

11. Floodplain Risk Management Plan

11.1 Purpose of the Plan

The Floodplain Risk Management Plan provides input into the strategic and statutory planning roles of Council. It provides a steering document to enable Council to effectively manage flood liable land moving forward. It also suggests an implementation plan based on priorities of floodplain risk management measures and availability of funding.

The Plan, consisting of proposed floodplain risk management measures, are provided in Table 11-1 and were developed from the recommendations made in the Floodplain Risk Management Study documented in the preceding sections of this report. Consultation with the community, Council and the FRMC on the recommendations and the preliminary proposed measures was undertaken. The Floodplain Risk Management Plan remains as “Draft” status until such time that it is adopted by Council. The Plan is also presented pictorially on Figure 1.

11.2 Funding and Implementation

11.2.1 Estimated Costs

Costs have been estimated for structural and non-structural measures. The costs of planning, policy, administrative and organisational non-structural measures are largely unknown to the consultant. The timing of the proposed works will be dependent on Council’s overall budgetary commitments and the availability of funding from external sources. The Plan can be progressively implemented with an anticipated timeframe of 3-5 years for high priority options and 5-10 years for medium priority options.

11.2.2 Alternative Funding sources

There are a number of funding bodies, which Council could consider applying to for supplementary funds. The Department of Planning, Industry and Environment (DPIE) offer support to local Councils through Floodplain Management Grants. Assistance under this Program is usually \$2 from government for every \$1 from Council.

The Natural Disaster Resilience Program (NDRP) is a joint Commonwealth/State program funded through the National Partnership Agreement on Natural Disaster Resilience. It provides funding through the Floodplain Grant Scheme (FRMGS) to address flood activities allocated through the existing Floodplain Management Program managed by DPIE (described above).

The Community Resilience Innovation Program (CRIP) is another program funded through the NDRP and supports a broad range of community-led projects designed to increase all-hazard disaster preparedness and build community capacity and resilience. Flood education and awareness programs may be eligible. Applications for funding from State or Commonwealth programs are highly competitive and the limited funds are allocated on an annual basis. Options put forward for funding assistance must be well supported and justified through demonstrated strong cost/benefit ratio and inclusion of positive environmental and social outcomes.

In addition to State and Federal Government, Council could approach other organisations (for example RMS, SES) or private owners (such as property developers, where appropriate) to assist with funding of measures.

11.3 On-going Review of Plan

This Floodplain Risk Management Plan should be regarded as a robust document, which requires review and amendments to be made over time. At a minimum, it is recommended that the Plan be reviewed every 10 years to ensure it remains relevant to the requirements of the area. In addition to scheduled reviews, the Plan should be reviewed following flood events, any change in State or Local Government legislation or alterations to funding availability. Implementation of the Plan should be monitored by the FRMC. The local community should continue to be informed of progress through Newsletters available via the Council website or displayed at Council Offices.

11.4 Management of Future Climate Change Flood Risks

The Floodplain Risk Management Plan includes measures which have the objective of managing the existing flood risk in the first instance. Additional measures, excluded from the current Plan, should be considered in future updates of the Plan to progressively address the changing flood risks as a result of future climate change. These may include:

Backflow devices on 5 additional trunk drainage outlets (as discussed in Section 10.1.1.1)

- Floodwater pumping facilities (as discussed in Section 10.2.4)
- Further improved and modified drainage infrastructure, if these become feasible in the future
- Revision design flood levels and of flood planning levels, minimum floor levels and other relevant development controls related to design flood levels. Flood studies would need to be updated to reflect new information on rainfall, sea level and flooding conditions, in line with Council's climate change an sea level rise policies (as discussed in Section 4.3.2)..

Council has committed to identify and respond to emerging hazards and risks associated with local climate change and this would be appropriately done in relation to flooding with the planned periodic reviews of the FRMP.

Table 11-1 Botany Bay and Foreshore Beach Floodplain Risk Management Plan

Measure ID	Measures considered	Responsibility	Initial Cost	Ongoing Cost	Features of the Measure	Recommended Priority Rankings
FM1	Option 2c Detention Basin- Booralee Park	Council	\$1.1M	Up to \$5K p.a. Inspection/ maintenance of basin outlet, basin sides.	<ul style="list-style-type: none"> Removal of embankment along western side of Jasmine Street Lowering the base of the park by 1m 300mm low flow outlet pipe connected to existing drainage network Feasibility study should be undertaken to assess if raised embankment (Option 2b- raising the existing embankment)) is preferred due to contaminated soil and other issues. 	<p>Medium – would significantly improve flood immunity in the surrounding area.</p> <p>Option to be further investigated following feasibility assessment (Option FM1A) in relation to site contamination to determine best design strategy for a detention basin.</p>
FM1A	Feasibility study for Booralee Park detention basin	Council	\$100K	N/A	<ul style="list-style-type: none"> A feasibility study should be undertaken to assess if raised embankment (Option 2b) is preferred over a lowered basin bed (Option 2c) due to contaminated soil and other issues. There is a risk of potential soil contamination based on historic usage of the park area. Soil contamination investigation is required. Aboriginal heritage investigation is also recommended as a part of the feasibility study. There is high potential for unrecorded Aboriginal artefacts in south-western portion of the park. Dam safety issues and design requirements need to be scoped. Consultation with Dam Safety NSW to be undertaken as required. 	<p>High – feasibility assessment should be undertaken in the near future for this high priority option</p>

Measure ID	Measures considered	Responsibility	Initial Cost	Ongoing Cost	Features of the Measure	Recommended Priority Rankings
FM2	Option 8 Drainage Augmentation-William Street	Council	\$1M	Up to \$5K p.a. Inspection/maintenance of drainage inlets	<ul style="list-style-type: none"> Upgrade of stormwater system in William Street (2x600mm pipe) 	Medium – would significantly improve flood immunity in the surrounding area.
FM3	Option 13a/16 Drainage Augmentation-Dent St + installation of backflow devices at 4 outlets	Council	\$1.5M (Dent Street drainage augmentation) +\$220K (backflow devices)	Up to \$5K p.a. Inspection/maintenance of drainage	Install Option 13a <ul style="list-style-type: none"> New culverts to drain water into the existing pond Connect pond with existing outlets to drain water into Botany Bay with backflow prevention devices. Requires detailed scoping and design study including proximity locating of major gas line and BIP groundwater treatment network. Install Option 1 backflow devices at 4 locations for protection from tide/storm surge for existing climate/sea levels to complete Option 16.	Medium – although relatively low benefit-cost ratio it would significantly improve flood immunity and flood hazard in the surrounding area.
PM1	Amendments to LEP and Section 10.7 certificates	Council	Council staff costs	N/A	LEP amendments shall be consistent with the requirements of the applicable Environmental Planning Instrument and Development Control Plan, to enable flood risks to be reduced and managed. Section 10.7 certificates to notate properties which are affected by flooding as identified in the Botany Bay and Foreshore Beach floodplain risk management study.	High – ensure planning documents are consistent and utilize the most up to date flood information.

Measure ID	Measures considered	Responsibility	Initial Cost	Ongoing Cost	Features of the Measure	Recommended Priority Rankings
PM2	Amendments to DCP	Council	Council staff costs	N/A	<p>Bayside Council is currently reviewing the DCP (as of June 2020). Recommendations for inclusion/ amendment relating to management of flood risk are provided below:</p> <ul style="list-style-type: none"> • Consideration should be made for consolidating all flood planning controls under a specific section for Flood Liable Land or in a separate Flood Policy instrument. • It is recommended that a flood planning level of 1% AEP + 0.5m freeboard be adopted, in line with flood planning provisions in draft Bayside LEP. The 0.5m freeboard is commensurate with the flood risk in the study area. • The inclusion of provisions specifying minimum floor levels for critical facilities should be considered. Typically the minimum floor level of such development is the PMF level. • The flood hazard and hydraulic categories mapping is to be consulted by Council in the planning and approval of proposed developments for flood-affected lots. Developments are not to be approved on high hazard or floodway areas. • Council should consider inclusion of requirements for flood compatible design in the development controls. • Inclusion of a fence policy whereby fences should not be constructed in floodways. Where this is 	High – ensure planning documents are consistent and provide clarity and utilize the most up to date flood information.

Measure ID	Measures considered	Responsibility	Initial Cost	Ongoing Cost	Features of the Measure	Recommended Priority Rankings
					unavoidable fences are to be of open construction that will not restrict the flow of floodwater.	
PM3	Management of flood risk at child care centres in high flood hazard areas	Council (advocacy only), property operator (funding and implementation)	Cost to be borne by property operator	N/A	<ul style="list-style-type: none"> Council should consult with the owners/operators of the Hippo's Friends Child Care Centre and Botany Bay Preschool regarding the flood risk to these properties. During the consultation Council should advocate for provision of suitable flood refuge spaces above PMF level on the properties if further assessment of the properties identifies no suitable spaces. The owner/operator should then consider redevelopment to provide flood refuge spaces. 	<p>Consultation with owner/operator is high priority.</p> <p>Implementation of redevelopment is considered medium priority, subject to stakeholder willingness and capacity to redevelop.</p>
RM1	Develop flood management plan for selected sensitive properties	Council (advocacy only), property operator (funding and implementation), SES (advice)	Cost to be borne by property operator	N/A	<ul style="list-style-type: none"> Council should consider consultation with the Heritage Botany Aged Care Facility regarding management of flood risk on the site. Development of a flood management plan for the site should be considered. Similar plans should be considered for Hippo's Friends Child Care Centre and Botany Bay Preschool. The plans should contain procedures for evacuation of children to flood-safe spaces within the property if possible. Emergency and evacuation procedures for Childcares shall include the flood risk management and emergency procedure. 	High – need to communicate flood risks to significant stakeholders in the floodplain.

Measure ID	Measures considered	Responsibility	Initial Cost	Ongoing Cost	Features of the Measure	Recommended Priority Rankings
RM2	Flood depth signage	Council	Static depth indicator and warning signs \$5K per sign, 19 signs Flashing warning light signs \$100K per sag location incl. dual independent systems at each location. 13 signs	\$5-10K p.a.	<ul style="list-style-type: none"> Flood depth signage (x10) at key road low points Flood depth and hazard warning signs (x9) ahead of the road low points to warn of possible flooding ahead Flashing light warning signs are recommended at 5 key high hazard locations (main roads and high risk locations) (x13 flashing signs). The signs serve as depth indicators and warning of flooding ahead during a flood event to reduce occurrences of people driving into floodwaters, in addition as a passive reminder of flooding risk. Flood depth indicator and signage requirement is to be consistent with the outcome of Hawkesbury Nepean and Georges River Floodplain Risk Management Strategy. 	High – aims to directly modify driver response to flood hazard during a flood event. Static signs are a low cost measure which also improves flood safety and flood awareness at each location.
RM3	Update of current emergency management planning	SES	SES costs	SES costs	<ul style="list-style-type: none"> It is recommended that the findings of this flood study are incorporated into the development of the Bayside Local Flood Plan, such as locations of roads being cut by flooding, locations of sensitive properties, emergency response classification, flood hazards. Incorporate the information on flood behaviour and hazards from this study into SES internal operations. The Bayside Local Flood Plan will be developed as part of the review cycle of the EMPLAN (2021). 	High – incorporate into the 3 yearly review cycle of EMPLAN (due 2021), including development of Bayside Local Flood Plan.

Measure ID	Measures considered	Responsibility	Initial Cost	Ongoing Cost	Features of the Measure	Recommended Priority Rankings
RM4	Flood education and awareness program	Council, SES	\$50K	Staff costs	<p>Measures may include:</p> <ul style="list-style-type: none"> Promotion of FloodSafe brochures to help residents understand the flood risk and prepare their property and personal plans for a flooding event. Flood depth signage in selected road locations (cost covered in measure RM2). Flood depth indicator and signage requirement is to be consistent with the outcome of Hawkesbury Nepean and Georges River Floodplain Risk Management Strategy. Provide flood mapping on an interactive mapping portal on Council's website for easier viewing. Provide graphic on website showing catchments in Botany Bay where studies have been completed. Promotion and support for SES information events. Enhanced messaging on flood risk on Council's floodplain management webpage. Promotion of flood proofing measures should also be included in flood education and awareness programs The program should be reviewed on a regular (e.g. 2 yearly) basis. 	High – community awareness is likely to significantly improve flood preparedness, reduce flood damages and reduce flood response and risk to people.

12. Acknowledgements

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- Residents of the study area;
- Bayside Council officers;
- Sydney Water;
- Sydney Ports Authority;
- NSW Department of Planning, Industry & Environment.


13. References

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14. Glossary

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. In this study AEP has been used consistently to define the probability of occurrence of flooding. The following relationships between AEP and ARI applies to this study (AR&R, 2016).

Frequency Descriptor	EY	AEP (%)	AEP (1 in x)	ARI
Very frequent	12			
	6	99.75	1.002	0.17
	4	98.17	1.02	0.25
	3	95.02	1.05	0.33
	2	86.47	1.16	0.50
	1	63.2	1.58	1.00
Frequent	0.69	50.00	2	1.44
	0.5	39.35	2.54	2.00
	0.22	20.00	5	4.48
	0.2	18.13	5.52	5.00
	0.11	10.00	10.00	9.49
Infrequent	0.05	5.00	20	20.0
	0.02	2.00	50	50.0
	0.01	1.00	100	100
	0.005	0.50	200	200
Rare	0.002	0.20	500	500
	0.001	0.10	1000	1000
	0.0005	0.05	2000	2000
	0.0002	0.02	5000	5000
Extremely Rare				
Extreme			PMP	

Australian Height Datum (AHD)

A common national surface level datum approximately corresponding to mean sea level.

Average Annual Damage (AAD)

Depending on its size (or severity), each flood will cause a different amount of flood damage to a flood prone area. AAD is the average damage per year that would occur in a nominated development situation from flooding over a very long period of time.

Average Recurrence Interval (ARI)	The long-term average number of years between the occurrences 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 will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event.
Catchment	The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
Development	<p>Is defined in Part 4 of the EP&A Act</p> <p>In fill development: refers to the development of vacant blocks of land that are generally surrounded by developed properties and is permissible under the current zoning of the land. Conditions such as minimum floor levels may be imposed on infill development.</p> <p>New development: refers to development of a completely different nature to that associated with the former land use. Eg. The urban subdivision of an area previously used for rural purposes. New developments involve re-zoning and typically require major extensions of exiting urban services, such as roads, water supply, sewerage and electric power.</p> <p>Redevelopment: refers to rebuilding in an area. Eg. As urban areas age, it may become necessary to demolish and reconstruct buildings on a relatively large scale. Redevelopment generally does not require either re-zoning or major extensions to urban services.</p>
Direct rainfall	Rainfall is applied across the two-dimensional model domain within the hydraulic model. As a consequence, runoff is generated over the entire catchment, rather than the traditional approach of calculating an inflow hydrograph using a separate hydrological model and lumping this inflow at an assumed location(s) in the hydraulic model domain.
Effective Warning Time	The time available after receiving advise of an impending flood and before the floodwaters prevent appropriate flood response actions being undertaken. The effective warning time is typically used to move farm equipment, move stock, raise furniture, evacuate people and transport their possessions.
Exceedances per Year (EY)	The number of times an event is likely to occur or be exceeded within any given year.
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
Flood fringe areas	The remaining area of flood prone land after floodway and flood storage areas have been defined.

Flood liable land	Is synonymous with flood prone land (i.e.) land susceptibility to flooding by the PMF event. Note that the term flooding liable land covers the whole floodplain, not just that part below the FPL (see flood planning area)
Floodplain	Area of land which is subject to inundation by floods up to and including the probable maximum flood event, that is flood prone land.
Floodplain risk management options	The measures that might be feasible for the management of particular area of the floodplain. Preparation of a floodplain risk management plan requires a detailed evaluation of floodplain risk management options.
Floodplain risk management plan	A management plan developed in accordance with the principles and guidelines in this manual. Usually include both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defines objectives.
Flood plan (local)	A sub-plan of a disaster plan that deals specifically with flooding. They can exist at state, division and local levels. Local flood plans are prepared under the leadership of the SES.
Flood planning levels (FPLs)	Are the combination of flood levels (derived from significant historical flood events or floods of specific AEPs) and freeboards selected for floodplain risk management purposes, as determined in management studies and incorporated in management plans. FPLs supercede the "designated flood" or the "flood standard" used in earlier studies.
Flood proofing	A combination of measures incorporated in the design, construction and alteration of individual buildings and structures subject to flooding, to reduce or eliminate flood damages.
Flood readiness	Readiness is an ability to react within the effective warning time.
Flood risk	<p>Potential danger to personal safety and potential damage to property resulting from flooding. The degree of risk varies with circumstances across the full range of floods. Flood risk in this manual is divided into 3 types, existing, future and continuing risks. They are described below.</p> <p>Existing flood risk: the risk a community is exposed to as a result of its location on the floodplain.</p> <p>Future flood risk: the risk a community may be exposed to as a result of new development on the floodplain.</p> <p>Continuing flood risk: the risk a community is exposed to after floodplain risk management measures have been implemented. For a town protected by levees, the continuing flood risk is the consequences of the levees being overtopped. For an area without any floodplain risk management measures, the continuing flood risk is simply the existence of its flood exposure.</p>
Flood storage areas	Those parts of the floodplain that are important for the temporary storage of floodwaters during passage of a flood. The extent and behaviour of flood storage

areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas

Floodway areas	Those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels.
Freeboard	Provides reasonable certainty that the risk exposure selected in deciding on a particular flood chosen as the basis for the FPL is actually provided. It is a factor of safety typically used in relation to the setting of floor levels, levee crest levels, etc. Freeboard is included in the flood planning level.
Hazard	A source of potential harm or situation with a potential to cause loss. In relation to this manual the hazard is flooding which has the potential to cause damage to the community.
Local overland flooding	Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.
m AHD	Metres Australian Height Datum (AHD)
m/s	Metres per second. Unit used to describe the velocity of floodwaters.
m ³ /s	Cubic metres per second "cumecs". A unit of measurement of creek or river flows or discharges. It is the rate of flow of water measured in terms of volume per unit time.
Mainstream flooding	Inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam.
Modification measures	Measures that modify either the flood, the property or the response to flooding.
Overland flow path	The path that floodwaters can follow as they are conveyed towards the main flow channel or if they leave the confines of the main flow channel. Overland flow paths can occur through private property or along roads.
Probable Maximum Flood (PMF)	The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land, that is, the floodplain.
Probable Maximum Precipitation (PMP)	The PMP is the greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to PMF estimation.
Risk	Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. In the context of the manual it is the likelihood of

consequences arising from the interaction of floods, communities and the environment.

Runoff

The amount of rainfall which actually ends up as a streamflow, also known as rainfall excess.

Stage

Equivalent to water level (both measured with reference to a specified datum)

TUFLOW

TUFLOW is a computer program which is used to simulate free-surface flow for flood and tidal wave propagation. It provides coupled 1D and 2D hydraulic solutions using a powerful and robust computation. The engine has seamless interfacing with GIS and is widely used across Australia.

Appendix A. Hydrologic Data

Table A-1: Design Rainfall Depths (mm) -ARR 2016

Duration	20%	5%	2%	1%	PMF
30 min	32.5	42.6	49.2	54.2	250
45 min	38.1	50	57.9	63.9	320
1 hour	42.3	55.8	64.7	71.5	400
1.5 hour	49.1	65	75.6	83.9	450
2 hour	54.6	72.5	84.7	94.2	500
3 hour	63.6	85.3	100	112	570
4.5 hour	74.8	101	120	134	-
6 hour	84.3	115	136	153	-
9 hour	100	139	165	186	-
12 hour	114	158	189	213	-

Appendix B. Flood Mapping

Peak Flood Depth:

- Figure B.1: Peak flood depth for 20% AEP event
- Figure B.2: Peak flood depth for 5% AEP event
- Figure B.3: Peak flood depth for 1% AEP event
- Figure B.4: Peak flood depth for PMF event

Flood Hazard:

- Figure B.5: True flood hazard classification for 20% AEP event
- Figure B.6: True flood hazard classification for 5% AEP event
- Figure B.7: True flood hazard classification for 1% AEP event
- Figure B.8: True flood hazard classification for PMF event

Hydraulic Categories:

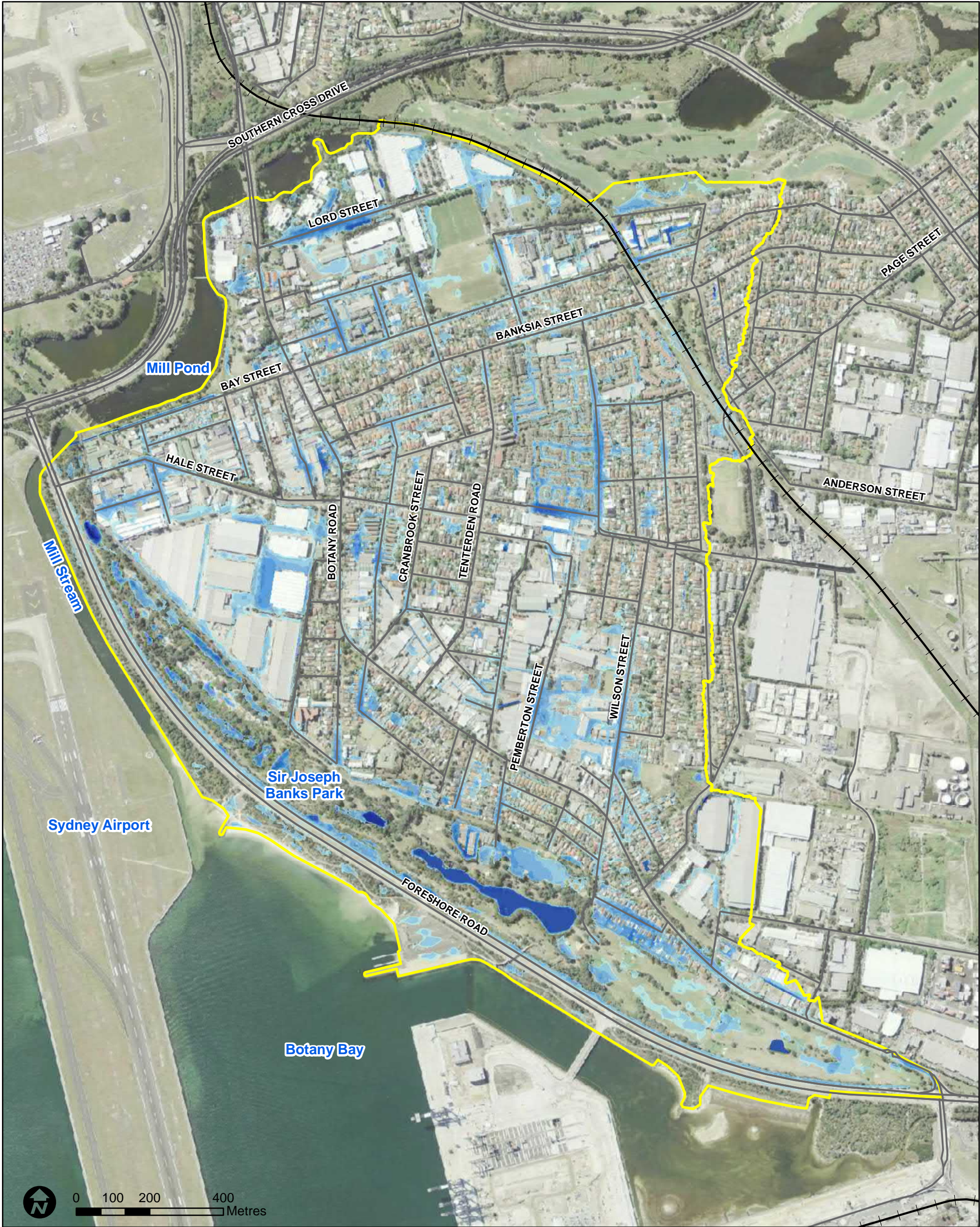
- Figure B.9: Hydraulic categorisation for 20% AEP event
- Figure B.10: Hydraulic categorisation for 5% AEP event
- Figure B.11: Hydraulic categorisation for 1% AEP event
- Figure B.12: Hydraulic categorisation for PMF event

Emergency Response Classification:

- Figure B.13: Emergency response classification for 1% AEP event
- Figure B.14: Emergency response classification for PMF event

Flood Lot Tagging:

- Figure B.15: Tagged 1% AEP flood lots
- Figure B.16: Tagged PMF flood lots



Legend

- Study Area
- Rail
- Roads

Peak Flood Depth (m)

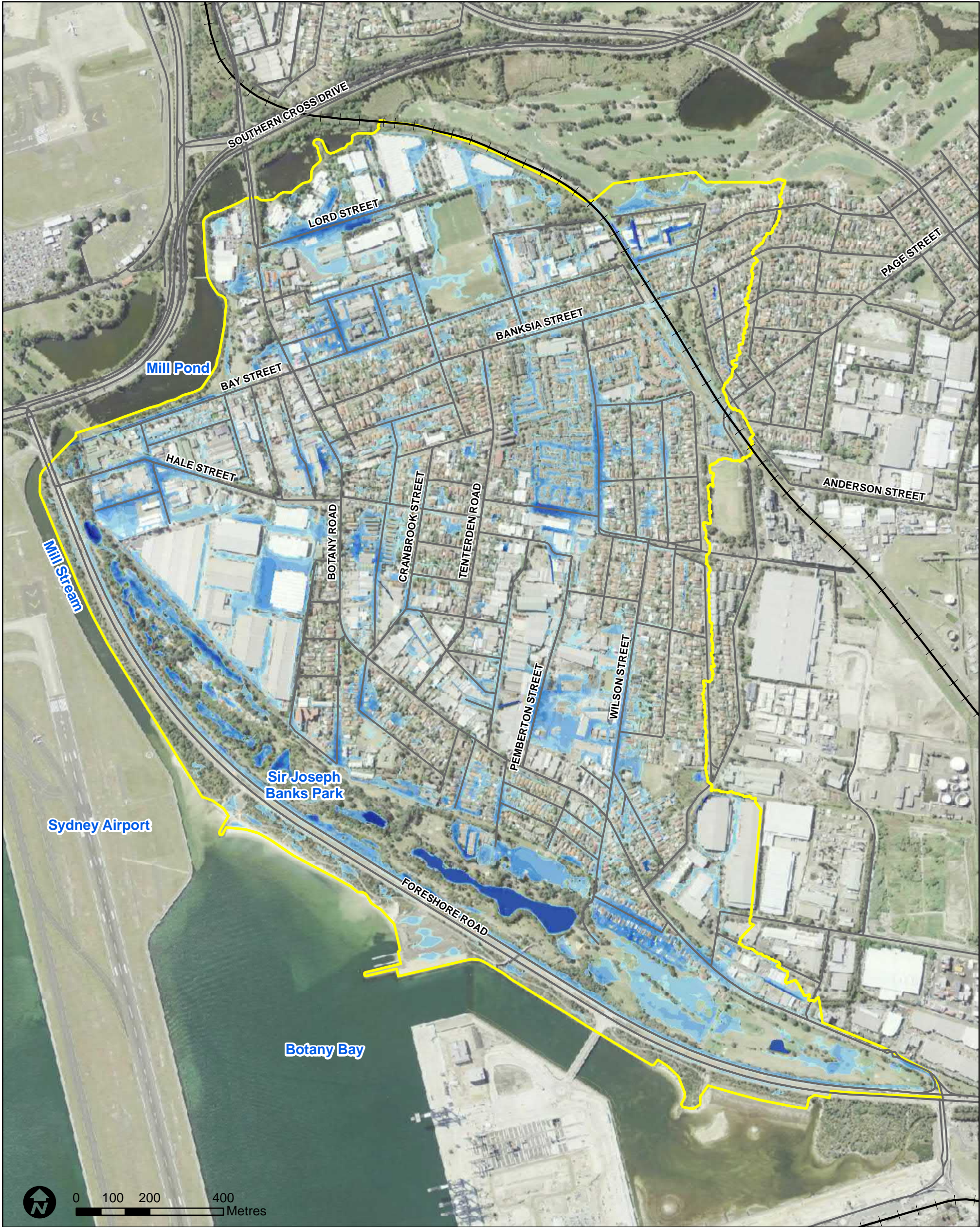
- | | |
|-------------|-------------|
| 0.05 to 0.1 | 0.75 to 1.0 |
| 0.1 to 0.25 | 1.0 to 1.5 |
| 0.25 to 0.5 | 1.5 to 2.0 |
| 0.5 to 0.75 | >2.0 |

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Peak flood depth for 20% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure B.1
CHECK	DATE	REV VER
AH	15/04/2020	2 1



Legend

- Study Area
- Rail
- Roads

Peak Flood Depth (m)

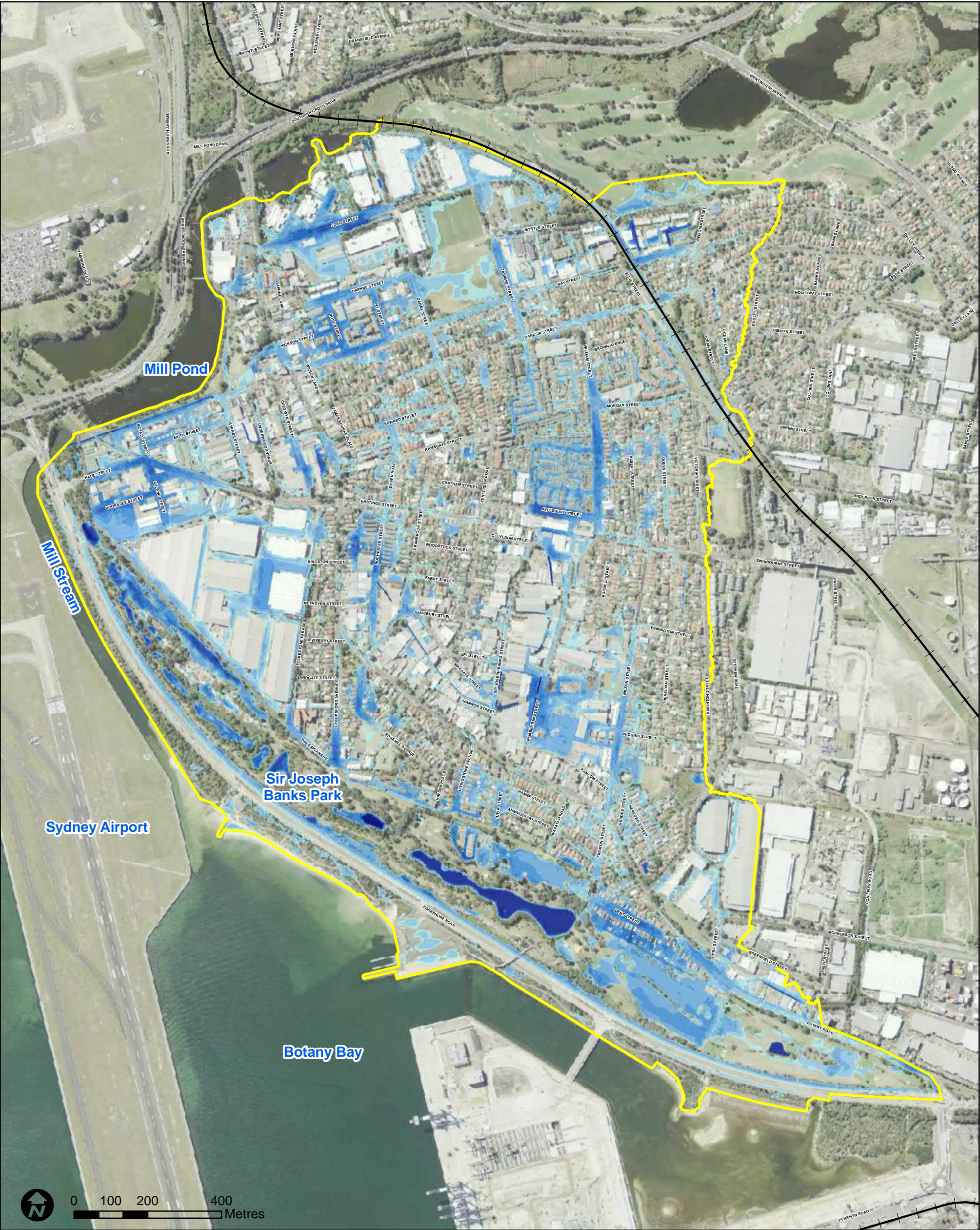
- | | |
|-------------|-------------|
| 0.05 to 0.1 | 0.75 to 1.0 |
| 0.1 to 0.25 | 1.0 to 1.5 |
| 0.25 to 0.5 | 1.5 to 2.0 |
| 0.5 to 0.75 | >2.0 |

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SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Peak flood depth for 5% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure B.2
CHECK	DATE	REV VER
AH	15/04/2020	2 1



Legend

- Study Area

Rail
- Peak Flood Depth (m)

0.05 to 0.1

0.1 to 0.25

0.25 to 0.5

0.5 to 0.75
- 0.75 to 1.0

1.0 to 1.5

1.5 to 2.0

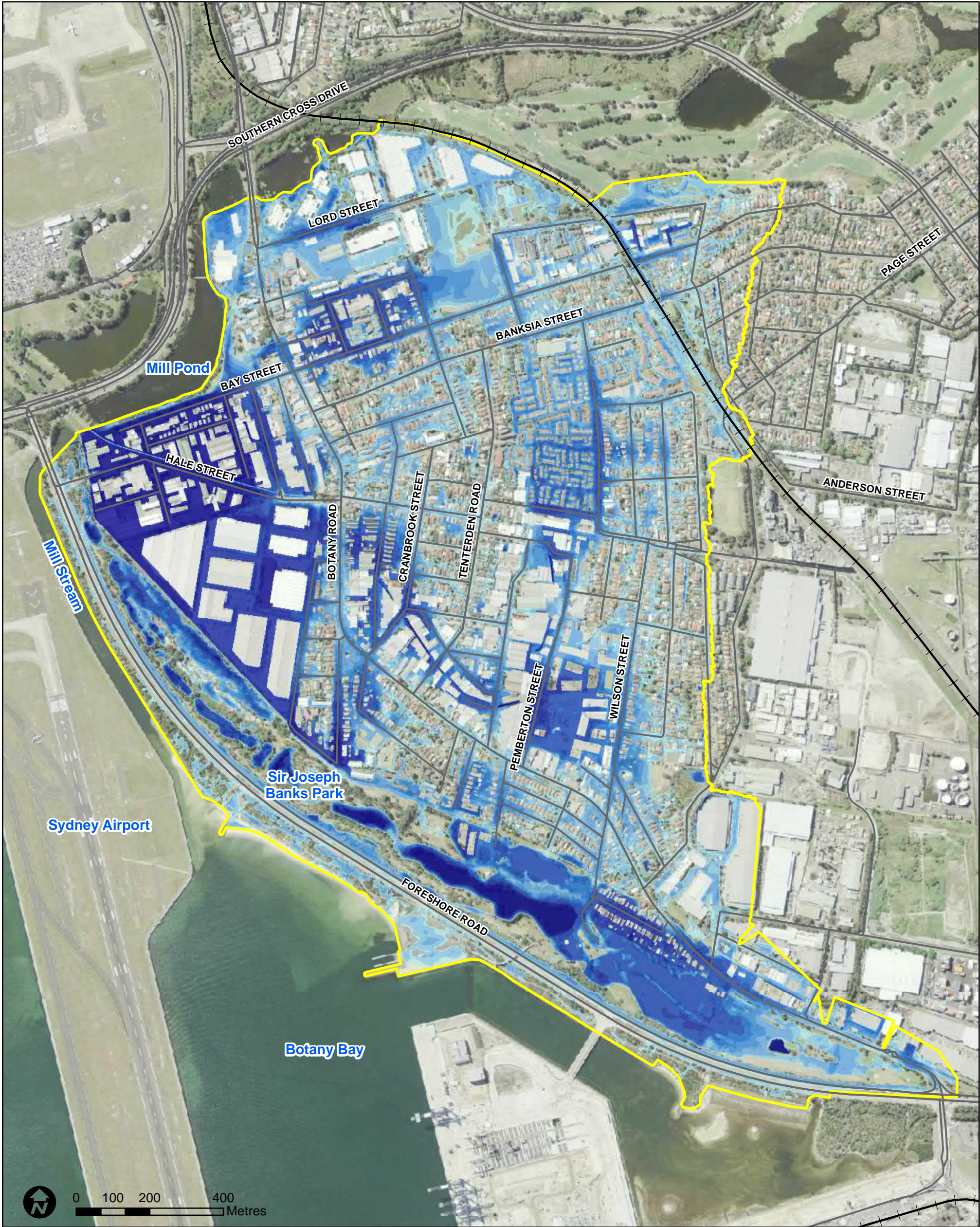
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JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Peak flood depth for 1% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure B.3
CHECK	DATE	REV VER
AH	15/04/2020	2 1



Legend

- Study Area
- Rail
- Roads

Peak Flood Depth (m)

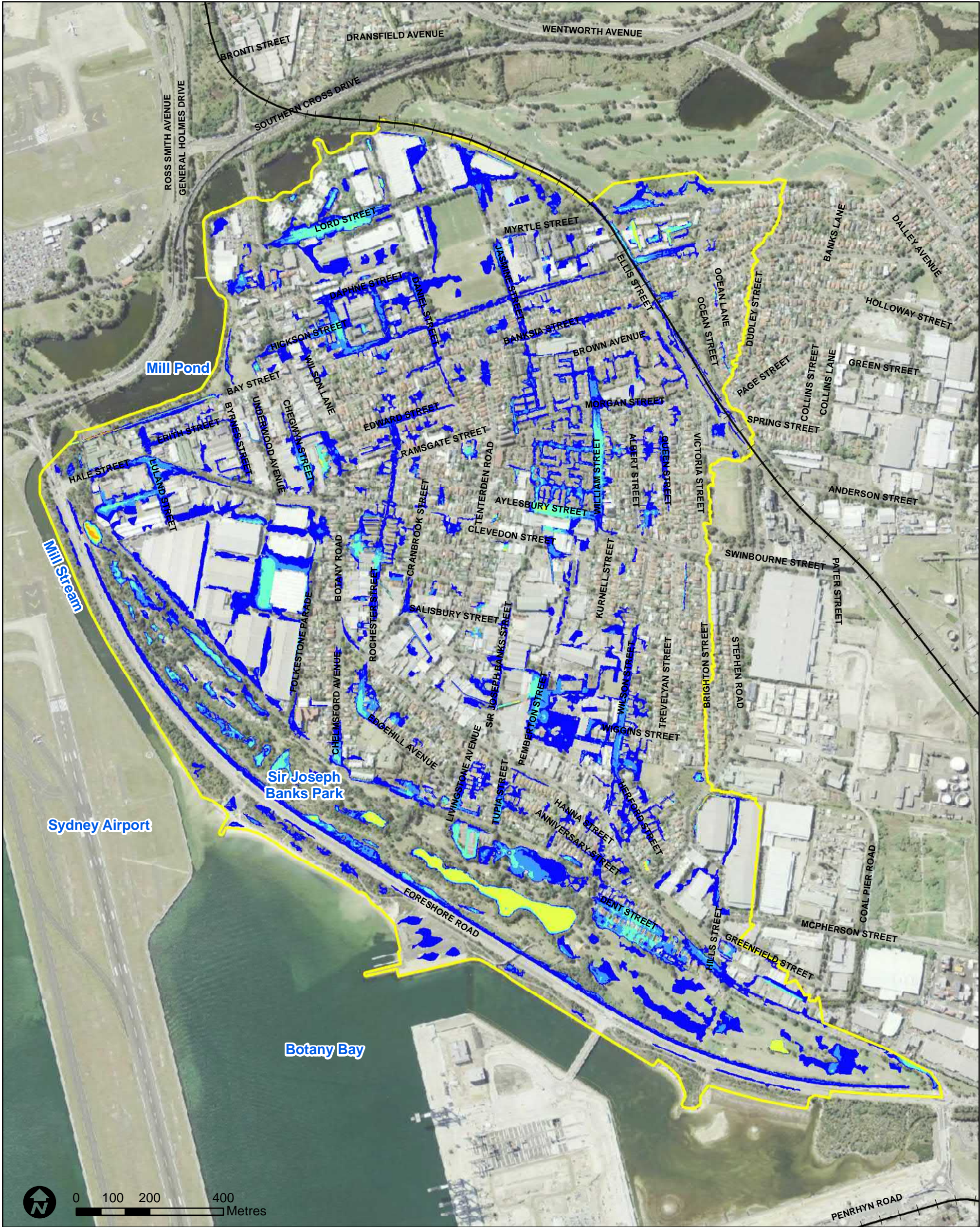
- | | |
|-------------|-------------|
| 0.05 to 0.1 | 0.75 to 1.0 |
| 0.1 to 0.25 | 1.0 to 1.5 |
| 0.25 to 0.5 | 1.5 to 2.0 |
| 0.5 to 0.75 | >2.0 |

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Peak flood depth for PMF event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure B.4
CHECK	DATE	REV VER
AH	15/04/2020	2 1



Legend

- Study area
- Rail
- Flood Hazard
 - H1 - No restrictions
 - H2 - Unsafe for small vehicles
 - H3 - Unsafe for vehicles, children and the elderly

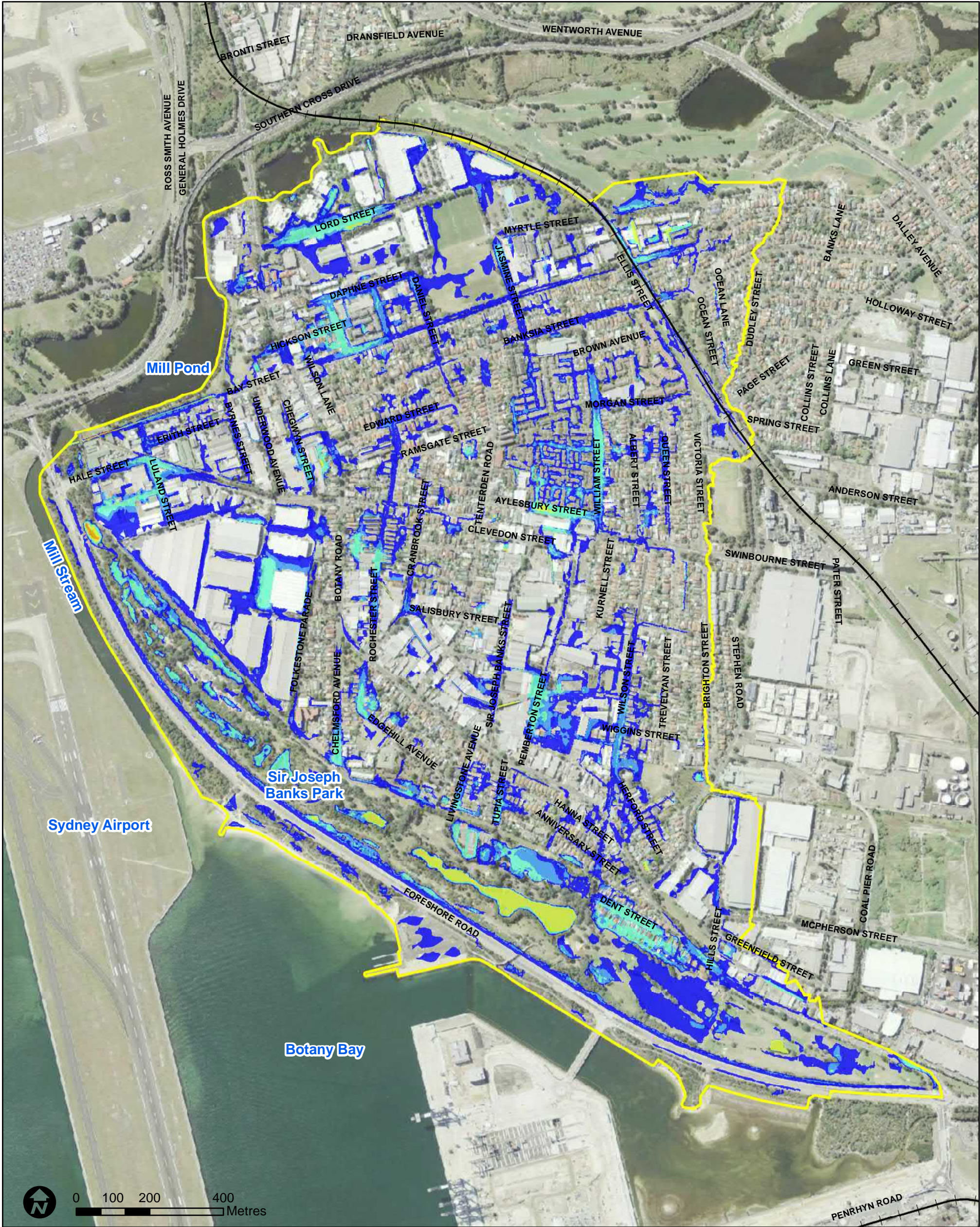
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for people or vehicles. Buildings require special engineering design and construction
- H6 - Not suitable for people, vehicles or buildings



Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000			A3	
SHEET	1 of 1		GDA 1994 MGA Zone 56		
TITLE	Flood Hazard Classification for 20% AEP Event				
PROJECT	Botany Bay Foreshore Beach FRMS				
CLIENT	Bayside Council				
DRAWN	PK	PROJECT #	MAP #	REV	VER
		IA190100	Figure B.5	2	1
CHECK	AH	DATE			
		23/04/2020			



Legend

- Study area
- Rail
- Flood Hazard
 - H1 - No restrictions
 - H2 - Unsafe for small vehicles
 - H3 - Unsafe for vehicles, children and the elderly

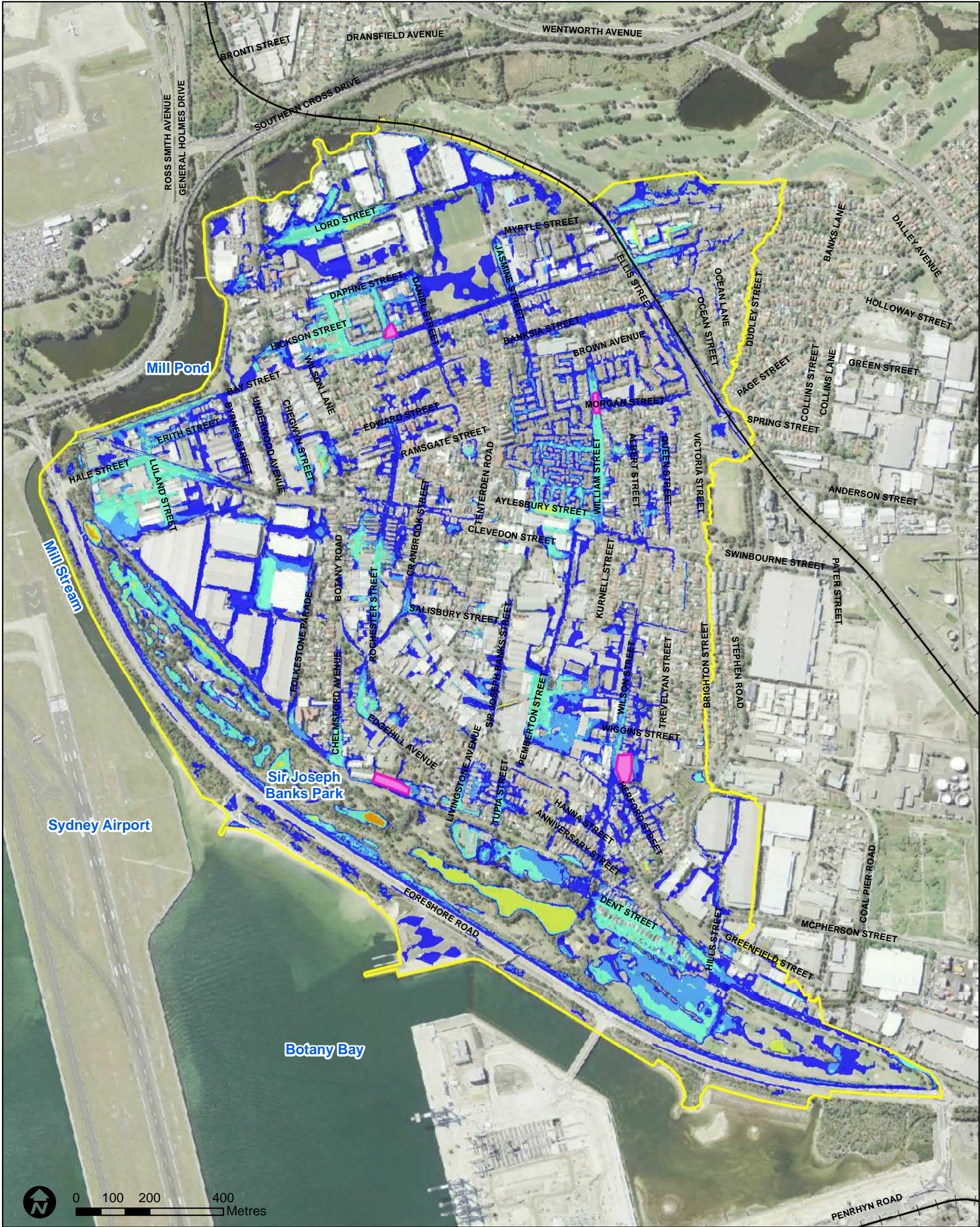
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for people or vehicles. Buildings require special engineering design and construction
- H6 - Not suitable for people, vehicles or buildings



Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Flood Hazard Classification for 5% AEP Event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure B.6
CHECK	DATE	REV VER
AH	23/04/2020	2 1



Legend

- Study area
- Rail
- Patch: Potential Risk to Life, High Hazard at Dwelling
- Flood Hazard
 - H1 - No restrictions
 - H2 - Unsafe for small vehicles

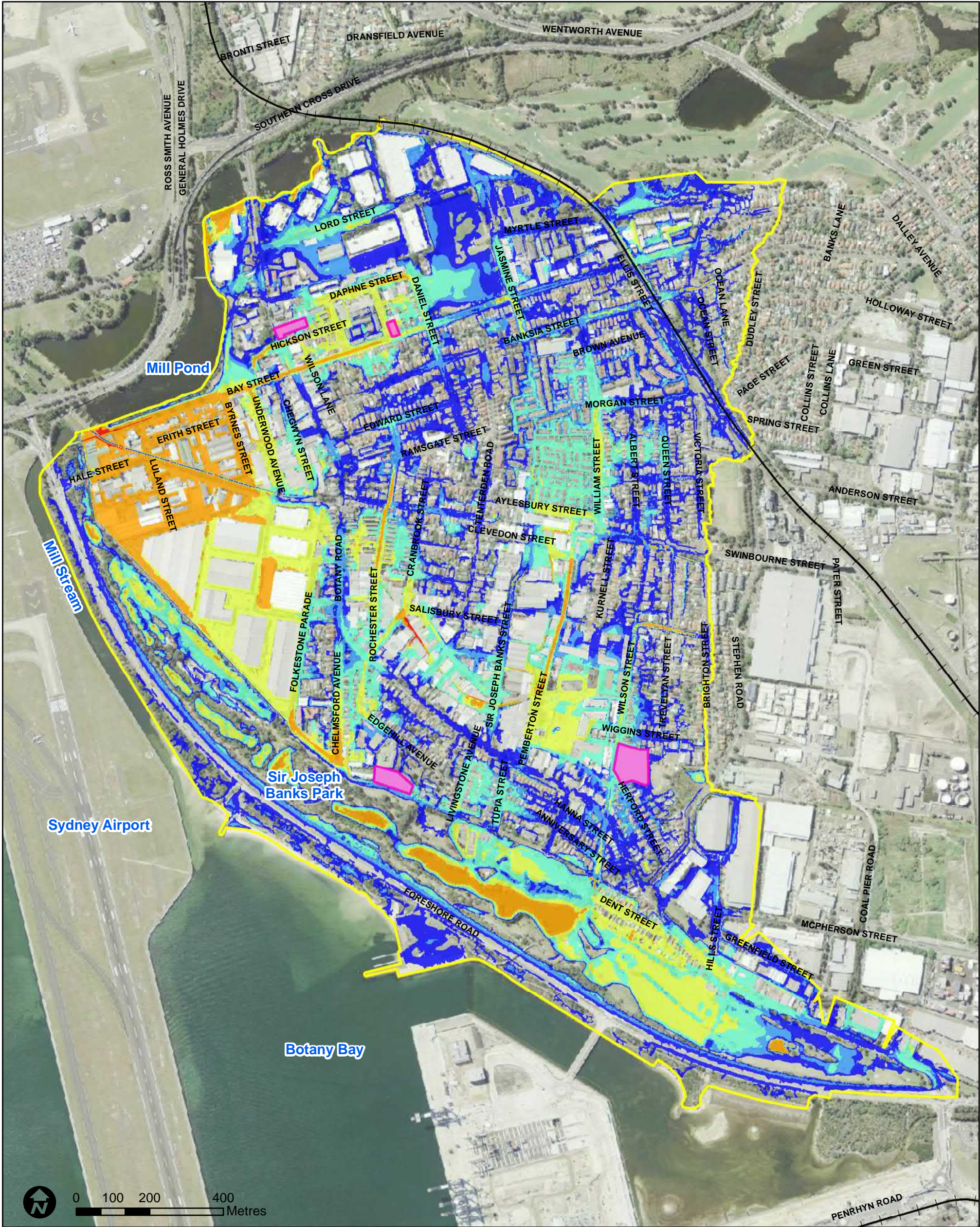
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for people or vehicles. Buildings require special engineering design and construction
- H6 - Not suitable for people, vehicles or buildings



Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000			A3	
SHEET	1 of 1		GDA 1994 MGA Zone 56		
TITLE	Flood Hazard Classification for 1% AEP Event				
PROJECT	Botany Bay Foreshore Beach FRMS				
CLIENT	Bayside Council				
DRAWN	PROJECT #	MAP #	REV VER		
PK	IA190100	Figure B.7	2 1		
CHECK	DATE				
AH	23/04/2020				



Legend

- Rail
- Study Area
- Patch: Potential Risk to Life, High Hazard at Dwelling
- Flood Hazard
 - H1 - No restrictions
 - H2 - Unsafe for small vehicles

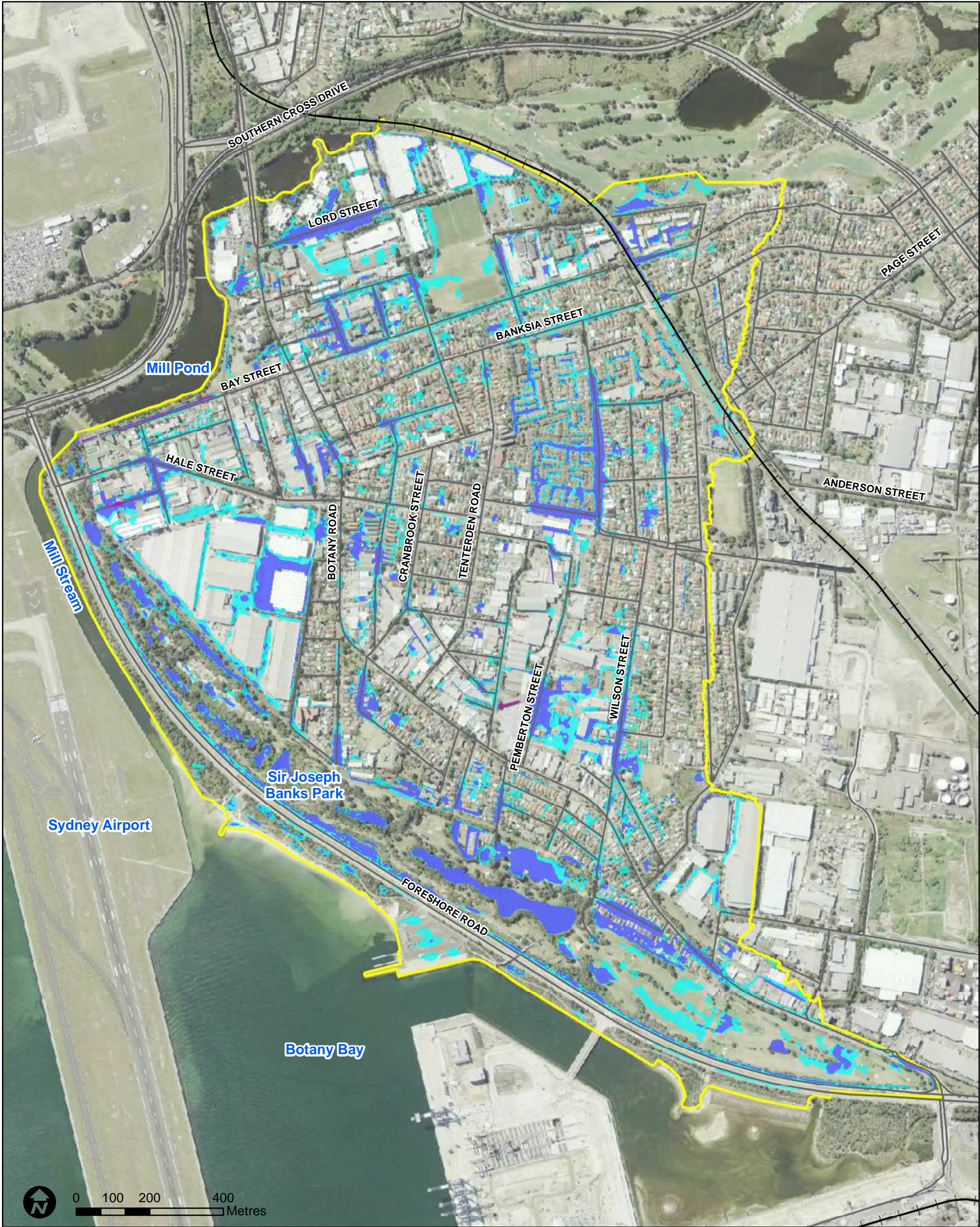
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for people or vehicles. Buildings require special engineering design and construction
- H6 - Not suitable for people, vehicles or buildings



Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE 1:10,000		A3	
SHEET 1 of 1		GDA 1994 MGA Zone 56	
TITLE Flood Hazard Classification for PMF Event			
PROJECT Botany Bay Foreshore Beach FRMS			
CLIENT Bayside Council			
DRAWN PK	PROJECT # IA190100	MAP # Figure B.8	REV VER 2 1
CHECK AH	DATE 23/04/2020		



Legend

- Study Area
- Rail
- Roads

Hydraulic Categorisation

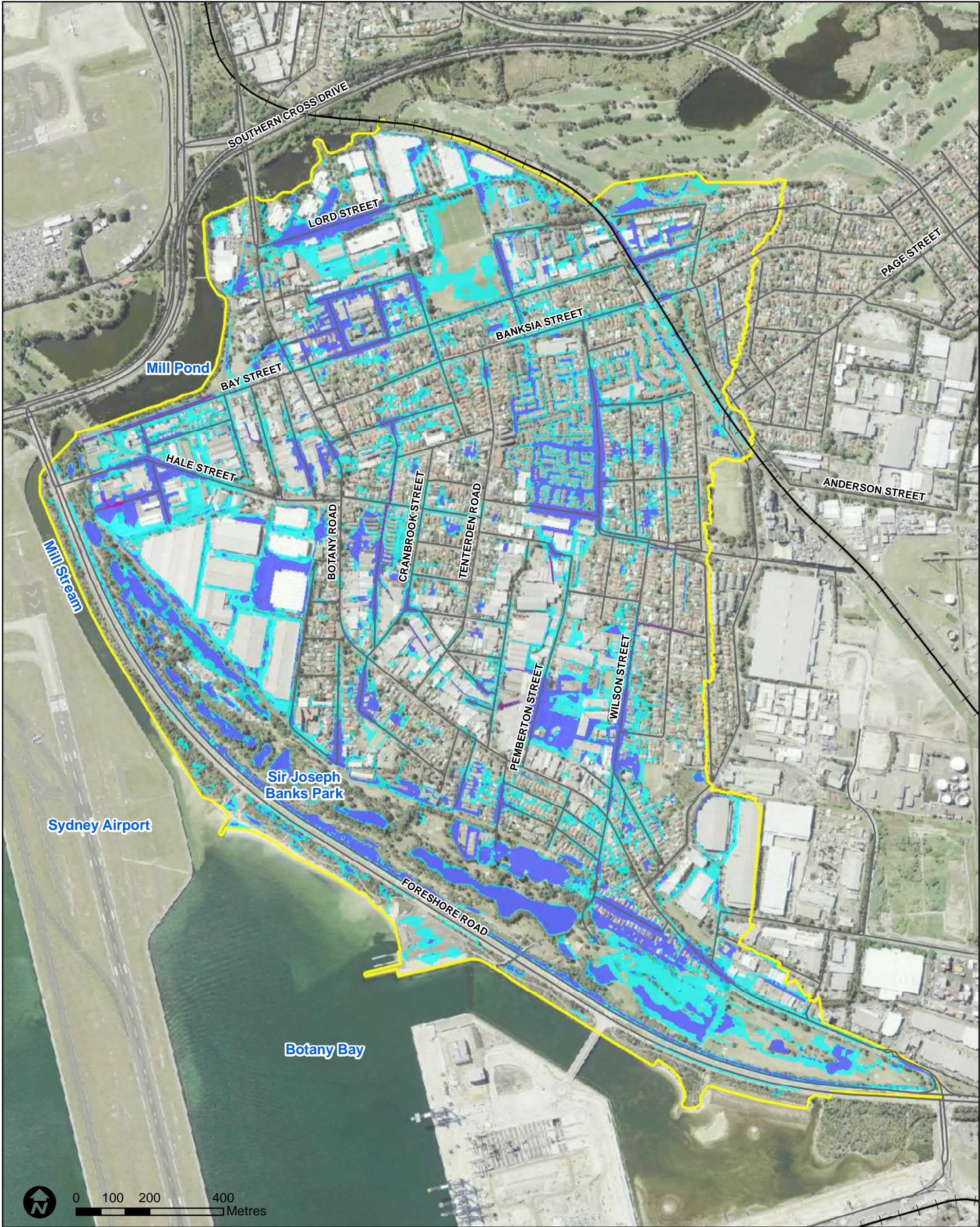
- Floodway
- Flood Storage
- Flood Fringe



Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Hydraulic categorisation for 20% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure B.9
CHECK	DATE	REV VER
PD	21/04/2020	2 1



Legend

- Study Area
- Rail
- Roads

Hydraulic Categorisation

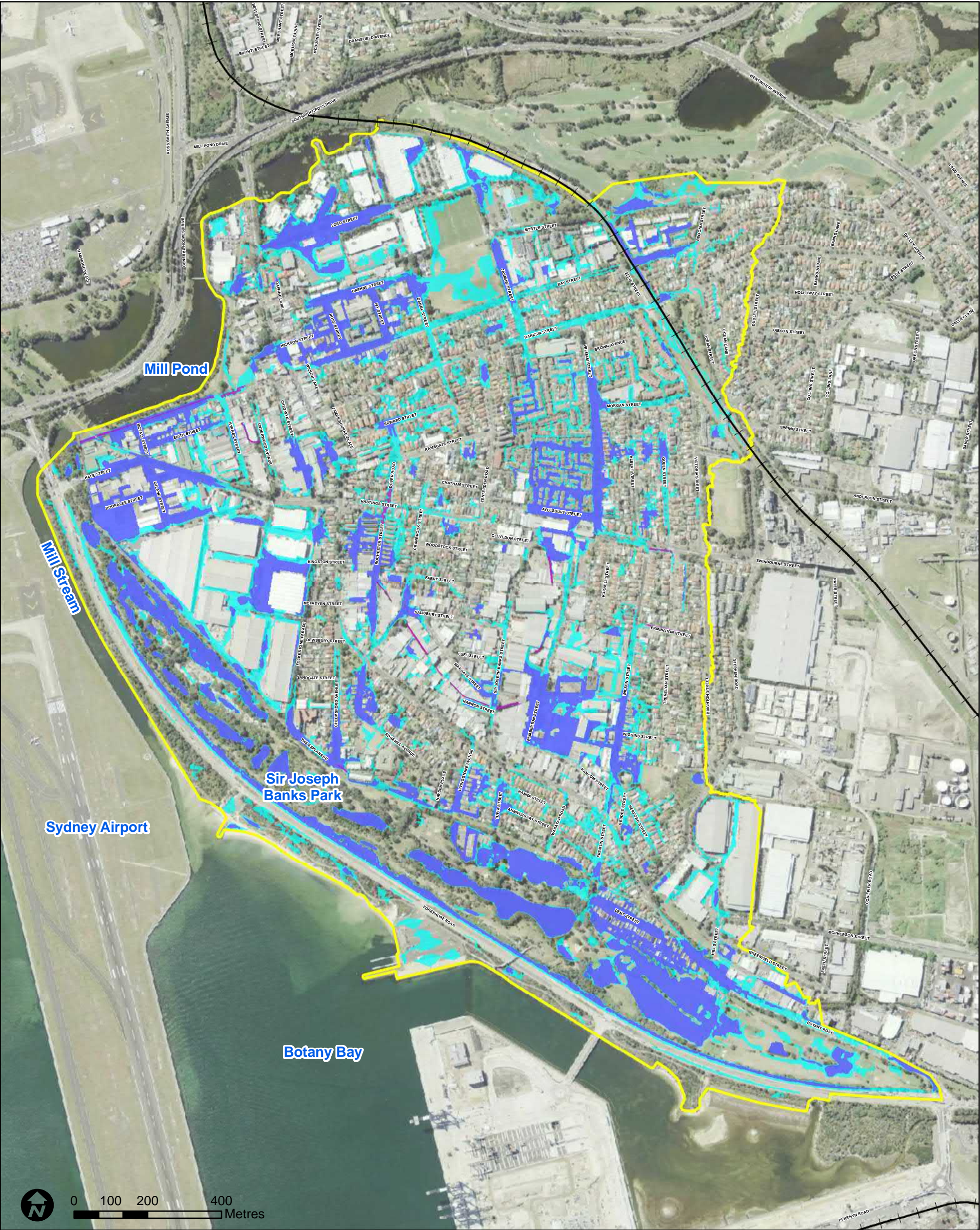
- Floodway
- Flood Storage
- Flood Fringe

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Hydraulic categorisation for 5% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure B.10
CHECK	DATE	REV VER
PD	21/04/2020	2 1



Legend

- Study Area
- Rail

Hydraulic Categorisation

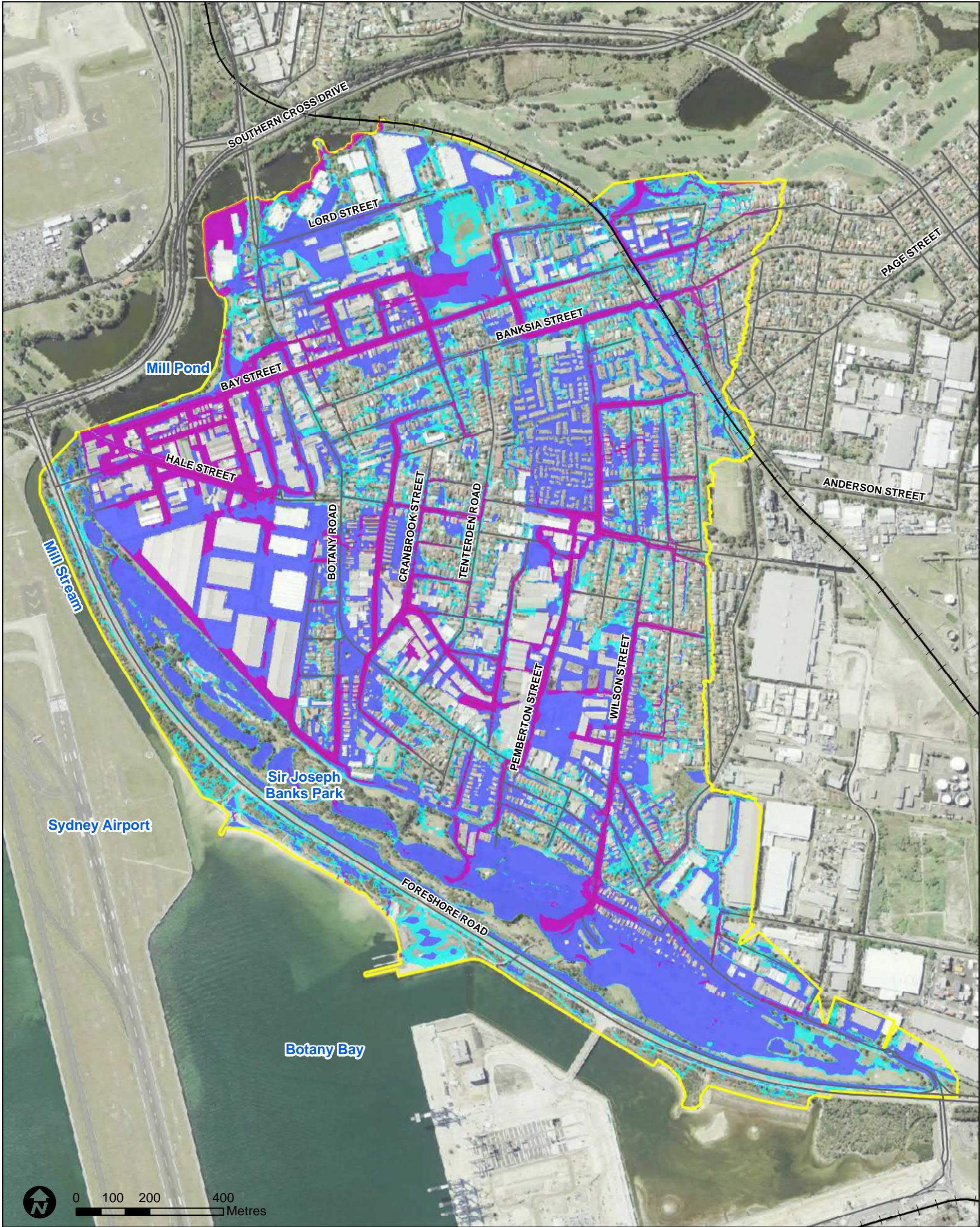
- Floodway
- Flood Storage
- Flood Fringe

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Hydraulic categorisation for 1% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure B.11
CHECK	DATE	REV VER
PD	15/04/2020	2 1



Legend

- Study Area
- Rail
- Roads

Hydraulic Categorisation

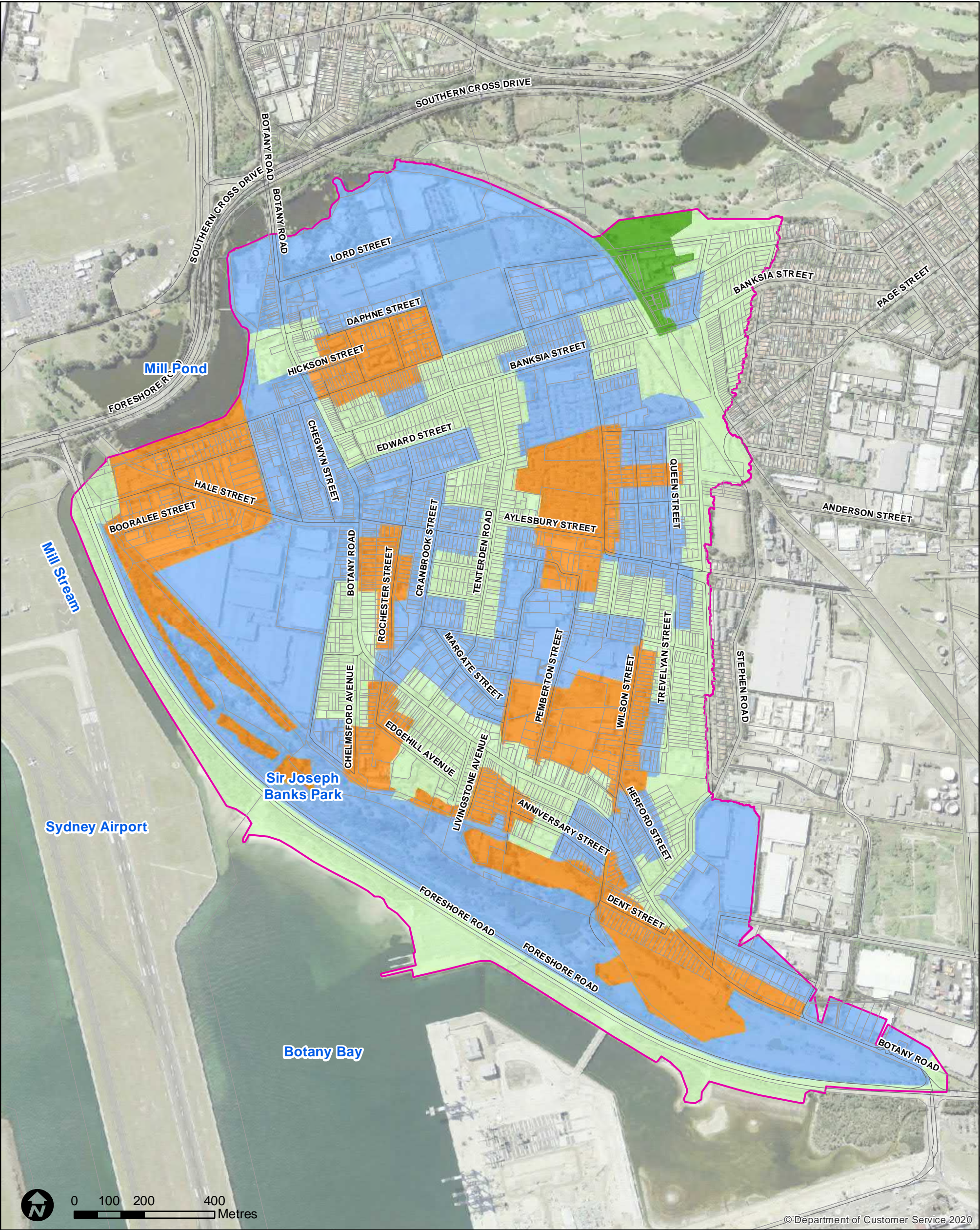
- Floodway
- Flood Storage
- Flood Fringe

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Hydraulic categorisation for PMF event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure B.12
CHECK	DATE	REV VER
PD	21/04/2020	2 1



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Legend

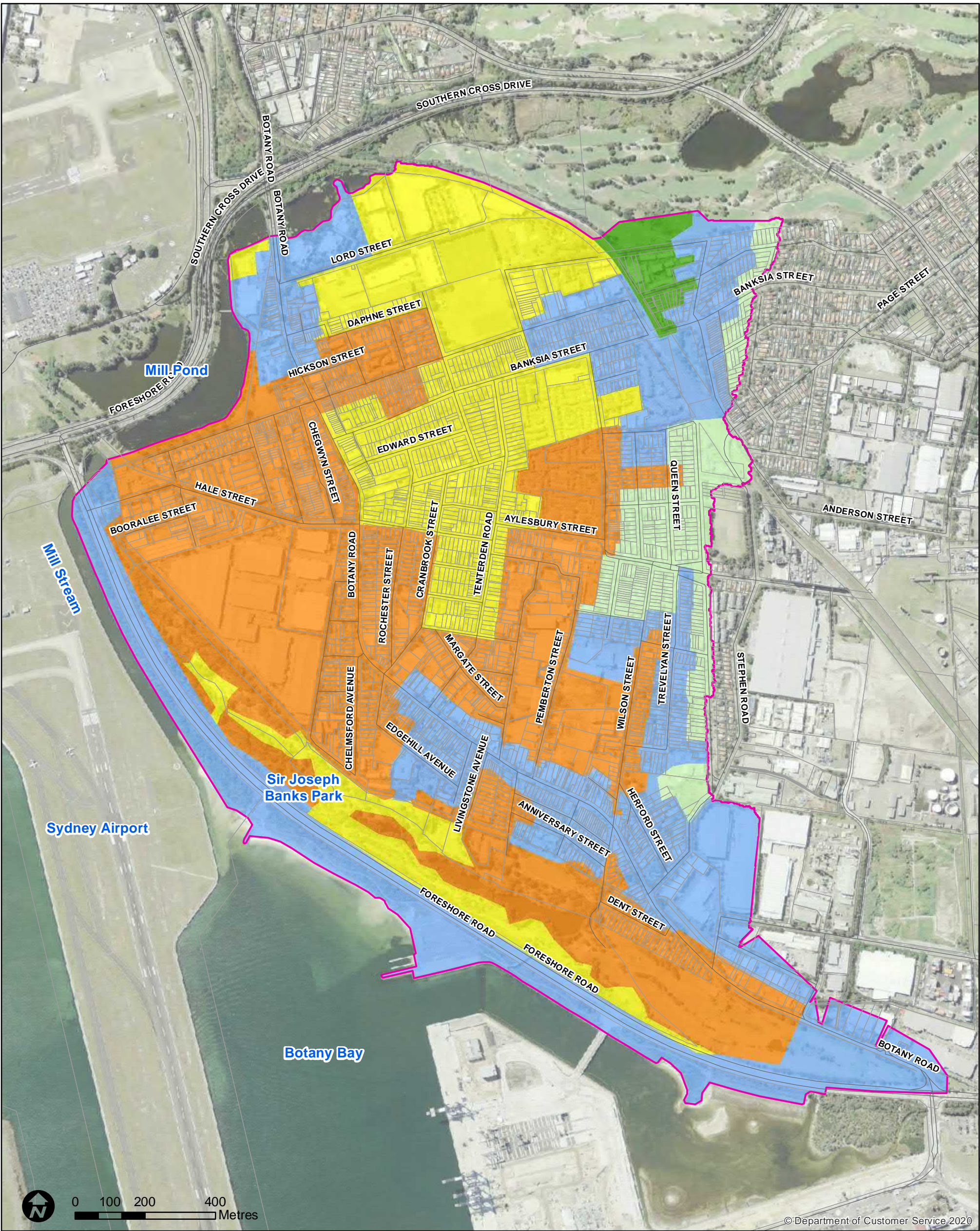
- | | | | |
|--|------------|--|--|
| | Cadastral | | FIS - Flooded, isolated and fully submerged |
| | Study area | | FIE - Flooded, isolated with an area elevated above 1% AEP |
| | | | FER - Flooded, exit route via rising road |
| | | | FEO - Flooded, exit route via overland escape |
| | | | NIC - Not flooded, indirect consequences |
- Emergency Response Classifications

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,500	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Flood Emergency Response Classifications 1% AEP Flood Event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	AI	PROJECT # IA190100
CHECK	AH	DATE 8/09/2020
		MAP # Figure B.13
		REV VER 2 1



Legend

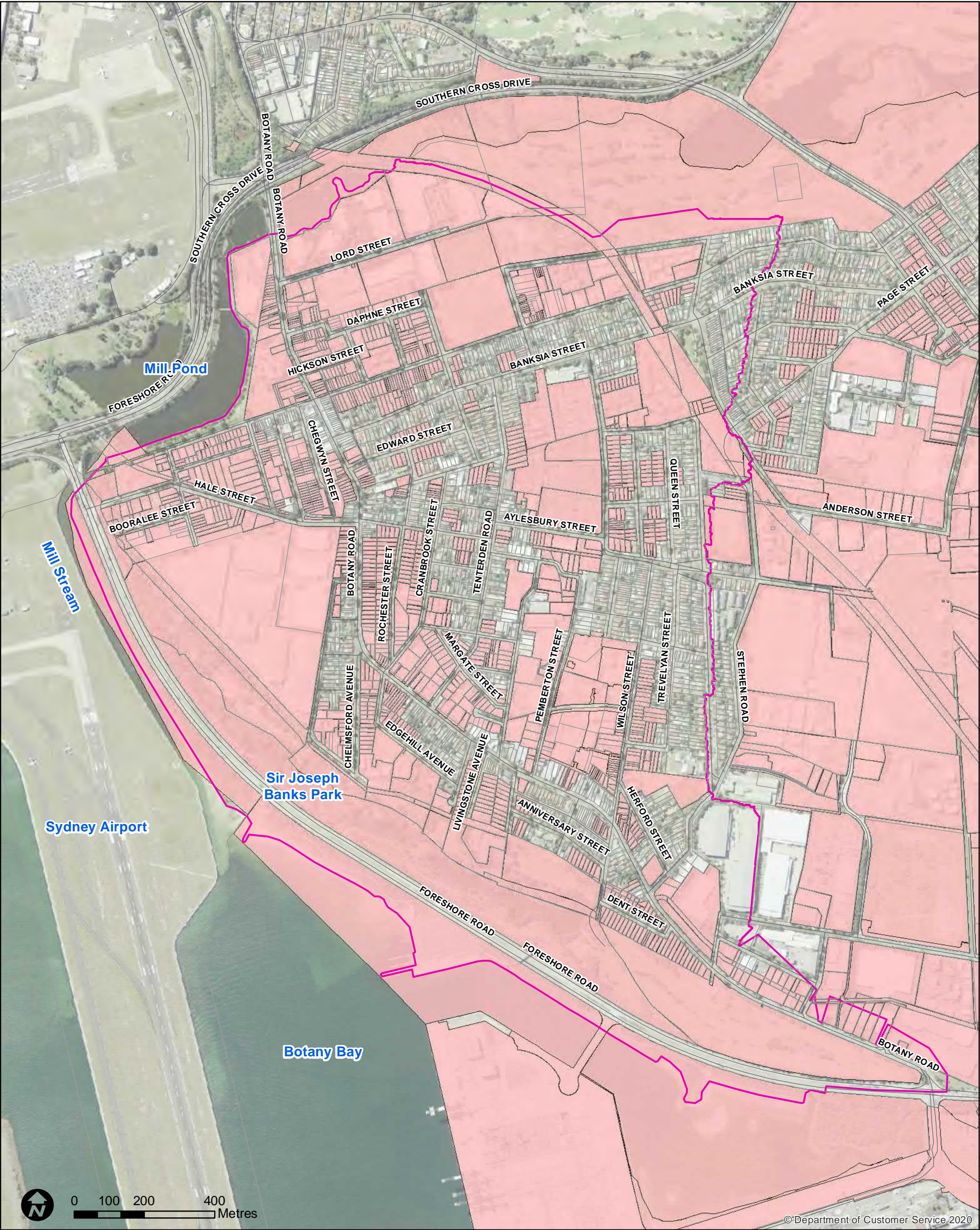
- | | |
|------------|---|
| Cadastre | Emergency Response Classifications |
| Study area | FIS - Flooded, isolated and fully submerged |
| | FIE - Flooded, isolated with an area elevated above PMF |
| | FER - Flooded, exit route via rising road |
| | FEO - Flooded, exit route via overland escape |
| | NIC - Not flooded, indirect consequences |

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,500	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Flood Emergency Response Classifications PMF Flood Event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
AI	IA190100	Figure B.14
CHECK	DATE	REV VER
AH	8/09/2020	2 1



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SCALE 1:10,500 A3
SHEET 1 of 1 GDA 1994 MGA Zone 56

TITLE Lots Tagging-1% AEP Flood Event
PROJECT Botany Bay Foreshore Beach FRMS

CLIENT Bayside Council

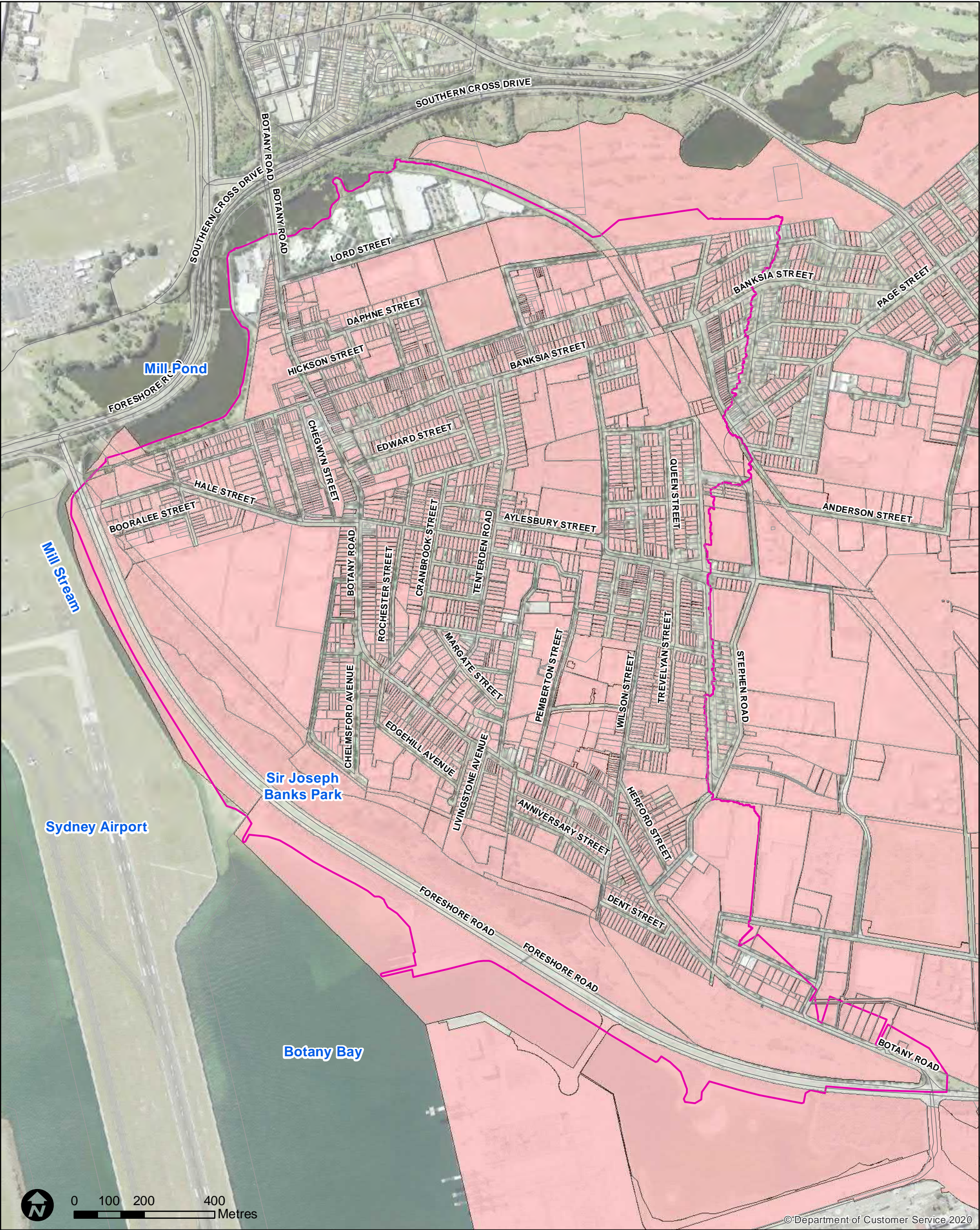
DRAWN	AI	PROJECT #	IA190100	MAP #	REV	VER
CHECK	AH	DATE	8/09/2020	Figure B.15	2	1

Legend

- | | |
|------------|----------|
| Cadastre | Lot Type |
| Study area | Tagged |

JACOBS

Data Sources: Bayside Council
LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.



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Legend

- Cadastre Lot Type
Study area Tagged

JACOBS

Data Sources: Bayside Council

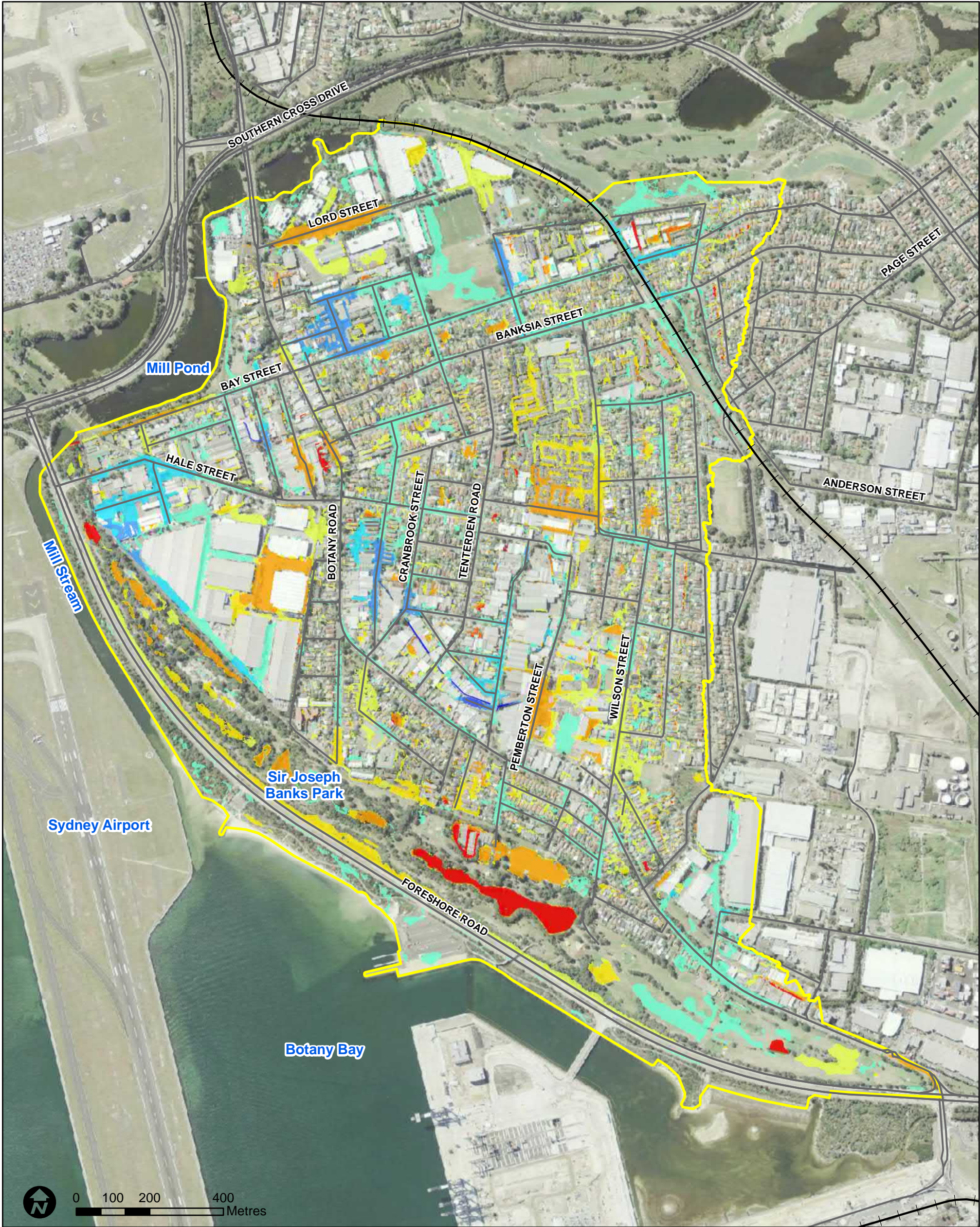
LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,500	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Lots Tagging-PMF	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
AI	IA190100	Figure B.16
CHECK	DATE	REV VER
AH	8/09/2020	2 1

Appendix C. Difference in Peak Flood Levels -Present Study and 2015 Flood Study

Difference in peak flood levels between this study and the 2015 Flood Study

- Figure C.1: Difference in peak flood levels for 20% AEP event
- Figure C.2: Difference in peak flood levels for 5% AEP event
- Figure C.3: Difference in peak flood levels for 1% AEP event
- Figure C.4: Difference in peak flood levels for PMF event



Legend

- Study Area

Rail

Roads
- Peak Flood Level Difference (m)

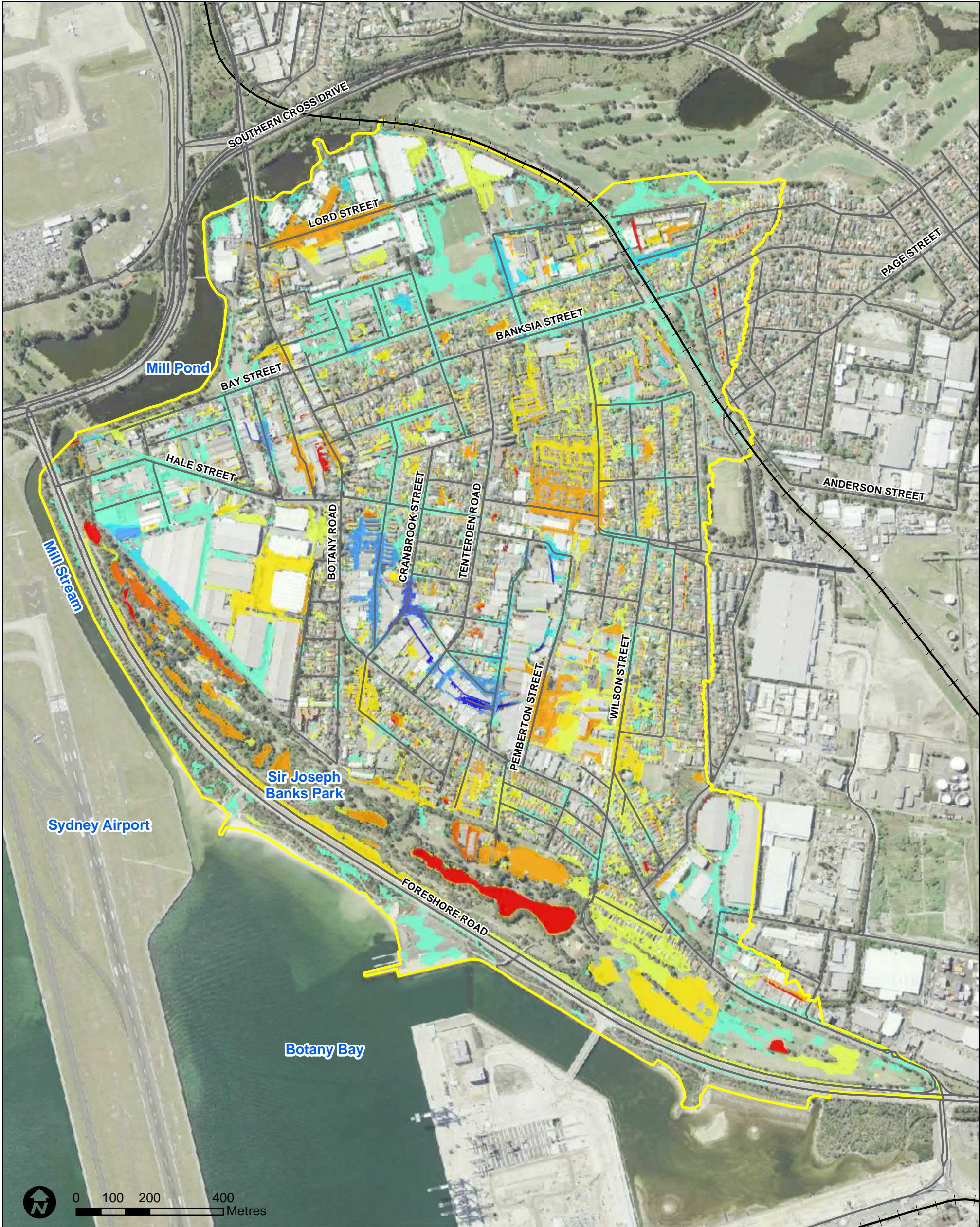
< -0.5	-0.05 to -0.01	0.1 to 0.3
-0.5 to -0.3	-0.01 to 0.01	0.3 to 0.5
-0.3 to -0.1	0.01 to 0.05	> 0.5
-0.1 to -0.05	0.05 to 0.1	

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Peak flood level difference between present study and 2015 flood study for 20% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure C.1
CHECK	DATE	REV VER
AH	15/04/2020	2 1



Legend

- Study Area

Rail

Roads
- Peak Flood Level Difference (m)

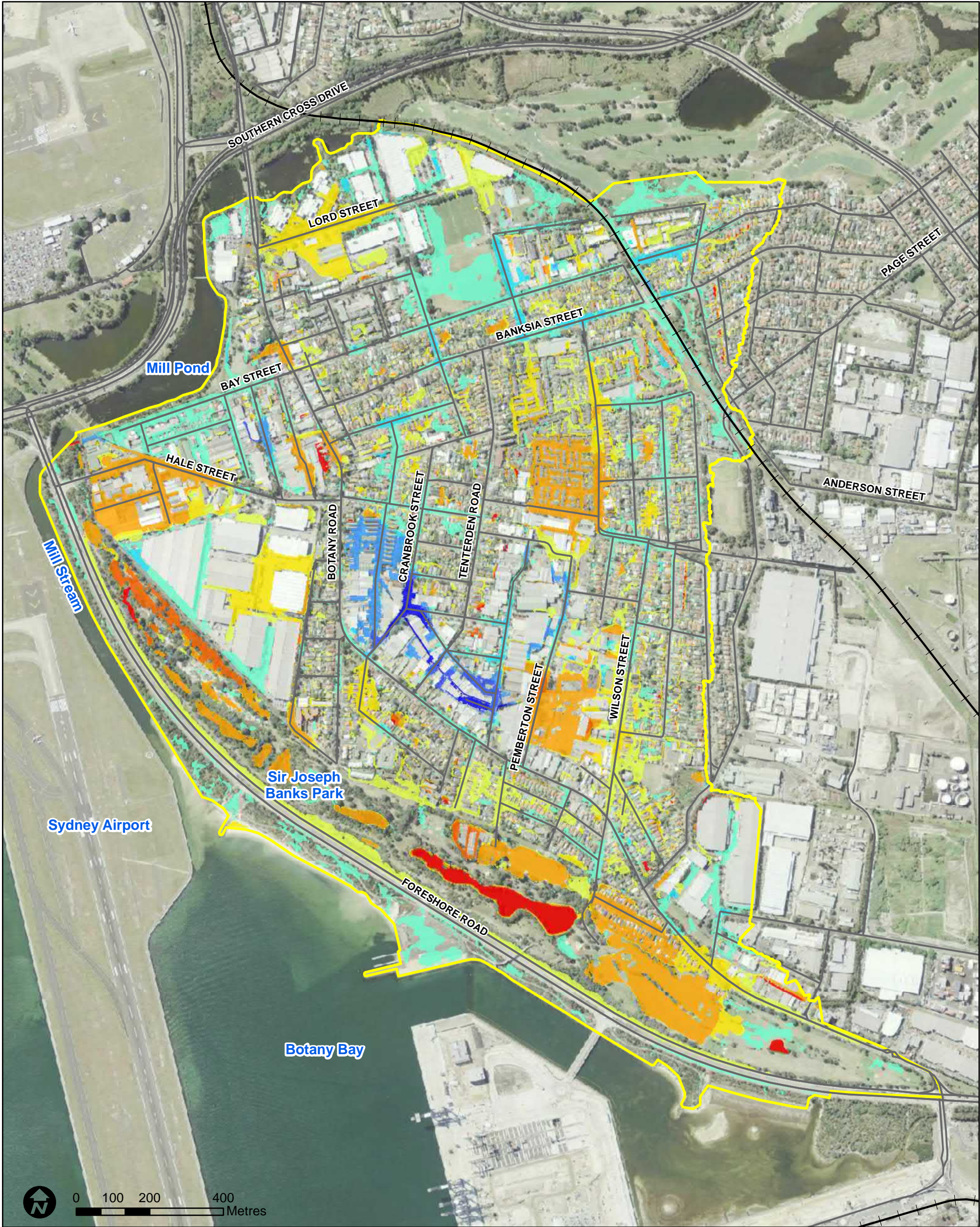
<div>< -0.5</div>	<div>-0.05 to -0.01</div>	<div>0.1 to 0.3</div>
<div>-0.5 to -0.3</div>	<div>-0.01 to 0.01</div>	<div>0.3 to 0.5</div>
<div>-0.3 to -0.1</div>	<div>0.01 to 0.05</div>	<div>> 0.5</div>
<div>-0.1 to -0.05</div>	<div>0.05 to 0.1</div>	

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Peak flood level difference between present study and 2015 flood study for 5% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure C.2
CHECK	DATE	REV VER
AH	15/04/2020	2 1



Legend

- Study Area

Rail

Roads
- Peak Flood Level Difference (m)

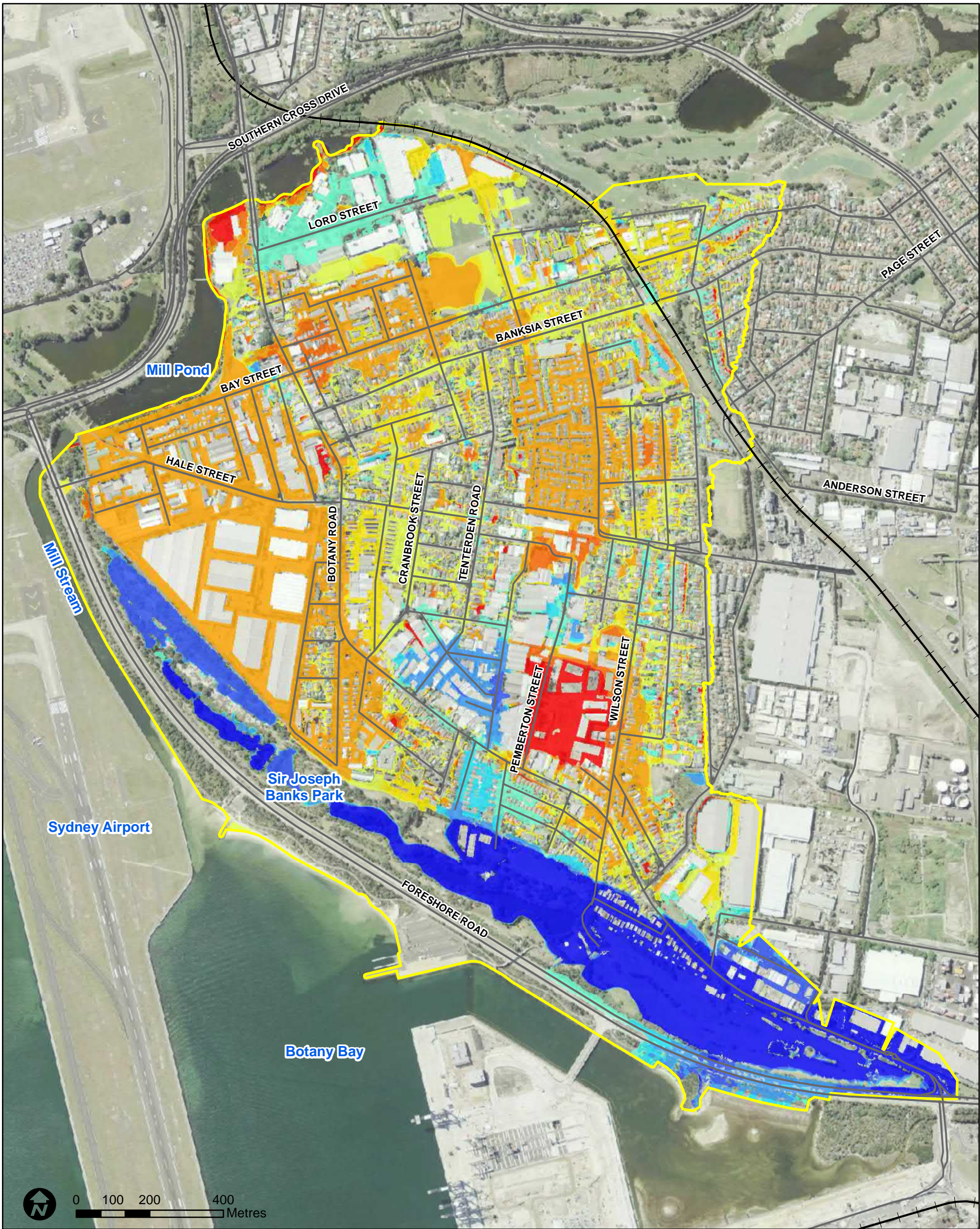
<div>< -0.5</div>	<div>-0.05 to -0.01</div>	<div>0.1 to 0.3</div>
<div>-0.5 to -0.3</div>	<div>-0.01 to 0.01</div>	<div>0.3 to 0.5</div>
<div>-0.3 to -0.1</div>	<div>0.01 to 0.05</div>	<div>> 0.5</div>
<div>-0.1 to -0.05</div>	<div>0.05 to 0.1</div>	

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Peak flood level difference between present study and 2015 flood study for 1% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure C.3
CHECK	DATE	REV VER
AH	15/04/2020	2 1



Legend

- Study Area
- Rail
- Roads

Peak Flood Level Difference (m)

- | | | |
|---------------|----------------|------------|
| < -0.5 | -0.05 to -0.01 | 0.1 to 0.3 |
| -0.5 to -0.3 | -0.01 to 0.01 | 0.3 to 0.5 |
| -0.3 to -0.1 | 0.01 to 0.05 | > 0.5 |
| -0.1 to -0.05 | 0.05 to 0.1 | |

JACOBS

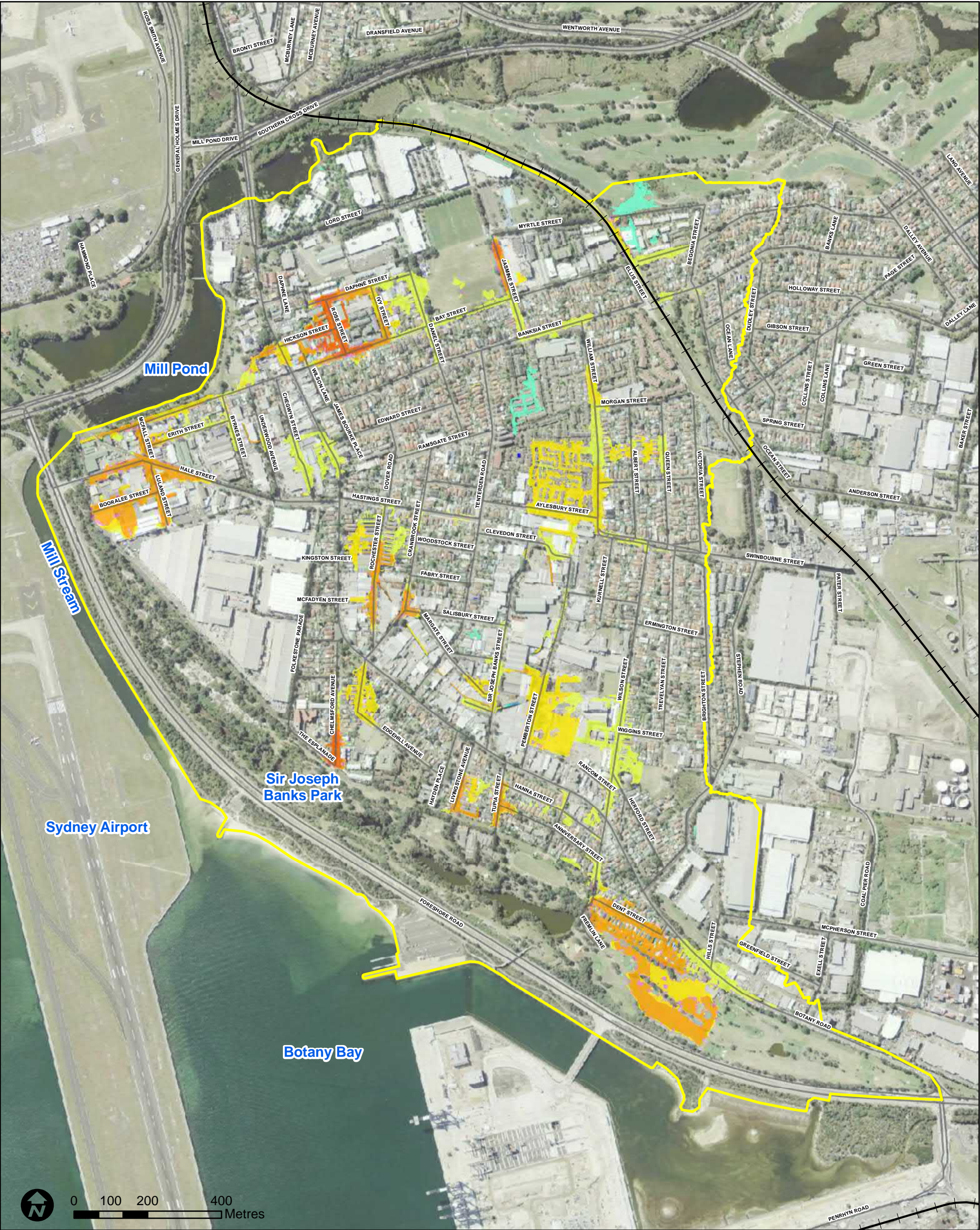
Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Peak flood level difference between present study and 2015 flood study for PMF event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure C.4
CHECK	DATE	REV VER
AH	15/04/2020	2 1

Appendix D. Sensitivity Analysis and Climate Change Mapping

- Figure D.1: Sensitivity - change in flood level - adopted ARR2016 blockages 5% AEP event
- Figure D.2: Sensitivity - change in flood level - adopted ARR2016 blockages 1% AEP event
- Figure D.3: Sensitivity - change in flood level - approved works 5% AEP event
- Figure D.4: Sensitivity - change in flood level - approved works 1% AEP event
- Figure D.5: Sensitivity - change in flood level - cumulative development 5% AEP event
- Figure D.6: Sensitivity - change in flood level - cumulative development 1% AEP event
- Figure D.7: Sensitivity - change in flood level - bulkhead removal 5% AEP event
- Figure D.8: Sensitivity - change in flood level - bulkhead removal 1% AEP event
- Figure D.9: Sensitivity - change in flood level – sea level rise in 2050 1% AEP event
- Figure D.10: Sensitivity - change in flood level - sea level rise in 2100 1% AEP event
- Figure D.11: Sensitivity - change in flood level – 10% increase in rainfall from 1% AEP event
- Figure D.12: Sensitivity - change in flood level – 24% increase in rainfall from 1% AEP event



Legend

- Study area
- Rail
- Roads

Change in Flood Levels (m)			
Was wet now dry	-0.1 to -0.05	0.05 to 0.1	
< -0.5	-0.05 to -0.01	0.1 to 0.3	
-0.5 to -0.3	-0.01 to 0.01	0.3 to 0.5	
-0.3 to -0.1	0.01 to 0.05	> 0.5	
		Was dry now wet	

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Sensitivity - change in flood level - adopted blockages 5% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure D.1
CHECK	DATE	REV VER
AH	15/04/2020	1 1



Legend

- New pipes
- Open channels
- Existing stormwater networks
- Study area

Change in Flood Levels (m)

- | | | |
|-----------------|----------------|-----------------|
| Was wet now dry | -0.1 to -0.05 | 0.05 to 0.1 |
| < -0.5 | -0.05 to -0.01 | 0.1 to 0.3 |
| -0.5 to -0.3 | -0.01 to 0.01 | 0.3 to 0.5 |
| -0.3 to -0.1 | 0.01 to 0.05 | > 0.5 |
| | | Was dry now wet |

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Sensitivity - Change in Flood Level - Approved Works 5% AEP Event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure D.3
CHECK	DATE	REV VER
AH	15/04/2020	1 1



Legend

- New pipes
- Open channels
- Existing stormwater networks
- Study area

Change in Flood Levels (m)			
Was wet now dry	-0.1 to -0.05	0.05 to 0.1	
< -0.5	-0.05 to -0.01	0.1 to 0.3	
-0.5 to -0.3	-0.01 to 0.01	0.3 to 0.5	
-0.3 to -0.1	0.01 to 0.05	> 0.5	
		Was dry now wet	



Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Sensitivity - Change in Flood Level - Approved Works 1% AEP Event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure D.4
CHECK	DATE	REV VER
AH	15/04/2020	1 1



Legend

- New pipes
- Open channels
- Existing stormwater networks
- Study area

Change in Flood Levels (m)

- | | | |
|-----------------|----------------|-----------------|
| Was wet now dry | -0.1 to -0.05 | 0.05 to 0.1 |
| < -0.5 | -0.05 to -0.01 | 0.1 to 0.3 |
| -0.5 to -0.3 | -0.01 to 0.01 | 0.3 to 0.5 |
| -0.3 to -0.1 | 0.01 to 0.05 | > 0.5 |
| | | Was dry now wet |

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Sensitivity - Change in Flood Level - Cumulative Development 5% AEP Event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure D.5
CHECK	DATE	REV VER
AH	15/04/2020	1 1



Legend

- Council's pipes

Open channels

Existing stormwater networks

Study area
- Change in Flood Levels (m)

Was wet now dry

< -0.5

-0.5 to -0.3

-0.3 to -0.1

-0.1 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.1

0.1 to 0.3

0.3 to 0.5

> 0.5

Was dry now wet



Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Sensitivity - Change in Flood Level - Cumulative Development 1% AEP Event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure D.6
CHECK	DATE	REV VER
AH	15/04/2020	1 1



Legend

- Study Area
- Sensitivity
- Bulkheads removed

Change in Flood Levels (m)			
Was wet now dry	-0.1 to -0.05	0.05 to 0.1	
< -0.5	-0.05 to -0.01	0.1 to 0.3	
-0.5 to -0.3	-0.01 to 0.01	0.3 to 0.5	
-0.3 to -0.1	0.01 to 0.05	> 0.5	
		Was dry now wet	



Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Sensitivity - Change in Flood Level - Bulkhead Removal 5% AEP Event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure D.7
CHECK	DATE	REV VER
AH	15/04/2020	1 1



Legend

Study Area

Proposed Mitigation

Bulkheads removed

Change in Flood Levels (m)

Was wet now dry

< -0.5

-0.5 to -0.3

-0.3 to -0.1

-0.1 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.1

0.1 to 0.3

0.3 to 0.5

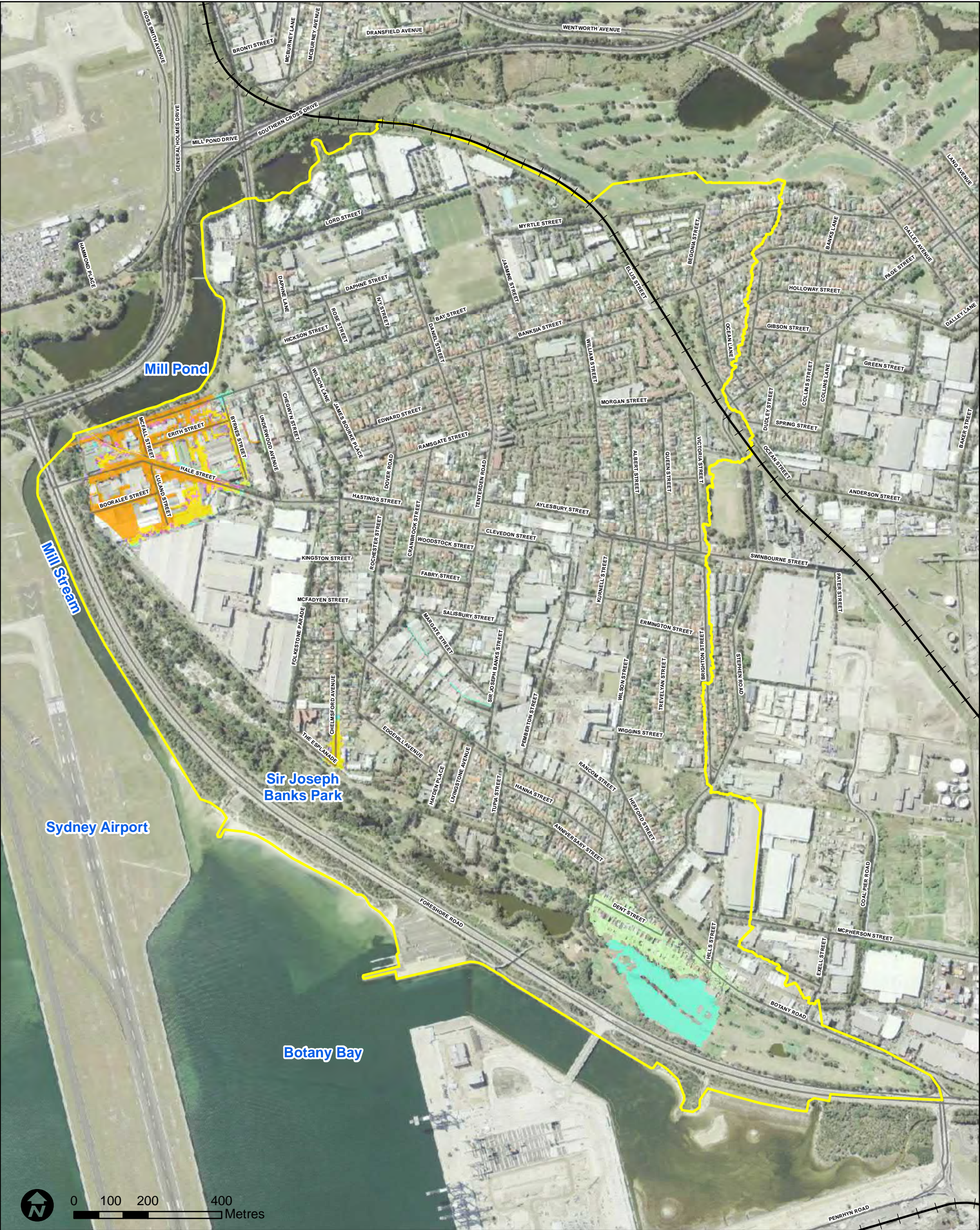
> 0.5

Was dry now wet

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Sensitivity - Change in Flood Level - Bulkhead Removal 1% AEP Event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure D.8
CHECK	DATE	REV VER
AH	15/04/2020	1 1



Legend

- Rail
- Study area
- Roads

Change in Flood Levels (m)

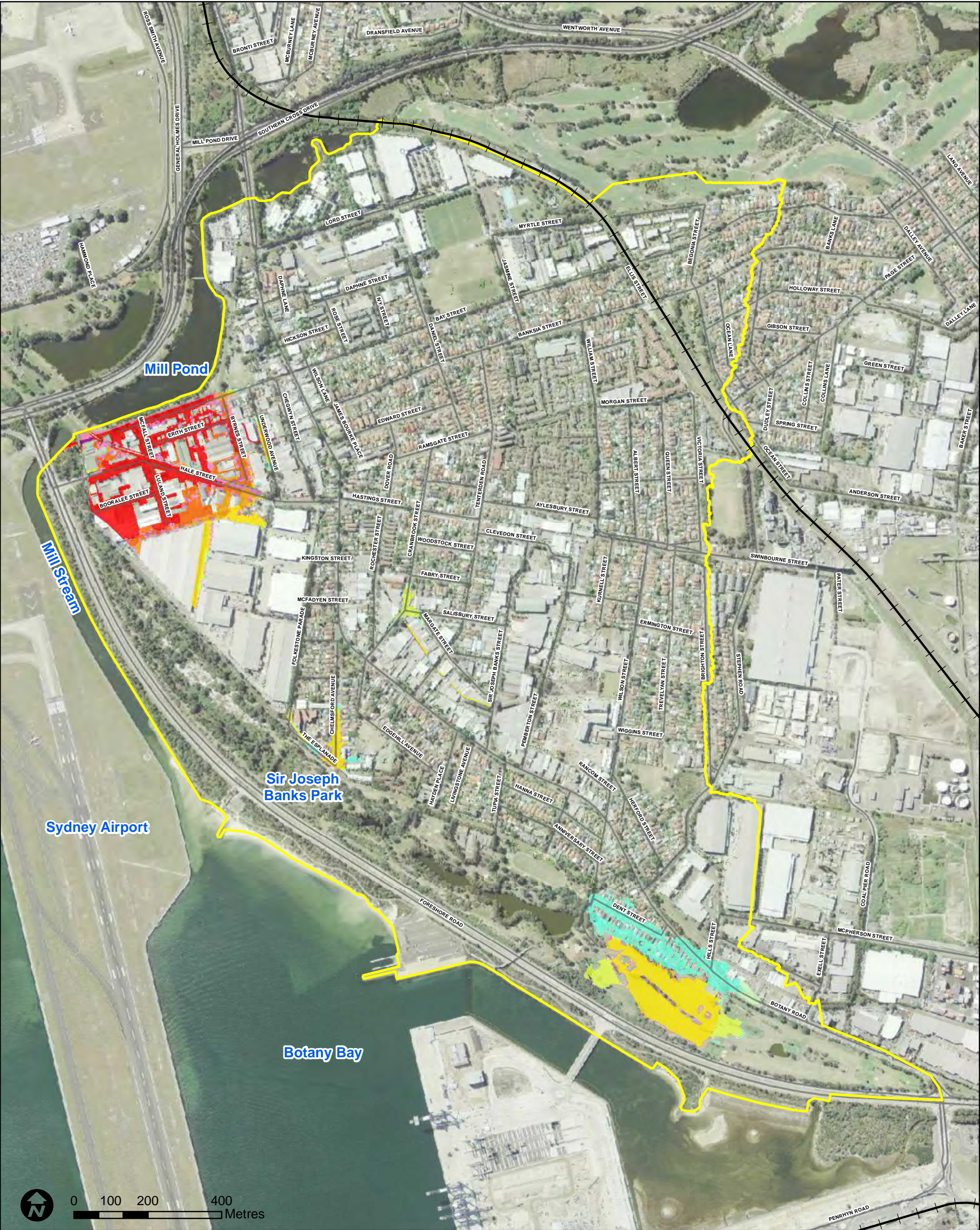
- | | |
|-----------------|--------------|
| < 0.01 | 0.30 to 0.50 |
| 0.01 to 0.05 | 0.50 to 0.70 |
| 0.05 to 0.10 | 0.70 to 1.0 |
| 0.10 to 0.30 | >1.0 |
| Was dry now wet | |

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Impacts of Sea Level Rise in Year 2050 - 1% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure D.9
CHECK	DATE	REV VER
AH	16/07/2020	1 1



Legend

- Rail
- Study area
- Roads

Change in Flood Levels (m)

- | | |
|-----------------|-----------------|
| Was wet now dry | 0.30 to 0.50 |
| < 0.01 | 0.50 to 0.70 |
| 0.01 to 0.05 | 0.70 to 1.0 |
| 0.05 to 0.10 | >1.0 |
| 0.10 to 0.30 | Was dry now wet |

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Impacts of Sea Level Rise in Year 2100 - 1% AEP event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure D.10
CHECK	DATE	REV VER
AH	16/07/2020	1 1



Legend

- Rail
- Study area
- Roads

Change in Flood Levels (m)

< 0.01	0.30 to 0.50
0.01 to 0.05	0.50 to 0.70
0.05 to 0.10	0.70 to 1.0
0.10 to 0.30	>1.0
Was dry now wet	



Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,171	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Climate change - 10% increase in rainfall from 1%AEP Event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure D.11
CHECK	DATE	REV VER
AH	22/09/2020	1 1



Legend

- Rail
- Study area
- Roads

Change in Flood Levels (m)

< 0.01	0.30 to 0.50
0.01 to 0.05	0.50 to 0.70
0.05 to 0.10	0.70 to 1.0
0.10 to 0.30	> 1.0
Was dry now wet	



Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:10,171	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Climate change - 24% increase in rainfall from 1%AEP Event	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure D.12
CHECK	DATE	REV VER
AH	22/09/2020	1 1

Appendix E. Other Mitigation Measures

The mitigation options discussed in Section 10 of this report were found to have merit in terms of hydraulic performance and were assessed in further detail including cost estimation and economic/multi-criteria feasibility. A number of additional options were initially assessed but were found to provide minimal flooding benefits or were not favourable in terms of other factors and were not shortlisted for detailed assessment. These additional options are discussed in this appendix including hydraulic assessment of the options.

E.1 Option 2 - Detention basin at Booralee Park

About 10 properties located on the western side of the Daniel Street are impacted in the 5% AEP flood event. It is proposed to utilise Booralee Park as a detention basin by a range of modifications including diversion of flows to the park, construction of embankments and lowering of the park surface, refer to Figure 10.3 in the main body of the report. A detention basin would be expected to hold flood waters originating from eastern and southern sides of the park resulting in improved flooding to downstream properties.

Three sub-options were assessed. The nature of works are described below:

- Option 2a: Removal of informal embankment along western side of Jasmine Street, to increase overland flows onto the park.
- Option 2b: As per Option 2a plus construction of a 2m high embankment along the western and southern sides of the park.
- Option 2c: As per Option 2a plus lowering the base of the park by 1m to form a detention basin, with a 300mm low flow pipe outlet connection to the existing drainage network.

Assessment of Options 2a, 2b and 2c are provided in Section 10.1.2.1 in the main body of this report. The findings of the assessment and evaluation are summarised below:

- Option 2c provides flooding improvements to a significant number of properties, and has been selected for further evaluation including costings and multi-criteria analysis.
- Option 2b provides flooding improvements, however, its use of an embankment to form a basin is not favourable to Council and stakeholders from an urban design and landscaping perspective, and hence is not a preferred option and is not considered further in this study. Its ranking as the preferred option may change pending the findings of site contamination investigations, to be undertaken during future feasibility study for the basin option. The presence of soil contamination may render the currently preferred Option 2c unfeasible or unfavourable and elevate the preference of Option 2b
- Option 2a provides minimal improvement in above-floor flooding and flood damages, and hence is excluded from further consideration.

In summary, Option 2c is currently the preferred basin option at Booralee Park and it is recommended that a subsequent feasibility study be undertaken, including site contamination investigations, to confirm the feasibility of Option 2c.

Mapping of the change in 5% and 1% AEP flood levels are provided in Figure 10.4 and Figure 10.5, respectively, in the main body of the report for the preferred Option 2c. The change in flood levels in the 1% AEP event are presented in Figure E.1 and Figure E.2 for Options 2a and 2b, respectively, on the following pages.



Legend

- Study area
- Existing stormwater networks
- Open channels
- Proposed Mitigation
- Embankment removal

Change in Flood Levels (m)			
Was wet now dry	-0.1 to -0.05	0.05 to 0.1	
< -0.5	-0.05 to -0.01	0.1 to 0.3	
-0.5 to -0.3	-0.01 to 0.01	0.3 to 0.5	
-0.3 to -0.1	0.01 to 0.05	> 0.5	
		Was dry now wet	

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:4,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Option 2a - Detention Basin - 1% AEP Change in Flood Level	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure E.1
CHECK	DATE	REV VER
AH	22/06/2020	1 1



Legend

- Study area
- Existing stormwater networks
- Open channels
- Proposed Mitigation
- Embankment removal
- New embankment

Change in Flood Levels (m)

- | | | |
|-----------------|----------------|-----------------|
| Was wet now dry | -0.1 to -0.05 | 0.05 to 0.1 |
| < -0.5 | -0.05 to -0.01 | 0.1 to 0.3 |
| -0.5 to -0.3 | -0.01 to 0.01 | 0.3 to 0.5 |
| -0.3 to -0.1 | 0.01 to 0.05 | > 0.5 |
| | | Was dry now wet |

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE 1:4,000 A3

SHEET 1 of 1 GDA 1994 MGA Zone 56

TITLE **Option 2b - Detention Basin - 1% AEP Change in Flood Level**

PROJECT Botany Bay Foreshore Beach FRMS

CLIENT Bayside Council

DRAWN	PROJECT #	MAP #	REV	VER
PK	IA190100	Figure E.2	1	1

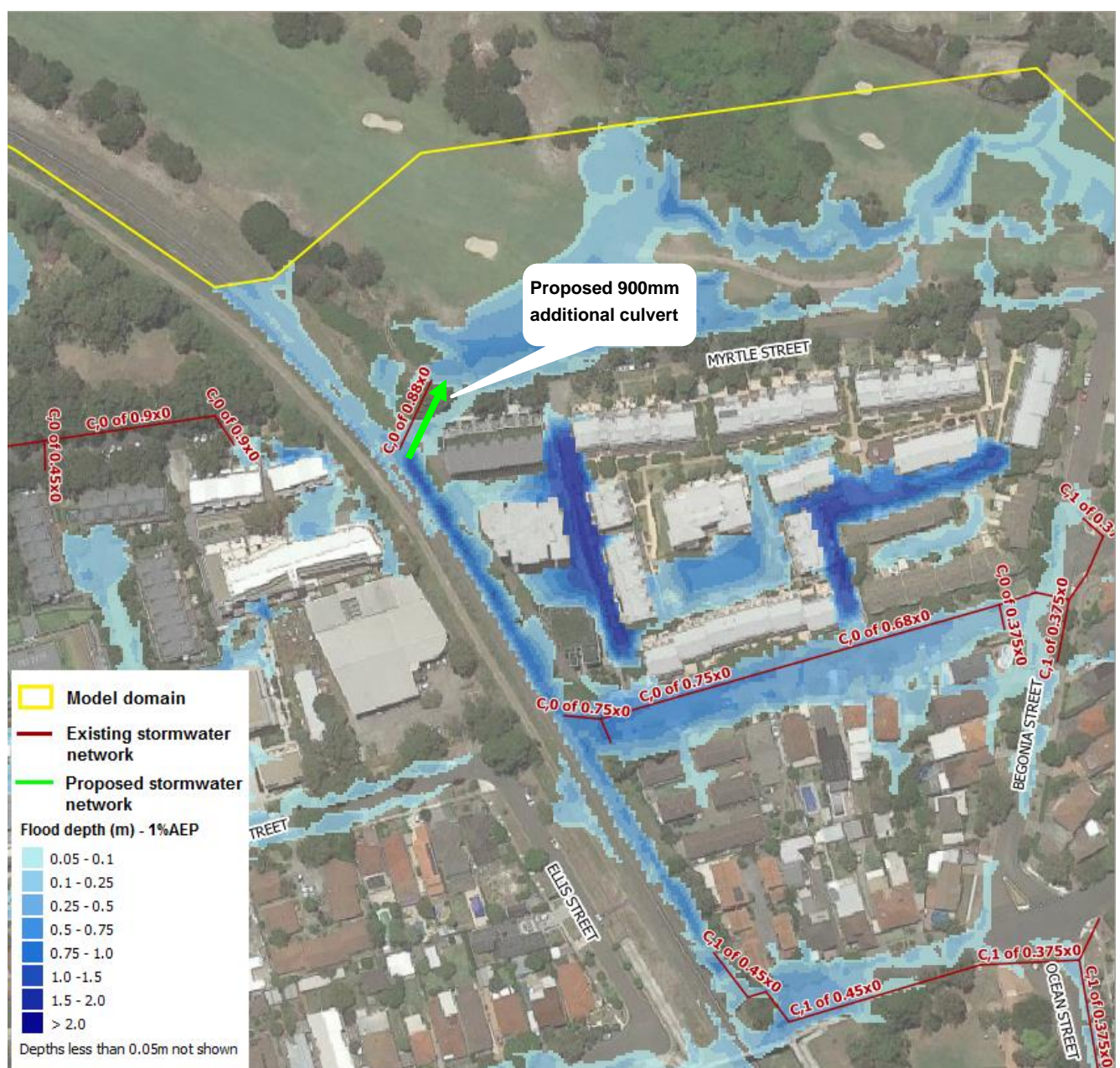
CHECK	DATE
AH	23/06/2020

E.2 Option 3 – Culvert augmentation at North of Railway near Myrtle Street

The existing culvert between the railway and Myrtle Street does not have adequate capacity to drain runoff generated from the upstream catchment area. Myrtle Street is raised which prevents free drainage of the area. A number of properties located between Myrtle Street and Bay Street are impacted by flooding.

An additional 900mm diameter pipe culvert is proposed at the Myrtle Street (Figure E.3) to address the existing flooding issue for the area. The proposed culvert will run parallel to the existing 900mm pipe. The proposed drainage augmentation is expected to reduce flooding impacts to properties located at north of the railway between Myrtle Street and Bay Street.

Figure E.3 Option 3 – New culvert north of Railway near Myrtle Street



Constraints assessment

The availability of the space for the proposed pipe and working next to the rail track are potential issues. Also, draining more overland flow into the golf course could impact on the golf course. Consultation with the golf course and land owner (Sydney Water) would be required.

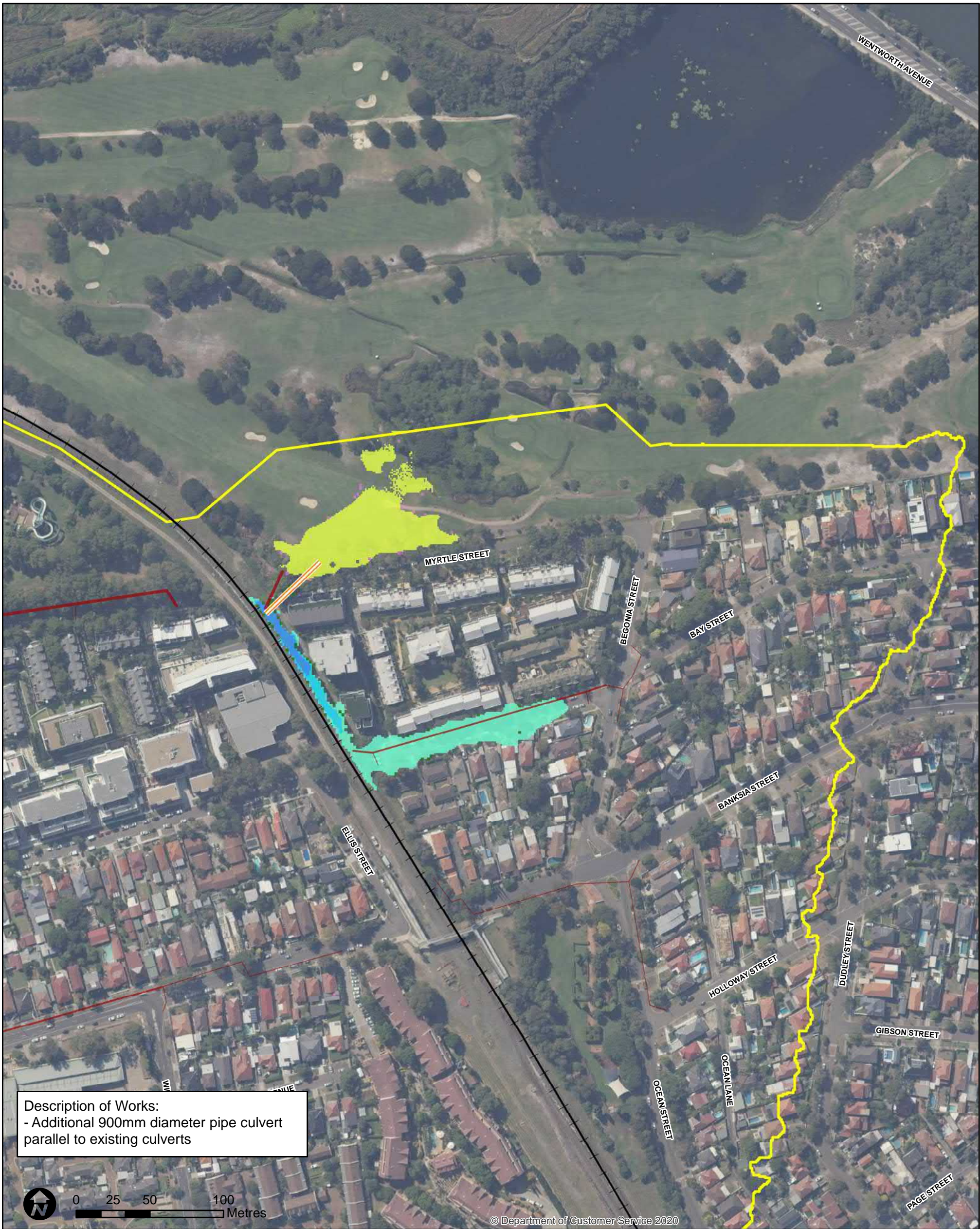
Hydraulic performance

Installation of an additional 900mm diameter pipe in this location to increase drainage capacity provides reductions of up to 0.2m in the 5% and 1% AEP flood events, although these improvements are limited to along the railway line and in Bay Street.

There are no reductions in the numbers of properties affected by flooding in the 1% AEP event. One residential property becomes above-floor flooded in the 5% AEP event. Refer to Figure E.4 and Figure E.5 for mapping of changes to flood levels in the 5% and 1% AEP events, respectively.

Preliminary evaluation

Option 3 provides minimal to no improvement in above-floor flooding and flood damages, and hence is excluded from further consideration.



Legend

- Study area

Existing stormwater networks

Proposed Mitigation

Pipe culvert
- Change in Flood Levels (m)

Was wet now dry

< -0.5

-0.5 to -0.3

-0.3 to -0.1

-0.1 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.1

0.1 to 0.3

0.3 to 0.5

> 0.5

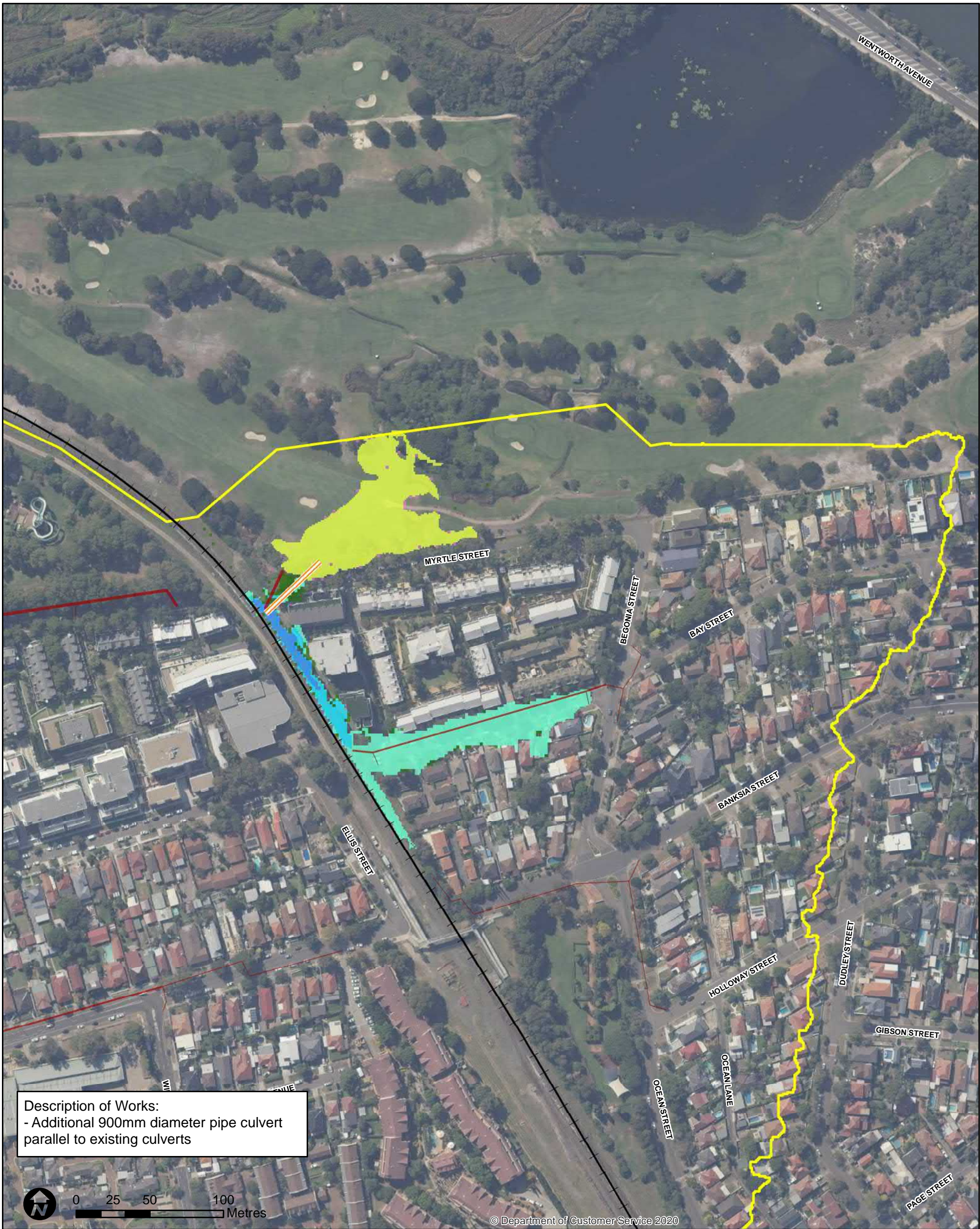
Was dry now wet



Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:2,500	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Option 3 - Drainage Augmentation - 5% AEP Change in Flood Level	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure E.4
CHECK	DATE	REV VER
AH	22/06/2020	1 1



Legend

- Study area
- Existing stormwater networks
- Proposed Mitigation
- Pipe culvert
- Change in Flood Levels (m)
- Was wet now dry
- < -0.5
- 0.5 to -0.3
- 0.3 to -0.1
- 0.1 to -0.05
- 0.05 to -0.01
- 0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.1
- 0.1 to 0.3
- 0.3 to 0.5
- > 0.5
- Was dry now wet

JACOBS

Data Sources: Bayside Council

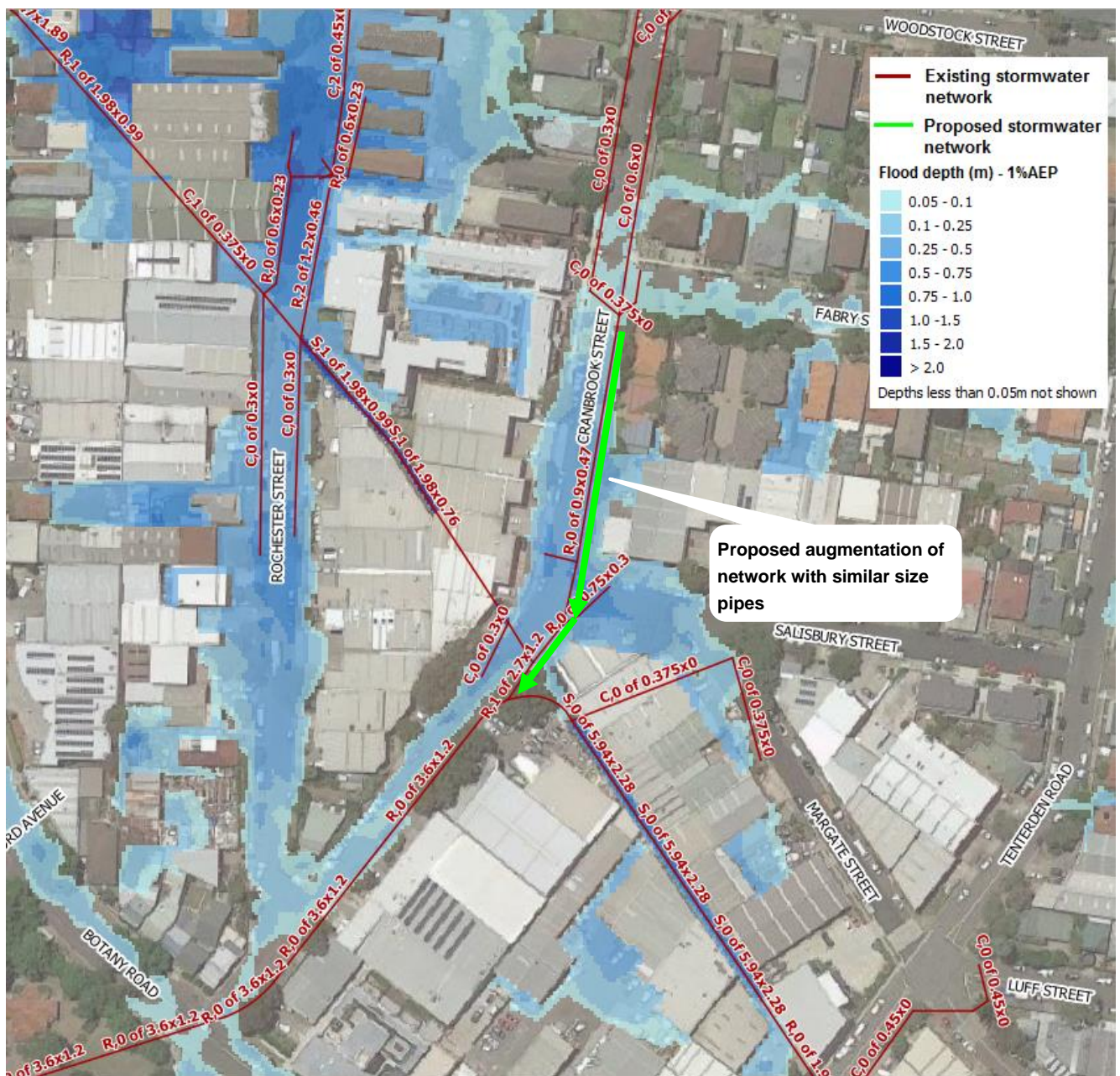
LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:2,500	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Option 3 - Drainage Augmentation - 1% AEP Change in Flood Level	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure E.5
CHECK	DATE	REV VER
AH	22/06/2020	1 1

E.3 Option 5 – Additional pipes near junction of Salisbury Street and Cranbrook Street

It is proposed to duplicate a branch of the stormwater network on Cranbrook Street as shown in Figure E.6. Existing pipes upstream of the rectangular culvert (3.6m x 1.2m) on Cranbrook Street have limited capacities and result in flood impacts on the surrounding properties. The existing 3.6m x 1.2m rectangular culvert located downstream of Cranbrook Street runs under capacity. Therefore, the proposed works are expected to reduce flood impacts to properties on Cranbrook Street and convey more flood waters to the downstream drainage network.

Figure E.6 Option 5 – Drainage duplication near junction of Salisbury Street and Cranbrook Street



Constraints assessment

Availability of space for the proposed stormwater pipes is a potential issue. Proposed pipe sizes need to consider potential downstream impacts.

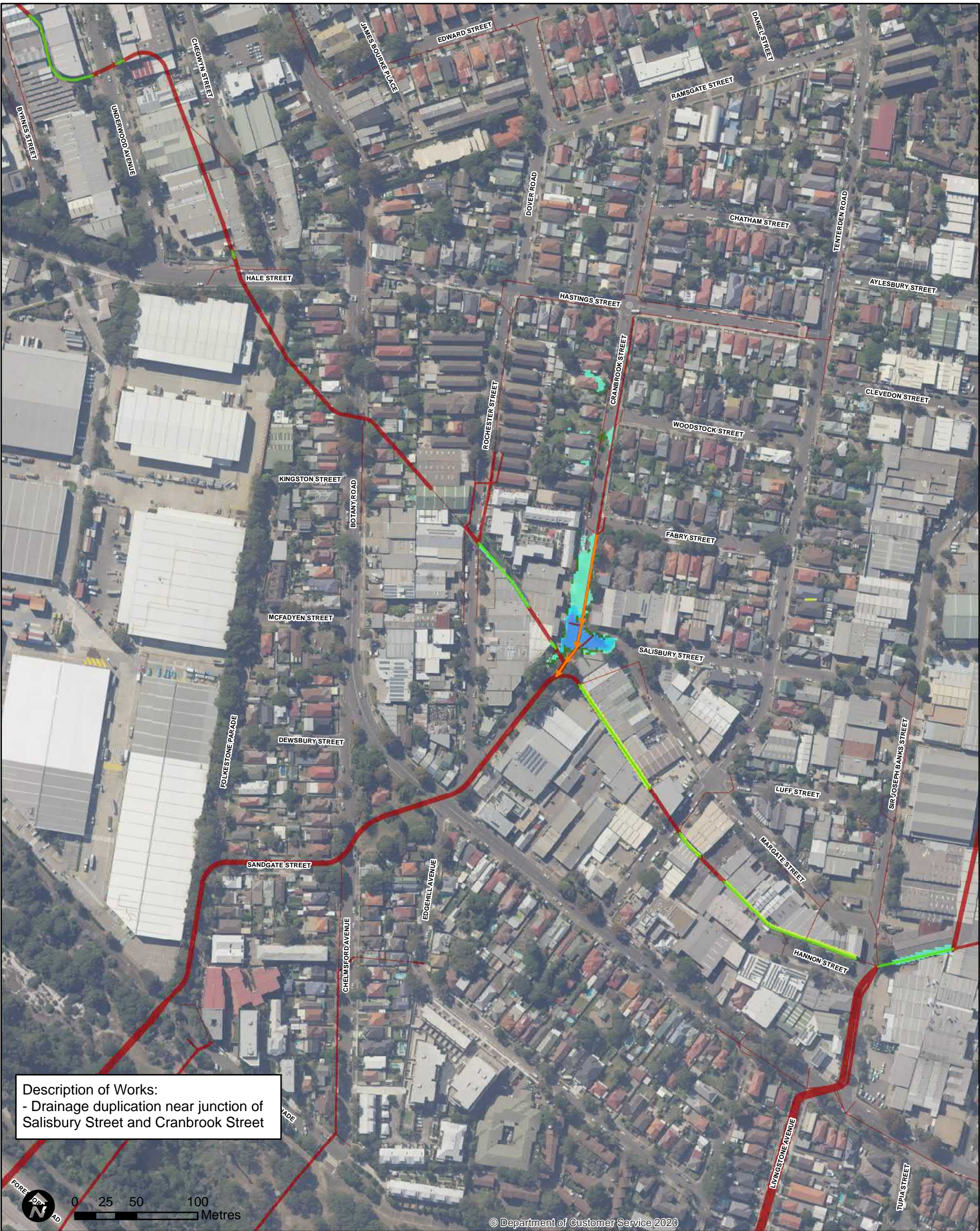
Hydraulic performance

Option 5 provides improvements in flood levels of up to 0.11m in the 5% AEP event and 0.13m in the 1% AEP event in Cranbrook Street and Salisbury Street. Additionally, there are improvements in flood levels of 0.02m in Rochester Street in the 1% AEP event. Refer to Figure E.7 and Figure E.8 for the 5% and 1% AEP change in flood levels, respectively.

Above-floor flooding at buildings is reduced by one residential property in the 1% AEP event and three residential properties in the 5% AEP event.

Preliminary evaluation

Option 5 provides minimal improvement in above-floor flooding and flood damages, and hence is excluded from further consideration.



Legend

- Study area
- Existing stormwater networks
- Open channels
- Proposed Mitigation
- New stormwater pipes

Change in Flood Levels (m)

- | | | |
|-----------------|----------------|-----------------|
| Was wet now dry | -0.1 to -0.05 | 0.05 to 0.1 |
| < -0.5 | -0.05 to -0.01 | 0.1 to 0.3 |
| -0.5 to -0.3 | -0.01 to 0.01 | 0.3 to 0.5 |
| -0.3 to -0.1 | 0.01 to 0.05 | > 0.5 |
| | | Was dry now wet |

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE 1:3,000 A3

SHEET 1 of 1 GDA 1994 MGA Zone 56

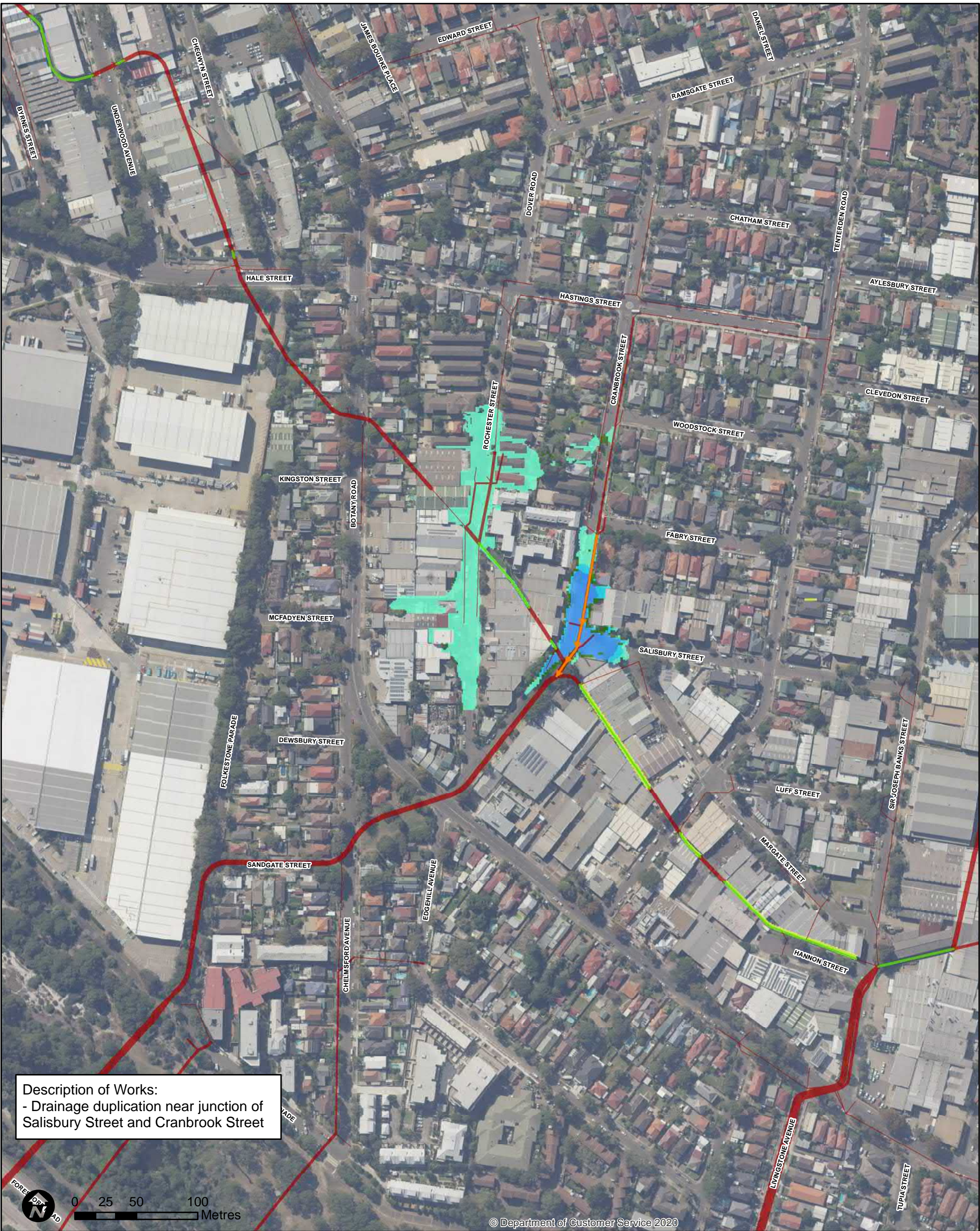
TITLE Option 5 - Drainage Augmentation - 5% AEP Change in Flood Level

PROJECT Botany Bay Foreshore Beach FRMS

CLIENT Bayside Council

DRAWN PK PROJECT # IA190100 MAP # Figure E.7 REV VER 1 1

CHECK AH DATE 22/06/2020



Legend

- Study area
- Existing stormwater networks
- Open channels
- Proposed Mitigation
- New storm water pipes

Change in Flood Levels (m)			
Was wet now dry	-0.1 to -0.05	0.05 to 0.1	
< -0.5	-0.05 to -0.01	0.1 to 0.3	
-0.5 to -0.3	-0.01 to 0.01	0.3 to 0.5	
-0.3 to -0.1	0.01 to 0.05	> 0.5	
		Was dry now wet	

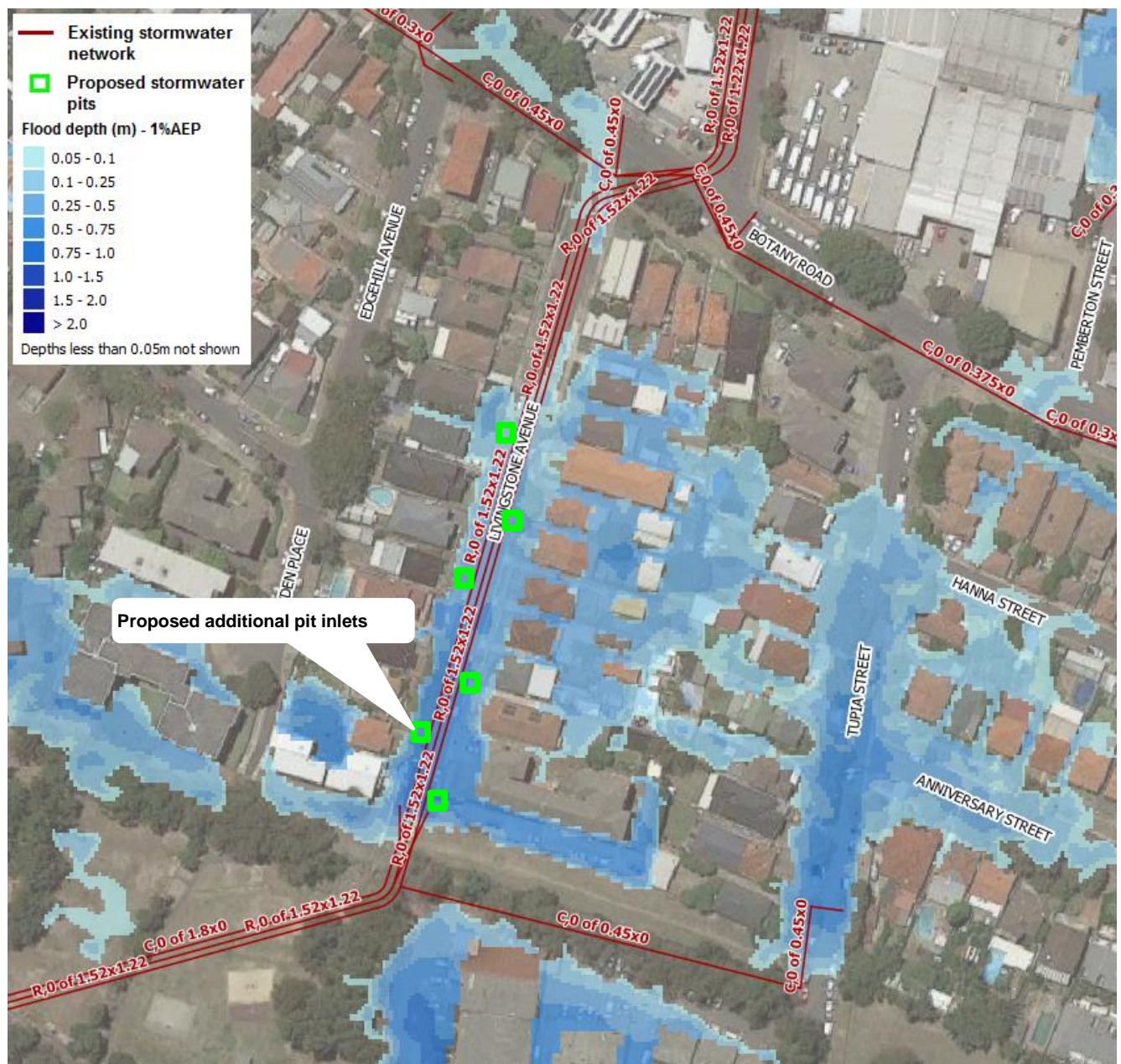
JACOBS

Data Sources: Bayside Council
LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:3,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Option 5 - Drainage Augmentation - 1% AEP Change in Flood Level	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure E.8
CHECK	DATE	REV VER
AH	22/06/2020	1 1

Flooding in this area occurs due to drainage low points forming ponding areas in Livingstone Avenue and Tupia Street, with depths of flooding over 0.5m in the 1% AEP event. A number of properties are affected by flooding around the Livingstone Avenue and Tupia Street.

Figure E.9 Option 6 – New pits along Livingstone Avenue



Constraints assessment

The proposed pits may increase flows in the downstream drainage network, which may result in reduced drainage and increased flood levels elsewhere. Removal of existing mature trees is likely to be required for laying new pipes and may raise environmental and community issues.

Hydraulic performance

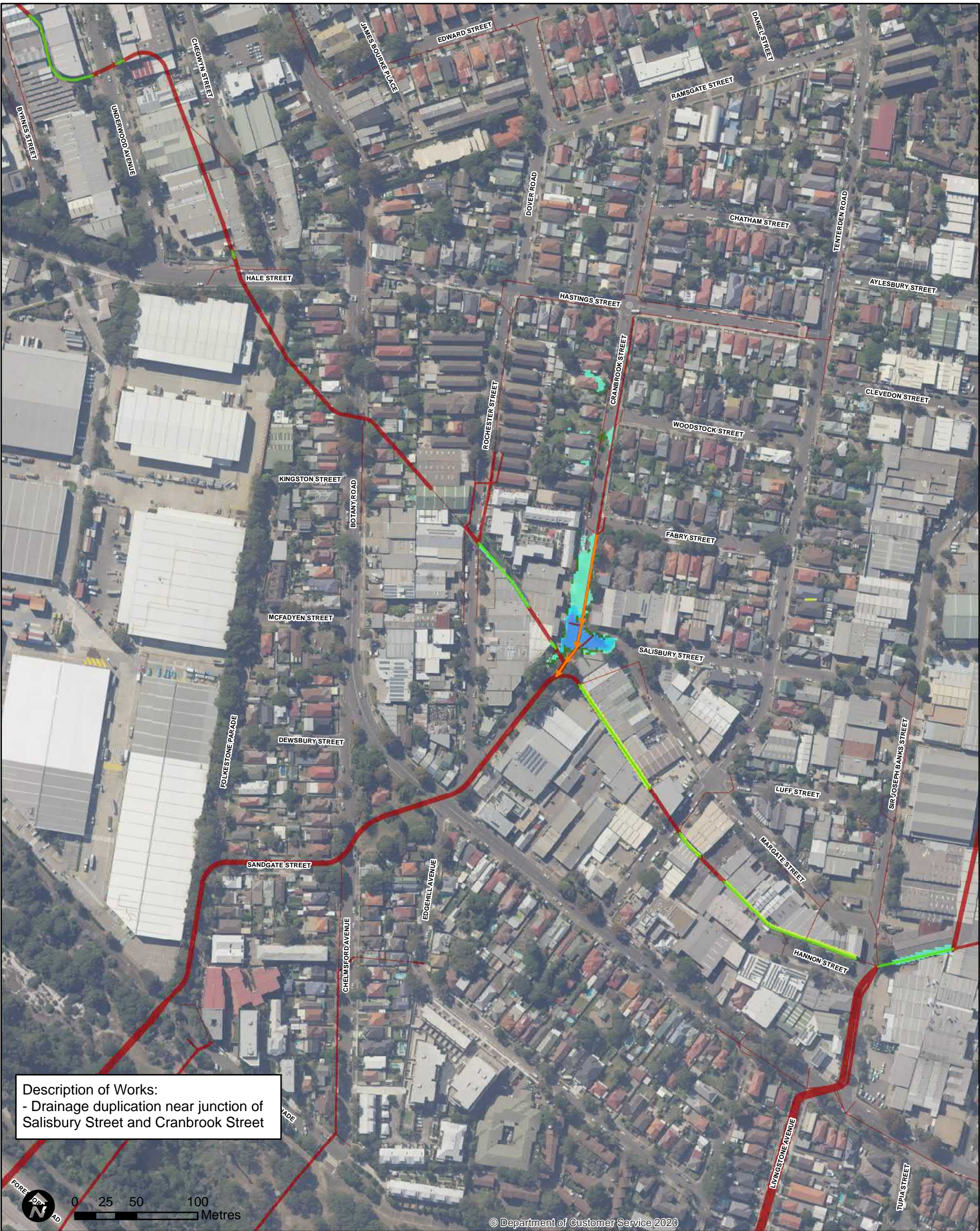
Option 6 results in significant reductions in flood levels of 0.33m in the 5% AEP and 0.4m in the 1% AEP events in Livingstone Avenue. The option also results in increases in flood levels of up to 0.05m in the 5% AEP event and 0.03m in the 1% AEP event, in Rochester Street, Cranbrook Street and Salisbury Street. Refer to Figure E.10 and Figure E.11 for mapping of changes to flood levels in the 5% and 1% AEP events, respectively.

Above-floor flooding at buildings is reduced by three residential properties in the 1% AEP event and one residential property in the 5% AEP event. One commercial property experiences new above-floor flooding in the 1% AEP event and one residential property in the 5% AEP event, as a result of this option.

Although the drainage upgrades are in the Livingstone Avenue area, the flood impact mapping shows that there are negative flood impacts in the vicinity of Rochester Street, Cranbrook Street and Salisbury Street. The increased pit inflows increase flows and water levels in the main trunk drainage open channel at key times during the flood event, which in turn reduces the drainage capacity and outflow from the Rochester Street to Salisbury Street ponding areas.

Preliminary evaluation

Option 6 provides minimal improvement in above-floor flooding and flood damages, and hence is excluded from further consideration.



Legend

- Study area
- Existing stormwater networks
- Open channels
- Proposed Mitigation
- New stormwater pipes

Change in Flood Levels (m)

- | | | |
|-----------------|----------------|-----------------|
| Was wet now dry | -0.1 to -0.05 | 0.05 to 0.1 |
| < -0.5 | -0.05 to -0.01 | 0.1 to 0.3 |
| -0.5 to -0.3 | -0.01 to 0.01 | 0.3 to 0.5 |
| -0.3 to -0.1 | 0.01 to 0.05 | > 0.5 |
| | | Was dry now wet |

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE 1:3,000 A3

SHEET 1 of 1 GDA 1994 MGA Zone 56

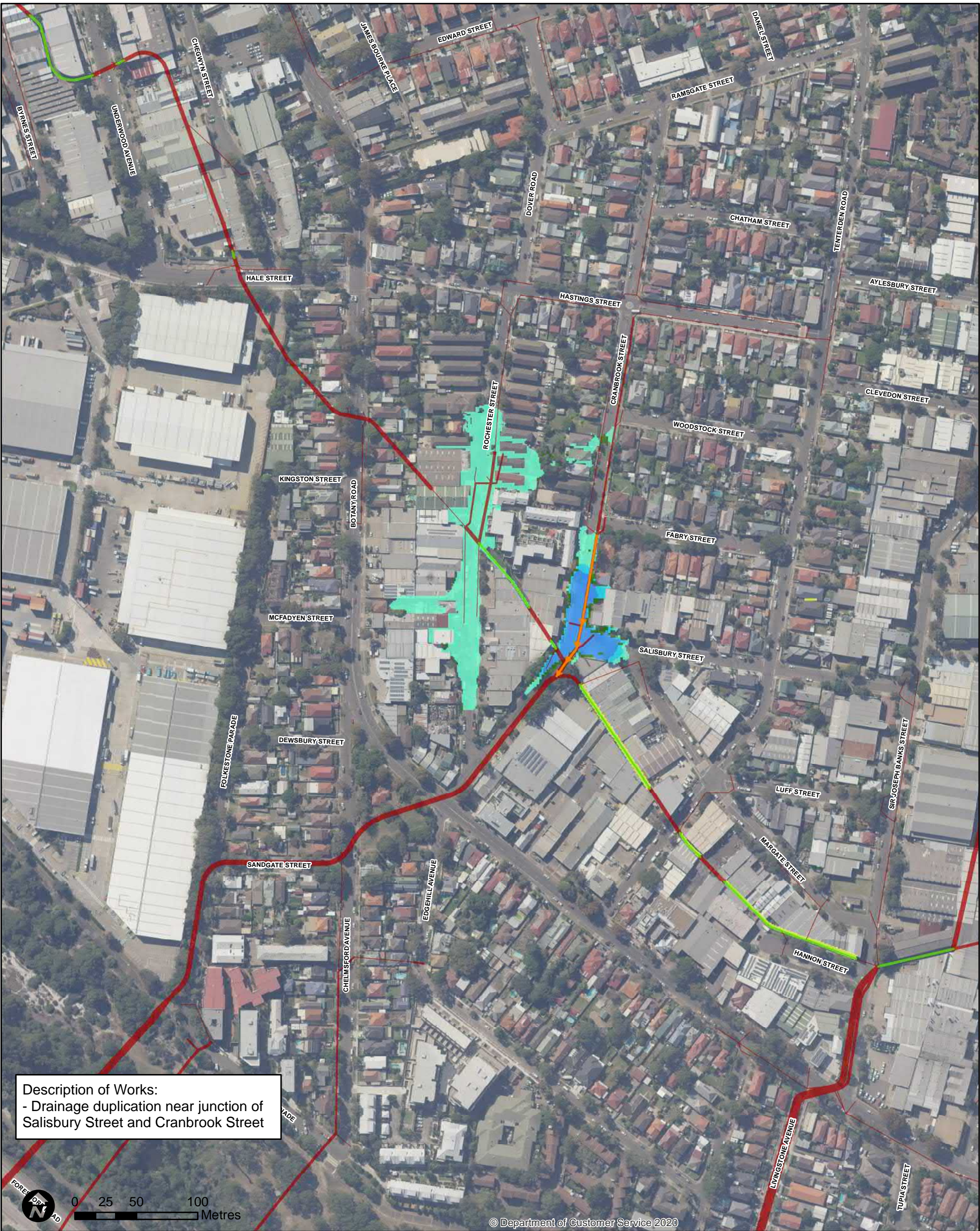
TITLE Option 5 - Drainage Augmentation - 5% AEP Change in Flood Level

PROJECT Botany Bay Foreshore Beach FRMS

CLIENT Bayside Council

DRAWN PK PROJECT # IA190100 MAP # Figure E.7 REV VER 1 1

CHECK AH DATE 22/06/2020



Legend

- Study area
 - Existing stormwater networks
 - Open channels
 - Proposed Mitigation
 - New storm water pipes
- Change in Flood Levels (m)
- | | | |
|-----------------|----------------|-----------------|
| Was wet now dry | -0.1 to -0.05 | 0.05 to 0.1 |
| < -0.5 | -0.05 to -0.01 | 0.1 to 0.3 |
| -0.5 to -0.3 | -0.01 to 0.01 | 0.3 to 0.5 |
| -0.3 to -0.1 | 0.01 to 0.05 | > 0.5 |
| | | Was dry now wet |

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE 1:3,000 A3

SHEET 1 of 1 GDA 1994 MGA Zone 56

TITLE **Option 5 - Drainage Augmentation - 1% AEP Change in Flood Level**

PROJECT Botany Bay Foreshore Beach FRMS

CLIENT Bayside Council

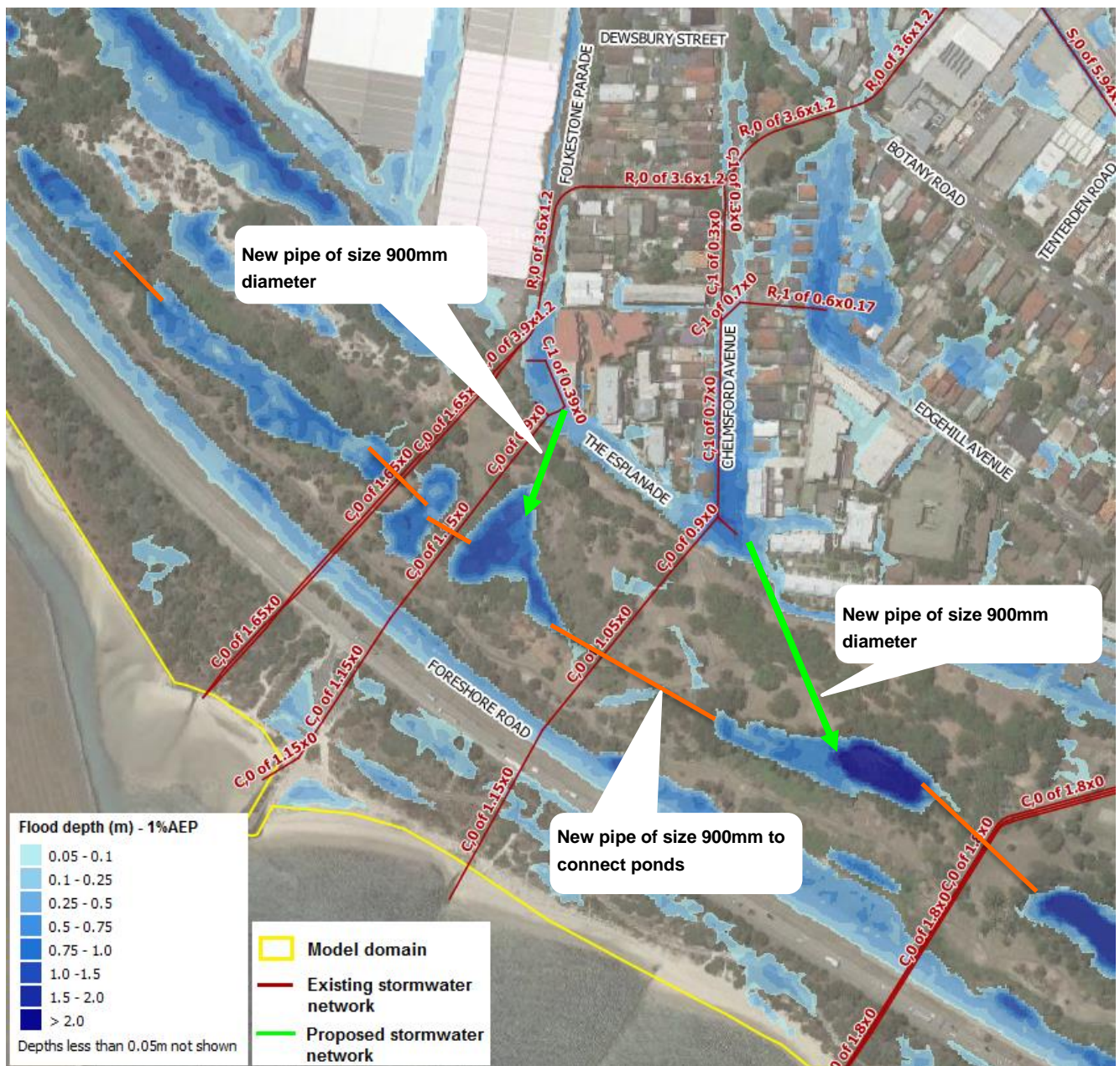
DRAWN PK PROJECT # IA190100 MAP # REV VER

CHECK AH DATE 22/06/2020 **Figure E.8** 1 1

E.5 Option 10 – Addition of pipes across The Esplanade to Sir Joseph Banks Park

Due to the hilly land in Sir Joseph Banks Park and limited capacity of the existing pipes, a number of properties are affected around the Chelmsford Avenue and Folkestone Parade area. Therefore, additional 900mm pipes are proposed as shown in Figure E.12 which will collect the water from flood-prone areas around The Esplanade and discharge into the low-lying wetland areas in Sir Joseph Banks Park. Contouring of the ground levels between individual ponds and wetlands is also proposed to hydraulically link each pond, providing improved drainage outlet tailwater conditions.

Figure E.12 Option 10 – Additional stormwater pipes across The Esplanade



Constraints assessment

There is minimal fall in ground elevation of about 1m between The Esplanade and likely discharge points in Sir Joseph Banks Park. Exceedingly flat pipe grades and minimal pipe cover are likely issues.

Availability of space for the proposed pipes in The Esplanade and Sir Joseph Banks Park are possible issues, including potential clashes with existing utilities.

There may also be environmental issues with discharge of stormwater into the wetlands in Sir Joseph Banks Park. A review of the environmental significance of the wetlands and presence of any environmental protections needs to be conducted.

Hydraulic performance

Option 10 results in reductions in flood levels of 0.25m in the 5% AEP and 0.3m in the 1% AEP events on the floodplain in Chelmsford Avenue. There are minor increases of 0.1m in flood levels within Sir Joseph Banks Park, which are considered tolerable in this open space. Refer to Figure E.13 and Figure E.14 for mapping of changes to flood levels in the 5% and 1% AEP events, respectively.

Above-floor flooding at buildings is reduced by three residential properties in the 1% AEP event. One residential property experiences new above-floor flooding in the 5% AEP event, as a result of this option.

Preliminary evaluation

Option 10 provides minimal improvement in above-floor flooding and flood damages, and hence is excluded from further consideration.



Legend

- Study area
- Existing stormwater networks
- Open channels
- Proposed Mitigation
- New stormwater pipes
- Interconnecting pipes

Change in Flood Levels (m)

- Was wet now dry
- < -0.5
- 0.5 to -0.3
- 0.3 to -0.1
- 0.1 to -0.05
- 0.05 to -0.01
- 0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.1
- 0.1 to 0.3
- 0.3 to 0.5
- > 0.5
- Was dry now wet

JACOBS

Data Sources: Bayside Council

LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:5,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Option 10 - Drainage Augmentation - 5% AEP Change in Flood Level	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure E.13
CHECK	DATE	REV VER
AH	22/06/2020	1 1



Legend

- Study area
- Existing stormwater networks
- Open channels
- Proposed Mitigation
 - New stormwater pipes
 - Interconnecting pipes

Change in Flood Levels (m)			
Was wet now dry	-0.1 to -0.05	0.05 to 0.1	
< -0.5	-0.05 to -0.01	0.1 to 0.3	
-0.5 to -0.3	-0.01 to 0.01	0.3 to 0.5	
-0.3 to -0.1	0.01 to 0.05	> 0.5	
		Was dry now wet	

JACOBS

Data Sources: Bayside Council
LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:5,000	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Option 10 - Drainage Augmentation - 1% AEP Change in Flood Level	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure E.14
CHECK	DATE	REV VER
AH	22/06/2020	1 1

E.6 Option 12 – Augmented drainage line at Hale Street and Booralee Street

A number of industrial properties located around the Luland Street are impacted by flooding. Therefore, additional stormwater pipes are proposed to drain floodwater from the affected area as shown in Figure E.15. The proposed stormwater pipes will run parallel to the existing network and will discharge into Mill Stream.

The proposed works would provide additional drainage capacity to the existing stormwater network and alleviate flood impacts to commercial properties. However, as flood behaviour in this area is likely to be influenced by tide and sea level rise, improvement of the drainage conditions would be less effective and likely to be limited to times when tailwater levels are not elevated.

Figure E.15 Option 12 – Additional drainage networks at Hale Street and Booralee Street



Constraints assessment

Works would need to be conducted under Foreshore Drive which is a major thoroughfare for the area, and there are likely to be a number of significant utilities in the road corridor with potential clashes. Construction methods such as microtunnelling may be restricted by low elevations and high groundwater levels.

Possible refinements to this option could include discharge to Mill Stream upstream of Foreshore Road to avoid crossing of this road. The hydraulic performance of this refined options may be slightly reduced with potentially higher tailwater levels due to catchment flooding in Mill Stream and existing afflux at Foreshore Road crossing of Mill Stream.

Availability of space for the proposed stormwater pipes may be an issue in the local roads. There may be environmental issues to discharge stormwater directly into Mill Stream such as scouring and disturbance of bed sediment.

Hydraulic performance

Option 12 results in reductions in flood levels of 0.08m in the 5% AEP and 0.04m in the 1% AEP events around Hale Street, Booralee Street and Luland Street. Refer to Figure E.16 and Figure E.17 for mapping of changes to flood levels in the 5% and 1% AEP events, respectively.

Above-floor flooding at buildings is reduced by 3 residential and industrial properties in the 1% AEP event and 2 residential properties in the 5% AEP event. One residential property experiences new above-floor flooding in the 5% AEP event.

Preliminary evaluation

Option 12 provides minimal improvement in above-floor flooding and flood damages and significant construction difficulty, hence is excluded from further consideration.



Description of Works:
- Augmented drainage line at Hale Street and Booralee Street

Legend

- Study area
- Existing stormwater networks
- Open channels
- Proposed Mitigation
- New stormwater pipes

Change in Flood Levels (m)			
Was wet now dry	-0.1 to -0.05	0.05 to 0.1	
< -0.5	-0.05 to -0.01	0.1 to 0.3	
-0.5 to -0.3	-0.01 to 0.01	0.3 to 0.5	
-0.3 to -0.1	0.01 to 0.05	> 0.5	
		Was dry now wet	

JACOBS

Data Sources: Bayside Council
LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:3,500	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Option 12 - Drainage Augmentation - 5% AEP Change in Flood Level	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure E.16
CHECK	DATE	REV VER
AH	22/06/2020	1 1



Description of Works:
- Augmented drainage line at Hale Street and Booralee Street

Legend

- Study area

Existing stormwater networks

Open channels

Proposed Mitigation

New stormwater pipes
- Change in Flood Levels (m)

Was wet now dry

< -0.5

-0.5 to -0.3

-0.3 to -0.1

-0.1 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.1

0.1 to 0.3

0.3 to 0.5

> 0.5

Was dry now wet

JACOBS

Data Sources: Bayside Council
LIMITATIONS: This mapping is based on data provided by the Bayside Council. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

SCALE	1:3,500	A3
SHEET	1 of 1	GDA 1994 MGA Zone 56
TITLE	Option 12 - Drainage Augmentation - 1% AEP Change in Flood Level	
PROJECT	Botany Bay Foreshore Beach FRMS	
CLIENT	Bayside Council	
DRAWN	PROJECT #	MAP #
PK	IA190100	Figure E.17
CHECK	DATE	REV VER
AH	22/06/2020	1 1

Appendix F. Cost Estimate Summaries

The following assumptions have been made in the cost estimation:

- Contaminated material assumed to be mix materials.
- No allowances for temporary bypass pumping and dewatering.
- Estimate assumes a single lump sum contract and does not allow for staging or division of scope and contracts
- Excludes authorities' fees and charges and excludes any land purchase / lease costs
- No allowance has been included for free issue items
- Allowances for protection/relocation of existing services and consultancy are indicative only
- No allowance for dewatering
- No allowance for underwater construction
- No allowance for protection of groundwater contaminations
- No allowance for excavating or boring through hard rock
- Carting the excavated material within 10km
- Length of traffic and pedestrian management are indicative only

Summaries of the implementation cost of the different mitigation options have been presented in the following tables.

Table F-1: Summary of the implementation cost of the mitigation measure Option 2C- Detention Basin at Booralee Park

Item	Total
Site Preparation	
-Clearing vegetation, and disposal	\$10,000
-Cut down 12nos. tree and cart away	\$12,000
-Excavation for basin, cartage within 10km and 90% compaction	\$432,000
-Safety fencing	\$10,000
Culvert Installation	
-Installation of 1-300mm (40m) and headwall	\$10,000
Play Ground	
-Re-establishment of playground (cricket field)	\$87,000
Service Relocation/Protection	
-Allowance for relocation/protection for existing utilities	\$10,000
Road Construction	
-Road re-construction with foot path (30m)	\$24,000
Sub Total	\$595,000
Other	
Traffic and pedestrian management (10days)	\$20,000
Cost of consultancy (feasibility studies, REF, design)	\$150,000
Contingency (30%)	\$179,000
Contractor's Prelims and Indirect Costs (25%)	\$149,000
Grand Total	\$1,093,000

Proposed works for mitigation Option 2C- Detention Basin at Booralee Park

- Removal of informal embankment along western side of Jasmine Street
- Construction of a 2m high embankment along the western and southern sides of the park
- Lowering the base of the park by 1m to form a detention basin, with a 300mm low flow pipe outlet connection to the existing drainage network

Table F-2: Summary of the implementation cost of the mitigation measure Option 4a- Drainage Augmentation around Bay Street

Item	Total
Site Preparation	
-Demolish existing road pavement and road base	\$443,000
-Excavation in clay in trench (1100m) and cartage within 10km and side protection	\$355,000
-Dispose of demolished mixed materials	\$1,835,000
-Safety fencing	\$30,000
Pipe Installation	
-Installation of 1015m pipes (various sizes)	\$5,277,000
-Installation of new double grate pits (15nos)	\$45,000
-Backflow prevention device (3no)	\$133,000
Service Relocation/Protection	
-Allowance for relocation/protection for existing utilities - (gas pipes, communication networks, sewer pipes, etc)	\$200,000
Road Construction	
-Road re-construction with foot path (1010m)	\$561,000
Sub Total	\$8,879,000
Other	
Traffic and pedestrian management (45days)	\$106,000
Cost of consultancy (feasibility studies, REF, design)	\$300,000
Contingency (30%)	\$2,664,000
Contractor's Prelims and Indirect Costs (25%)	\$2,220,000
Grand Total	\$14,169,000

Proposed works for mitigation Option 4a- Drainage Augmentation around Bay Street

- Augmentation of drainage networks along Ivy Street, Rose Street, Hickson Street, Bay Street and Botany Road
- Size of the proposed pipes will vary between 450mm and 900mm

Table F-3: Summary of the implementation cost of the mitigation measure Option 7a- Drainage Augmentation near Pemberton Street

Item	Total
Site Preparation	
-Demolish existing road pavement and road base	\$118,000
-Excavation in clay in trench (200m) and cartage within 10km and side protection	\$36,000
-Dispose of demolished mixed materials	\$447,000
-Safety fencing	\$15,000
Micro Tunnelling Boring Machine	
-Setup cost	\$7,120,000
Pipe Installation	
-Installation of 240m of pipes (various sizes)	\$93,000
-Installation of 55m of 900mm pipe by micro tunnelling	\$164,000
-Installation of new double grate pits (12nos)	\$36,000
Service Relocation/Protection	
-Allowance for relocation/protection for existing utilities - (gas pipes, communication networks, sewer pipes, etc)	\$50,000
Road Construction	
-Road re-construction with foot path (240m)	\$134,000
Sub Total	\$8,213,000
Other	
Traffic and pedestrian management (14days)	\$33,000
Cost of consultancy (feasibility studies, REF, design)	\$150,000
Contingency (30%)	\$2,464,000
Contractor's Prelims and Indirect Costs (25%)	\$2,054,000
Grand Total	\$12,914,000

Proposed works for mitigation Option 7a- Drainage Augmentation near Pemberton Street

- Drainage duplication near junction of Pemberton Street and Mahroot Street
- Size of the proposed pipe is 900mm
- Micro tunnelling under existing properties

Table F-4: Summary of the implementation cost of the mitigation measure Option 8- Drainage Augmentation in William Street

Item	Total
Site Preparation	
-Demolish existing road pavement and road base	\$44,000
-Excavation in clay in trench (170m) and cartage within 10km and side protection	\$51,000
-Dispose of demolished mixed materials	\$148,000
-Safety fencing	\$5,000
Pipe Installation	
-Installation of 2-600mm pipe (160m)	\$115,000
-Installation of new double grate pits (2nos)	\$9,000
Service Relocation/Protection	
-Allowance for relocation/protection for existing utilities - (gas pipes, communication networks, sewer pipes, etc)	\$50,000
Road Construction	
--Road re-construction with foot path (140m)	\$89,000
Sub Total	\$511,000
Other	
Traffic and pedestrian management (14days)	\$32,900
Cost of consultancy (feasibility studies, REF, design)	\$150,000
Contingency (30%)	\$154,000
Contractor's Prelims and Indirect Costs (25%)	\$128,000
Grand Total	\$975,900

Proposed works for mitigation Option 8- Drainage Augmentation in William Street

- Drainage upgrade at William Street with 2-600mm pipe

Table F-5: Summary of the implementation cost of the mitigation measure Option 11- Drainage Augmentation in William Street and near Pemberton Street and Clevedon Street

Item	Total
Site Preparation	
-Demolish existing road pavement, road base and concrete	\$65,000
-Excavation in clay in trench (300m) and cartage within 10km and side protection	\$76,000
-Dispose of demolished mixed materials	\$301,000
-Safety fencing	\$20,000
Micro Tunnelling Boring Machine	
-Setup cost	\$7,120,000
Pipe Installation	
-Installation of 330m of pipes (various sizes)	\$172,000
-Installation of 125m of pipes by micro tunnelling (various sizes)	\$244,000
-Installation of new double grate pits (6nos)	\$18,000
Service Relocation/Protection	
-Allowance for relocation/protection for existing utilities - (gas pipes, communication networks, sewer pipes, etc)	\$100,000
Road Construction	
--Road re-construction with foot path (250m)	\$138,000
Sub Total	\$8,254,000
Other	
Traffic and pedestrian management (21days)	\$49,000
Cost of consultancy (feasibility studies, REF, design)	\$200,000
Contingency (30%)	\$2,477,000
Contractor's Prelims and Indirect Costs (25%)	\$2,064,000
Grand Total	\$13,044,000

Proposed works for mitigation Option 11- Drainage Augmentation in William Street and near Pemberton Street and Clevedon Street

- Drainage upgrade at William Street with 600mm pipe
- Drainage duplication near Pemberton Street and Clevedon Street
- Micro tunnelling under existing properties

Table F-6: Summary of the implementation cost of the mitigation measure Option 13a- Drainage Augmentation near Dent St

Item	Total
Site Preparation	
-Clearing vegetation, excavation for pipe and flow diversion channel; fencing	\$222,000
Culvert/Pipe Installation	
-Stormwater networks to drain floodwater into the retention pond and connecting the pond with existing outlet	\$505,000
-Backflow prevention devices	\$196,000
-Pipe jacking	\$70,000
Service Relocation/Protection	
-Allowance for relocation/protection for existing utilities - (gas pipes, communication networks, etc)	\$50,000
Sub Total	\$993,000
Other	
Cost of consultancy (feasibility studies, REF, design)	\$150,000
Contingency (30%)	\$298,000
Contractor's Prelims and Indirect Costs (25%)	\$249,000
Grand Total	\$1,690,000

Proposed works for mitigation Option 13a- Drainage Augmentation near Dent St

- New culverts (2-900mmX2400mm) across the Fremfins Lane
- New culverts (2-900mmX2400mm) to drain the water from pond into the Botany Bay via existing pipes
- Undulating ground levelling along southern edge of properties on Dent Street

Table F-7: Summary of the implementation cost of the mitigation measure Option 16: Option 1 + Option 13a

Item	Total
Site Preparation	
-Clearing vegetation, excavation for pipe and flow diversion channel; fencing	\$222,000
Culvert/Pipe Installation	
-Stormwater networks to drain floodwater into the retention pond and connecting the pond with existing outlet	\$505,000
-Pipe jacking	\$70,000
Backflow Prevention	
-Installation of back flow prevention devices	\$415,000
Service Relocation/Protection	
-Allowance for relocation/protection for existing utilities - (gas pipes, communication networks, etc)	\$50,000
Sub Total	\$1,262,000
Other	
Cost of consultancy (feasibility studies, REF, design)	\$150,000
Contingency (30%)	\$379,000
Contractor's Prelims and Indirect Costs (25%)	\$316,000
Grand Total	\$2,107,000

Proposed works for mitigation Option 13a- Drainage Augmentation near Dent St

- Backflow prevention devices (Option 1)
- New culverts (2-900mmX2400mm) across the Fremains Lane
- New culverts (2-900mmX2400mm) to drain the water from pond into the Botany Bay via existing pipes
- Undulating ground levelling along southern edge of properties on Dent Street

Table F-8: Summary of the implementation cost of the mitigation measure Option 17: Option 1 + Option 4a + Option 12

Item	Total
Site Preparation	
-Demolish existing road pavement and road base	\$498,000
-Excavation in clay in trench (1100m) and cartage within 10km and side protection	\$392,000
-Dispose of demolished mixed materials	\$2,044,000
-Safety fencing	\$40,000
Pipe Installation	
-Installation of 1500m pipes (various sizes)	\$5,437,000
-Installation of new double grate pits (21nos)	\$63,000
-Backflow prevention devices	\$219,000
Micro Tunnelling Boring Machine	
-Setup cost	\$7,377,000
-Installation of 175m of pipes by micro tunnelling (various sizes)	\$478,000
Service Relocation/Protection	
-Allowance for relocation/protection for existing utilities - (gas pipes, communication networks, sewer pipes, etc)	\$300,000
Road Construction	
-Road re-construction with foot path (1350m)	\$738,000
Sub Total	\$17,586,000
Other	
Traffic and pedestrian management (45days)	\$106,000
Cost of consultancy (feasibility studies, REF, design)	\$350,000
Contingency (30%)	\$5,276,000
Contractor's Prelims and Indirect Costs (25%)	\$4,397,000
Grand Total	\$27,715,000

Proposed works for mitigation Option 17: Option 1 + Option 4a + Option 12

- Backflow prevention devices (Option 1)
- Augmentation of drainage networks along Ivy Street, Rose Street, Hickson Street, Bay Street and Botany Road. Size of the proposed pipes will vary between 450mm and 900mm (Option 4a)
- Augmented drainage line along Hale Street and Booralee Street and micro tunnelling under existing sewer main (Option 12)

Table F-9: Summary of the implementation cost of the mitigation measure Option 18: Option 4a + Option 12

Item	Total
Site Preparation	
-Demolish existing road pavement and road base	\$498,000
-Excavation in clay in trench (1100m) and cartage within 10km and side protection	\$392,000
-Dispose of demolished mixed materials	\$2,044,000
-Safety fencing	\$40,000
Pipe Installation	
-Installation of 1500m pipes (various sizes)	\$5,437,000
-Installation of new double grate pits (21nos)	\$63,000
Micro Tunnelling Boring Machine	
-Setup cost	\$7,377,000
-Installation of 175m of pipes by micro tunnelling (various sizes)	\$478,000
Service Relocation/Protection	
-Allowance for relocation/protection for existing utilities - (gas pipes, communication networks, sewer pipes, etc)	\$300,000
Road Construction	
-Road re-construction with foot path (1350m)	\$738,000
Sub Total	\$17,367,000
Other	
Traffic and pedestrian management (45days)	\$106,000
Cost of consultancy (feasibility studies, REF, design)	\$350,000
Contingency (30%)	\$5,211,000
Contractor's Prelims and Indirect Costs (25%)	\$4,342,000
Grand Total	\$27,376,000

Proposed works for mitigation Option 18: Option 4a + Option 12

- Augmentation of drainage networks along Ivy Street, Rose Street, Hickson Street, Bay Street and Botany Road. Size of the proposed pipes will vary between 450mm and 900mm (Option 4a)
- Augmented drainage line along Hale Street and Booralee Street and micro tunnelling under existing sewer main (Option 12)

Table F-10: Summary of the implementation cost of the mitigation measure Option 19: Option 2c + Option 4a + Option 12

Item	Total
Site Preparation	
-Demolish existing road pavement and road base	\$520,000
-Excavation in clay in trench (1100m), excavation for basin and cartage within 10km and side protection	\$824,000
-Dispose of demolished mixed materials	\$2,044,000
-Safety fencing	\$50,000
Pipe Installation	
-Installation of 1500m pipes (various sizes)	\$5,437,000
-Installation of new double grate pits (21nos)	\$63,000
-Installation of 1-300mm (40m) and headwall	\$10,000
Play Ground	
-Re-establishment of playground (cricket field)	87000
Micro Tunnelling Boring Machine	
-Setup cost	\$7,377,000
-Installation of 175m of pipes by micro tunnelling (various sizes)	\$478,000
Service Relocation/Protection	
-Allowance for relocation/protection for existing utilities - (gas pipes, communication networks, sewer pipes, etc)	\$310,000
Road Construction	
-Road re-construction with foot path (1380m)	\$762,000
Sub Total	\$17,962,000
Other	
Traffic and pedestrian management (45days)	\$106,000
Cost of consultancy (feasibility studies, REF, design)	\$350,000
Contingency (30%)	\$5,389,000
Contractor's Prelims and Indirect Costs (25%)	\$4,491,000
Grand Total	\$28,298,000

Proposed works for mitigation Option 18: Option 2c + Option 4a + Option 12

- Removal of informal embankment along western side of Jasmine Street
- Construction of a 2m high embankment along the western and southern sides of the park
- Lowering the base of the park by 1m to form a detention basin, with a 300mm low flow pipe outlet connection to the existing drainage network
- Augmentation of drainage networks along Ivy Street, Rose Street, Hickson Street, Bay Street and Botany Road. Size of the proposed pipes will vary between 450mm and 900mm (Option 4a)
- Augmented drainage line along Hale Street and Booralee Street and micro tunnelling under existing sewer main (Option 12)

Appendix G. Flood Compatible Materials Guide

Table G-1 Flood Compatible Materials

component	most suitable	second preference	to be avoided	not permitted
flooring and sub-floor structure	<ul style="list-style-type: none"> concrete slab-on-ground monolithic construction <p>Note: clay filling is not permitted beneath slab-on-ground construction which could be inundated</p> <ul style="list-style-type: none"> suspension reinforced concrete slab 	<ul style="list-style-type: none"> timber floor (T&G boarding, marine plywood) full epoxy sealed on joints 	<ul style="list-style-type: none"> timber floor (T&G boarding, marine plywood) with ends only epoxy sealed on joints and provision for side clearance for board swelling 	<ul style="list-style-type: none"> timber floor close tog round with surrounding base timber flooring with ceilings or soffit linings timber flooring with seal on top only
floor covering	<ul style="list-style-type: none"> clay tile concrete, precast or in situ concrete tiles epoxy, formed-in-place mastic flooring formed-in-place rubber sheets with chemical set adhesives silicone floors formed-in-place vinyl sheets with chemical set adhesives 	<ul style="list-style-type: none"> cement/bituminous formed-in-place cement/latex formed-in-place rubber tiles, with chemical set adhesive terrazzo vinyl tile with chemical set adhesive vinyl tiles asphaltic adhesive loose rugs ceramic tiles with acid and alkali resistant grout 	<ul style="list-style-type: none"> asphalt tiles with asphaltic adhesive loose fit nylon or acrylic carpet with closed cell rubber underlay 	<ul style="list-style-type: none"> asphalt tiles carpeting, glue-down type or fixed with smooth-edge or jute felts ceramic tiles chipboard / particleboard cork linoleum PVA emulsion cement rubber sheets or tiles vinyl sheets or tiles vinyl sheets or tiles coated on cork or wood backings fibre
wall structure (up to FPL)	<ul style="list-style-type: none"> solid brickwork, blockwork, reinforced concrete or mass 	<ul style="list-style-type: none"> two skins of brickwork or blockwork with inspection 	<ul style="list-style-type: none"> brick or blockwork veneer construction with inspection 	<ul style="list-style-type: none"> inaccessible cavities large window openings

roof structure (where FPL is above the ceiling level)	<ul style="list-style-type: none"> reinforced concrete construction galvanised metal construction 	<ul style="list-style-type: none"> timber trusses with galvanised fittings 	<ul style="list-style-type: none"> traditional timber roof construction 	<ul style="list-style-type: none"> inaccessible flat roof construction ungalvanised steelwork e.g lintels, arch bay tie rods, beams, etc. unsecured roof tiles
doors	<ul style="list-style-type: none"> solid panel with water proof adhesives flush door with marine ply filled with closed cell foam painted metal construction aluminium or galvanised steel frame 	<ul style="list-style-type: none"> flush panel or single panel with marine plywood and water proof adhesive T&G lined door, framed ledged and braced painted steel timber frame fully epoxy 	<ul style="list-style-type: none"> flywire screens standard timber frame 	<ul style="list-style-type: none"> hollow core ply with PVA adhesive and honeycomb paper core
wall and ceiling linings	<ul style="list-style-type: none"> villaboard brick - face or glazed in waterproof mortar concrete concrete block steel with waterproof application stone - natural, solid or veneer waterproof grout glass blocks glass plastic sheeting or walls with 	<ul style="list-style-type: none"> brick - common plastic wall tiles metals - non ferrous rubber mouldings and trim wood - solid or exterior grade plywood fully sealed 	<ul style="list-style-type: none"> chipboard - exterior grade hardboard - exterior grade wood - solid (boards and trim) with allowance for swelling wood, plywood - exterior grades fibrous plaster board 	<ul style="list-style-type: none"> chipboard fibreboard panels mineral boards paperboard plasterboard, gypsum plaster wall coverings - paper, burlap cloth types wood - standard plywood strawboard
insulation	<ul style="list-style-type: none"> foam or closed cell type 	<ul style="list-style-type: none"> reflective insulation 	<ul style="list-style-type: none"> bat or blanket types 	<ul style="list-style-type: none"> open cell fibre types
windows	<ul style="list-style-type: none"> aluminium frame with stainless steel or brass rollers 	<ul style="list-style-type: none"> epoxy sealed timber waterproof glues with stainless steel or brass fittings galvanised or painted steel 		<ul style="list-style-type: none"> timber with PVA glues, mild steel fittings
nails, bolts, hinges and fittings	<ul style="list-style-type: none"> brass, nylon or stainless steel removable pin hinges 		<ul style="list-style-type: none"> mild steel 	

Appendix H. Public Exhibition Consultation

H.1 Residence occupier letter

1 October 2020

Our Ref: SF17/2145
Contact: Pulak Saha

Occupier
«Address»
«Suburb»

Dear Occupier

Botany Bay and Foreshore Beach Floodplain Risk Management Study and Plan

Bayside Council is responsible for identifying and managing areas at risk of flooding within the local government boundary.

Council recently completed the Floodplain Risk Management Study for Botany Bay and Foreshore Beach Catchment. The study has identified your property as being at risk of flooding in a 1% annual exceedance probability (1 in 100 chance in one year).

A Floodplain Risk Management Study determines how Council can reduce the flood risk.

Summary of the Findings:

A range of structural and non-structural flood mitigation options for the study area were assessed for suitability including:

- **Property modification measures:** Amendments to planning instruments and controls including the Local Environmental Plan (LEP) and Development Control (DCP) Plan were investigated and recommended.
- **Response modification measures:** flood depth signage on roads, updates to emergency management and planning, flood education and awareness and site specific flood plans were investigated.
- **Flood modification measures:** A total of 19 structural options i.e. flood modification measures were identified and assessed as options for implementation. These included detention basins, local and trunk drainage upgrades and backflow prevention devices on drainage lines. Following three options were recommended for further feasibility investigations.
 - a) Detention basin at Booralee Park, Botany **(FM1)**
 - b) Drainage augmentation at William Street Botany **(FM2)**
 - c) Drainage augmentation along the rear of the Dent Street properties **(FM3)**

Learn More

To help you understand what this means, we have created an online page where you can read and comment on the studies, submit questions, or view our responses to frequently asked questions. This page will be open from 1 October 2020 to 29 October 2020 and can be found at www.haveyoursay.bayside.nsw.gov.au

Hard copies of the studies will also be available during the same period at:

- Eastgardens Library, 152 Bunnerong Road, Eastgardens
- Rockdale Library, 444 – 446 Princes Highway, Rockdale

Bayside Council Floodplain Management

Bayside Council has a Floodplain Management page on our public website, where you can read the studies for all catchment areas within the Bayside area. The Botany Bay and Foreshore Beach Catchment study, will be available here from 1st of October 2020 <https://www.bayside.nsw.gov.au/index.php/area/environment/floodplain-management>

Flood extent, hazard layers and flood affected property information are now available in Bayside Council's [online mapping system](#).

Managing Flood Risk

We encourage you to learn more about living in an area with a risk of flooding. The NSW State Emergency Service provides information that can help you before, during and after a flood.

- Prepare Your Home and Business: <https://www.ses.nsw.gov.au/flood-resources/during-a-flood/prepare-your-home-and-business/>
- Be Aware: <https://www.ses.nsw.gov.au/flood-resources/during-a-flood/be-aware/>

If you would like to speak with a Council Officer about flooding in this catchment, please contact Pulak Saha, Strategic Floodplain Engineer on 02 9562 1617 or by email at flooding@bayside.nsw.gov.au. You can also speak to the flood modeller at Jacobs Pty Ltd on 61 2 9928 2145.

Yours faithfully



Clare Harley
Manager – Strategic Planning

H.2 Public Exhibition Web Page

11/25/2020

Managing Flooding in Botany, Pagewood and Banksmeadow | Have Your Say Bayside



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Managing Flooding in Botany, Pagewood and Banksmeadow



Consultation has concluded

Bayside Council has recently drafted a Floodplain Risk Management Study and Plan, for the Botany Bay and Foreshore Beach catchment area.

Background

In 2015, the Botany Bay Foreshore Beach Catchment Flood Study was conducted to identify the risk of flooding in the suburbs of Botany, Pagewood and Banksmeadow. At that time, 4,300 letters were sent to residents and owners to gather their experiences of flooding in the catchment. Community feedback was used to confirm the location of

https://haveyoursay.bayside.nsw.gov.au/botanybay_fmmp

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flooding hotspots identified by the study.

The Draft Floodplain Risk Management Study and Plan (Draft FRMSP) builds on the findings of the 2015 Flood Study, as its purpose is to determine how we can reduce the risk of flooding. It focusses on:

- Informing the planning of future developments
- Strengthening emergency management procedures; and
- Increasing community awareness.

Recommendations of the Draft FRMSP

The study assesses a number of flood mitigation measures, and recommends the most feasible options for further investigation. There are three categories of mitigation measures:

- **Property modification (PM) measures:** A number of amendments to planning instruments and controls, including the Local Environmental Plan and Development Control Plan were investigated and recommended.
- **Response modification (RM) measures:** This includes recommendations regarding flood depth signage on roads, updates to emergency management plans and procedures, flood education and awareness programs and site specific flood plans.
- **Flood modification (FM) measures:** This covers structural options for reducing the risk of flooding. Nineteen options were investigated, and three were recommended for further feasibility studies:
 - Detention basin at Booralee Park, Botany
 - Drainage augmentation at William Street, Botany
 - Drainage augmentation behind Dent Street properties.

Full details of the proposed measures can be viewed in Table 3 of the **Draft FRMSP Executive Summary** (pages 18 - 24). A **one page summary** has also been provided.

What's happening now?

The Botany Bay and Foreshore Beach Floodplain Risk Management Strategy and Plan is now on exhibition until 29 October 2020. You can view both the **Executive Summary**, and **the full study**.

Hard copies of the documents will also be available at:

- Eastgardens Library, 152 Bunnerong Road, Eastgardens.
- Rockdale Library, 444-446 Princes Highway, Rockdale.



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Have your say

You are invited to provide your feedback on the measures that have been proposed:

- Online: **Use the feedback form below**
- Email: **flooding@bayside.nsw.gov.au**
- In writing: Pulak Saha, Strategic Floodplain Engineer, Bayside Council, PO Box 21, ROCKDALE NSW 2216

The last day to give feedback is **29 October 2020**.

What happens next?

We will review your feedback before finalising the Botany Bay Floodplain Risk Management Strategy and Plan with Council. We will then move to assessing the best ways to implement the measures outlined in the plan, including conducting further feasibility studies.

Further Information

Please contact Pulak Saha, Strategic Floodplain Engineer on 9562 1617 or email **flooding@bayside.nsw.gov.au** for any further information.

BOTANY BAY AND FORESHORE BEACH DRAFT FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

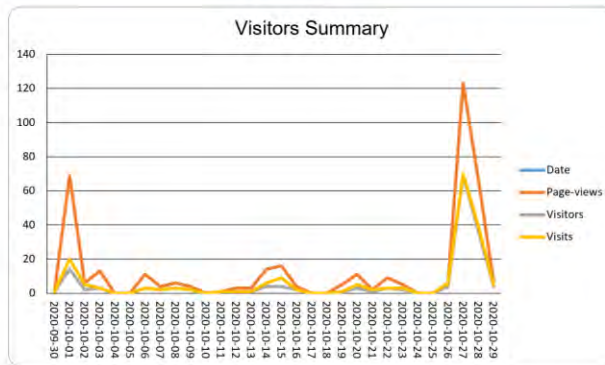
Botany Bay and Foreshore Beach Draft Floodplain Risk Management Study and Plan

Privacy Statement: All submissions will be stored in Council's Records System and may be included in Council's Meeting Business Paper (minus identifying contact details) . However please note that any personal information is accessible to the public upon written application subject to Council's Privacy Management Plan and the Government information (Public Access) Act 2009.

CLOSED: This survey has concluded.

H.3 Consultation Outcomes

Project Report:	Managing Flooding in Botany, Pagewood and Banksmeadow	30-Sep-2020	to	29-Oct-2020
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Project Highlights	
Total Visits	193
New Registrations	1
Video views	0
Photo Views	0
Document Downloads	85

Admin Notes

ENGAGED PARTICIPANTS	9		
Engaged Actions Performed	Registered	Unverified	Anonymous
Contributed on Forums	0	0	0
Participated in Surveys	0	0	9
Contributed to Newsfeeds	0	0	0
Participated in Quick Polls	0	0	0
Posted on Guestbooks	0	0	0
Contributed to Stories	0	0	0
Asked Questions	0	0	0
Placed Pins on Places	0	0	0
Contributed to Ideas	0	0	0

INFORMED PARTICIPANTS	57
Informed Actions Performed	Participants
Viewed a video	0
Viewed a photo	0
Downloaded a document	47
Visited the Key Dates page	1
Visited an FAQ list Page	5
Visited Instagram Page	0
Visited Multiple Project Pages	49
Contributed to a tool (engaged 9)	

AWARE PARTICIPANTS	150
Aware Actions Performed	Participants
Visited at least one Page	150

ENGAGEMENT TOOLS SUMMARY								
Forum Topics	0	Guestbooks	0	Places	0	News Feeds	0	Ideas
Qandas	0	Quick Polls	0	Stories	0	Survey Tools	1	0

Tool Type	Engagement Tool Name	Tool Status	Visitors	Contributors		
				Registered	Unverified	Anonymous
SurveyTools	Botany Bay and Foreshore Beach Draft Floodplain Risk Management Study and Plan	Published	17	0	0	9

INFORMATION WIDGET SUMMARY							
DOCUMENTS	3	PHOTOS	0	VIDEOS	0	FAQS	1
						KEY DATES	1

Widget Type	Engagement Tool Name	Visitors	Downloads/Views
Document	Executive Summary of the FRMSP.pdf	29	34
Document	Full Floodplain Risk Management Study and Plan.pdf	22	24
Document	Summary Map of the Recommendations.pdf	21	27
FAQ	faqs	5	5
Key Dates	Key Date	1	1

Table H-1 Public exhibition community submissions and FRMS responses

*Note, names and addresses of community members withheld.

ID	Date	Address	Communication method	Community Feedback	Response
1	29/09/2020		Phone	For last 7 years, I have been requesting for drainage in Rochester St Botany. When will this be done?	<p>We reviewed the flooding and drainage conditions in Rochester Street and while we note there is substantial flooding at the low point in the street, a viable drainage option could not be identified which provides significant improvements to the flooding conditions. We have tested options including significant upgrades of the drainage system but due to physical constraints, such as available space, sufficient increase in drainage capacity cannot be provided to improve flooding in Rochester Street.</p> <p>Council's focus is therefore on alternative measures including public education and awareness of flooding in the catchment, flood signage and planning controls for new developments to help minimise the risk to public safety and damage to property.</p> <p>Council's information indicates that there are street drainage network available along the street kerb and gutter to capture minor rain events. The street drainage system is only typically designed for the 20% AEP (1 in 5 chance in a year) event, and flooding within the road corridor for events larger than this is common. Major storm events are partially intercepted and conveyed by the pits/pipes system while the rest of the runoff will freely follow from natural depressions and/or road reserve (gutters, road, footpaths). It is impossible to design a system to capture both minor and major events (1 in 100 chance in any year) runoff as it is cost prohibitive. Council is not required to provide this capacity under any legislation or design guidelines.</p> <p>You can also lodge a formal request (CRM) for the cleaning of drainage system via our customer service on 1300581299.</p>
2	30/09/2020		Phone	<ul style="list-style-type: none"> - I lived at Botany Road for 34 years and had no flooding. - I think flooding occurs due to the blocked drains from leaves. Every autumn grates and pits gets blocked with leaves from the trees which are located in the road reserve. Can Council crews clean the pits and pipes regularly? - Is this study related to the increased rate? 	<p>Flooding: Floods do not occur in a regular pattern. There may be a period of no floods and a period of several floods. For example, the last time the Brisbane River flooded before the 2011 disaster was in 1974. Residents who moved there in more recent times may never have considered flooding an issue until the floods in January 2011. Following extensive rain every water course and obstructed overland flow path will flood.</p> <p>With regards to the cleaning and maintenance: Maintenance: Council has a service level guarantee to sweep the gutters of every street within the LGA twice per month. A manual sweeping crew has been created on the East side of the LGA to sweep out from behind parked cars in areas where the gutter is generally inaccessible. The level of service in relation to street sweeping in the former Botany Council area has increased substantially since the merger with the amount of debris, leaves and litter being swept from that area increasing 92% on what was previously collected from 498t/annum to 957t/annum current.</p> <p>Council has dedicated creeks and drains crews on both the east and the west of the LGA and every pit across the LGA is inspected once per annum and cleaned as required. Vegetation and litter from open waterways is cleaned on a regular schedule and a proactive program of known hot spot pits targets cleaning of pits prior and post significant rainfall. Residents are encouraged to communicate to the environmental management team within Council if they have a pit they would suggest for the LGA flooding Hotspot list. Council's city works department has scheduled more regular servicing of the Gross Pollutant and silt traps within the ex-Botany Council area since amalgamation resulting in an additional 19.8t of pollution being removed from our waterways annually compared to the previous year. You can also lodge a formal request (CRM) for the cleaning of drainage system via our customer service on 1300581299.</p> <p>Increased Rate: This study is not related to the rate increase. Funding for the flood mitigation options are covered by stormwater levy and funding from the Department of Planning, Industry and Environment.</p>
3			Email	<p>I would like to ask what you are doing about drainage on our street in Herford St, Botany?</p> <p>For the past 6 years I have been highlighting that there is no drainage in Herford Street and after any rain it floods, making it impossible to get to a car or cross the street without getting very wet. Will the council be responsible should that flood my house?</p>	<p>We have reviewed the flooding conditions in your location and identified them as low hazard in the 1% AEP (1 in 100 chance in a year) flood event. As a part of the floodplain risk management study our focus has been on flood affected areas where the flood hazard is high and there is a significant risk to life and property. Unfortunately given the number of high flood hazard areas in other parts of the study area we were not able to identify higher priority drainage works for your location under the flood risk management program. We continue to list drainage works in your location under Council's register of requested works and will be prioritised based on the risk and availability of funding.</p>
4	2/10/2020		Email	1. The study acknowledges that the existing stormwater drainage system is problematic but it fails to address the ability of the system to at least in the interim, function to its design state if it is maintained and maintained on a regular and systematic basis.	<p>1. Regarding Maintenance of the existing system:</p> <p>Council has a service level guarantee to sweep the gutters of every street within the LGA twice per month. A manual sweeping crew has been created on the East side of the LGA to sweep out from behind parked cars in areas where the gutter is generally inaccessible. The level of service in relation to street sweeping in the former Botany Council area has increased substantially since the merger with the amount of debris, leaves and litter being swept from that</p>

ID	Date	Address	Communication method	Community Feedback	Response
				<p>2. The concept of the study to adapt the grounds of Booralee Park as a detention basin has, apart from the ground's user ability not considered the impacts that may be attributable to groundwater levels increasing particularly in regard to–</p> <p>(a) Its infiltration index;</p> <p>(b) Basement structures nearby; and</p> <p>(c) The unwanted movement o f contamination both in the groundwater and the ground matrix o f the park itself.</p> <p>3. It is known that in year 2007 storm events gave rise to unidentified changes to the northern shoreline of Botany Bay, notable of which were the obstruction of the Sydney Water (SW) stormwater outlets by beach sand and the reverse flow of contaminated seawater in the ponds of Sir Joseph Banks Park both of which had an impact on stormwater management, particularly the lower reaches of the Botany residential area. I am aware the SW recently extended the outlets well into Botany Bay but as far as I can determine, the Sir Joseph Banks Park phenomena has not been addressed in the study.</p> <p>4. The study proposes in the short term the installation of tidal control devices at stormwater outlets. I assume they are to be fitted to the assets of SW. However, it is my experience that tidal control devices that are subject to seawater immersion ultimately fail and fail at a time when the design operation is most expected. Accordingly, if this proposal has the approval of SW then perhaps their placement and effectiveness should be first the subject of a quantifiable risk assessment.</p> <p>I trust the above comments will be given due consideration by the Council but I also take the opportunity to reiterate my concerns as to the maintenance of the existing drainage structure. It is my observation that the system is not being maintained.</p> <p>I make this point to yourself in good faith and with the upmost of sincerity.</p> <p>Further, the study if implemented will affect the ordinary residents of Botany (increase in household insurance premiums, alterations and additions complications etc). As such I would have thought–</p> <ul style="list-style-type: none"> • Access would have been made available to the lot tagging study; • The study(s) would have brought forward these matters for all to be aware of; and • Notwithstanding the public exhibition of the Floodplain Study, the letter advising of the study's existence should have in my view been addressed to the affected landowners in person and sent to the postal address the Council has on file. 	<p>area increasing 92% on what was previously collected from 498t/annum to 957t/annum current. Council has dedicated creeks and drains crews on both the east and the west of the LGA and every pit across the LGA is inspected once per annum and cleaned as required. Vegetation and litter from open waterways is cleaned on a regular schedule and a proactive program of known hot spot pits targets cleaning of pits prior and post significant rainfall. Residents are encouraged to communicate to the environmental management team within Council if they have a pit they would suggest for the LGA flooding Hotspot list.</p> <p>Council's city works department has scheduled more regular servicing of the Gross Pollutant and silt traps within the ex-Botany Council area since amalgamation resulting in an additional 19.8t of pollution being removed from our waterways annually compared to the previous year.</p> <p>2. The Detention basin has been modelled in the flood study as a concept. A detailed feasibility study will be undertaken in the next stage to identify the suitability of the system based on the benefit and cost analysis and environmental assessment.</p> <p>3. Sydney Water has extended the existing stormwater line and constructed the groynes to stop the sand movement. Recent inspection shows that these outlets are working freely without any sand blockage.</p> <p>The consultant has reviewed the option to include backflow devices for the outlet in Botany Bay which is included in the report. Backflow devices have been recommended as a long term solution to stop reverse flow in Sir Joseph Banks Park.</p> <p>4. Detailed feasibility will be undertaken prior to the construction of the reverse flap device and risk assessment will be undertaken to understand the impact of the failure of these devices.</p> <p>Please note that Council doesn't put together flood studies or floodplain risk management plans for, or on behalf of insurance companies. Flood Studies are a legal requirement for Council to complete and part of our responsibilities to help manage flood risk in the community. Insurance companies generally rely on their own assessment of risk and can use their own methods to identify flood risk.</p> <ul style="list-style-type: none"> - Flood tagging was completed based on the risk of flooding. A copy of the report can be provided. - Letters for this study were sent to all 1% AEP flood affected properties (having a chance of 1 in 100 in any year) owners and occupiers.

ID	Date	Address	Communication method	Community Feedback	Response
				As you will no doubt appreciate the maintenance of the stormwater system is a matter for which I have concerns and for this reason I am happy to assist in whichever way possible.	
5	2/10/2020		Phone	Will this affect my property value? Is it related to the global warming? I live in third floor, can flood affect my property? What is the timeframe of the works	There are many factors that can affect the value of any property including inflation, a change in interest rates, increased aircraft noise or construction of a new road or shopping centre nearby. The extent to which a property's value is affected once it has been identified as flood affected is impossible to determine. While the notification may affect one potential buyer's decision to purchase a property it may have no impact for another. Ultimately, it is the market that determines the value. It is safer to stay within the house in a flooding situation which can withstand flood forces as there will be no warning prior to the 1% AEP flooding event. Flood model indicates that flood depth will not reach the third floor of this unit. Implementation of the future stage of the study can take approximately 24 to 36 months and depends on availability of funding.
6	2/10/2020		Phone	We are trying to find the risk to the units as it was built 3 years ago. Basement seems to be have adequate protection from flooding as there is a crest provided in the basement driveway. When will the construction of the detention basin in Booralee park start and who will fund these. We are very positive as the Council is undertaking this study to identify the risk of flooding in the catchment.	Any recent development required the protection of the basement up to 300mm above the 1 in 100 year flood level. Timeframe: A feasibility study will be undertaken to determine the suitability of the mitigation option based on the detailed cost and benefit analysis and environmental assessment. Construction of the mitigation option can take 18 to 36 months based on the complexity of the project.
7	12/10/2020		Phone	This property only had flooding twice in last 20 years. I don't think I should be tagged. Also why the St Joseph Banks Park Pond water is too high? I think the pump is failing.	Floods do not occur in a regular pattern. There may be a period of no floods and a period of several floods. For example, the last time the Brisbane River flooded before the 2011 disaster was in 1974. Residents who moved there in more recent times may never have considered flooding an issue until the floods in January 2011. Following extensive rain every water course will flood. Tagging was completed based on the flood risk to a property. The pond water level is controlled by rainfall infiltration, groundwater levels and other climatic conditions like evaporation. There is no pump that lowers the pond level. Water level recedes slowly after the rain event.
8	12/10/2020		Phone	Flooding in Cheguin Street occurs frequently and no fix in last 5 years. How long do we have to wait. Flood water gets in to the electrical room. Councils pipes are small and blocked. Council is responsible to remove flooding. Why there is no plan in the current FRMS to fix this issue?	We have reviewed the flooding conditions in your location and identified them as low hazard in the 1% AEP (1 in 100 chance in one year) flood event. As a part of the floodplain risk management study our focus has been on flood problem areas where the flood hazard is high and there is a significant risk to life and property. Unfortunately given the number of high flood hazard areas in other parts of the study area we were not able to identify higher priority drainage works for your location under the flood risk management program. We continue to list drainage works in your location under Council's register of requested works and will be prioritised based on the risk to life/damage and availability of funding. You can also lodge a formal request (CRM) to clean blocked of drainage system via our customer service on 1300581299.
9	13/10/2020		Phone	I have an approved DA for this site and I am not sure how this will affect my development. I have identified number of errors in the DA conditions and I would like to discuss this with someone.	Flood risk management study will not impact the existing development which is already approved. You can contact Council's development services team to understand the process of modifying the DA conditions.
10	28/10/2020		Email	I do not have flooding problems at Lang Ave Pagewood NSW on the corner of Lang and Bay St. Be careful not to generalise the whole area.	This site is not within the study area. However, it is located in the Springvale drain and floodvale drain catchment. This site is affected in 1% AEP (1 in 100 chance in any year) flooding. Flood study for this catchment was completed in 2014. You can lodge an application for a detailed flood advice using the form below: https://www.bayside.nsw.gov.au/sites/default/files/2020-06/Flood%20Advice%20Application%20Form%20WORD%202020%2021.pdf Floods do not occur in a regular pattern. There may be a period of no floods and a period of several floods. For example, the last time the Brisbane River flooded before the 2011 disaster was in 1974. Residents who moved there in more recent times may never have considered flooding an issue until the floods in January 2011. Following extensive rain every water course will flood.
11	28/10/2020		HYS page	Issues Raised: - Firstly, your picture of flooding outside Dominos isn't even shot in Botany/Banksmeadow or Pagewood. It's in Mascot. I have lived on the border of Botany/Banksmeadow for 30+ yrs. The gutters and drains used to always be maintained. Prior to the merge, apart from the bottom of Hill and Excel st in	Facebook page included an indicative image of flooding. The Have your say page included a picture of flood affected area in the study area of Botany, part of Banksmeadow and Pagewood. Maintenance: Council has a service level guarantee to sweep the gutters of every street within the LGA twice per month. A manual sweeping crew has been created on the East side of the LGA to sweep out from behind parked cars in areas where

ID	Date	Address	Communication method	Community Feedback	Response
				<p>Banksmeadow where it would flood on occasions, these other surrounding areas including Mascot, never used to flood like this nor as often. These areas were never flood prone areas. Now however it seems to be happening every time it rains. Obviously this change of high waters rising during rain doesn't just change & happen by itself. It is caused by not being maintained as it should be. Botany, Banksmeadow, East Pagewood and Mascot were once beautiful areas but are now very neglected suburbs, looking dirty and slum like. 's quite embarrassing to live in an area I was once very proud and felt privileged to be a part of. Please bring back the care that was once given to these areas.</p> <p>- In the 30+ yrs we never experienced flooding at our house or build up of water until in more recent yrs.</p> <p>- It's unacceptable that we should pay higher insurance or worse not be covered for flooding because a council doesn't do what should be done. Nor is it acceptable that this same council now wishes to increase our rates when they don't even look after the suburb as they should. Traffic has increased tenfold, and the roads have potholes. Overdevelopment has helped either. It</p>	<p>the gutter is generally inaccessible. The level of service in relation to street sweeping in the former Botany Council area has increased substantially since prior to merger with the amount of debris, leaves and litter being swept from that area increasing 92% on what was previously collected from 498t/annum to 957t/annum current.</p> <p>Council has dedicated creeks and drains crews on both the east and the west of the LGA and every pit across the LGA is inspected once per annum and cleaned as required. Vegetation and litter from open waterways is cleaned on a regular schedule and a proactive program of known hot spot pits targets cleaning of pits prior and post significant rainfall. Residents are encouraged to communicate to the environmental management team within Council if they have a pit they would suggest for the LGA flooding Hotspot list.</p> <p>Council's city works department has scheduled more regular servicing of the Gross Pollutant and silt traps within the ex-Botany Council area since amalgamation resulting in an additional 19.8t of pollution being removed from our waterways annually compared to the previous year.</p> <p>Flooding: Floods do not occur in a regular pattern. There may be a period of no floods and a period of several floods. For example, the last time the Brisbane River flooded before the 2011 disaster was in 1974. Residents who moved there in more recent times may never considered flooding an issue until the floods in January 2011. Following extensive rain every water course will flood. Tagging was completed based on the flood risk to a property.</p> <p>Rates and Traffic: A flood risk management study is partially funded by Department of Planning, Industry and Environment. It does not contribute to the increased Council rate. Also, all new developments are assessed by the relevant officer based on the Local Development Control (LEP) and Local Development Control and other relevant legislation.</p>
12	28/10/2020		Email and HYS	<p>This is a common issue we have suffered with for 10 years we have been living with since we moved her. These photos should show you how terrible it is. I have more photos also some news footage.</p> <p>We flood when it is high tide. We flood every time there is a big rainfall. We have inadequate drains for storm water. And yes these drains are managed by RMS seeing we are on Botany Rd. There is one on Hill St as well that is managed by bayside. We (all the neighbours) have to physically remove all the waste from drains as the fallen leaves from the residual Oak trees (the other big contributing factor). We are in the middle of the worse section it generally starts from the golf club 1434 and continues to 1420 Botany Road. Please do something about it.</p>	<p>The Floodplain Risk Management Plan includes installation of trunk drainage backflow devices to be installed at several locations in Option 13a/Option 16 which would prevent tidal inundation of this location during high tides. Option 13a/Option 16 also provides some improvement in flooding at this location in the 1% AEP flood by improving the surface drainage of the Dent Street sag point, which extends out to the resident's location.</p> <p>In the study we have investigated the potential for other options to be implemented for this area. However, given the low and flat terrain and other physical constraints, no other feasible options could be identified to improve flooding conditions in this location.</p>
13	27/10/2020		Email	<p>- Flooding caused by excessive rain and lack of storm water drainage or over capacity to existing stormwater</p> <p>- Bayside council might consider - along the lines of what Randwick council is doing at Maroubra beach - constructing underground storm water containment at Booralee, Sir Joseph Banks parks or wherever possible really etc. 28mil to do this - might as well do it right the first time.</p> <p>Council also should to consider adding stormwater drainage where there is none and ensuring building cannot happen in flood prone areas.</p>	<p>Thank you for your feedback.</p> <p>A detailed feasibility of the flood mitigation option will be undertaken in the next stage of the study to identify viability of the mitigation options based on the environmental impact and benefit and cost ratio.</p> <p>in this study, augmentation of the existing drainage network was considered as a long term strategy. Council will review the requirement for the additional drainage based on the priority and availability of funding.</p> <p>Flood related development controls are included in the Bayside Local Environmental Plan and Development Control plan to ensure that the new development is suitable of the flood hazard of the land and has no significant impact on the existing developments.</p>
14	27/10/2020			<p>From my experience around many Botany properties and roads, one issue is the ability of the drainage to get water off our roads. On many streets there are very few drains. An example is Daphne Street. On other streets, Daphne St, Botany Rd (Outside of Cosi Nero), the drains are not at the lowest point of the road, meaning that rain water pools. Perhaps I missed it, but the streets need to be assessed and addressed in the plan. I can understand that it may be desirable to limit the drains on a street to slow down water entering the system, but we've had these problems in heavy down pours where the volume of water over a short period of</p>	<p>- Augmentation of the existing drainage network is considered as a long term strategy. Council will review the requirement for the additional drainage based on the priority and availability of funding.</p> <p>- The option to raise road is not viable as it will cause other issues with access and services. In addition, existing basements can be redesigned to stop the flood water entering the basement. All new developments are required to provide a crest/hump in the basement driveway access to enable protection up to the habitable flood level.</p>

ID	Date	Address	Communication method	Community Feedback	Response
				<p>time means the road floods and then floods our basement causing significant damage. I believe the that a part of the issue here is the lack of drains, not the pipes or outflows.</p> <p>Another consideration for property modifications would be to allow us to raise our driveways or lower the roads. This will help us slow down the flooding into our basement and might work for other properties. Thanks!</p>	
15	27/10/2020		Email	We are in Fremlin St and have not experienced any flooding as yet.	<p>This site is not affected in 1% AEP Flooding. The 1% AEP flood means there is a 1% (1 in 100) chance of a flood of this height, or higher occurring in any one year.</p> <p>This site is affected in PMF flooding. The PMF is the largest and rarest flood that could conceivably occur at a particular location. Generally, it is not physically or economically possible to provide complete protection against this event.</p>
16	26/10/2020		Email	<p>With the reference to the above letter I would like to draw your kind attention that the theory and reality are not the same. Council risk management study shows my property as being risk of flooding in a 1% AEP (1 in 100 chance in one year) but reality is this property has not been affected by any flood since the suburb established and build our house. The house I live in was bought in 1999 and my neighbour of Livingstone avenue has been living there since they built their house. He passed away at the age of 85 a few years back. He never experienced any flood either. However my opinions are not from a professional point of view rather than a reality.</p>	Floods do not occur in a regular pattern. There may be a period of no floods and a period of several floods. For example, the last time the Brisbane River flooded before the 2011 disaster was in 1974. Residents who moved there in more recent times may never have considered flooding an issue until the floods in January 2011. Following extensive rain every water course will flood. Tagging was completed based on the flood risk to a property.
17	27/10/2020		Email	<p>- I have concerns about the proposed detention at Booralee park. This is where the current soccer field is located. It is already in bad condition and under-utilised. What is the impact of have the detention there? How else can this section of the park be used? Is it an option to redevelop it?</p> <p>- Is it possible to install an artificial turf pitch on top of the detention for all local children a adults to use year round? (See Heffron). There is regular flooding at Botany road between Lord and Bay streets. The draining here needs to be improved. And I believe the leaves from the trees than line Botany road are not appropriate. They are too large and no doubt significantly clog up the drains. They are also not appropriate as powerlines are along this stretch and as such need to be trimmed in a v shape. Surely there are better alternatives.</p>	<p>Detention basin in Booralee Park may have an impact on the existing use of the park. A detailed feasibility of the flood mitigation option in Booralee Park will be undertaken in the next stage of the study to identify viability of the mitigation options based on the environmental impact and benefit and cost ratio.</p> <p>An artificial turf field shall be flood free to avoid major damages to the field. This option may not be viable if the detention system option goes ahead to reduce flooding in the vicinity of the field.</p> <p>- Council has a service level guarantee to sweep the gutters of every street within the LGA twice per month. A manual sweeping crew has been created on the East side of the LGA to sweep out from behind parked cars in areas where the gutter is generally inaccessible. The level of service in relation to street sweeping in the former Botany Council area has increased substantially since the merger with the amount of debris, leaves and litter being swept from that area increasing 92% on what was previously collected from 498t/annum to 957t/annum current.</p> <p>Council has dedicated creeks and drains crews on both the east and the west of the LGA and every pit across the LGA is inspected once per annum and cleaned as required. Vegetation and litter from open waterways is cleaned on a regular schedule and a proactive program of known hot spot pits targets cleaning of pits prior and post significant rainfall. Residents are encouraged to communicate to the environmental management team within Council if they have a pit they would suggest for the LGA flooding Hotspot list. Council's city works department has scheduled more regular servicing of the Gross Pollutant and silt traps within the ex-Botany Council area since amalgamation resulting in an additional 19.8t of pollution being removed from our waterways annually compared to the previous year. You can also lodge a formal request (CRM) for the cleaning of drainage system via our customer service on 1300581299.</p>
18	19/10/2020		Phone	I want to confirm whether the existing owner need to take any action for the mitigation options and flood planning controls will be applicable for all new developments.	<p>As a owner of the property, no action is required as part of this flood risk management study. You may need to notify your insurance provider with the latest information available regarding flooding.</p> <p>Flood related development controls are included in the Bayside Local Environmental Plan and Development Control plan to ensure that the development is suitable of the flood hazard of the land and has no significant impact on the existing developments.</p>
19	27/10/2020		Email	Having been on this site since 1982 and lived in this area for 61 years, I feel that if the authorities (State Government, Sydney Water and Councils etc.) responsible for flood mitigation/management were more proactive, rather than reactive in the upgrading and maintenance of the storm water system, the likelihood of flooding would definitely be reduced.	<p>Maintenance:</p> <p>Council has a service level guarantee to sweep the gutters of every street within the LGA twice per month. A manual sweeping crew has been created on the East side of the LGA to sweep out from behind parked cars in areas where the gutter is generally inaccessible. The level of service in relation to street sweeping in the former Botany Council area has increased substantially since prior to merger with the amount of debris, leaves and litter being swept from that area increasing 92% on what was previously collected from 498t/annum to 957t/annum current.</p> <p>Council has dedicated creeks and drains crews on both the east and the west of the LGA and every pit across the LGA is inspected once per annum and cleaned as required. Vegetation and litter from open waterways is cleaned on a regular schedule and a proactive program of known hot spot pits targets cleaning of pits prior and post significant rainfall. Residents are encouraged to communicate to the environmental management team within Council if they</p>

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