

REPORT

Leamac Property Group &
Coronation Property Co. Pty Ltd

Moore Point Precinct

Flood Evacuation Strategy

April 2020




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1. EXECUTIVE SUMMARY

This Flood Evacuation Strategy Report has been prepared by J. Wyndham Prince on behalf of Leamac Property Group & Coronation Property Co. Pty Ltd to understand the flood evacuation plan of the development in relation to a Planning Proposal at Moore Point, Liverpool (the site).

The site is located east of Liverpool CBD on the opposite side of the Georges River and north of Newbridge Road. It provides a site area of 38.5 hectares (approx.) and is currently developed with industrial uses. It's important to note that there is nothing contained within this report to preclude rezoning of the site to its intended land uses.

The site is situated within Liverpool Collaboration Area's Georges River North precinct and is subject to the priorities and actions of the Liverpool Place Strategy (Strategy), which was released by the Greater Sydney Commission (GSC) in December 2018. The Strategy states that by 2036 Liverpool will be a rejuvenated river city, offering diverse and growing residential and employment opportunities. Major health, education and retail precincts, and a mixture of open spaces and parklands alongside the Georges River, will create a rich mix of jobs and workplaces, public spaces, shops and entertainment.

Under the Strategy the site is identified as 'mixed use', which comprises: 'a mixture of commercial, retail, residential and community uses that provide sustainable employment, that is complementary to, and not in competition with, the commercial core'.

The 2019 Annual report summary for Liverpool Collaboration Area highlighted key steps commenced and completed to address the imperatives acknowledged in the Strategy to accelerate the delivery of the Collaboration Area. These included:

- Engagement with TfNSW to prepare the Liverpool Place-based Integrated Transport Strategy and accelerated investment; and
- Flood studies and floodplain risk management plan completed by Liverpool City Council.

The land uses reflected in the Strategy are reinforced in Liverpool City Council's Local Strategic Planning Statement (LSPS), which identifies the site for investigation as residential/mixed use to support the CBD and Innovation Precinct in tandem with linking open space and green corridors.

The LSPS provides the following short to medium term action (12-24 months) specific to the Georges River North precinct:

Action 11.2 – Investigate amendments to LEP to rezone River precinct north of Newbridge Road (Moore Point) as a mixed-use zone to support the Liverpool CBD and Innovation Precinct, with an extensive open space system and cross-river linkages (short to medium term)

The Planning Proposal involves the creation of a mixed use precinct, providing new homes, jobs and open space adjoining the Georges River and connecting to Liverpool CBD.

Key features of the proposal include:

- Adaptive re-use of existing heritage item;
- Connections to Liverpool CBD and Train Station; and
- Foreshore embellishments and new open spaces;
- Transport, intersection and collector road improvements
- Educational and cultural facilities

The Planning Proposal aligns with the priorities of Government and the implementation phase of the Place Strategy by facilitating the transformation of the Collaboration Area with new jobs, infrastructure, green spaces and housing. The Planning Proposal responds to The Pulse of Greater Sydney's performance indicators, which sit under the following key themes:

Infrastructure and Collaboration

The Planning Proposal will facilitate additional jobs, education and housing in close proximity to Liverpool CBD and Train Station. The proposal will support additional medium and long-term housing supply in Liverpool CBD through diverse and new housing products. The proposal supports the continual expansion and growth of Liverpool Innovation precinct and nearby health infrastructure, with potential to provide complementary uses near Liverpool Hospital and educational and cultural facilities on the site.

Productivity

The Planning Proposal supports the growth of the thirty-minute city, ensuring Liverpool emerges as a premier CBD in the Western City. The proposal provides capacity for new transport infrastructure on the site, road and intersection upgrades and locating density near major transport infrastructure (Liverpool Train Station and Badgery's Creek Aerotropolis). The proposal encourages additional business activity and investment in Liverpool by providing new commercial uses that will complement Liverpool CBD.

Liveability

The Planning Proposal significantly improves upon the existing use of the site by creating walkable places for people to live work and play. This includes foreshore embellishments to the Georges River, improved connections across the Georges River and adaptative re-use of existing heritage items. These measures will contribute to Sydney's Green Grid, improve access to services in Liverpool CBD and establish a community that celebrates identity and place.

Sustainability

The Planning Proposal addresses the urban heat island effect by significantly increasing the quantum of green space on the site for active and passive recreational use. The proposal will provide new parks and green connections to surrounding open spaces, including Haigh Park, which will contribute to the urban tree canopy of the area.

Overall, the Planning Proposal represents a clear and consistent strategic line of site with the priorities of government. It meets the performance indicators, priorities and objectives expressed in the District Plan, Place Strategy, LSPS and The Pulse of Greater Sydney.

Nothing contained in the body of this report/assessment would preclude the Planning Proposal from rezoning and gazettal for residential/mixed use purposes.

Over recent years a total of nine (9) flood studies have been completed which all ascertain that the Precinct can be made suitable for development with minor adjustment through controlled cut and fill that have no adverse impacts of the surrounding flood regime. All NSW and Federal Floodplain guidelines have been adhered to the preparation of this study. All future studies can be completed at Development Consent stage with controls implemented through the consent conditions to reflect any outcomes required.

The Flood evacuation Strategy developed for the Precinct will ensure the safety of the future residents and has been an integral part of the flood impact assessment.

Flood Evacuation

The safe evacuation of people from flood affected areas during a Probable Maximum Flood (PMF) event is a vital consideration of the Flood Management strategy and for the planning of the development. Flood evacuation routes are identified to ensure a 'continuous rising grade' can be maintained to a level above the PMF for all evacuees, with connections to Newbridge Road to the south of the Precinct. In addition, use of the proposed pedestrian bridges linking the Moore Point Precinct to the Liverpool CBD will provide additional early flood evacuation options during a PMF event for this Precinct.

The proposed Flood Evacuation Strategy for the developed Precinct, therefore, provides a basis for the detailed design and development of the Precinct to ensure that the environmental, urban amenity, engineering and economic objectives for stormwater management are achieved.

2. THE EXISTING ENVIRONMENT

2.1. Overview

The site is located east of Liverpool CBD on the opposite side of the Georges River and north of Newbridge Road. It provides a site area of 38.5 hectares (approx.) and is currently developed with industrial uses.

The site is situated within Liverpool Collaboration Area's Georges River North precinct and is subject to the priorities and actions of the Liverpool Place Strategy (Strategy), which was released by the Greater Sydney Commission (GSC) in December 2018. The site location is shown in **Plate 2-1**.

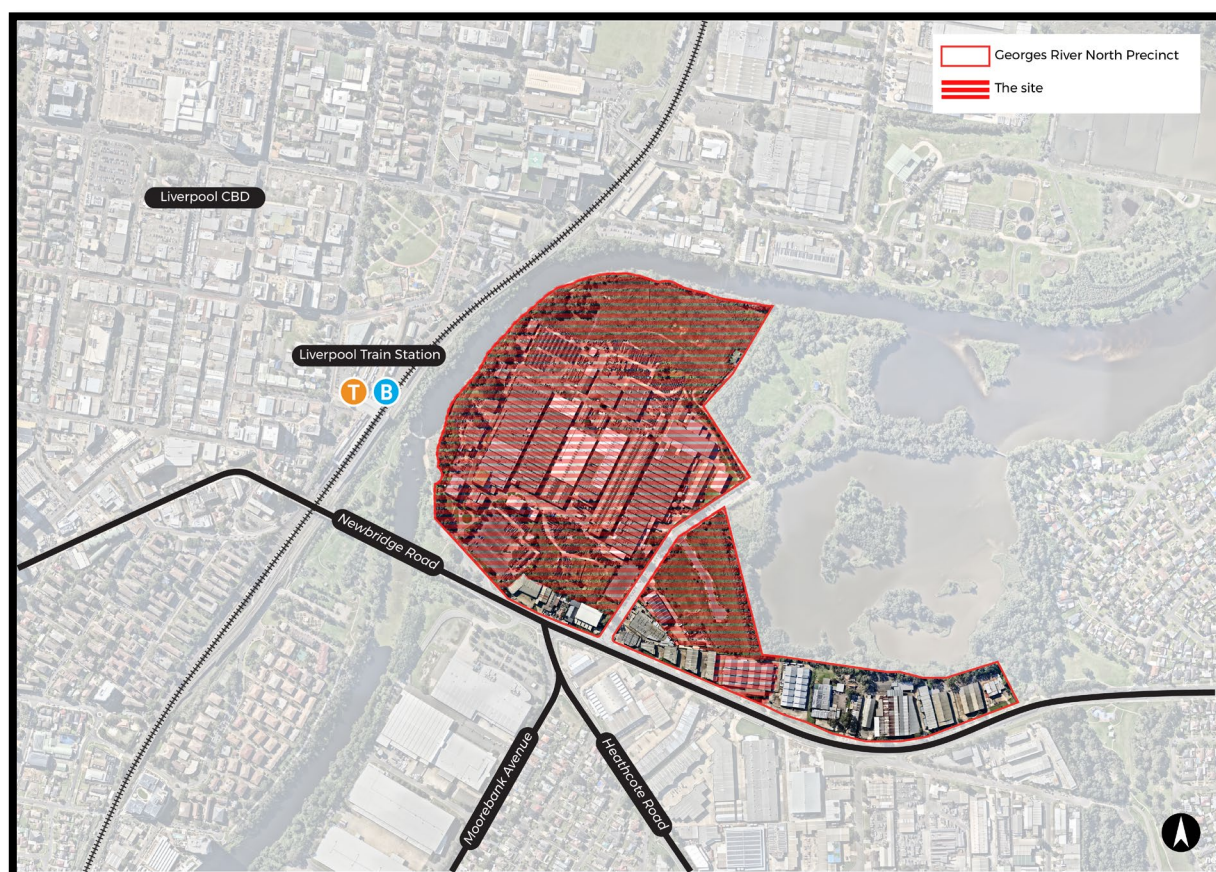


Plate 2-1 – Precinct Locality Map

The Precinct is currently zoned as IN2 – Light Industrial and is primarily used for industrial/commercial purposes, with open space located throughout the Precinct. The current industrial land use results in an overall percentage imperviousness of approximately 90%. The Precinct is relatively flat, with grading towards Georges River and Lake Moore at approximately 0.7%.

During the 1% AEP event, the Precinct is partially inundated by mainstream flooding, which breach the banks of the Georges River. Current flood modelling for the area has determined that during the 1% AEP event the depth of small ponding occurs within the Precinct with pockets of depth up to 2 m. For details of the existing flood constraints on the Precinct, refer to Flood Impact Assessment Report (JWP, April 2020).

3. THE PROPOSED DEVELOPMENT

3.1. The site

A planning proposal is to be submitted to Council in support of an amendment to the Liverpool Local Environmental Plan (LEP) 2008. The proposal is to rezone approximately 38.5 ha parcel of land to accommodate a new integrated mixed-use development. The precinct master plan is shown in **Plate 3-1**.

The Planning Proposal involves the creation of a mixed use precinct, providing new homes, jobs and open space adjoining the Georges River and connecting to Liverpool CBD. Key features of the proposal include:

- Adaptive re-use of existing heritage;
- Foreshore embellishments and new open spaces;
- Educational and cultural facilities;
- Connections to Liverpool CBD and Train Station; and
- Transport, intersection and collector road improvements.

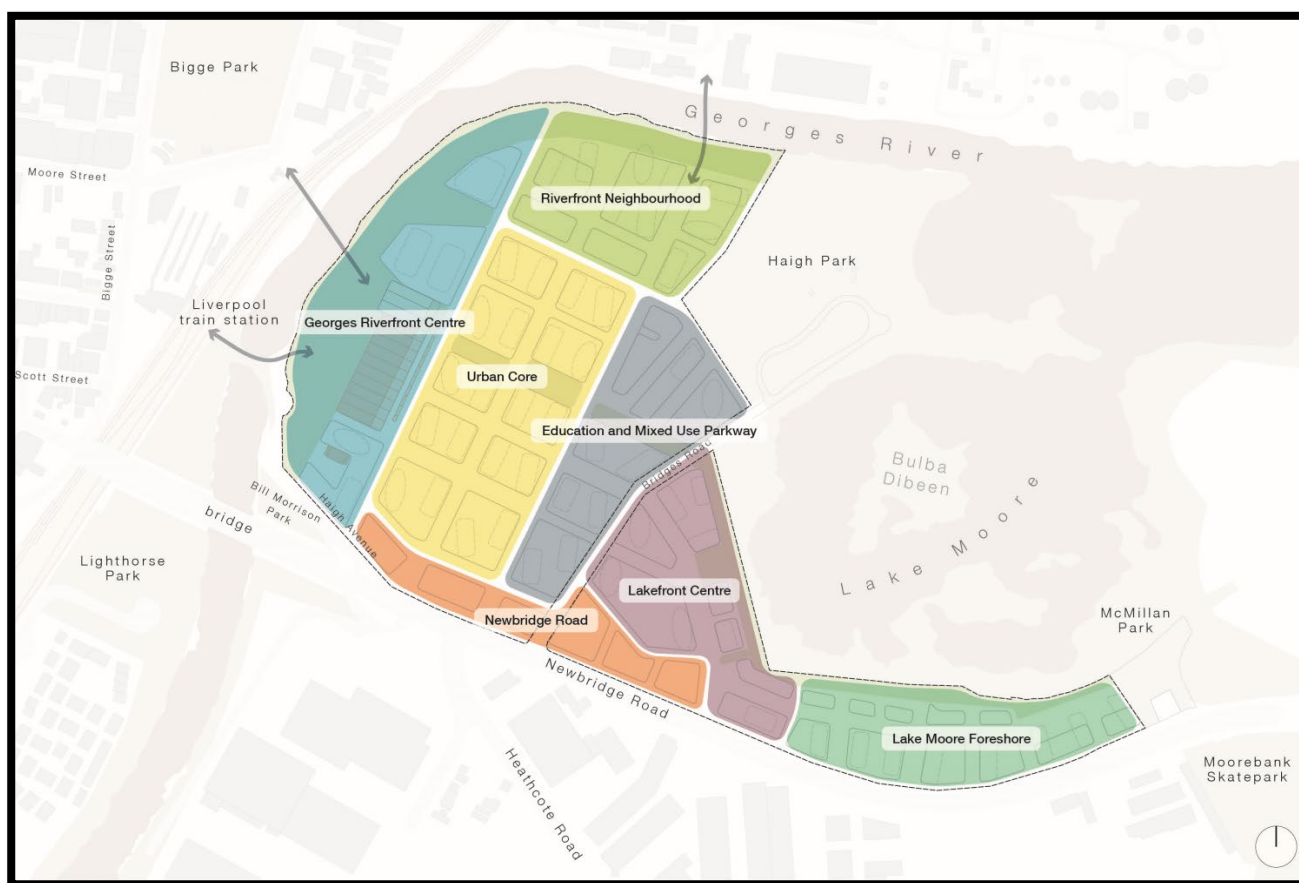


Plate 3-1 –Precinct masterplan

3.2. Regional context

The Liverpool Collaboration Area considers multiple stakeholders and is organised by the Greater Sydney Commission. The purpose of this area is to solve the complex urban issues that are anticipated with the future growth of the Liverpool LGA in order to achieve better outcomes for the area. The area is shown below on **Plate 3-2**.

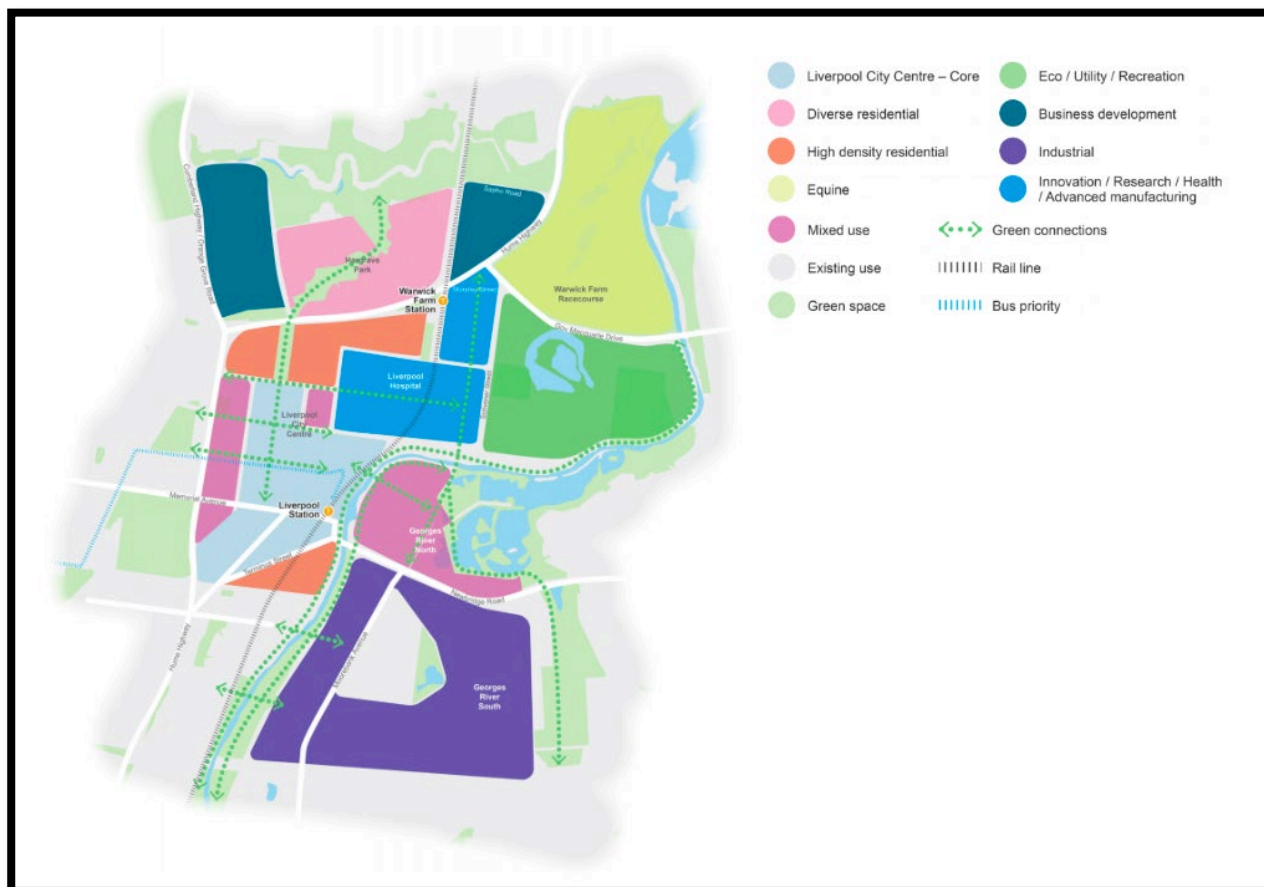


Plate 3-2 – A Place Strategy for Liverpool (Source: Liverpool Collaboration Area Place Strategy 2018)

The Liverpool Place Strategy identifies 10 key priorities for the Liverpool Collaboration Area to address the issues of connectivity, liveability, productivity, sustainability and governance. Priority eight (8) is to “*Develop a network of high-quality open space linked by the Greater Sydney Green Grid and invest in improvements to the Georges River and its foreshores*”.

As part of addressing the sustainability priorities and actions, the report highlights that future development close to the Georges River must address flooding challenges. Action item 24 is to “*Prepare a floodplain constraints categorisation study (led by Council) and a flood evacuation study (led by State Emergency Service)*”. Currently, Council is undertaking the flood constraint study, and the State Emergency Service will be undertaking the flood evacuation study in the near future. An important consideration for the redevelopment of the Moore Point precinct will be to consider the following regional constraints:

- Localised flood impact; and
- Precinct flood evacuation strategy.

4. FLOOD EVACUATION STRATEGY

J. Wyndham Prince has assessed the flood behaviour for the 1% AEP and PMF storm events under developed conditions. The detail on developed condition flood modelling and results refer to the Flood Impact Assessment Report (JWP, April 2020).

4.1. Flood behaviour under developed conditions

The 1% AEP storm event result for the developed condition shows that the peak flood level at the Georges River is 9.2 m AHD with no breach of the riverbank; leaving the Moore Point precinct unaffected from flood event up to 1% AEP. The proposed development cut and fill within the Precinct prevented the breakout flows from entering the Precinct along the western precinct boundary. In addition, the provision of the proposed flood control/levee to the south of Newbridge Road restricts mainstream flows from breaching the banks of the Georges River during the 1% AEP event. This management measure prevents the Georges River from breaching its banks and removes the existing flood impact of properties south of the Newbridge Road in 1% AEP storm event.

However, during the PMF event, the level of flood affectation on the Precinct is similar to 'existing' conditions of 12.4 m AHD, with mainstream flows breaching the banks of the Georges River and inundating the Precinct.

The flood level and extent mapping for developed conditions 1% AEP and PMF storm events are shown in **Figures 4.1 – 4.2 in Appendix A**.

4.2. Flood Warning Time

The Precinct is inundated by mainstream flows from the Georges River during the PMF event which is a long duration event of up to 36-hours that will occur and recede reasonably slowly (over a number of days).

Due to the catchment size and developed nature of the catchment, sufficient flood warning time is available for the Precinct. Given that all development will be required to be above the 9.7 m AHD Flood planning level (i.e. 1% AEP level plus 0.5 m freeboard) there will be approximately 8.5 hours before the flood water would reach this flood planning level during a PMF event and start to impact the residential component of this Precinct. **Plate 4-1** shows the rate of rise of floodwaters upstream of Liverpool Weir for the 1% AEP flood and the PMF events. The PMF event is used emergency response planning, and the 1% AEP flood is provided as a comparison.

The rate of rise of floodwaters is approximately 0.9 m/hr to the Liverpool weir. Given the furthest distance that residents will need to travel, by foot, from the Georges River waterfront to land above the PMF level is approximately 1.8 km and using an average walking pace of 3 km/hr, all residents would only need to **36 min** to exit the Precinct during a flood evacuation operation.

Assuming that mobilisation of the SES will be take approximately one (1) hour after the commencement of the PMF event and it would take a further (2) hours period for localised door knocking, an hour for the resident to prepare for an evacuation and the 36 min to travel to high ground, this would leave approximately 4.9 hr spare evacuation time for this Precinct.

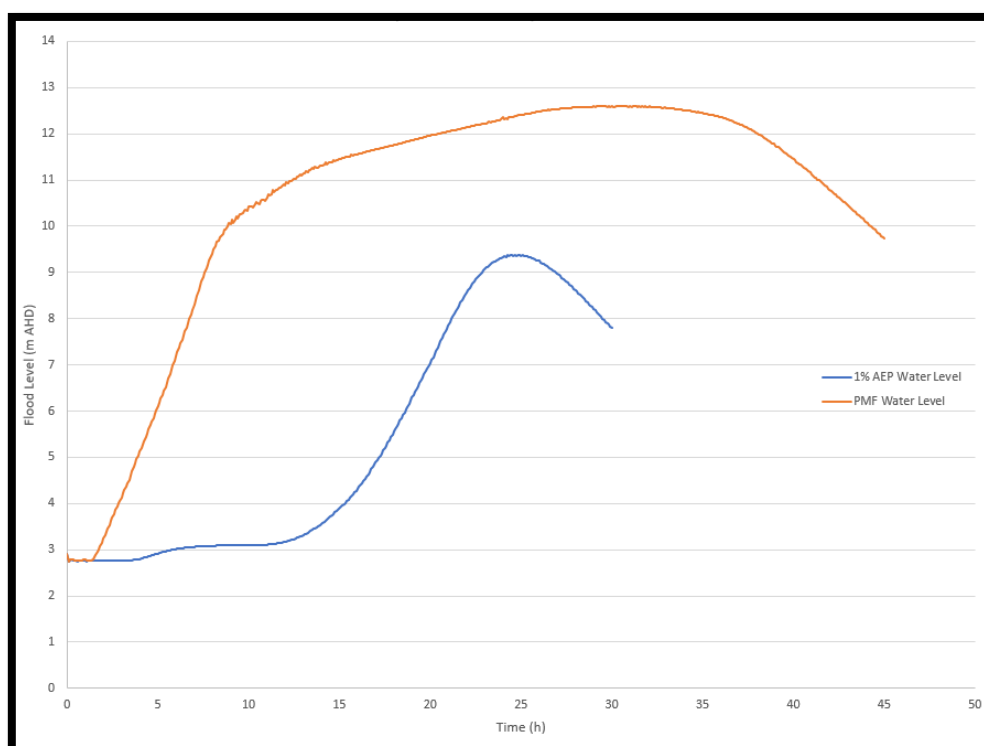


Plate 4-1 – Rate of Rise of Floodwaters upstream of Liverpool Weir

4.3. Flood Evacuation Plan

The Precinct is inundated by mainstream flows from the Georges River during the PMF event. Furthermore, the PMF is a long duration event of up to 36-hours that will occur and recede reasonably slowly (over a number of days). Therefore, flood evacuation will be necessary to ensure the safety of the future population that use/reside within the Precinct.

The safe evacuation of people from flood-affected areas during a PMF storm event is a key consideration of the Flood Management strategy and for the planning of the development. Flood evacuation routes are to be identified to ensure a 'continuous rising grade' is provided to a land level above the PMF. This is shown in **Figure 4.3** in **Appendix A**.

The following key items have been identified to inform the rezoning of the Precinct:

- All new roads are to be used for flood evacuation purposes, with a constantly rising grade towards Newbridge Road or towards the major evacuation route within the Precinct. This will ensure every residential property has the ability to evacuate towards land above the regional PMF level;
- The land east and west of the site is above the regional PMF level, and flood evacuation should, therefore, be directed to this area via Newbridge Road;
- Ensure all the habitable floor levels within the Precinct have minimum floor levels, including garage floor levels are above the 1% AEP flood level plus approach freeboard and that vehicular access from the buildings to the local road is above these requirements; and
- The proposed pedestrian footbridges connecting the development to the western side of the Georges River (Liverpool CBD side) could be used for early flood evacuation but would not be the primary flood evacuation route for the Precinct.

The flood evacuation strategy will ultimately need to be considered and adopted by the State Emergency Services (as applicable) and by Council. The flood evacuation strategy will be further developed as part of the staged construction of the Moore Point precinct to ensure compliance with the required guidelines and statutory agencies (i.e. SES).

These preliminary assessments for the site (from a flood evacuation perspective) demonstrate that development of the Moore Point precinct can be effectively managed and ensures suitable flood evacuation can occur in the event of a major flood incident.

5. GLOSSARY

Term	Definition
Airborne Laser Survey (ALS)	Is a technique for obtaining a definition of the surface elevation (ground, buildings, power lines, trees, etc.) by pulsing a laser beam at the ground from an airborne vehicle (generally a plane) and measuring the time taken for the laser beam to return to a scanning device fixed to the plane. The time taken is a measure of the distance which, when ground-truthed, is generally accurate to $\pm 150\text{mm}$.
Annual Exceedance Probability (AEP)	The chance or probability of a natural hazard event (usually a rainfall or flooding event) occurring annually. Normally expressed as a percentage.
Australian Rainfall and Runoff (AR&R)	Refers to the current edition of Australian Rainfall and Runoff published by the Institution of Engineers, Australia.
Dam Crest Flood (DCF)	The flood event where a dam embankment is first overtopped.
Dam Safety Committee (DSC)	A NSW statutory body aligned with Department of Primary Industries. Its function is to ensure the safety of dams within NSW.
Digital Terrain Model (DTM)	Is a spatially referenced three-dimensional (3D) representation of the ground surface represented as discrete point elevations where each cell in the grid represents an elevation above an established datum.
Exceedances per Year (EY)	The number of times a year that statistically a storm flow is exceeded.
Floodplain Planning Level (FPL)	The FPL is a height used to set floor levels for property development in flood-prone areas. It is generally defined as the 1% AEP flood level plus 0.5m freeboard.
Floodplain Development Manual (FDM) and Guidelines (April 2005)	<p>The FDM is a document issued by the Department of Environment Climate Change and Water (DECCW) that provides a strategic approach to floodplain management. The guidelines have been issued by the NSW Department of Planning (DoP) to clarify issues regarding the setting of FPL's.</p> <p>This document is also the framework for the development of Floodplain Risk Management Studies and Plans.</p>
Floodplain Storage Areas	Parts of a floodplain that are important for the temporary storage of floodwaters during the passage of a flood. Loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation.
Floodway	The 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.
Hyetograph	The distribution of rainfall over time.
Hydrograph	Is a graph that shows how the stormwater discharge changes with time at any particular location.

Term	Definition
Hydrology	The term given to the study of the rainfall and runoff process as it relates to the derivation of hydrographs for given floods.
J. Wyndham Prince Pty Ltd (JWP)	Consulting Civil Infrastructure Engineers and Project Managers undertaking these investigations
MUSIC	A modelling package designed to help urban stormwater professionals visualise possible strategies to tackle urban stormwater hydrology and pollution impacts. MUSIC stands for Model for Urban Stormwater Improvement Conceptualisation and has been developed by the Cooperative Research Centre (CRC),
Peak Discharge	Is the maximum stormwater runoff that occurs during a flood event
Potential Loss of Life (PLL)	Potential Loss of Life assessment
Population at Risk (PAR)	Population at risk assessment
Probable Maximum Flood (PMF)	The greatest depth of precipitation for a given duration meteorologically possible for 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.
Triangular Irregular Network (TIN)	A technique used in the created DTM by developing a mass of interconnected triangles. For each triangle, the ground level is defined at each of the three vertices, thereby defining a plane surface over the area of the triangle
TUFLOW	A computer program that provides two-dimensional (2D) and one dimensional (1D) solutions of the free surface flow equations to simulate flood and tidal wave propagation. It is specifically beneficial where the hydrodynamic behaviour, estuaries, rivers, floodplains and urban drainage environments have complex 2D flow patterns that would be awkward to represent using traditional 1D network models.
XP-RAFTS	Is a runoff routing model that uses the Laurenson non-linear runoff routing procedure to develop a sub catchment stormwater runoff hydrograph from either an actual event (recorded rainfall time series) or a design storm utilising Intensity-Frequency-Duration data together with dimensionless storm temporal patterns as well as standard AR&R 1987 data.

6. REFERENCES

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GHD, 2007, *“Liverpool CBD Floodplain Management Study Report”*, prepared for Liverpool City Council.

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J. Wyndham Prince, 2016 *“1 Heathcote Road, Moorebank Desktop Flood Study”*, prepared for LAC JV Pty Ltd.

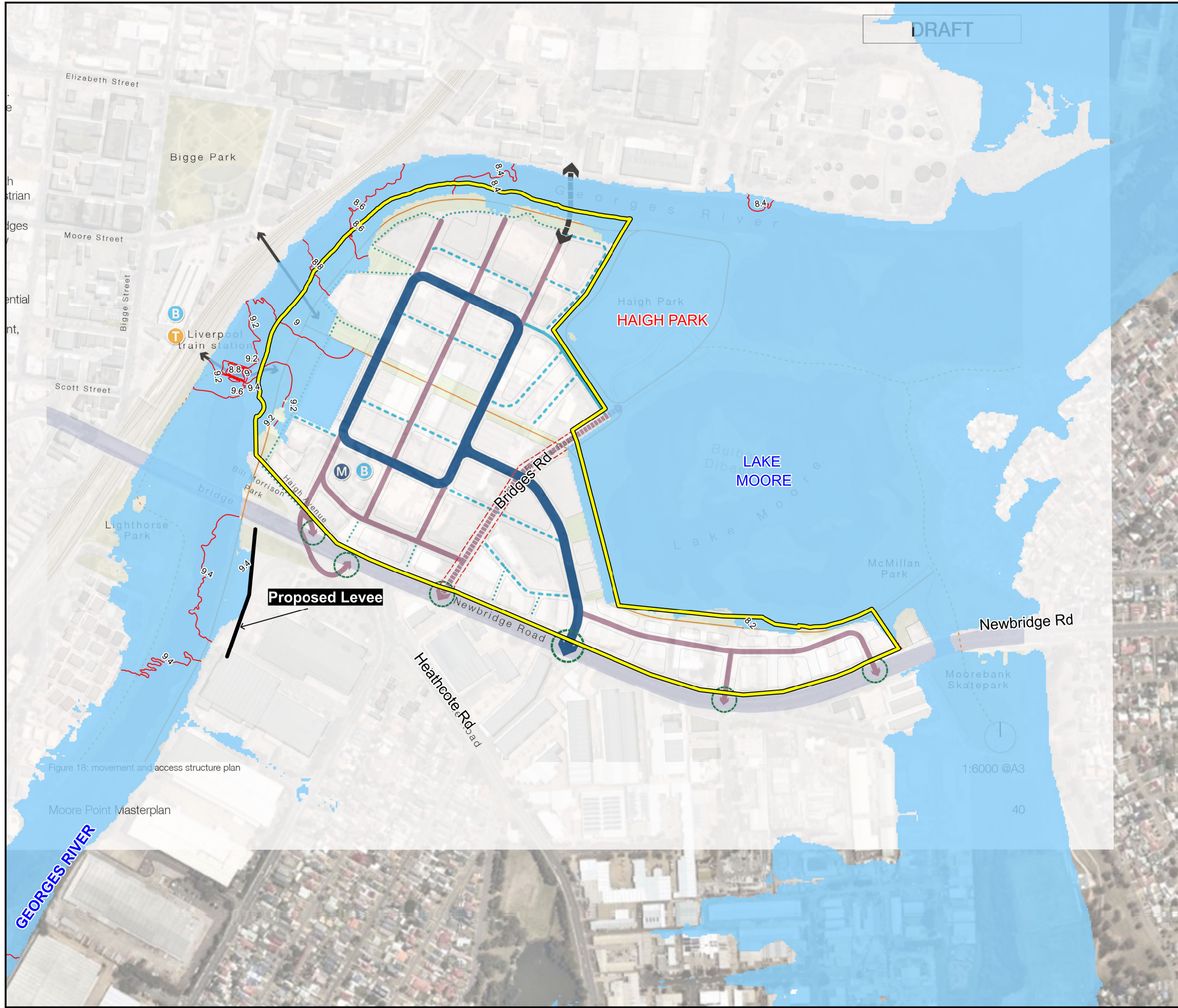
J. Wyndham Prince, 2016 *“Liverpool Waterfront Water Cycle and Flood Management Strategy”*, prepared for LAC JV Pty Ltd.

BMT, 2019 *“Georges River Flood Study”*, prepared for Canterbury Bankstown and Liverpool City Council.

APPENDIX A

FLOOD MAPPING FIGURES

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J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS

LEGEND

- Site Boundary
- Flood Extent
- 0.2 m Flood Level Contour

N

0 80

metres

Scale 1:2,000 @ A3

1:6000 @A3

40

Projection: GDA 1994 MGA Zone 56

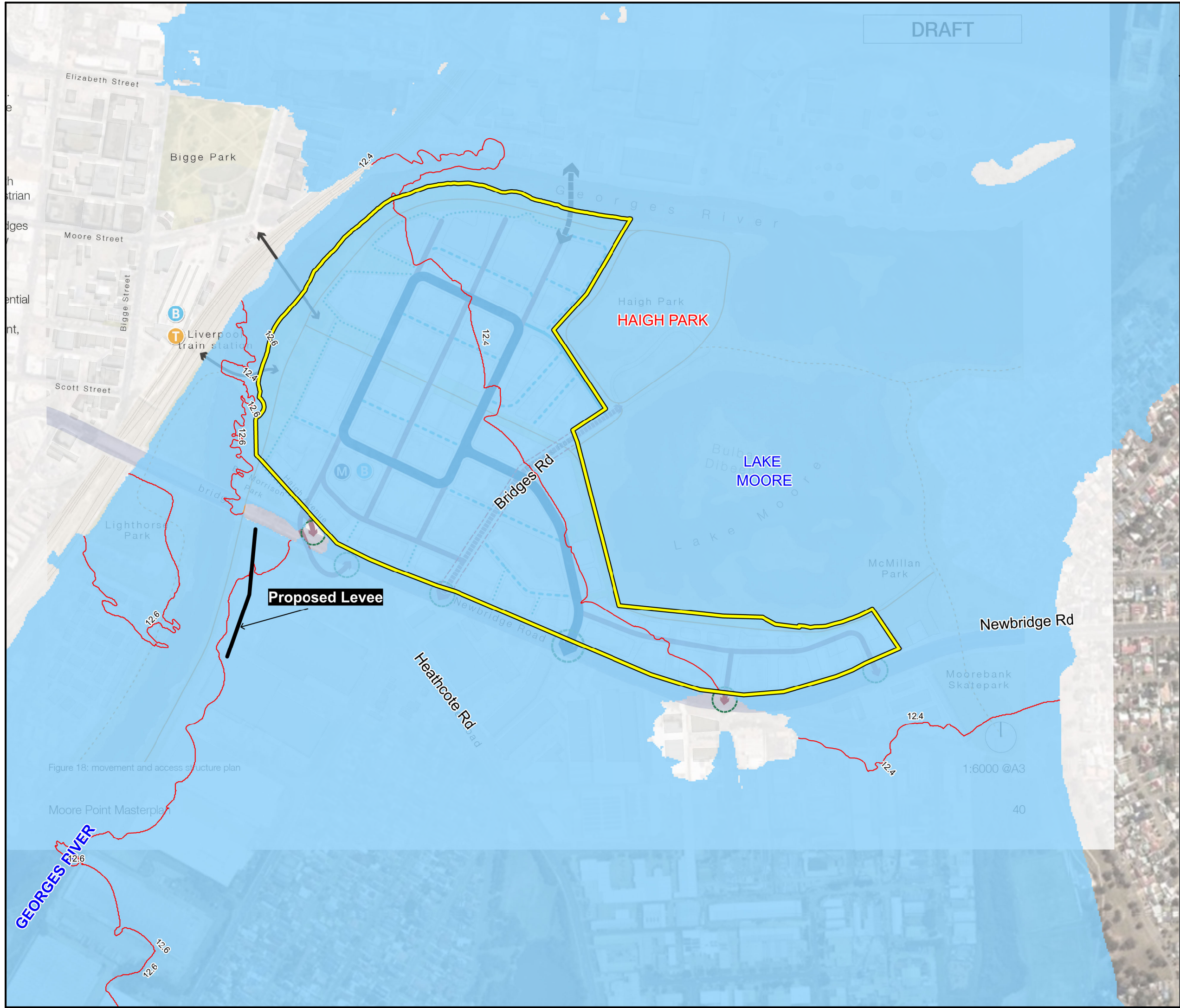
Figure - 4.1
Moore Point
Flood Impact Assessment

1% AEP Flood Levels
Developed Condition

2020/04/07

B

Filename: Figure 6.6 - PMF_Developed_Flood Levels.wor



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CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS

LEGEND

- Site Boundary
- Flood Extent
- 0.2 m Flood Level Contour

Figure - 4.2
Moore Point
Flood Impact Assessment

PMF Levels
Developed Condition

2020/04/07

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Figure 18: movement and access structure plan

Moore Point Masterplan

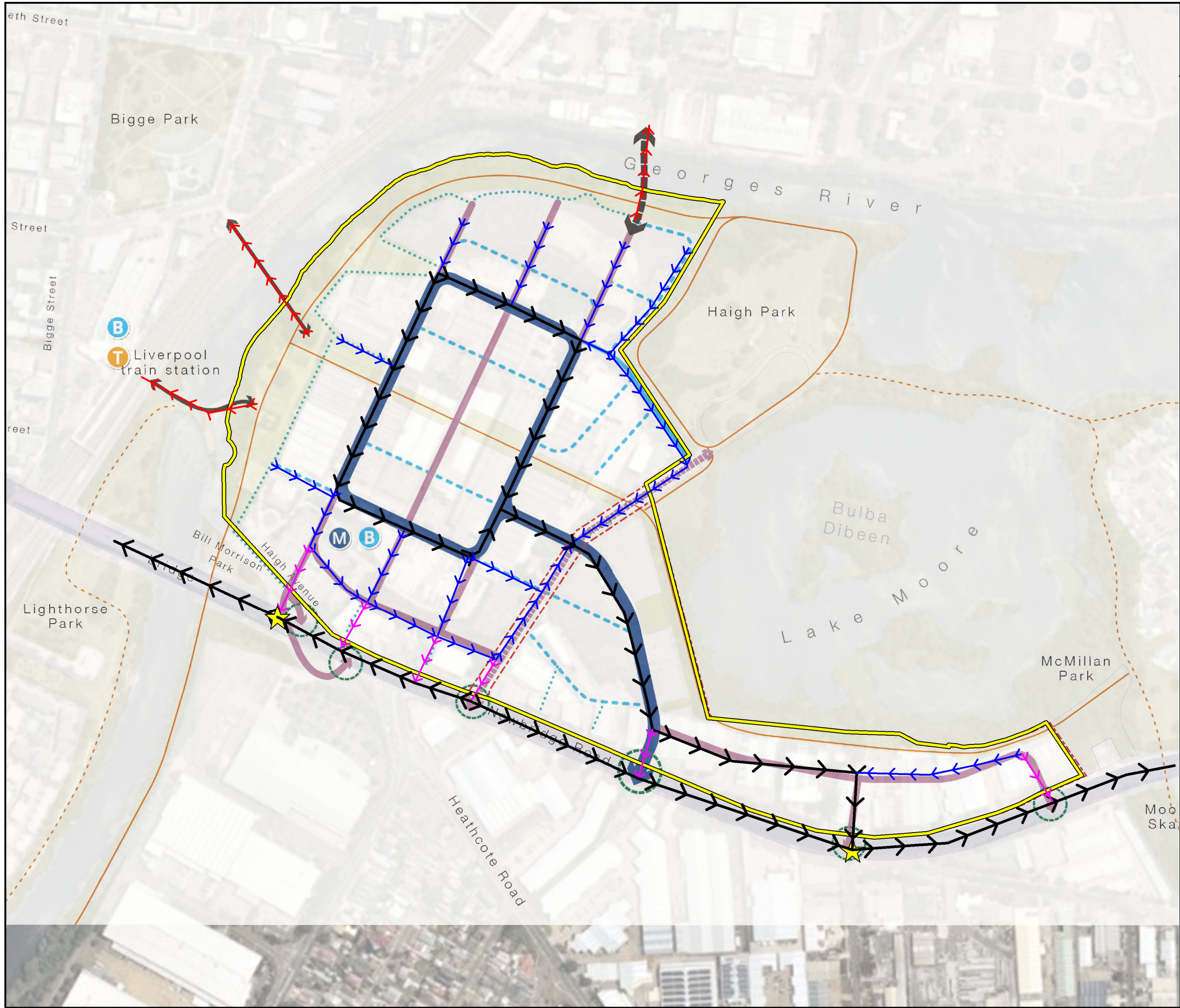
1:6000 @A3

40

0 80 metres
Scale 1:2,000 @ A3

Projection: GDA 1994 MGA Zone 56

Filename: Figure 7.1 - Flood Evacuation.wor



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CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS

LEGEND

- Site Boundary
- Primary Flood Evacuation Route
- Local Flood Evacuation Route
- Alternate Access to Newbridge Road
- Early Pedestrian Flood Evacuation Route
- Location Above PMF

N

0 60 metres

Scale 1:1,500 @ A3

Projection: GDA 1994 MGA Zone 56

Figure - 4.3
Moore Point
Flood Impact Assessment

Proposed Flood Evacuation Routes

2020/04/07 B