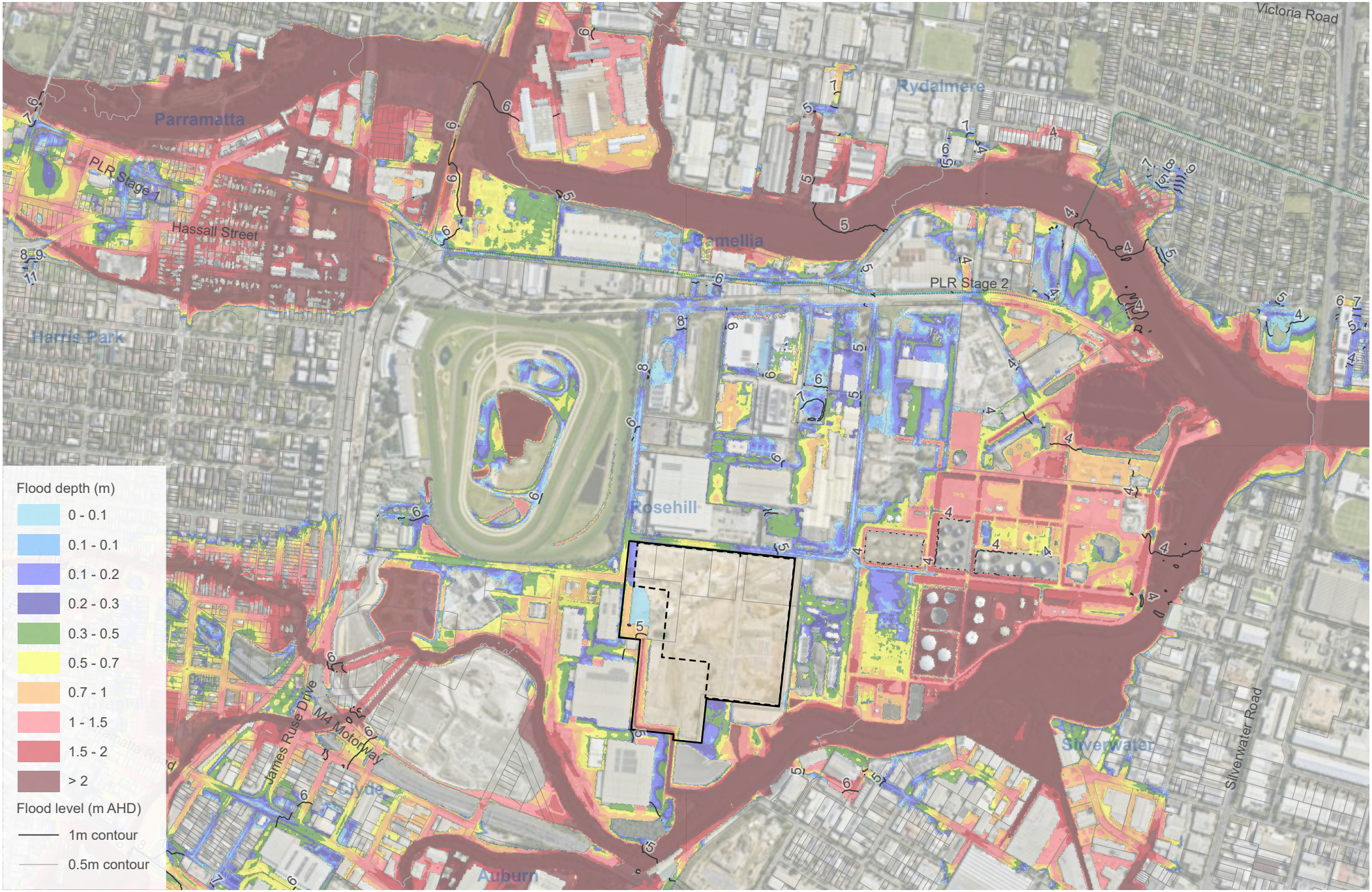
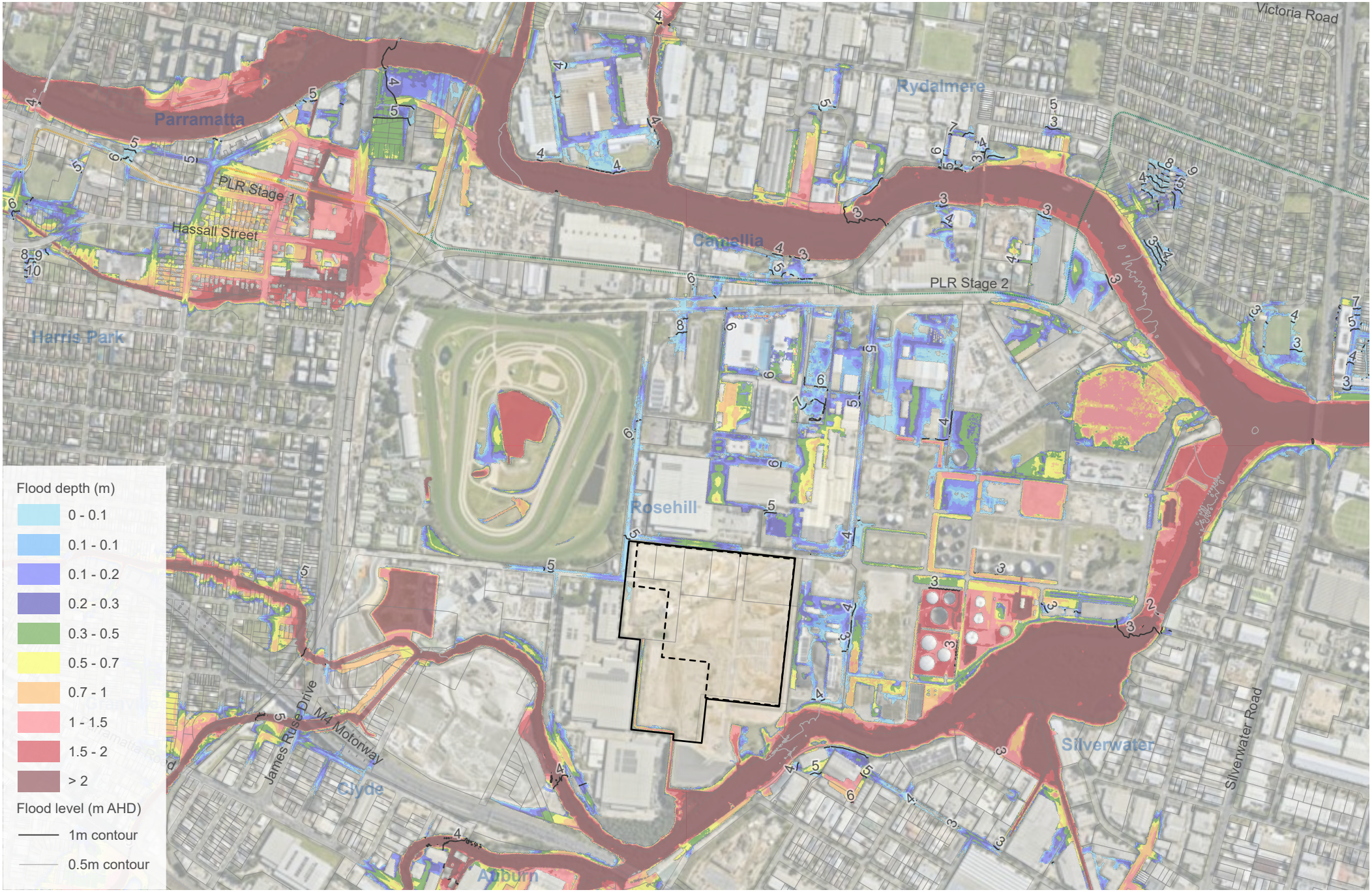



**Figure B-2** Base Case Flood Level and Depth 50% of PMF Event




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

**Figure B-3** Base Case Flood Level and Depth FFA 1% AEP Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N

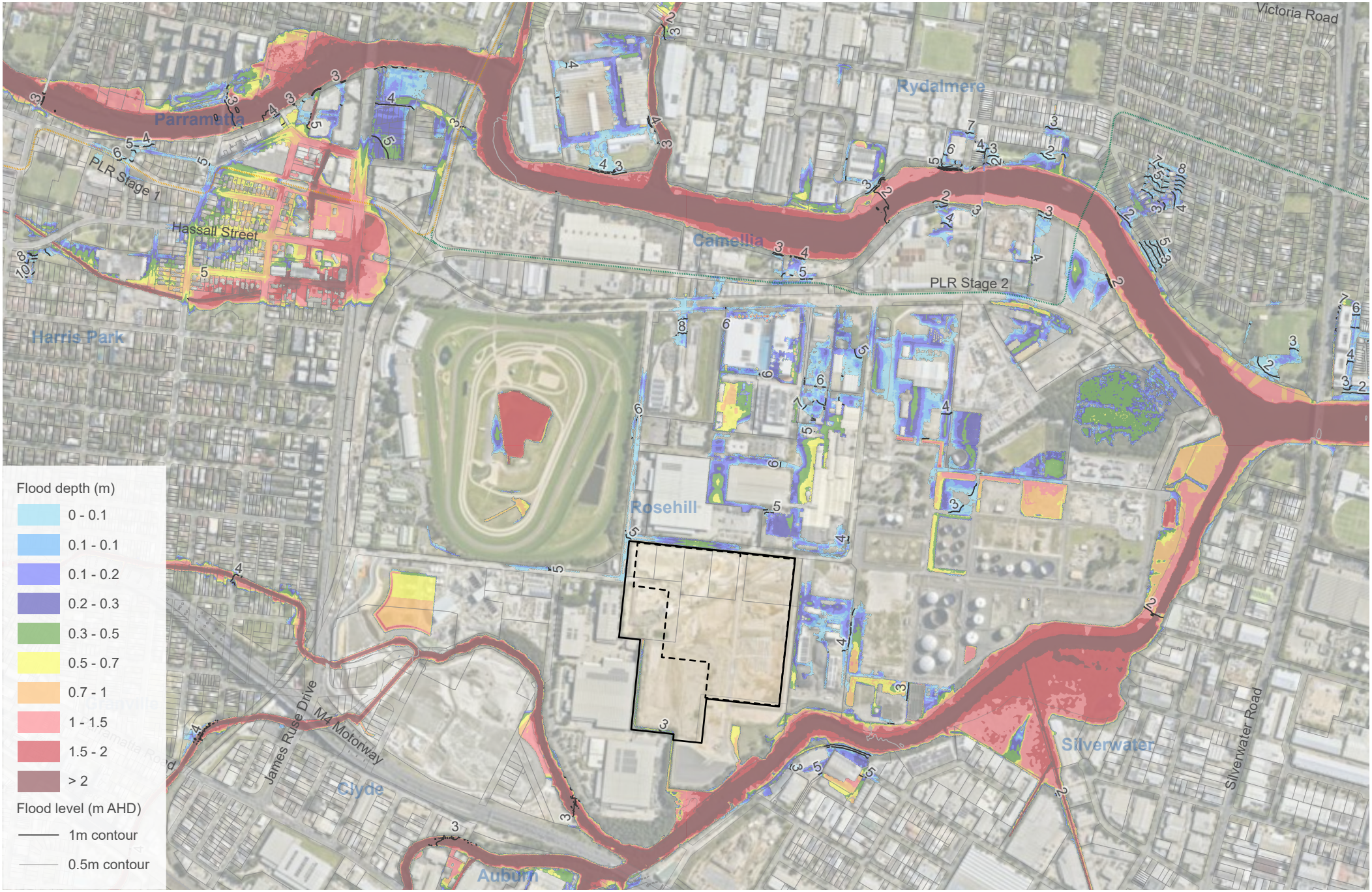



**Figure B-4** Base Case Flood Level and Depth 5% AEP Event

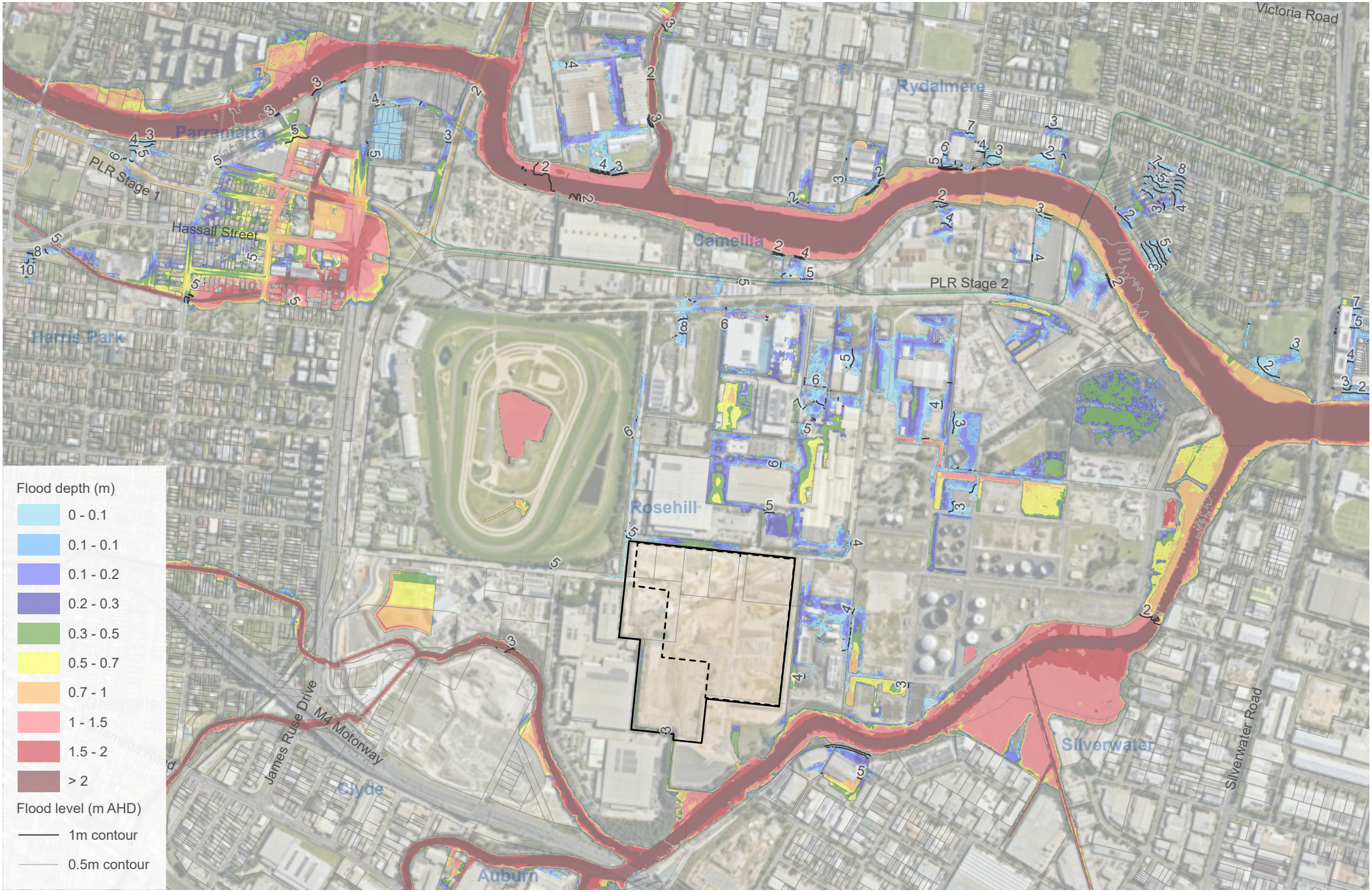



**Figure B-5** Base Case Flood Level and Depth 10% AEP Event

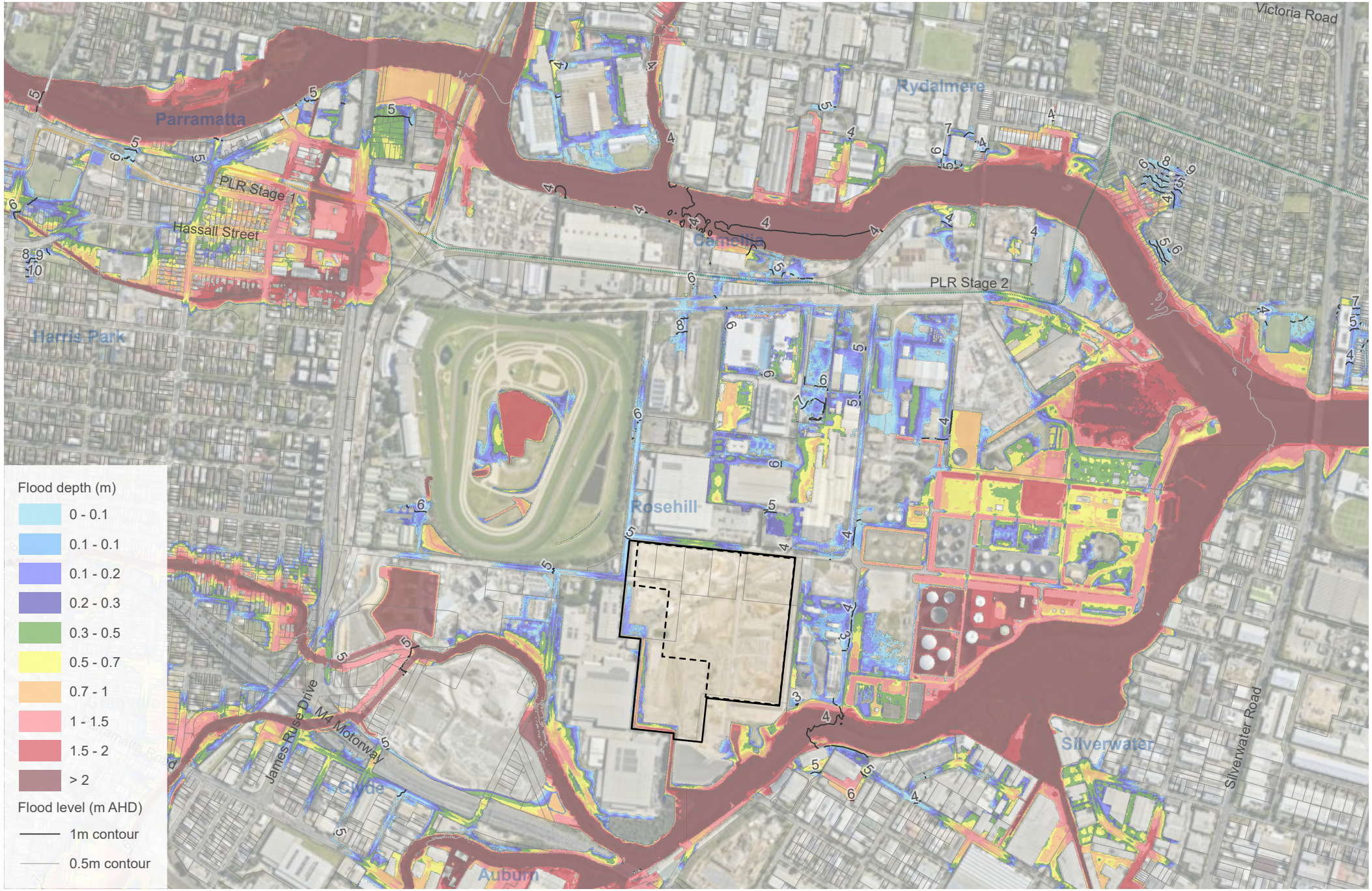



**Figure B-6** Base Case Flood Level and Depth FFA 1% AEP RCP4.5 2150 Climate Change Event

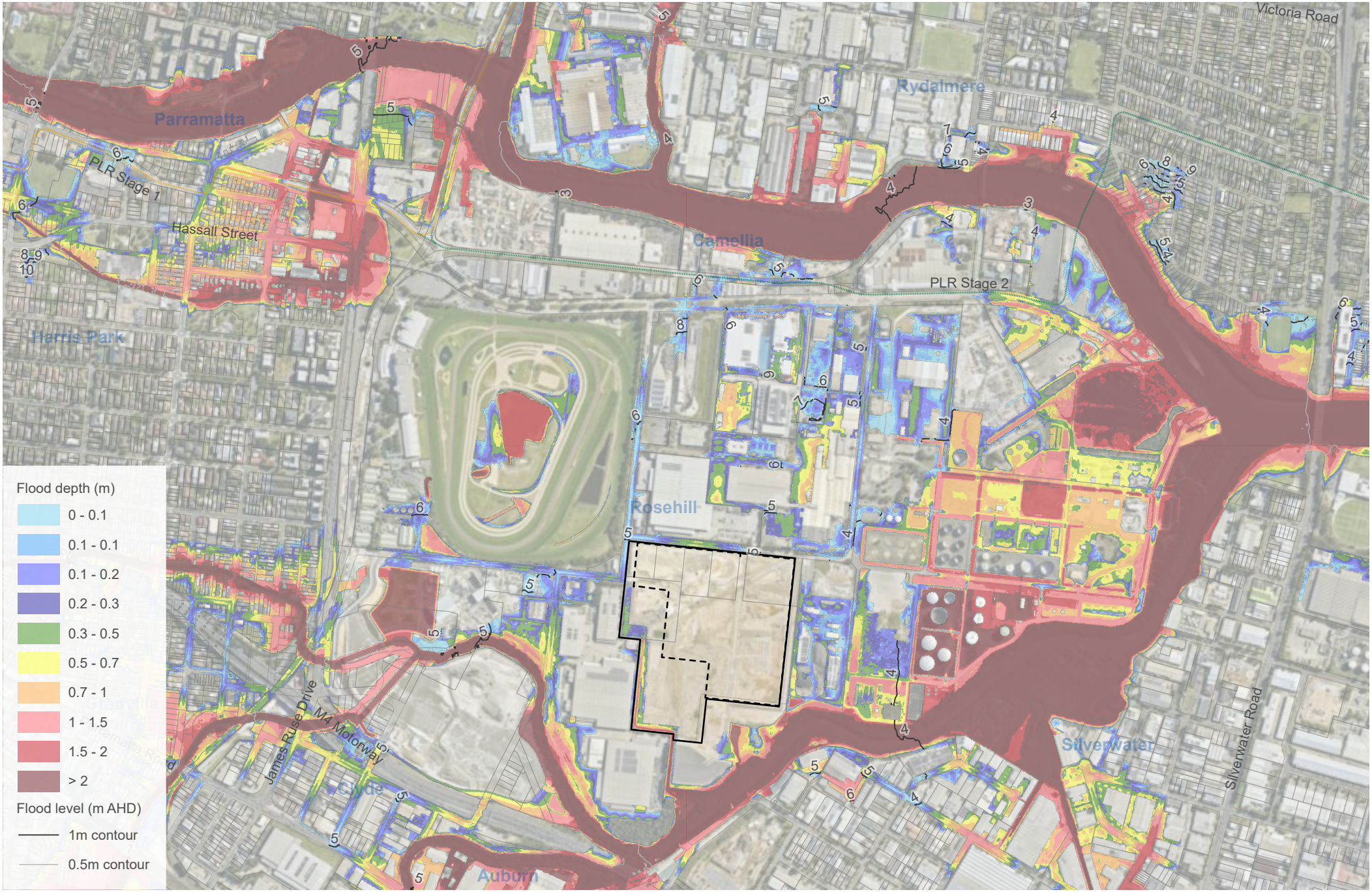



**Figure B-7** Base Case Flood Level and Depth FFA 1% AEP RCP8.5 2150 Climate Change Event

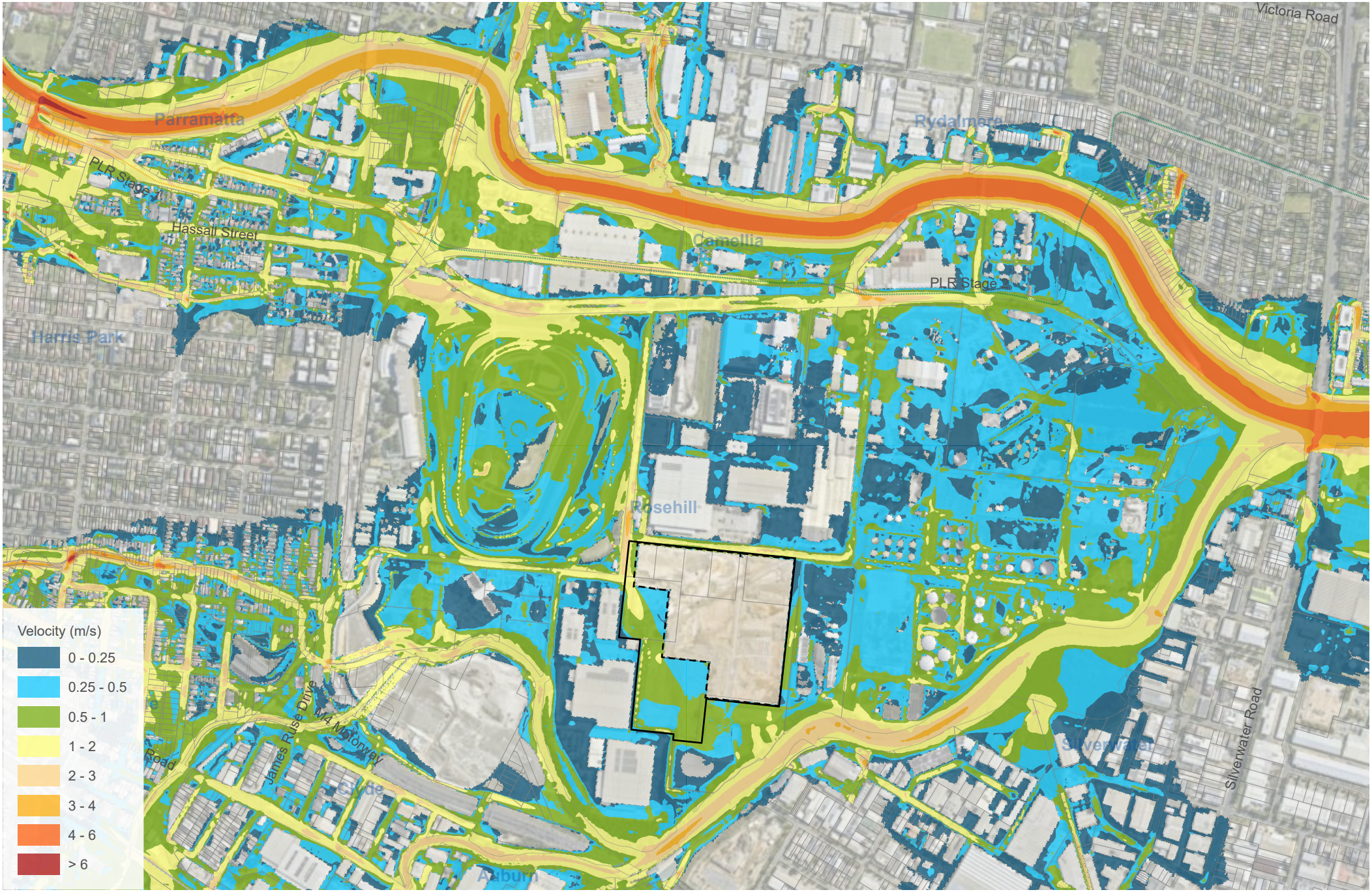



**Figure B-8** Base Case Flow Velocity PMF Event


**Figure B-9** Base Case Flow Velocity 50% of PMF Event


**Figure B-10** Base Case Flow Velocity FFA 1% AEP Event


**Figure B-11** Base Case Flow Velocity 5% Event


Camellia-Rosehill WRRF site

Site filling outline

Cadastre

**Figure B-12** Base Case Flow Velocity 10% Event

0 200 400 600 m

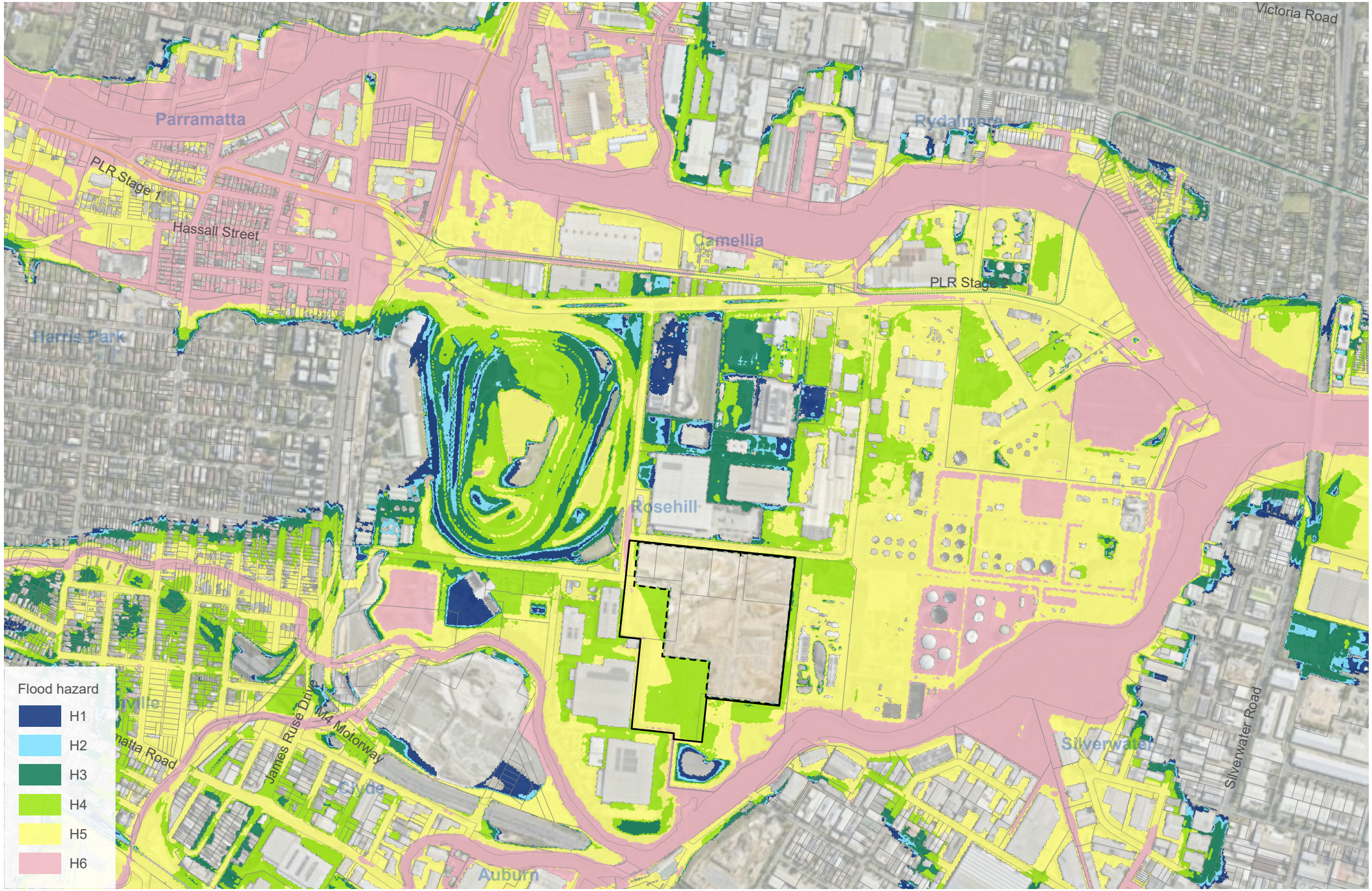
Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N


**Figure B-13** Base Case Flow Velocity FFA 1% AEP RCP4.5 2150 Climate Change Event


**Figure B-14** Base Case Flow Velocity FFA 1% AEP RCP8.5 2150 Climate Change Event




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

**Figure B-15** Base Case Flood Hazard - PMF Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N


**Figure B-16** Base Case Flood Hazard - 50% of PMF Event


**Figure B-17** Base Case Flood Hazard - FFA 1% AEP Event


Camellia-Rosehill WRRF site

Site filling outline

Cadastre

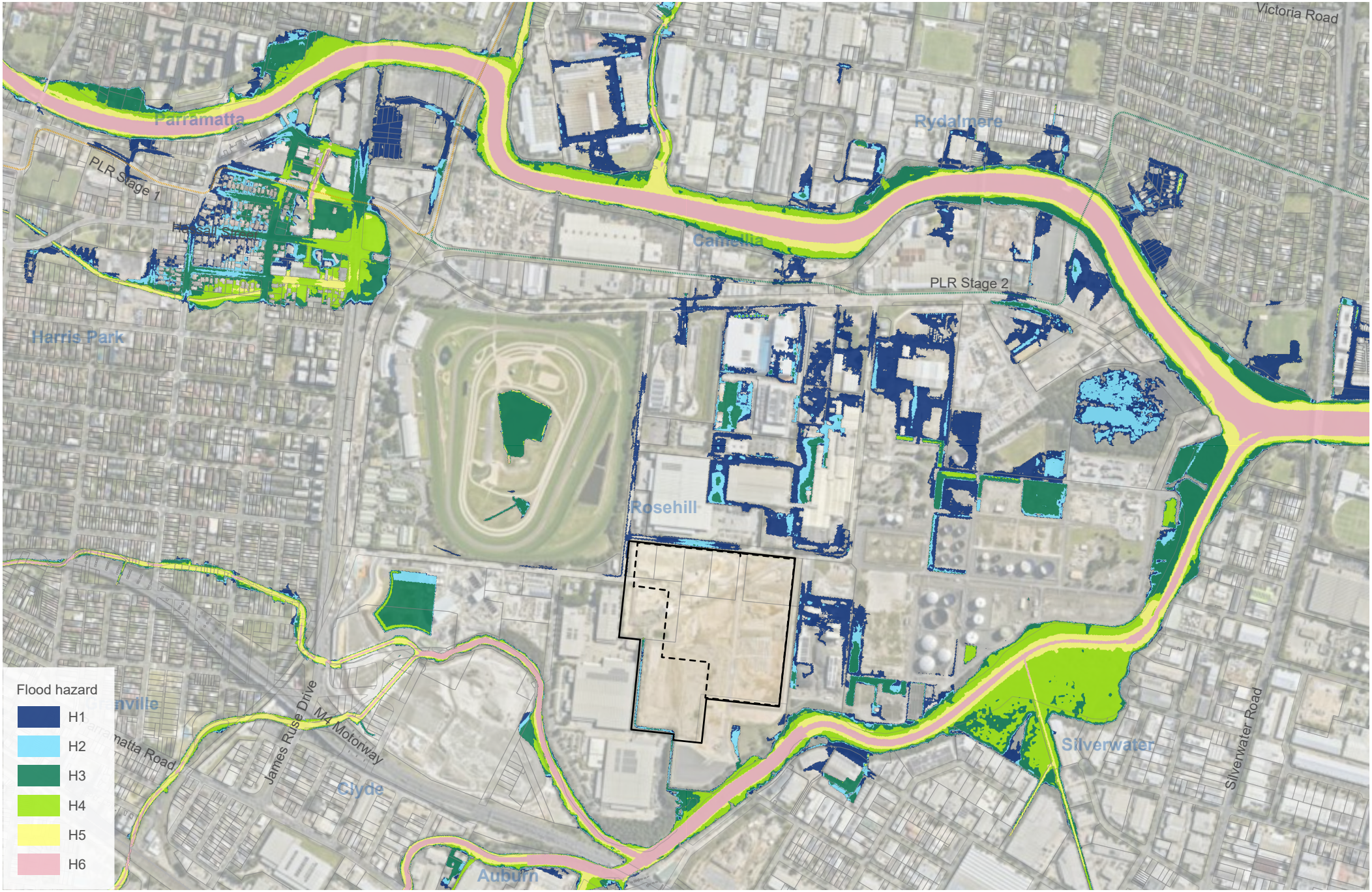
**Figure B-18** Base Case Flood Hazard - 5% AEP Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

**Figure B-19** Base Case Flood Hazard - 10% AEP Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N


Camellia-Rosehill WRRF site

Site filling outline

Cadastre

**Figure B-20** Base Case Flood Hazard - FFA 1% AEP RCP4.5 2150 Climate Change Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N


Camellia-Rosehill WRRF site

Site filling outline

Cadastre

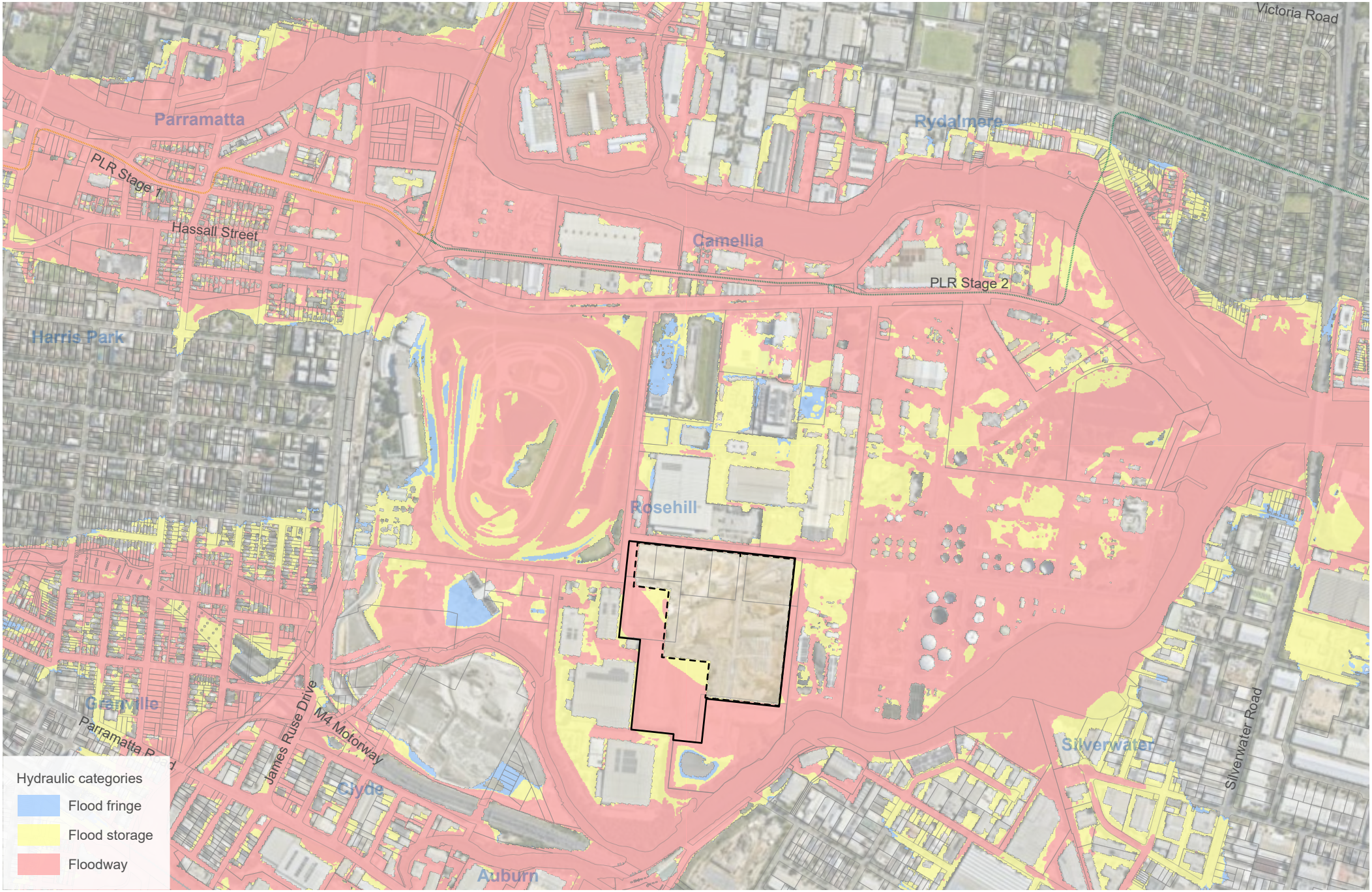
**Figure B-21** Base Case Flood Hazard - FFA 1% AEP RCP8.5 2150 Climate Change Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

**Figure B-22** Base Case Hydraulic Categories - PMF Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N

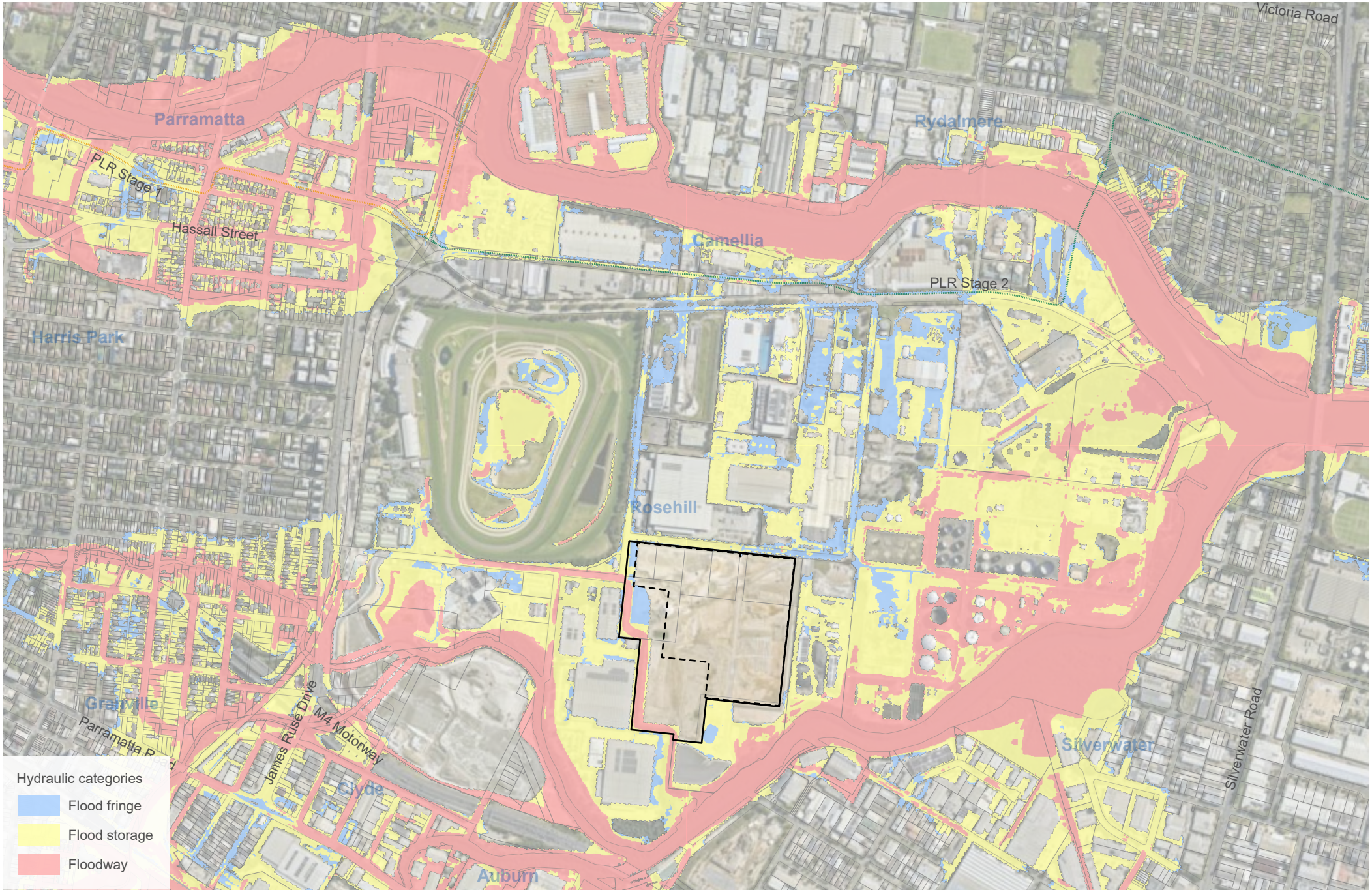
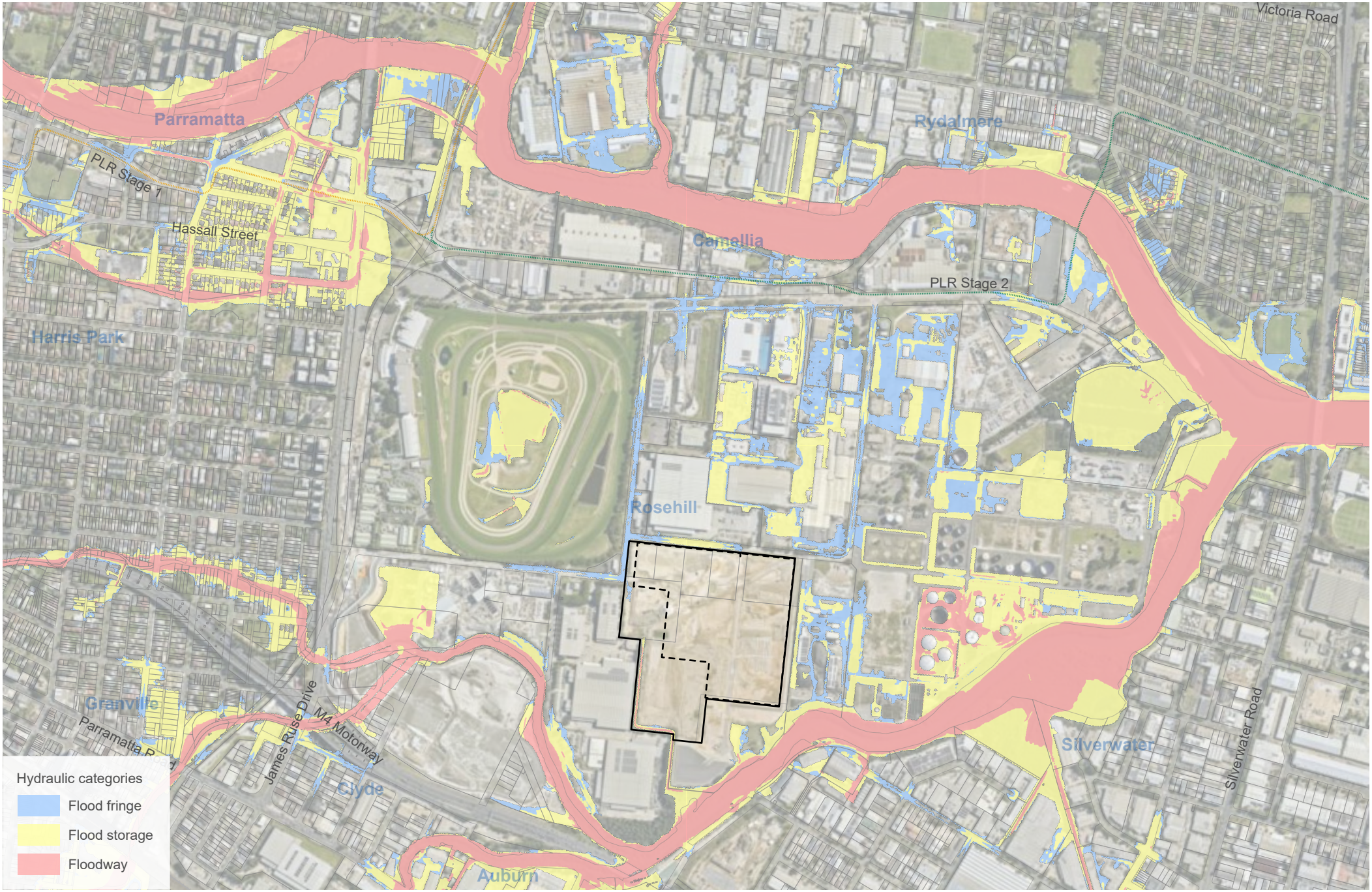



**Figure B-23** Base Case Hydraulic Categories - 50% of PMF Event




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

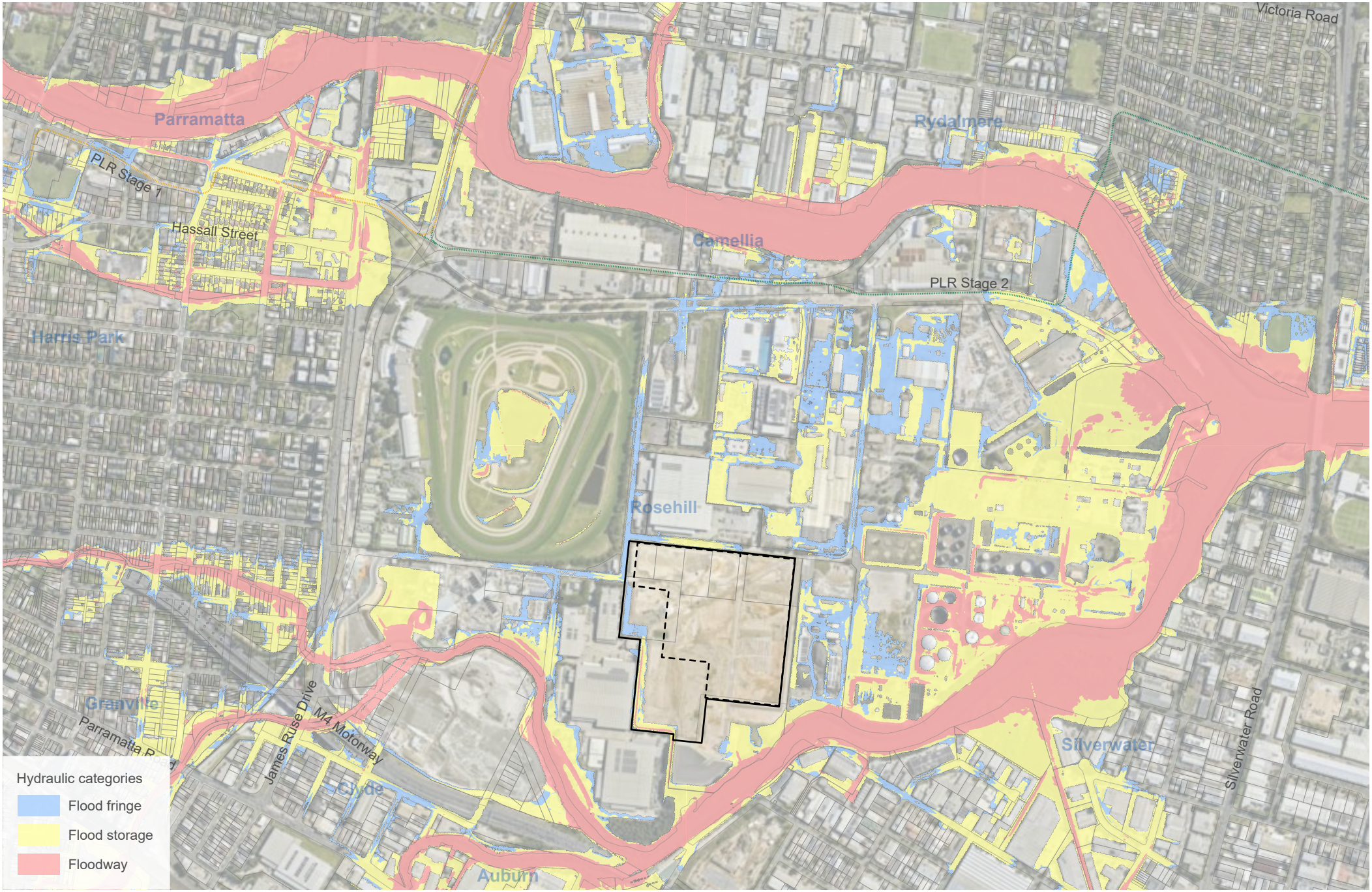
**Figure B-24** Base Case Hydraulic Categories - FFA 1% AEP Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

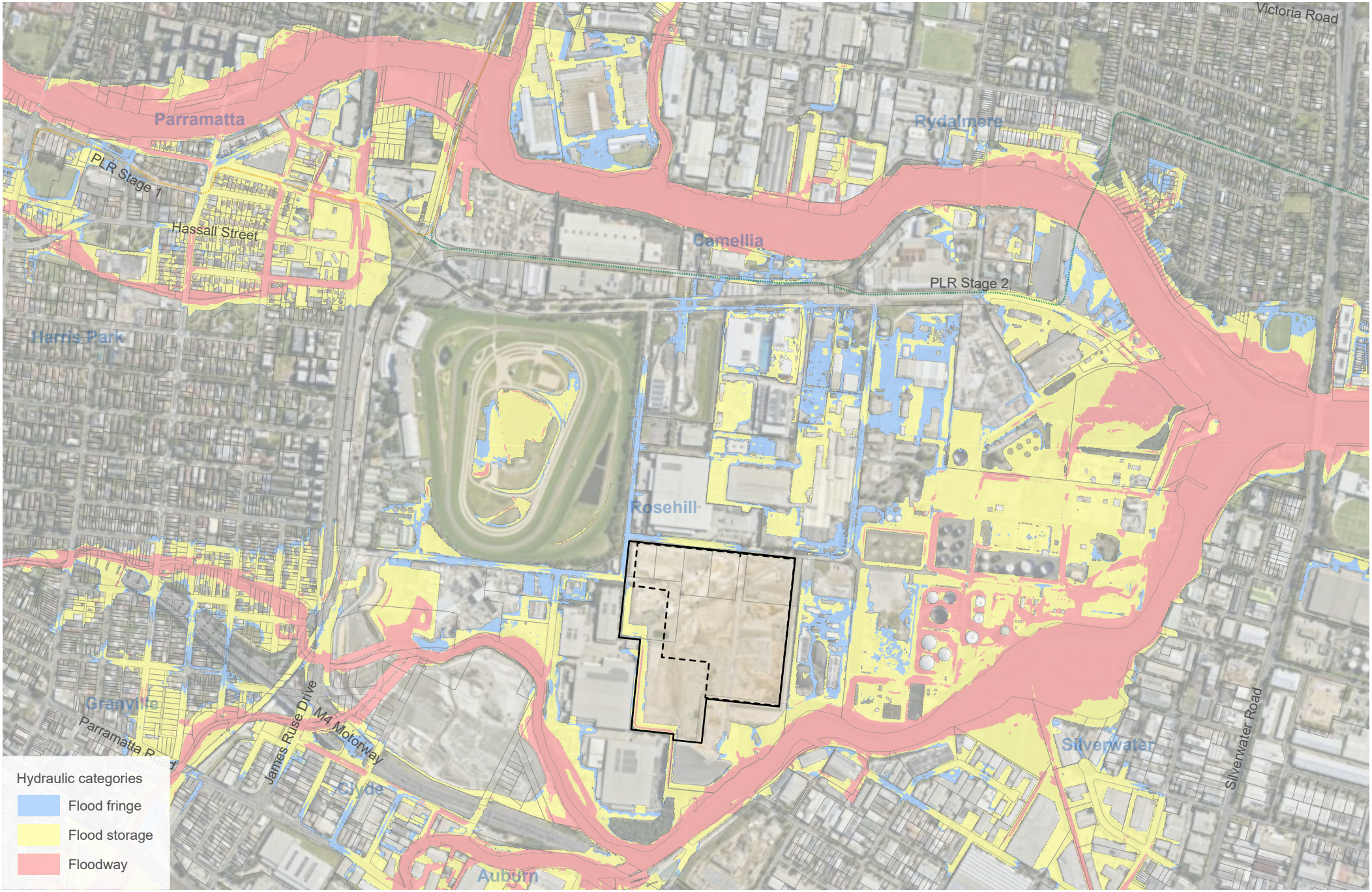
**Figure B-25** Base Case Hydraulic Categories - FFA 1% AEP RCP4.5 2150 Climate Change Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

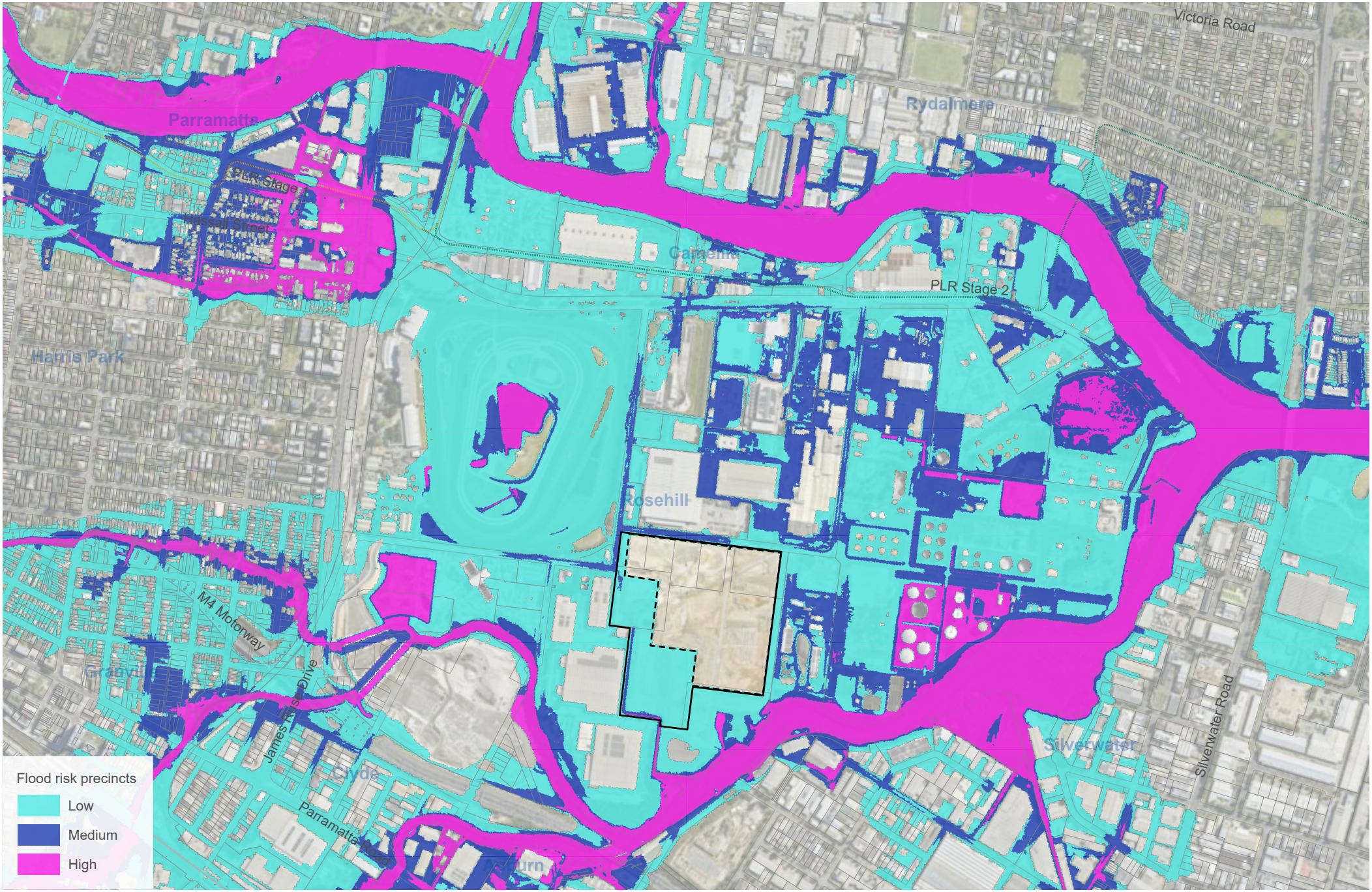
**Figure B-26** Base Case Hydraulic Categories - FFA 1% AEP RCP8.5 2150 Climate Change Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

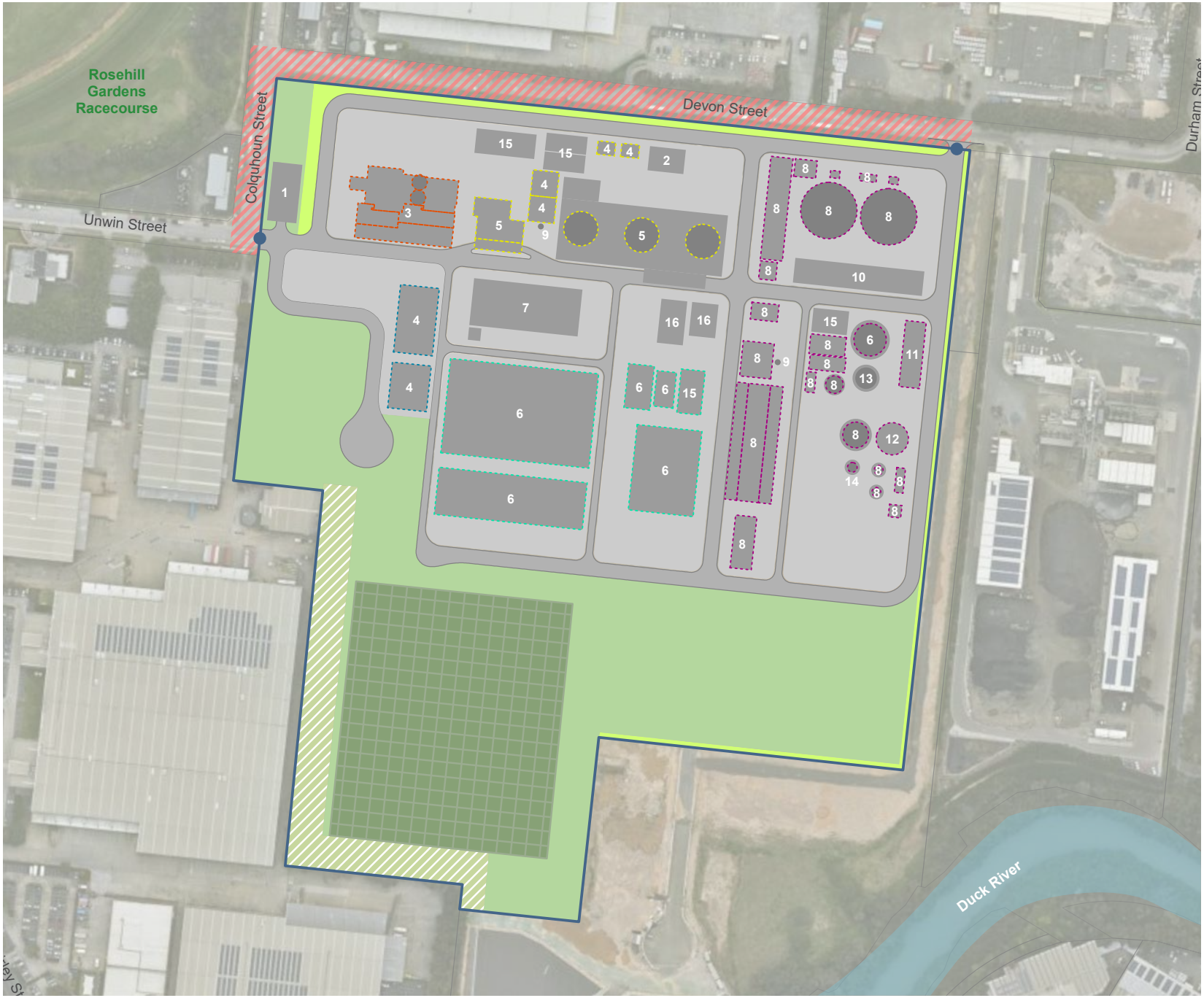
**Figure B-27** Base Case Flood Risk Precincts

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025 Scale: 1:17,408 @ A4
Basemap: MetroMap 2025 Web Mercator Auxiliary Sphere

N

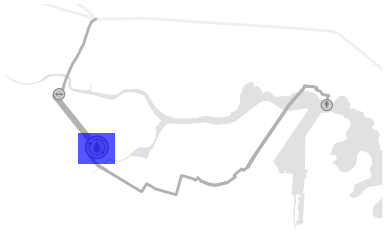
# Appendix C. Project design information




**Key**

1. Admin building
2. Workshop
3. Inlet works
4. Primary treatment
5. Biosolids treatment and handling (digestors)
6. Secondary/ tertiary treatment
7. Odour control
8. Advanced treatment
9. Foul water pumps
10. Chemical storage
11. River release pump station
12. River release tank
13. Brine tank
14. River release standpipe
15. Switchrooms
16. Cogeneration units and flare

- Inlet works
- Primary treatment
- Secondary/tertiary treatment
- Biosolids handling
- Advanced water treatment



- Camellia-Rosehill WRRF boundary
- Site access
- Potential ground mounted solar area
- Structure
- Tank
- Hardstand
- Landscaping
- Native grasses
- Vegetation to be retained
- Public interface zone

**Figure 3-3** Indicative layout of the WRRF

0 50 100 150 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:3,750 @ A4
GDA2020 MGA Zone 56

N


**Figure 3-6** Indicative changes to Camellia pumping station


Camellia-Rosehill WRRF boundary
Proposed River Release Pipeline - Open trench
Proposed River Release Pipeline - Trenchless

**Figure 3-6a** Indicative river release pipeline alignment

0 100 200 300 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025
Scale: 1:5,000 @ A4
GDA2020 MGA Zone 56

N


Proposed River Release Pipeline - Open trench

Proposed River Release Pipeline - Trenchless

**Figure 3-6b** Indicative river release pipeline alignment

0 100 200 300 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:5,000 @ A4
GDA2020 MGA Zone 56

N


Proposed River Release Pipeline - Open trench

Proposed River Release Pipeline - Trenchless

**Figure 3-6c** Indicative river release pipeline alignment

0 100 200 300 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:5,000 @ A4
GDA2020 MGA Zone 56

N


Proposed River Release Pipeline - Open trench

Proposed River Release Pipeline - Trenchless

**Figure 3-6d** Indicative river release pipeline alignment

0 100 200 300 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:5,000 @ A4
GDA2020 MGA Zone 56

N


Proposed River Release Pipeline - Open trench

Proposed River Release Pipeline - Trenchless

**Figure 3-6e** Indicative river release pipeline alignment

0 100 200 300 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:5,000 @ A4
GDA2020 MGA Zone 56

N

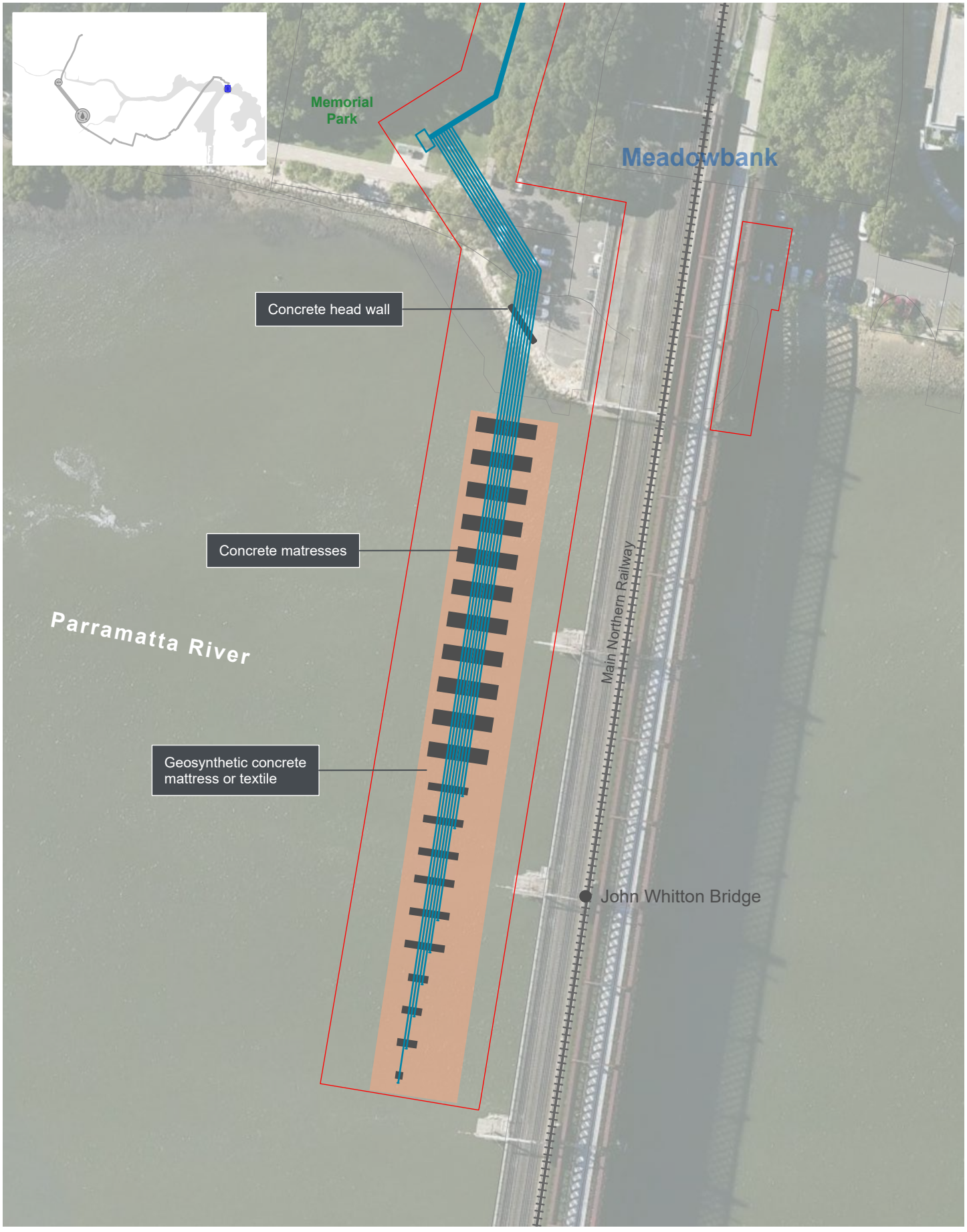
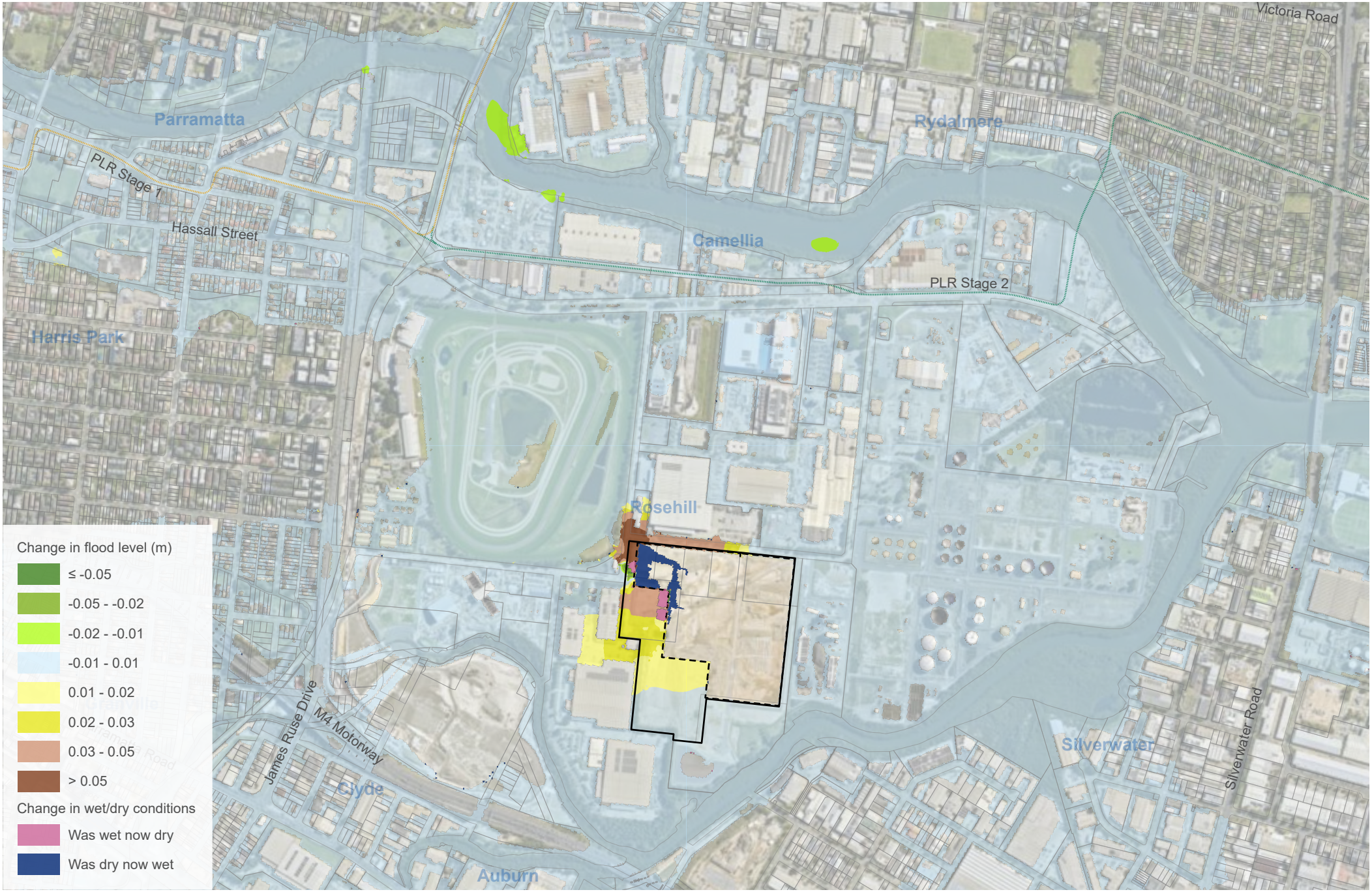



**Figure 3-8** Indicative layout of the proposed river release structure

# Appendix D. Flood mapping – Design case




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

**Figure D-1** Change in Flood Level - Design versus Base Case PMF Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N

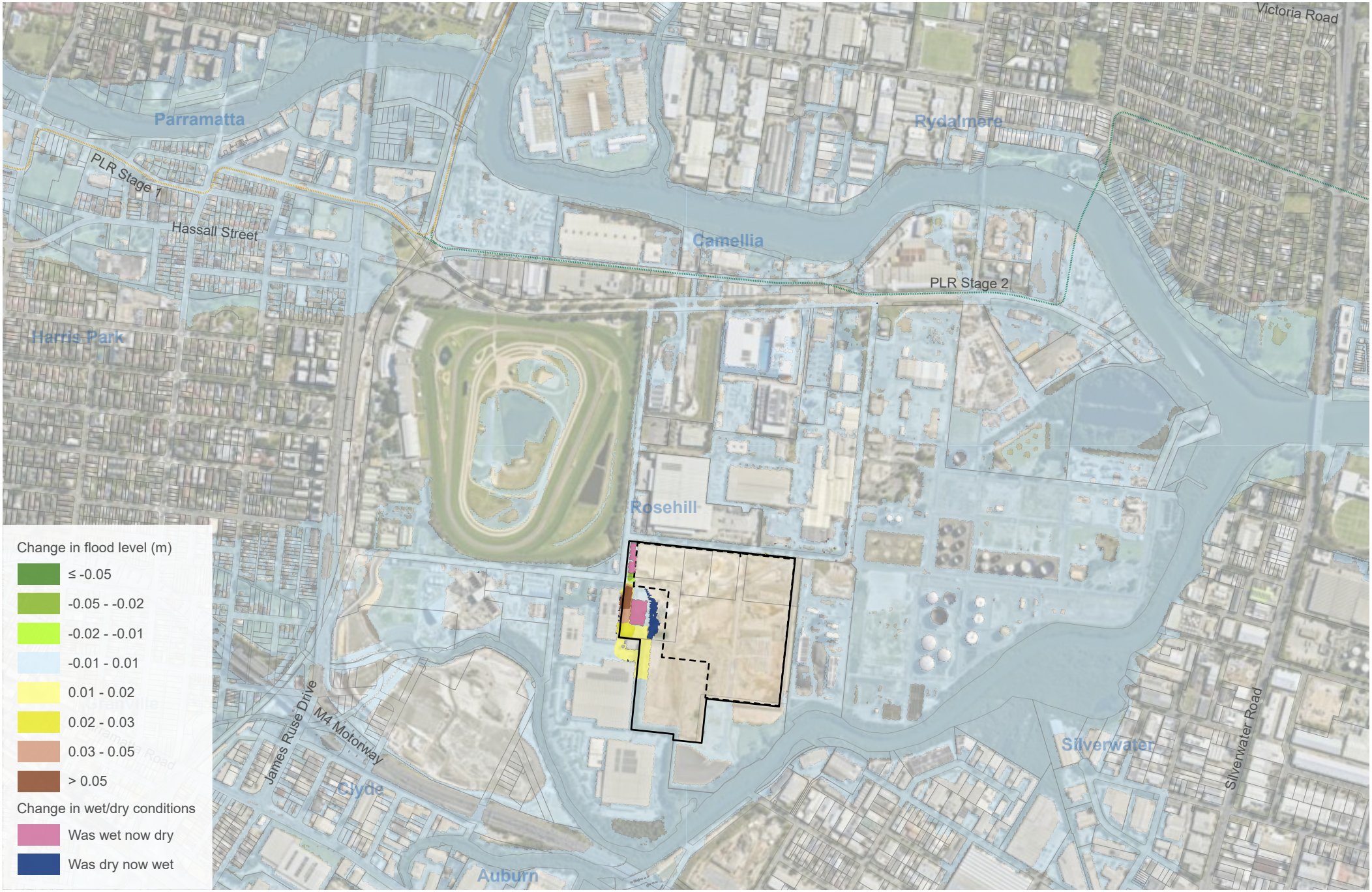



**Figure D-2** Change in Flood Level - Design versus Base Case 50% of PMF Event


**Figure D-3** Change in Flood Level - Design versus Base Case FFA 1% AEP Event


**Figure D-4** Change in Flood Level - Design versus Base Case 5% AEP Event


**Figure D-5** Change in Flood Level - Design versus Base Case 10% AEP Event

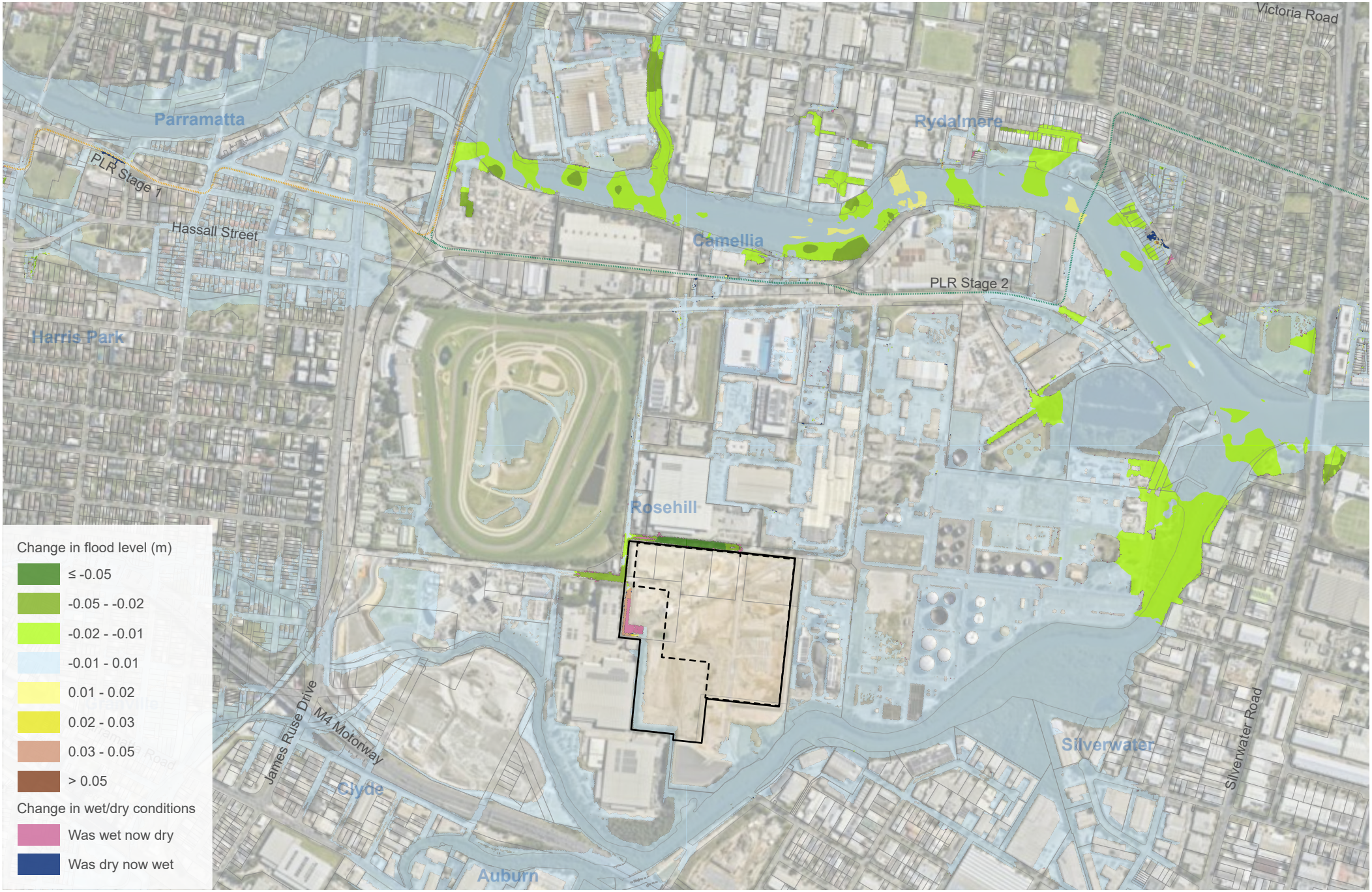



**Figure D-6** Change in Flood Level - Design versus Base Case FFA 1% AEP RCP4.5 2150 Climate Change Event

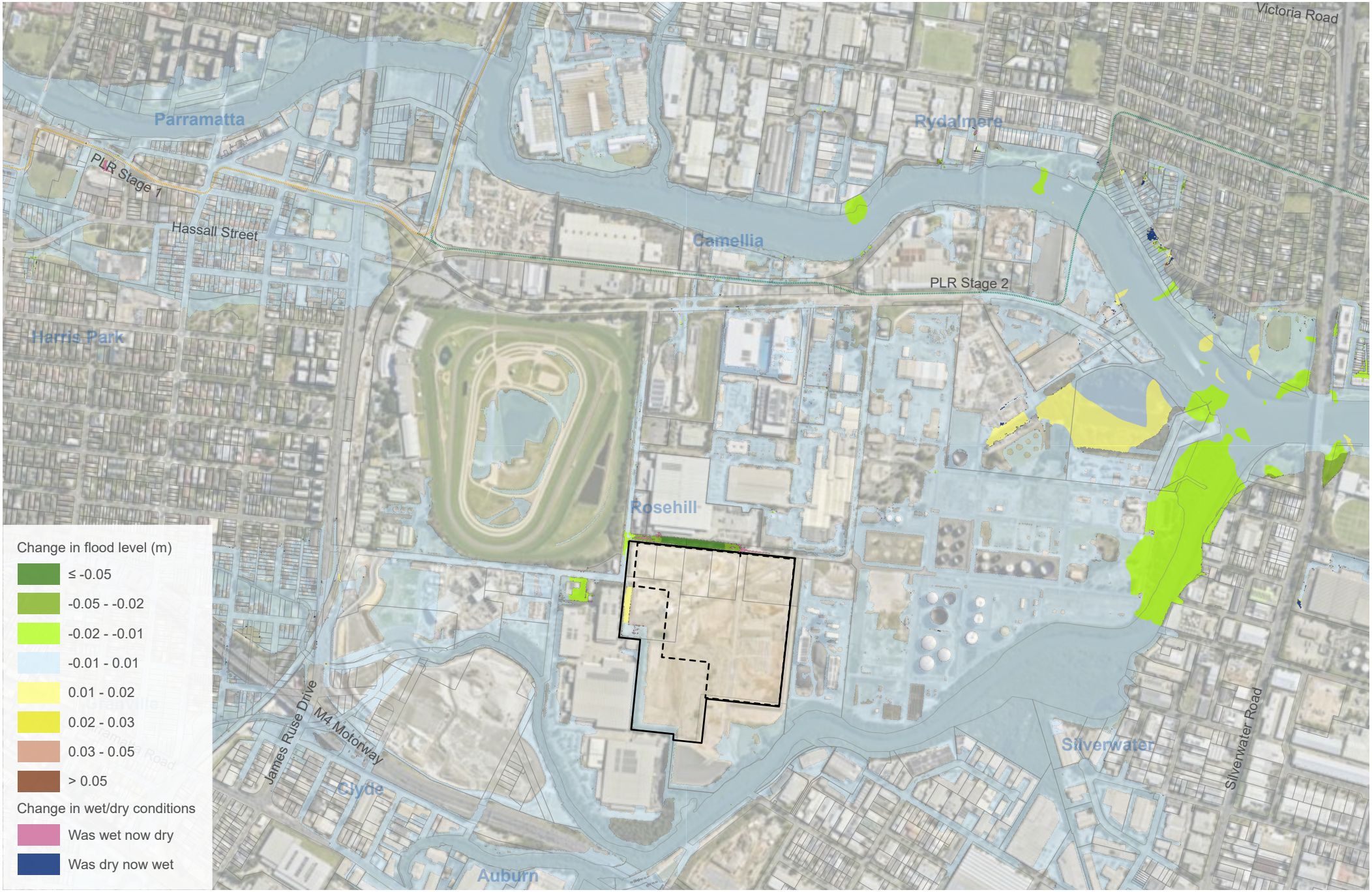
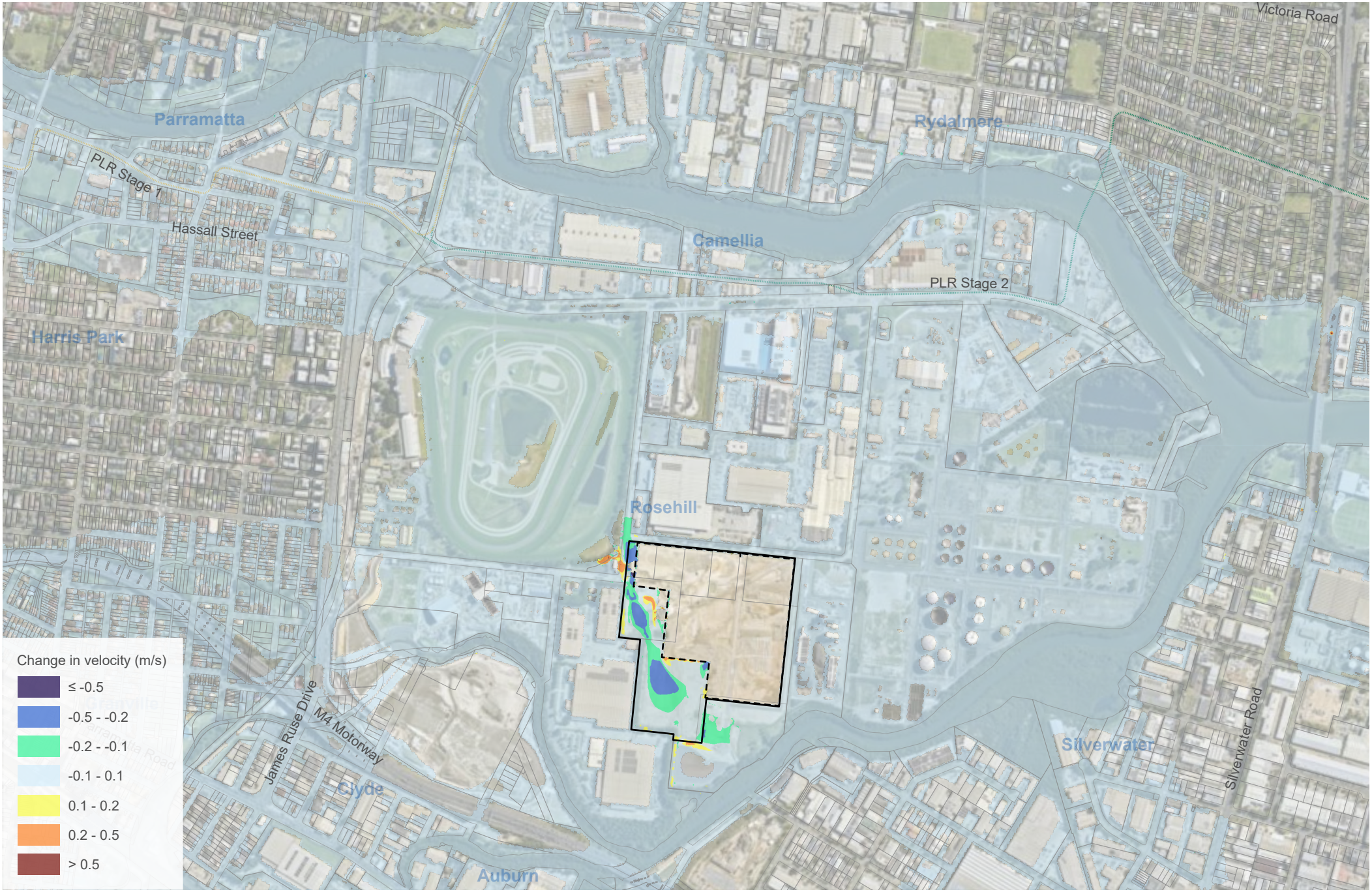



**Figure D-7** Change in Flood Level - Design versus Base Case FFA 1% AEP RCP8.5 2150 Climate Change Event




Camellia-Rosehill WRRF site

Site filling outline

Cadastre

**Figure D-8** Change in Flow Velocity - Design versus Base Case PMF Event

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:14,000 @ A4
GDA2020 MGA Zone 56

N


**Figure D-9** Change in Flow Velocity - Design versus Base Case 50% of PMF Event


**Figure D-10** Change in Flow Velocity - Design versus Base Case FFA 1% AEP Event


**Figure D-11** Change in Flow Velocity - Design versus Base Case 5% Event


**Figure D-12** Change in Flow Velocity - Design versus Base Case 10% Event


**Figure D-13** Change in Flow Velocity - Design versus Base Case FFA 1% AEP RCP4.5 2150 Climate Change Event


**Figure D-14** Change in Flow Velocity - Design versus Base Case FFA 1% AEP RCP8.5 2150 Climate Change Event

# Appendix E. Flood mapping – Sensitivity assessments

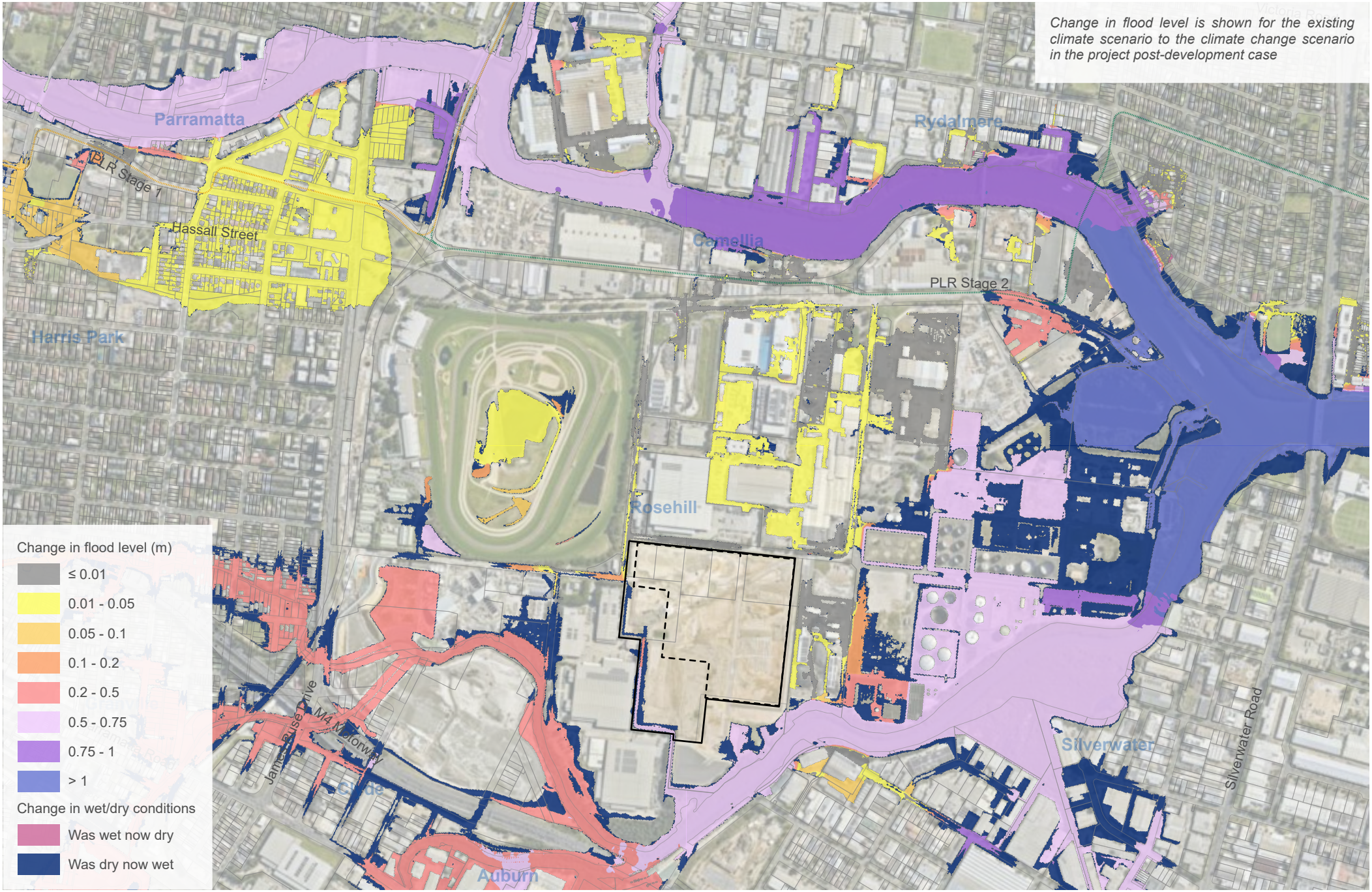



**Figure E-1** Climate Change Impact - FFA 1% AEP RCP4.5 2150 Flood Event

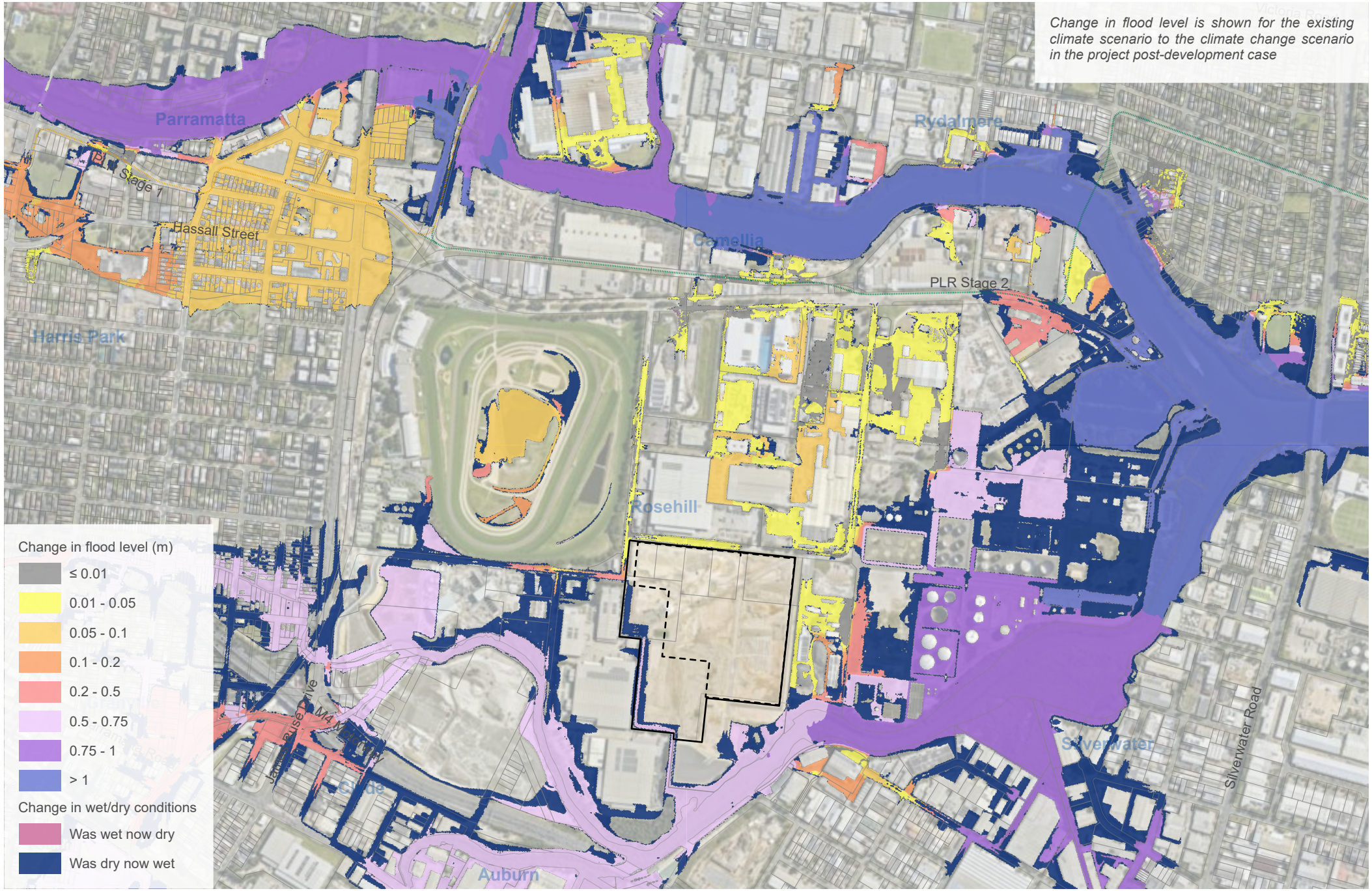



**Figure E-2** Climate Change Impact - FFA 1% AEP RCP8.5 2150 Flood Event

# Appendix F. Agency requirements

**Table F-1. Agency requirements – Flooding**

| Agency Requirements | Where addressed |
|---|---|
| **Department of Climate Change, Energy, the Environment and Water – Conservation Programs, Heritage and Regulation** | |
| 6. The EIS must include a flood impact and risk assessment (FIRA). As a minimum the FIRA must*: | This report. |
| Consider the relevant provisions of the NSW Flood Risk Management Manual and toolkit, and existing council and government studies, information and requirements. | Section 4.2 |
| Identify and describe existing flood behaviour and flood constraints on the site and its surrounding areas for the full range of events, including 5% AEP, 1% AEP, 0.5% AEP or 0.2% AEP and 1 in 2,000 AEP flood and PMF events and provide an assessment of the compatibility of the development and its users with flood behaviour. This may require flood modelling where existing flood information is not available. | Refer to Section 4.4.1 for agreed flood events for assessment.<br>Refer to Section 2.3 and Section 5.2 for existing flood behaviour.<br>Refer to Section 5.1 for details of the flood modelling.<br>Refer to Section 6.2 and 7 for assessment of compatibility of the project with the flooding conditions. |
| Determine and describe changes in post development flood behaviour, impacts of flooding on existing community and on the development and its future community for full range of events, 5% AEP, 1% AEP, 0.5% AEP or 0.2% AEP flood and PMF events. This will typically require flood modelling. | Section 6.2 and 7. |
| Consider impacts of climate change due to any increase in rainfall intensities. The 0.5% AEP or 0.2% AEP events can be used to provide an understanding of the scale of change of flood behaviour relative to the 1% AEP event. | Section 6.4.1 |
| Propose and assess the effectiveness of management measures including development controls required to minimise the impacts and risks of flooding to the development and its users and existing community. | Section 10.4. |
| **NSW State Emergency Service (SES)** | |
| The SEARs should include a flood assessment detailing:<br>An assessment of the flood risk up to and including the Probable Maximum Flood (PMF). | Section 5.2 and 6.2. |
| Climate change considerations. | Flood behaviour discussed in Section 5.2 and 6.2 includes assessment of climate change flood scenarios.<br>Impact of climate change on flooding discussed in Section 6.4.1. |
| Time to onset, duration, depth, velocity and hydraulic hazard of any flooding. | Section 5.2 and 6.2. |
| An assessment of the impact of the proposed development of flood behaviour, particularly regarding any proposed fill on the site, and any discharge from the site both during standard operating and during emergency releases. | Section 6.2, Section 7.<br>Water discharges from the site not assessed in this report. |
| Seeking advice from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) regarding the impact of the proposed development on flood behaviour for adjacent and downstream areas. | Section 4.4.1. |

| Agency Requirements | Where addressed |
|---|---|
| **City of Parramatta Council – Comments and Requirements** | |
| "the proposal displaces floodwaters – and with it environmental impacts - onto neighbouring land. This is not acceptable and would expose Council and Sydney Water to ongoing liability and remedial cost." | Refer Section 6.2 for flood impact assessment, indicating minor impacts. |
| "The overland flow paths across the site must be acknowledged, modelled and provided for in the design to Council's satisfaction." | Section 5.1.2 describes site topography in the Base case (post-site raising). Key flow paths through site retained in Base and Design cases. |
| "This cannot rely on underground pipes and culverts and in any modelling, it must be assumed that any such underground pipes and culverts are fully blocked." | Section 5.1.2 describes site topography in the Base case (post-site raising). Key flow paths through site retained in Base and Design cases. Refer Section 6.2 for flood impact assessment, indicating minor impacts. |
| "Overland flow paths must convey the 1% AEP events plus allow for 500mm freeboard including allowance for climate change increasing both rainfall intensity and sea levels." | Section 6.2.7. |
| "Inundation of the site from the creek/river system must address the PMF event and recognise that this is a 'critical' facility necessary for the community's ongoing operation as described in LEP 2023 and DCP 2023." | Section 6.2.7 for site flood immunity. |
| The design of the facility should ensure that this risk is adequately managed to ensure the facility can operate during a 1 in 100-year ARI event. | Section 1.1 for project overview and description. Section 6.2.7 for site flood immunity. |
| **Sydney Metro** | |
| The assessment of flood behaviour should take into account approved future development including Sydney Metro - West, and any changes in flood behaviour resulting from those developments. In this regard it should be noted that the detailed design of the Clyde Stabling and Maintenance Facility and the Rosehill Services Facility is ongoing, and consultation with Sydney Metro will be required to ensure co-ordination of flood model data. | Section 5.1.1, Section 8.2.1. |

# Appendix G. Independent peer review

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Level 5, 348 Edward Street,
Brisbane, QLD, 4000
Australia

ABN: 54 010 830 421

Our ref: L.003875.001.01_GPOP_FIA_Peer_Review.docx

5 November 2025

Jacobs
7/177 Pacific Highway
North Sydney NSW 2060

Attention: Lih

Dear Lih Chong

**RE: INDEPENDENT PEER REVIEW FOR GPOP FLOOD MODELLING**

In September 2025 BMT was engaged to undertake an independent peer review of the flood modelling undertaken by Jacobs for the Greater Parramatta and Olympic Peninsula (GPOP) Water Cycle Management (WCM) project. This letter sets out the scope and findings of BMT's review, including the adequacy of the assessment in meeting the project specific Secretary's Environmental Assessment Requirements (SEARs), SSI 74258485.

## Scope of Independent Review

The scope of the peer review was as follows:

- Detailed review of TUFLOW hydraulic model developed by Jacobs for the GPOP project.
- Review of the derivation and application of the long duration Probable Max Flood (PMF)
- Review of the Flood Assessment Report to ensure that the reporting accurately describes the modelling inputs, assumptions and outputs
- Review of assessment outcomes against the project specific SEARs requirements in relation to flooding.

## Data Received

The following data was supplied to BMT to enable the review to be undertaken.

- Draft Flood Assessment Report (IA319500-00-T-V-RPT-00-08_01_Flood Impact and Risk Assessment) dated 27 August 2025
- Final Draft Flood Assessment Report (IA319500-00-T-V-RPT-00-08_02_Flood Assessment Report) dated 1 October 2025
- TUFLOW models as follows:
  - Base case (GPOP_PR_EXG07_CNF0.5_~s1~_~e1~_~e2~_~s2~.tcf)
  - Design case (GPOP_PR_DES04_CNF0.5_~s1~_~e1~_~e2~_~s2~.tcf)
  - Pre-site raising sensitivity test (GPOP_PR_SEN01_CNF0.5_~s1~_~e1~_~e2~_~s2~.tcf)
  - Original City of Parramatta Flood Study model (S1_ParraR_EX040_v02_~s1~_~e1~_~e2~_~s2~.tcf)

- A variation of the TUFLOW model, schematised to use a coarser 4m spatial resolution, was also supplied for the pre-development, post-development and sensitivity assessment (pre-capping) cases.
- Raw and processed TUFLOW model results.
- The hydrologic WBNM model with supporting PMP (GSAM) calculations.
- Reports for the following previous relevant studies:
  - Paramatta River Flood Study Final Report (Stantec, June 2024)
  - Sydney Olympic Park Master Plan 2050 (Mott Macdonald, September 2024)
  - Clyde Maintenance and Stabling Facility Flooding and Hydrology Report (Gamuda, November 2023)
  - City of Ryde Council Flood Harmonisation Study – Flood Study Update Draft Report (WMA Water, January 2023)
- Planning Secretary's Environmental Assessment Requirements for GPOP (Issued September 2024) including Attachment A – Agency Input.

To facilitate the review and data handover, an inception meeting was held on 3 September 2025 between Jacobs, Sydney Water and BMT in which an overview of the flood assessment was presented to BMT.

## Peer Review Findings

BMT has completed a detailed review of the flood modelling and associated reporting for the GPOP Flood Assessment. The key findings of the review are summarised below and should be read in conjunction with the main Flood Assessment Report. The initial findings were provided to Jacobs with additional supporting details and Jacobs subsequently provided a response to address each review finding. Subsequent review comments by BMT on Jacobs' responses are provided in italics.

### Hydraulic Model Review

The review of the hydraulic (TUFLOW) models focussed on the changes made to the model to represent and assess the proposed development. This included the following:

- That updated hydrology has been implemented correctly in the model.
- Representation of the project's proposed infrastructure and associated structures and drainage infrastructure is appropriate and reflects the design plans.
- Applied Manning's n values are appropriate and consistent with those adopted in the flood study or otherwise justified.
- General model health and stability.
- Checks that the model results match those documented in the associated report.

The key findings of the hydraulic model review are summarised below.

1. The model is developed from the Parramatta River Flood Study model with modifications made to incorporate more recent topography, extend the model to accommodate the PMF event and improve the overall stability of the model. The model cell size is 2m for events up to and including the 1% AEP and 4m for the PMF and 50%of PMF events. BMT was satisfied that the model is fit for the purposes of the GPOP assessment.

2. A comprehensive model handover package was provided to facilitate this review. BMT was able to initiate the TUFLOW model with the supplied files.

3. General instability was noted along lengths of the Paramatta River. This was most pronounced near the downstream boundary and is potentially resulting from the schematisation of the boundary. The instability is evident in the peak water surface grids and this follows through to the processed flood impact grids. The downstream boundary is located a significant distance from the area of interest and within the area of interest the model appears stable. It is also noted that the instability was present in Council's adopted model and that Jacobs has improved (reduced) the degree of instability in the model. BMT is satisfied that the instabilities in the model are not impacting on flood impacts associated with the development.

4. A Manning's n value of 0.04 is considered low for 'high density residential' land use. We note that this value was used in Council's adopted flood study and that the Council study calibrated the model using this value. Given that the adopted model was calibrated using this value then no further action is recommended for the GPOP assessment.

5. The schematisation of the administration building within the model is overly conservative and will obstruct more flow than intended during the '50% of PMF' and PMF flood events. In BMT's opinion, amending this issue will reduce and not worsen mapped flood impacts. It is recommended that this modelling issue is addressed, although this can wait until later stages of the design process.

   *Following review, Jacobs acknowledged the issue and agreed with BMT that the issue results in a conservative impact estimate. The update will be deferred to detailed design stage. BMT is satisfied with this response.*

6. Checks show that the mapped flood impacts correspond to those derived from model results files. There are instances of spurious flood impacts located a significant distance from the site, for example in the modelled climate change events. These impacts are predominantly located in the Paramatta River and BMT agrees that they are associated with model instability rather than as a result of the project. It is recommended that further explanation is provided within the report.

   *Following review, Jacobs has since provided additional commentary and justification in the Final Draft report on these impacts to note that they are not a result of the project.*

### Hydrology update Review (Long Duration PMP)

The hydrology update review focused on the derivation of the Probable Maximum Precipitation (PMP) and its implementation within the hydrologic WBNM model (an existing model) in order to derive Probable Maximum Flood (PMF) inflows. No issues were identified and the PMF was derived appropriately. Note that this review excluded a review of the WBNM model itself as this was unchanged from an adopted model except for application of the updated PMP rainfall inputs.

### Flood Assessment Report Review

A technical review of the Flood Assessment Report was undertaken which considered the following:

- Whether the report is sufficiently detailed to convey the key findings of the assessment.
- That the report accurately describes the model inputs and assumptions.
- That the presented impact mapping is appropriate and reflects the model results.

- That the reporting is sufficient to respond to the project SEARs and any other feedback from other agencies.

- Commentary on the acceptability, or otherwise, of presented flood impacts in the context of the SEARs guidelines and general best practice.

The key findings of the Flood Assessment Report Review are documented below.

7. Overall, the report is detailed and provides sufficient background/context to the assessment along with clearly documenting the assessment itself.

8. The Executive Summary would benefit from a short paragraph introducing the potential sources of flooding i.e. Paramatta River, Duck River etc before describing flood depths.

   *Following review, Jacobs has since provided additional text in the Executive Summary of the Final Draft report which sufficiently describes the sources of flooding.*

9. Table 1-2 which details the project SEARs states Item 1e (hydraulic function) is addressed in Section 6.2.3. Section 6.2.3 briefly describes changes in flood hazard and does not refer to hydraulic function. It would be better to refer to Section 6.2.8 which covers hydraulic function

   *The table was since updated by Jacobs in the Final Draft report, noting that the affected table is now Table 1-3.*

10. The climate change tailwater elevation stated in Table 5-3 should be reported as 2.84m AHD and not 1.84m AHD.

    *The table was since updated by Jacobs in the Final Draft report.*

11. Page 38 notes that the CoP model uses 2013 LiDAR but it is earlier stated that 2014 LiDAR is used. This should be checked and made consistent.

    *All CoP LiDAR references have been updated to 2013 in the Final Draft Report.*

12. Whilst the site might not impact on evacuation routes, it could result in placing more people in an area with flood evacuation constraints. It is recommended that some additional commentary is provided in Section 6.2.11 which discusses emergency management, in this regard or refer to the development of flood evacuation management plans at later stages of the design.

    *Additional commentary has been added to the Final Draft Report and notes that a flood management plan will be prepared for the WRRF.*

13. It is understood that the agreed project base case includes the placement of 1.7m fill across a significant part of the subject site. The site raising and its impact on flooding is the subject of a separate REF but the cumulative impact of both site raising and the WRRF will be greater than that shown for the WRRF. Whilst the site raising and the current development have been somewhat separated for the purposes of project approvals, an adjacent landowner may not care for this distinction and it will be the overall cumulative impact of the combined project stages that are of concern. For a PMF event, an assessment of flood impacts typically focuses on the potential for a proposed development to change flood behaviour as this may impact on safety and emergency management considerations. There is generally less of a focus on changes in water levels, particularly if the changes are small in relation to the overall flood depths. There is however a sensitive receptor nearby (Sydney Metro West) which has key features raised above the PMF level.

Any increase in PMF level could therefore compromise it's PMF immunity. BMT understands that the GPOP project is in consultation with Sydney Metro West to ensure that the outcomes of the current assessment do not adversely impact on Sydney Metro West. It is recommended that this dialogue continues and that combined impacts of the capping and development are presented to them.

*Sydney Water has confirmed that they are continuing to engage with Sydney Metro on this matter.*

14. Given that the proposed pumping station upgrade is located within the extent of the TUFLOW model developed for the assessment and that the pumping station upgrade will represent additional obstruction to flow, further commentary/information should be provided on why this has been assessed qualitatively only and not included in the model. BMT accepts that it is not inundated in events up to and including the 1% AEP event and agrees that the upgrades impact on flooding is expected to be minor. In BMT's opinion the report would benefit from a figure showing the planned extension to the existing pumpstation also showing the PMF flood depths and flow vectors. This would aid understanding that the impact of the extension is expected to be minimal.

    *Jacobs has since provided an additional figure showing the existing and proposed building footprints along with the flow behaviour.*

15. Regarding the proposed pipeline east of the WRRF, BMT agrees that a qualitative assessment of the pipeline is sufficient given that the vast majority of the pipeline is to be located underground. BMT notes that the report states the potential for changes to flood behaviour from two aerial crossings of the Smalls and Charity Creeks with the potential for impacts to be assessed at detailed design stage. Given that any impacts are likely to be relatively minor and that the report nominates management measures (FL8 in Table 10-2) to mitigate or avoid impacts then the assessment is considered sufficient for the purpose of the FIRA and EIS. The recommendation provided in the report that the impacts should be assessed at detailed design stage is endorsed by BMT.

## Project SEARs

BMT reviewed the project SEARs against the GPOP WCM flood assessment and our opinion on whether these recommendations have been satisfied is documented in Table 1.1. Based on the provided flood modelling and the Final Draft report, it is BMT's opinion that all the project SEARs have been sufficiently addressed.

### Table 1.1 SEARS

| SEARS | BMT Review |
|---|---|
| 1) Changes to flood behaviour during construction and operation for a full range of flood events up to the probable maximum flood (taking into account sea level rise and storm intensity due to climate change) must be addressed (and modelled) including: | Considered fully addressed for WRRF. Climate change does not use the most recent uplift factors (ARR4.2) but we note that the adopted approach was agreed with BCS. Other project features (pipelines and pumpstation) not modelled but sites are assessed qualitatively given the low level of flood risk. |
| (a) time to onset, duration, depth, velocity and hydraulic hazard of any flooding | A detailed description of existing flood behaviour is described within the report. Time to onset of flooding was not initially reported on but was since updated following initial BMT review. BMT considers this SEARs requirement to be addressed. |
| (b) any detrimental increases in the potential flood affectation of other properties, assets and infrastructure | There are little to no expected flood impacts for all events up to and including the 1% AEP event. In the more extreme events the flood impacts have been presented and BMT agrees that the impacts are minor in relation to the depth of flooding |
| (c) consistency (or inconsistency) with applicable Council floodplain risk management plans | Adequately demonstrated in the report. The updated model's peak flood levels within the area of interest agree closely with Council's adopted model developed through the NSW FRM process. |
| (d) compatibility with the flood hazard of the land | Sufficiently documented |
| (e) compatibility with the hydraulic functions of flow conveyance in flood ways and storage areas of the land | Sufficiently documented |
| (f) downstream velocity and scour potential | Negligible changes in flow velocities modelled. Potential for scour of disturbed surfaces noted during construction phase. Mitigation measures are proposed to minimise the potential for scour |
| (g) impacts the development may have upon existing community emergency management arrangements for flooding. These matters must be discussed with the State Emergency Service and Council | Section 4.4 documents consultations with both Council and the NSW SES. This requirement is considered to be met although consultation with the SES will be ongoing through the development of an operational Flood Evacuation Management Plan. |
| (h) any impacts the development may have on the social and economic costs to the community as a consequence of flooding | Sufficiently documented given the minimal expected impact |
| (i) and independent peer-review, with the findings detailed in the EIS, including how any recommendations and findings have been addressed | This letter documents the peer review undertaken by BMT. |
| (j) impact on existing development consents that apply to the site | Sufficiently documented |
| 2) Flood management objectives and outcomes must be clearly identified and substantiated to address the characteristics of the environment and relevant legislative, management and guidance requirements. | Design criteria and performance outcomes identified and documented |
| 3) A flood impact and risk assessment (FIRA), prepared in accordance with relevant guidelines, and having regard to advice provided by Biodiversity, Conservation and Science Group. | Sufficiently documented |

## Limitations of Review

The focus of the peer review is on the flood model set up and ability of the model to satisfactorily determine flood impacts along with the report to ensure that the modelling assumptions and outcomes are adequately documented. Aspects such as the design/feasibility of the proposed infrastructure have not been assessed as part of this review.

In undertaking the peer review, BMT has relied upon, and presumed accurate, information (or absence thereof) provided by Jacobs. Except as otherwise stated in this review, BMT 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 review may change.

Yours Sincerely,

**BMT**

**Barry Rodgers**
Principal Consultant