10. Conclusions and Recommendations

10.1 Conclusions

The Council for the City of Canada Bay is responsible for local planning and land management in the Concord West Precinct area (i.e. the study area) which is located on the eastern bank of Powells Creek. There are several areas within the precinct which are currently undergoing development or are proposed for redevelopment, such as Sydney Water's Powells Creek Bank Renewal project, construction of the new Canada Bay Primary School, road and drainage works for Victoria Avenue and proposed rezoning of several industrial lots.

Detailed hydrologic and hydraulic modelling were undertaken using the available data and additional data collected as part of this study to define flooding behaviour for the study area. The hydraulic model, developed using TUFLOW, was calibrated and verified against observed flood levels. The TUFLOW model was utilised to define flood behaviour for the full range of flood events including 50%, 20% 10%, 5%, 2% and 1% AEP events and the PMF event for the baseline conditions which include the new school, the redeveloped playing fields to the south of the new school, Victoria Avenue road and drainage works and works associated with North Strathfield Rail Underpass project. A climate change sensitivity analysis was undertaken for the baseline conditions both for increased rainfall intensity and sea level rise scenarios.

The flooding assessment for the proposed scenarios included Sydney Water's Powells Creek Bank Renewal project, the Master Plan for Concord West Precinct (with no flood mitigation measures) and the Master Plan with flood mitigation measures. Whilst there are some improvements in flood levels as a result of the Powells Creek Bank Renewal project particularly on properties adjacent to the creek and immediately downstream of Pomeroy Street, the Master Plan results in flood level increases of up to 0.06m in the 5% and 1% AEP events, which impacts on a number of existing residential properties which are already sensitive to existing flooding conditions. Hence flood mitigation works were considered to mitigate flood impacts and to maintain access to properties north of the George Street sag point in the 1% AEP event.

A number of flood mitigation options were identified and assessed. Upgrade of the existing pipe network upstream of Homebush Bay Drive was found to be ineffective in improving flooding conditions, with minor improvements (< 0.01m) to Master Plan case flood levels. Amplification of the drainage culverts under Homebush Bay Drive were not assessed in detail due to the presence of existing underground services and potential opposition from stakeholders. Whilst providing an overland flow path from Victoria Avenue sag point through Sydney Olympic Park land to Powells Creek provided significant improvements in 1% AEP flood levels at Canada Bay Public School and in the low-lying area to the north of Victoria Avenue, this option requires approval from Sydney Olympic Park Authority.

Feasible options for mitigating flood impacts with the Master Plan were assessed which involved on-site works for Site 1& 2 and re-grading of George Street Sag point. Several iterations were undertaken to develop a concept design for the flood mitigation strategy for Site 1 & 2 by balancing cut and fill volumes and loss of flood storage due to the proposed buildings. Several iterations were also required to develop a concept design for the re-grading of the George Street sag point. Conclusions on the concept design for Site 1 & 2, George Street and planning controls are discussed below.

10.1.1 Site 1 & 2

The Site 1 and Site 2 mitigation strategy maintains existing flooding conditions by balancing cut (lands located below 1% AEP flood event) and fill volumes due to the proposed buildings. The flooding assessment with the selected mitigation options for Site 1 & 2 assumed that all proposed flood storage areas and the floodway were empty prior to start of a storm event. The effectiveness of the mitigation options would be diminished if the proposed flood storage areas and the floodway were full with water prior to start of a storm event.

The low-lying nature of the site, flat grades and shallow water table depth of 0.75m may result in extended duration of ponding within the proposed flood storage areas and the floodway. The potential rise in groundwater table due to extended duration of pondage could result in a permanently wet floodway bed if management measures are not included to improve sub-soil drainage. Sea level rise may also impact on the site in terms of direct seawater inundation and interaction with flooding. Further investigations and design development are required to ensure the long-term viability of the flood mitigation strategy.

Areas proposed for flood storages and the floodway are affected by acid sulphate soils and other industrial contamination and would be subject to greater than 0.5m depth of flooding during frequent storm events. Hence, these areas are not considered safe for children and need to be fenced off with porous fencing. Ponding in these areas may also pose other amenity, health and safety issues.

The focus of this study has been on flood impact mitigation and hence issues relating to groundwater and drainage have not been considered in detail. Further investigations are required to determine if the high groundwater and poor drainage can be managed or if the proposed mitigation strategy design can be refined to minimise their impacts. Additionally, if sub-soil drainage is installed, an assessment needs to be undertaken on whether it increases the risk of site contamination leaching into the site runoff.

Site 1 and Site 2 are located north of the George Street sag point. Access to Site 1 and Site 2 is cut off when the George Street sag point is subject to flooding. The mitigation measure for George Street sag point is critical for flood risk management for Site 1 and Site 2 and the adjoining areas if alternative flood emergency access from Homebush Bay Drive to the area north of the sag point is not feasible.

10.1.2 George Street

The proposed mitigation works to service the George Street sag point ensures that the sag point is trafficable in the 1% AEP event. However, the sag point is subject to up to 0.7m flood depth in the PMF event with the mitigation strategy.

Access to the proposed buildings on Site 1 and Site 2 in addition to the existing adjacent properties would be required to facilitate emergency (e.g. fire, medical needs) evacuation needs during flood events larger than the 1% AEP event. If flood emergency access to Site 1 and Site 2 from Homebush Bay Drive is found to be unfeasible, further investigations and design would be required to ensure the sag point is trafficable in the PMF event.

The new bypass floodway would discharge into Powells Creek, parts of which are owned by Sydney Water. Hence Sydney Water should be consulted as a stakeholder, and approval may be required prior to construction of the proposed bypass floodway. Other stakeholders relevant to discharging into Powells Creek may include OEH.

A culvert solution, instead of a floodway, has not been considered as the concentrated flows and high discharge velocities are likely to increase risk of scour in Powells Creek and which is likely to be a concern for stakeholders.

The bypass floodway involves excavation of existing soil, may also encounter contaminated soils and involve demolition of the existing amenities block and an irrigation tank.

10.1.3 Planning Controls

Whilst the 2013 LEP and 2013 DCP addresses Council's responsibility for the management of flood prone land policy to some extent, additional planning controls are required for the Concord West Precinct to comply with the requirements of Government's Flood Prone Land Policy.

The Master Plan includes significant increase in development on lands located within the FPA and the Master Plan would result in substantial increase in resident population within the study area. Whilst the Master Plan with the concept design improves flood access to properties located north of the George Street sag point up to and including the 1% AEP event, access to all proposed buildings would be required to facilitate emergency (eg. fire and medical needs) evacuation needs during floods rarer than the 1% AEP event to be consistent with this S117 Direction. If flood emergency access to Site 1 and Site 2 from Homebush Bay Drive is found to be unfeasible, further investigations and design would be required to ensure the sag point is trafficable in the PMF event to be consistent with S117 Direction.

Additional planning controls to be considered for the precinct include the following:

- Flood compatible materials for building components to be used for new development/redevelopment;
- Safety of people and damages to vehicles in the basement car park (if possible and provided);
- Safety of people living near constructed flood storage areas and floodways;
- Requirements for porous fencing on flood liable land;
- Improved flood education and preparedness;
- The consequent cumulative impact on flood behaviour due to filling and/or new buildings; and
- Impacts of climate change and sea level rise.

10.2 Recommendations

Recommendations on Site 1 & 2, the George Street Sag point and planning controls are provided below:

10.2.1 Site 1 & 2

The focus of this study has been on flood impact mitigation and hence issues relating to groundwater and drainage have not been considered in detail. Further investigations are recommended to determine if the high groundwater and poor drainage can be managed or if the proposed mitigation strategy design can be refined to minimise their impacts. Additionally, if sub-soil drainage is installed, an assessment needs to be undertaken on whether it increases the risk of site contamination leaching into the site runoff.

Alternative options for managing flood impacts and flood risk due to development of Site 1 and 2 should be considered if the identified issues cannot be addressed with the current suggested mitigation strategy, including the following:

- The mitigation option involving an overland flow path from Victoria Avenue sag point through Sydney Olympic Park land to Powells Creek should be investigated further, initially by discussion with Sydney Olympic Park Authority. Consultation with other stakeholders such as Sydney Water and OEH may also be required;
- The proposed development (buildings) could be consolidated further to minimise flood impacts without requiring excavation of low laying lands; and
- Alternative vehicular access to Site 1 and Site 2 from Homebush Bay Drive for alternative flood emergency access, in lieu of or augmenting the improvement of flood access in George Street.
- These alternative options should be considered in the overall suite of measures available for Site 1 and 2. Considering the broad range of issues identified, a holistic and integrated design and environmental assessment study is required for Site 1 and 2 to address these issues and provide a sustainable design.

10.2.2 George Street

The following recommendations are made for the proposed mitigation works for the George Street sag point:

- Further design development of George Street sag modifications for road design and traffic aspects. The final design will affect the flood hazard, flood accessibility and trafficability. Investigate if road is passable in events greater than the 1% AEP and further enhancements to proposed drainage infrastructure to further improve flood accessibility.
- The proposed works are to be refined further to avoid demolition of the existing amenities block and the irrigation tank by installing culverts under the corner of the oval to short-cut the floodway corner near the amenities block. This would avoid the floodway encroaching on the amenities block and the light or transmitter pole adjacent, and would negate the need for a footbridge.
- Stakeholders (Sydney Water, OEH) are to be consulted about the proposed works and discharge into Powells Creek.
- It should be noted that approval will be required from the City of Canada Bay for the proposed floodway on public land to the west of site 5, and that consultation would also likely be required with the Department of Education and Communities in terms of the option for culverts under the school oval.

10.2.3 Planning Controls

The following recommendations are made for consideration by Council:

- Council should amend its LEP to apply the model local provisions clause 7.3 (flood planning) to all lands located within the flood planning area defined in this study. Council should adopt the flood planning levels defined in this study based on the following freeboards above the 1% AEP flood levels:
  - 0.5m for areas impacted by flooding in Powells Creek; and
  - 0.3m for areas impacted by overland flooding.
- A new DCP is to be prepared to address the flood risk for the Concord West Precinct identified in this study including the following:
  - Access to all proposed buildings to facilitate emergency (eg. fire and medical needs) evacuation needs during floods rarer than the 1% AEP;
  - Flood compatible materials for building components to be used for new development/redevelopment;
  - Safety of people and damages to vehicles in the basement car park;
  - Safety of people living near constructed flood storage areas and floodways;
  - Requirement for porous fencing on flood liable land;
  - Improved flood education and preparedness;
  - The consequent cumulative impact on flood behaviour due to filling and/or new buildings;
  - Impacts of climate change and sea level rise; and
  - Implications of setting habitable floor level and basement car park entry level below RL 3 mAHD.
- Council communicates flood risk for the study area in a responsible manner to allow the community to make informed decisions where discretion exists and to complement emergency management education and preparedness programs;
- Council considers to provide Section 149 notifications relating to flooding for the study area;
- A revised planning strategy is to be formulated for Site 1 & 2 based on the findings of this study.

11. References

- BMT WBM (2010) TUFLOW User Manual.
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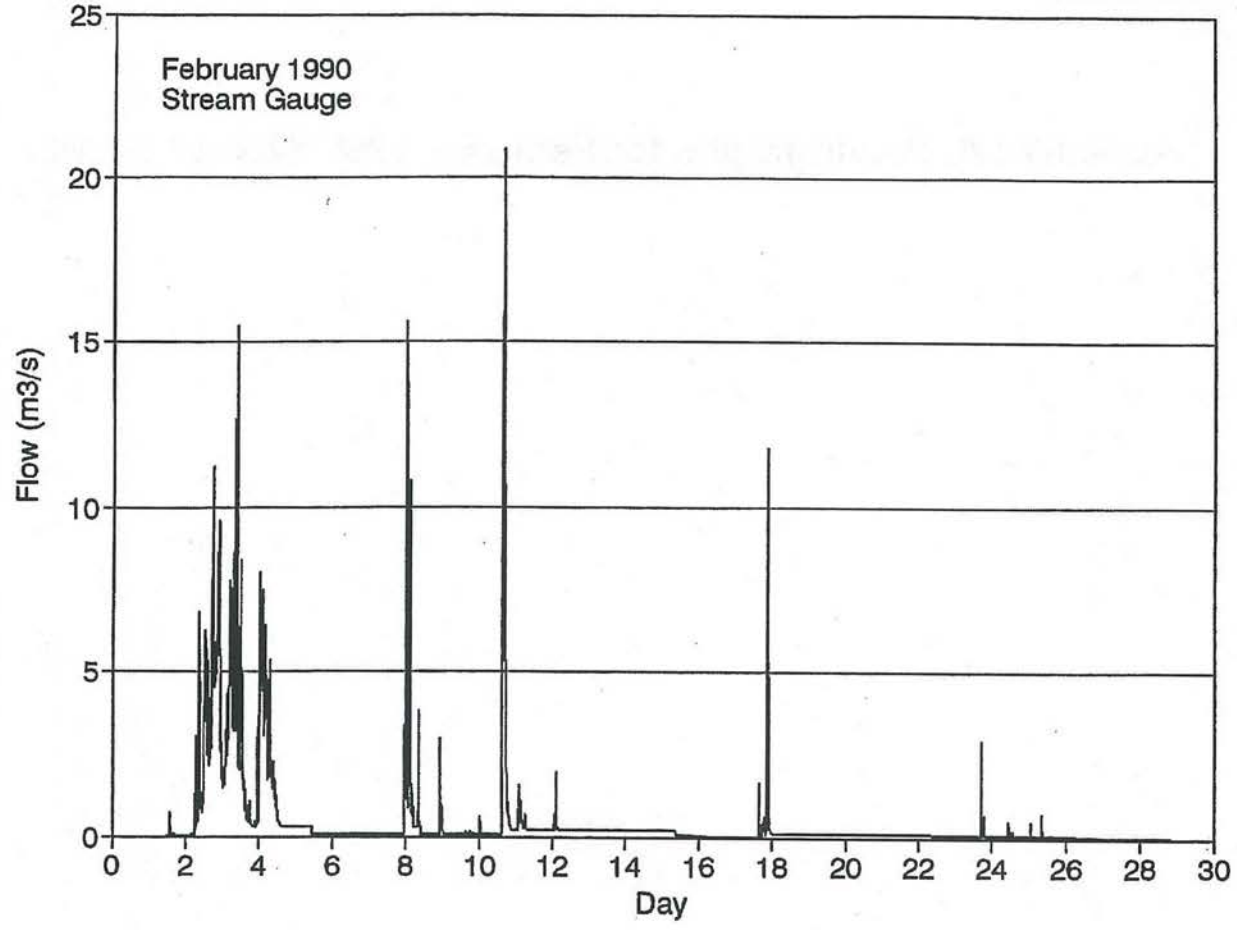
- New South Wales Government (2005) Floodplain Development Manual the management of flood liable land.
- North Strathfield Railway Underpass Design Joint Venture (2013) Design Report, Design Package DP11.2 - Hydrology and Drainage Report. Northern Sydney Freight Corridor, North Strathfield Rail Underpass – Detailed Design. Prepared by Sinclair Knight Merz and Parsons Brinckerhoff.
- Rawlinsons (2015), The Australian Construction Handbook, Rawlinsons Publishing, Perth, Australia
- SKM (2005) Lower Parramatta River Floodplain Risk Management Study, Flood Study Review, Final, March 2005
- Sydney Water (1997) Powells Creek SWC 50 Capacity Assessment.
- Webb McKeown & Associates (1998) Powells Creek and Saleyards Creek Flood Study, prepared for Strathfield Municipal Council.

Appendix A. Pluviographs for February 1990 Storms Events

FIGURE 5

STREAMFLOW AND PLUVIOGRAPH DATA FEBRUARY 1990



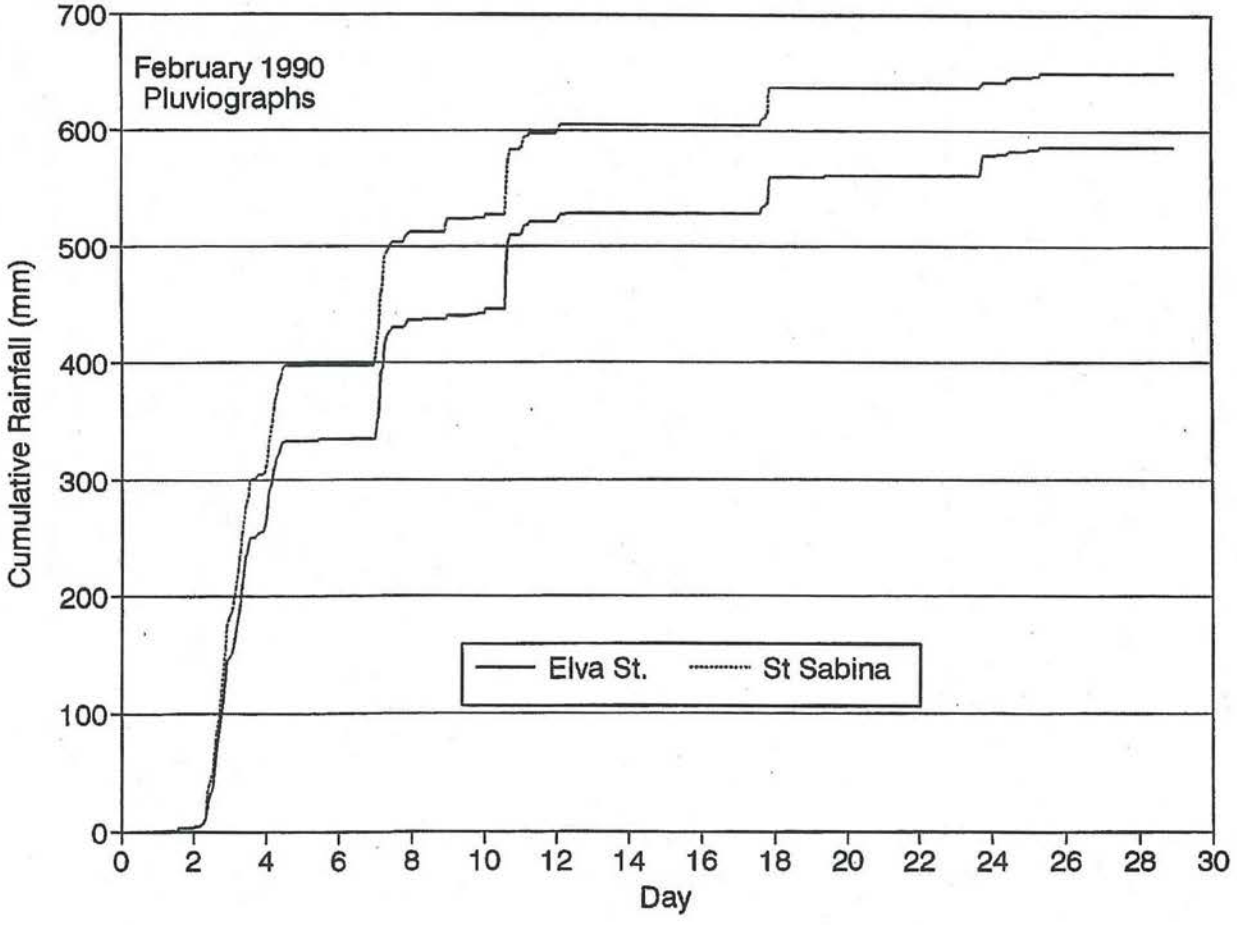


FIGURE 6

PLUVIOGRAPH DATA
2-4 FEBRUARY 1990

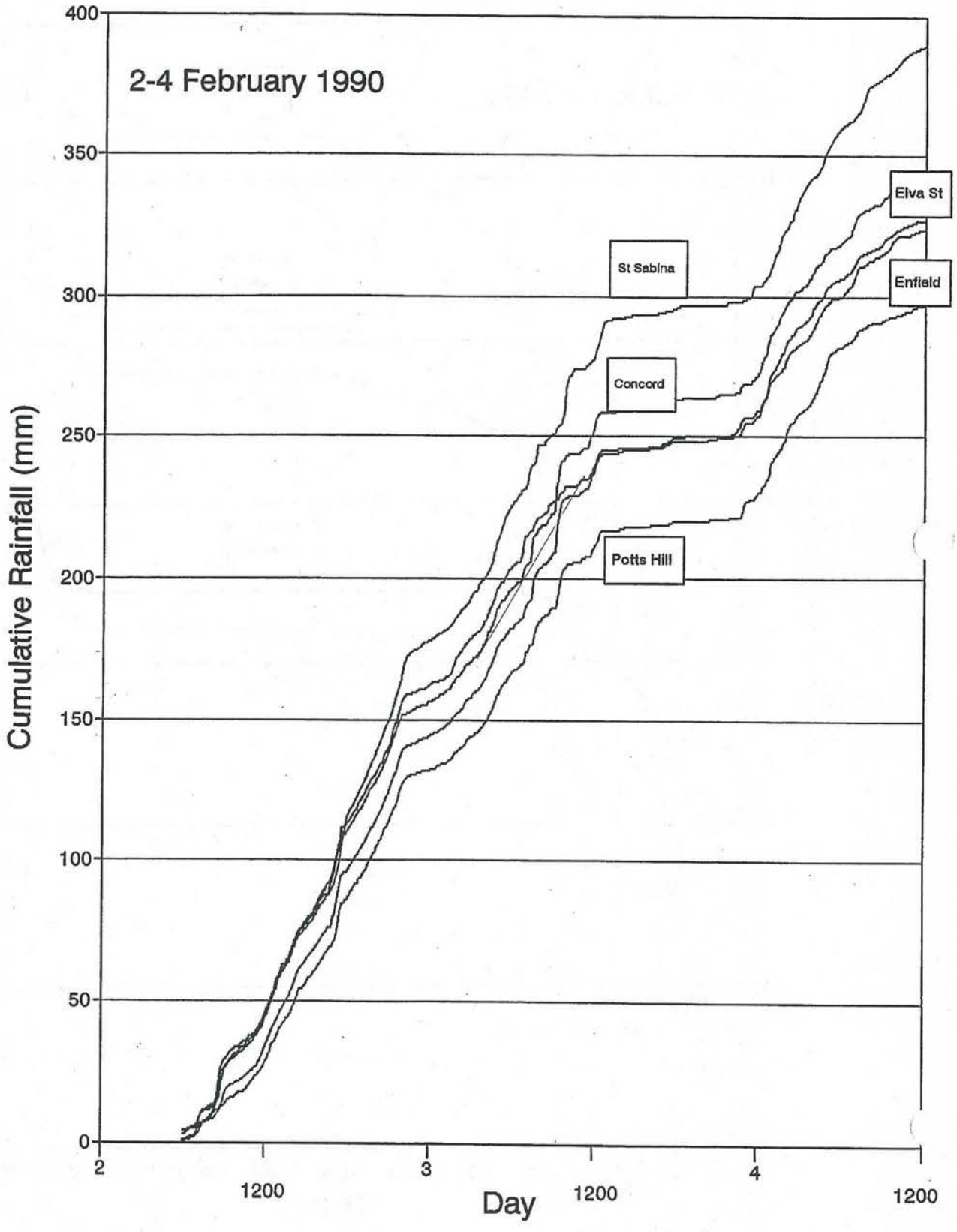


FIGURE 8

PLUVIOGRAPH DATA
7 FEBRUARY 1990

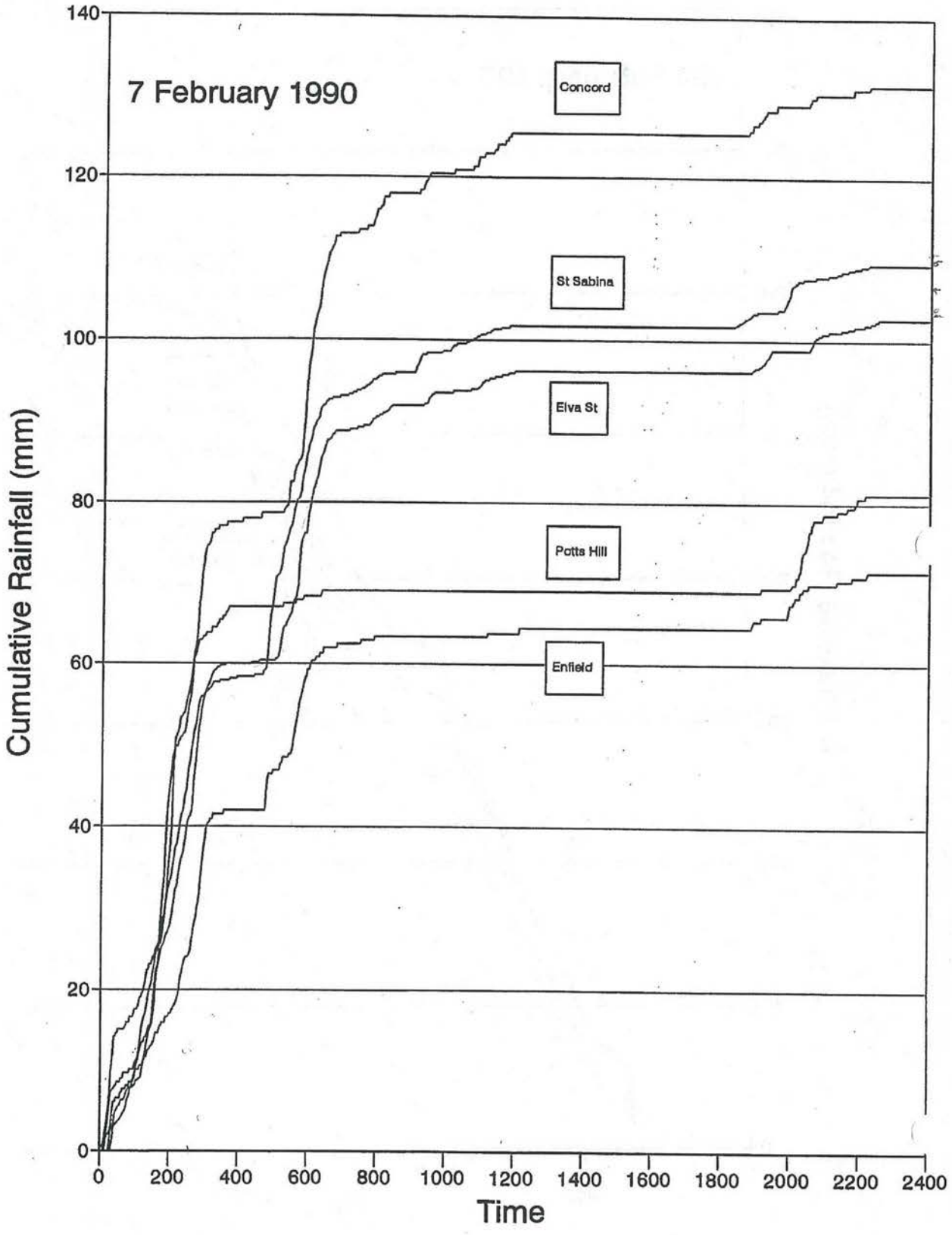


FIGURE 10

PLUVIOGRAPH DATA
10 FEBRUARY 1990

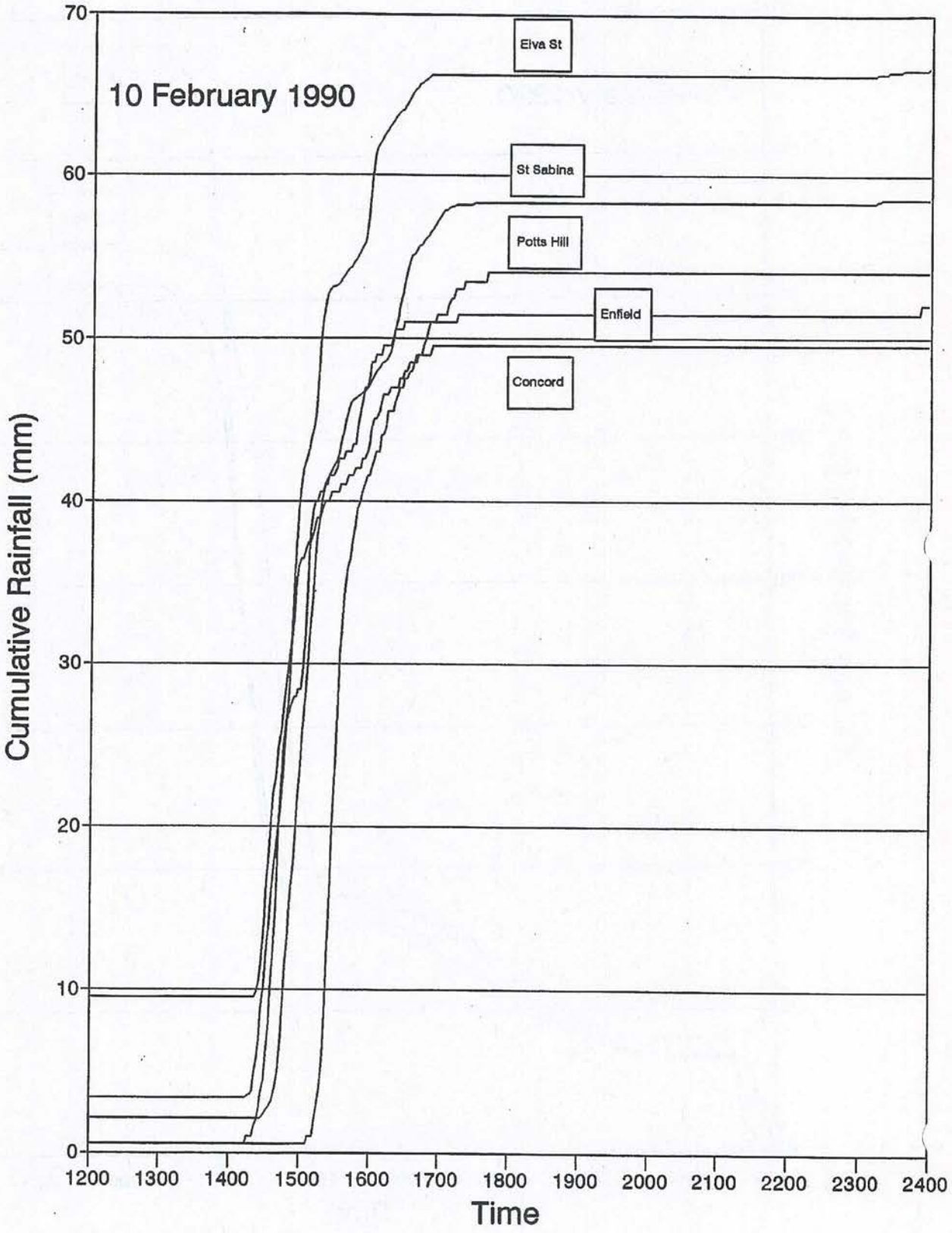
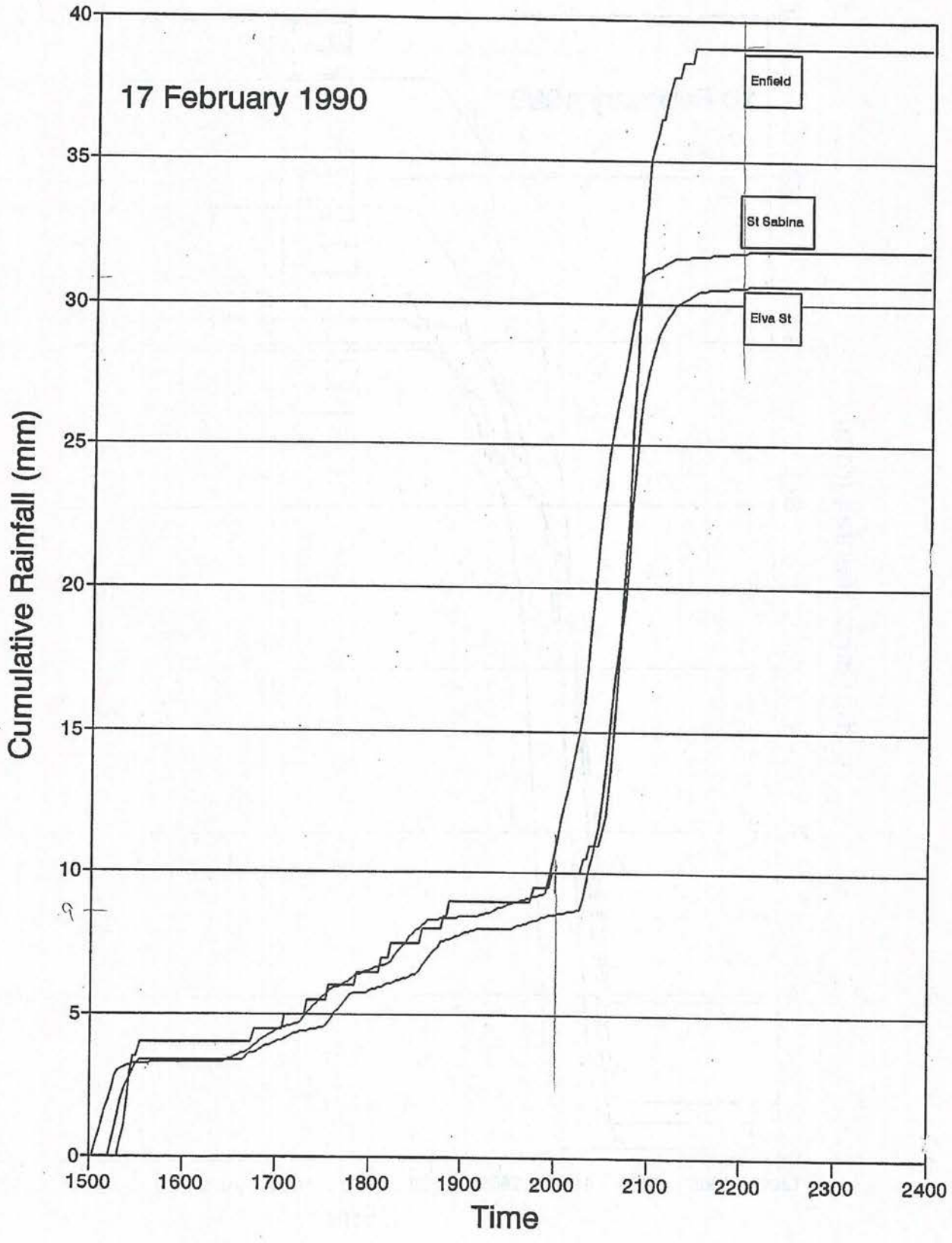


FIGURE 12

PLUVIOGRAPH DATA
17 FEBRUARY 1990



Appendix B. Local Sub-Catchment Hydrology Validation

Comparison of DRAINS peak flows and rational method peak flows for 100 year ARI 25 minute storm event

	DRAINS Results for 100y25min storm						Rational Method for 100y25min storm				
Name	Total Area (ha)	Paved Area %	Grass Area %	Paved Time (min)	Grass Time (min)	Max Flow Q (cu.m/s)	C' 10	C10	C1	Q (cu.m/s)	Diff %
C Up_01	3.8125	56	44	4.07	8.14	2.01	0.45	0.70	0.84	1.51	25%
C Up_02	10.1205	54	46	6.63	13.26	4.56	0.45	0.69	0.83	3.97	13%
C Up_03	12.8136	59	41	7.46	14.92	5.70	0.45	0.71	0.86	5.19	9%
C Up_04	1.9058	71	29	2.88	5.75	1.07	0.45	0.77	0.92	0.83	22%
C Up_05	4.9641	63	37	4.64	9.28	2.65	0.45	0.73	0.88	2.06	22%
C Up_06	3.7503	55	45	4.03	8.07	1.97	0.45	0.70	0.83	1.48	25%
C Up_07	10.9356	55	45	6.89	13.78	4.92	0.45	0.70	0.83	4.32	12%
C Up_08	8.7203	65	35	6.15	12.30	4.26	0.45	0.74	0.89	3.67	14%
C Rail_01	0.4068	70	30	1.33	2.66	0.23	0.45	0.76	0.92	0.18	24%
C Rail_02	0.4796	70	30	1.44	2.89	0.27	0.45	0.76	0.92	0.21	24%
C Rail_03	1.2654	70	30	2.34	4.69	0.72	0.45	0.76	0.92	0.55	24%
C Rail_04	1.1316	69	31	2.22	4.43	0.64	0.45	0.76	0.91	0.49	24%
C Rail_05	1.5068	70	30	2.56	5.11	0.84	0.45	0.76	0.92	0.65	23%
C Rail_06Cess	0.83	57	43	3.35	6.70	0.45	0.45	0.70	0.85	0.33	26%
C Rail_08Cess	0.172	70	30	2.07	4.15	0.10	0.45	0.76	0.92	0.07	24%
C Rail_09Cess	0.0673	70	30	1.52	3.04	0.04	0.45	0.76	0.92	0.03	23%
C Down_01	1.1615	71	29	2.25	4.49	0.66	0.45	0.77	0.92	0.51	23%
C Down_02	3.3967	61	39	3.84	7.68	1.83	0.45	0.72	0.87	1.39	24%
C Down_03	9.8512	72	28	4.17	8.33	5.41	0.45	0.77	0.93	4.32	20%
C Down_07	6.1925	61	39	5.18	10.37	3.22	0.45	0.72	0.87	2.54	21%
C Down_08	3.4117	70	30	3.85	7.70	1.88	0.45	0.76	0.92	1.48	21%
C Down_09	4.529	67	33	4.43	8.87	2.46	0.45	0.75	0.90	1.93	22%
C Down_10	2.1874	87	13	3.08	6.16	1.26	0.45	0.84	1.01	1.04	17%
C Down_11	2.436	87	13	3.25	6.50	1.40	0.45	0.84	1.01	1.16	17%
C Down_12	1.4673	87	13	2.52	5.05	0.85	0.45	0.84	1.01	0.70	17%
C Down_13	1.9232	80	20	2.89	5.78	1.10	0.45	0.81	0.97	0.88	19%
C Rail_06Dive	0.21	80	0	3.35	6.70	0.10	0.45	0.81	0.97	0.10	3%
C Rail_06Rail	0.64	57	43	3.35	6.70	0.35	0.45	0.70	0.85	0.26	26%
C Rail_07Cess	0.273	80	20	2.00	4.00	0.16	0.45	0.81	0.97	0.13	20%
C Rail_07Rail	0.496	80	20	2.00	4.00	0.29	0.45	0.81	0.97	0.23	20%
C Rail_08Rail	0.773	80	20	2.07	4.15	0.44	0.45	0.81	0.97	0.35	20%
C Rail_09Dive	0.112	70	30	1.52	3.04	0.06	0.45	0.76	0.92	0.05	24%
C Rail_09Rail	0.362	70	30	1.52	3.04	0.21	0.45	0.76	0.92	0.16	24%
C Rail_08Dive	0.179	80	20	2.07	4.15	0.10	0.45	0.81	0.97	0.08	20%
C Down_04a	2.35	75	25	3.20	6.39	1.32	0.45	0.79	0.94	1.05	20%
C Down_04b	1.7961	74	26	2.79	5.58	1.01	0.45	0.78	0.94	0.80	21%
C Down_04c	1.319	65	35	2.39	4.79	0.75	0.45	0.74	0.89	0.55	26%
C Down_04d	1.5736	65	35	2.61	5.23	0.87	0.45	0.74	0.89	0.66	24%
C Down_04e	1.2828	63	37	2.36	4.72	0.72	0.45	0.73	0.88	0.53	26%
C Down_04f	1.1942	59	41	2.28	4.55	0.67	0.45	0.71	0.86	0.48	28%
C Down_05a	3.5497	42	58	3.93	7.85	1.83	0.45	0.64	0.76	1.28	30%
C Down_05b	2.0317	14	86	2.97	5.94	1.03	0.45	0.51	0.61	0.59	43%
C Down_05c	5.3374	82	18	4.81	9.63	3.00	0.45	0.82	0.98	2.48	17%
C Down_06a	8.0322	52	48	5.90	11.81	3.85	0.45	0.68	0.82	3.11	19%
C Down_06b	3.9887	59	41	4.16	8.32	2.12	0.45	0.71	0.86	1.62	24%
C Down_06c	3.3957	55	45	3.84	7.68	1.80	0.45	0.70	0.83	1.34	26%
C Down_06d	3.3826	61	39	3.83	7.66	1.82	0.45	0.72	0.87	1.39	24%
C Down_06e	3.3682	57	43	3.82	7.65	1.80	0.45	0.70	0.85	1.35	25%
C Down_06f	2.8908	59	41	3.54	7.08	1.55	0.45	0.71	0.86	1.17	24%
C Down_06g	2.1889	66	34	3.08	6.16	1.20	0.45	0.75	0.89	0.93	23%

C1	1.2	
I	170.2	mm/h for 100y25min storm
10I1=	51	mm/h
F1y	1.2	for 100yr

Appendix C. Flood Maps for Baseline Condition

Legend

Flood Level (mAHD)

Value

High : 22.5

Low : 1

1m Flood Level Contour

Study Area

JACOBS

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

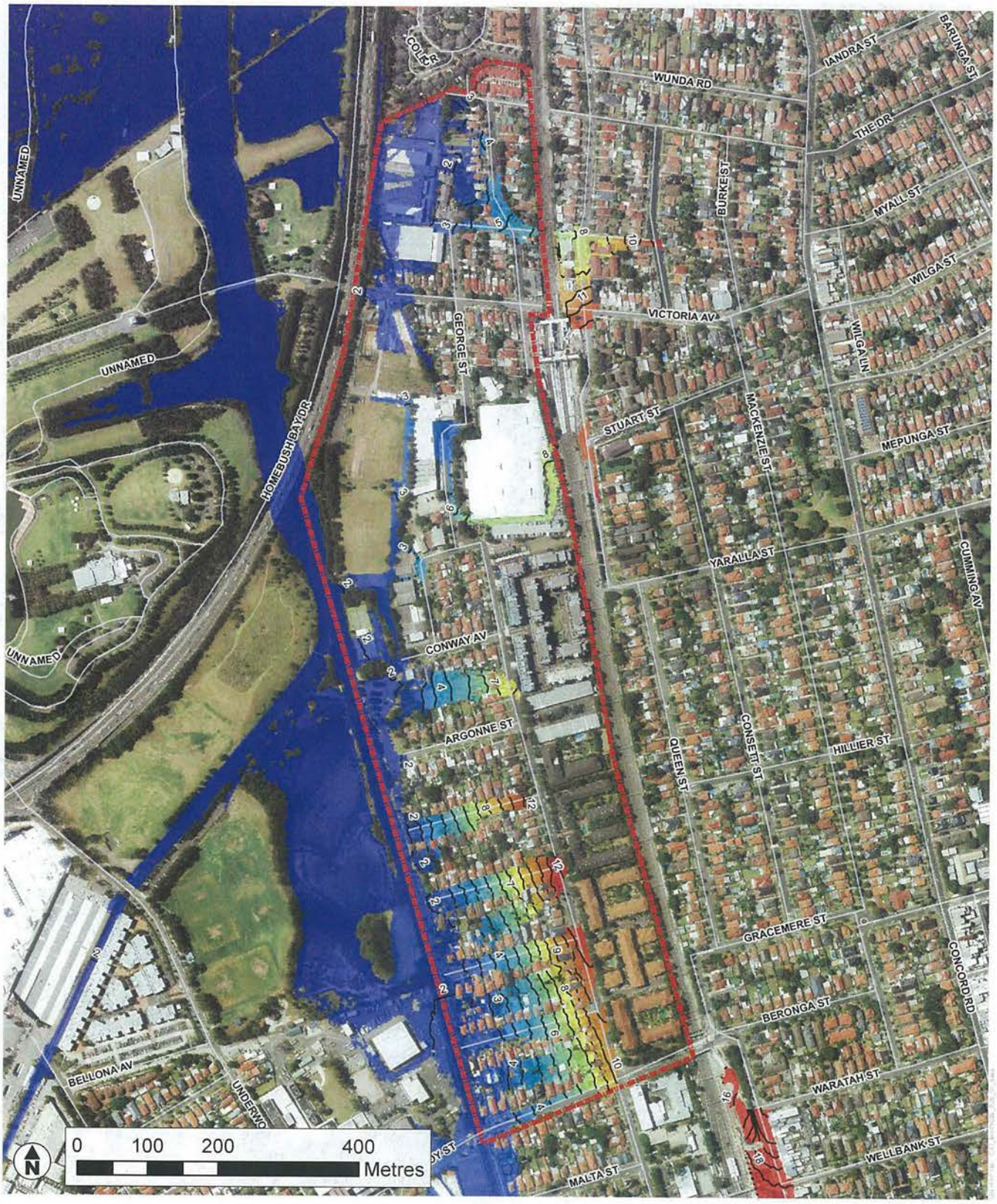
TITLE 50% AEP Flood Level - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046600	MAP C-1	1	1

CHECK LC DATE 30/5/2015



Legend

Flood Level (mAHD)

Value

High : 22.5

Low : 1

1m Flood Level Contour

Study Area

JACOBS

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

TITLE 20% AEP Flood Level - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
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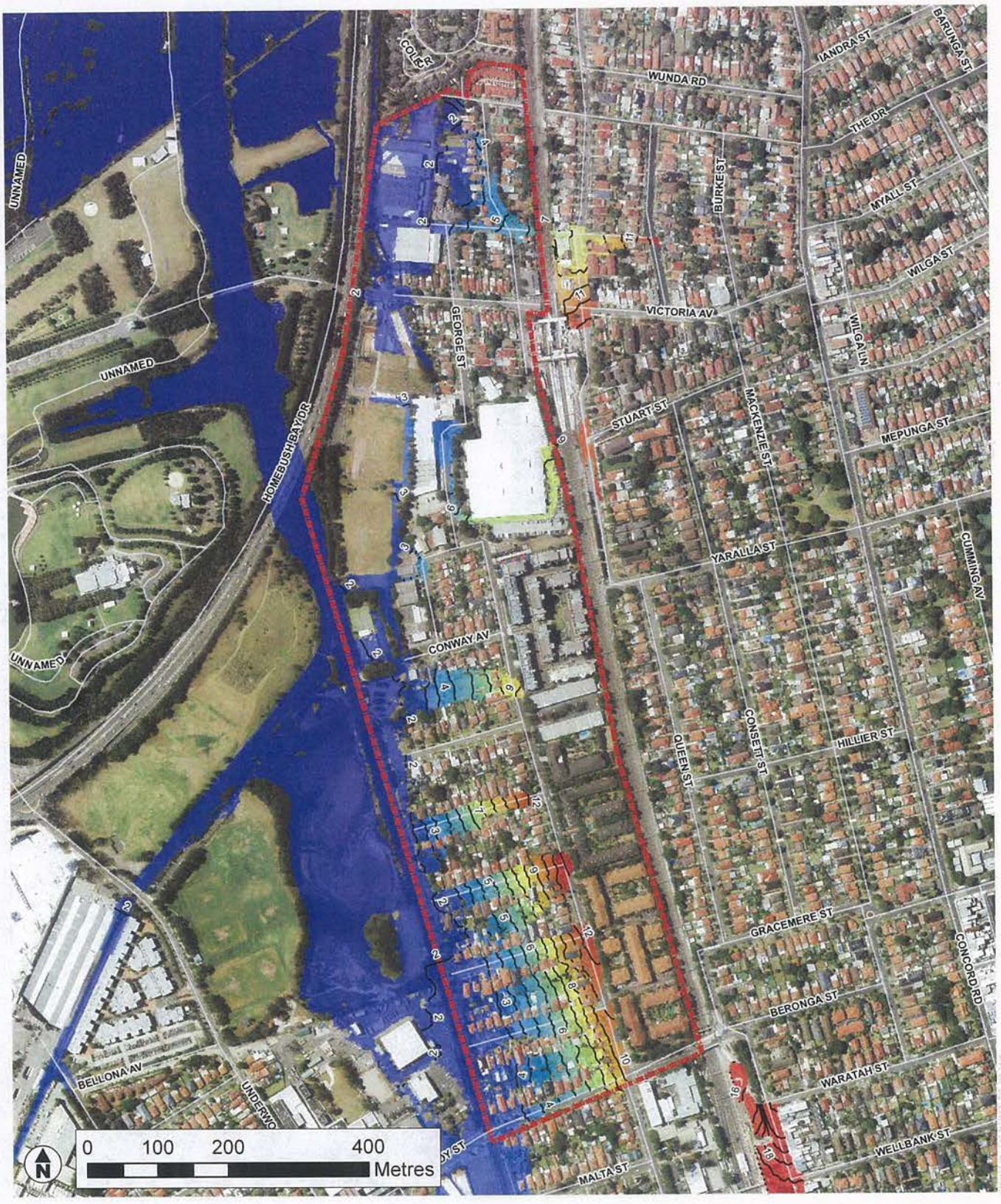
CHECK LC DATE 7/05/2015



Legend

Flood Level (mAHD)

Value

High : 22.5

Low : 1

1m Flood Level Contour

Study Area

JACOBS

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

TITLE 10% AEP Flood Level - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
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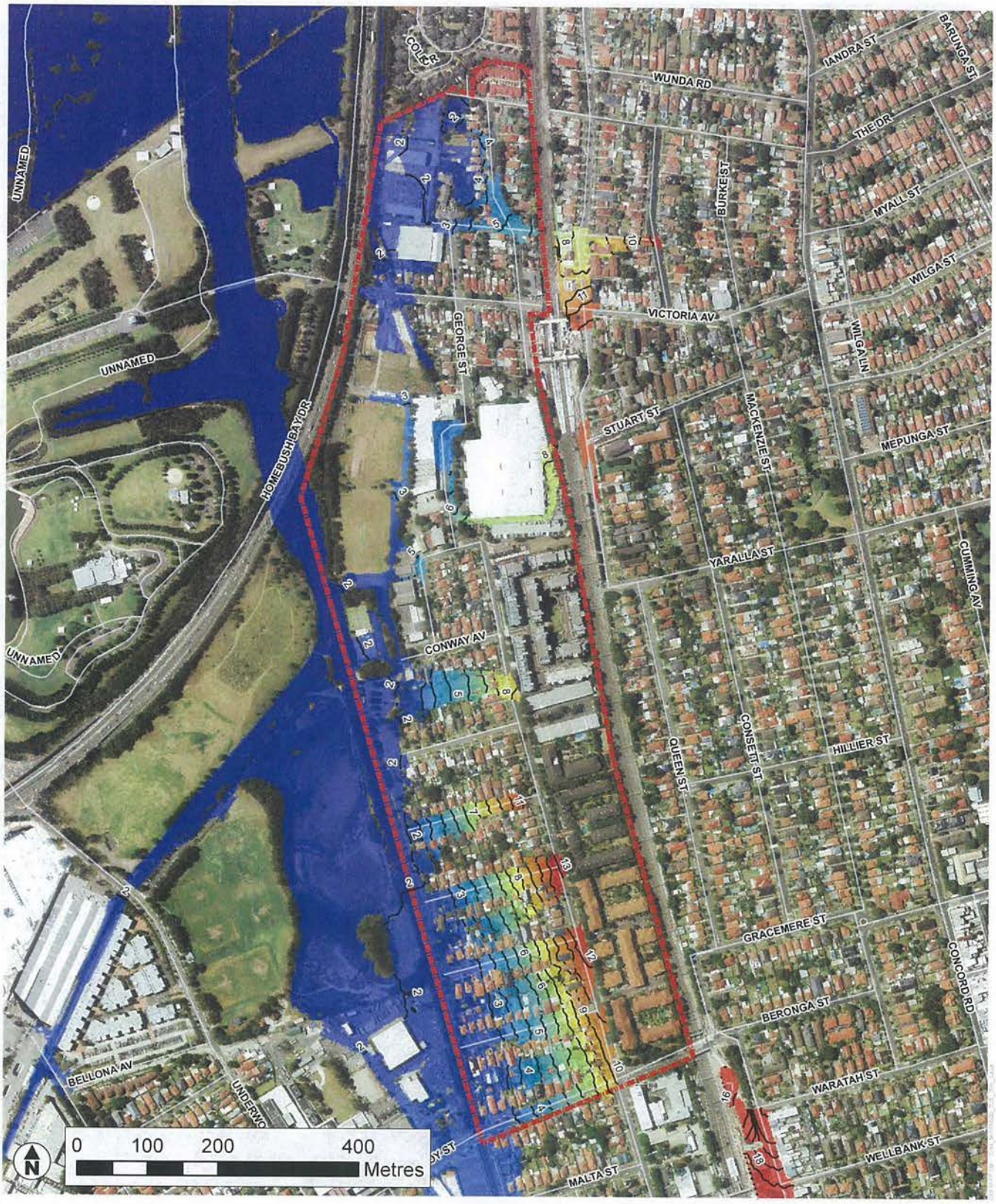
CHECK LC DATE 7/05/2019



Legend

Flood Level (mAHD)

Value

High : 22.5

Low : 1

1m Flood Level Contour

Study Area

JACOBS

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

TITLE 5% AEP Flood Level - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
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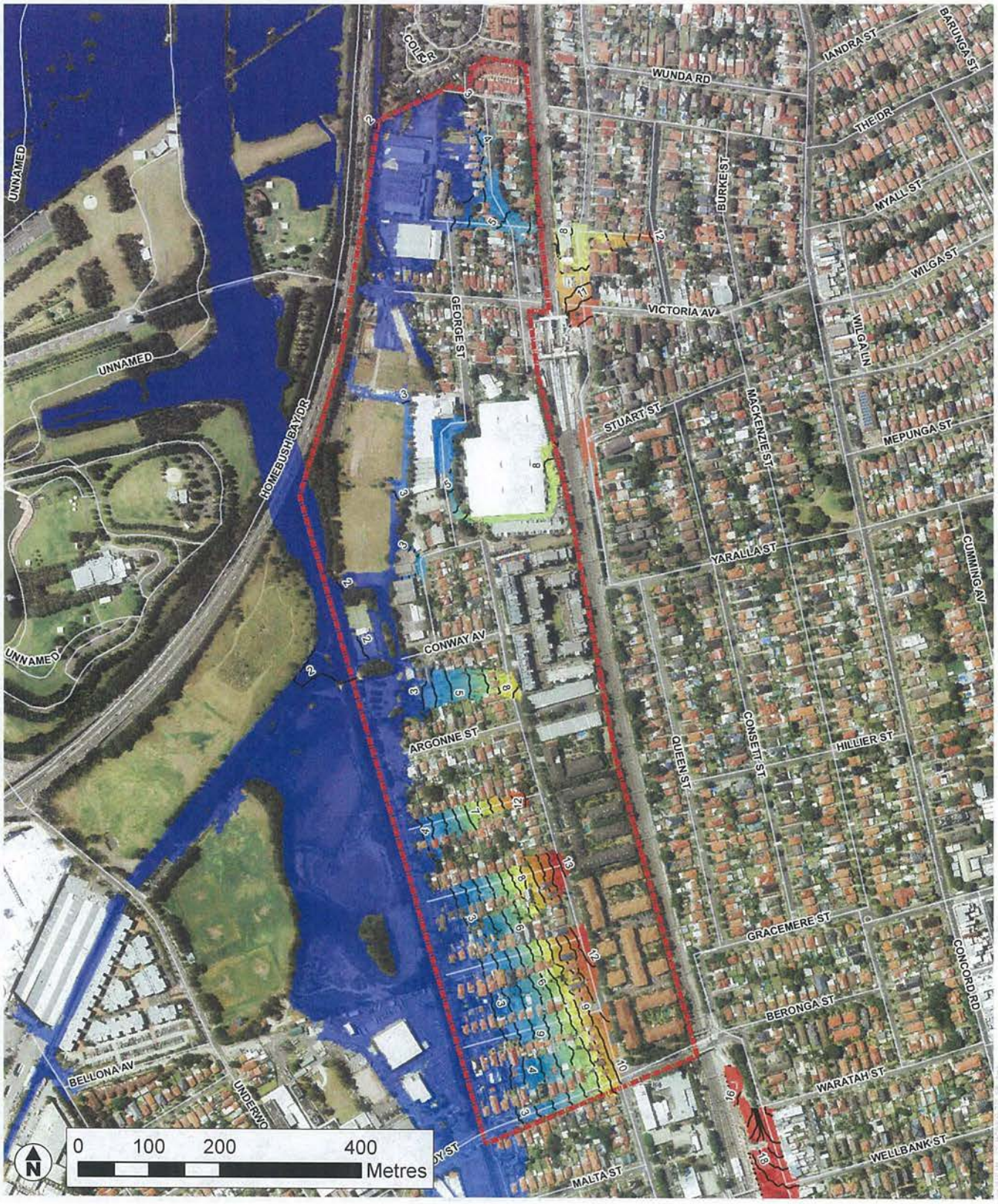
CHECK LC DATE 7/05/2015



Legend

Flood Level (mAHD)

Value

High : 22.5

Low : 1

1m Flood Level Contour

Study Area

JACOBS

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

TITLE 2% AEP Flood Level - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046800	MAP C-5	1	1

CHECK LC DATE 7/05/2019

Legend

Flood Level (mAHD)

Value

High : 22.5

Low : 1

1m Flood Level Contour

Study Area

JACOBS

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

TITLE 1% AEP Flood Level - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
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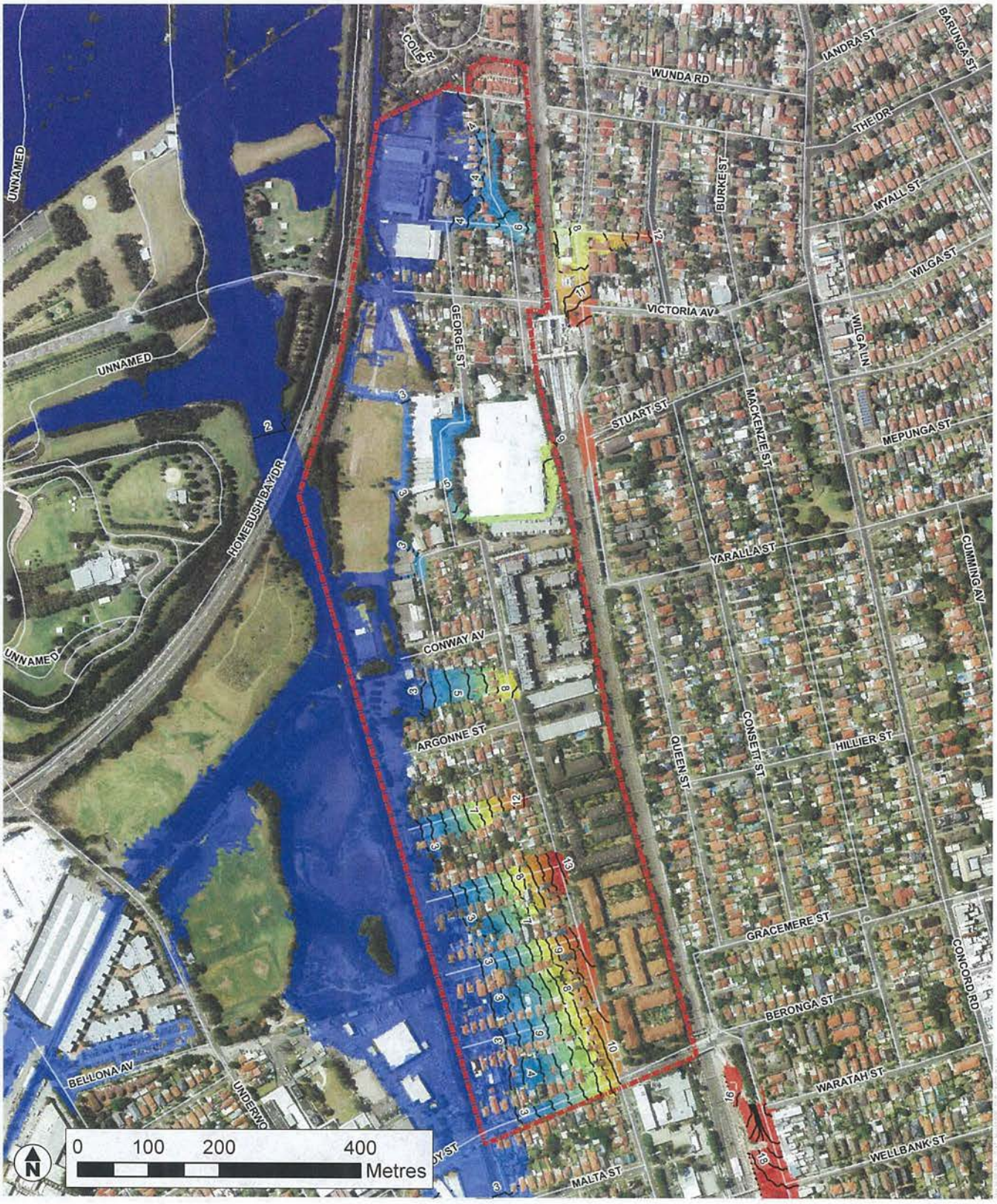
CHECK LC DATE 7/09/2015



Legend

Flood Level (mAHD)

Value

High : 22.5

Low : 1

1m Flood Level Contour

Study Area

JACOBS

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

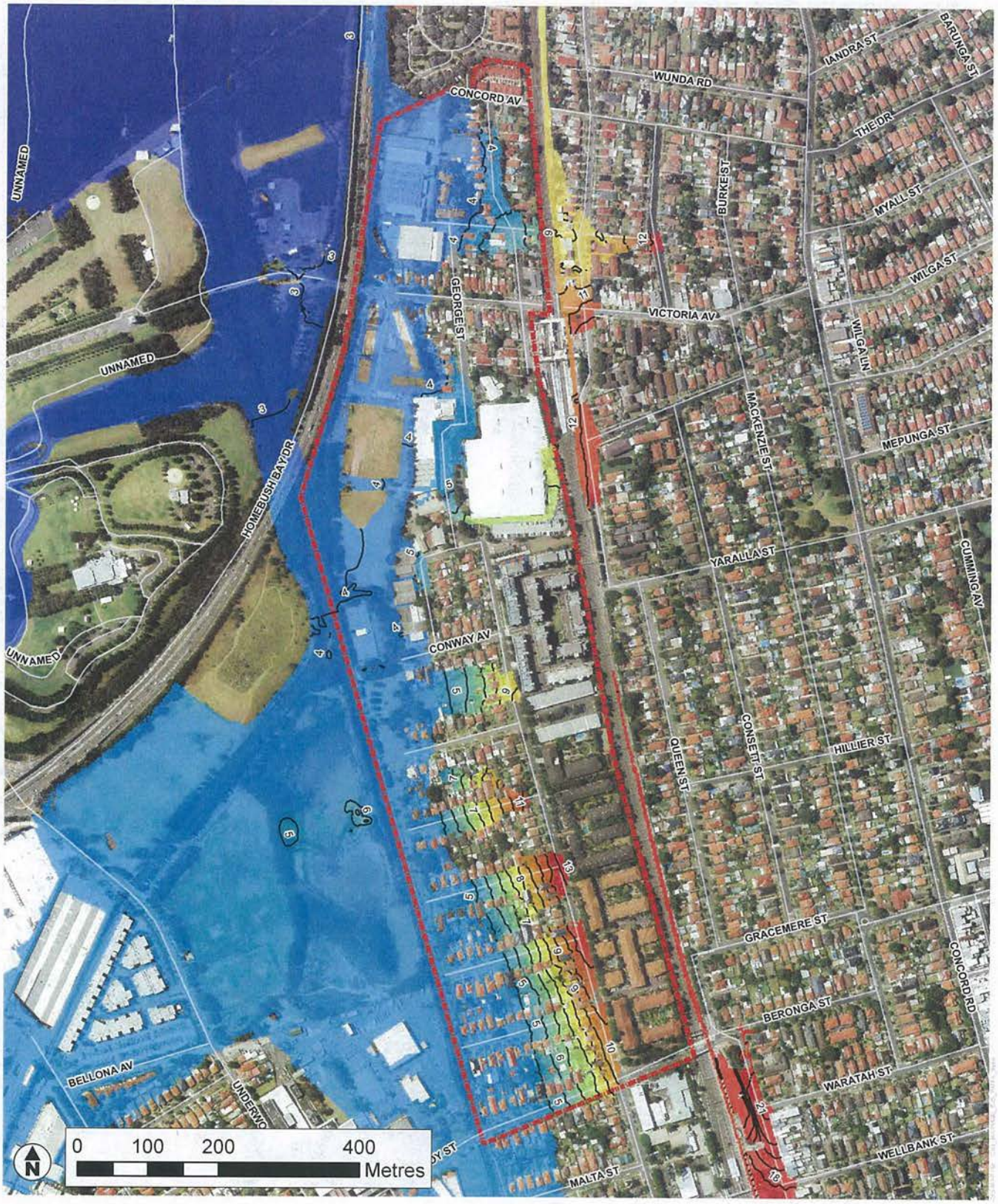
TITLE 0.5% AEP Flood Level - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046600	MAP C-7	1	1

CHECK LC DATE 7/05/2015



Legend

Flood Level (mAHD)

Value

High : 22.5

Low : 1

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

TITLE PMF Flood Level - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046600	MAP C-8	1	1

CHECK LC DATE 7/05/2015

Legend

Flood Planning Area (1% AEP Flood Level plus Freeboard)

- 0.3m Freeboard
- 0.5m Freeboard

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

TITLE Flood Planning Area

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA045600	FIGURE C-9	1	1

CHECK AH DATE 7/08/2015

Legend

Depth (m)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

TITLE 50% AEP Flood Depth - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046800	MAP C-10	1	1

CHECK LC DATE 7/05/2015

Legend

Depth (m)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

TITLE 20% AEP Flood Depth - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046600	MAP C-11	1	1

CHECK LC DATE 7/05/2015

Legend

Depth (m)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

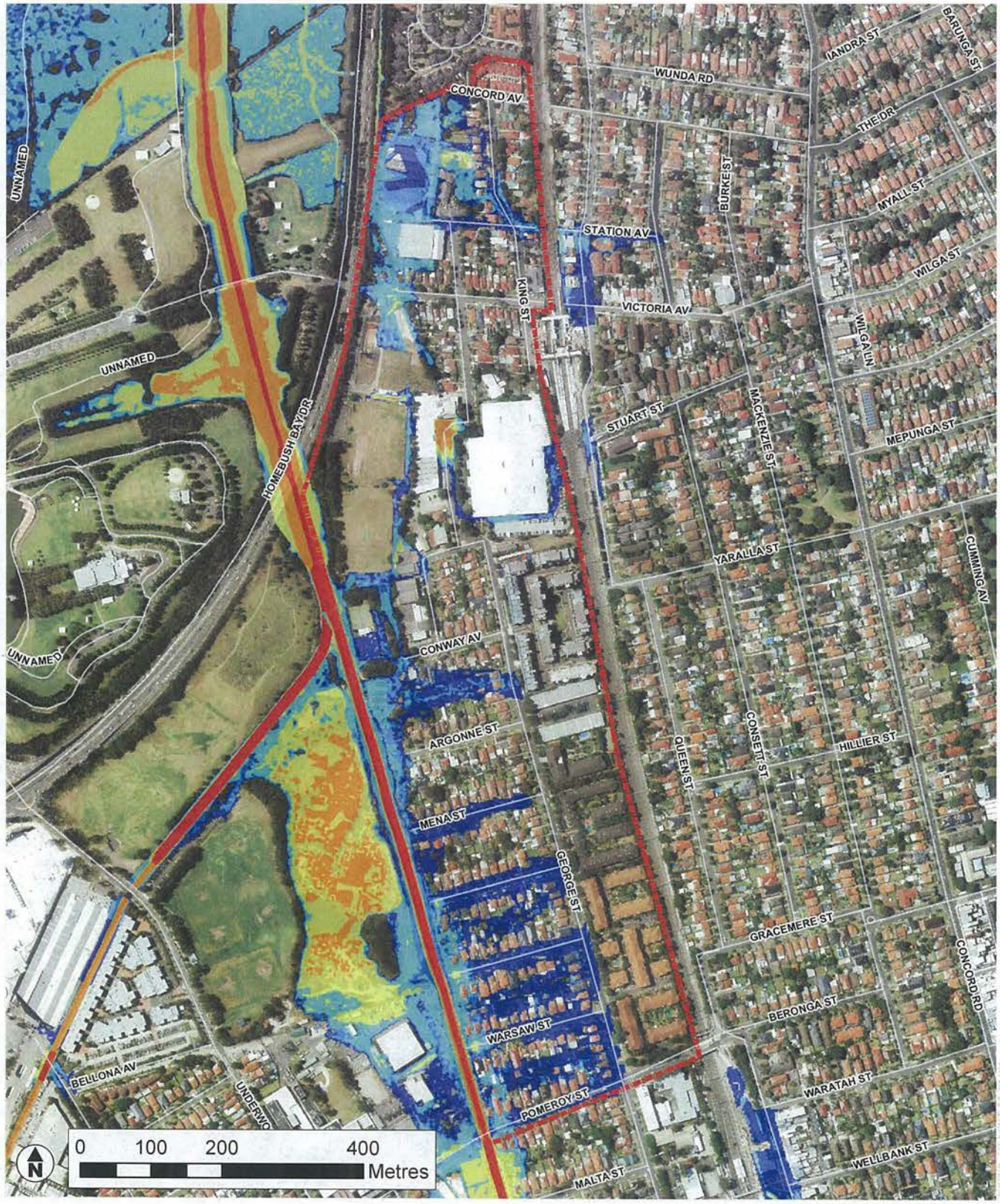
TITLE 10% AEP Flood Depth - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046800	MAP C-12	1	1

CHECK LC DATE 7/05/2013



Legend

Depth (m)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

TITLE 5% AEP Flood Depth - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046600	MAP C-13	1	1

CHECK LC DATE 7/05/2015

JACOBS

Legend

Depth (m)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

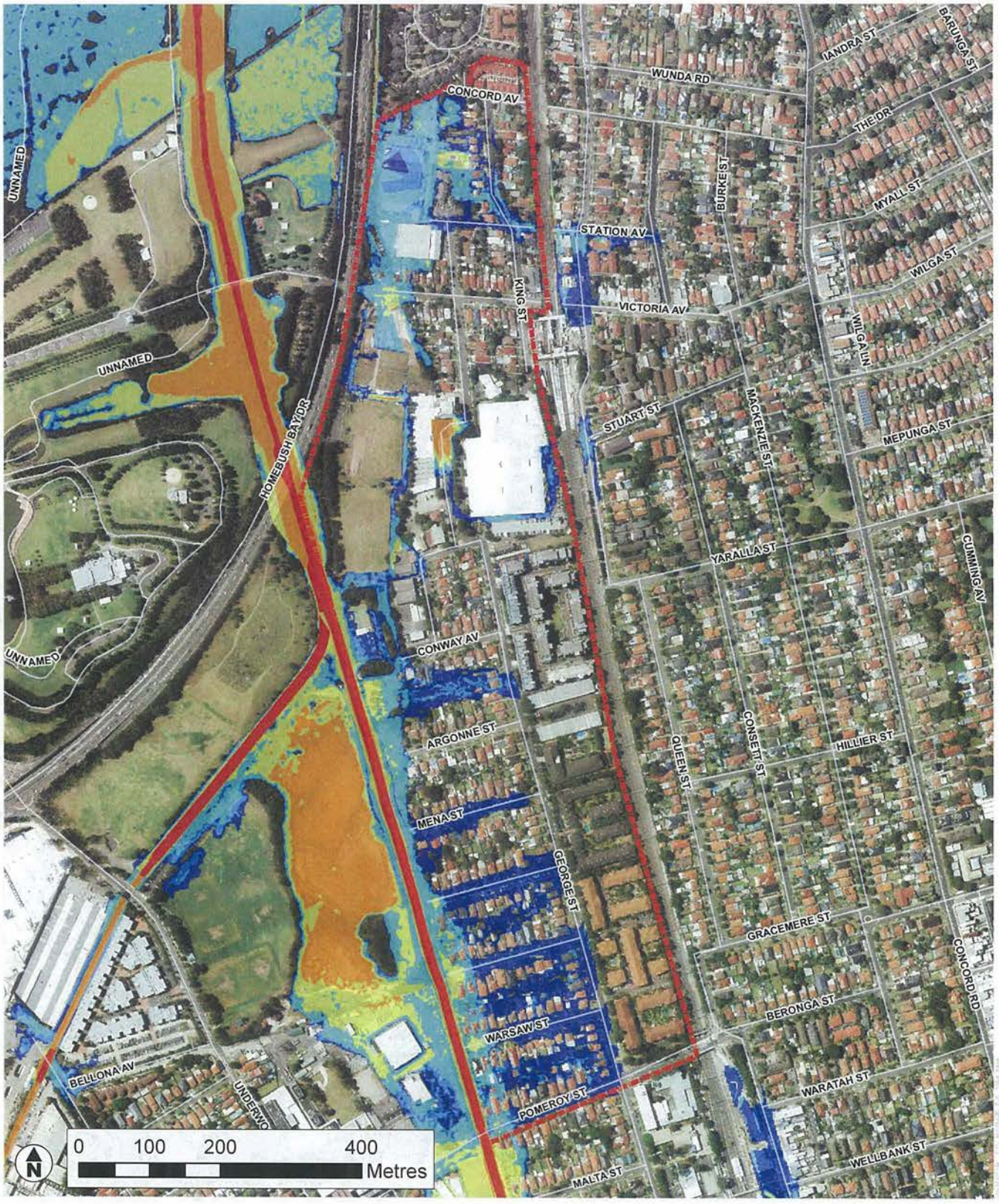
TITLE 2% AEP Flood Depth - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046800	MAP C-14	1	1

CHECK LC DATE 7/05/2015



Legend

Depth (m)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

TITLE 1% AEP Flood Depth - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046800	MAP C-15	1	1

CHECK LC DATE 7/09/2015

Legend

Depth (m)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

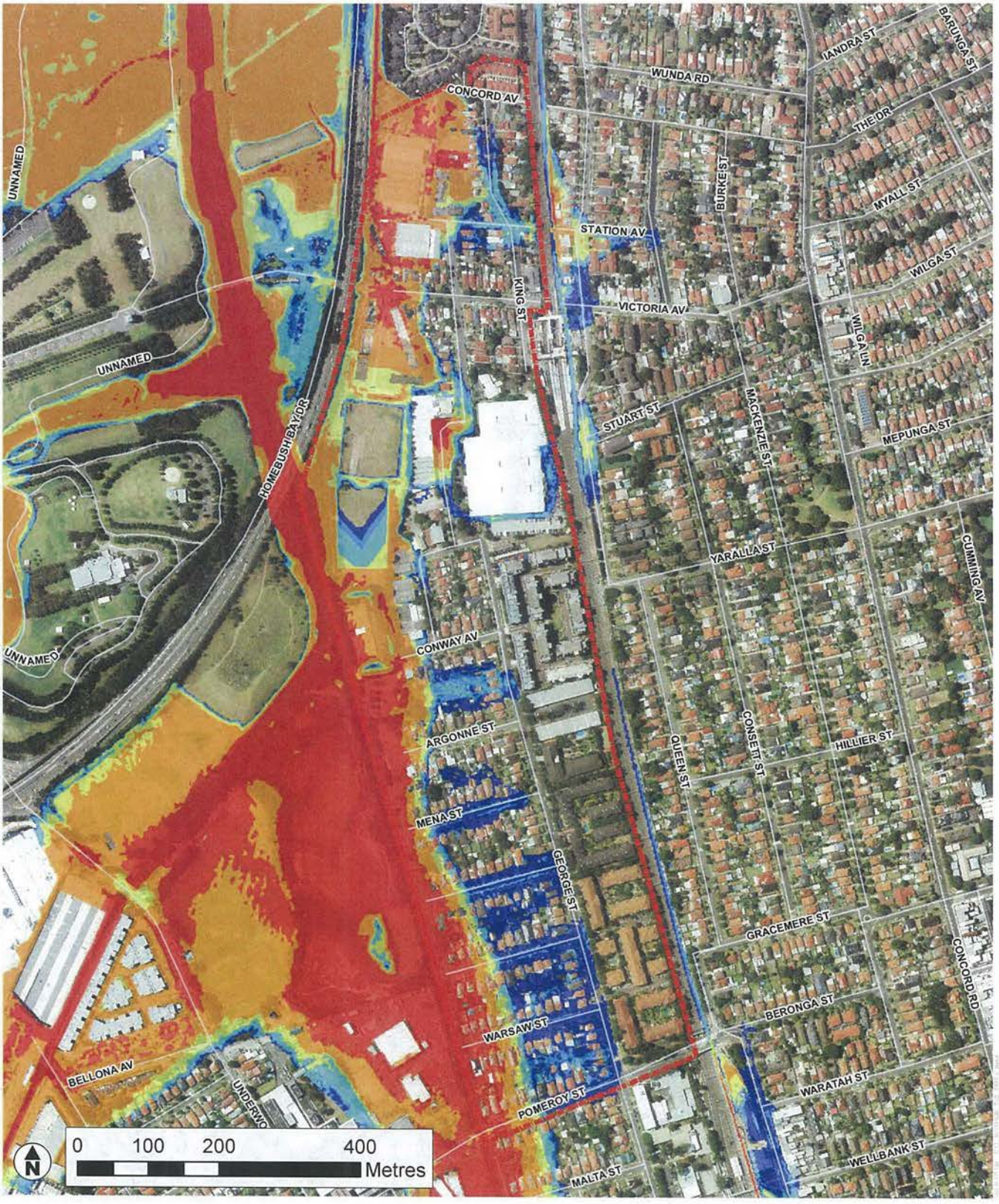
TITLE 0.5% AEP Flood Depth - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046600	MAP C-16	1	1

CHECK LC DATE 7/05/2015



Legend

Depth (m)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

TITLE PMF Flood Depth - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA045600	MAP C-17	1	1

CHECK LC DATE 7/05/2015

Legend

Velocity (m/s)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

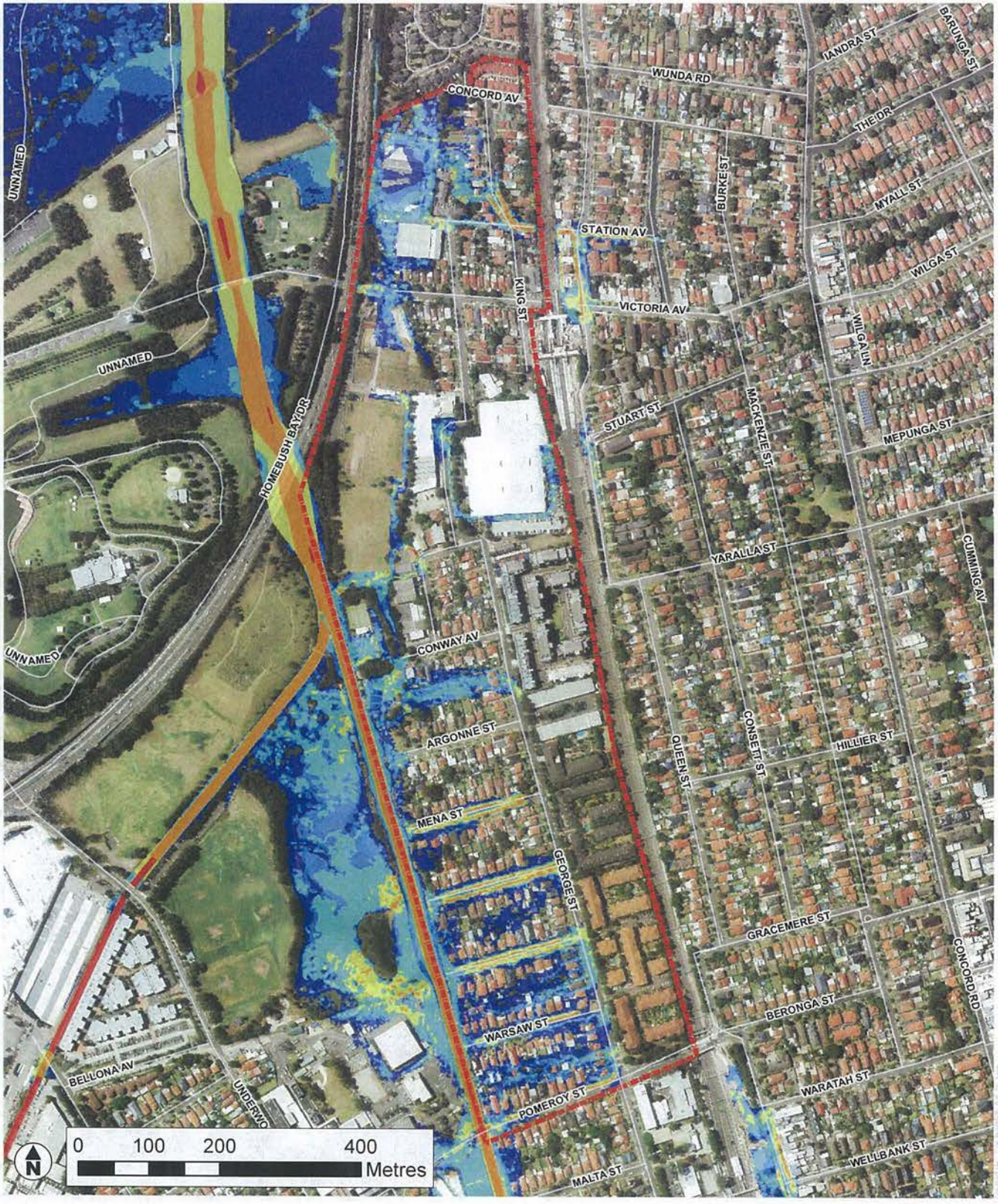
TITLE 50% AEP Flood Velocity - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA048600	MAP C-18	1	1

CHECK LC DATE 7/03/2019



Legend

Velocity (m/s)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

TITLE 20% AEP Flood Velocity - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046600	MAP C-19	1	1

CHECK LC DATE 7/09/2019

Legend

Velocity (m/s)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

TITLE 10% AEP Flood Velocity - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046800	MAP C-20	1	1

CHECK DATE

LC 7/05/2015

Legend

Velocity (m/s)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

TITLE 5% AEP Flood Velocity - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046600	MAP C-21	1	1

CHECK LC DATE 7/05/2015

Legend

Velocity (m/s)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

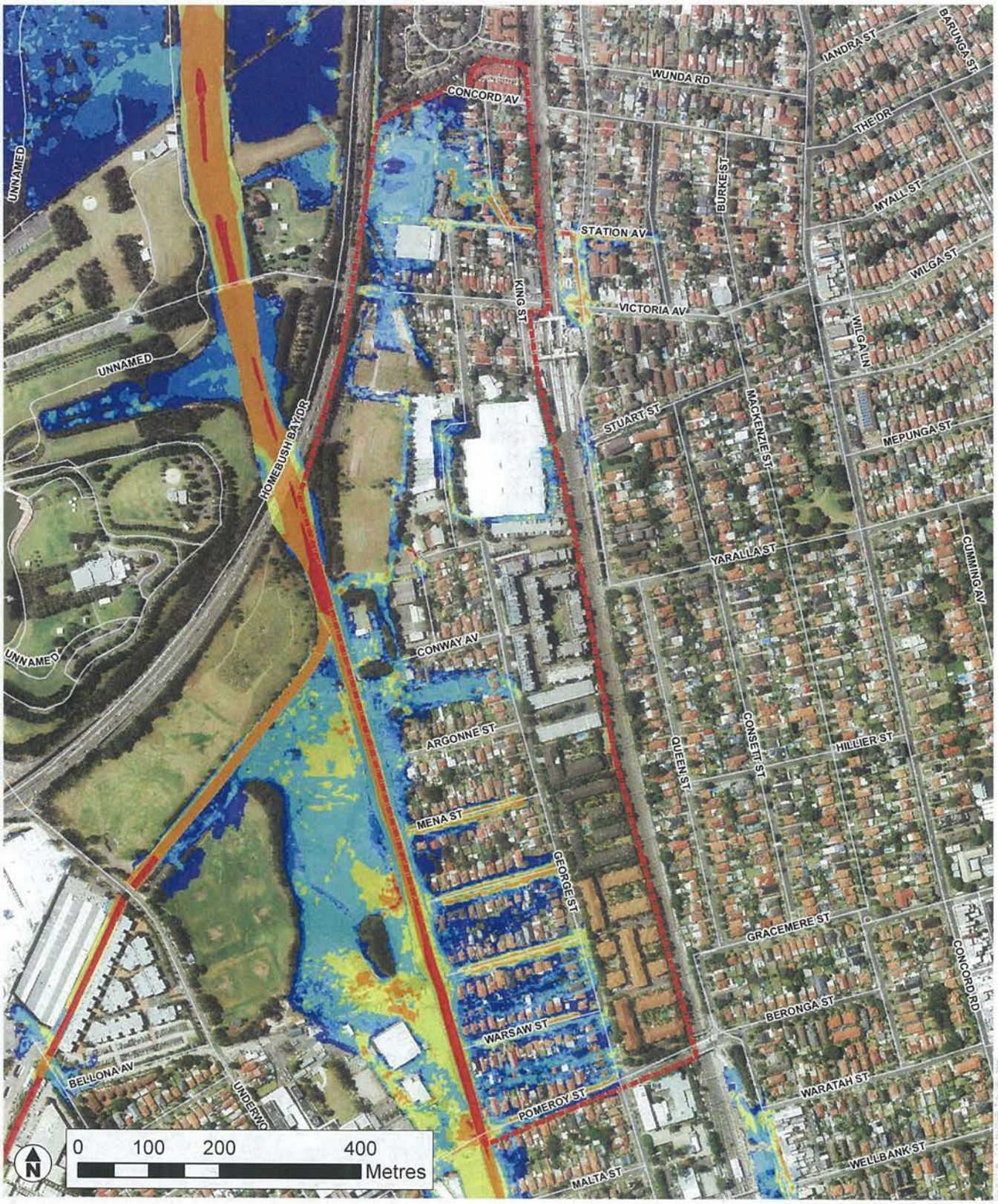
TITLE 2% AEP Flood Velocity - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046500	MAP C-22	1	1

CHECK LC DATE 7/05/2015



Legend

Velocity (m/s)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

TITLE 1% AEP Flood Velocity - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN LC | PROJECT # IA016800 | MAP # MAP C-23 | REV 1 | VER 1

CHECK LC | DATE 7/05/2015

JACOBS

Legend

Velocity (m/s)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

JACOBS

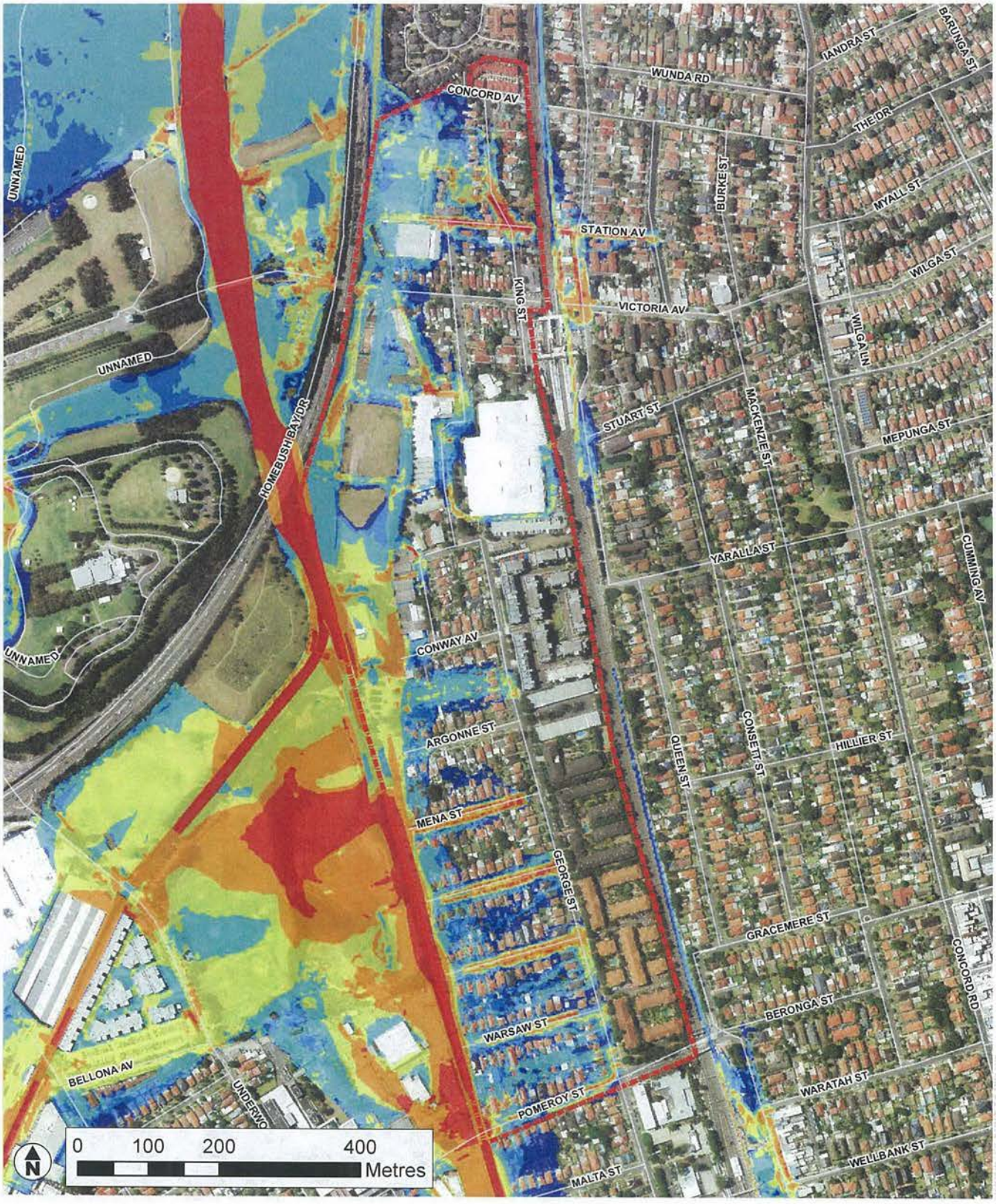
TITLE 0.5% AEP Flood Velocity - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046500	MAP C-24	1	1

CHECK LC DATE 7/05/2015



Legend

Velocity (m/s)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

Study Area

JACOBS

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

TITLE PMF Flood Velocity - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046600	MAP C-25	1	1

CHECK LC DATE 7/05/2019

Legend

Flood Hazard Categories

- Low Hazard
- High Hazard
- Study Area

JACOBS

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

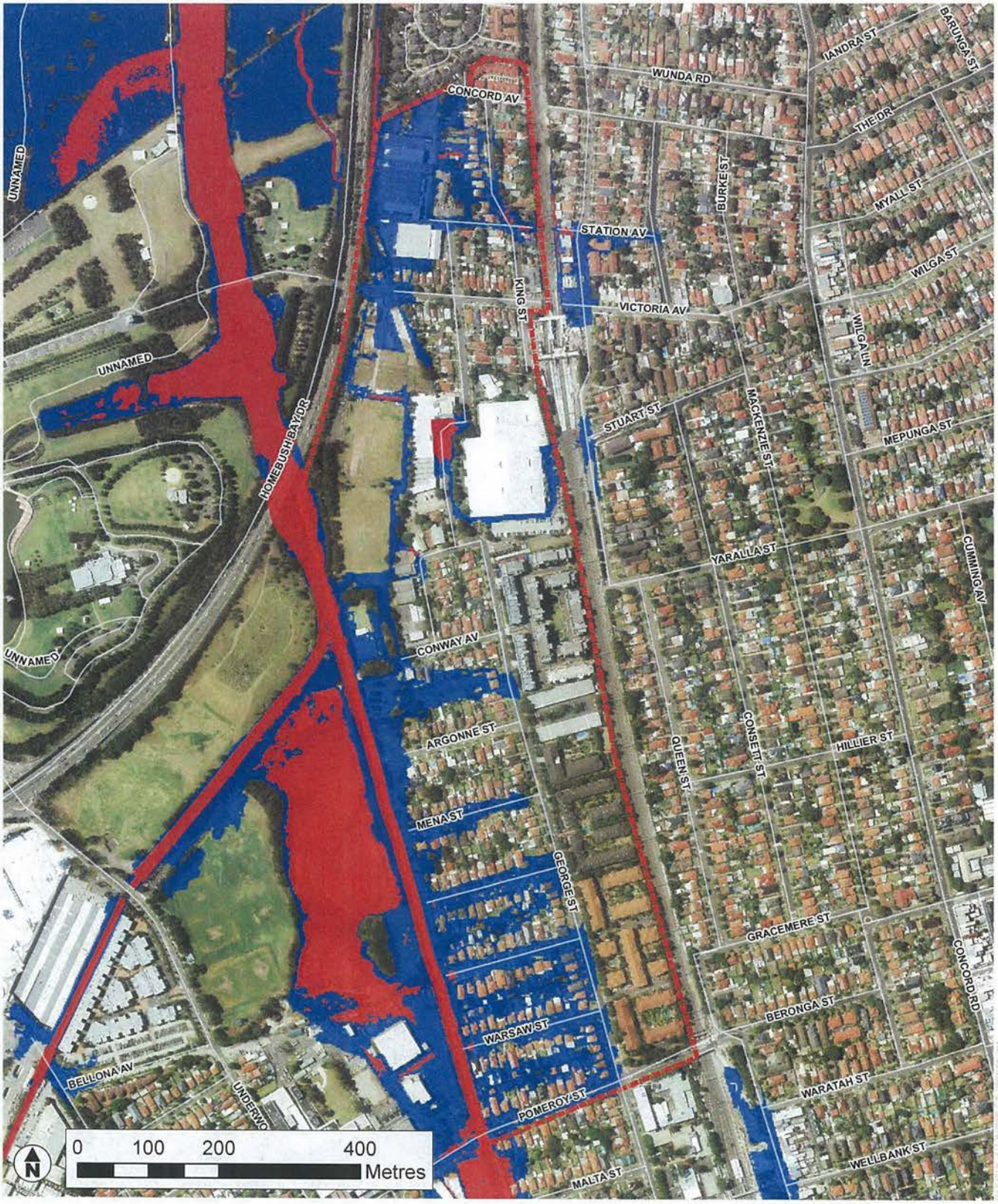
TITLE 5% AEP Flood Hazard - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA016600	MAP C-26	1	1

CHECK LC DATE 7/05/2015



Legend

Flood Hazard Categories

- Low Hazard
- High Hazard
- Study Area

JACOBS

A3

SHEET 1 of 1

GDA 1994 MGA Zone 56

TITLE 1% AEP Flood Hazard - Baseline Case

PROJECT Concord West Precinct Masterplan Flood Study

CLIENT City of Canada Bay

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA046800	MAP C-27	1	1

CHECK LC DATE 7/05/2015