ENGENY
WATER MANAGEMENT

CITY OF MELBOURNE

Melbourne Water

Melbourne Water & City of Melbourne

City of Melbourne Planning Scheme Overlays

Overlay Delineation Report

4/11/2020

V3000_111_REP-001-1

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1	4/11/2020	Client Issue	Paul Clemson	Glenn Ottrey	Paul Clemson	Glenn Ottrey
Signatures						

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1 INTRODUCTION

1.1 REPORT OBJECTIVE

Melbourne Water and City of Melbourne engaged Engeny Water Management (Engeny) to develop flood related planning scheme overlays for flood prone areas of the municipality. The development of the planning scheme overlays follows on from six flood studies undertaken within the municipality.

Planning authorities (such as Melbourne Water and City of Melbourne) can use flood information to articulate local planning objectives and strategies for flooding in their Local Planning Policy Framework (LPPF) and apply the most appropriate flood provision to control land use and development in flood affected areas as defined by the relevant planning scheme overlay.

This report documents the processes undertaken by Engeny to develop the flood related planning scheme overlays.

1.2 RELEVANT STUDIES

The delineation of the planning scheme overlays is based on flood modelling results from the following studies:

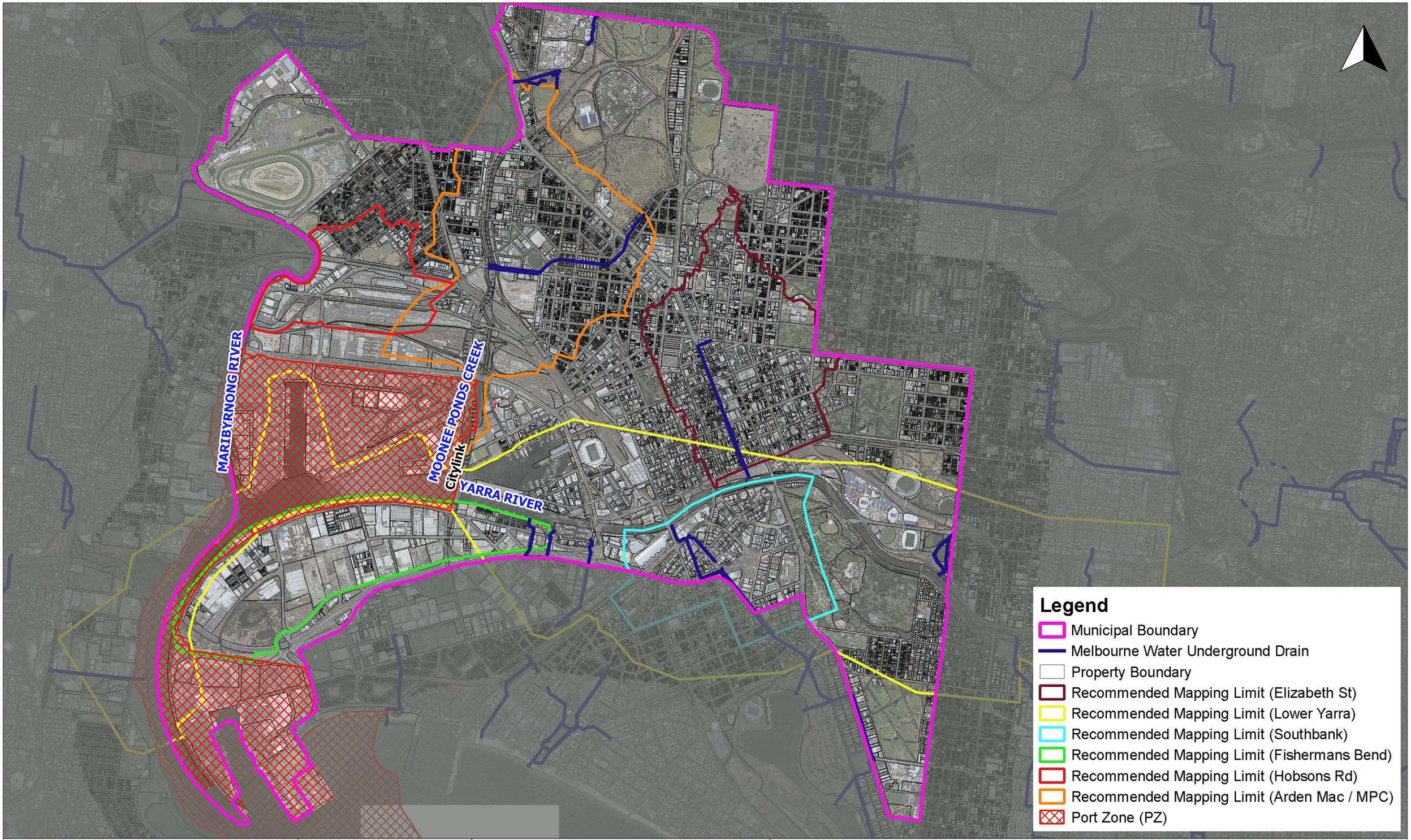
- Arden Macaulay Precinct and Moonee Ponds Creek
- Elizabeth Street Drain
- Fishermans Bend
- Hobsons Road
- Lower Yarra
- Southbank

For each of the flood studies, the delineation of the planning scheme overlays is based on the 1 % annual exceedance probability (AEP) storm event for a year 2100 climate change scenario. The year 2100 climate change scenario includes an 18.5 % increase in rainfall intensity compared to current climate conditions and allowance for sea level rise of 0.8 metres.

Figure 1.1 displays the locations of the relevant flood studies used for the basis of the planning scheme overlays within the City of Melbourne. Some of the flood studies extend beyond the Melbourne municipality boundary, but planning scheme overlays are only proposed within the City of Melbourne. Planning scheme overlays are not proposed within the Port of Melbourne as this area is within a different planning scheme.

This report documents the methodology adopted to develop the planning scheme overlays and does not provide details of the flood modelling studies. The following documentation can be referred to for details of the flood modelling studies:

- Technical Report: Australian Rainfall Runoff Sensitivity Analysis (Engeny Water Management, 22/07/2020)
- Southbank Flood Modelling Update and Climate Change Scenarios (Water Modelling Solutions, 21/04/2020)
- Southbank Stormwater Infrastructure Assessment: Final Report (BMT WBM, August 2015)
- Elizabeth Street Melbourne - Flood Modelling Report (Water Technology, August 2017)
- Addendum to Elizabeth Street, Melbourne Flood Modelling Report (Water Technology, August 2017) (Water Technology, 20/12/2019)
- Elizabeth Street Main Drain Catchment Flood Modelling (Water Technology, 13/02/2020)
- Elizabeth Street Main Drain Catchment Flood Modelling (Water Technology, 9/04/2020)
- Fishermans Bend Flood Mapping (GHD, December 2019)
- Arden Macaulay Precinct & Moonee Ponds Creek Flood Modelling (Engeny Water Management, August 2020)
- Hobsons Road Catchment Flood Mapping Update (Venant Solutions, 17/06/2020)
- Hobsons Road Catchment Flood Mapping – Response to Rain Consulting Model Review (Venant Solutions, 22/04/2020)
- Lower Yarra River Flood Mapping (GHD, 24/09/2020)



Level 34, Tenancy 5, 360 Elizabeth St,
Melbourne VIC 3000
PO Box 12192, A'Beckett St
VIC 8006
www.engeny.com.au
P: 03 9888 6978
F: 03 9830 2601
E: melb@engeny.com.au

ENGENY WATER MANAGEMENT

Melbourne Water

CITY OF MELBOURNE

300 0 300 600 900 1200 m

Scale in metres (1:35000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
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City of Melbourne Planning Scheme Overlays

Figure 1.1
Locality Plan

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2 APPLICABLE FLOOD PLANNING ZONES AND OVERLAYS

Planning authorities (such as Melbourne Water and City of Melbourne) have a range of tools to choose from to identify flood affected land in the planning scheme. There are four types of flood provisions available, which are:

- Urban Floodway Zone (UFZ);
- Floodway Overlay (FO);
- Land Subject to Inundation Overlay (LSIO); and
- Special Building Overlay (SBO).

The various flood provisions have been derived based on the type of flooding and the potential level of risk to life and property. The level of planning control in each provision is commensurate with the potential flood risk. For example, the UFZ is a restrictive provision that prohibits most uses and development. It is designed to be applied to urban environments where there is a high potential flood risk and only low intensity uses and development (such as recreation) are suitable. In contrast, the LSIO is used for both urban and rural environments to identify land with a lower potential flood risk. The LSIO requires a permit for buildings and works and does not prohibit either use or development.

The UFZ, FO and LSIO all relate to mainstream flooding from a river or stream, while the SBO relates to stormwater flooding along overland flow paths in catchments with underground drainage systems.

Within the City of Melbourne, management of drainage assets is summarised by the following:

- Melbourne Water manages rivers and creeks, and flooding related to these assets.
- Melbourne Water manages the trunk drainage system, which is typically larger underground drainage assets with a contributing catchment area exceeding approximately 60 hectares, and the flooding related to these assets.
- City of Melbourne manages the local drainage system, which is typically smaller underground drainage assets that discharge stormwater into Melbourne Water's drainage system, and the flooding related to these assets.

To ensure that appropriate planning controls are implemented for the different types of flooding within the municipality, and so that flooding is separated into areas of management by Melbourne Water and by City of Melbourne, it is proposed to implement the following planning scheme overlays:

- Land Subject to Inundation Overlay Schedule 3 (LSIO3): this overlay defines flooding relating to rivers and creeks, managed by Melbourne Water.
- Special Building Overlay Schedule 2 (SBO2): this overlay defines overland flow paths associated with Melbourne Water's underground drainage system, managed by Melbourne Water.
- Special Building Overlay Schedule 3 (SBO3): this overlay defines overland flow paths associated with City of Melbourne's underground drainage system, managed by City of Melbourne.

3 DEVELOPMENT OF THE OVERLAYS

3.1 METHODOLOGY OVERVIEW

The delineation of the flood extents to define the planning scheme overlays is based on the methodology defined in Flood Mapping Projects Guidelines and Technical Specifications Version 9 (Melbourne Water, 2018). The same methodology has been adopted for the delineation of the LSIO3, SBO2 and SBO3.

The overlays are based on the predicted flooding as a result of the 1 % AEP storm event for a year 2100 climate change scenario. For a rainfall event of this magnitude, all areas of the municipality will have some degree of runoff on the surface. The intention of the overlays is to define areas of flooding in which it is appropriate to implement the controls associated with the LSIO and SBO.

The delineation of the planning scheme overlays used the raw flooding modelling results from the various flood studies, which consist of large datasets of gridded data with results such as flood depth for each grid cells. A series of processes is applied to the gridded data in order to define the extent of the overlay.

The overlay delineation process is summarised by the following:

- Flood extent filtering criteria were applied to the flood modelling results. The filtering criteria:
  - Include areas where the predicted flood depth is equal to or greater than 0.05 metres
  - Exclude isolated areas of flooding with an area less than 100 square metres
  - Include surrounded dry areas if the area is less than or equal to 100 square metres
- After the application of the filtering criteria, a smoothing process was applied to the edges of the flood extent to convert the gridded shape to a smoothed flood extent.
- The flood extent was removed from properties if the following criteria were satisfied:
  - Less than 2 % of the total area of the property was impacted by the flood extent, AND
  - Less than 25 % of the road frontage of the property was impacted by the flood extent.
- In areas that the flood extent was discontinuous, but joined by wet cells in the raw modelling outputs (which may have been filtered from the flood extent due to low depths of flow), the discontinuous sections of the flood extent were joined.
- Manual adjustments were made to remove the overlays from bridges or elevated roads, where the flood modelling identified that water was flowing underneath the bridge or elevated road, but the bridge deck of surface of the elevated road was not predicted to be inundated by the main flow path.
- The overlays were manually separated between LSIO3, SBO2 and SBO3.

The following sections of this report provide specific examples of the delineation of the overlays.

3.2 FLOOD EXTENT SMOOTHING

The flood modelling results used as the basis of the planning scheme overlays consist of large datasets of gridded data with results such as flood depth for each grid cell. The initial process of applying the filtering criteria identified in Section 3.1 results in a gridded flood extent, which represents the gridded cells that have satisfied the filtering criteria.

A smoothing process is then applied to the edges of the gridded flood extent to create a less blocky flood extent.

Figure 3.1 provides an example of the smoothing process.

Figure 3.1: Example of the flood extent smoothing process

3.3 PROPERTY AREA AND ROAD FRONTAGE CRITERIA

Where the smoothed flood extent only covered a small portion of a property, the planning scheme overlay was removed from the property if the following criteria are satisfied:

- Less than 2 % of the total area of the property was impacted by the flood extent, AND
- Less than 25 % of the road frontage of the property was impacted by the flood extent.

Figure 3.2 provides an example of two properties where areas of the initial flood extent were removed from the final planning scheme overlay as the above conditions were satisfied. The predicted flood risk for these properties is relatively low and implementing the planning scheme overlay for these properties would have provided limited benefits.

Figure 3.3 provides an example where small portions (less than 2 % of the property area) of several properties are predicted to be flooded, but the planning scheme overlay has been retained as more than 25 % of the property's road frontage is impacted by the flood extent. In these instances, if the property was to redevelop with a below ground car park or garage, there would be a potential risk of floodwater flowing into the underground area. Retaining the planning scheme overlay allows for this risk to be managed.

Figure 3.2: Example where flooded areas removed from the planning scheme overlay

Figure 3.3: Example where small flooded areas within properties retained in the planning scheme overlay

3.4 FORMING CONNECTED FLOW PATHS

In areas that the flood extent produced by the initial application of the filtering criteria to the raw modelling outputs was discontinuous, but joined by wet cells in the raw modelling outputs (which may have been filtered from the flood extent due to low depths of flow in steeper sections of the flow path), the discontinuous sections of the flood extent were joined.

No additional properties have been impacted by the planning scheme overlays due to the process of joining the discontinuous sections of the flood extent.

Figure 3.4 provides an example of where discontinuous sections of the flood extent have been connected in the final planning scheme overlay.

Figure 3.4: Example of joining discontinuous sections of the flood extent

3.5 BRIDGES AND ELEVATED ROADS

In some areas, particularly along creeks and rivers, manual adjustments were made to remove the overlays from bridges or elevated roads, where the flood modelling identified that water was flowing underneath the bridge or elevated road, but the bridge deck of surface of the elevated road was not predicted to be inundated by the main flow path.

Flood modelling, such as the flood studies used as the basis for the delineation of the planning scheme overlays, typically use Light Detection and Ranging (LiDAR) data as the main source of topographical data to define surface levels in the model. Typically, structures such as bridges and elevated roads have been removed from the LiDAR data by interpolating surface levels on either side of the structure. This allows the LiDAR to approximate the surface levels beneath the bridge or raised road.

In order to identify whether bridges or road structures are predicted to be overtopped, first return LiDAR was used to define the surface level of the bridge or elevated road. The first return LiDAR is the raw LiDAR prior to interpolation being applied to remove features such as bridges, elevated roads and vegetation. The surface level of the bridge or elevated road was compared to the

water surface level predicted by the flood modelling and if the water surface level was below the surface level of the bridge or elevated road, the bridge or elevated road was removed from the planning scheme overlay.

Figure 3.5 provides an example of where a bridge was removed from the planning scheme overlay, while Figure 3.6 provides an example of where an elevated train line was removed from the planning scheme overlay. Figure 3.7 provides an example of where a bridge was retained in the planning scheme overlay as the deck of the bridge is predicted to be overtopped.

Figure 3.5: Example of bridge removed from the planning scheme overlay

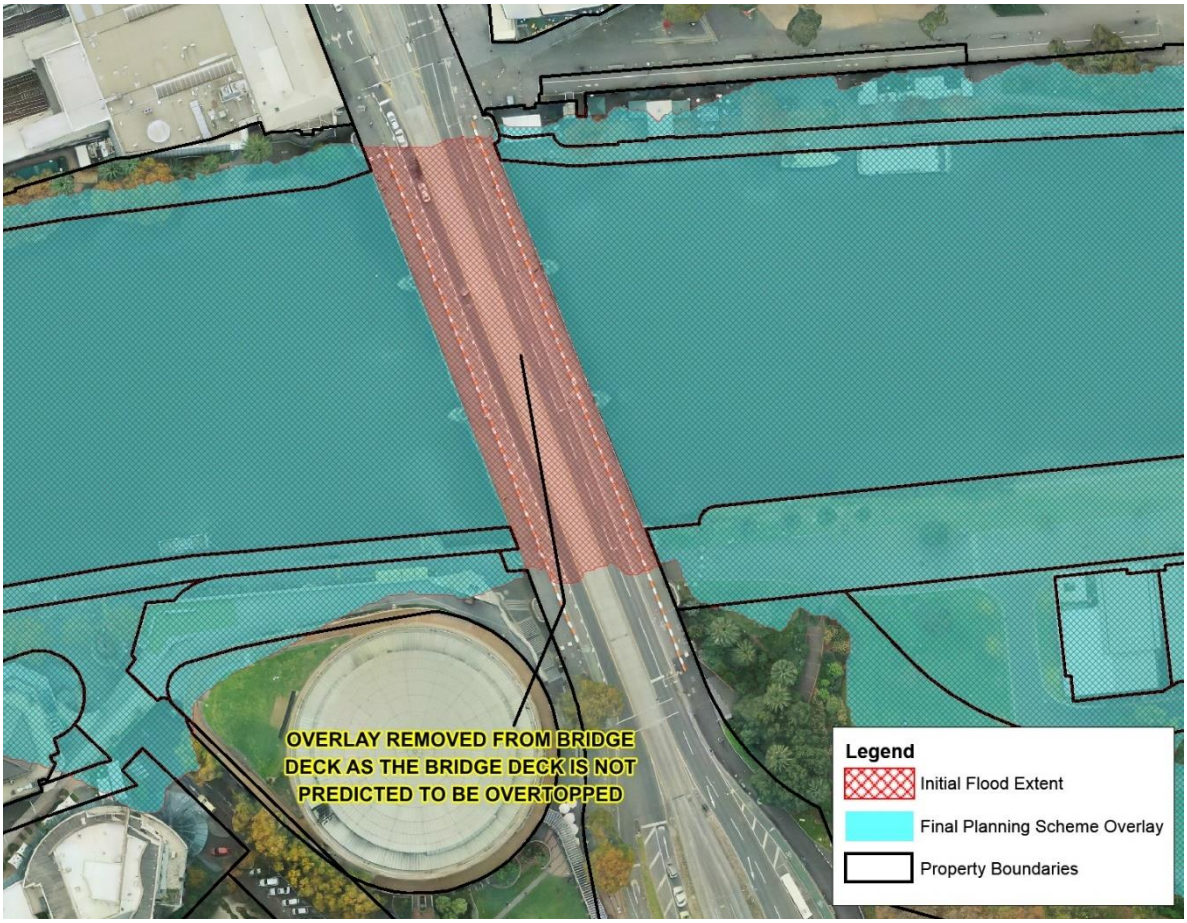

Figure 3.6: Example of elevated train line removed from the planning scheme overlay

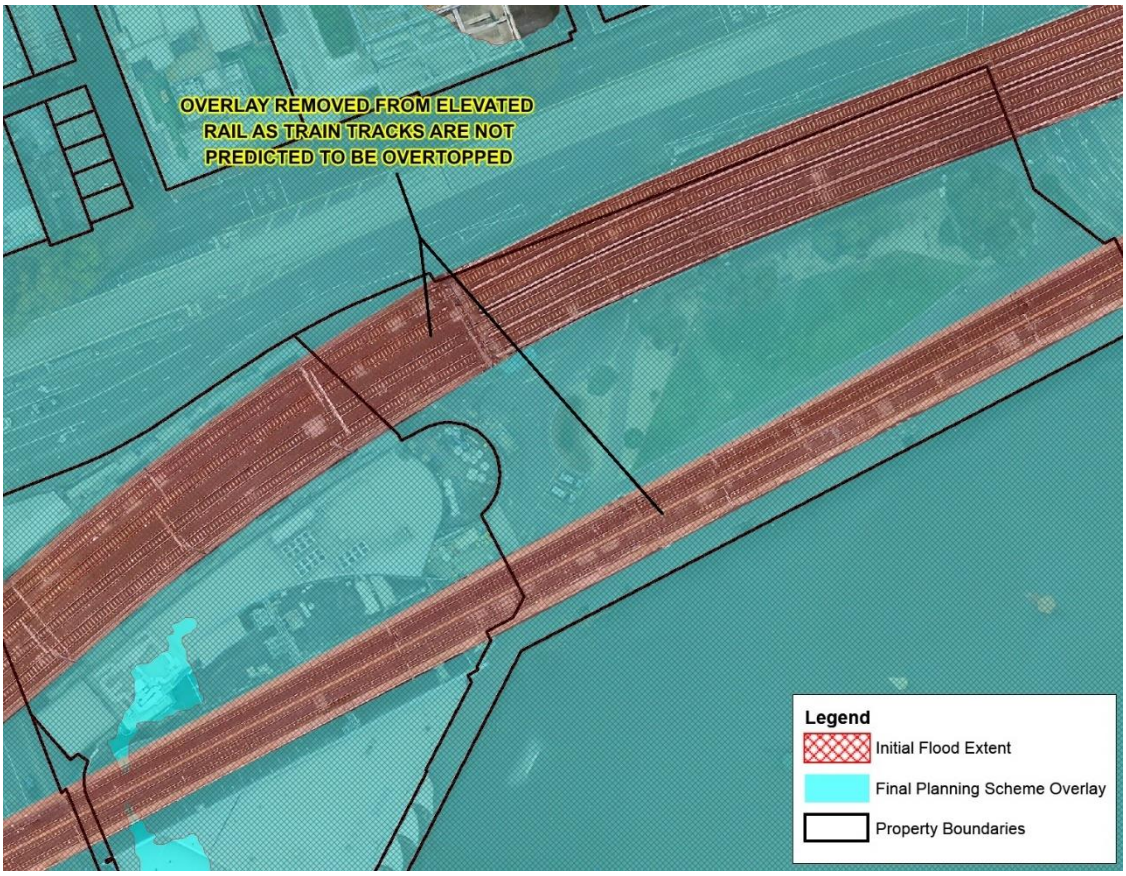

Figure 3.7: Example of bridge retained in the overlay, as well as elevated road removed from the overlay

3.6 SEPARATING MELBOURNE WATER AND CITY OF MELBOURNE OVERLAYS

The flood extents were separated into the various planning scheme overlays so that:

- The LSIO3 defines flooding associated with Melbourne Water's creeks and rivers
- The SBO2 defines overland flow paths associated with Melbourne Water's underground drainage system
- The SBO3 defines overland flow paths associated with City of Melbourne's underground drainage system

Typically, the approach taken avoids having more than one planning scheme overlay overlapping a property, where appropriate. In some instances, such as large properties or properties in which there is a large difference (~0.5 metres) in the flood level associated with Melbourne Water's and City of Melbourne's drainage system, more than one planning scheme overlay has intentionally been applied to a property.

3.7 MAP

Appendix A provides a series of plans displaying the final extents of the LSIO3, SBO2 and SBO3.

3.8 PROPERTIES IMPACTED

Table 3.1 provides a summary of the number of properties that are impacted by the planning scheme overlays. The assessment of the number of properties impacted by the overlays is based on the property boundaries as defined by the Department of Environment, Land, Water and Planning's VMPROP_PARCEL_VIEW layer, in ESRI Shape format, downloaded from the Spatial Datamart Victoria website on 5 October 2010. It should be noted that this layer includes some property boundaries that relate to road reserves.

As shown in the table, there is a total of 3448 property boundaries that are impacted by the planning scheme overlays. Of these properties, 47 properties are impacted by more than one planning scheme overlay and 42 properties would be referred to both City of Melbourne and Melbourne Water as they are impacted by both a City of Melbourne overlay (SBO3) and at least one of Melbourne Water's overlay (LSIO3 and / or SBO2).

Table 3.1: Number of properties impacted by each planning scheme overlay

Planning Scheme Overlay	Number of Properties
Properties impacted by LSIO3 (referral to Melbourne Water)	1731
Properties impacted by SBO2 (referral to Melbourne Water)	295
Properties impacted by SBO3 (referral to City of Melbourne)	1470
Total properties impacted	3448
Properties with more than one overlay	47
Properties that would be referred to Melbourne Water and City of Melbourne (i.e. impacted by SBO3 and either LSIO3 or SBO2)	42

4 SUMMARY

This report documents the processes undertaken by Engeny to develop flood related planning scheme overlays with the City of Melbourne. The delineation of the planning scheme overlays is based on flood modelling results from the following studies:

- Arden Macaulay Precinct and Moonee Ponds Creek
- Elizabeth Street Drain
- Fishermans Bend
- Hobsons Road
- Lower Yarra
- Southbank

For each of the flood studies, the delineation of the planning scheme overlays is based on the 1 % AEP storm event for a year 2100 climate change scenario. The year 2100 climate change scenario includes an 18.5 % increase in rainfall intensity compared to current climate conditions and allowance for sea level rise of 0.8 metres.

It is proposed to implement the following planning scheme overlays:

- Land Subject to Inundation Overlay Schedule 3 (LSIO3): this overlay defines flooding relating to rivers and creeks, managed by Melbourne Water.
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The delineation of the flood extents to define the planning scheme overlays is based on the methodology in Flood Mapping Projects Guidelines and Technical Specifications Version 9 (Melbourne Water, 2018). The same methodology has been adopted for the delineation of the LSIO3, SBO2 and SBO3.

There is a total 3448 properties that are impacted by the planning scheme overlays. Of these properties, 47 properties are impacted by more than one flood related planning scheme overlay and 42 properties would be referred to both City of Melbourne and Melbourne Water as they are impacted by both a City of Melbourne overlay (SBO3) and at least one of Melbourne Water's overlays (LSIO3 and / or SBO2).

5 QUALIFICATIONS

a) In preparing this document, including all relevant calculation and modelling, Engeny Water Management (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

b) Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.

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   ii) Engeny considers it prudent to revise any aspect of the works in light of any information which becomes known to it after the date of submission.

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g) This Report does not provide legal advice.

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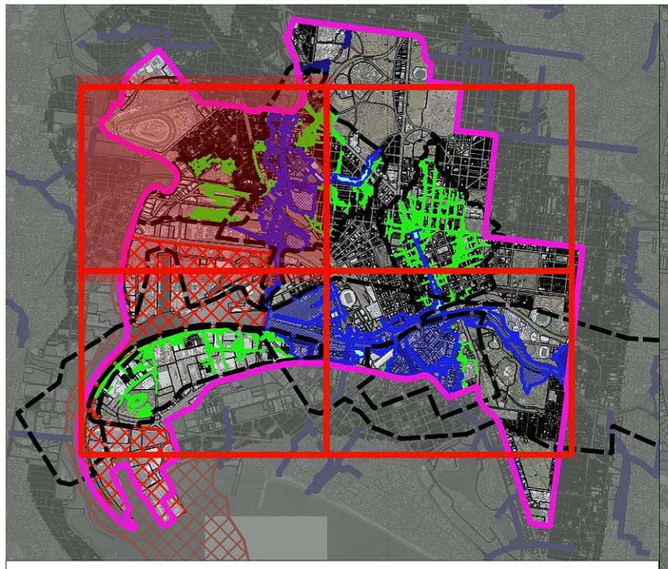
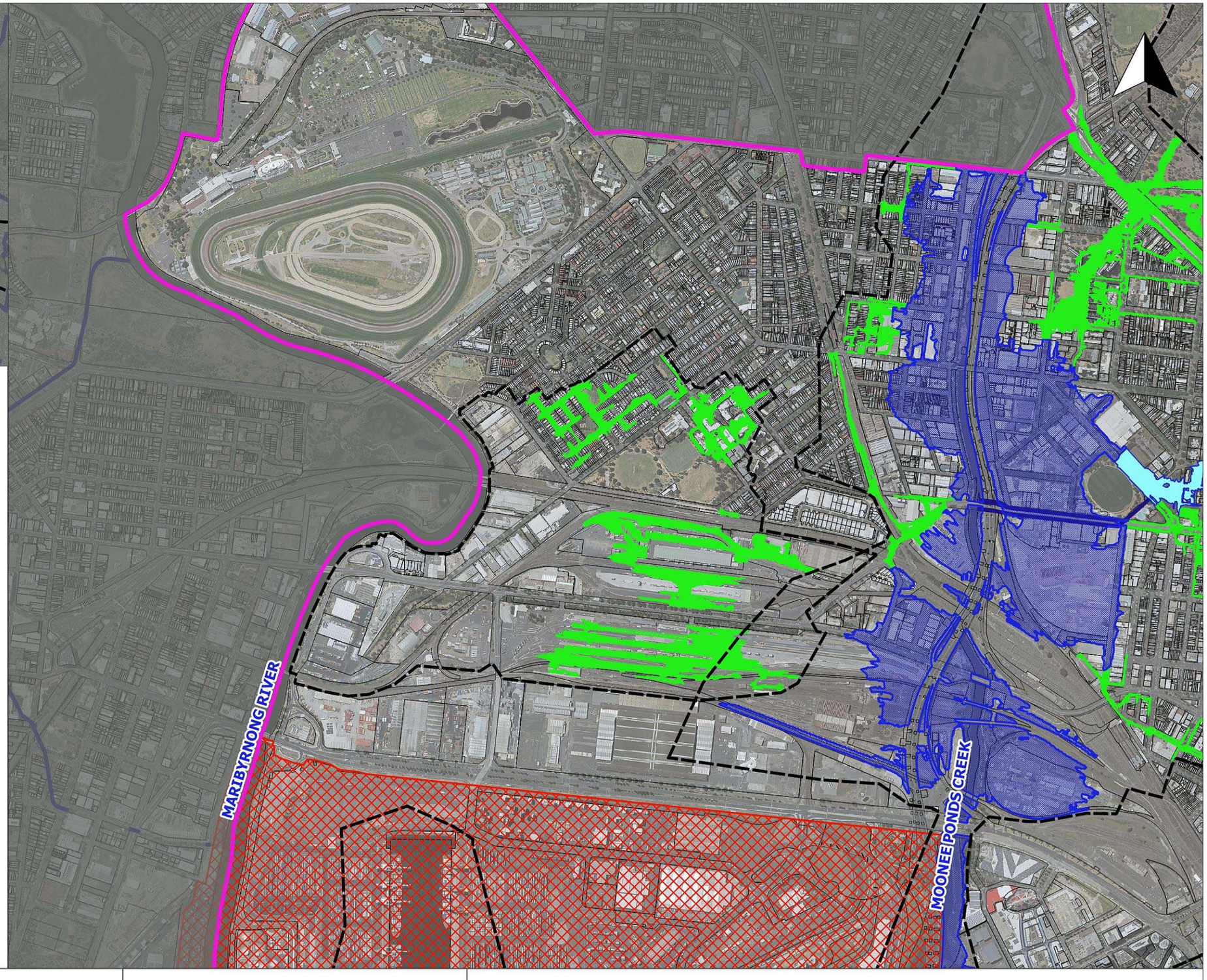
Appendix A:
Planning Scheme Overlay Map





Legend

- Municipal Boundary
- Melbourne Water Underground Drain
- Property Boundary
- Flood Study Mapping Limits
- LSIO3 (Melbourne Water)
- SBO2 (Melbourne Water)
- SBO3 (City of Melbourne)
- Port Zone (PZ)

Level 34, Tenancy 5, 360 Elizabeth St,
Melbourne VIC 3000
PO Box 12192, A'Beckett St
VIC 8006
www.engeny.com.au
P: 03 9888 6978
F: 03 9830 2601
E: melb@engeny.com.au

ENGENY WATER MANAGEMENT

Melbourne Water

CITY OF MELBOURNE

100 0 100 200 300 400 m

Scale in metres (1:14000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

City of Melbourne Planning Scheme Overlays

Appendix A
Planning Scheme Overlays
Map Location 1 of 4

Job Number: V3000_111
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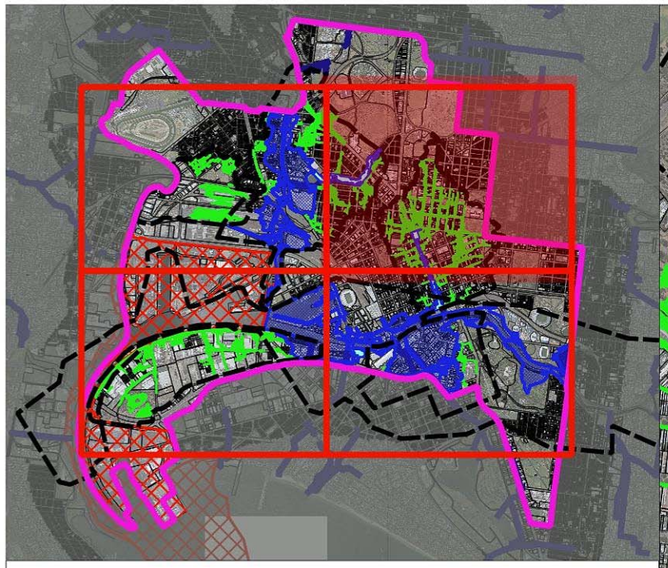

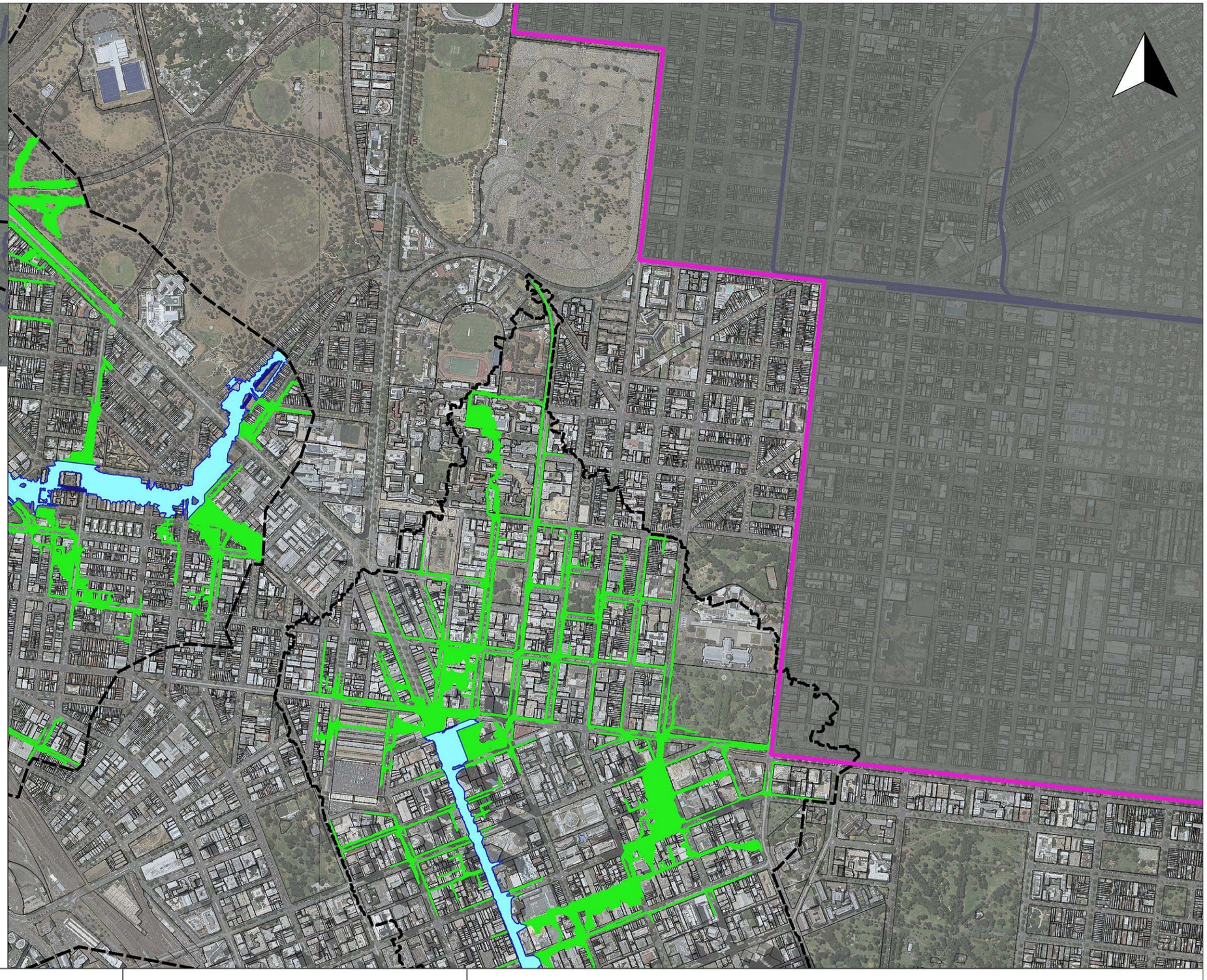

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City of Melbourne Planning Scheme Overlays

Appendix A
Planning Scheme Overlays
Map Location 2 of 4

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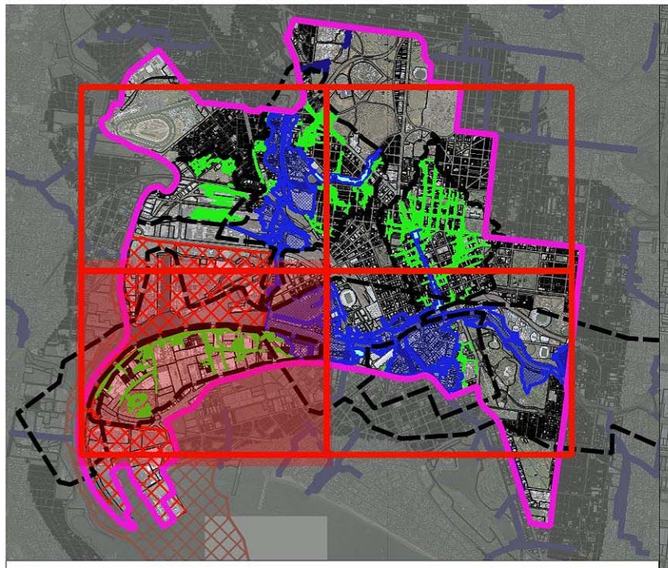

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MARIBYRNONG RIVER

MOONEE PONDS CREEK

Citylink

YARRA RIVER

West Gate Fwy

YARRA RIVER

Level 34, Tenancy 5, 360 Elizabeth St,
Melbourne VIC 3000
PO Box 12192, A'Beckett St
VIC 8006
www.engeny.com.au
P: 03 9888 6978
F: 03 9830 2601
E: melb@engeny.com.au

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Appendix A
Planning Scheme Overlays
Map Location 3 of 4

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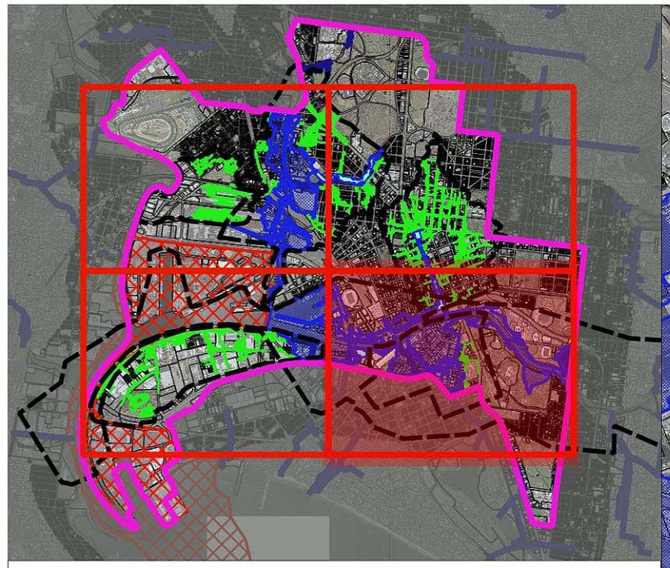

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St Kilda Rd

Level 34, Tenancy 5, 360 Elizabeth St,
Melbourne VIC 3000
PO Box 12192, A'Beckett St
VIC 8006
www.engeny.com.au
P: 03 9888 6978
F: 03 9830 2601
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Appendix A
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Map Location 4 of 4

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engeny.com.au

P: 03 9888 6978
Level 34, Tenancy 5, 360 Elizabeth Street, Melbourne VIC 3000 | PO Box 12192 Melbourne VIC 8006