Expert Evidence

Amendment C384 to the Melbourne Planning Scheme

Hydrology and Hydraulics

Prepared for:

City of Melbourne

Panel Hearing

October 2022

Project Name	Rain Consulting - Expert Evidence – Amendment C384 to the Melbourne Planning Scheme
Client	City of Melbourne
Rain ID	257_01
Document Name	257_01_EE01

Version History

Version Number	Status	Authors	Reviewer	Date of Issue
v01	Final	LJC	RBM	03 October 2022

Disclaimer

Carbon Offsetting - Rain Consulting deeply recognise our responsibility to address the environmental impacts of our businesses and those we are associated with. Human induced climate change has increased average and extreme temperatures, changed rainfall patterns and created more severe and less predictable storms. That's why we're striving for net negative carbon. 29.6 kg of CO_2 have been emitted in the creation of this project. In line with the 2C pathway, we have offset 2.5 times this (**74.0 kg offset**) with South Pole Australia (https://www.southpole.com/sp-australia). South Pole Australia is an Australian Government Carbon Neutral Certified Organisation.

Rain respectfully acknowledges the Traditional Owners of the lands on which we work, live and play. We also pay our respects to their Elders, past and present, and Aboriginal Elders of other communities.

Table of Contents

1 Report Author

Luke Cunningham CPENG
Principal and Director
Rain Consulting Pty Ltd
PO Box 402
Chelsea Victoria 3196

Qualifications
Bachelor Environmental Engineering (with honours, Monash University)

Affiliations
- Member of Engineers Australia
- Chartered Professional Engineer
- Registered Professional Engineer (Civil) Victoria

Areas of Expertise
Key areas of expertise relevant to this report are summarised below
- Assessment of drainage and flood related issues
- Hydrological and hydraulic modelling and assessments in urban areas
- Flood mapping and mitigation

2 Report Contributors

Rianda Mills
Principal and Director
Rain Consulting Pty Ltd
PO Box 402
Chelsea Victoria 3196

Qualifications
Bachelor Environmental Engineering (with honours, University of Western Australia).

Affiliations
- Member of Engineers Australia

Areas of Expertise
Key areas of expertise relevant to this report are summarised below
- Assessment of drainage and flood related issues
- Hydrological and hydraulic modelling and assessments in urban areas
- Flood mapping and mitigation

Scope of Contribution
Rianda Mills assisted in the preparation of this report, including background data reviews and preparation of materials, under my supervision.

3 Scope of the Report

In relation to Amendment C384 to the Melbourne Planning Scheme I have been engaged by the City of Melbourne to act as an expert on hydrologic and hydraulic matters only relating to the proposed Schedule 3 to the Special Building Overlay (SBO3).

I have been asked to:

- Explain my involvement and provide an overview of flood modelling and mapping as it relates to the Amendment.
- Consider and express my opinions about the hydrologic aspects of the Amendment including the strategic basis for the Amendment having regards to the PPN12 Planning Practice Note (Applying the Flood Provisions in Planning Schemes).
- Consider and respond to the hydrologic modelling issues raised in all SBO3 related submissions received to the Amendment.
- Provide my expert opinion on the Amendment.

4 Basis of this Report

This report outlines my earlier involvement (refer Section 5) and consideration of the following documents which specifically relate to the proposed SBO3:

- Planning Practice Note 12: Applying the Flood Provisions in Planning Schemes (a guide for councils)
- Amendment C384melb Explanatory Report
- Amendment C384melb Instruction Sheet
- Amendment C384melb Maps
- Schedule 3 to Clause 44.05 Special Building Overlay
- Amendment C384melb Notice of the preparation of Amendment C384melb
- Good Design Guide for Buildings in Flood Affected Areas in Fishermans Bend, Arden and Macaulay
- Planning for Sea Level Rise Guidelines (Port Phillip and Westernport Region)
- Technical Report 1 – Australian Rainfall and Runoff Sensitivity Analysis
- Technical Report 2 – Southbank Flood Modelling Update and Climate Change Scenarios
- Technical Report 3 – Southbank Stormwater Infrastructure Assessment: Final Report
- Technical Report 4 – Elizabeth Street Melbourne Flood Modelling Report
- Technical Report 5 – Arden Macaulay Precinct & Moonee Ponds Creek Flood Modelling Model Build Report
- Technical Report 7 – Hobsons Road Catchment Flood Mapping Update
- Technical Report 8 – Fishermans Bend Flood Mapping
- Technical Report 9 – City of Melbourne Planning Scheme Overlays: Overlay Delineation Report
- August 2022 Future Melbourne Committee Minutes and Agenda Items 6.2 and 6.3
- Submissions directly relevant to the SBO3 (Submission: 2,5,6,10,11,12,17,18,19,20,23,27,28,31,32,33,38,40,41,42)

5 Past Involvement

My personal past involvement in this amendment spans across several years.

In a former role at Water Technology Pty Ltd, I was the project manager and later the project director of the Elizabeth Street Flood Study. My primary task across both roles was to review the flood modelling work and reporting of project engineers and to liaise with both Melbourne Water and City of Melbourne.

Between November 2018 and October 2019, I worked for City of Melbourne as a Drainage Engineer. While my day-to-day role focused on drainage infrastructure management, maintenance, and planning, I assisted the Climate Adaptation and City Strategy and Place teams with preparing for the amendment. This involved initial liaison and meetings with Melbourne Water to plan the timing of the amendment as well as advice and planning from a technical perspective of which previous studies could be included in the amendment. My role also included some preliminary planning into further flood modelling of other catchments for potential future amendments.

In November 2019, Rain Consulting was requested to quote on providing 'Flood Modelling Expertise for Planning Scheme Amendment' which was awarded to Rain Consulting in December 2019. The work, completed by Rianda Mills and me, broadly included:

- Liaison with consultants across all studies to assist with any technical queries
- Liaison with Melbourne Water where required to discuss any technical issues
- Review results and technical reports of all models
- Peer review of models
- Work with consultants during the filtering process
- Work with the project team to incorporate the technical reports into the amendment

Rain Consulting's engagement continued until mid-2021.

In March 2020, Rain Consulting was engaged by City of Melbourne for me to participate in a Design Sprint held between various arms of state government, City of Melbourne, and City of Port Phillip. The Design Sprint was a 10-day workshop focused on urban design challenges given the modelled flooding in the Arden, Macaulay and Fishermans Bend areas. The outputs of the work created in the Design Sprint later contributed to the exhibited version of the "Good Design Guide for Buildings in Flood Affected Areas in Fishermans Bend, Arden and Macaulay".

In November 2020 Rain Consulting were engaged by City of Melbourne to process the raw model results from the Southbank, Elizabeth Street, Fishermans Bend, Arden Macaulay and Moonee Ponds Creek, and Hobsons Road flood models. The purpose of this work was to process the data into a format that could be easily utilised within the City of Melbourne's internal mapping program.

In February 2022, the City of Melbourne engaged Rain Consulting to consider and respond to submissions received in response to the exhibition of Amendment C384 as it related to land proposed to be affected by SBO3. In total, 20 submissions were reviewed, and short reports were prepared depending on the nature of the submission. As a part of considering the submissions, I undertook a site inspection where I considered it necessary to do so to inform my opinion.

6 Overview of Flood Modelling and Mapping

Six flood studies have been completed which inform Amendment C384, with five of them being relevant to the SBO3. The sixth model which covers the Lower Yarra River does not result in any flooding which has been classified as SBO3 and has hence not been considered in this report.

The five flood modelling reports I consider to be relevant are as follows:

- Southbank Flood Modelling: A flood modelling report originally produced by WBM BMT for City of Melbourne (2015) which investigated the existing flood conditions at the time and investigated potential flood mitigation and stormwater quality improvements. The modelling was updated by Water Modelling Solutions for City of Melbourne (2020). While several changes were made to the model, the main task was to update the model to incorporate climate change conditions (rainfall intensity and sea level rise).
- Elizabeth Street Catchment Modelling: A flood modelling report was produced by Water Technology for City of Melbourne (2017). The work focused on defining existing and future (climate change) flood conditions.
- Arden, Macaulay, and Moonee Ponds Creek Modelling: The most recent modelling completed by Engeny Water Management for City of Melbourne and Melbourne Water (2020) was derived from previous modelling developed by AECOM in 2013 as part of planning for major developments within the study area. The 2020 work focused on predicting flooding across the catchment in climate change conditions.
- Hobsons Road Catchment Modelling: A flood model was originally created by Engeny Water Management for City of Melbourne for the JJ Holland Park Stormwater Harvesting Investigation (2016) and the Hobsons Road Flood Management Plan (2017). The model was then updated by Venant Solutions for City of Melbourne (2020). While several changes were made to the model, the main task was to update the model to incorporate climate change conditions (rainfall intensity and sea level rise).
- Fishermans Bend Modelling: Models covering Fishermans Bend date back several years, with the original model being created by URS. The 2019 GHD 'Water Sensitive Drainage and Flood Strategy for Fishermans Bend' was the basis for the updated modelling and mapping delivered for City of Melbourne in 2020. Climate change conditions were also incorporated in the 2020 updates.

The following is common across all models:

- All were built to the flood mapping guidelines of the time: Throughout the period of modelling, Melbourne Water has maintained a *Flood Mapping Projects Guidelines and Technical Specifications* document. This document is frequently updated. We understand that each model developed was developed with reference to these Guidelines. The purpose of the Melbourne Water guidelines is to *"facilitate a consistent best-practice approach that meets the needs of Melbourne Water and local government".*
- All models are TUFLOW: Each model has been created in the flood modelling software TUFLOW. TUFLOW (Two-dimensional Unsteady Flow) solves the shallow water equations and is widely used as the preferred model for modelling urban floods. ESTRY is TUFLOW's 1D open channel and underground pipe network engine. Currently, only two software packages are accepted by Melbourne Water, being TUFLOW and HEC-RAS. The version of HEC-RAS referred

to in the Melbourne Water *Flood Mapping Projects Guidelines and Technical Specifications* document is a 1-D model only, and hence not suitable for use in detailed modelling of urban areas such as seen in the catchments in question.

- All associated Digital Elevation Models are based on LiDAR information as a starting point to build upon: LiDAR (light detection and ranging) data has been used in all studies. LiDAR is a method used to determine surface elevations of the ground surface through the measurement of reflected light from a laser to return to a receiver. LiDAR has been captured several times in the last decade in various forms by various state and local authorities. One of the primary uses of LiDAR is flood modelling inputs. LiDAR has been used as the basis for creating a DEM (Digital Elevation Model) for each catchment and has in some areas has been supplemented by the modeller with additional information captured from site visits, ground survey or aerial photography.
- All include details of the drainage network: Both the City of Melbourne and Melbourne Water hold detailed information regarding their drainage assets. The City of Melbourne is generally responsible for assets with smaller upstream catchment areas and the level of service of these assets is usually aimed at the more frequent rainfall events rather than the larger and less frequent 1% AEP flood events. Melbourne Water generally manage the main drains, channels and waterways which have varying capacity depending on their original design intent. Each TUFLOW model is a 1-dimensional/2-dimensional model meaning that the underground drainage network (1d network) is included as well as the above ground surface model (2d network). Modellers were provided location-based information on the drainage assets within each model. The drainage information details the type of asset and includes the dimensions of the asset and the inverts (relative levels) of the asset where known. Where information is not available, modellers generally make decisions based on engineering judgement.
- Blockage assumptions: Each model includes a representation of the underground drainage network. While blockage sensitivity tests may have been completed, the extents presented for Amendment C384 assume no blockage within the drainage network. This represents a well maintained and serviced drainage network in all cases.
- All are based on Australian Rainfall and Runoff 1987 rainfall runoff methods: Each of the flood studies are based on the methods for rainfall generation and loss calculations from Australian Rainfall and Runoff (ARR) 1987. ARR19 was the first major update to the methodology and data backing rainfall estimation since ARR87 (1987) was released. While first released as ARR16, ARR19 was officially released in May 2019. There are many updates to flood estimation techniques when comparing ARR19 to ARR87, most relevant to the studies in question are the changes to design rainfall estimates. The ARR19 methodologies are based on a more extensive database of an additional 30 years of rainfall records and the inclusion of an additional 2,300 rainfall stations. Given the studies were underway when this change over occurred, a decision was made by Melbourne Water and City of Melbourne to continue with ARR87 to maintain consistency across each of the catchments. This decision was supported by the Engeny review which was commissioned to investigate the potential differences that may be seen if models were to be updated to the newer methodology.
- Calculation of Rainfall Excess Inflow: Rainfall excess refers to the rain water that remains after losses have been calculated, and can be considered runoff to be entered to the model. As previously noted, all models used an ARR87 methodology of calculating design storms and the associated losses. Models adopted one of three acceptable inflow methods:

- Direct rainfall on grid
- Runoff to pit and grid
- Inflow hydrographs

- All include the predicted impacts of climate change in the year 2100: All models appropriately incorporate the predicted impacts of climate change. Predictions include an 18.5% increase in rainfall intensity for Melbourne in the year 2100 as well as 0.8 m sea level rise. Sea level increases are relevant to the catchments which are tidally influenced.
- Influence of the Yarra River: Each of the models interact with the Yarra River to varying degrees. In tidally influenced areas of the Yarra River, a cyclical tidal boundary sourced form modelling of Port Phillip Bay was adopted. In other areas, downstream influences of the Yarra River were adopted from the Lower Yarra flood study.

7 Hydrology and Planning Practice Note 12

Planning Practice Note 12 (PPN12), June 2015 is a document prepared by DELWP in conjunction with Melbourne Water to provide councils with guidance around applying the flood provisions in planning schemes. PPN12 also describes the types of flood provisions available to an authority to implement in relation to Section 62(e) of the Planning and Environment Act 1987 to *"regulate or prohibit any use or development in hazardous areas, or areas likely to become hazardous"*.

PPN12 describes the two types of flooding which are the basis of the flood zones and overlays in planning schemes. PPN12 describes the two types as:

Mainstream Flooding

"Heavy rainfall produces surface run-off which flows into streams and rivers. When there is a large amount of run-off, water overflows the river banks on to adjacent low-lying land causing flooding. This is called mainstream flooding and can occur in both rural and urban areas. The UFZ, FO and LSIO identify areas affected by mainstream flooding in planning schemes."

Stormwater Flooding

"During severe storms in urban areas, land can be affected by overland flows. These occur when the rainfall run-off exceeds the capacity of the piped drainage system and no provision has been made for overland flows. This is called stormwater flooding and often occurs in areas where there is a high density of existing development and a high flood damage potential. The SBO identifies areas affected by stormwater flooding in planning schemes."

It is my opinion, that of the provisions available, the Special Building Overlay (SBO) is the most relevant to apply within the urbanised areas of the City of Melbourne. The SBO provides a means to apply a flood related control to areas known to be affected by flooding through the setting of a 'design flood event' (DFE), with the land within this area being referred to as 'land subject to inundation'. The 1% Annual Exceedance Probability (AEP) event is used in Victoria for land use planning and building purposes.

In many cases, detailed flood modelling projects such as those completed in preparation of Amendment C384 are the basis for defining the 1% AEP flood extent, or the land subject to inundation.

The flood studies completed within the City of Melbourne cover both *"mainstream flooding"* (the Yarra River) and *"stormwater flooding in urban areas only"*. Within the urbanised areas, detailed drainage systems are present in Melbourne, many of which are very old and designed to past standards and requirements. This drainage system is managed and maintained by both Melbourne Water and City of Melbourne. Melbourne Water manage the trunk drainage system, with the City of Melbourne managing the remaining network which feeds to the trunks. In 1% AEP rainfall events, the underground drainage system is not capable of conveying all flows, and hence overland flow occurs.

Within the studies completed, all 1% AEP flooding due to the underground drainage system being exceeded have been identified for application of the SBO. Where flooding is assessed to be due to the Melbourne Water underground drainage network, an SBO2 has been recommended. Where flooding is assessed to be due to the CoM underground drainage network, an SBO3 has been recommended.

The flood modelling and mapping completed within the City of Melbourne is the best available information to my knowledge that describes the interaction between above and below ground stormwater flow in a 1% AEP event within the urbanised areas of Melbourne. The hydrological methodologies adopted within each study are industry accepted methods of estimating the likely rainfall and runoff in a 1% AEP design event. The hydraulic modelling methodologies adopted within each study are industry accepted methods to estimate when and how the underground drainage network will be exceeded and key characteristics of the resultant overland flow path.

8 Submissions

44 submissions (43 on time and 1 late) were received in response to the proposed Amendment C384. I was instructed to consider Submission 10 but do no longer proffer a view as I have been instructed that the submission has since been withdrawn. Themes of the submissions varied. I have been asked to respond to the 'hydrologically' themed submissions made in response to the SBO3. I have therefore responded to submissions that both relate to the SBO3 and made comment regarding any relevant technical matters from the modelling. I have not reviewed any other submissions in detail. It is important to note that many of the below submissions raise separate issues which are outside my area of expertise, and I am instructed these matters will be addressed by others.

8.1 Submission 2 – 17 Park Drive, Parkville

Overlay Proposed: SBO3

Technical Issue Raised: Maintenance of drainage system

Assessment of Modelled Flooding: Flooding originating from Laneway CL1420 north-east of the property moves south along Park Drive combining with flooding from Story Street and filling both carriageways before inundating a portion of 17 Park Drive. The floodwater then continues, crossing Flemington Road and continuing on to eventually discharge into Moonee Ponds Creek. As flood waters move past the property, they inundate the full length of the property's frontage and 3% of the property's total area. The inundation ranges from 0.00 metres to 0.09 metres in depth with an average depth of inundation of 0.07 metres, across inundated areas.

Immediately in front of the subject site, Park Drive experiences flood depths of up to 0.28 metres, covering the entire width of the road and footpath.

Discussion on Technical Issue Raised: The submission references drains on "*Park Drive Parkville, and including all Parkville and corner Park Drive and Flemington Road*" not being maintained and requiring clean-out. Modelling completed considers a well maintained (free from blockage) stormwater network. I can state that the modelling methodology is appropriate in simulating a well-maintained network. If the models were to simulate a poorly maintained network via blockages, we would generally expect to see larger flood extents than occur in the current proposed overlay.

8.2 Submission 4 – 34 Newton Street, Kensington

Overlay Proposed: LSIO1, SBO3

Technical Issue Raised: Anomalous results in modelling

Assessment of Modelled Flooding: Flooding relating to the SBO3 originates from the north-east, flowing from Cairncross Lane, through Holgate Lane and into Newton Street. The floodwater then continues in a south-westerly direction along Newton Street before spilling onto Mercantile Parade. As flood waters move past the property, they completely inundate Newton Street, but water does not enter the subject site.

Immediately in front of the subject site, Newton Street experiences flood depths of up to 0.12 metres, covering the entire width of the road and potentially parts of the footpath.

Discussion on Technical Issue Raised: The submission states that *"Newton Street, Kensington is in no way subject to flooding. The highlighted section of the street on the map is grassed area and water does not sit, swell or is subject to flooding"*

Upon reviewing the flood shape in this area, it is evident that the overland flow path is shown to flow along both the asphalt road reserve and grassed areas. Reviews of the terrain model along Newton Street and the upstream and downstream areas also support that it is plausible that a flow path would exist along Newton Street. It also cannot be assumed that flooding will not occur on land on the basis that there is no known record or recollection of it having flooded in the past.

8.3 Submission 5 – 15 Park Drive, Parkville

Overlay Proposed: SBO3

Technical Issue Raised: Maintenance of drainage system

Assessment of Modelled Flooding: Flooding originating from Laneway CL1420 north-east of the property moves south along Park Drive combining with flooding from Story Street and filling both carriageways before inundating a portion of 15 Park Drive. The floodwater then continues, crossing Flemington Road, continuing on to eventually discharge into Moonee Ponds Creek. As flood waters move past the property, they inundate the full length of the property's frontage and 4% of the property's total area. The inundation ranges from 0.00 metres to 0.09 metres in depth with an average depth of inundation of 0.07 metres.

Immediately in front of the subject site, Park Drive experiences flood depths of up to 0.28 metres, covering the entire width of the road and footpath.

Discussion on Technical Issue Raised: The submission states that the drainage network would give the opportunity for flood water to disperse if the system was maintained and improved. Modelling

completed considers a well maintained (free from blockage) stormwater network. I can state that the modelling methodology is appropriate in simulating a well-maintained network. If the models were to simulate a poorly maintained network via blockages, we would generally expect to see larger flood extents than occur in the current proposed overlay.

8.4 Submission 6 – 11 and 25 Park Drive, Parkville

Overlay Proposed: SBO3

Technical Issue Raised: Application of pumps within the hydraulic model

Assessment of Modelled Flooding (11 Park Drive): Flooding originating from Laneway CL1420 north-east of the property moves south along Park Drive combining with flooding from Story Street and filling both carriageways before inundating a portion of 11 Park Drive, while flooding originating to the northwest of the property at Morrah Street moves through the Ievers Reserve and inundates the rear and southern side of the property. These floodwaters then combine and continue across Flemington Road, inundating North Melbourne Primary School and continuing south-west along Harris Street before combining with floodwaters moving southward along Moonee Ponds Creek. As flood waters move past the property, they inundate the full length of the property's frontage, 40% of the Laneway and 36% of the property's total area. The inundation ranges from 0.00 metres to 0.16 metres in depth with an average depth of inundation of 0.08 metres, across inundated areas.

Immediately in front of the subject site, Park Drive experiences flood depths of up to 0.28 metres, covering the entire width of the road and footpath.

Assessment of Modelled Flooding (25 Park Drive): Flooding originating from Laneway CL1420 north-east of the property moves south along Park Drive combining with flooding from Story Street and filling both carriageways before inundating a portion of 11 Park Drive, while flooding originating to the north-west of the property at Morrah Street moves through the Ievers Reserve and inundates the rear and southern side of the property. These floodwaters move south combining and crossing Flemington Road, inundating North Melbourne Primary School and continuing south-west along Harris Street before combining with floodwaters moving southward along Moonee Ponds Creek. As flood waters move past the property, they inundate the 100% of the length of the property's frontage, 100% of the Laneway and 3% of the property's total area. The inundation ranges from 0.00 metres to 0.08 metres in depth with an average depth of inundation of 0.06 metres, across inundated areas.

Immediately in front of the subject site, Park Drive experiences flood depths of up to 0.31 metres, covering the entire width of the road and footpath.

Discussion on Technical Issue Raised: The submission states that the assumption that pump stations will fail is "*unfair and unreasonable*" and that if the pumps are operational, the flood conditions would be different to what is shown. An analysis of the subject site has shown that it is unlikely that the operation of the pump stations at Moonee Ponds Creek would impact flood extents at or immediately surrounding the subject sites. While there may be localised impacts around the pumps, it is common practice from Melbourne Water to model pumps as not operational in flood events where they believe they would be likely to fail due to power outages or other mechanical issues. It is my opinion that the modelling approach of showing the pumps off is sound, and whether the pumps are operational or not would not impact flood conditions at the subject site.

8.5 Submission 11 – 13 Park Drive, Parkville

Overlay Proposed: SBO3

Technical Issue Raised: Drainage maintenance, storing water for drought

Assessment of Modelled Flooding: Flooding originates north-east of the subject site upstream of Morrah Street moves through Ievers Reserve. Flows split at Story Street with a portion heading towards Park Drive and the remainder staying within CL1511. Story Street overland flows pass through the site to join the overland flow path coming from Ievers Reserve at Flemington Road. Flows continue south across Flemington Road, inundating North Melbourne Primary School and continuing south-west along Harris Street before combining with floodwaters moving southward along Moonee Ponds Creek. As flood waters move past and through the property, they inundate 100% of the property frontage on Park Drive and 22.5% of the property's total area. Within the property, inundation ranges from 0.04 metres to 0.135 metres in depth with an average depth of inundation of 0.07 metres, across inundated areas.

Discussion on Technical Issue Raised: The submission questions whether "cleaning the drain more frequently" would mitigate the issue. Modelling completed considers a well maintained (free from blockage) stormwater network. I can state that the modelling methodology is appropriate in simulating a well-maintained network. If the models were to simulate a poorly maintained network via blockages, we would generally expect to see larger flood extents than occur in the current proposed overlay.

The submission also questions whether a strategy for saving flood water for drought periods would be a mitigation option. Stormwater harvesting systems generally target more frequent rainfall events to enable adequate storage for drawn down and reuse. Larger detention can be an effective method of mitigating flood risk if designed appropriately. I cannot comment on any future capital planning at City of Melbourne as I do not have knowledge of this.

8.6 Submission 12 – 5 Curran Street, North Melbourne

Overlay Proposed: SBO3

Technical Issue Raised: Anomalous results in modelling

Assessment of Modelled Flooding: Flooding is shown to originate from the intersection of Dryburgh Street and Curran Street east of the property, but likely begins further south on Dryburgh Street. Once reaching Curran Street, floodwaters move west along Curran Street inundating the parking lane of the west bound carriageway and footpath. It is likely that there is contributing flows also originating from Langfords Lane. Floodwater continues west along Curran Street joining floodwaters moving south-west along Melrose Street before combining with floodwaters moving southward along Moonee Ponds Creek. Maximum flood depths on the property reach up to 0.09m with a mean depth of 0.06m. 100% of the property frontage is inundated, cutting off the property's access to Curran Street.

Immediately in front of the subject site, Curran Street experiences flood depths of up to 0.18 meters, covering the parking lane of the west bound carriageway.

Discussion on Technical Issue Raised: I visited the subject site and surrounding areas in March 2022 to verify potential overland flow paths.

The submitter claimed that they believed that water would not be seen on the south side of Curran Street. It was evident from the visit that in an overland flow event, water could flow along the western side of Dryburgh Street. Any water on the western side of Dryburgh Street would likely then flow into Curran Street, with the roundabout on Curran and Dryburgh acting as the high point. Once on Curran Street, I believe that flows would remain in the kerb and channel as they move in a westerly direction towards Melrose Street due to the cross fall of Curran Street from the centre median towards the southern side of Curran Street. I believe that the modelling shown a sound representation of the potential 1% AEP flow path.

The submitter also claimed that the Hotham Hill area was excluded from the 2013 AECOM model and that *"Engeny had erroneously extrapolated the AECOM data for Curran St"*. While I did not review the AECOM model, I did review the Engeny model in this area. The model shows a rainfall input over the Hotham Hill area. The pre-filtered flood model results from the Engeny model show a flood extent originating from this area at the West Coburg Tramway. Discussions I have had with Engeny confirm that they agree with my interpretation of their model and that the inclusion of Hotham Hill is appropriately modelled. I therefore disagree with the submission that the modelling in the Hotham Hill area is erroneous.

8.7 Submission 17 – 127 Leveson Street, North Melbourne

Overlay Proposed: SBO3

Technical Issue Raised: Inadequate drainage

Assessment of Modelled Flooding: Flooding originating from Queensberry Street south of the property moves north along Leveson Street filling the north bound carriageway before combining with floodwaters in the southbound carriageway before crossing Arden Street and inundating the property. The floodwater inundates the property and neighbouring properties to the west and north. Flooding continues north on Leveson Street joining flooding moving north-west along Courtney Street. These floodwaters then join flooding from the north moving through South Melbourne Primary School and continue south-west along Harris Street before combining with floodwaters moving southward along Moonee Ponds Creek. As flood waters move past the property, they inundate 100% of the property frontage and 100% of the property's total area. The inundation ranges from 0.00 meters to 0.37 meters in depth with an average depth of inundation of 0.16 meters.

Immediately in front of the subject site, Leveson Street experiences flood depths of up to 0.29 meters, covering the entire width of the road and footpath. To the south of the subject site where flood waters cross Arden Street, flooding reaches depths of up to 0.44 meters.

Discussion on Technical Issue Raised: The submission raises several issues. The submission discusses the need to provide adequate stormwater infrastructure. With regards to any future flood mitigation, I cannot comment on any future capital planning at City of Melbourne as I do not have knowledge of this. Modelling completed considers a well maintained (free from blockage) stormwater network. I can state that the modelling methodology is appropriate in simulating a well-maintained network. If the models were to simulate a poorly maintained network via blockages, we would generally expect to see larger flood extents than occur in the current proposed overlay.

8.8 Submission 18 – 177 Drummond Street, Carlton

Overlay Proposed: SBO3

Technical Issue Raised: Accuracy of the terrain model

Assessment of Modelled Flooding: Flooding originating north-east of the property moves south along Drummond Street filling the parking lane of the north bound carriageway and passing the property. Additional flooding originating to the north-west of the property on Ormond Place fills the full width of Ormond Place and is shown to inundate the rear of the property. These floodwaters move south combining on Pelham Street and moving west towards Lygon Street before combining with floodwaters moving south-west and eventually making their way to discharge into the Yarra River. Although no inundation occurs along the frontage to Drummond Street, the northbound parking lane directly in front of the property experiences inundation. 100% of the rear of the property and access to Ormond Place is inundated to 1% of the property's total area. The inundation ranges from 0.00 metres to 0.06 metres in depth with an average depth of inundation of 0.06 metres across inundated areas.

Immediately in front of the subject site, Drummond Street experiences flood depths of up to 0.10 metres in the north bound parking lane, while to the rear of the property Ormond Place experiences depths of up to 0.09 metres.

Discussion on Technical Issue Raised: I visited the subject site and surrounding areas in March 2022 to verify potential overland flow paths. LiDAR information was used to inform and build the surface within the Elizabeth Street flood model. While there is potential that the LiDAR would not have accurately picked up the rear driveway levels due to the overhanging second story, further review of the terrain model used in the Elizabeth Street flood model shows a shallow low point along the laneway, sloping to the south. This is consistent with my findings from the site visit. Given the local terrain and the presence of private stormwater connections to the laneway, it is my opinion that the laneway would be subject to flooding in a large storm event. The application of the overlay will allow council to respond to any future proposed development at the subject site and make an appropriate assessment based on the available flood advice. The existence of current fill or the raising of a property does not eliminate a future flood risk if site conditions were to change.

8.9 Submission 19 – 35 Ireland Street, West Melbourne

Overlay Proposed: SBO3

Technical Issue Raised: Inadequate drainage

Assessment of Modelled Flooding: Flooding originating from Hawke Street east of the property moves west along Ireland Street, with flows from Tait Lane contributing to the volume filling the west bound carriageways of Ireland Street and inundating the footpath. Floodwaters inundate the property frontage as they move westward combining with flooding from the east bound carriageway and flooding from Abbotsford Street as they continue west to eventually discharge into Moonee Ponds Creek. As flood water moves past the property, they inundate 100% of the property's frontage. Both 3/35 and 4/35 are not impacted by flooding within their individual parcels in the proposed overlay.

Immediately in front of the subject site, Ireland Street experiences flood depths of up to 0.21 meters, covering the parking lane of the road and the full width of the footpath.

Discussion on Technical Issue Raised: The submission raises several issues. The submission discusses the need to provide 'fit-for-purpose' stormwater infrastructure and that the existing drainage network is 'degraded'. With regards to any future flood mitigation, I cannot comment on any future capital planning at City of Melbourne as I do not have knowledge of this. Modelling completed considers a well maintained (free from blockage) stormwater network. I can state that the modelling methodology is appropriate in simulating a well-maintained network. If the models were to simulate a poorly maintained network via blockages, we would generally expect to see larger flood extents than occur in the current proposed overlay.

8.10 Submission 20 – 458 and 460 Abbotsford Street, North Melbourne

Overlay Proposed: SBO3

Technical Issue Raised: Filtering methodology

Description of Flooding (458 Abbotsford Street, North Melbourne): Flooding originating from Chapman Street north of the property moves south along Abbotsford Street inundating the full width of the south bound carriageway and footpath and partially inundates the property. Floodwater continues south on Abbotsford Street joining floodwaters moving west along Haines Street and continue west before combining with floodwaters moving southward along Moonee Ponds Creek. As flood waters move past the property, they inundate 100% of the property frontage.

Although floodwaters do not inundate the property, immediately in front of the subject site Abbotsford Street experiences flood depths of up to 0.21 meters, covering the entire width of the south bound carriageway and footpath.

Description of Flooding (460 Abbotsford Street, North Melbourne): Flooding originating from Chapman Street north of the property moves south along Abbotsford Street inundating the full width of the south bound carriageway and footpath and partially inundates the property. Floodwater continues south on Abbotsford Street joining floodwaters moving west along Haines Street and continue west before combining with floodwaters moving southward along Moonee Ponds Creek. As flood waters move past the property, they inundate 100% of the property frontage and 1% of the property's total area. The inundation ranges from 0.00 metres to 0.05 metres in depth and has an average depth of 0.05 metres across the inundated area.

Immediately in front of the subject site, Abbotsford Street experiences flood depths of up to 0.21 meters, covering the entire width of the south bound carriageway and footpath.

Discussion on Technical Issue Raised: Per the filtering methodology, the overlay would be removed from an impacted property parcel if:

- 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.

460 Abbotsford Street fails both criteria.

It is my opinion that the filtering criteria has been applied correctly at this property. I cannot comment on the planning concerns raised in the submission as this is outside my area of expertise.

8.11 Submission 21 – 57 Ireland Street, West Melbourne

Overlay Proposed: SBO3

Technical Issue Raised: Inadequate drainage

Assessment of Modelled Flooding: Flooding originating from Hawke Street east of the property moves west along Ireland Street filling the west bound carriageways of Ireland Street and inundating the full width of the footpath. Floodwaters inundate the property frontage as they move westward combining with flooding from the east bound carriageway and flooding from Abbotsford Street as they continue west to eventually discharge into Moonee Ponds Creek. Although floodwaters do not inundate the property area, they effectively inundate 100% of the property frontage cutting off the property's access to Ireland Street.

Immediately in front of the subject site, Ireland Street experiences flood depths of up to 0.25 meters, covering the parking lane of the road and the full width of the footpath.

Discussion on Technical Issue Raised: The submission discusses the need to provide 'suitable' stormwater infrastructure. I cannot comment on any future capital planning at City of Melbourne as I do not have knowledge of this. With regards to any future flood mitigation, I cannot comment on any future capital planning at City of Melbourne as I do not have knowledge of this. Modelling completed considers a well maintained (free from blockage) stormwater network. I can state that the modelling methodology is appropriate in simulating a well-maintained network. If the models were to simulate a poorly maintained network via blockages, we would generally expect to see larger flood extents than occur in the current proposed overlay.

8.12 Submission 23 – 133 Leveson Street, North Melbourne

Overlay Proposed: SBO3

Technical Issue Raised: Recent flood mitigation

Assessment of Modelled Flooding: Flooding originating from Queensberry Street south of the property moves north along Leveson Street filling the north bound carriageway, combining with floodwaters in the southbound carriageway and crossing Arden Street before inundating the property. The floodwater inundates the property and all neighbouring properties. Flooding continues north on Leveson Street and northwest through neighbouring properties to eventually discharge into Moonee Ponds Creek. As flood waters move past the property, they inundate 100% of the property frontage and 100% of the property's total area. The inundation ranges from 0.01 metres to 0.31 metres in depth with an average depth of inundation of 0.07 metres.

Immediately in front of the subject site, Leveson Street experiences flood depths of up to 0.29 metres, covering the majority of the width of the road and footpath. To the south of the subject site where flood waters cross Arden Street, flooding reaches depths of up to 0.44 metres.

Discussion on Technical Issue Raised: The submission discusses flooding experienced at the subject site pre and post recent flood mitigation works undertaken by City of Melbourne. The submitter's experiences of flooding at the site appear to correlate well with the flooding shown in the modelling.

The City of Melbourne undertook mitigation works in mid-2021 to alleviate flooding in the area. While flood modelling used for the SBO3 does not include the changes made to the drainage network in this area, it is my opinion that the flood extents shown in the SBO3 are representative of the best available information of flooding available at this time. This is in line with the recommendation in PPN12 that *"if detailed information on flooding is not available, in the interim the floodplain management authority should identify land known to be subject to inundation as best it can"*. Flood models will require continual updates moving forward as the City of Melbourne and Melbourne Water complete mitigation works or upgrade works, and upon completion, overlays could then be reviewed.

8.13 Submission 26 – Parkville

Overlay Proposed: SBO3

Technical Issue Raised: Anomalous results in modelling

Overview: Submission 26 is provided by residents in the Parkville area and does not single out a particular property.

Discussion on Technical Issue Raised: The submission questions the flooding seen around Park Drive, Story Street and Flemington Road. The submission states:

"Parkville is on a hill and from the top to the bottom of Park Drive is at least a 10 metre fall. In fact from Story Street to Flemington Road is almost 5 metres. the drop from Park Drive to behind the properties is approximately 2 metres. Without an Archimedes Screw water will not flow up the hill!"

I visited the subject site and surrounding areas in March 2022 to verify potential overland flow paths and have since reviewed the LiDAR in further detail. On Park Drive, the fall between Gatehouse Street and Flemington Road is approximately 15 m at a slope of 1 in 41. Between Story Street and Flemington Road, the fall is approximately 3.3 m at a slope of 1 in 36. I am not certain of the exact location of the "drop from Park Drive to behind the properties" but suspect it is referring to the flow path shown on Story Street between Park Drive and Ievers Reserve. In this area, flows are approaching from the north-east on Park Drive. When flows reach Story Street, the flows split with some flows moving towards Ievers Reserve and others continuing along Park Drive. The slope from Park Drive to Ievers Reserve along Story Street is downhill with a drop of around 1.8 m. In this location, flows are not moving from Ievers Reserve towards Park Drive.

The submission also stated:
"From the walkaround and from the plans the contours clearly show amazing drops even at the bottom of Park Drive near Flemington Road to Ievers Reserve our engineer clearly felt there was no way areas outlined in your proposal could flood and that any heavy rainfalls would clear very rapidly given the topography."

Reviewing the LiDAR information, steep slopes are seen throughout the area, including Flemington Road between Park Drive and Ievers Reserve. The modelling results show that flood water originating

from the north-east drains towards this area and accumulates in the south-east bound lanes of Flemington Road. The model results show that water ponds in the low point immediately adjacent to Ievers Reserve, storing in the road reserve until the drainage network is able to convey the flows away, and/or flows break over the high point in the centre of Flemington Road. The flooding seen between Ievers Reserve and Park Drive on Flemington Road is caused by this backing up of flood waters and is not necessarily influenced by the slope of the land. Flooding in this area is primarily due to the flow path and drainage constriction on Flemington Road.

8.14 Submission 27 – 61 Ireland Street, West Melbourne

Overlay Proposed: SBO3

Technical Issue Raised: Inadequate drainage

Assessment of Modelled Flooding: Flooding originating from Hawke Street east of the property moves west along Ireland Street filling the west bound carriageways of Ireland Street and inundating the full width of the footpath. Floodwaters inundate the property frontage as they move westward combining with flooding from the east bound carriageway and flooding from Abbotsford Street as they continue west to eventually discharge into Moonee Ponds Creek. As floodwaters move westward past the property, they inundate 24% of the property's area 100% of the property frontage cutting the property's access to Ireland Street. Depths of inundation range from 0.00 metres to 0.10 metres with an average depth of inundation of 0.07 metres, across inundated areas.

Immediately in front of the property, Ireland Street experiences flood depths of up to 0.25 meters, covering the parking lane of the road and the full width of the footpath.

Discussion on Technical Issue Raised: The submission discusses the existing stormwater infrastructure to be inadequate. With regards to any future flood mitigation, I cannot comment on any future capital planning at City of Melbourne as I do not have knowledge of this. Modelling completed considers a well maintained (free from blockage) stormwater network. I can state that the modelling methodology is appropriate in simulating a well-maintained network. If the models were to simulate a poorly maintained network via blockages, we would generally expect to see larger flood extents than occur in the current proposed overlay.

8.15 Submission 31 – 93 Park Drive, Parkville

Overlay Proposed: SBO2 and SBO3

While the subject site is proposed to be SBO2, areas discussed by the submission are impacted by the SBO3.

Technical Issue Raised: Anomalous results in modelling

Assessment of Modelled Flooding: Flooding originating to the northwest of the property at and upstream of Morrah Street moves through Ievers Reserve and inundates the rear of the property. These floodwaters continue south through the Ievers Reserve combining with waters on Story Street and continuing south across Flemington Road, inundating North Melbourne Primary School and continuing south-west along Harris Street before combining with floodwaters moving southward along Moonee Ponds Creek. As flood waters move past the property, they inundate 100% of the

Laneway and 9% of the property's total area. The inundation ranges from 0.00 metres to 0.13 metres in depth with an average depth of inundation of 0.09 metres, across inundated areas.

Immediately behind the subject site, CL1487 experiences flood depths of up to 0.21 metres, covering the entire width of the laneway.

Discussion on Technical Issue Raised: The submission discusses three separate areas where they believe the flood mapping to be incorrect. I visited the subject site and surrounding areas in March 2022 to verify potential overland flow paths. Each area is discussed separately below.

Morrah Street Inflows – The submission discusses how the overland flow path appears in the modelling to originate at Morrah Street at the northern end of Ievers Reserve. I have reviewed this particular area in the Engeny TUFLOW model and found an inflow point located on Morrah Street at the location where the overland flow path appears. Upon review of the catchment area that creates the runoff for the inflow point, it was seen that it does take into account the upstream area as described by the submission. It is considered that the inflow point and methodology of applying is fit for purpose in defining the upstream area.

Morrah Street to Park Drive Flows – The submitter states that they believe that *"…water from Morrah Street would not flow west, but instead is flowing down Park Drive. (Of course, water from that section of Morrah Street between Park Drive and the reserve does flow to the west, including water coming down the west side of Park Drive.)"*

The submission is correct that flows from Morrah Street at Park Drive would travel west towards the main flow path shown. In reality, the flows would continue down the western side of Park Drive. It is likely that the depths of flow from this point are too shallow to be shown in the flood modelling results presented. The flood modelling does not suggest that flows from Park Drive travel west onto Morrah Street. I believe that the results show are sound in this location.

Story Street to Park Drive Flows – The submission claims: *"Flooding cannot occur in Story Street between Park Drive and the east lane at Ievers Reserve on account of the slope of Story Street (downhill to the west)."*

Flooding shown in the overlay is approaching the reserve from Park Drive, rather than from the reserve along Story Street towards Park Drive as thought by the submitter.

The flood extent shown in the proposed overlay on Story Street is considered reasonable.

8.16 Submission 32 – Elizabeth Street

Overlay Proposed: SBO3

Technical Issue Raised: Maintenance

Overview: Submission 32 discusses the Elizabeth Street catchment and does not single out a particular property.

Discussion on Technical Issue Raised: The submission discusses a number of issues, one of which is the maintenance of drainage pipes and pits within the Elizabeth Street catchment. With regards to any future flood mitigation, I cannot comment on any future capital planning at City of Melbourne as

I do not have knowledge of this. Modelling completed considers a well maintained (free from blockage) stormwater network. I can state that the modelling methodology is appropriate in simulating a well-maintained network. If the models were to simulate a poorly maintained network via blockages, we would generally expect to see larger flood extents than occur in the current proposed overlay.

8.17 Submission 33 – 19 O'Shannasy Street, North Melbourne

Overlay Proposed: SBO3

Technical Issue Raised: No history of flooding, anomalous results in modelling, drainage maintenance

Assessment of Modelled Flooding: Flooding originating from Queensberry Street southeast of the property moves north along Leveson Street breaking through properties between Arden Street and O'Shanassy Street. Floodwater fills both east and west bound carriageways between Arden Lane and Leveson Street and passing the front of the property before continuing northwest along Market Lane and Courtney Street and through neighbouring properties to eventually discharge into Moonee Ponds Creek. As flood waters move past the property, they inundate the full frontage of the property and 1% of the property's total area. The inundation ranges from 0.00 metres to 0.12 metres in depth and has an average depth of 0.08 metres across the inundated area.

Immediately in front of the subject site, O'Shanassy Street experiences flood depths of up to 0.33 metres, covering the majority of the width of the road and footpath.

Discussion on Technical Issue Raised: The submission discusses several technical issues. The first is that the subject site has not been flood affected since 1972. It cannot be assumed that flooding will not occur on land because there is no known record or recollection of it having flooded in the past. Nevertheless, the presence of a past event occurring does not change the statistical likelihood that another event can happen the next year, or any other year. It is not considered relevant that the property has not flooded since 1972.

The submission also suggests that flood water would not impact the site *"as water runoff would move along its lowest point (northern aspect) and flow towards Arden St Oval (north-western orientation".* I have reviewed the surface topography (via LiDAR information). Within the proposed flood extent, the topography used within the hydraulic model appears to slope in an easterly direction from the round-a-bout at the intersection of O'Shanassy Street and Errol Street towards a low point further east (around 13 O'Shanassy Street) which then slopes in a north to north-westerly direction to join the main flow path associated with the Arden Street drain. Based on this, it is considered that the proposed overlay is reflective of the terrain.

The submission suggests that maintenance may be a way to mitigate flood risk. With regards to any future flood mitigation, I cannot comment on any future capital planning at City of Melbourne as I do not have knowledge of this. Modelling completed considers a well maintained (free from blockage) stormwater network. I can state that the modelling methodology is appropriate in simulating a well-maintained network. If the models were to simulate a poorly maintained network via blockages, we would generally expect to see larger flood extents than occur in the current proposed overlay.

8.18 Submission 38 – 800-810 Lorimer Street, Port Melbourne

Overlay Proposed: SBO3

Technical Issue Raised: Insufficient information

Assessment of Modelled Flooding: Flooding originating from Turner Street and Graham Street inundate the property on three sides as the waters move north to discharge into the Yarra River via the council drainage network. The property experiences 100% inundation of frontage on Lorimer Street, Turner Street and Graham Street. As floodwaters move along Graham Street and Lorimer Street, they inundate 28% of the property's total area. Depth of inundation on the property ranges from 0.00 metres to 0.69 metres in depth with an average depth of inundation of 0.32 metres, across inundated areas.
Immediately in front of the property, Lorimer Street experiences flood depths of 0.37 metres, while alongside the property, Graham Street experiences flood depths of 0.48 metres and to the rear of the property 0.27 metres.

Discussion on Technical Issue Raised: The application claims there is insufficient information regarding flood levels and required flood levels. This information is available directly from the City of Melbourne. The Fishermans Bend flood model has adequate information within to provide the requested information to the submitter.

8.19 Submission 40 – 402-432 and 434-444 Macaulay Road, Kensington

Overlay Proposed: SBO3

Technical Issue Raised: Existing built form not represented in modelling

Assessment of Modelled Flooding (402-432 Macaulay Road, Kensington): Flooding originating from Macaulay Road west of the subject site moves east along the east bound parking lane of Macaulay Road before moving north along Barnett Street, filing the north bound parking lane and footpath before joining floodwaters originating from CL159 and continuing east along CL159 and inundating the subject site. Floodwaters originating within the site car park move north-east through the property to join water inundating 53% of the property from CL159 and CL167. Floodwaters then continue north-east through the site joining floodwaters that sit behind the Moonee Ponds Creek levee walls, prior to ultimately joining and moving south along Moonee Ponds Creek. As flood water move across the property, they inundate 50% of the property frontage to Macaulay Road and 100% of frontage on to CL169.

Depth of inundation on the property ranges from 0.00 metres to 0.75 metres in depth with an average depth of inundation of 0.11 metres, across inundated areas.

Assessment of Modelled Flooding (434-444 Macaulay Road, Kensington): Flooding originating from Macaulay Road west of the subject site moves east along the east bound parking lane of Macaulay Road before moving north along Barnett Street, filing the north bound parking lane and footpath before joining floodwaters originating from CL159 and continuing east along CL159 and inundating around 1% of the subject site. Floodwaters then continue north-east through neighbouring 402-432 and join floodwaters that sit behind the Moonee Ponds Creek levee walls, prior to ultimately joining and moving south along Moonee Ponds Creek. Although no inundation is shown to occur along

Macaulay Road, the frontage along Barnett Street experiences 33% inundation, while frontage to CL159 experiences 100% inundation.

The depth of inundation on the property ranges from 0.00 metres to 0.11 metres in depth with an average depth of inundation of 0.07 metres, across inundated areas. Immediately alongside the subject site, Barnett Street and CL159 experience flood depths of up to 0.27 metres.

Discussion on Technical Issue Raised: The submission states *"The Amendment also fails to acknowledge existing built form conditions, for instance, the existing industrial buildings on the Site and existing impact this may have for instance on the directional flow of water during a flood event"*. I have reviewed this area of the Engeny TUFLOW model and can confirm that the existing buildings are accounted for through the use of a higher Manning's roughness coefficient set to represent conditions in an industrial area. Buildings have not been blocked out completely in the modelling per standard modelling practice in models of this type as flow may travel through or beneath buildings. It is my opinion that the representation of the existing built form of the site is adequate.

8.20 Submission 41 – 2a O'Shanassy Street, North Melbourne

Overlay Proposed: SBO3

Technical Issue Raised: Inadequate drainage

Assessment of Modelled Flooding: Flooding originating from Queensberry Street south of the property moves north along Leveson Street combining with flooding from Courtney Street filling the east and west bound carriageways of O'Shanassy Street and inundating the footpath. Floodwaters inundate O'Shanassy Street, Courtney Street, Market Lane and neighbouring properties. Floodwater then continues northwest along Market Lane and Courtney Street and through neighbouring properties to eventually discharge into Moonee Ponds Creek. As flood waters move past the property, they inundate 100% of the property frontage and 84% of the property's total area. As part of filtering process used for developing the flood overlays, gaps within the flooded area are closed, as such the flood overlay in this area shows 100% of the property as inundated. The inundation ranges from 0.00 meters to 0.20 meters in depth with an average depth of inundation of 0.07 meters.

Immediately in front of the subject site, O'Shanassy Street experiences flood depths of up to 0.25 meters, covering the majority of the width of the road and footpath. To the north of the subject site where flood waters are conveyed along Courtney Street, flooding reaches depths of up to 0.45 meters.

Discussion on Technical Issue Raised: The submission discusses the need to upgrade stormwater infrastructure. With regards to any future flood mitigation, I cannot comment on any future capital planning at City of Melbourne as I do not have knowledge of this. Modelling completed considers a well maintained (free from blockage) stormwater network. I can state that the modelling methodology is appropriate in simulating a well-maintained network. If the models were to simulate a poorly maintained network via blockages, we would generally expect to see larger flood extents than occur in the current proposed overlay.

8.21 Submission 42 – 129 Leveson Street, North Melbourne

Overlay Proposed: SBO3

Technical Issue Raised: Inadequate drainage

Assessment of Modelled Flooding: Flooding originating from Queensberry Street south of the property moves north along Leveson Street filling the north bound carriageway, combining with floodwaters in the southbound carriageway and crossing Arden Street before inundating the property. The floodwater inundates the property and all neighbouring properties. Flooding continues north on Leveson Street and northwest through neighbouring properties, continuing on to eventually discharge into Moonee Ponds Creek. As flood waters move past the property, they inundate 100% of the property frontage and 100% of the property's total area. The inundation ranges from 0.09 meters to 0.31 meters in depth with an average depth of inundation of 0.19 meters.
Immediately in front of the subject site, Leveson Street experiences flood depths of up to 0.29 meters, covering the majority of the width of the road and footpath. To the south of the subject site where flood waters cross Arden Street, flooding reaches depths of up to 0.44 meters.

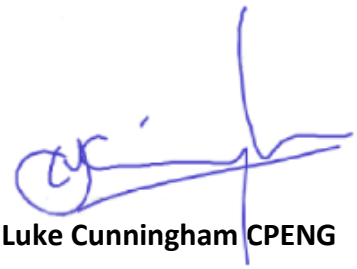
Discussion on Technical Issue Raised: The submission discusses the need to upgrade storm water infrastructure. With regards to any future flood mitigation, I cannot comment on any future capital planning at City of Melbourne as I do not have knowledge of this. Modelling completed considers a well maintained (free from blockage) stormwater network. I can state that the modelling methodology is appropriate in simulating a well-maintained network. If the models were to simulate a poorly maintained network via blockages, we would generally expect to see larger flood extents than occur in the current proposed overlay.

9 Conclusions

It is my opinion that the flood modelling and mapping completed within the City of Melbourne catchments identified within my report are strategically justified and support the introduction of a SBO3 as proposed by Amendment C384 to the Melbourne Planning Scheme. The flood modelling and mapping completed within the City of Melbourne is the best available information to my knowledge that describes the interaction between above and below ground stormwater flow in a 1% AEP event within the urbanised areas of Melbourne. The modelling completed is of a high technical standard.

10 Declaration

I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.



Luke Cunningham CPENG
Director
Rain Consulting Pty Ltd
0419 269 831
luke@rainconsulting.com.au
03 October 2022