Flood Risk Assessment

Large Erecting Shop, South Eveleigh

304600711

Transport Asset Holding Entity (TAHE)

18 August 2022

Cardno

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Stantec

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Executive Summary

This report provides a site-specific flood risk assessment for the State-led rezoning of Lot 5 In DP 1175706 Large Erecting Shop (LES) in South Eveleigh.

As described by TTW, 2022

> *The proposed new planning controls are intended to facilitate the following:*
>
> - *Alterations within the existing LES to convert the ground level into commercial office and retail premises,*
> - *Creation of two new 'internal' storeys within the existing LES building envelope for use as commercial office premises,*
> - *External upgrade and conservation work to the existing LES building to ensure it is fit for purpose and environmentally sustainable,*
> - *Heritage interpretation and conservation work generally throughout the LES site,*
> - *Services augmentation, and*
> - *Publicly accessible space upgrades.*

The site-specific flood risk assessment was undertaken using the floodplain model assembled for the 2018 Alexandra Canal Catchment Wide Flood Study Update.

Flood Depths

It is noted from **Figures E2, E6 and E10** and **Table 1** that:

- The 5% AEP and 1% AEP flood depths are < 0.2 m deep ie. very shallow
- The PMF depths are < 0.33 m deep ie. shallow
- The incremental PMF depths above the 1% AEP flood depth is < 0.1 m except at Locations G and H where it is around 0.3 m.

Flood Velocities

It is noted from **Figures E3, E7** and **E11** that:

- The 5% AEP and 1% AEP flood velocities are < 0.5 m/s ie. low velocities
- In the PMF the flood velocities remain < 0.5 m/s except where the velocity increases to > 0.5 m/s at the western end of Locomotive Street and flows south through the cul-de-sac.

Flood Hazard Categories

It is noted from **Figures E4, E8** and **E12** that:

- The 5% AEP and 1% AEP flood hazard is category H1 ie. generally safe for vehicles, people and buildings
- In the PMF the flood hazard is generally category H1 ie. generally safe for vehicles, people and buildings. There are some isolated pockets of category H2 flood hazard along Locomotive Street along the overland flowpath at the eastern end of the LES which is unsafe for small vehicles.

Climate Change

As noted from **Table 1**, the incremental PMF depths above the 1% AEP flood depth is < 0.1 m except at Locations G and H where it is around 0.3 m. Consequently, the potential impact of climate change on 1% AEP flood level will be far less than 0.1 m given the likelihood of the PMF on a catchment of the size of the Alexandra Canal catchment is around 1 in 10,000,000 AEP.

While external works will be required it is expected that any filling will be limited and that any impact any impacts will be minor and will be confined within the property or in the public domain given the limited inundation experienced within the property.

Assessment of Council Requirements

An assessment of the requirements of the City of Sydney as set out in Section 4 General Requirements and Section 5 Flood Planning Levels is in Table 2.

It is noted from the floodplain modelling that at the eastern end of the LES the proposed ground floor level is close to the model ground levels outside the building ie. the proposed floor is flush with the external ground level. If this is the case and the ground level in the model is an accurate representation of ground levels in this area, then the ground floor level does not comply with the minimum flood planning level of the 1% AEP flood level. For the floor level to achieve compliance it would be necessary to either raise the floor level to the flood planning level or for flood barriers to be installed to exclude flood waters entering the LES. If these doors are outward opening (for fire), then any flood barriers would need to be located just inside the doorways. The most suitable barrier would likely be a reverse ramp push-up barrier. Examples of this barrier are given in **Figures 4, 5** and **6.** It is noted that a 0.3 m high flood barrier would protect the eastern entries up to and including the PMF. If the ground floor was to be protected up to the PMF level, then a further flood barrier would be needed to protect at the entry near Reference Location E.

The raising of the internal floor level to the flood planning level or installation of internal flood barriers would have nil impact of flooding given the assessed flood extents in all floods up to the 1% AEP flood do not enter the building.

While external works will be required, given the current shallow overland flow paths around the LES it is expected that any impacts will be minor and will be confined within the property or in the public domain (eg. Locomotive St) and will not adversely impact on other developments, properties or infrastructure.

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1 Introduction

This report provides a site-specific flood risk assessment for the State-led rezoning of Lot 5 In DP 1175706 Large Erecting Shop (LES) in South Eveleigh.

1.1 Background

As described by TTW, 2022:

> *The Large Erecting Shop (LES) is a large industrial building with a footprint of approximately 6,000sqm located at the northwest of the South Eveleigh Precinct. The LES ceased formal operation in 1988 and has been largely unoccupied since approximately 2017.*
>
> *The NSW Government is committed to working with the local community to develop the biggest innovation district of its kind in Australia, being Tech Central. The South Eveleigh Precinct is a key neighbourhood within Tech Central, delivering workplaces and collaboration spaces that support the vision for a new tech and innovation ecosystem. The inclusion of the LES within the broader South Eveleigh Precinct has the potential to support further innovation, collaboration and jobs for the future.*
>
> *Transport for NSW (TfNSW) is therefore seeking to adaptively use the LES for a mix of uses, including commercial office and retail premises. Such land uses are currently not permitted within the planning controls that apply to the LES building, which still reflect its former infrastructure function. As such, a State-led rezoning application is being proposed to the Department of Planning and Environment (DPE) to amend the planning controls that currently apply to the site under State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021 (Precincts SEPP).*
>
> *The proposed new planning controls are intended to facilitate the following:*
>
> - *Alterations within the existing LES to convert the ground level into commercial office and retail premises,*
> - *Creation of two new 'internal' storeys within the existing LES building envelope for use as commercial office premises,*
> - *External upgrade and conservation work to the existing LES building to ensure it is fit for purpose and environmentally sustainable,*
> - *Heritage interpretation and conservation work generally throughout the LES site,*
> - *Services augmentation, and*
> - *Publicly accessible space upgrades.*
>
> *While external works are required, the proposal does not seek to significantly alter the existing building footprint of the LES. Further it is proposed that the general form of the existing building and key architectural features of the existing building are retained in any future reuse of the building for commercial purposes, noting that the LES is part of the Eveleigh Railway Workshops complex included on the State Heritage Register.*

Since 2015 Mirvac has successfully developed the South Eveleigh Precinct. With the completion of the Locomotive Workshop project, which also involved the adaptive use of industrial buildings listed on the State Heritage Register, it is now considered a logical time to adapt and integrate the LES into the broader technology precinct. Mirvac, on behalf of TfNSW, are therefore preparing documentation to support the State- led rezoning application.

An architectural 3D overview is given in **Figure 1.**

Figure 1 Architectural 3D Overview (Source: Figure 1, TTW, 2022)

1.2 Location

The location of LES is indicated in **Figure 2**.

Figure 2 Location of the LES (Source: Figure 2, TTW, 2022)

As described, in part, by TTW, 2022:

> *The LES is an isolated building at the northwest of the South Eveleigh Precinct as identified in Figure 2. The South Eveleigh Precinct is located approximately 200 m to the southwest of Redfern Train Station and approximately 20 0m to the west of the future Sydney Metro Waterloo Metro Station. The South Eveleigh Precinct includes an overall area of approximately 13.2 hectares.*
>
> *The LES site is currently legally described as being part of Lot 5, in Deposited Plan 1175706. This allotment also includes the North Eveleigh Precinct, the rail lines separating the North and South Eveleigh Precincts, and Redfern Railway Station. It is proposed that the LES building will be subdivided from this overall allotment*
>
> *The LES is owned by TAHE NSW and managed by Transport Heritage NSW. It is currently being used as a maintenance facility for heritage locomotives, but it requires significant capital investment to bring it up to the required standards for continued use and avoid further deterioration.*
>
> *The LES is a rectangular building consisting of two main bays with twin gable roofs running the length of the workshop. Internally, the workshops are articulated with regular cast-iron columns supporting both roof and overhead cranes. Main elevations are regularly articulated with twin semi-circular arched windows with smaller arched windows above.*

1.3 Proposed Controls

As described by TTW, 2022:

> *The proposed amendments to the Precincts SEPP involve the inclusion of the LES site within the 'Business Zone—Business Park' zone, which applies to the majority of the South Eveleigh Precinct and notably is the existing zoning for the adjacent Locomotive Shops.*
>
> *Further, the State-led rezoning application proposes new development standards including a maximum gross floor area (GFA) control on the LES site of up to 15,000 m^2. Other minor changes as required may be proposed to the Precincts SEPP to facilitate the reuse of the LES building for commercial office and retail purposes.*

1.4 Flooding Considerations

It is noted that flooding investigations have been previously completed for the Alexandra Canal Catchment.

Cardno now Stantec prepared the Alexandra Canal Catchment Flood Study and Floodplain Risk Management Study and Plan for the City of Sydney (Cardno, 2014). The studies defined both mainstream and overland inundation throughout the entire catchment, which includes the subject site. A SOBEK model was assembled for the 2014 studies.

The 2014 flood study was subsequently superseded by the Alexandra Canal Catchment Wide Flood Study Update (WMAwater, 2018). The TUFLOW model adopted by WMAwater for this study was provided to Cardno now Stantec.

The TUFLOW model is a detailed 1D/2D flood model which describes the flooding behaviour throughout the study area. This model incorporates all pits and pipes from data provided by the City of Sydney (WMAwater, 2018). The adopted grid size for the TUFLOW hydraulic model is 2 m x 2 m.

Cardno now Stantec adopted the WMAwater model and has not modified it as part of the current assessment

1.5 Objectives

The objectives were to:

- Undertake a flood risk assessment of flooding in the vicinity of the subject site and its impact or otherwise on the proposed development*;*
- Identify any measures that might be incorporated into the proposed works to meet the intent of the City of Sydney Interim Floodplain Management Policy.

2 Flood Risk Assessment

The site-specific flood risk assessment for the State-led rezoning of Lot 5 In DP 1175706 Large Erecting Shop (LES) was undertaken using the floodplain model assembled for the Alexandra Canal Catchment Wide Flood Study Update (WMAwater, 2018).

2.1 Existing Conditions

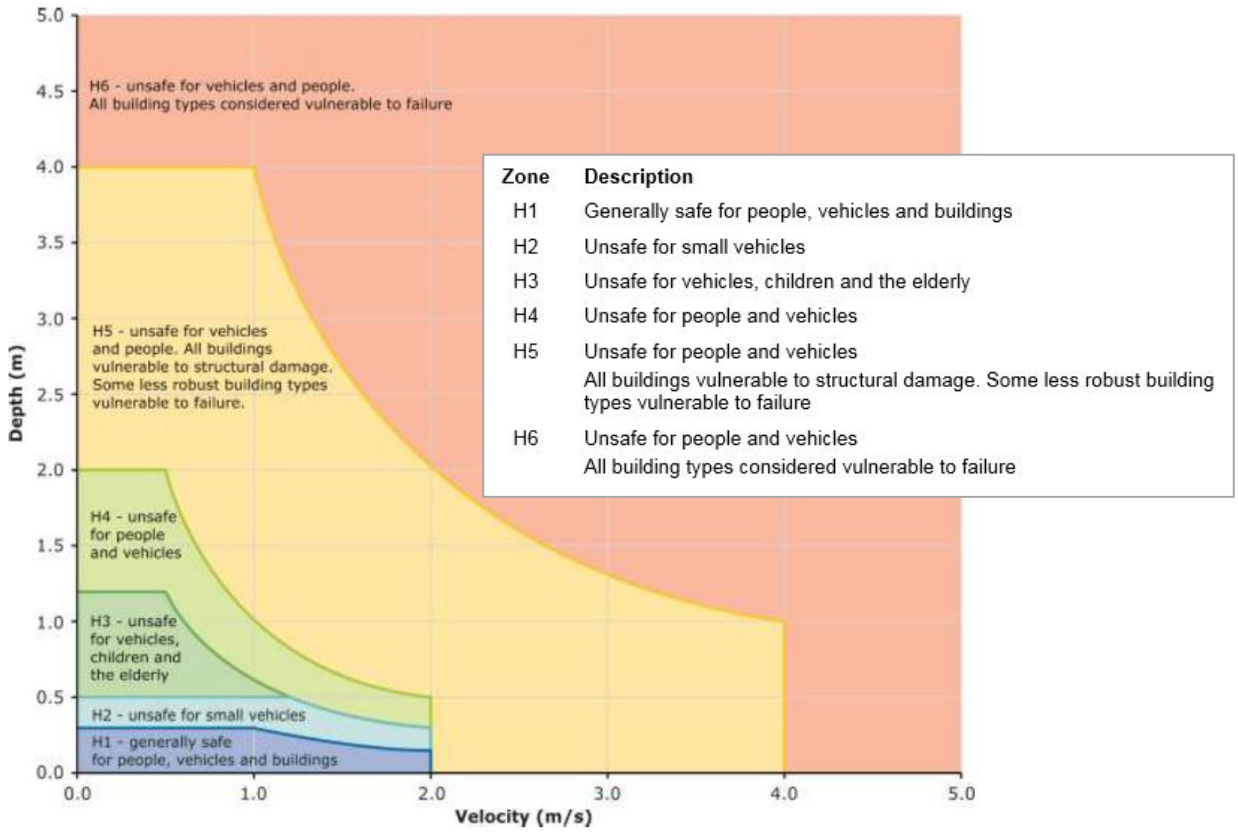
The 5% AEP flood levels, depths, velocities under Existing Conditions are mapped in **Figures E1, E2** and **E3** in **Appendix A**.

The 1% AEP flood levels, depths, velocities under Existing Conditions are mapped in **Figures E5, E6** and **E7** in **Appendix A**.

The PMF levels, depths, velocities under Existing Conditions are mapped in **Figures E9, E10** and **E11** in **Appendix A**.

Flood hazard vulnerability curves based on six categories H1 – H6 are as shown below.

It is noted that H1 conditions would be trafficable for small and large vehicles while H2 conditions would be trafficable for larger vehicles only.



The provisional flood hazard categories on the site and on adjoining properties in the 5% AEP, 1% AEP and PMF events are plotted respectively in **Figures E4, E8 and E12** which are attached in **Appendix A**.

Based on the 1% AEP flood extents a series of reference locations were identified as set out in **Figure 3**. The flood levels and depths at these reference locations and the resulting freeboard at each ground floor entry is summarised in **Table 1**.

Table 1 Flood Levels and Depths at Reference Locations around the LES

Floor Level (m AHD) 21.5

Reference Location	Ground Level (mAHD)	5% AEP		1% AEP		PMF		PMF Increment above 1% AEP FL (m)	Freeboard at Entries		Comment
		Flood Level (mAHD)	Depth (m)	Flood Level (mAHD)	Depth (m)	Flood Level (mAHD)	Depth (m)		1% AEP (m)	PMF (m)	
A	21.65	21.68	0.04	21.70	0.06	21.79	0.14	0.09			
B	21.52	21.68	0.16	21.70	0.18	21.79	0.27	0.09	-0.20	-0.29	Entries
C	21.54	21.65	0.11	21.67	0.13	21.76	0.22	0.08			
		21.63		*21.65*		*21.73*		*0.08*	-0.15	-0.23	Entry
D	21.47	21.60	0.13	21.62	0.15	21.70	0.22	0.07			
		21.56		*21.58*		*21.66*		*0.08*	-0.08	-0.16	Entry
E	21.37	21.47	0.10	21.49	0.12	21.57	0.20	0.08	0.02	-0.07	Entry
		20.79		*20.80*		*20.85*		*0.05*	0.70	0.65	Entry
F	20.64	20.66	0.02	20.67	0.03	20.71	0.07	0.04			
G	21.15	21.28	0.13	21.30	0.16	21.47	0.33	0.17	0.20	0.03	Entries
H	21.30	21.34	0.04	21.37	0.07	21.58	0.28	0.21			

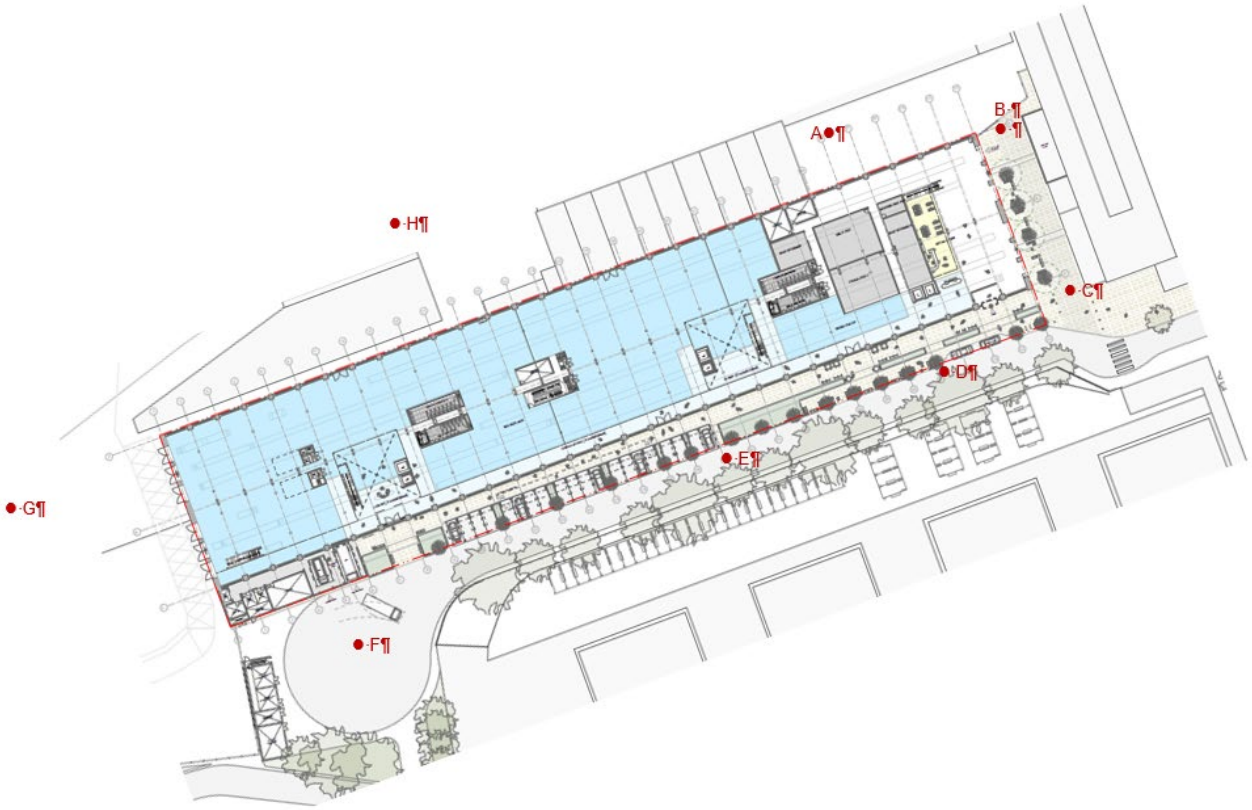


Figure 3 Reference Locations

2.1.1 Flood Depths

It is noted from **Figures E2, E6 and E10** and **Table 1** that:

- The 5% AEP and 1% AEP flood depths are < 0.2 m deep ie. very shallow
- The PMF depths are < 0.33 m deep ie. shallow
- The incremental PMF depths above the 1% AEP flood depth is < 0.1 m except at Locations G and H where it is around 0.3 m.

2.1.2 Flood Velocities

It is noted from **Figures E3, E7** and **E11** that:

- The 5% AEP and 1% AEP flood velocities are < 0.5 m/s ie. low velocities
- In the PMF the flood velocities remain < 0.5 m/s except where the velocity increases to > 0.5 m/s at the western end of Locomotive Street and flows south through the cul-de-sac.

2.1.3 Flood Hazard Categories

It is noted from **Figures E4, E8** and **E12** that:

- The 5% AEP and 1% AEP flood hazard is category H1 ie. generally safe for vehicles, people and buildings
- In the PMF the flood hazard is generally category H1 ie. generally safe for vehicles, people and buildings. There are some isolated pockets of category H2 flood hazard along Locomotive Street along the overland flowpath at the eastern end of the LES which is unsafe for small vehicles.

2.1.4 Climate Change

Chapter 6 of Book 1 of the 2019 edition of Australian Rainfall and Runoff provides an approach to address the risks from climate change in projects and decisions that involve estimation of design flood characteristics while further research is undertaken to reduce key uncertainties. The chapter uses output from the Climate Futures web tool developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO). Four Representative Concentration Pathways (RCPs) are identified for greenhouse gas and aerosol concentrations. The RCPs are designated as 2.6, 4.5, 6.0 and 8.5, and use of RCPs 4.5 and 8.5 (low and high concentrations, respectively) is recommended for climate change impact assessment.

The 200 yr ARI and 500 yr ARI floods are surrogates for 100 yr ARI floods with climate change rainfall increases under RCP4.5 and RCP8.5 conditions.

As noted from **Table 1**, the incremental PMF depths above the 1% AEP flood depth is < 0.1 m except at Locations G and H where it is around 0.3 m. Consequently, the potential impact of climate change on 1% AEP flood level will be far less than 0.1 m given the likelihood of the PMF on a catchment of the size of the Alexandra Canal catchment is around 1 in 10,000,000 AEP.

3 Assessment of Council Requirements

As described in the Interim Floodplain Management Policy released by the City of Sydney (which is attached in **Appendix C**):

> *The Floodplain Management Policy provides direction with respect to how floodplains are managed within the Local Government Area (LGA) of the City of Sydney Council (the City).*
>
> *The City has a responsibility to manage floodplains to ensure that any:*
>
> - *new development will not experience undue flood risk; and*
> - *existing development will not be adversely flood affected through increased damage or hazard as a result of any new development.*
>
> *The Policy provides controls to facilitate a consistent, technically sound and best practice approach for the management of flood risk within the City's LGA. …..*

As described, in part, by TTW, 2022:

> *The proposed new planning controls are intended to facilitate the following:*
>
> - *Alterations within the existing LES to convert the ground level into commercial office and retail premises,*
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> - *Services augmentation, and*
> - *Publicly accessible space upgrades.*
>
> *While external works are required, the proposal does not seek to significantly alter the existing building footprint of the LES. Further it is proposed that the general form of the existing building and key architectural features of the existing building are retained in any future reuse of the building for commercial purposes, noting that the LES is part of the Eveleigh Railway Workshops complex included on the State Heritage Register.*

An assessment of the requirements of the City of Sydney as set out in Section 4 General Requirements and Section 5 Flood Planning Levels is as follows.

Table 2 Assessment of General Requirements

Objective	Requirement	Comment
Fencing		
• To ensure that fencing does not result in any significant obstruction to the free flow of floodwaters; and • To ensure that fencing will remain safe during floods and not become moving debris that potentially threatens the security of structures or the safety of people.	• Fencing is to be designed and constructed in such a manner that it will not modify the flow of floodwaters and cause damage to surrounding land.	It is noted that as part of the proposed development that the current substantial fencing along the Locomotive Street boundary will be removed as part of the development to activate this area. It expected that the removal of existing fencing will reduce a current potential obstruction to overland flows.
Industrial / Commercial Properties		
• To minimise the damage to industrial and commercial properties from flooding; and • To minimise risk to human life from the inundation of industrial and commercial properties and to minimise economic cost to the community resulting from flooding.	• The City may consider merits-based approaches presented by the applicant. The proposed industrial or commercial buildings must meet the Flood Planning Level Requirements detailed in Section 5; and • The proposed industrial or commercial development should not increase the likelihood of flooding on other developments, properties or infrastructure.	How the proposed refurbishment of the LES could meet the Flood Planning Level requirement is discussed below. While external works will be required, given the current shallow overland flow paths around the LES it is expected that any impacts will be minor and will be confined within the property or in the public domain (eg. Locomotive St) and will not adversely impact on other developments, properties or infrastructure.
Car Parking		
• To minimise the damage to motor vehicles from flooding; • To ensure that motor vehicles do not become moving debris during floods, which threaten the integrity or blockage of structures or the safety of people, or damage other property; and • To minimise risk to human life from the inundation of basement and other car park or driveway areas.	• The proposed car park should not increase the risk of vehicle damage by flooding inundation; • The proposed garage or car park should not increase the likelihood of flooding on other developments, properties or infrastructure; • The proposed garage or car park must meet the Flood Planning Level Requirements detailed in Section 5; and • Open car parking - The minimum surface level of open space car parking subject to	It is anticipated that current parallel parking along Locomotive St will be replaced by parking bays along the southern frontage of the property. While Locomotive St currently experiences shallow overland flows and future parking bays may experience shallow inundation, it is noted that flooding in the 5% AEP and 1% AEP in this area is category H1 ie. generally safe for vehicles, people and buildings while in the PMF the flood hazard is generally category H1 with some isolated

	inundation should be designed giving regard to vehicle stability in terms of depths and velocity during inundation by flood waters. Where this is not possible, it shall be demonstrated how the objectives will be met.	pockets of category H2 flood hazard along Locomotive St and along the overland flowpath at the eastern end of the LES which is unsafe for small vehicle.
Filling of Flood Prone Land		
• To ensure that any filling of land that is permitted as part of a development consent does not have a negative impact on the floodplain.	• Unless a floodplain risk management plan for the catchment has been adopted, which allows filling to occur, filling for any purpose, including the raising of a building platform in flood-prone areas is not permitted without Council approval. Application for any filling must be supported by a flood assessment report from a suitably qualified engineer which certifies that the filling will not increase flood affectation elsewhere.	While external works will be required it is expected that any filling will be limited and that any impact any impacts will be minor and will be confined within the property or in the public domain given the limited inundation experienced within the property.
Consideration of the Impact of Climate Change		
• To prevent the potential impact of climate change.	• For those developments which have a lifespan of more than fifty years the impact due to sea level rise and impacts due to increased rainfall intensities shall be considered. • Meet the allowances for sea level rise as recommended in the NSW Government Coastal Planning Guideline: Adopting Sea Level Rise 2010 (recently withdrawn from publication). Specifically, this shall include and allowance of 40cm by 2050 and a 90cm by 2100 from the 2009 Mean Sea Level. • Where in the opinion of the City the proposed development is of reasonable impact to regional or catchment trunk drainage, the drainage system design shall allow for a minimum of 10% increased rainfall.	As discussed in Section 2.1.4 the potential impact of climate change on 1% AEP flood level will be far less than 0.1 m. The site is remote from the sea and tidal watercourses, and is not otherwise subject to influence of sea level rise. The property is located close to the catchment boundary and is subject to local overland flows only.

Table 3 Flood Planning Level Requirements

Objective	Requirement	Comment
Industrial / Commercial Properties		
Business - Mainstream or local drainage flooding	Merits approach presented by the applicant with a minimum of the 1% AEP flood level	The flood levels and depths at the reference locations and the resulting freeboard at each ground floor entry is summarised in **Table 1**.
Retail Floor Levels - Mainstream or local drainage flooding	Merits approach presented by the applicant with a minimum of the 1% AEP flood. The proposal must demonstrate a reasonable balance between flood protection and urban design outcomes for street level activation.	Refer to the discussion below regarding achieving the intent of the flood planning level requirements for business and/or retail use on the Ground Floor.
Above ground car park		
Open car parks - Mainstream or local drainage	5% AEP flood level	It is anticipated that current parallel parking along Locomotive St will be replaced by parking bays along the southern frontage of the property. While Locomotive St currently experiences shallow overland flows and future parking bays may experience shallow inundation, it is noted that flooding in the 5% AEP and 1% AEP in this area is category H1 ie. generally safe for vehicles, people and buildings while in the PMF the flood hazard is generally category H1 with some isolated pockets of category H2 flood hazard along Locomotive St and along the overland flowpath at the eastern end of the LES which is unsafe for small vehicle.

*Note**s***

1) The below ground garage/car park level applies to all possible ingress points to the car park such as vehicle entrances and exits, ventilation ducts, windows, light wells, lift shaft openings, risers and stairwells.

2) Local drainage flooding occurs where:

- *The maximum cross sectional depth of flooding in the local overland flow path through and upstream of the site is less than 0.25 m for the 1% AEP flood; and*
- *The development is at least 0.5m above the 1% AEP flood level at the nearest downstream trapped low point; and*
- *The development does not adjoin the nearest upstream trapped low point; and*

- *Blockage of an upstream trapped low point is unlikely to increase the depth of flow past the property to greater than 0.25m in the 1% AEP flood.*

3) *Mainstream flooding occurs where the local drainage flooding criteria cannot be satisfied.*

4) *A property is considered to be outside the floodplain where it is above the mainstream and local drainage flood planning levels including freeboard.*

It is noted from the floodplain modelling that at the eastern end of the LES the proposed ground floor level is close to the model ground levels outside the building ie. the proposed floor is flush with the external ground level. If this is the case and the ground level in the model is an accurate representation of ground levels in this area, then the ground floor level does not comply with the minimum flood planning level of the 1% AEP flood level. For the floor level to achieve compliance it would be necessary to either raise the floor level to the flood planning level or for flood barriers to be installed to exclude flood waters entering the LES. If these doors are outward opening (for fire), then any flood barriers would need to be located just inside the doorways. The most suitable barrier would likely be a reverse ramp push-up barrier. Examples of this barrier are given in **Figures 4, 5** and **6.** It is noted that a 0.3 m high flood barrier would protect these entries up to and including the PMF. If the ground floor was to be protected up to the PMF level, then a further flood barrier would be needed to protect at the entry near Reference Location E.

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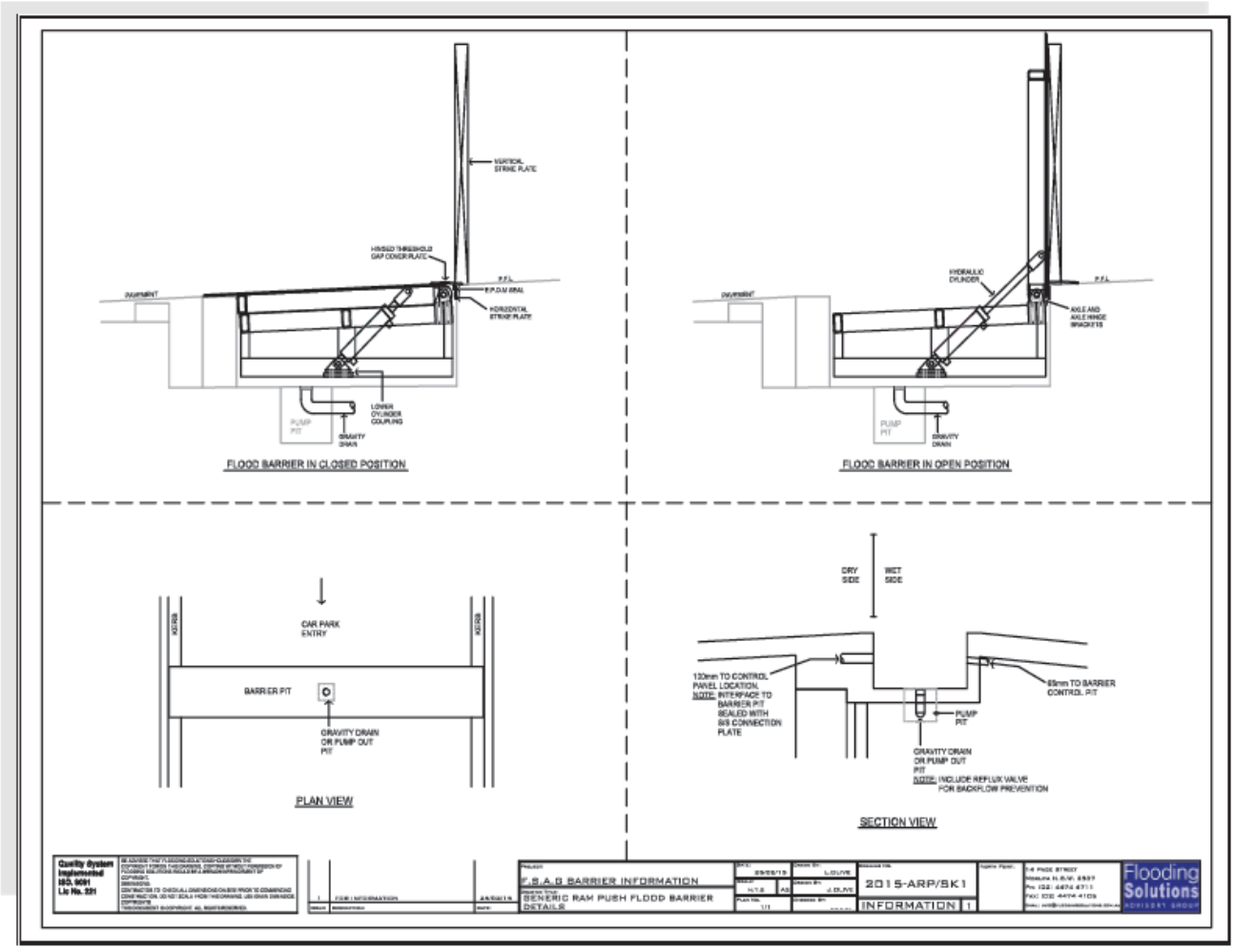

Figure 4 Ram Push-Up Flood Barrier Details – Courtesy Flooding Solutions Pty Ltd

Figure 5 Self Closing Ram Push Flood Barrier Closed Position - Courtesy of Flooding Solutions Pty Ltd

Figure 6 Self Closing Ram Push Flood Barrier Open Position - Courtesy of Flooding Solutions Pty Ltd

4 Conclusions

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It is noted from **Figures E4, E8** and **E12** that:

- The 5% AEP and 1% AEP flood hazard is category H1 ie. generally safe for vehicles, people and buildings
- In the PMF the flood hazard is generally category H1 ie. generally safe for vehicles, people and buildings. There are some isolated pockets of category H2 flood hazard along Locomotive Street along the overland flowpath at the eastern end of the LES which is unsafe for small vehicles.

Climate Change

As noted from **Table 1**, the incremental PMF depths above the 1% AEP flood depth is < 0.1 m except at Locations G and H where it is around 0.3 m. Consequently, the potential impact of climate change on 1% AEP flood level will be far less than 0.1 m given the likelihood of the PMF on a catchment of the size of the Alexandra Canal catchment is around 1 in 10,000,000 AEP.

While external works will be required it is expected that any filling will be limited and that any impact any impacts will be minor and will be confined within the property or in the public domain given the limited inundation experienced within the property.

Assessment of Council Requirements

An assessment of the requirements of the City of Sydney as set out in Section 4 General Requirements and Section 5 Flood Planning Levels is in Table 2.

It is noted from the floodplain modelling that at the eastern end of the LES the proposed ground floor level is close to the model ground levels outside the building ie. the proposed floor is flush with the external ground level. If this is the case and the ground level in the model is an accurate representation of ground levels in this area, then the ground floor level does not comply with the minimum flood planning level of the 1% AEP flood level. For the floor level to achieve compliance it would be necessary to either raise the floor level to the flood planning level or for flood barriers to be installed to exclude flood waters entering the LES. If these doors are outward opening (for fire), then any flood barriers would need to be located just inside the doorways. The most suitable barrier would likely be a reverse ramp push-up barrier. Examples of this barrier are given in **Figures 4, 5** and **6.** It is noted that a 0.3 m high flood barrier would protect the eastern entries up to and including the PMF. If the ground floor was to be protected up to the PMF level, then a further flood barrier would be needed to protect at the entry near Reference Location E.

The raising of the internal floor level to the flood planning level or installation of internal flood barriers would have nil impact of flooding given the assessed flood extents in all floods up to the 1% AEP flood do not enter the building.

While external works will be required, given the current shallow overland flow paths around the LES it is expected that any impacts will be minor and will be confined within the property or in the public domain (eg. Locomotive St) and will not adversely impact on other developments, properties or infrastructure.

5 References

Acoustic Logic (2022) “LES Building, South Eveleigh Precinct, Noise and Vibration Impact Assessment”, *Final Report*, Revision 1, prepared for Mirvac Office Developments, 8 June 2022.

TTW (2022) “Large Erecting Shop, Existing Structure Condition and Structural Study”, *Report*, prepared for Mirvac, 8 June 2022.

Large Erecting Shop, South Eveleigh

APPENDIX A
FIGURES

Cardno

now

Stantec

Flood Risk Assessment
Mirvac Large Erecting Shed (LES)

Benchmark Conditions
5% AEP
Flood Extents & Flood Levels

Legend

- Site
- 0.5m Water Level Contour (mAHD)
- Flood Extent

FIGURE E1

1:2,500 Scale at A3

0 30 60 90 120 m

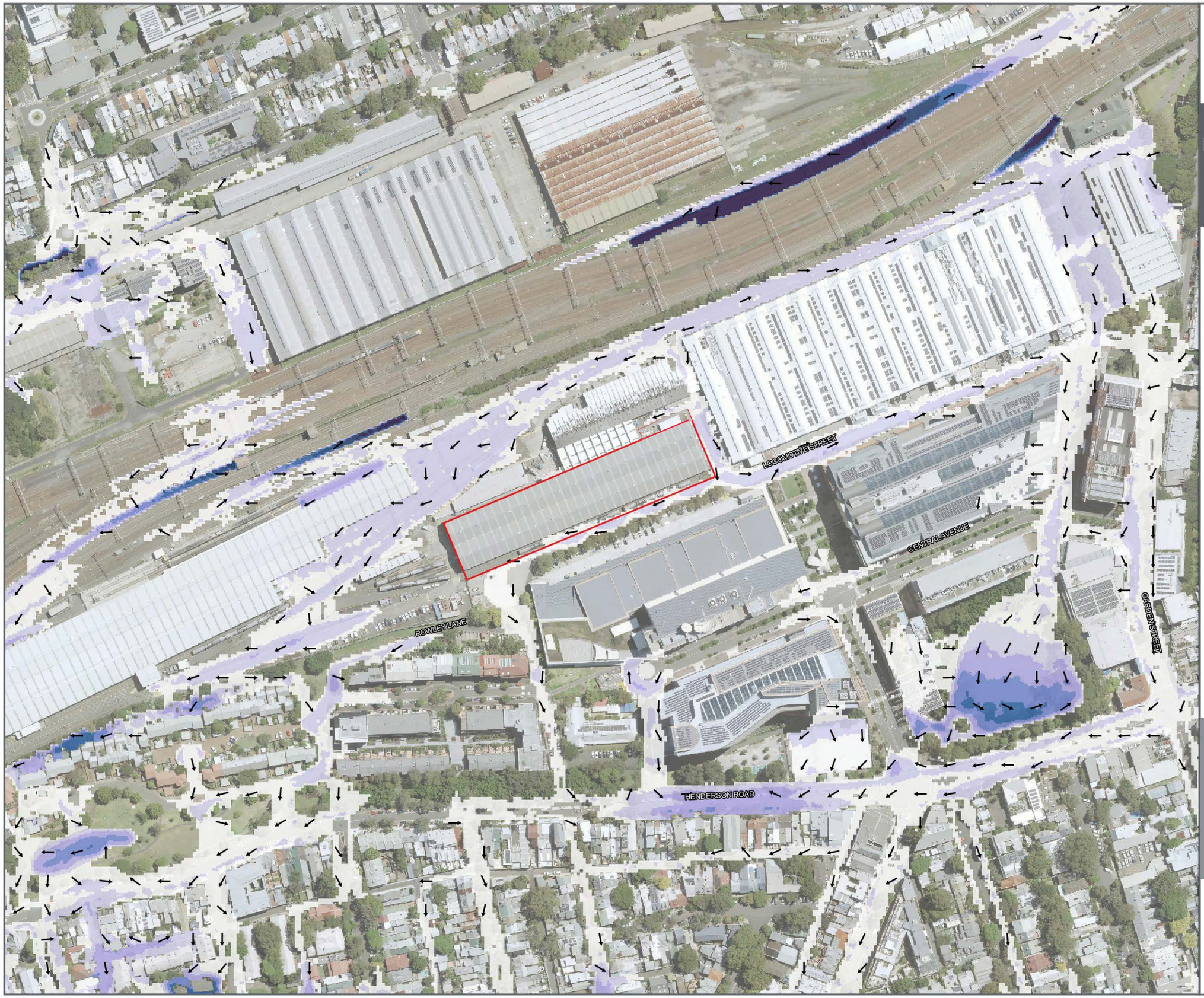
N

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz

Flood Risk Assessment
Mirvac Large Erecting Shed (LES)

Benchmark Conditions
5% AEP
Flood Depths



Legend

- Site
- Velocity Vector

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE E2

1:2,500 Scale at A3

0 30 60 90 120 m

N

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz

Flood Risk Assessment Mirvac Large Erecting Shed (LES)

Benchmark Conditions
5% AEP
Flood Velocities

Legend

- Site

Flood Velocity (m/s)

- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

FIGURE E3

1:2,500 Scale at A3

0 30 60 90 120 m

N

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz

Flood Risk Assessment
Mirvac Large Erecting Shed (LES)

Benchmark Conditions
5% AEP
Flood Hazard Categories

Legend

- Site

Hazard Category

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

FIGURE E4

1:2,500 Scale at A3

0 30 60 90 120 m

N

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz

Flood Risk Assessment
Mirvac Large Erecting Shed (LES)

Benchmark Conditions
1% AEP
Flood Extents & Flood Levels

Legend

- Site
- 0.5m Water Level Contour (mAHD)
- Flood Extent

LOCOMOTIVE STREET
CENTRAL AVENUE
GARDEN STREET
ROWLEY LANE
HENDERSON ROAD

FIGURE E5

1:2,500 Scale at A3

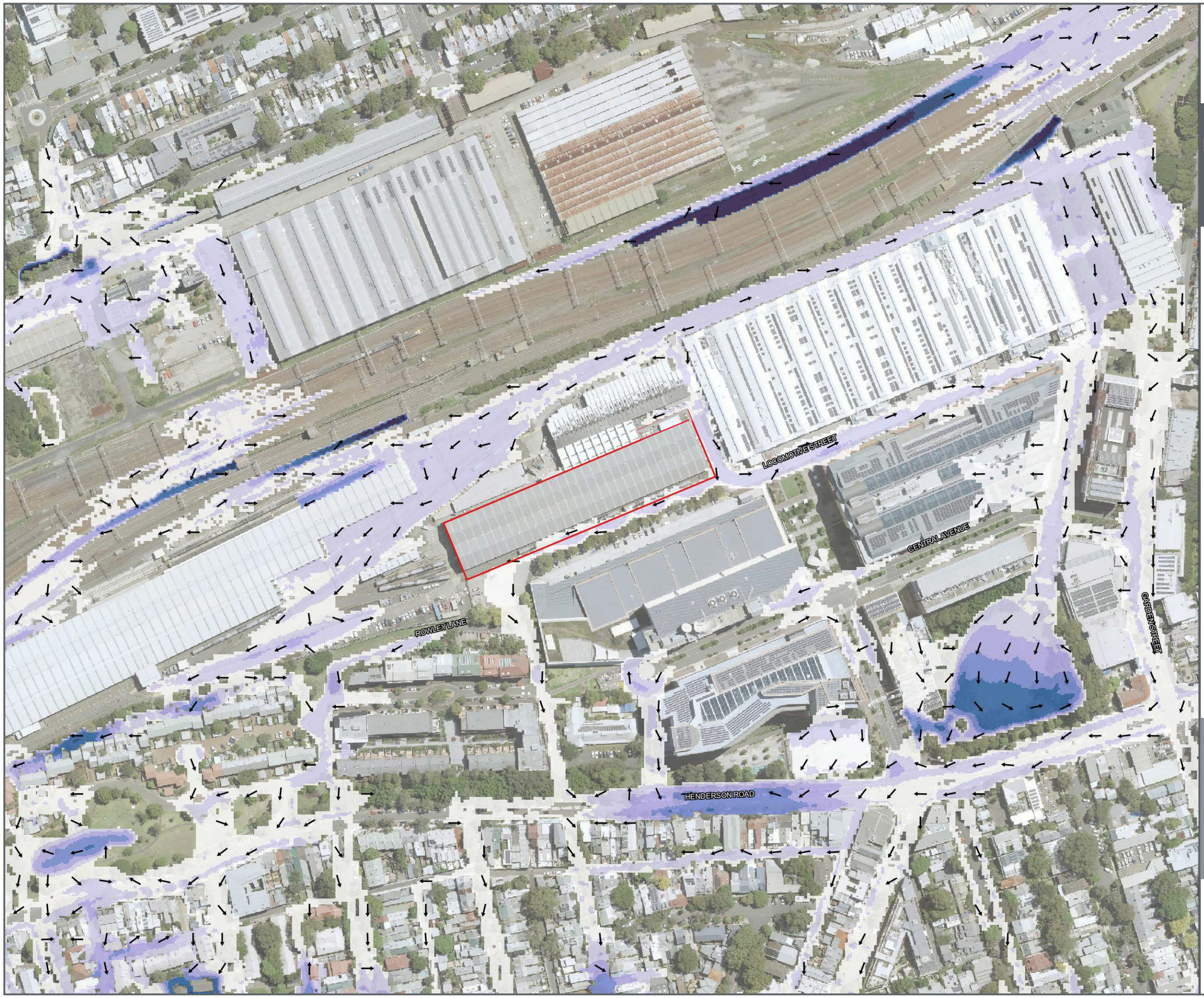
0 30 60 90 120 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz

Flood Risk Assessment
Mirvac Large Erecting Shed (LES)

Benchmark Conditions
1% AEP
Flood Depths



Legend

- Site
- Velocity Vector

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE E6

1:2,500 Scale at A3

0 30 60 90 120 m

N

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz

Flood Risk Assessment
Mirvac Large Erecting Shed (LES)

Benchmark Conditions
1% AEP
Flood Velocities

Legend

- Site

Flood Velocity (m/s)

- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

FIGURE E7

1:2,500 Scale at A3

0 30 60 90 120 m

N

Cardno NOW Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz

Flood Risk Assessment Mirvac Large Erecting Shed (LES)

Benchmark Conditions
1% AEP
Flood Hazard Categories

Legend

- Site

Hazard Category

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

FIGURE E8

1:2,500 Scale at A3

0 30 60 90 120 m

N

Cardno NSW Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz

Flood Risk Assessment Mirvac Large Erecting Shed (LES)

Benchmark Conditions
PMF
Flood Extents & Flood Levels

Legend

- Site
- 0.5m Water Level Contour (mAHD)
- Flood Extent

LOCOMOTIVE STREET
CENTRAL AVENUE
GARDEN STREET
ROWLEY LANE
HENDERSON ROAD

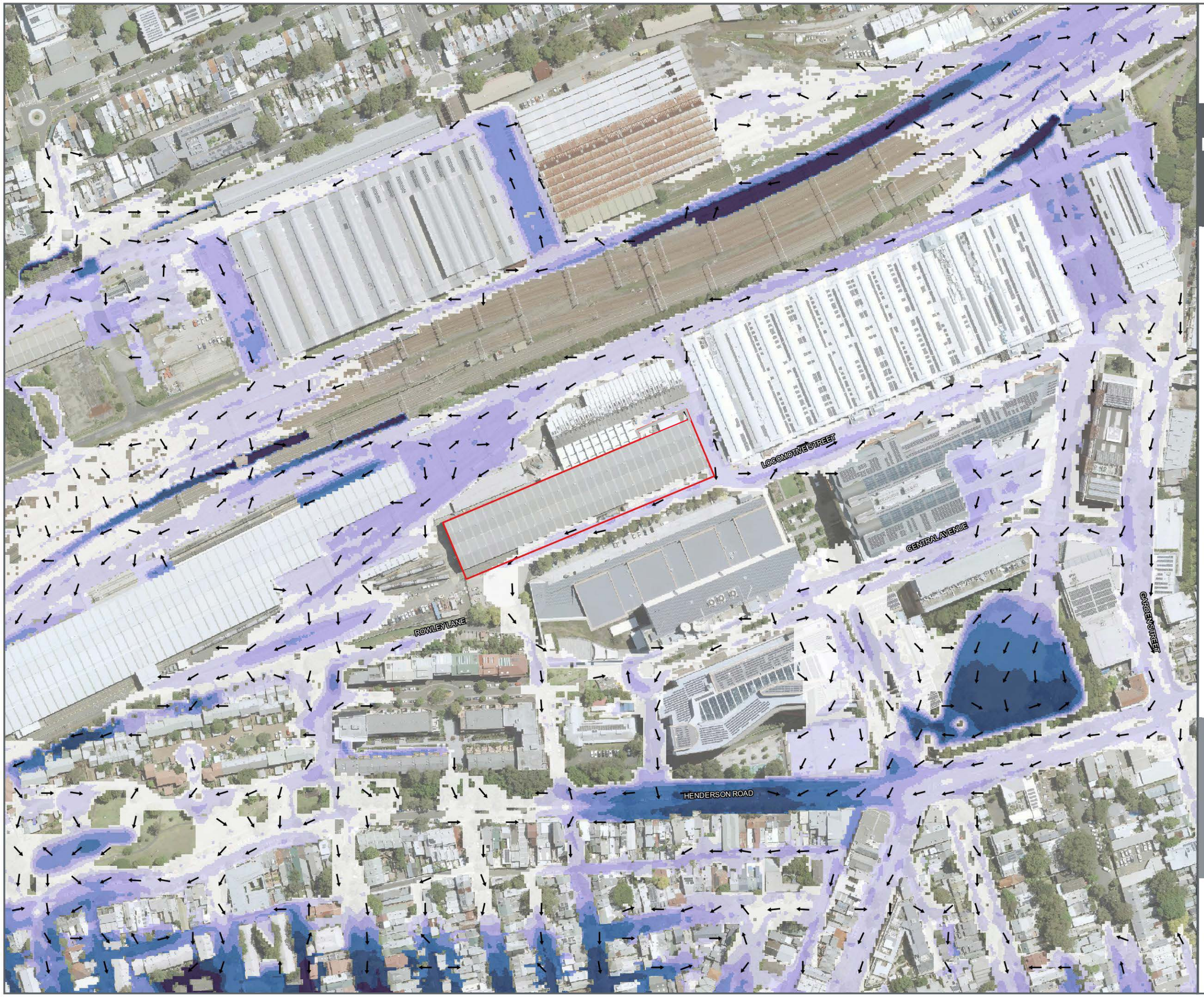
FIGURE E9

1:2,500 Scale at A3

0 30 60 90 120 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz



Flood Risk Assessment Mirvac Large Erecting Shed (LES)

Benchmark Conditions
PMF
Flood Depths

Legend

- Site
- Velocity Vector

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE E10

1:2,500 Scale at A3

0 30 60 90 120 m

N

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz

Flood Risk Assessment
Mirvac Large Erecting Shed (LES)

Benchmark Conditions
PMF
Flood Velocities

Legend

- Site

Flood Velocity (m/s)

- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

FIGURE E11

1:2,500 Scale at A3

0 30 60 90 120 m

N

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz

Flood Risk Assessment
Mirvac Large Erecting Shed (LES)

Benchmark Conditions
PMF
Flood Hazard Categories

LOCOMOTIVE STREET
CENTRAL AVENUE
GARDEN STREET
ROWLEY LANE
HENDERSON ROAD

Legend

- Site

Hazard Category

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

FIGURE E12

1:2,500 Scale at A3

0 30 60 90 120 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-6-24| Project:304682002
Coordinate System: MGA Zone 56
Map: Mirvac_Large_Erecting_Shed (LES)_Figure.qgz

Large Erecting Shop, South Eveleigh

APPENDIX B
SELECTED ARCHITECTURAL DRAWINGS

Cardno

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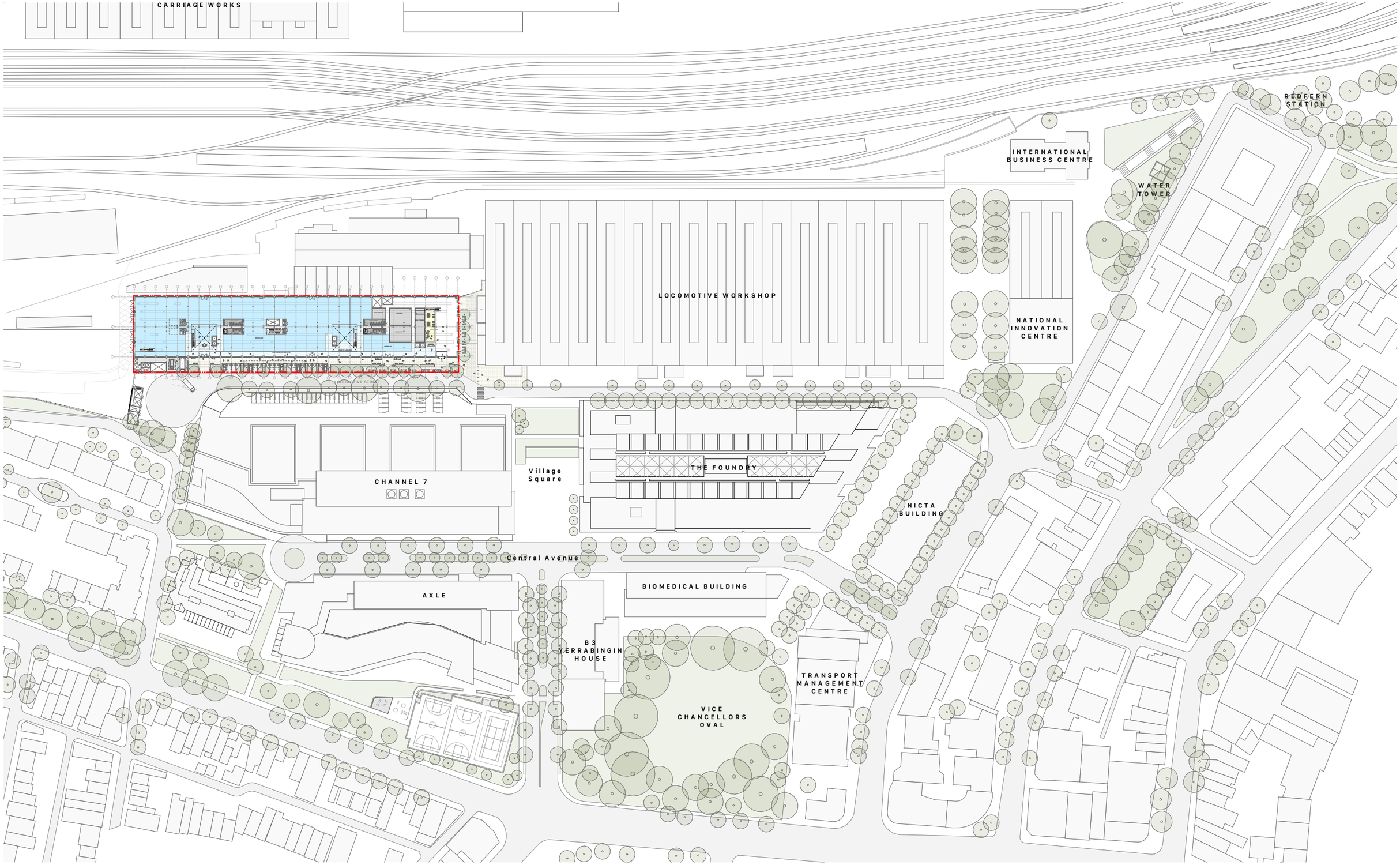
Stantec



1 PLAN Site Plan 1:2000
1:2000

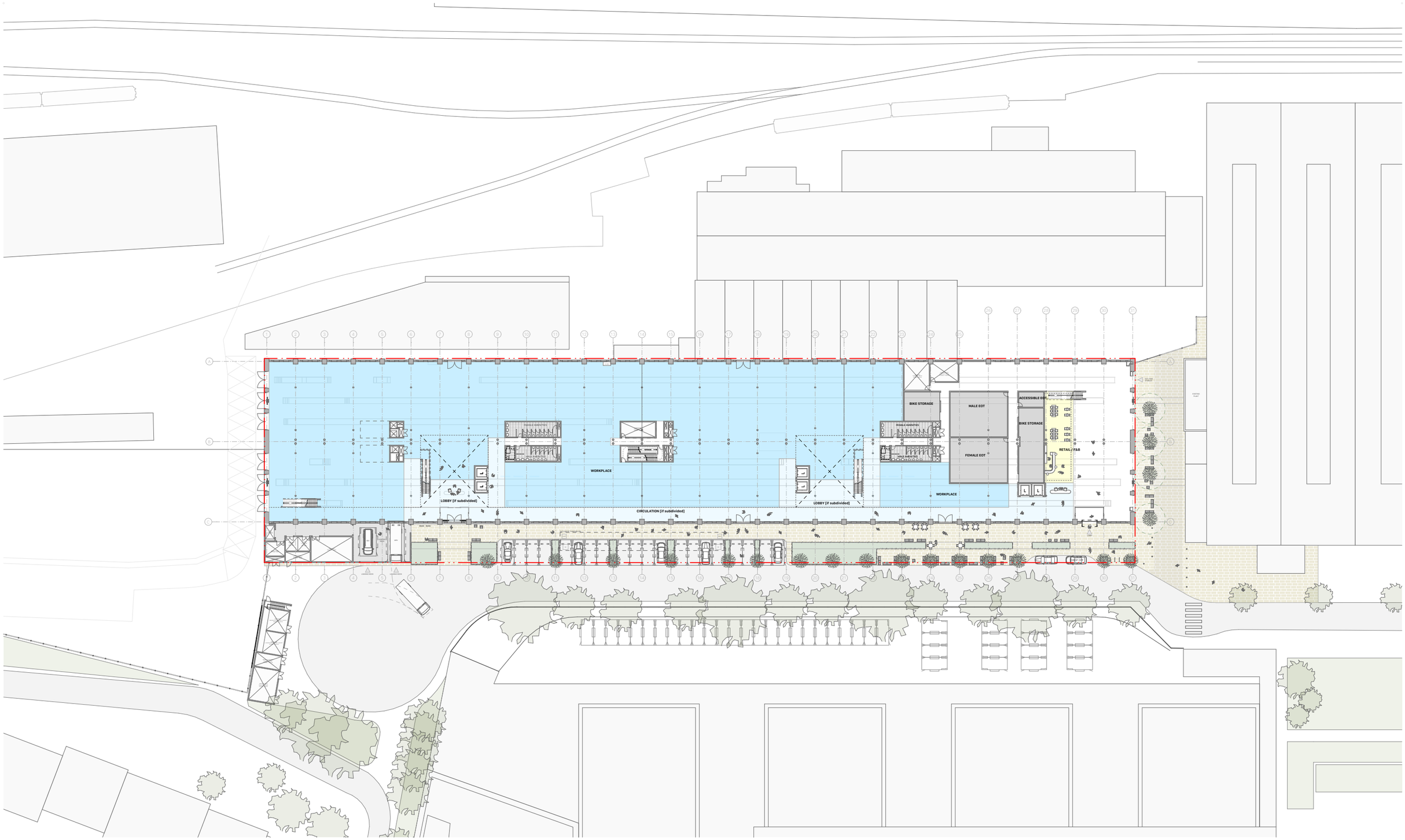
17/8/2022

MVLES-001 — Site Plan
MIRVAC — LARGE ERECTING SHOP

Scale
1:2000 @ A3

0 20 50 100m

fjmtstudio



1 PLAN Proposed Ground Floor Plan
1:750

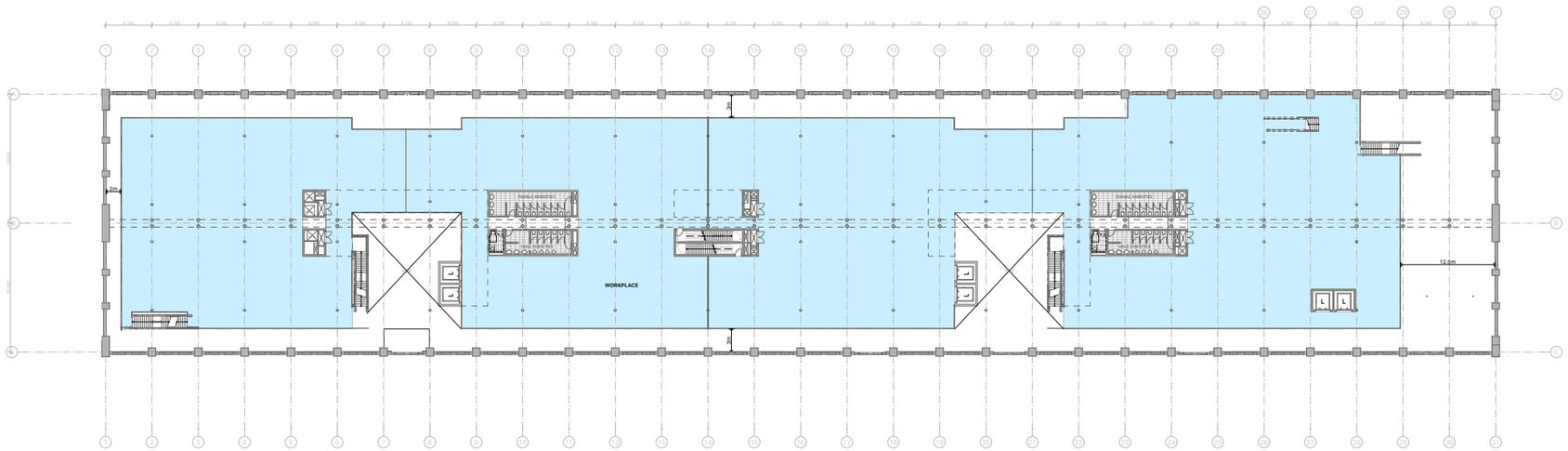
17/8/2022

MVLES-002 — Proposed Ground Floor Plan
MIRVAC — LARGE ERECTING SHOP

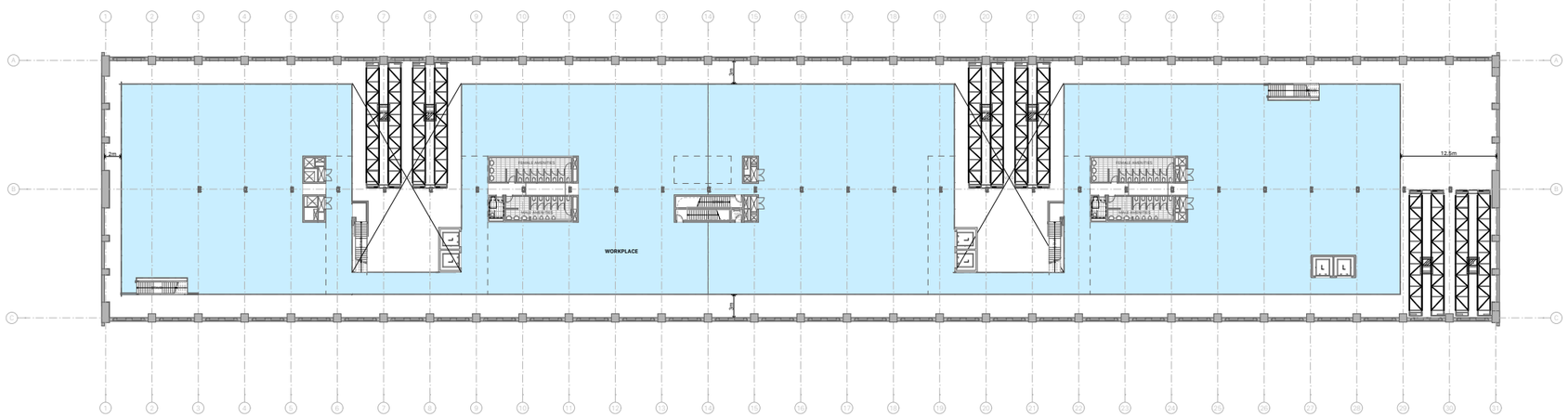
Scale
1:750 @ A3

0 7.5 15 30m

fjmtstudio



1 PLAN Proposed Level 1 Plan
1:750



2 PLAN Proposed Level 2 Plan
1:750

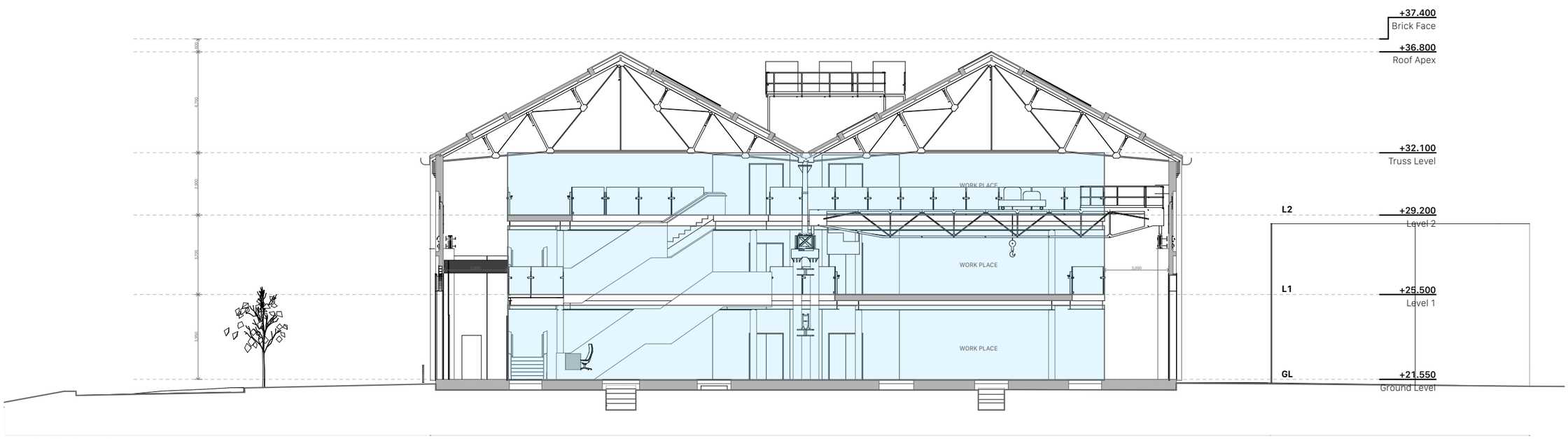
11/8/2022

MVLES-003 — Proposed Level 1 & 2 Plans
MIRVAC — LARGE ERECTING SHOP

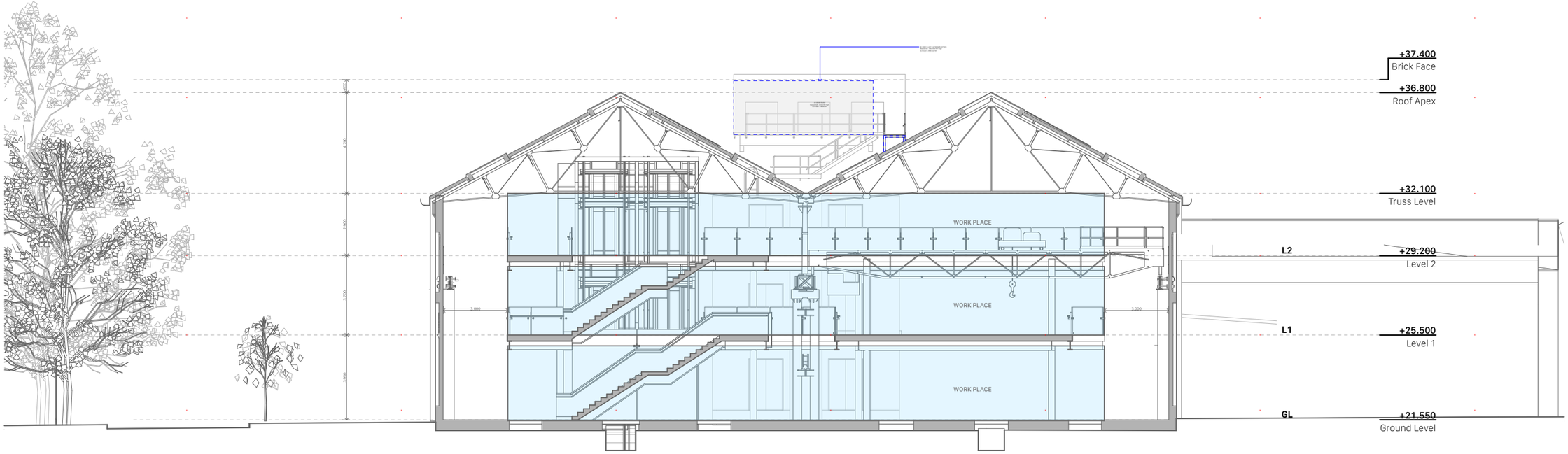
Scale
1:750 @ A3

0 7.5 15 30m

fjmtstudio



2 SECTION Section AA
1:200



3 SECTION Section BB
1:200

11/8/2022

MVLES-007 — Short Section
MIRVAC — LARGE ERECTING SHOP

Scale
1:200 @ A3

0 2 5 10m

fjmtstudio

Large Erecting Shop, South Eveleigh

APPENDIX C
CITY OF SYDNEY INTERIM FLOODPLAIN MANAGEMENT POLICY

Cardno

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Stantec

Interim Floodplain Management Policy

Purpose

The Floodplain Management Policy provides direction with respect to how floodplains are managed within the Local Government Area (LGA) of the City of Sydney Council (the City).

The City has a responsibility to manage floodplains to ensure that any:

- new development will not experience undue flood risk; and
- existing development will not be adversely flood affected through increased damage or hazard as a result of any new development.

The Policy provides controls to facilitate a consistent, technically sound and best practice approach for the management of flood risk within the City's LGA. In forthcoming years the City will complete Floodplain Risk Management Plans and then integrate outcomes from these plans into planning controls. Once this process is completed this interim policy will be withdrawn.

Scope

This Policy applies to all new developments within the City of Sydney.

Definitions

Term	Meaning
Annual Exceedance Probability (AEP)	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. 1% AEP flood is approximately equal to 1 in 100 year Average Recurrent Interval (ARI) flood event (or simply 100 year flood). It has 1% chance to occur in a given year.
Australian Height Datum (AHD)	A common national plan of level corresponding approximately to mean sea level.
Average Recurrence Interval (ARI)	The long-term average number of years between the occurrence of a flood as big as or larger than, the selected event. For example, floods with a discharge as great as, or greater than, the 20 year ARI flood event may occur on average once every 20 years.

Term	Meaning
Basement Car Parking or Below-Ground Car Parking	The car parking area generally below ground level where inundation of the surrounding areas may raise water levels above the entry level to the basement, resulting in inundation. Basement car parks are areas where the means of drainage of accumulated water in the car park has an outflow discharge capacity significantly less than the potential inflow capacity.
Below-Ground Garage/Car park	Applies where the floor of the parking and/or access surface is more than 1 m below the surrounding natural ground.)
Carport	A structure used to house motor vehicles, which has a minimum of two sides "open" and not less than one third of its perimeter "open".
Critical Facilities	Includes hospitals and ancillary services, communication centres, police, fire SES, major transport facilities, sewerage and electricity plants; any installations containing critical infrastructure control equipment and any operational centres for use in a flood.
Effective Warning Time	The time available after receiving advice of an impending flood and before the floodwaters prevent appropriate flood response actions being undertaken. The effective warning time is typically used to raise furniture, evacuate people and transport their possessions.
Evacuation	The transfer of people and or stock from areas where flooding is likely, either close to, or during a flood event. It is affected not only by warning time available, but also the suitability of the road network, available infrastructure, and the number of people that have to evacuate during floods.
Extreme Flood	An estimate of the probable maximum flood (PMF), which is the largest flood that could conceivably occur at a particular location, generally estimated from the probable maximum precipitation (PMP). Generally it is not physically or economically possible to provide complete protection against this event.
Flood	A relatively high stream flow that overtops the natural or artificial banks in any part of a stream, channel, river, estuary, lake or dam, and/or local overland flooding associated with major drainage as defined by the NSW Floodplain Development Manual (FDM) before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
Flood Compatible Materials	Those materials used in building which are resistant to damage when inundated. A list of flood compatible materials is attached.
Flood Evacuation Strategy	The proposed strategy for the evacuation of areas with effective warning time during periods of flood as specified within any policy of Council, the floodplain risk management plan (FRMP), the relevant state government disaster plan, by advices received from the State Emergency Services (SES) or as determined in the assessment of individual proposals.
Floodplain	The area of land which is subject to inundation by floods up to and including the probable maximum flood (PMF) event.

Term	Meaning
Floodplain Development Manual (FDM)	The document dated April 2005, published by the New South Wales Government and entitled 'Floodplain Development Manual: the management of flood liable land'.
Flood Planning Area	The area of land below the FPL and thus subject to flood related development controls.
Flood Planning Level (FPL)	The combinations of flood levels and freeboards selected for floodplain risk management purposes, as determined in flood studies and floodplain risk management studies and plans.
Floodplain Risk Management Plan (FRMP)	A plan prepared for one or more floodplains in accordance with the requirements of the FDM or its predecessor.
Floodplain Risk Management Study (FRMS)	A study prepared for one or more floodplains in accordance with the requirements of the FDM or its predecessor.
Flood Storage	Those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood.
Floodway	Those areas, often aligned with obvious naturally defined channels, where a significant discharge of water occurs during floods. They are also areas where, if only partially blocked, will cause a significant redistribution of flood flow or significant increase in flood levels, which many impact on other properties.
Freeboard	A factor of safety expressed as the height above the design flood level. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action; localised hydraulic behaviour and impacts that are specific event related, such as levee and embankment settlement; cumulative impacts of fill in floodplains and other effects such as changes in rainfall patterns as a result of climate change.
Garage	A private building or part of a building used to park or keep a motor vehicle and that is not defined as a carport.
Habitable Floor Area	• in a residential situation: a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom; • in an industrial or commercial situation: an area used for offices or to store valuable possessions susceptible to flood damage in the event of a flood.
Hazardous Materials	Solids, liquids, or gases that can harm people, other living organisms, property, or the environment. These may include materials that are radioactive, flammable, explosive, corrosive, oxidizing, asphyxiating, bio-hazardous, toxic, pathogenic, or allergenic. Also included are physical conditions such as compressed gases and liquids or hot materials, including all goods containing such materials or chemicals, or may have other characteristics that render them hazardous in specific circumstances.
Large Scale Development	For the purposes of this document refers to a proposal that involves site disturbance 1000m2 of land or greater.

Term	Meaning
Local Overland ~~Flooding~~ Flow Path	Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.
Probable Maximum Flood (PMF)	The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation.
Probable Maximum Precipitation (PMP)	The greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to the estimation of the probable maximum flood.
Reliable Access During A Flood	The ability for people to safely evacuate an area subject to imminent flooding within effective warning time, having regard to the depth and velocity of flood waters, the suitability of the evacuation route, and without a need to travel through areas where flood hazard increases
Section 149 Planning Certificate	Information, including the statutory planning controls that apply to a parcel of land on the date the certificate is issued.
Shed	Includes machinery sheds, garden and storage sheds but does not include a garage or car park.
Suitably Qualified Engineer	An engineer who is included in the National Professional Engineers Register, administered by the Institution of Engineers Australia.
Survey plan	A plan prepared by a Registered Surveyor which shows the information required for the assessment of an application in accordance with the provisions of this Policy.

Policy statement

1 Introduction

The Policy has been prepared in accordance with the guidelines provided in the NSW Government Floodplain Development Manual (2005) (FDM). This manual guides Council in the development and implementation of local Floodplain Risk Management Plans to produce robust and effective floodplain risk management outcomes.

In accordance with the FDM, the Flood Risk Management Process entails four sequential stages:

- Stage 1:Flood Study
- Stage 2:Floodplain Risk Management Study
- Stage 3:Floodplain Risk Management Plan
- Stage 4:Implementation of the Plan

The City is progressively producing Floodplain Risk Management Plans for each of the individual drainage catchments within the City's LGA. Floodplain Risk Management Plans consider the existing flood environment and recommend specific measures to manage the impact of flooding. In assessing the flood environment, elements such as known flood behaviour, evacuation issues, site access and the potential impact of sea level rise are taken into consideration. This information is used to create floodplain risk mapping for each catchment.

Floodplain Risk Management Plans provide a range of measures that can be used to mitigate the impact of flooding. Invariably one of the most successful measures is the implementation of effective land use planning. This document provides the means for implementing the Floodplain Risk Management Plans and associated mapping for the control of development on the floodplain within the City.

1.1 Aims and Objectives of the Policy

- To inform the community of the City's Policy with regard to the use of flood prone land;
- To establish guidelines for the development of flood prone land that are consistent with the NSW Flood Policy and NSW Floodplain Development Manual (2005) as updated by the Floodplain Management Guides;
- To control development and activity within each of the individual floodplains within the City having regard to the characteristics and level of information available for each of the floodplains;
- To minimise the risk to human life and damage to property by controlling development on flood prone land;
- To apply a merit based approach to all development decisions taking into account ecological, social and environmental considerations;
- To ensure that the development or use of floodplains does not adversely impact upon the aesthetic, recreational and ecological values of the waterway corridors;
- To ensure that all land uses and essential services are appropriately sited and designed in recognition of all potential floods;
- To ensure that all development on the floodplain complies with Ecologically Sustainable Development (ESD) principles and guidelines; and
- To promote building design that considers requirements for the development of flood prone land and to ensure that the development of flood prone land does not have significant impacts upon the amenity of an area.

1.2 Background

This Policy has been prepared having regard to the provisions of the NSW Flood Policy and NSW Floodplain Development Manual (2005).

Sydney Local Environmental Plan 2012 (Sydney LEP 2012) requires the consent authority to be satisfied that all new development adequately protects the safety of property and life, and avoid significant adverse impacts on flood behaviour and the environment. Specified flood planning controls apply to all land which is at or below the flood planning level. The requirements set out in Sydney LEP 2012 must be met before development consent is granted.

This Policy is to be read in conjunction with the provisions of Sydney LEP 2012 and Sydney DCP 2012.

1.3 Relationship to other Policies

This Policy is to be read in conjunction with Sydney LEP 2012 and Sydney DCP 2012. It includes but is not limited to the development types listed below:

- Single dwellings, terraces, and dual occupancy buildings;
- Residential flat, commercial and mixed use developments;
- Industrial developments; and
- Other development types and uses, as detailed in the Sydney DCP 2012.

In conjunction with the development type requirements, the Sydney LEP 2012 and Sydney DCP 2012 also require:

- Sustainable water use practices;
- The reduction of stormwater pollution on receiving waterways; and
- That development does not exacerbate the potential for flood damage or hazard for existing development or public domain.

1.4 Application of Policy

The policy is written in an objectives/requirements format. Where an applicant seeks variation from the requirements, appropriate written justification indicating how the proposal meets the relevant objectives, must be provided for the consideration of Council.

2 Application Requirements

2.1 Required Information

Applications must include information that addresses all relevant controls listed within this document and the following matters as applicable:

a Development applications affected by this Policy shall be accompanied by a survey plan showing:

- i the position of the existing building/s or proposed building/s;
- ii the existing ground levels and features to Australian Height Datum around the perimeter of the site and contours of the site; and
- iii the existing or proposed floor levels to Australian Height Datum.

b Applications for earthworks, filling of land, infrastructure and subdivision shall be accompanied by a survey plan (with a minimum contour interval of 0.25m) showing relative levels to Australian Height Datum.

c For large scale developments, or developments that in the opinion of the City are in critical situations, where an existing catchment based flood study is not available, a flood assessment report prepared by a suitably qualified engineer using a hydrologic and hydraulic dynamic one or two dimensional computer model.

d Where the controls for a particular development proposal require an assessment of structural soundness during potential floods, the following impacts must be addressed:

- iv hydrostatic pressure;
- v hydrodynamic pressure;
- vi impact of debris; and
- vii buoyancy forces.

Foundations need to be included in the structural analysis. Scour protection may be required at foundations.

3 Development Provisions

The Department of Planning and Infrastructure has produced a group of Model Local Provisions for inclusion in Local Environmental Plans. The Model Local Provisions have been produced to address common topics raised by Councils in Local Environmental Plan preparation and provide them with guidance in what is to be considered in the assessment of development proposals. The Model Clause for Flood Planning has been adopted as clause 7.15 in Sydney LEP 2012. The Performance Criteria listed under Section 3.2 below reflects the considerations specified in Sydney LEP 2012.

Sydney DCP 2012 provides prescriptive planning controls in Section 3.7. The objectives of these planning controls are to:

- Ensure an integrated approach to water management across the City through the use of water sensitive urban design principles.
- Encourage sustainable water use practices.
- Assist in the management of stormwater to minimise flooding and reduce the effects of stormwater pollution on receiving waterways.
- Ensure that development manages and mitigates flood risk, and does not exacerbate the potential for flood damage or hazard to existing development and to the public domain.
- Ensure that development above the flood planning level as defined in the Sydney LEP 2012 will minimise the impact of stormwater and flooding on other developments and the public domain both during the event and after the event.

Note: A number of flood studies and associated flood risk management plans are currently under development. New development will be required to conform to the requirements of these flood studies and associated flood risk management plans once endorsed by Council.

3.1 Performance Criteria

If a proposal does not meet the requirements of the relevant Prescriptive Provisions, consent must not be granted to development unless the consent authority is satisfied with the following the provision and assessment of information relating to the development. The development:

a is compatible with the established flood hazard of the land. In areas where flood hazard has not been established through previous studies or reports, the flood hazard must be established in accordance with the Floodplain Development Manual considering the following:

- i Impact of flooding and flood liability is to be managed ensuring the development does not divert floodwaters or interfere with flood storage or the natural function of the waterway;
- ii Flood behaviour (for example, flood depths reached, flood flow velocities, flood hazard, rate of rise of floodwater);
- iii Duration of flooding for a full range of events;
- iv Appropriate flood mitigation works;
- v Freeboard;
- vi Council's duty of care – Proposals to address or limit; and
- vii Depth and velocity of flood waters for relevant flood events.

b will not significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties;

c incorporates appropriate measures to manage risk to life from flood considering the followings:

- i The proposed development should not result in any increased risk to human life
- ii Controls for risk to life for floods up to the Flood Planning Level
- iii Controls for risk to life for floods greater than the Flood Planning Level

iv Existing floor levels of development in relation to the Flood Planning Level and floods greater than the Flood Planning level

v Council's duty of care – Proposals to address and limit

vi What level of flooding should apply to the development e.g. 1 in 100 year, etc

vii Effective flood access and evacuation issues

viii Flood readiness – Methods to ensure relative flood information is available to current and future occupants and visitors;

d will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of creek or channel banks or watercourses;

e is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding;

f is consistent with the principles of Ecologically Sustainable Development; and

g adequately considers the impact of climate change.

It is to be noted that with regard to climate change, appropriate benchmarks based on the best available current information have been used in producing the flood risk management plans that inform this document.

Some prescriptive requirements such as flood planning level requirements may be relaxed if Council can be satisfied that the projected life of the proposed development is for a relatively short-term and therefore does not warrant the imposition of controls that consider impacts beyond the cessation of the proposed development. This will only be considered for uses where the residual risk to the occupation of the development is considered to be low. This may include certain temporary or demountable structures but would not include residential developments.

3.2 Concessional Development – Minor Additions

a. The City acknowledges that in some instances, relatively minor building additions will have minimal impact on the floodplain and will not present an unmanageable risk to life. Council will give consideration for the following forms of development on suitable sites:

i attached dwelling additions of up to 40m^2 of habitable floor area at or above the same level as the existing adjoining approved floor level for habitable floor area. The allowance for additions shall be made no more than once for any given development;

ii additions to Commercial and Industrial Uses of up to an additional 100 m^2 or 20% (whichever the less) of the Gross Floor Area of the existing building at no less than the same level as the existing adjoining approved floor level. The allowance for additions shall be made no more than once for any given development.

b. As part of any consent issued pursuant to this section Council will require:

i a restriction on the property title requiring compliance with the flood studies and associated flood risk management plans.

ii the existing development is to be suitably upgraded to address the potential impacts of flooding.

3.3 Heritage Considerations

The City acknowledges that certain buildings or structures require preservation due to their heritage significance. Developments with heritage significance can be assessed on a merit based approach provided the following requirements are satisfied:

i. Expert assessment has identified the structure or development as having heritage conservation value;

ii. Planning instruments have specifically identified the existing developmentas having heritage conservation value and provide the appropriate level of statutory protection;
iii. The highest practical level of flood protection is provided while maintaining an appropriate balance with heritage conservation;
iv. The proposed development will not be subject to frequent flooding risk that may jeopardise the long term viability or heritage conservation of the development. Comprehensive assessment would be required where the development is subject to flooding in storms more frequent than the 5% AEP flood;
v. A restriction shall be placed on the property title, identifying the flooding risk and requiring conservation of heritage values.

4 General Requirements

The following ancillary development issues are to be considered in the assessment of proposed development of flood prone land.

Development Type/ Aspect	Objective	Requirement
Fencing	• To ensure that fencing does not result in any significant obstruction to the free flow of floodwaters; and • To ensure that fencing will remain safe during floods and not become moving debris that potentially threatens the security of structures or the safety of people.	Fencing is to be designed and constructed in such a manner that it will not modify the flow of floodwaters and cause damage to surrounding land.
Residential Properties	• To minimise the damage to residential properties from flooding; and • To minimise risk to human life from the inundation of residential properties and to minimise economic cost to the community resulting from flooding.	• The proposed residential building or dwelling must be free from flooding up to and including the 1% AEP flood and must meet the Flood Planning Level Requirements detailed in Section 5; and • The proposed residential building or dwelling should not increase the likelihood of flooding on other developments, properties or infrastructure.
Industrial and Commercial Properties	• To minimise the damage to industrial and commercial properties from flooding; and • To minimise risk to human life from the inundation of industrial and commercial properties and to minimise economic cost to the community resulting from flooding.	• The City may consider merits-based approaches presented by the applicant. The proposed industrial or commercial buildings must meet the Flood Planning Level Requirements detailed in Section 5; and • The proposed industrial or commercial development should not increase the likelihood of flooding on other developments, properties or infrastructure.

Development Type/ Aspect	Objective	Requirement
Car Parking	• To minimise the damage to motor vehicles from flooding; • To ensure that motor vehicles do not become moving debris during floods, which threaten the integrity or blockage of structures or the safety of people, or damage other property; and • To minimise risk to human life from the inundation of basement and other car park or driveway areas.	• The proposed car park should not increase the risk of vehicle damage by flooding inundation; • The proposed garage or car park should not increase the likelihood of flooding on other developments, properties or infrastructure; • The proposed garage or car park must meet the Flood Planning Level Requirements detailed in *Section 5*; and • Open car parking - The minimum surface level of open space car parking subject to inundation should be designed giving regard to vehicle stability in terms of depths and velocity during inundation by flood waters. Where this is not possible, it shall be demonstrated how the objectives will be met.
Filling of Flood Prone Land	To ensure that any filling of land that is permitted as part of a development consent does not have a negative impact on the floodplain.	Unless a floodplain risk management plan for the catchment has been adopted, which allows filling to occur, filling for any purpose, including the raising of a building platform in flood-prone areas is not permitted without Council approval. Application for any filling must be supported by a flood assessment report from a suitably qualified engineer which certifies that the filling will not increase flood affectation elsewhere.
On-Site Sewer Management (Sewer mining)	• To prevent the spread of pollution from on-site sewer management systems during periods of flood; and • To assist in the ongoing operation of on-site sewer management systems during periods of flood.	The treatment facility must be located above the 1% AEP flood level and must comply with Flood Planning Level requirements, or are otherwise protected and may function if below this level.
Storage of Hazardous Substances	To prevent the potential spread of pollution from hazardous substances.	The storage of products which, in the opinion of the City, may be hazardous or pollute floodwaters, must be placed above the 1% AEP flood level or placed within an area protected by bunds or levels such that no flood waters can enter the bunded area and must comply with the Flood Planning Level requirement for such a facility.

Development Type/ Aspect	Objective	Requirement
Consideration of the Impact of Climate Change	To prevent the potential impact of climate change.	• For those developments which have a lifespan of more than fifty years the impact due to sea level rise and impacts due to increased rainfall intensities shall be considered. • Meet the allowances for sea level rise as recommended in the NSW Government Coastal Planning Guideline: Adopting Sea Level Rise 2010 (recently withdrawn from publication). Specifically, this shall include and allowance of 40cm by 2050 and a 90cm by 2100 from the 2009 Mean Sea Level. • Where in the opinion of the City the proposed development is of reasonable impact to regional or catchment trunk drainage, the drainage system design shall allow for a minimum of 10% increased rainfall.

5 Flood Planning Levels

A Flood Planning Level refers to the permissible minimum building floor levels. For below-ground parking or other forms of below-ground development, the Flood Planning Level refers to the minimum level at each access point. Where more than one flood planning level is applicable the higher of the applicable Flood Planning Levels shall prevail.

Development		Type of flooding	Flood Planning Level
Residential	Habitable rooms	Mainstream flooding	1% AEP flood level + 0.5 m
		Local drainage flooding (Refer to Note 2)	1% AEP flood level + 0.5 m or Two times the depth of flow with a minimum of 0.3 m above the surrounding surface if the depth of flow in the 1% AEP flood is less than 0.25 m
		Outside floodplain	0.3 m above surrounding ground
	Non-habitable rooms such as a laundry or garage (excluding below-ground car parks)	Mainstream or local drainage flooding	1% AEP flood level
Industrial or Commercial	Business	Mainstream or local drainage flooding	Merits approach presented by the applicant with a minimum of the 1% AEP flood level
	Schools and child care facilities	Mainstream or local drainage flooding	Merits approach presented by the applicant with a minimum of the 1% AEP flood level + 0.5m
	Residential floors within tourist establishments	Mainstream or local drainage flooding	1% AEP flood level + 0.5 m
	Housing for older people or people with disabilities	Mainstream or local drainage flooding	1% AEP flood level + 0.5 m or a the PMF, whichever is the higher
	On-site sewer management (sewer mining)	Mainstream or local drainage flooding	1% AEP flood level
	Retail Floor Levels	Mainstream or local drainage flooding	Merits approach presented by the applicant with a minimum of the 1% AEP flood. The proposal must demonstrate a reasonable balance between flood protection and urban design outcomes for street level activation.
Below-ground garage/ car park	Single property owner with not more than 2 car spaces.	Mainstream or local drainage flooding	1% AEP flood level + 0.5 m

Development		Type of flooding	Flood Planning Level
	All other below-ground car parks	Mainstream or local drainage flooding	1% AEP flood level + 0.5 m or the PMF (whichever is the higher) See Note 1
	Below-ground car park outside floodplain	Outside floodplain	0.3 m above the surrounding surface
Above ground car park	Enclosed car parks	Mainstream or local drainage flooding	1% AEP flood level
	Open car parks	Mainstream or local drainage	5% AEP flood level
Critical Facilities	Floor level	Mainstream or local drainage flooding	1% AEP flood level + 0.5m or the PMF (whichever is higher)
	Access to and from critical facility within development site	Mainstream or local drainage flooding	1% AEP flood level

Note***s***

1) The below ground garage/car park level applies to all possible ingress points to the car park such as vehicle entrances and exits, ventilation ducts, windows, light wells, lift shaft openings, risers and stairwells.

2) Local drainage flooding occurs where:

- The maximum cross sectional depth of flooding in the local overland flow path through and upstream of the site is less than 0.25m for the 1% AEP flood; and
- The development is at least 0.5m above the 1% AEP flood level at the nearest downstream trapped low point; and
- The development does not adjoin the nearest upstream trapped low point; and
- Blockage of an upstream trapped low point is unlikely to increase the depth of flow past the property to greater than 0.25m in the 1% AEP flood.

3) Mainstream flooding occurs where the local drainage flooding criteria cannot be satisfied.

4) A property is considered to be outside the floodplain where it is above the mainstream and local drainage flood planning levels including freeboard.

6 Flood Compatible Materials

Where required for development, the following materials are to be applied. Materials not listed may be accepted by Council subject to certification of the suitability of the material of the manufacturer.

Component	Flood Compatible Material
Flooring and Sub-floor	▪ Concrete slab-on-ground monolith construction ▪ Suspended reinforced concrete slab
Wall Structure	▪ Solid brickwork, blockwork, reinforced concrete or mass concrete
Wall and Ceiling Linings	▪ Fibro-cement board ▪ Brick, face or glazed ▪ Clay tile glazed in waterproof mortar ▪ Concrete ▪ Concrete block ▪ Steel with waterproof applications ▪ Stone, natural solid or veneer, waterproof grout ▪ Glass blocks ▪ Glass ▪ Plastic sheeting or wall with waterproof adhesive
Roof Structure	▪ Reinforced concrete construction ▪ Galvanised metal construction
Doors	▪ Solid panel with water proof adhesives ▪ Flush door with marine ply filled with closed cell foam ▪ Painted metal construction ▪ Aluminium or galvanised steel frame
Insulation	▪ Closed cell solid insulation ▪ Plastic/polystyrene boards
Windows	▪ Aluminium frame with stainless steel rollers or similar corrosion and water resistant material.
Nails, Bolts, Hinges and Fittings	▪ Brass, nylon or stainless steel ▪ Removable pin hinges ▪ Hot dipped galvanised steel wire nails or similar
Main Power Supply	▪ Subject to the approval of the relevant authority the incoming main commercial power service equipment, including all metering equipment, shall be located above the designated flood planning level. Means shall be available to easily disconnect the dwelling from the main power supply.
Wiring	▪ All wiring, power outlets, switches, etc., should be located above the designated flood planning level. All electrical wiring installed below this level should be suitable for continuous underwater immersion and should contain no fibrous components. This will not be applicable for below-ground car parks where the car park complies with flood planning level requirements. ▪ Earth leakage circuit-breakers (core balance relays) or Residual Current Devices (RCD) must be installed. ▪ Only submersible type splices should be used below maximum flood level. ▪ All conduits located below the relevant designated flood level should be so installed that they will be self-draining if subjected to flooding.
Electrical Equipment	▪ All equipment installed below or partially below the designated flood planning level should be capable of disconnection by a single plug and socket assembly.

Component	Flood Compatible Material
Heating and Air Conditioning Systems	▪ Heating and air conditioning systems should be installed in areas and spaces of the house above the designated flood planning level.
Fuel storage for heating purposes	▪ Heating systems using gas or oil as a fuel should have a manually operated valve located in the fuel supply line to enable fuel cut-off. ▪ The heating equipment and related fuel storage tanks should be mounted on and securely anchored to a foundation pad of sufficient mass to overcome buoyancy and prevent movement that could damage the fuel supply line. The tanks should be vented above the flood planning level.
Ducting for heating/cooling purposes	▪ All ductwork located below the relevant flood level should be provided with openings for drainage and cleaning. Self-draining may be achieved by constructing the ductwork on a suitable grade. Where ductwork must pass through a water-tight wall or floor below the relevant flood level, a closure assembly operated from above relevant flood level should protect the ductwork.

Responsibilities

The Technical Services Manager is responsible for the development and revision of the policy. The City's Planning team together with the Public Domain team are responsible for communicating the policy and ensuring systems are in place to validate its compliance.

Consultation

The initial draft edition of the Interim Floodplain Management Policy was first reviewed by internal stakeholders of the City including City Operations and City Planning divisions. The Policy was then revised to take account of this input.

The City's Floodplain Risk Management Committee was initially informed regarding the need for the interim policy in December 2012. During the March 2013 Floodplain Risk Management Committee meeting a presentation was made by City staff regarding the draft policy. Copies of the policy were then provided to all Committee members for comment. Some minor changes were then made to the draft policy following feedback from committee members.

References

Laws and standards	• Local Government Act 1993, Section 733 • Environment Planning and Assessment Act 1979
Policies and procedures	• *Floodplain Development Manual: the management of flood liable land*, New South Wales Government, Published April 2005 • Sydney LEP 2012 • Sydney DCP 2012 • South Sydney DCP 1997, Green Square precinct amended 2006

Approval

Council approved this policy on 12 May 2014.

Review

Review period	Next review date	TRIM reference
City Operations will review this policy every 2 years	May 2016	2014/216277