

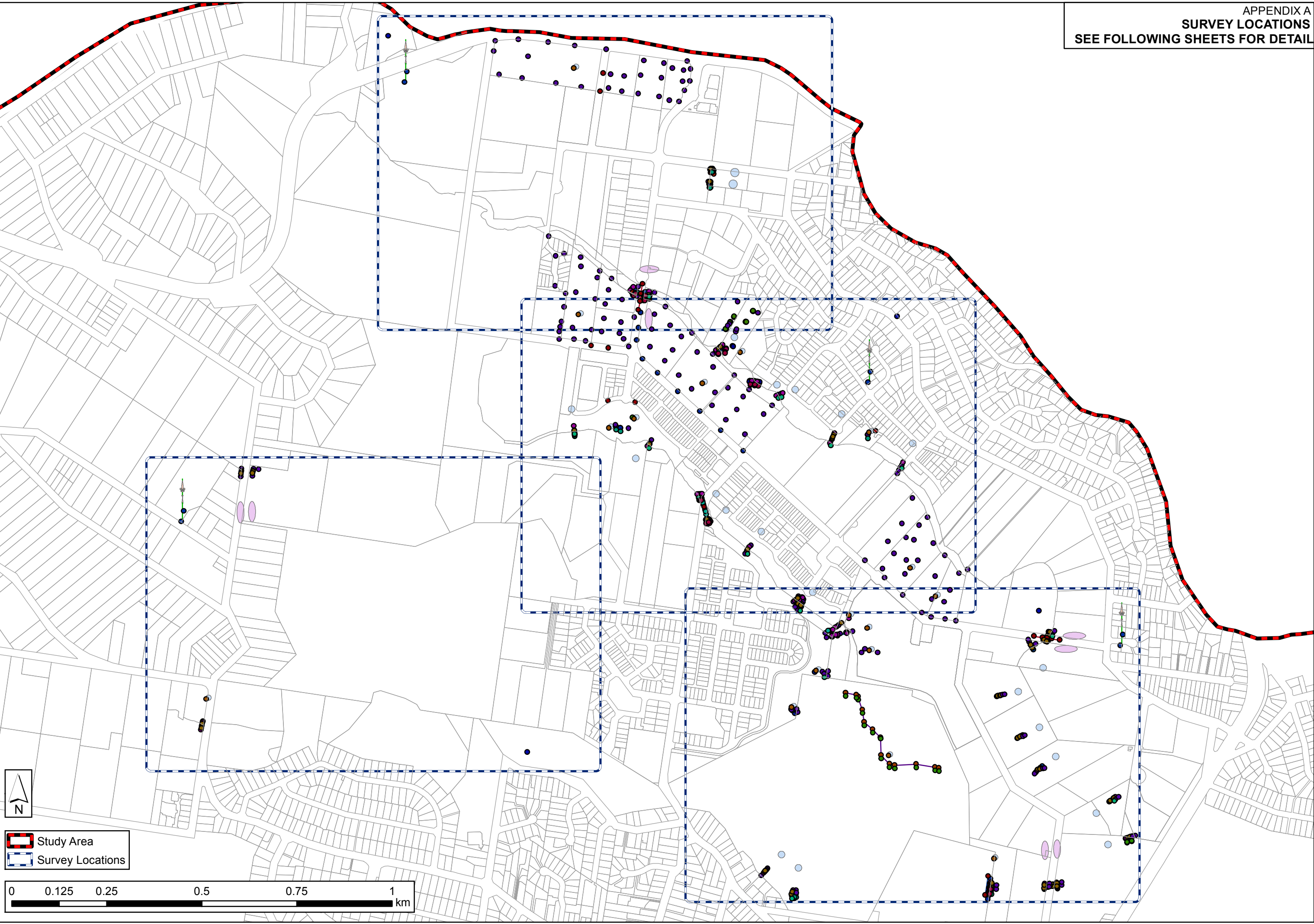
INGLESIDE, ELANORA AND WARRIEWOOD OVERLAND FLOW FLOOD STUDY

VOLUME 2 – APPENDICES

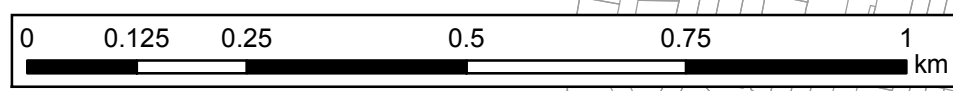
DRAFT REPORT

APPENDIX A.Detail Survey Data





Study Area
Survey Locations



SURVEYING | CIVIL | DEVELOPMENT

Erina: (02) 4367 7334

Hornsby: (02) 9482 9498

www.cbhsurvey.com.au



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LIABILITY LIMITED BY A SCHEME APPROVED UNDER PROFESSIONAL STANDARDS LEGISLATION

PLAN: NORTH NARRABEEN FLOOD STUDY

ORIGIN OF LEVELS: MGA

DATE OF SURVEY: NOV & DEC 2016; JAN 2017

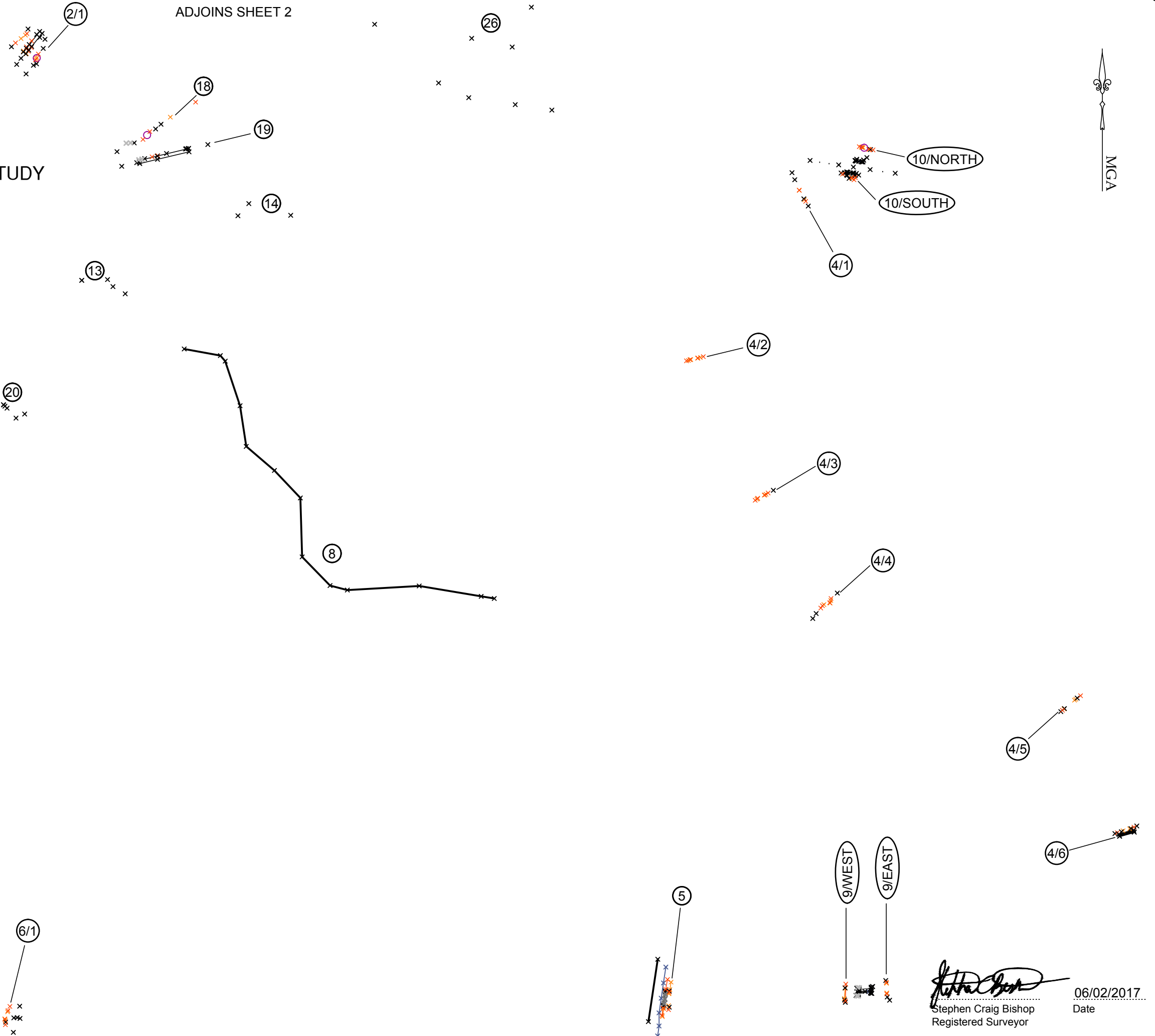
REF No: 2016330-1

SHEET 1 OF 4

0 15 30 60 90 120 150

REDUCTION RATIO 1:3000 @ A3

ADJOINS SHEET 2




Stephen Craig Bishop
Registered Surveyor

06/02/2017
Date

ADJOINS SHEET 3

PLAN: NORTH NARRABEEN FLOOD STUDY

ORIGIN OF LEVELS: MGA
DATE OF SURVEY: NOV & DEC 2016; JAN 2017
REF No: 2016330-1
SHEET 2 OF 4



Stephen Craig Bishop
Stephen Craig Bishop
Registered Surveyor

06/02/2017
Date

ADJOINS SHEET 4

0 15 30 60 90 120 150
REDUCTION RATIO 1:3000 @ A3

SURVEYING | CIVIL | DEVELOPMENT

Erina: (02) 4367 7334
Hornsby: (02) 9482 9498
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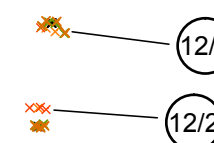
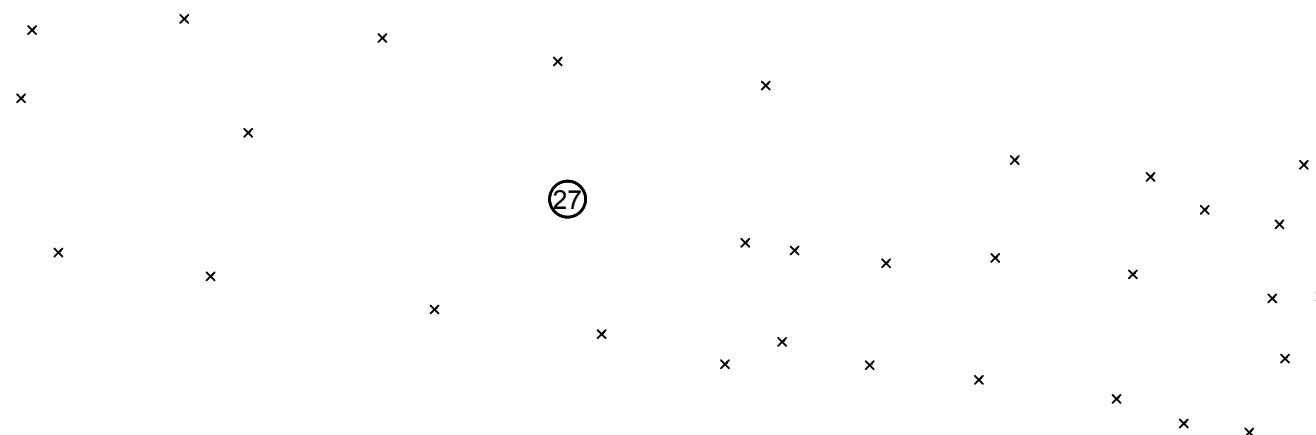
**CHASE
BURKE
HARVEY**

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LIABILITY LIMITED BY A SCHEME APPROVED UNDER PROFESSIONAL STANDARDS LEGISLATION

ADJOINS SHEET 1



0 15 30 60 90 120 150
REDUCTION RATIO 1:3000 @ A3

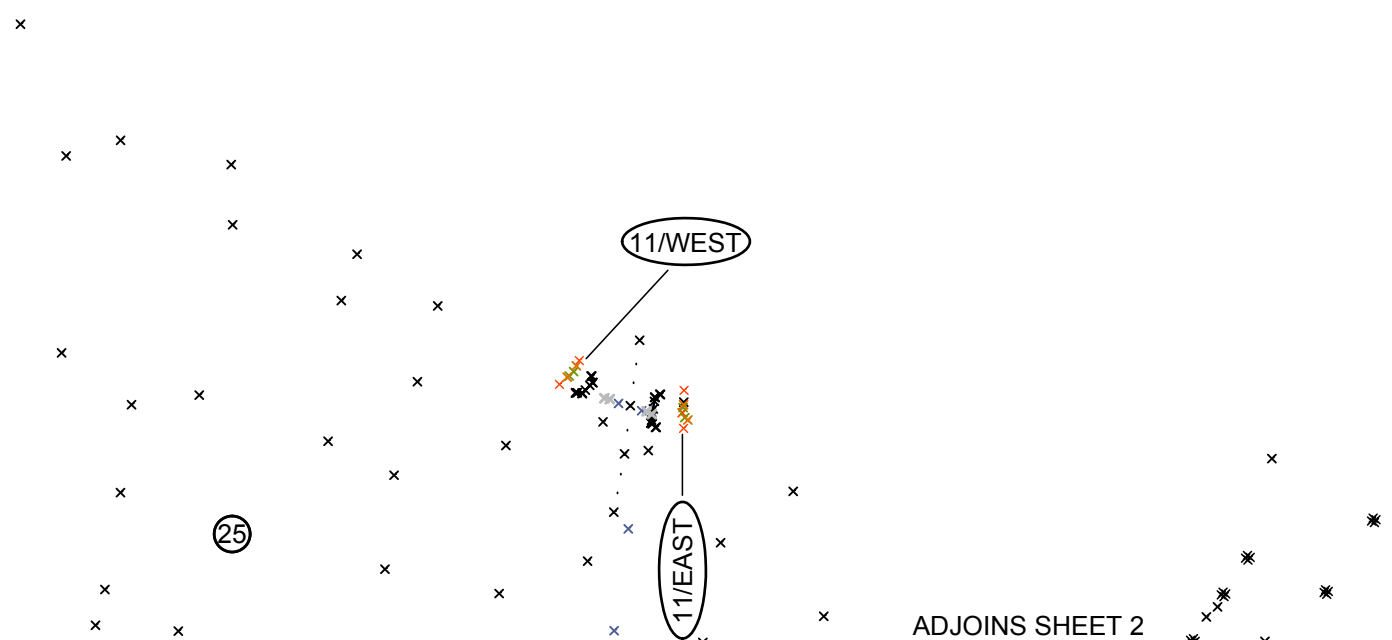



Stephen Craig Bishop
Registered Surveyor

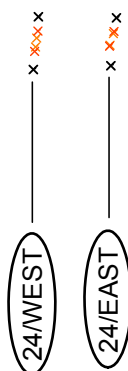
06/02/2017
Date

PLAN: NORTH NARRABEEN FLOOD STUDY

ORIGIN OF LEVELS: MGA
DATE OF SURVEY: NOV & DEC 2016; JAN 2017
REF No: 2016330-1
SHEET 3 OF 4



ADJOINS SHEET 2

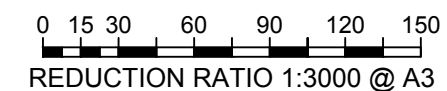


SURVEYING | CIVIL | DEVELOPMENT

Erina: (02) 4367 7334
Hornsby: (02) 9482 9498
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HARVEY**

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ADJOINS SHEET 2

PLAN: NORTH NARRABEEN FLOOD STUDY

ORIGIN OF LEVELS: MGA
DATE OF SURVEY: NOV & DEC 2016; JAN 2017
REF No: 2016330-1
SHEET 4 OF 4


Stephen Craig Bishop
Registered Surveyor

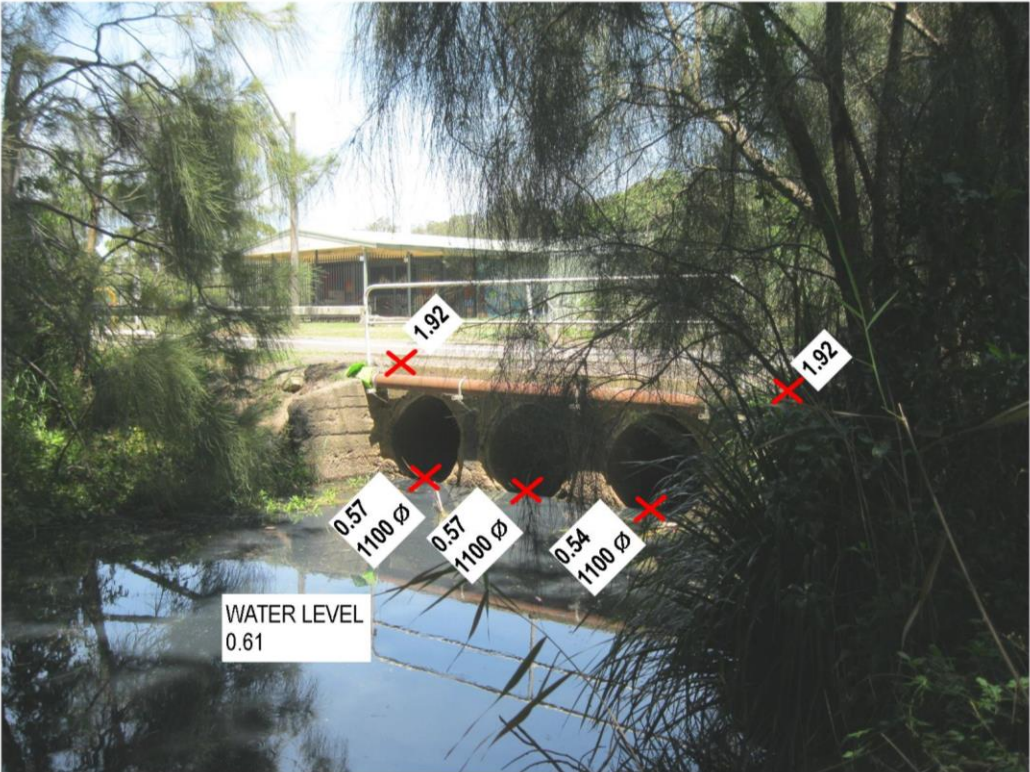
06/02/2017
Date



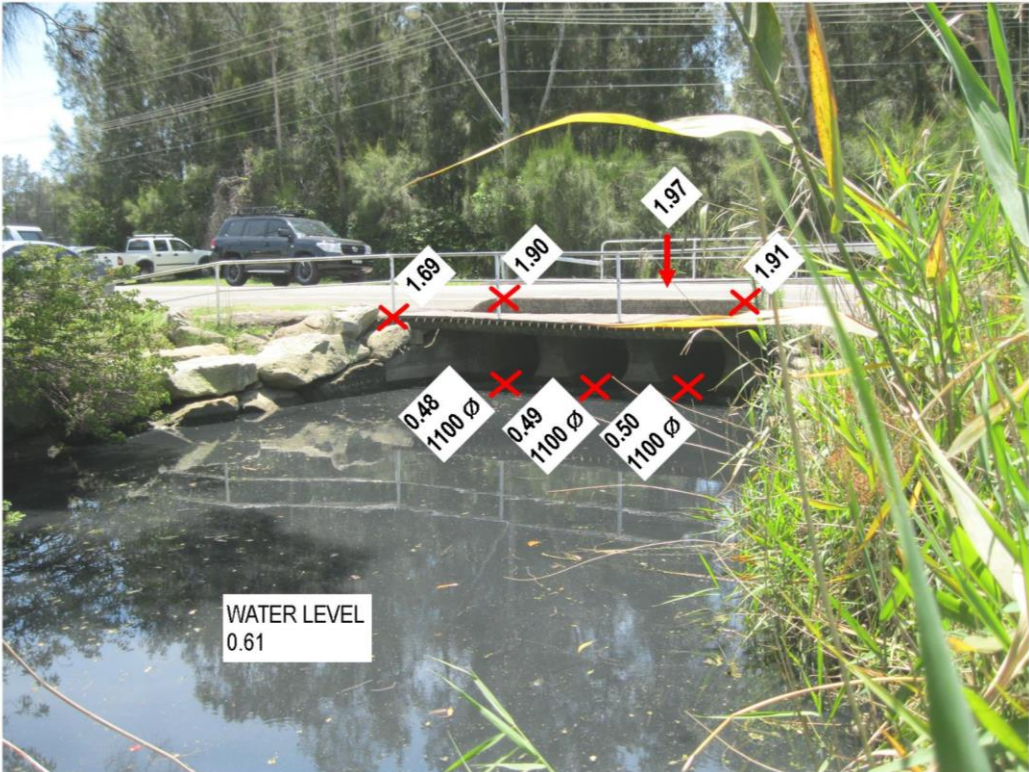
ID7-cs1 us



ID7-cs2 ds



ID9-Culvert East1



ID9-Culvert West2



ID10-Culvert Nth ds



ID10-Culvert Sth us



ID11-Culvert East



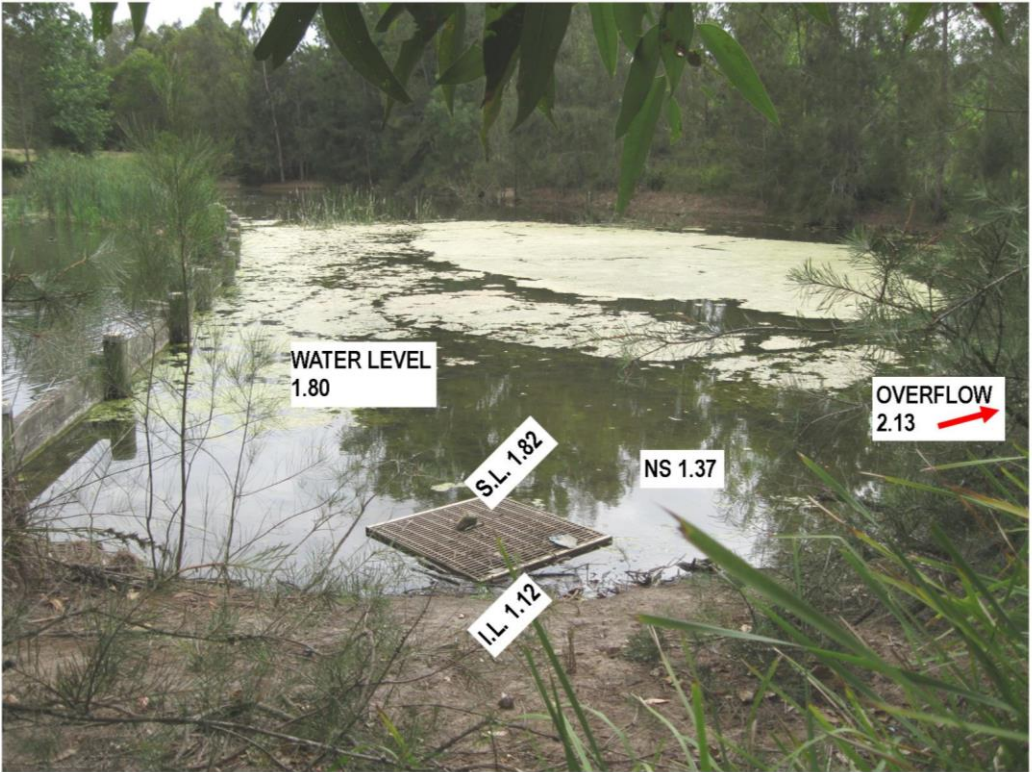
ID11-Culvert West



ID12-cs1 us



ID12-cs2 dsHW



ID13-B



ID14-B



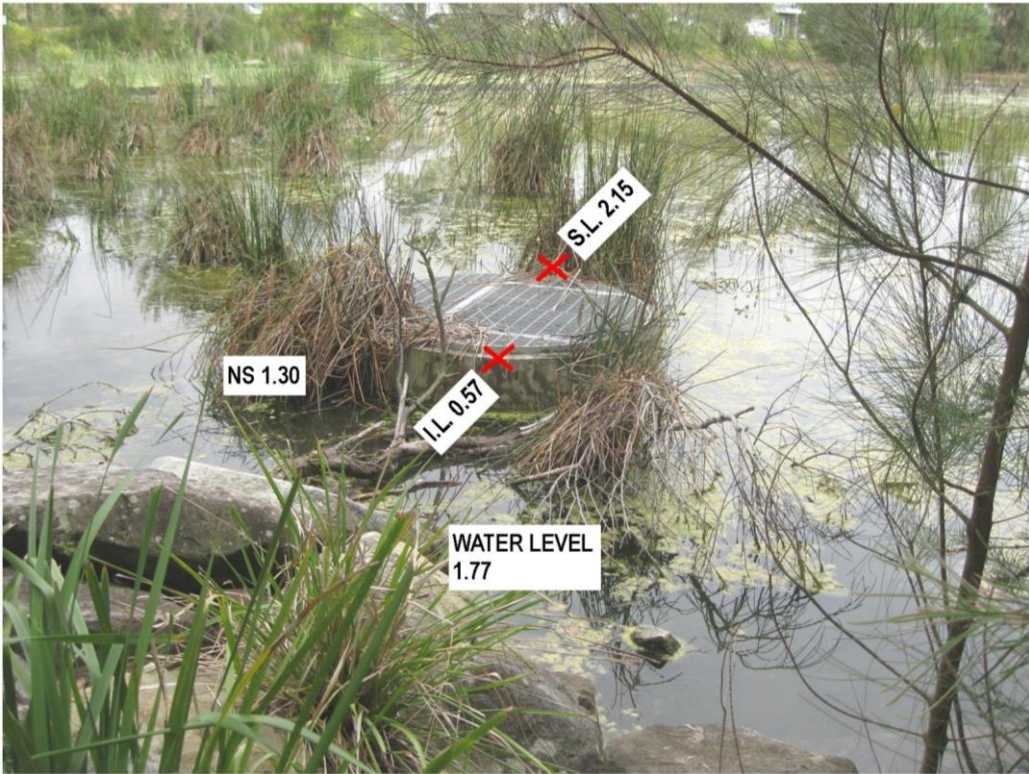
ID15 A



ID16 C



ID17 A



ID20-B

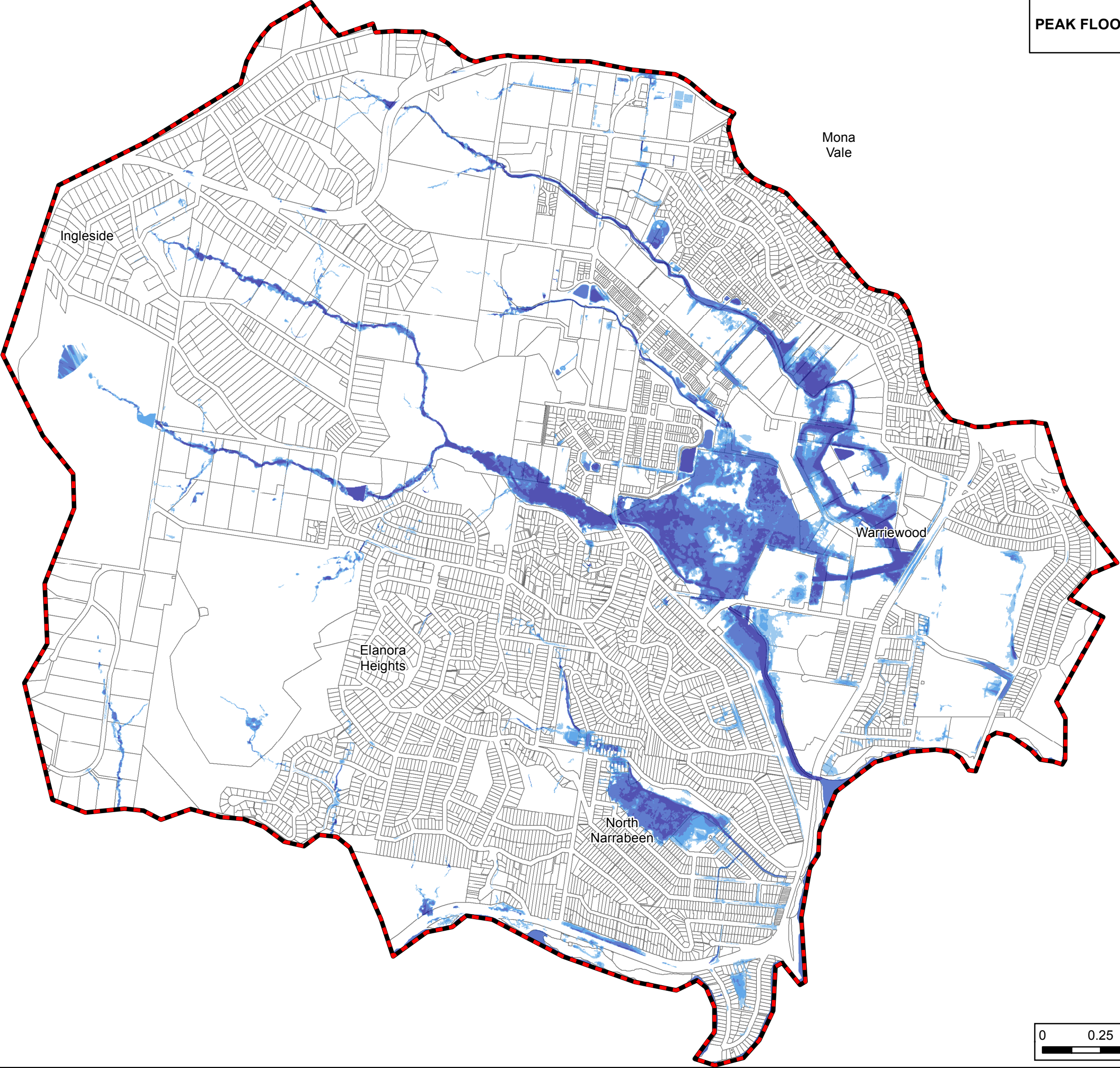


ID21 B

APPENDIX B.Design Flood Mapping



FIGURE B1
PEAK FLOOD DEPTHS AND EXTENTS
20% AEP EVENT



 Study Area

Depth (m)

	0.00 to 0.15
	0.15 to 0.30
	0.30 to 0.50
	0.50 to 1.00
	> 1.00

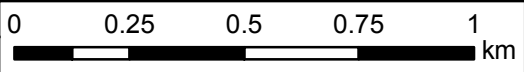
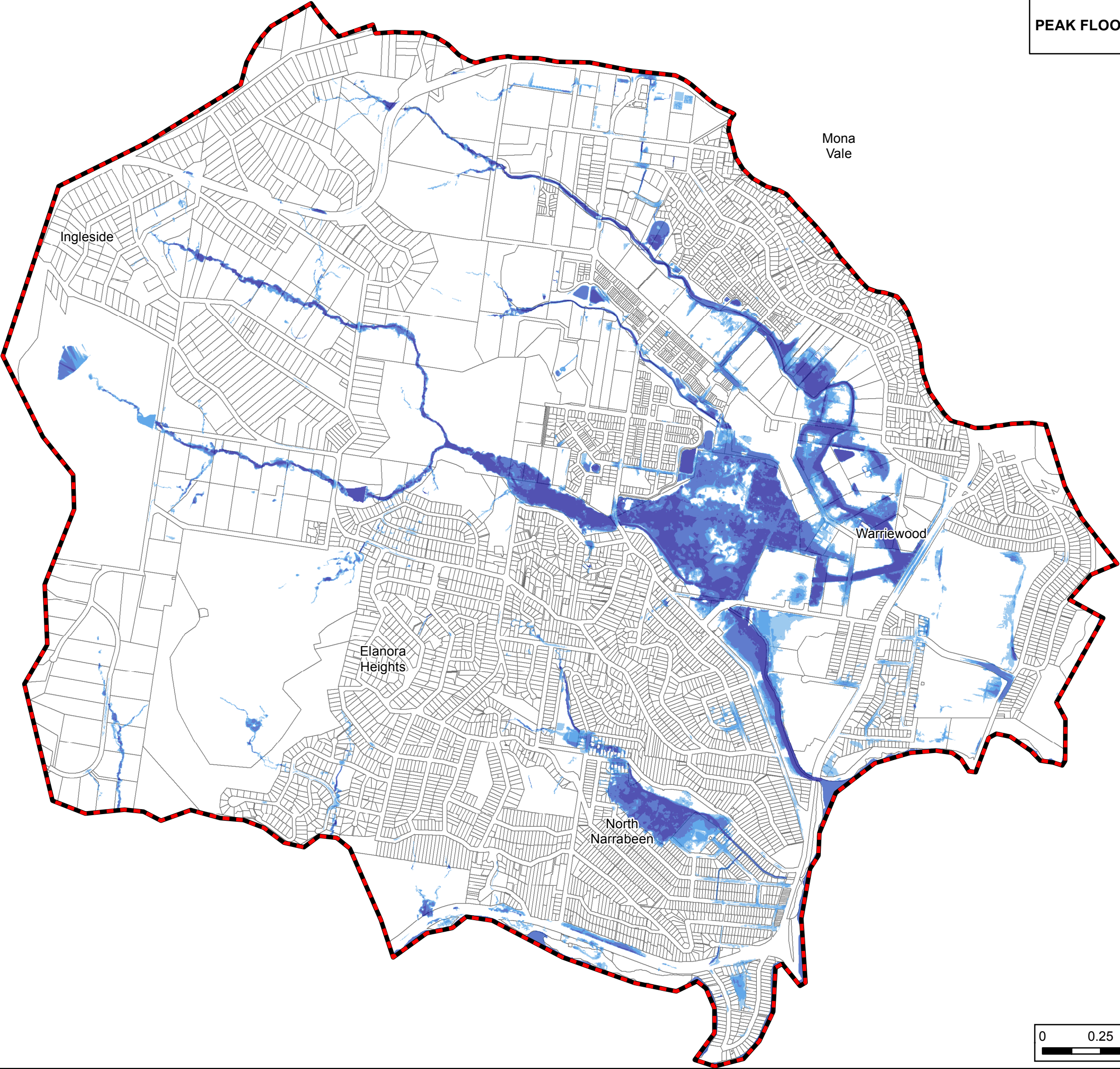


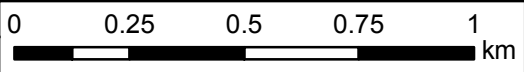
FIGURE B2
PEAK FLOOD DEPTHS AND EXTENTS
10% AEP EVENT



 Study Area

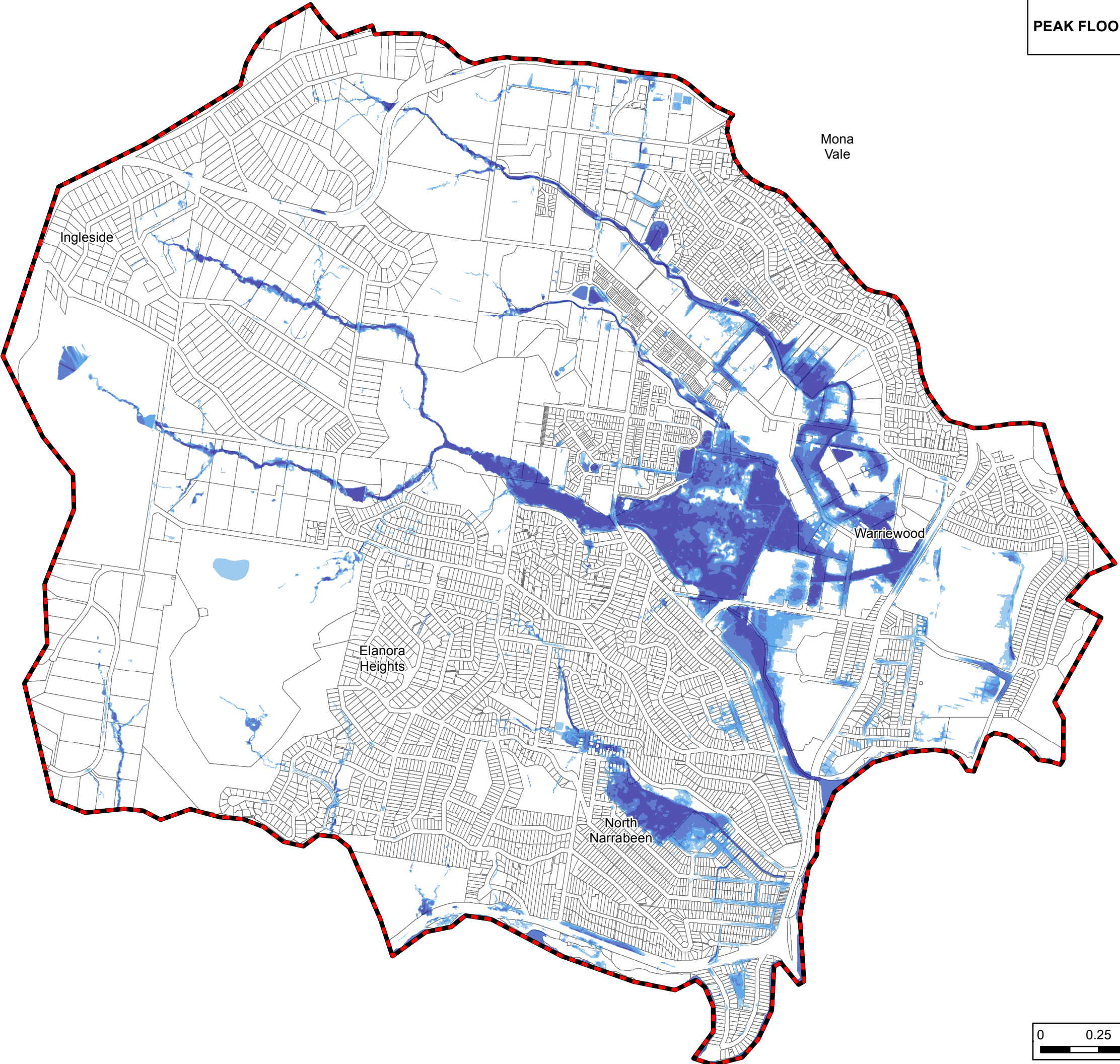
Depth (m)

	0.00 to 0.15
	0.15 to 0.30
	0.30 to 0.50
	0.50 to 1.00
	> 1.00



J:\Jobs\116059\ArcGIS\ArcMap\Report_Figures\AppendixB_Figures\FigureB03_PeakFloodLevelsandDepths_5AEP.mxd

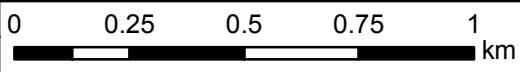
FIGURE B3
PEAK FLOOD DEPTHS AND EXTENTS
5% AEP EVENT



 Study Area

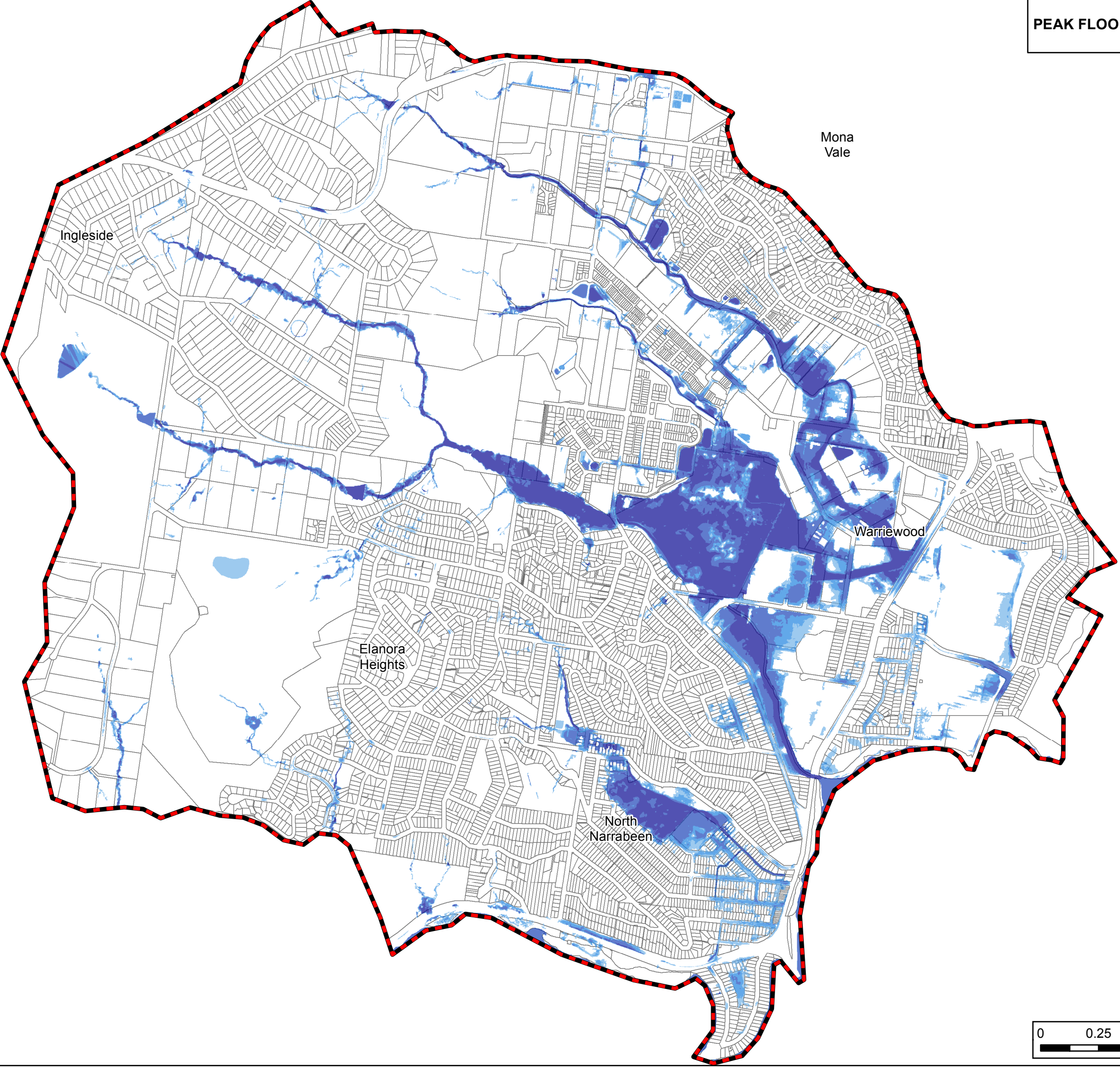
Depth (m)

	0.00 to 0.15
	0.15 to 0.30
	0.30 to 0.50
	0.50 to 1.00
	> 1.00



J:\Jobs\116059\ArcGIS\ArcMap\Report_Figures\AppendixB_Figures\FigureB04_PeakFloodLevelsandDepths_2AEP.mxd

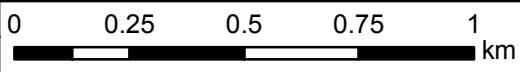
FIGURE B4
PEAK FLOOD DEPTHS AND EXTENTS
2% AEP EVENT



 Study Area

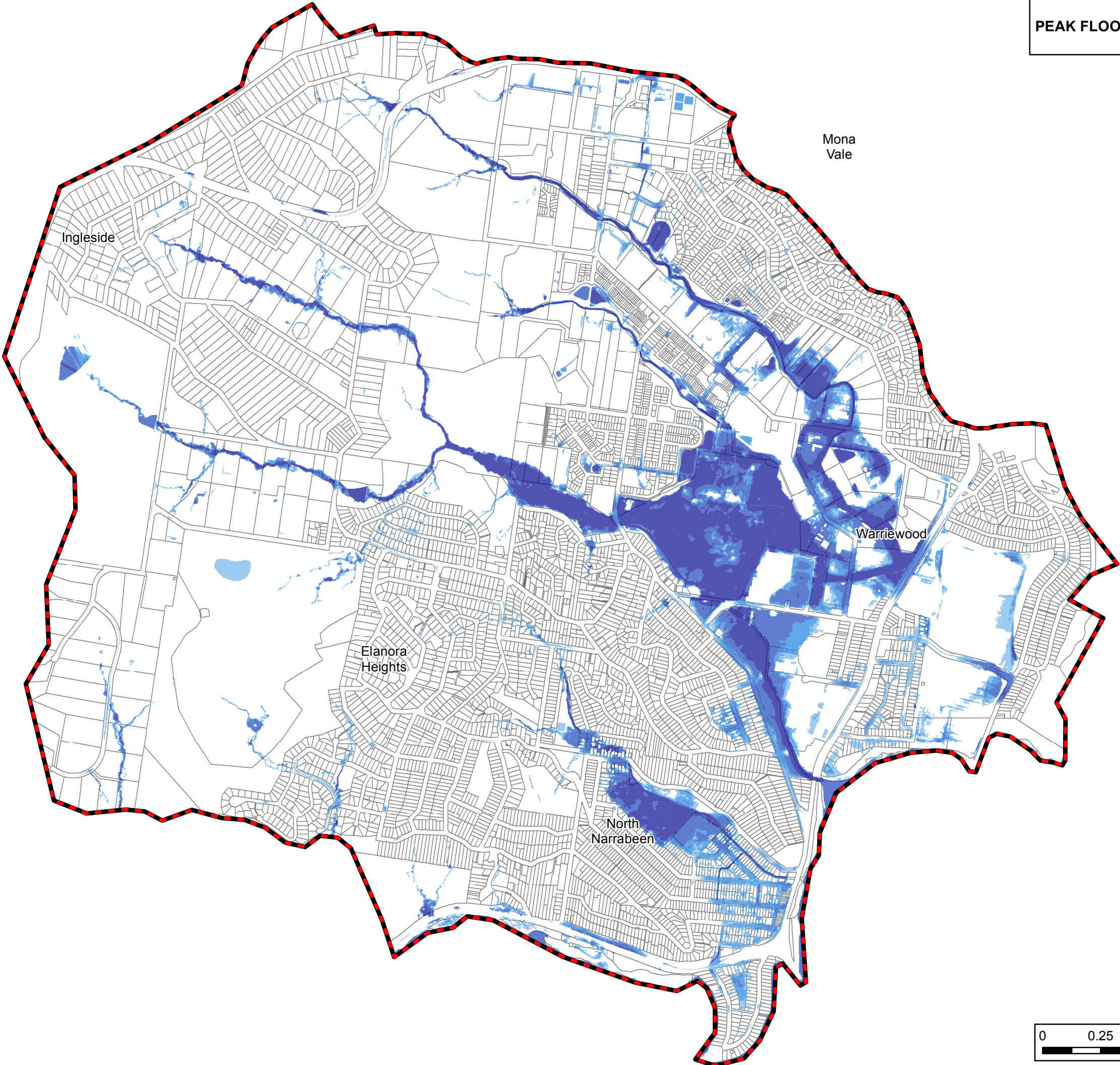
Depth (m)

	0.00 to 0.15
	0.15 to 0.30
	0.30 to 0.50
	0.50 to 1.00
	> 1.00



J:\Jobs\116059\ArcGIS\ArcMap\Report_Figures\AppendixB_Figures\FigureB05_PeakFloodLevelsandDepths_1AEP.mxd

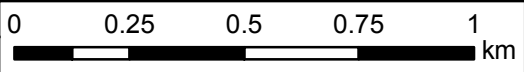
FIGURE B5
PEAK FLOOD DEPTHS AND EXTENTS
1% AEP EVENT



 Study Area

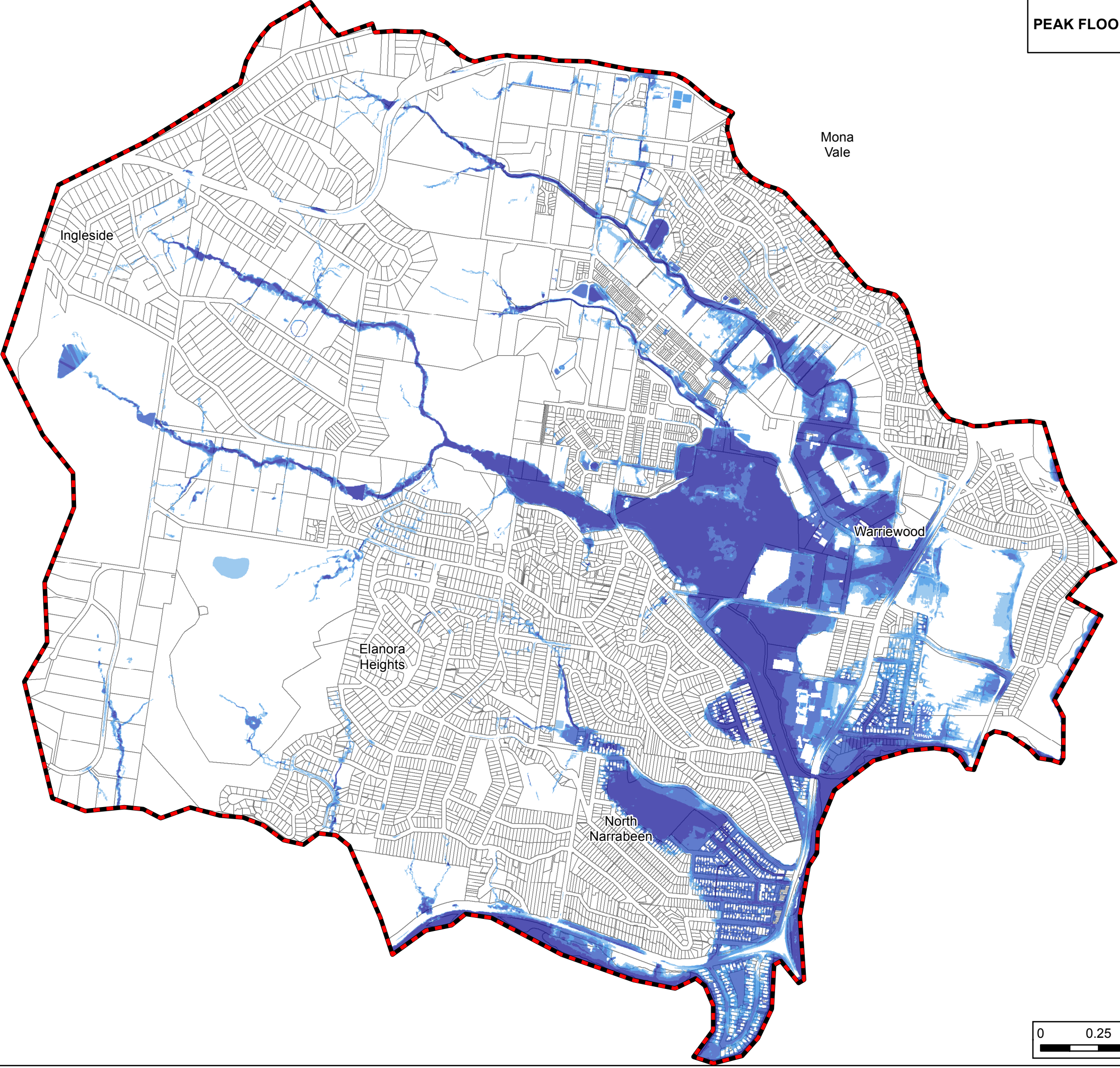
Depth (m)

	0.00 to 0.15
	0.15 to 0.30
	0.30 to 0.50
	0.50 to 1.00
	> 1.00



J:\Jobs\116059\ArcGIS\ArcMap\Report_Figures\AppendixB_Figures\FigureB06_PeakFloodLevelsandDepths_0.5AEP.mxd

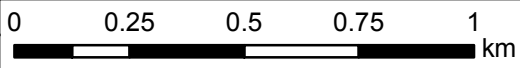
FIGURE B6
PEAK FLOOD DEPTHS AND EXTENTS
0.5% AEP EVENT



 Study Area

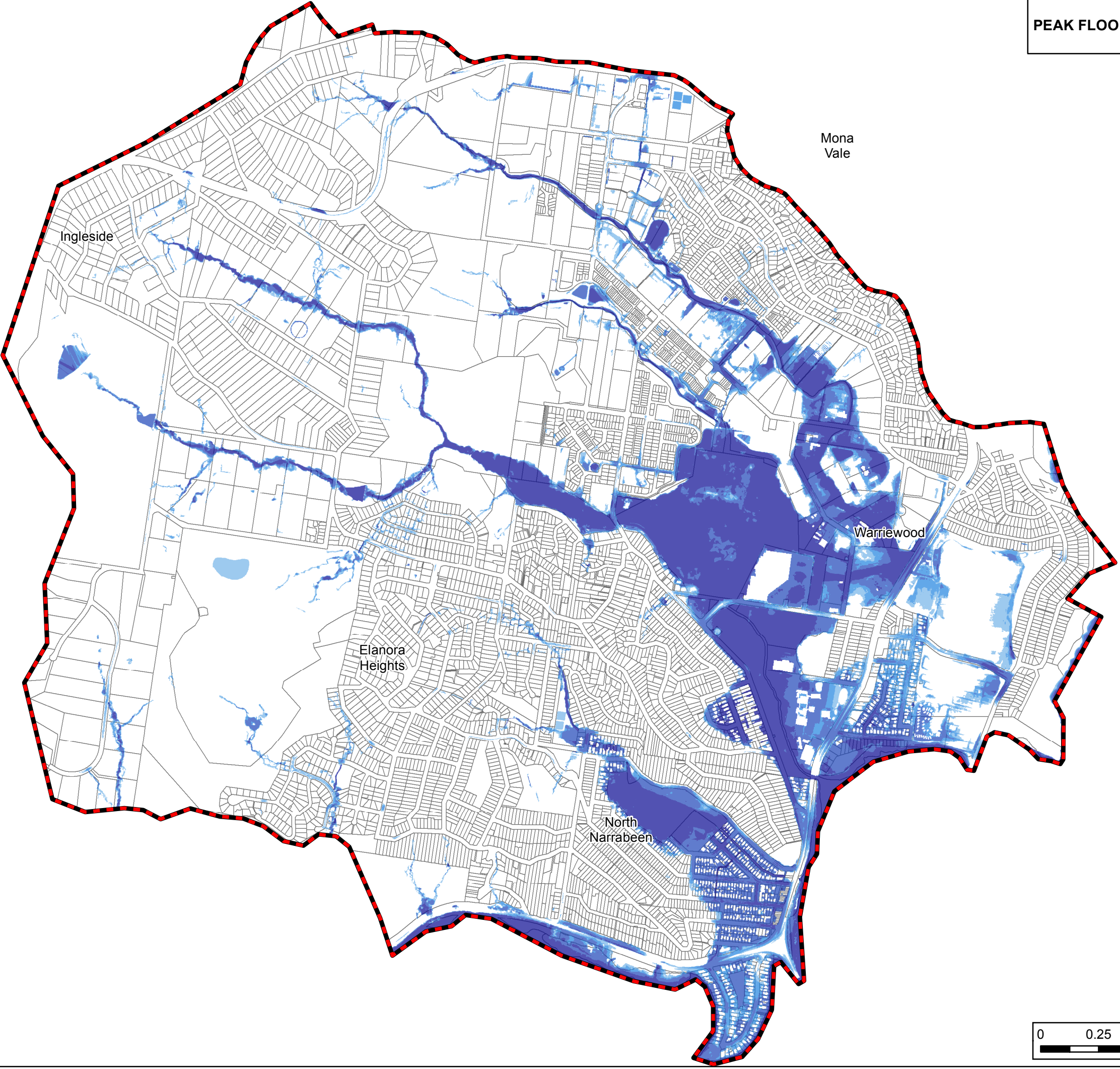
Depth (m)

	0.00 to 0.15
	0.15 to 0.30
	0.30 to 0.50
	0.50 to 1.00
	> 1.00



J:\Jobs\116059\ArcGIS\ArcMap\Report_Figures\AppendixB_Figures\FigureB07_PeakFloodLevelsandDepths_0.2AEP.mxd

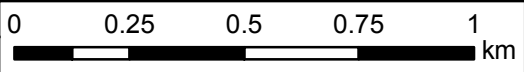
FIGURE B7
PEAK FLOOD DEPTHS AND EXTENTS
0.2% AEP EVENT



 Study Area

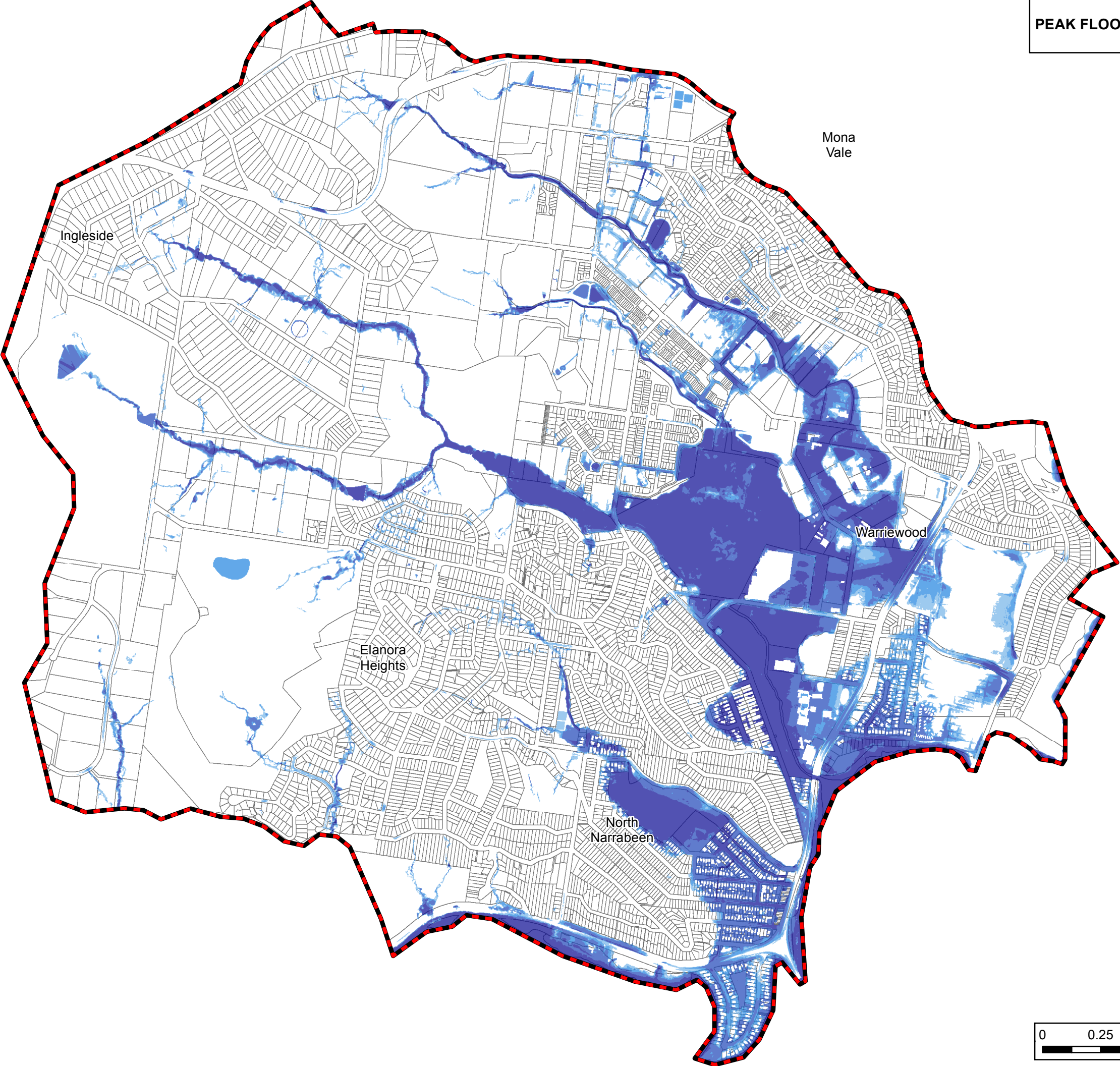
Depth (m)

	0.00 to 0.15
	0.15 to 0.30
	0.30 to 0.50
	0.50 to 1.00
	> 1.00



J:\Jobs\116059\ArcGIS\ArcMap\Report_Figures\AppendixB_Figures\FigureB08_PeakFloodLevelsandDepths_0.1AEP.mxd

FIGURE B8
PEAK FLOOD DEPTHS AND EXTENTS
0.1% AEP EVENT



 Study Area

Depth (m)

	0.00 to 0.15
	0.15 to 0.30
	0.30 to 0.50
	0.50 to 1.00
	> 1.00

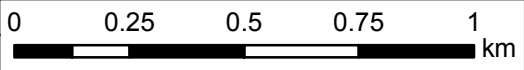
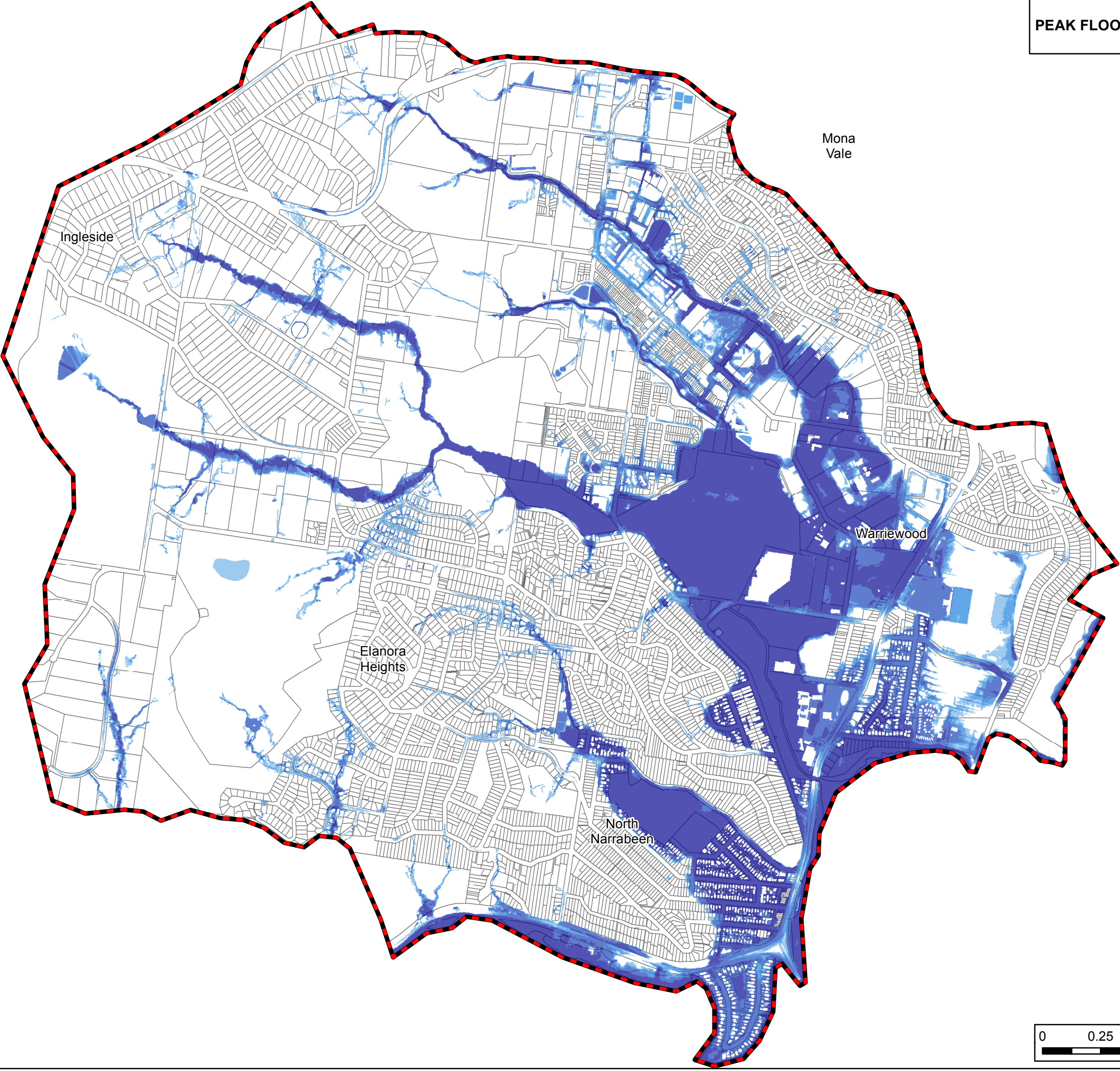


FIGURE B9
PEAK FLOOD DEPTHS AND EXTENTS
PMF EVENT



 Study Area

Depth (m)

	0.00 to 0.15
	0.15 to 0.30
	0.30 to 0.50
	0.50 to 1.00
	> 1.00

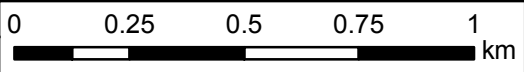
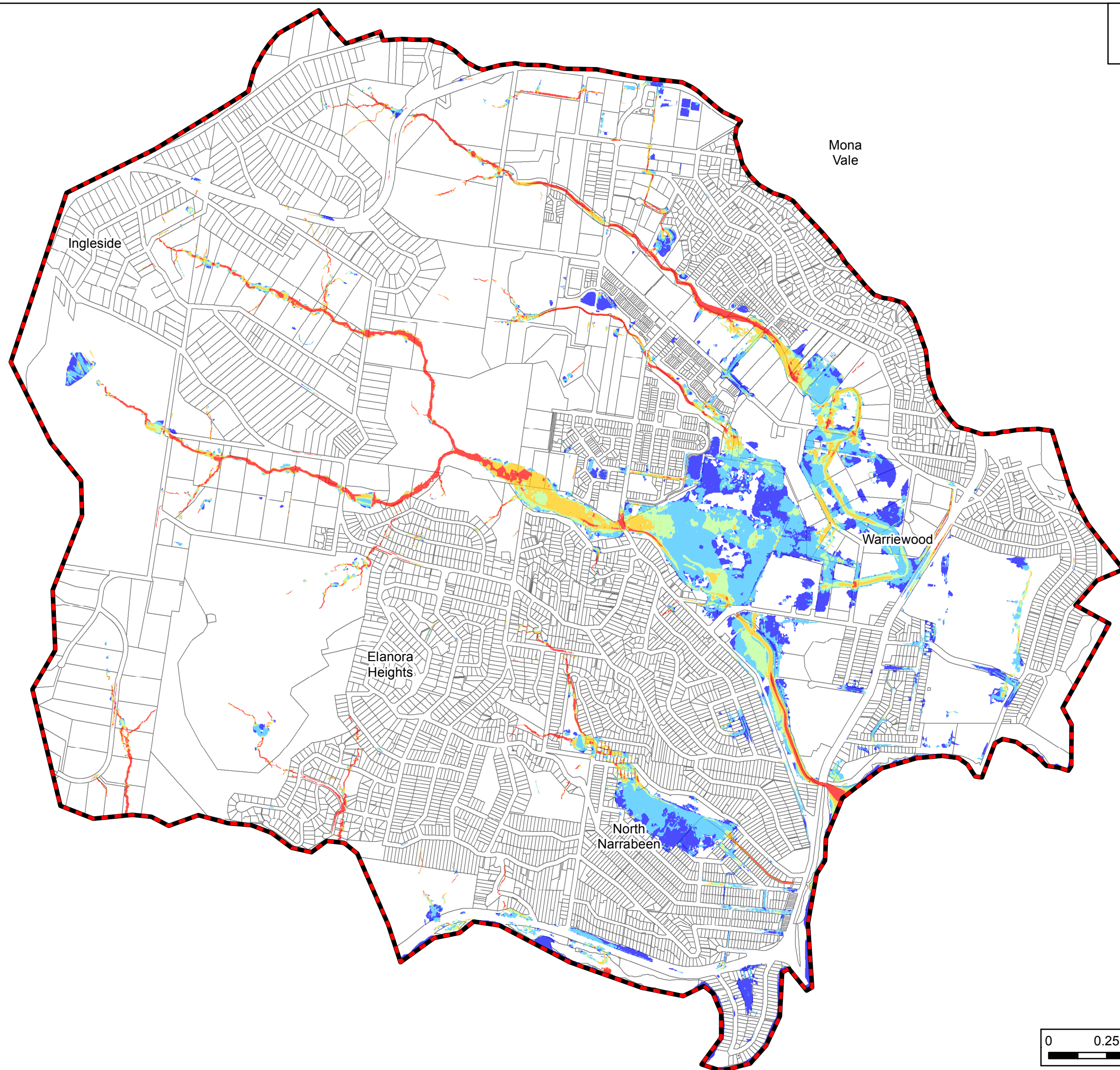


FIGURE B10
PEAK FLOOD VELOCITIES
20% AEP EVENT



Study Area

Velocity (m/s)

- 0 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

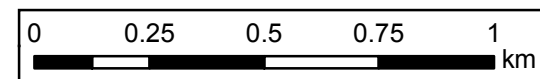


FIGURE B11
PEAK FLOOD VELOCITIES
10% AEP EVENT

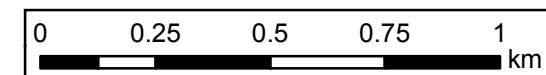
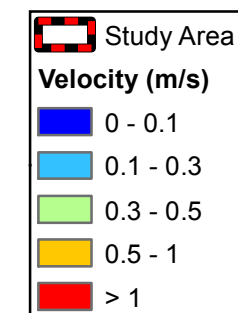
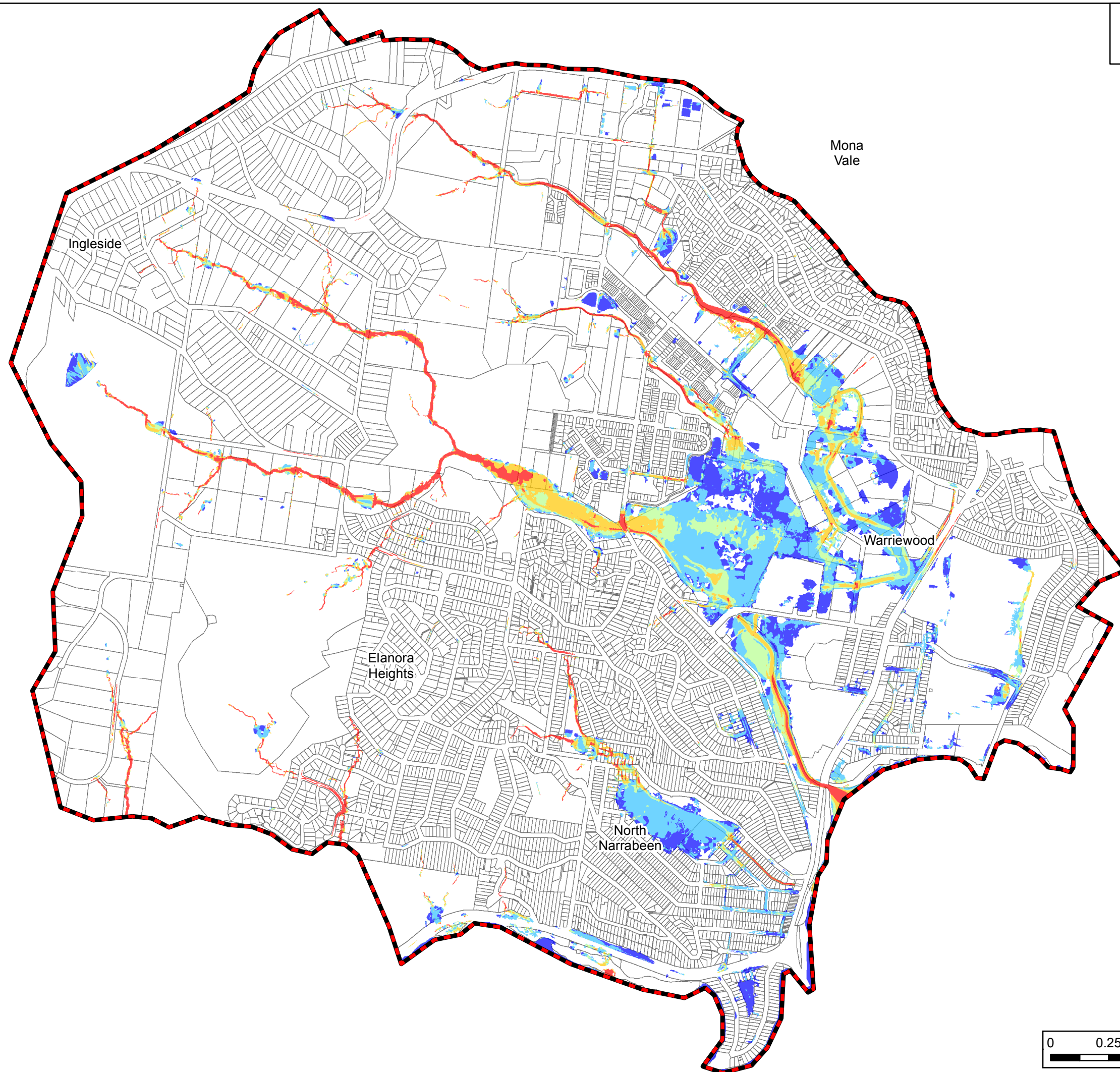


FIGURE B12
PEAK FLOOD VELOCITIES
5% AEP EVENT

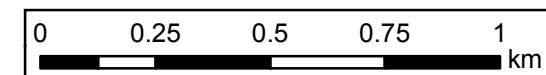
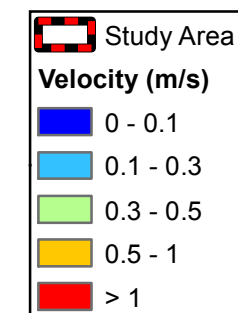
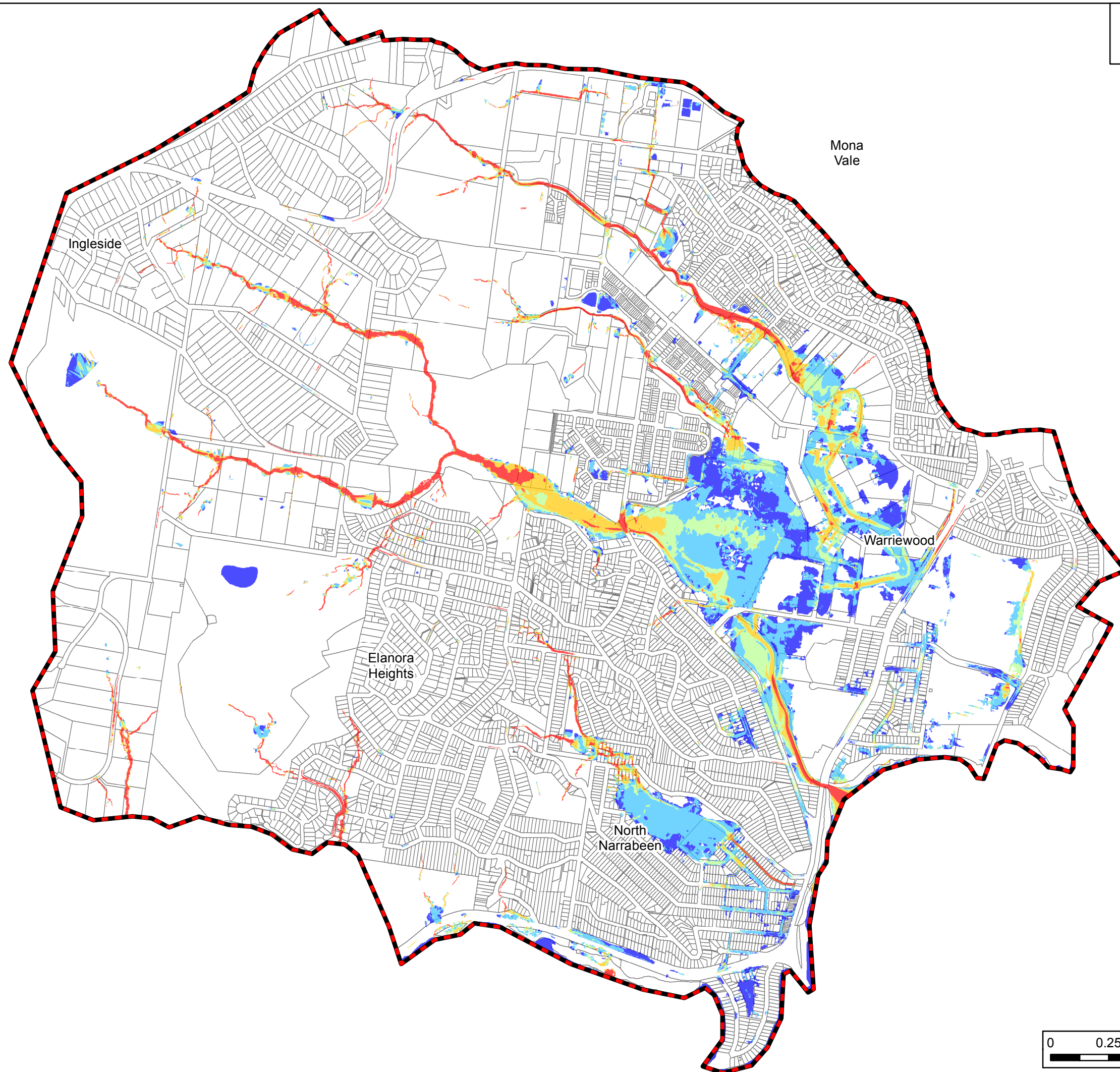


FIGURE B13
PEAK FLOOD VELOCITIES
2% AEP EVENT

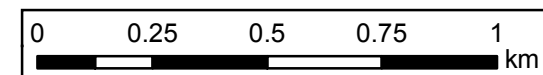
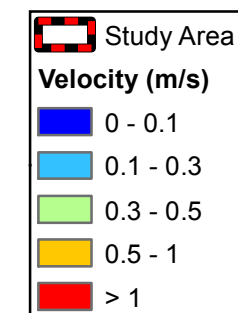
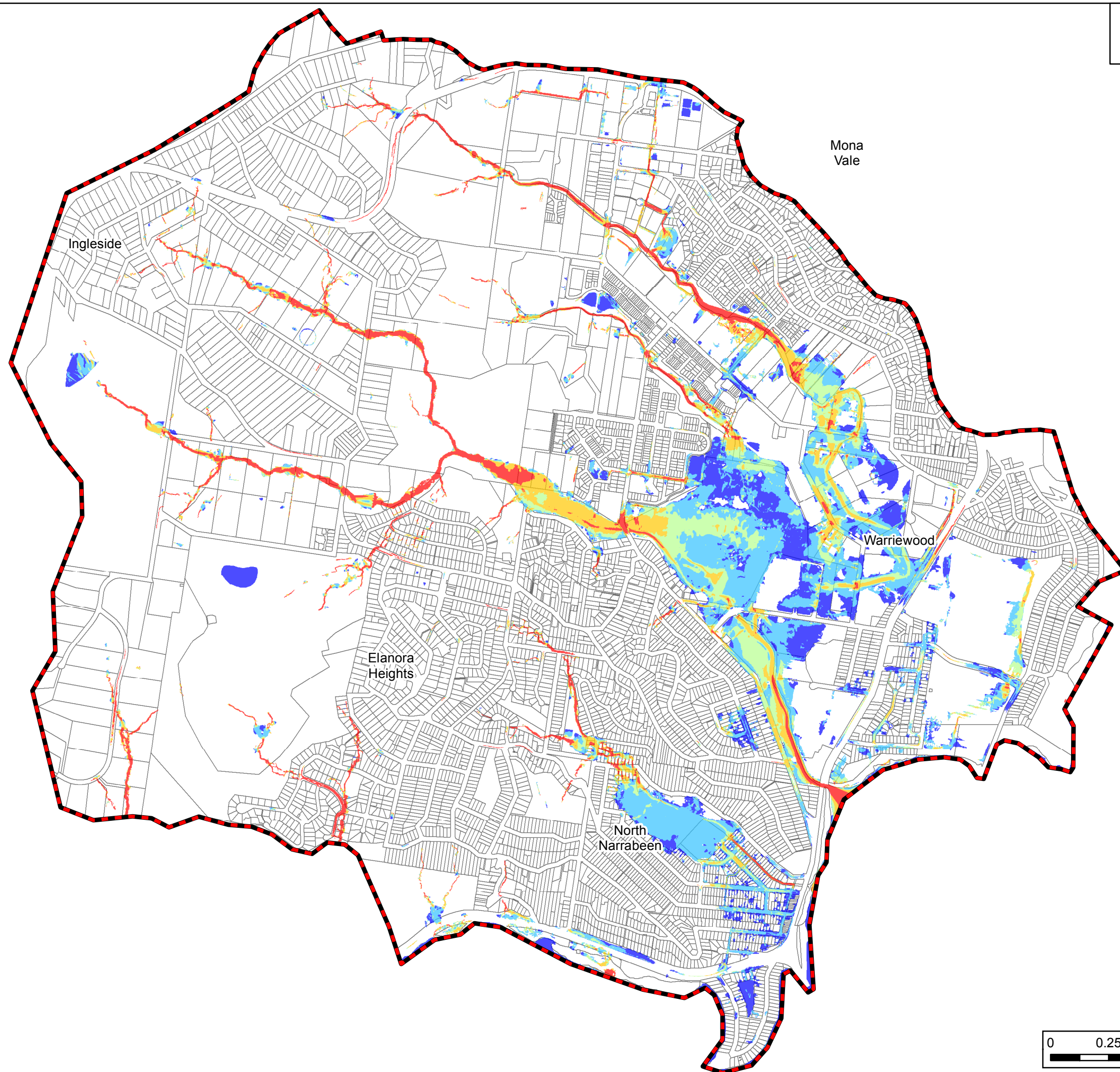


FIGURE B14
PEAK FLOOD VELOCITIES
1% AEP EVENT

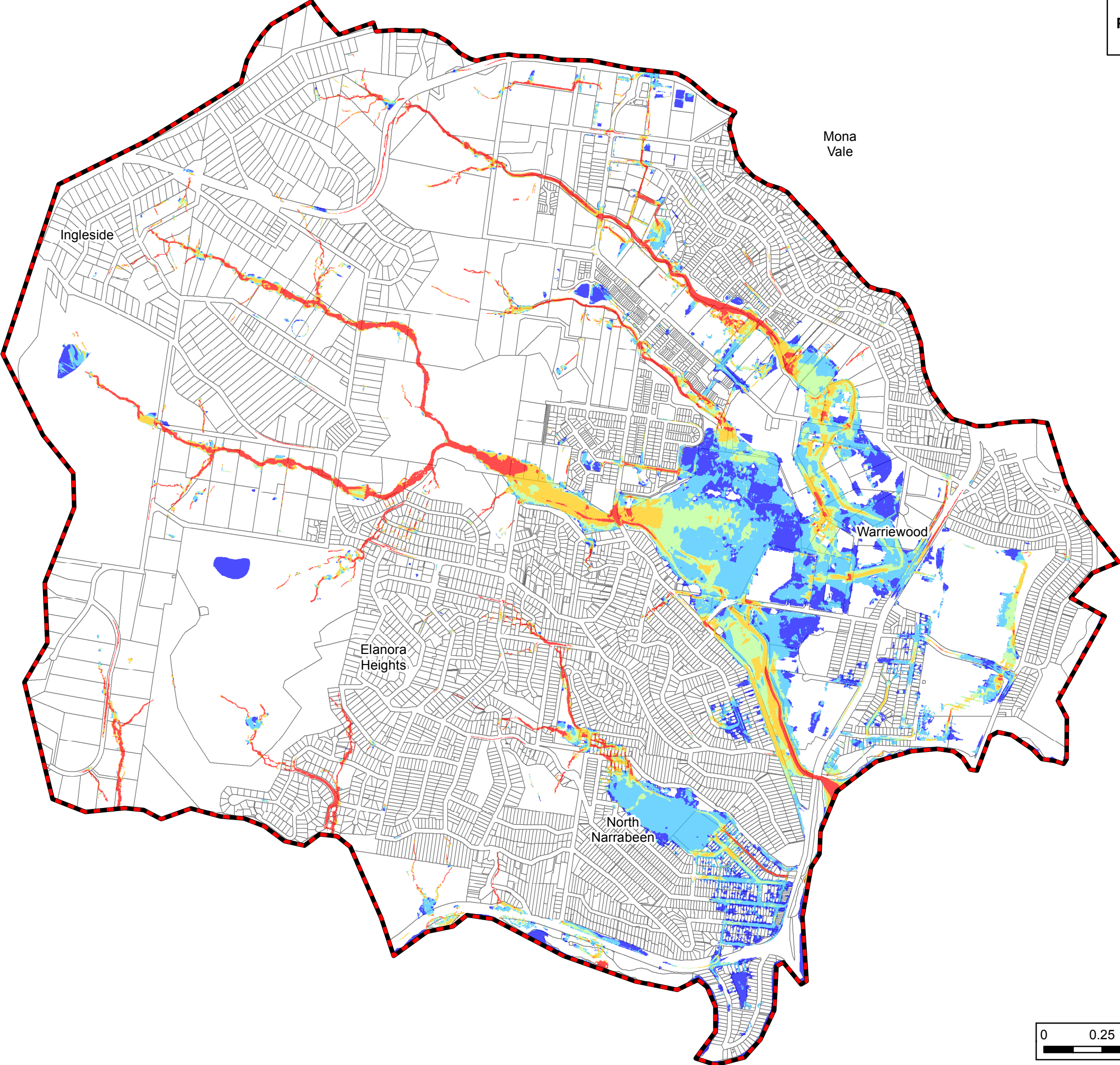


FIGURE B15
PEAK FLOOD VELOCITIES
0.5% AEP EVENT

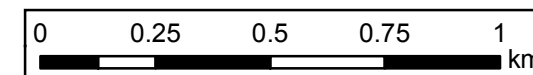
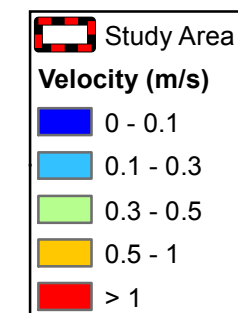
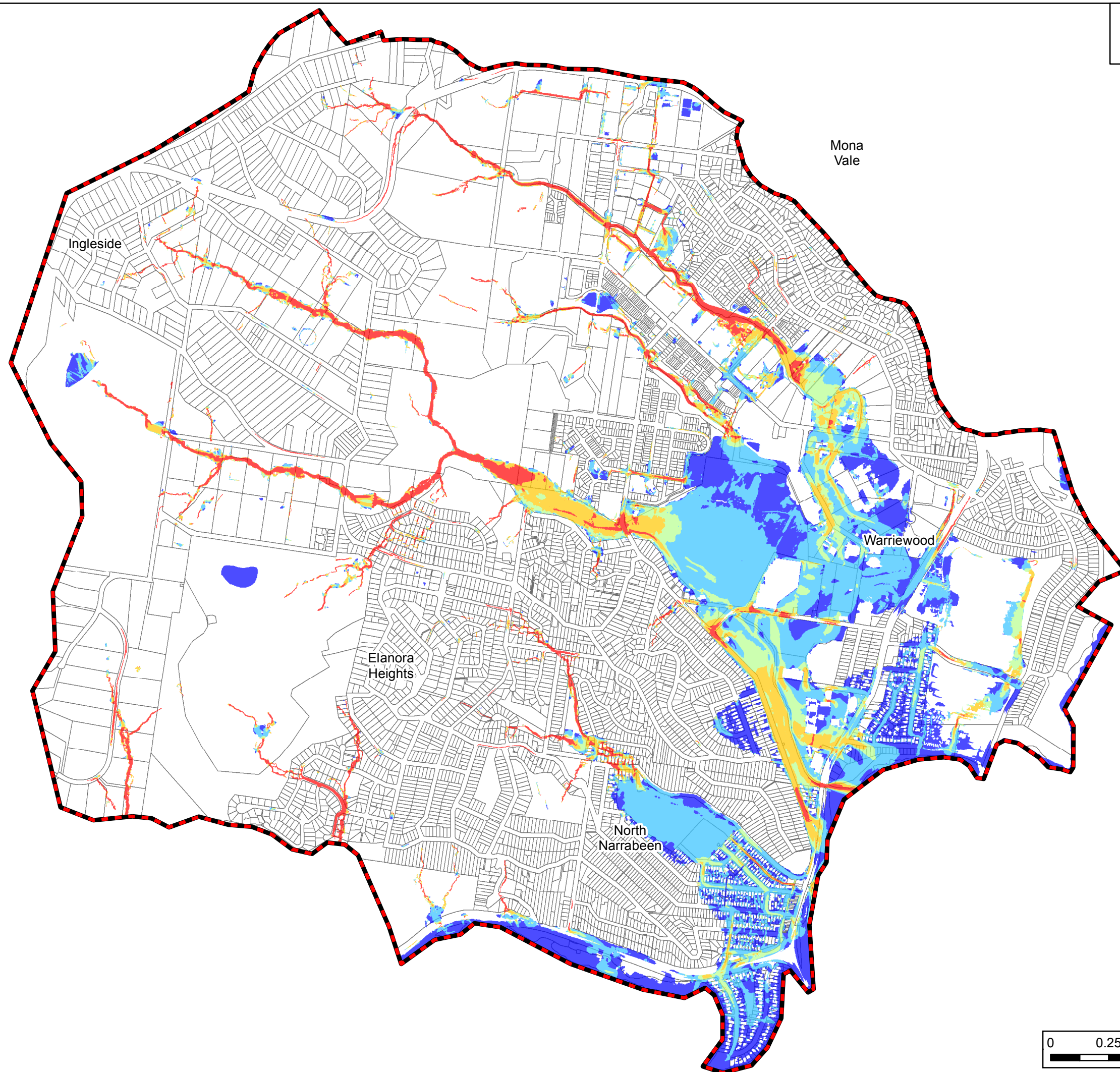


FIGURE B16
PEAK FLOOD VELOCITIES
0.2% AEP EVENT

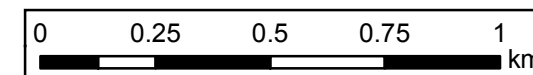
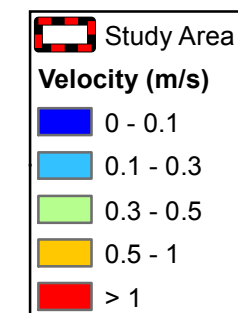
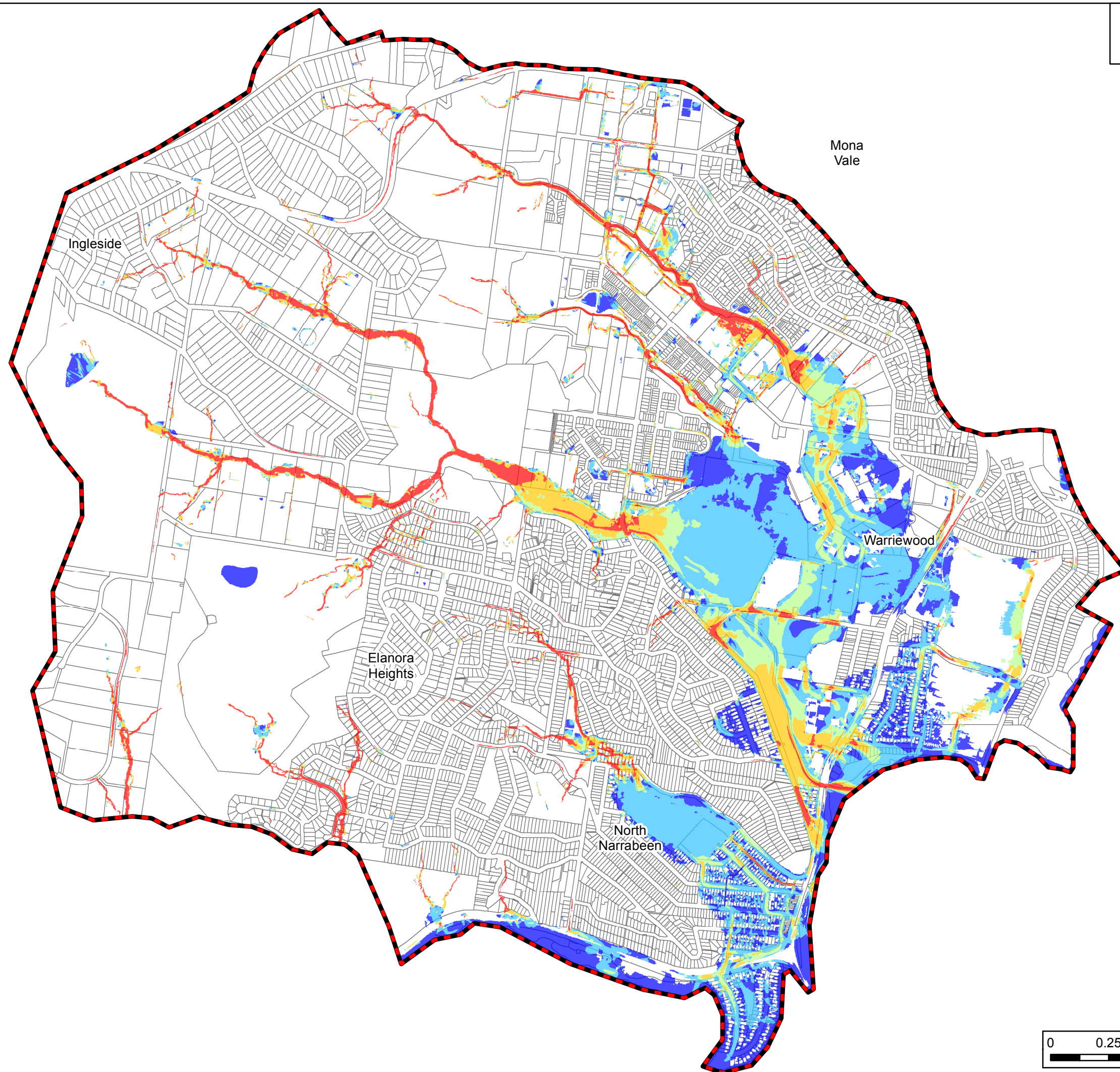


FIGURE B17
PEAK FLOOD VELOCITIES
0.1% AEP EVENT

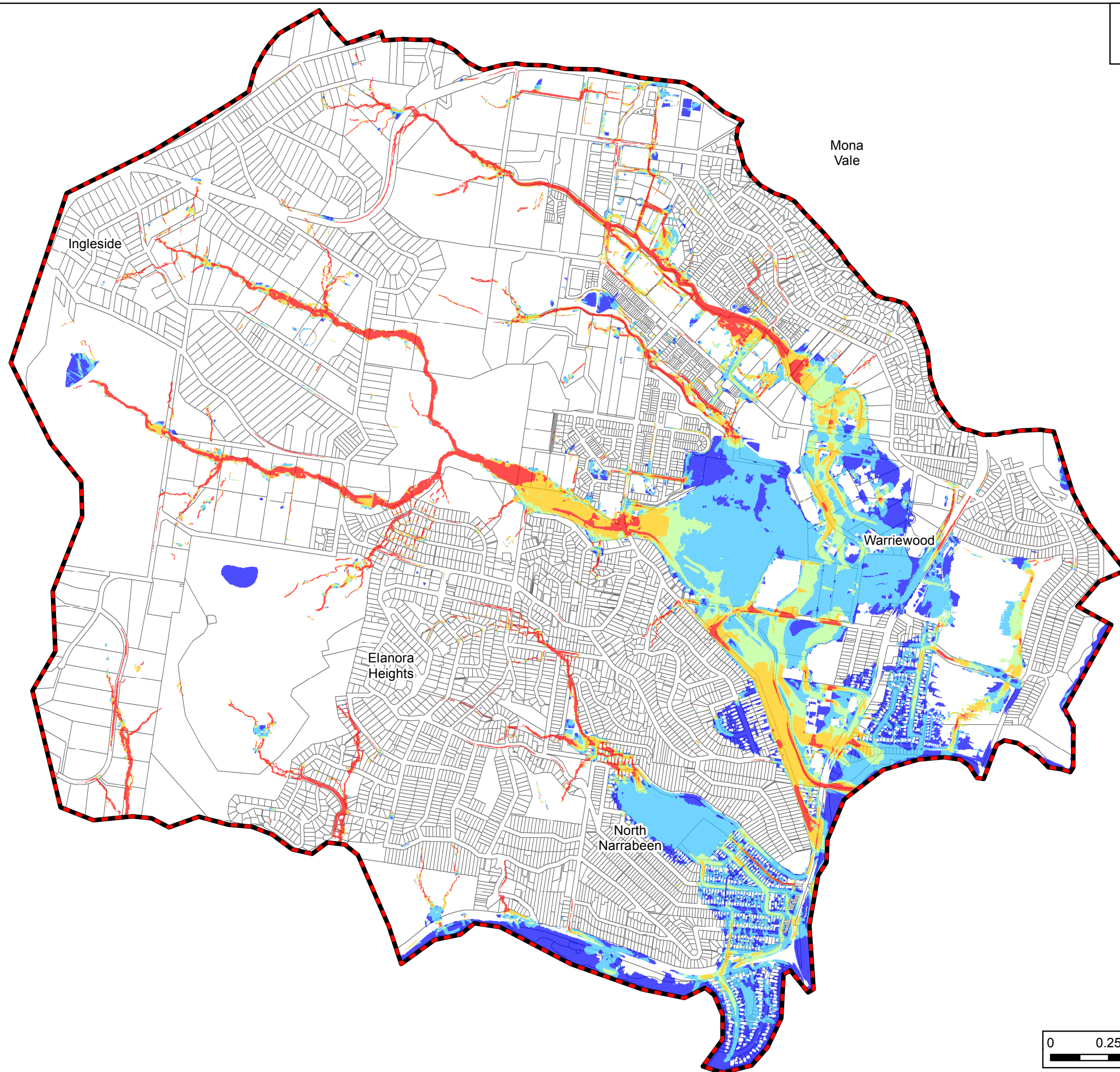


FIGURE B18
PEAK FLOOD VELOCITIES
PMF EVENT

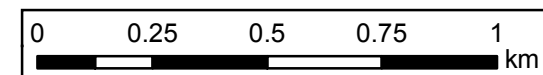
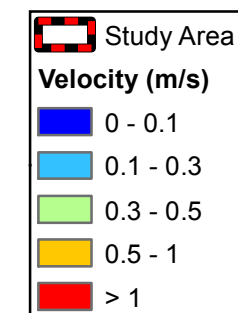
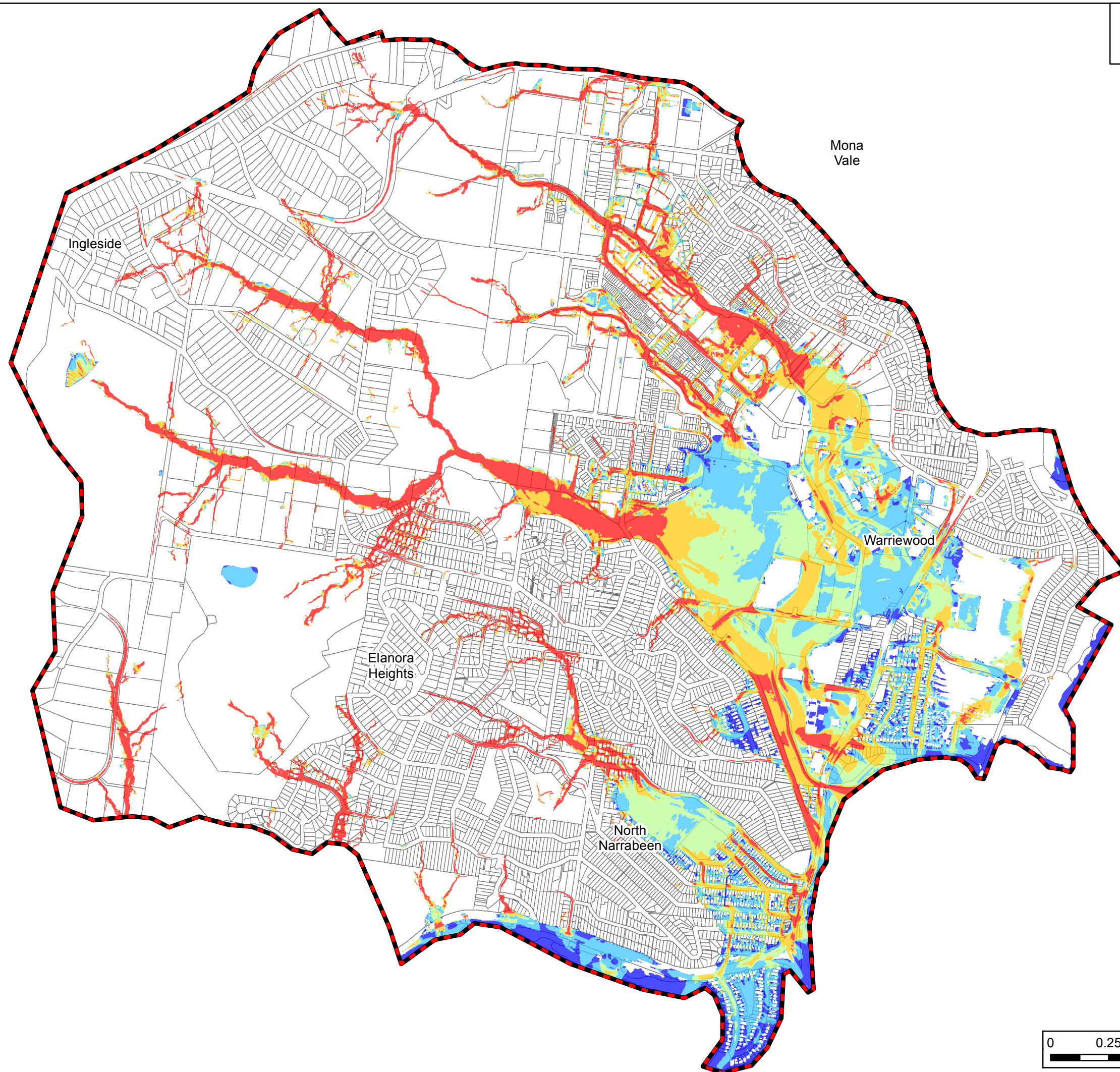


FIGURE B19
HYDRAULIC HAZARD (FDM)
20% AEP EVENT

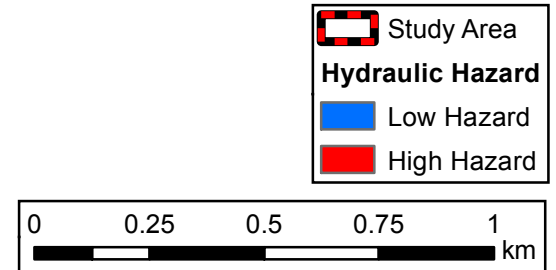
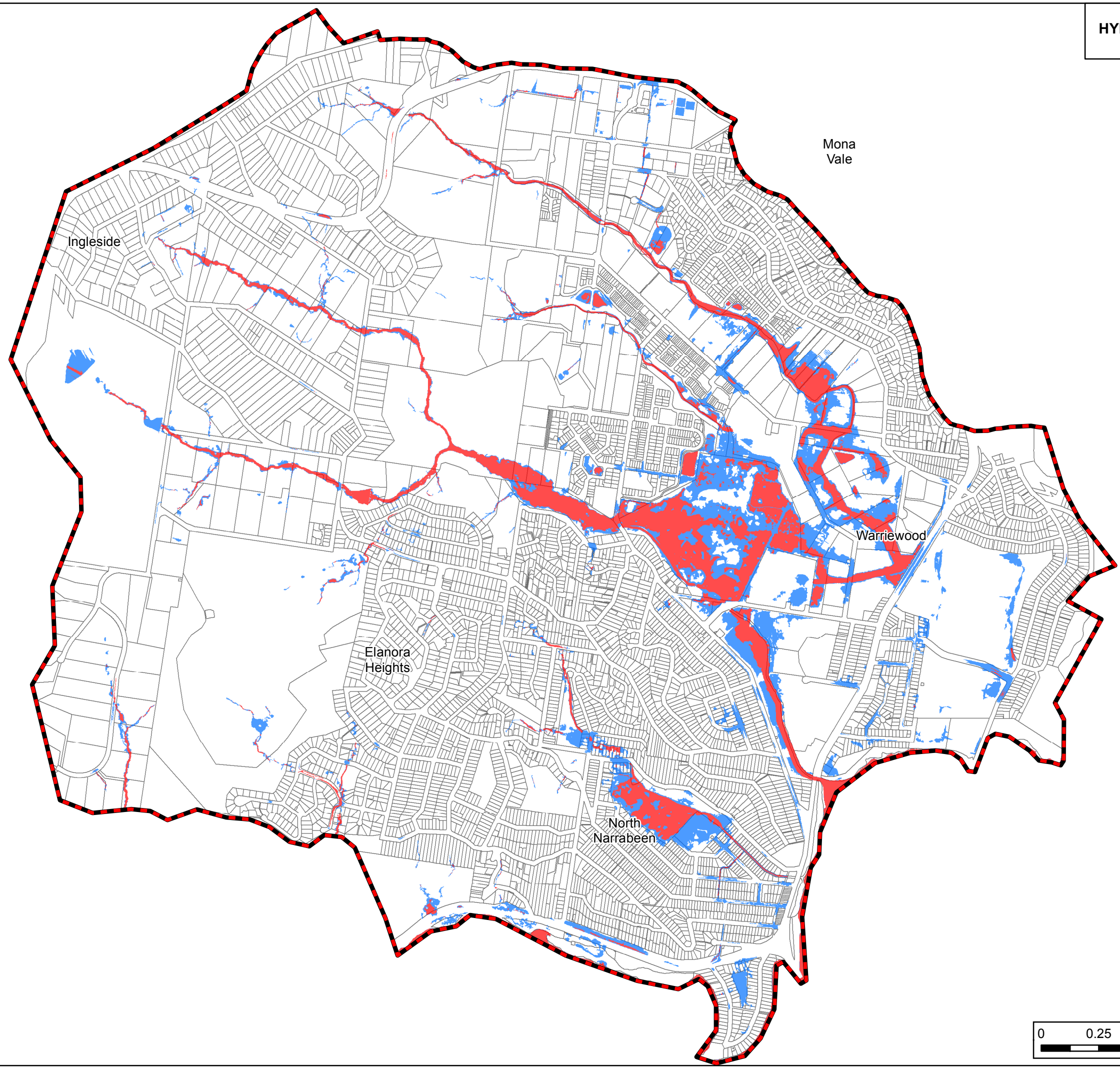
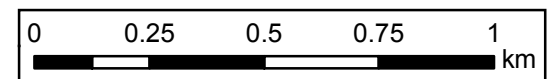
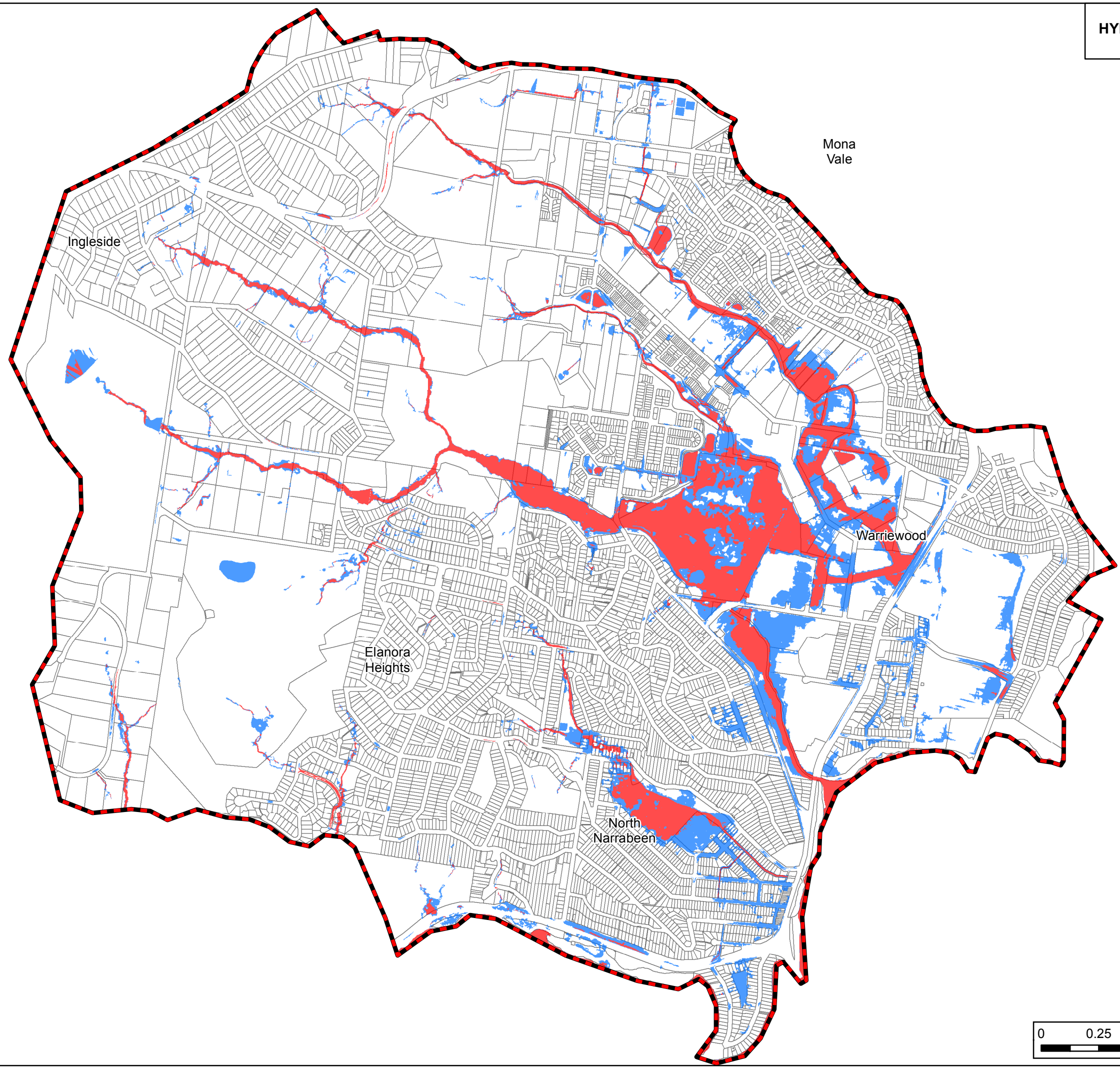
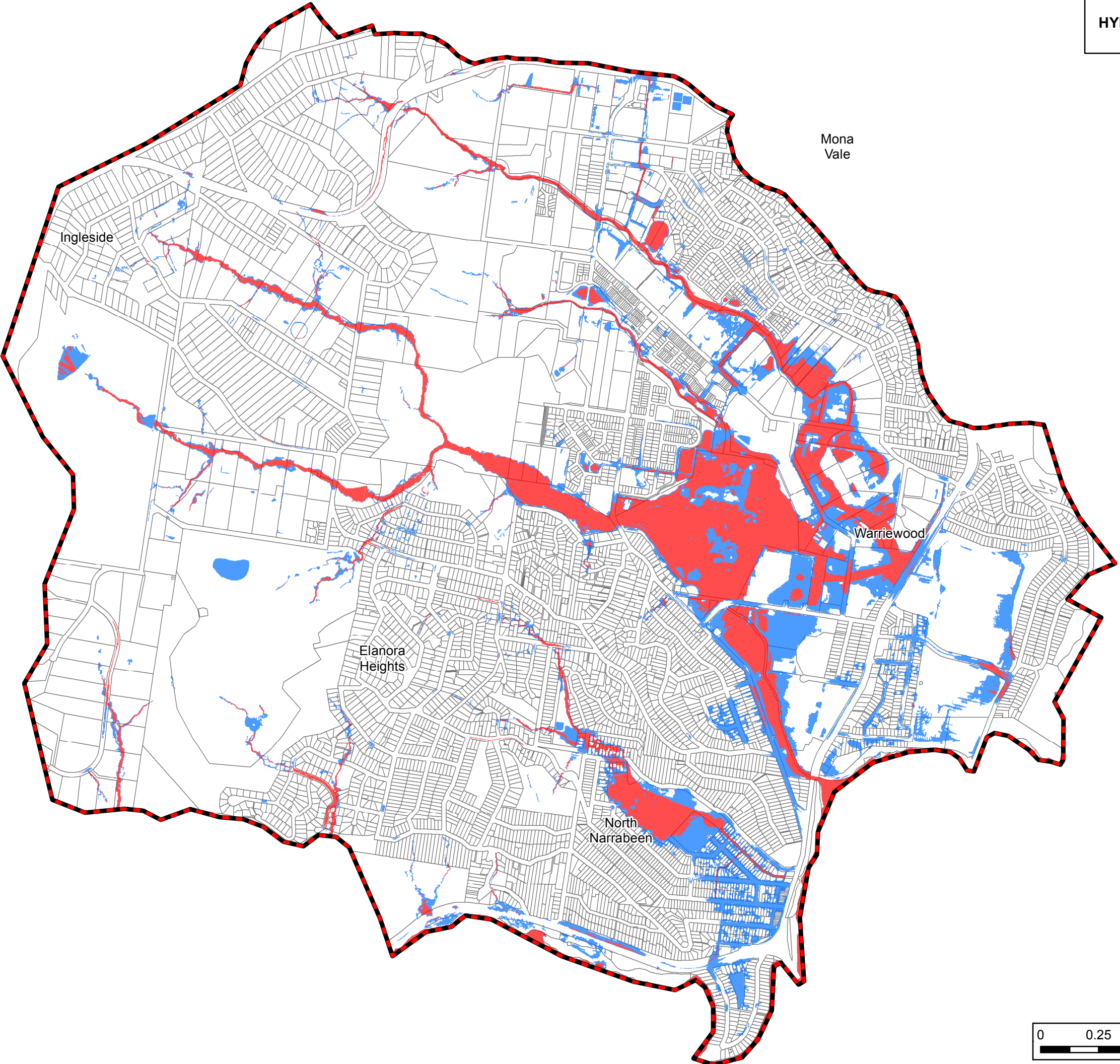


FIGURE B20
HYDRAULIC HAZARD (FDM)
5% AEP EVENT



- Study Area
- Hydraulic Hazard
 - Low Hazard
 - High Hazard

FIGURE B21
HYDRAULIC HAZARD (FDM)
1% AEP EVENT



- Study Area
- Hydraulic Hazard**
- Low Hazard
 - High Hazard

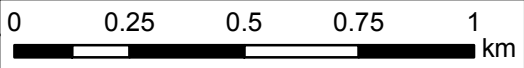
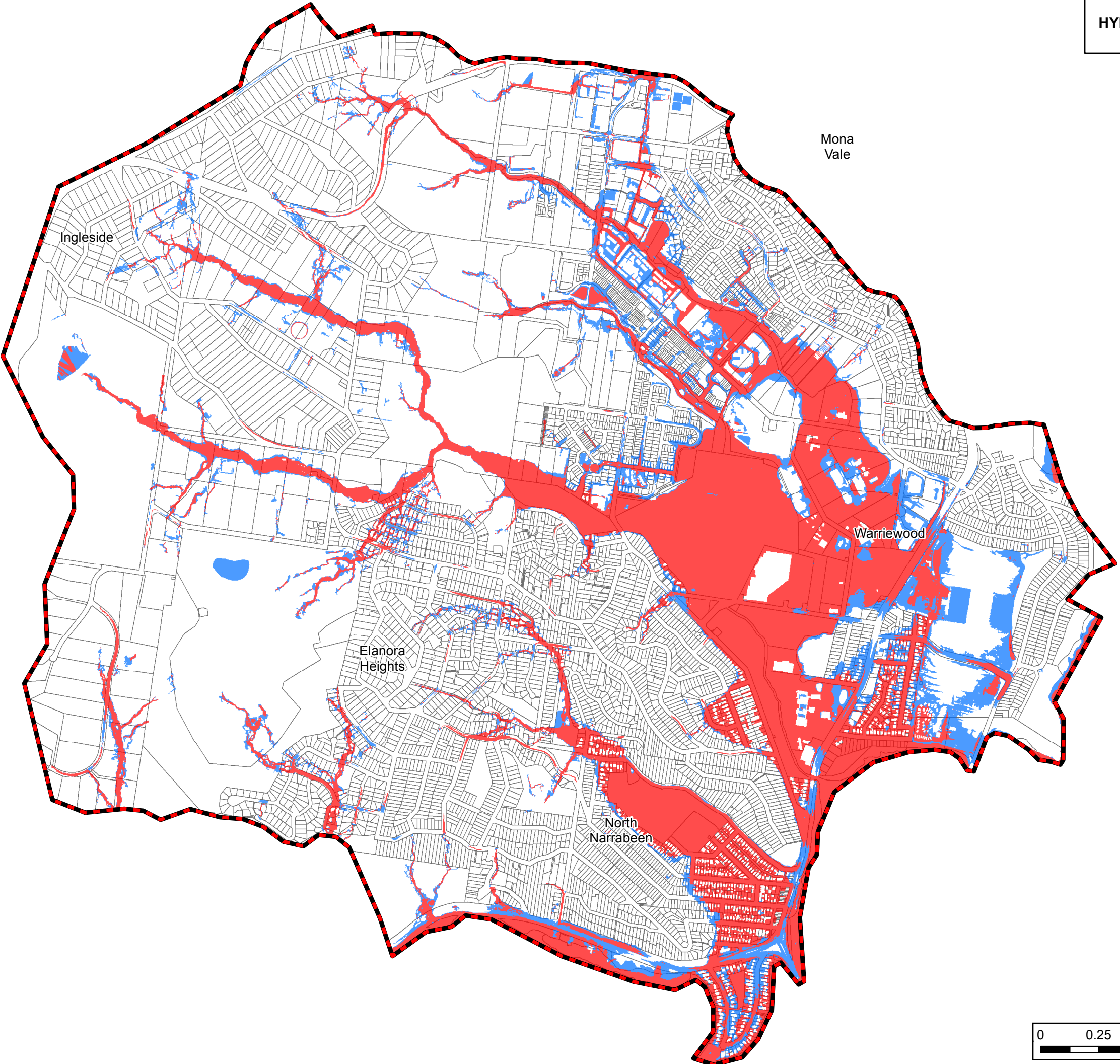


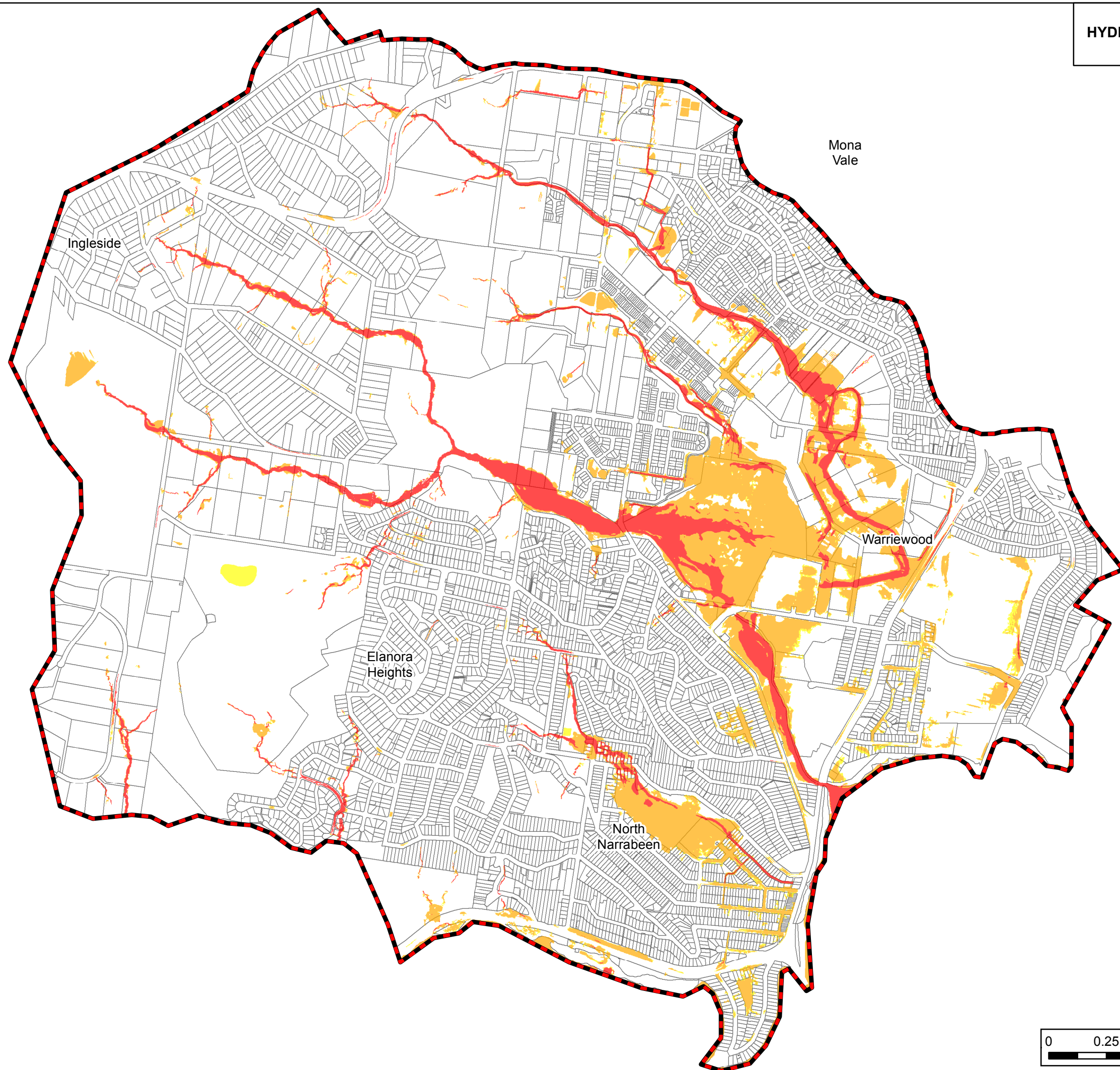
FIGURE B22
HYDRAULIC HAZARD (FDM)
PMF EVENT



Study Area
Hydraulic Hazard
Low Hazard
High Hazard

0 0.25 0.5 0.75 1 km

FIGURE B23
HYDRAULIC CATEGORISATION
5% AEP EVENT



 Study Area

Hydraulic Categorisation

 Floodway

 Flood Storage

 Flood Fringe

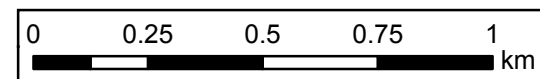
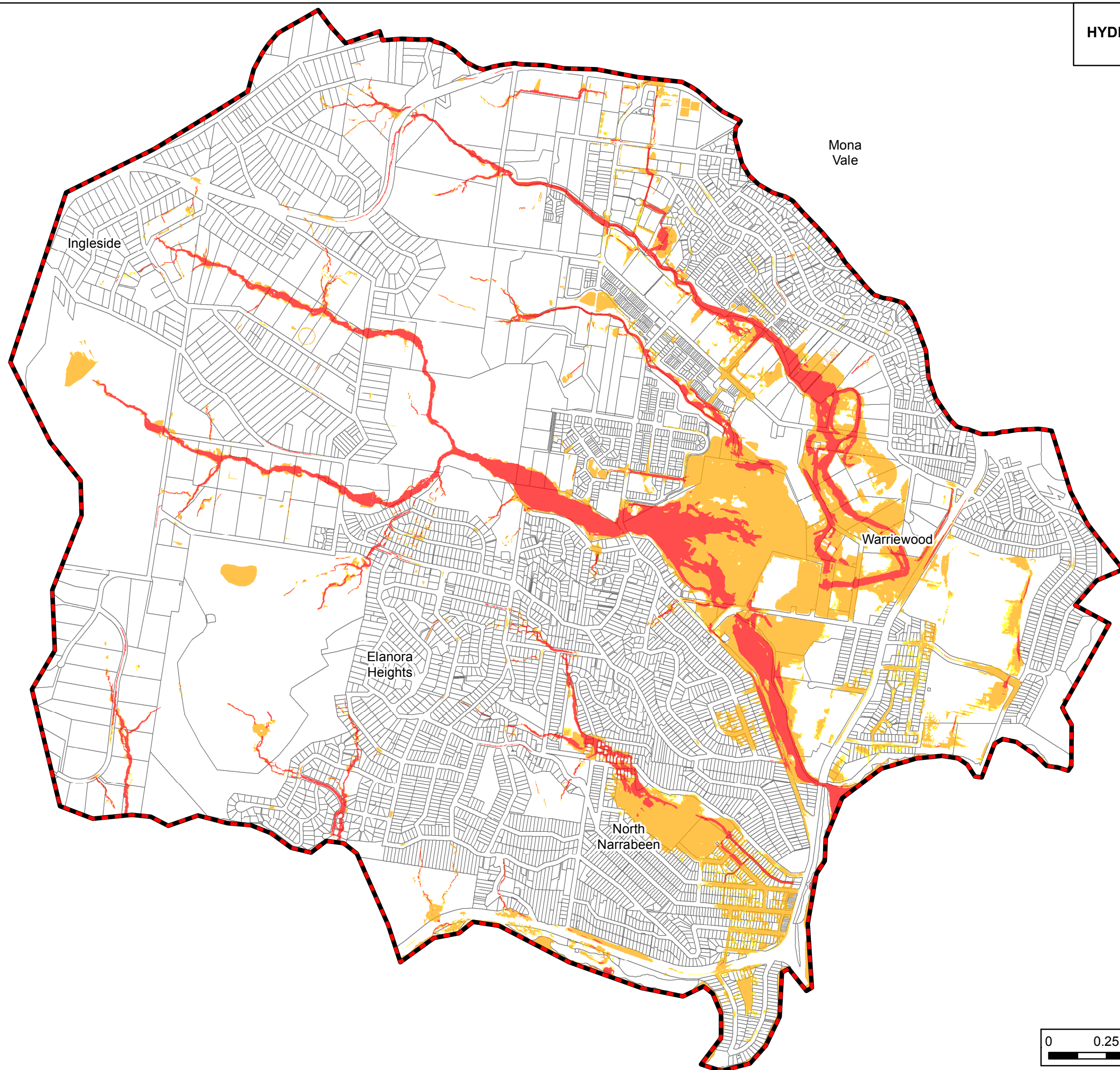


FIGURE B24
HYDRAULIC CATEGORISATION
1% AEP EVENT



-  Study Area
- Hydraulic Categorisation**
-  Floodway
 -  Flood Storage
 -  Flood Fringe

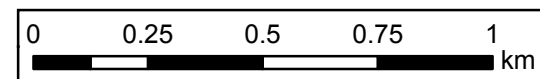


FIGURE B25
HYDRAULIC CATEGORISATION
PMF EVENT

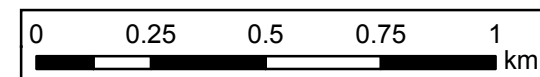
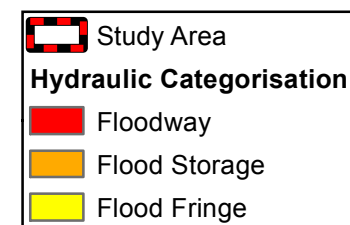
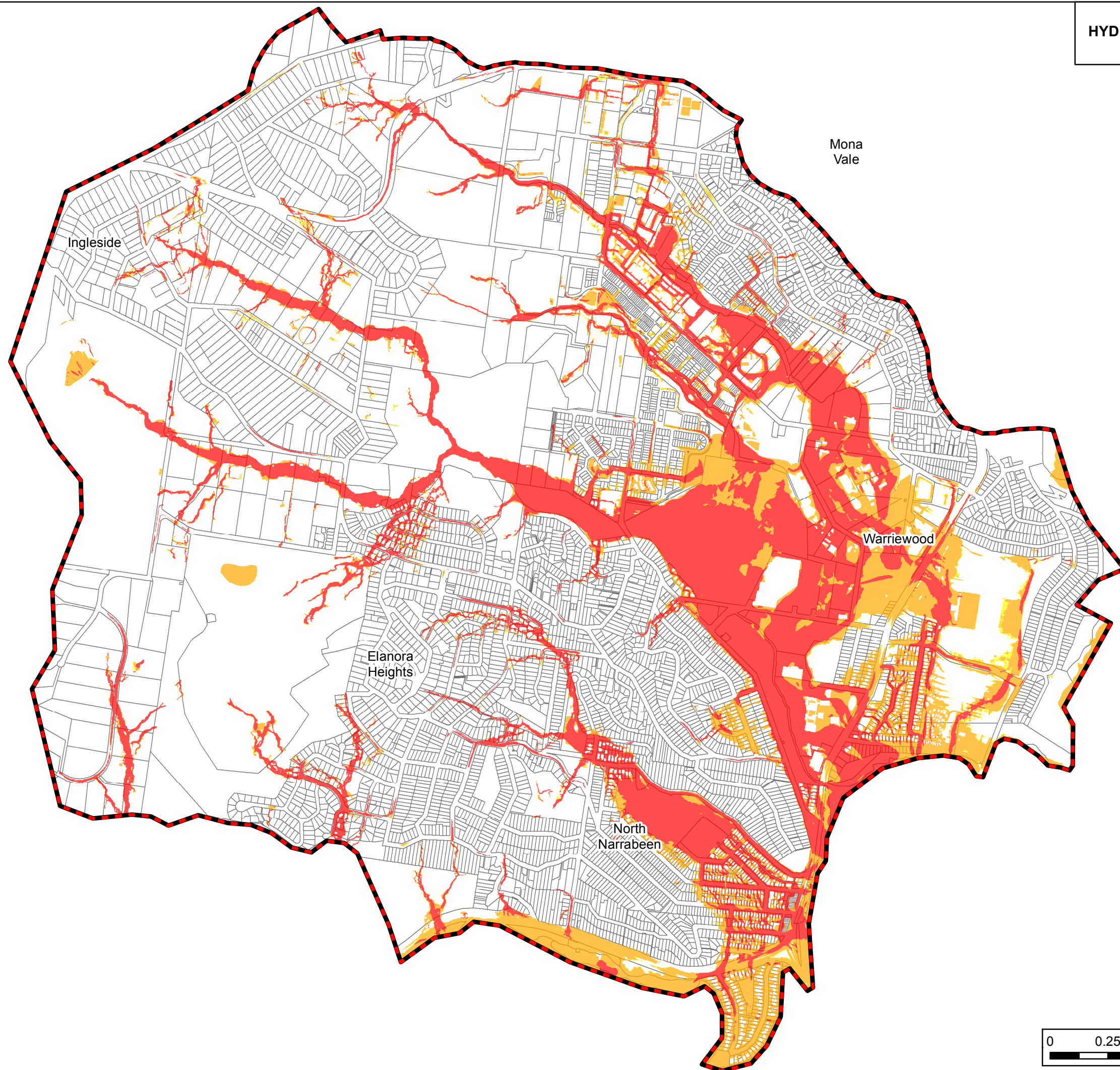
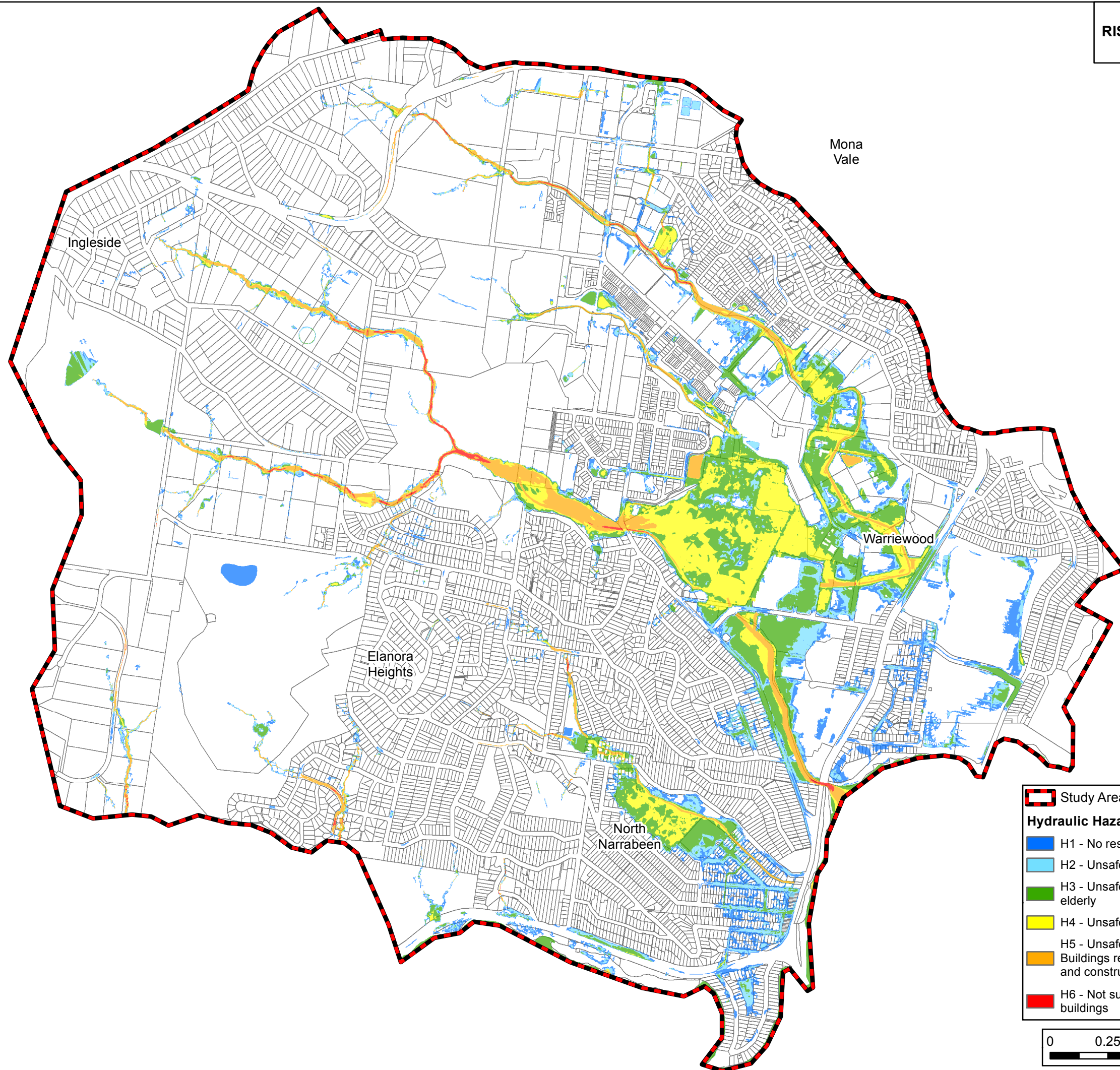


FIGURE B26
RISK TO LIFE (AEMI HAZARD)
1% AEP EVENT



- Study Area**
- Hydraulic 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 and vehicles.
Buildings require special engineering design and construction
 - H6 - Not suitable for people, vehicles and buildings

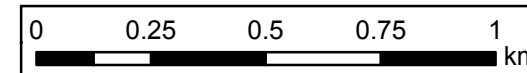
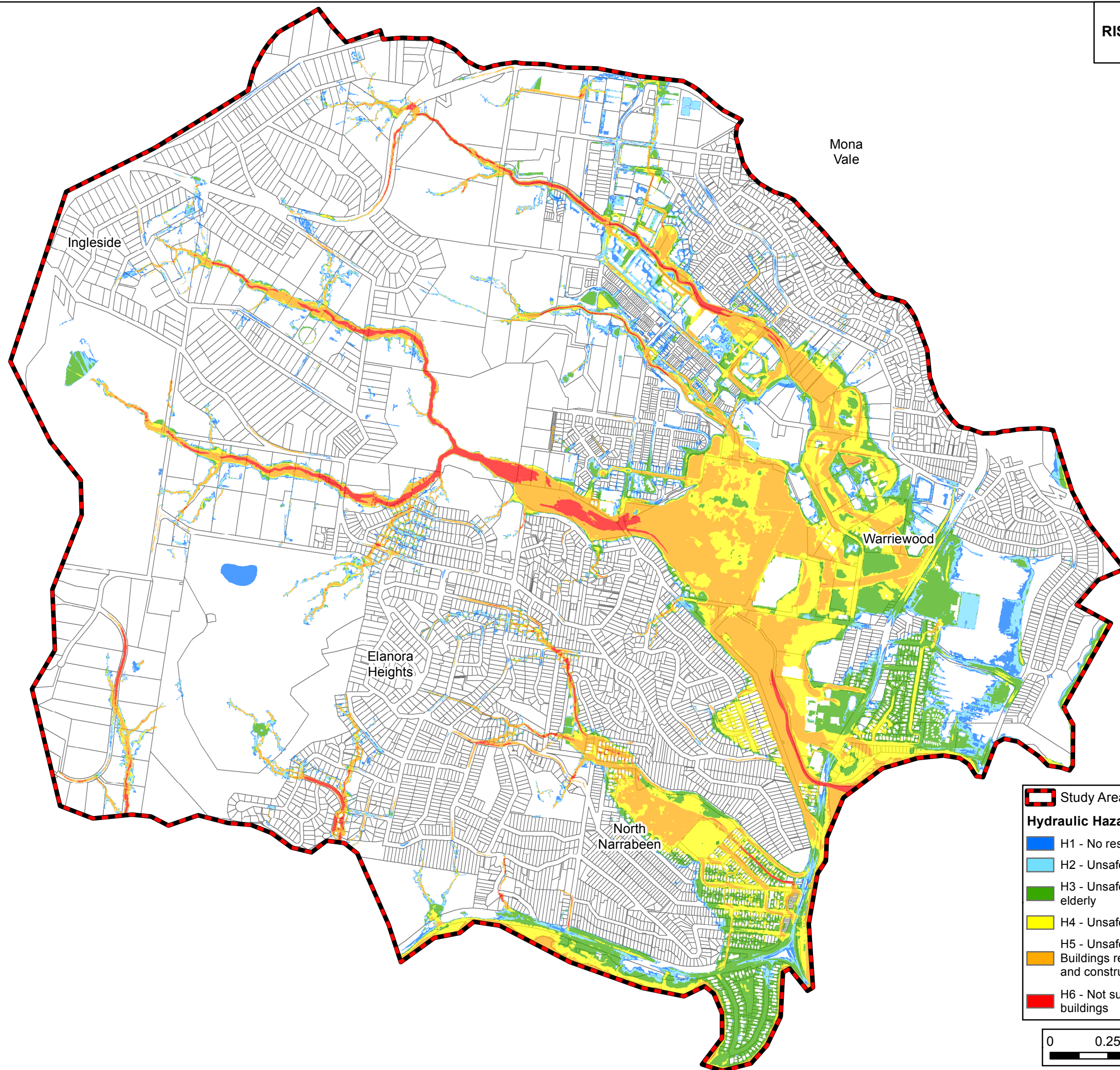
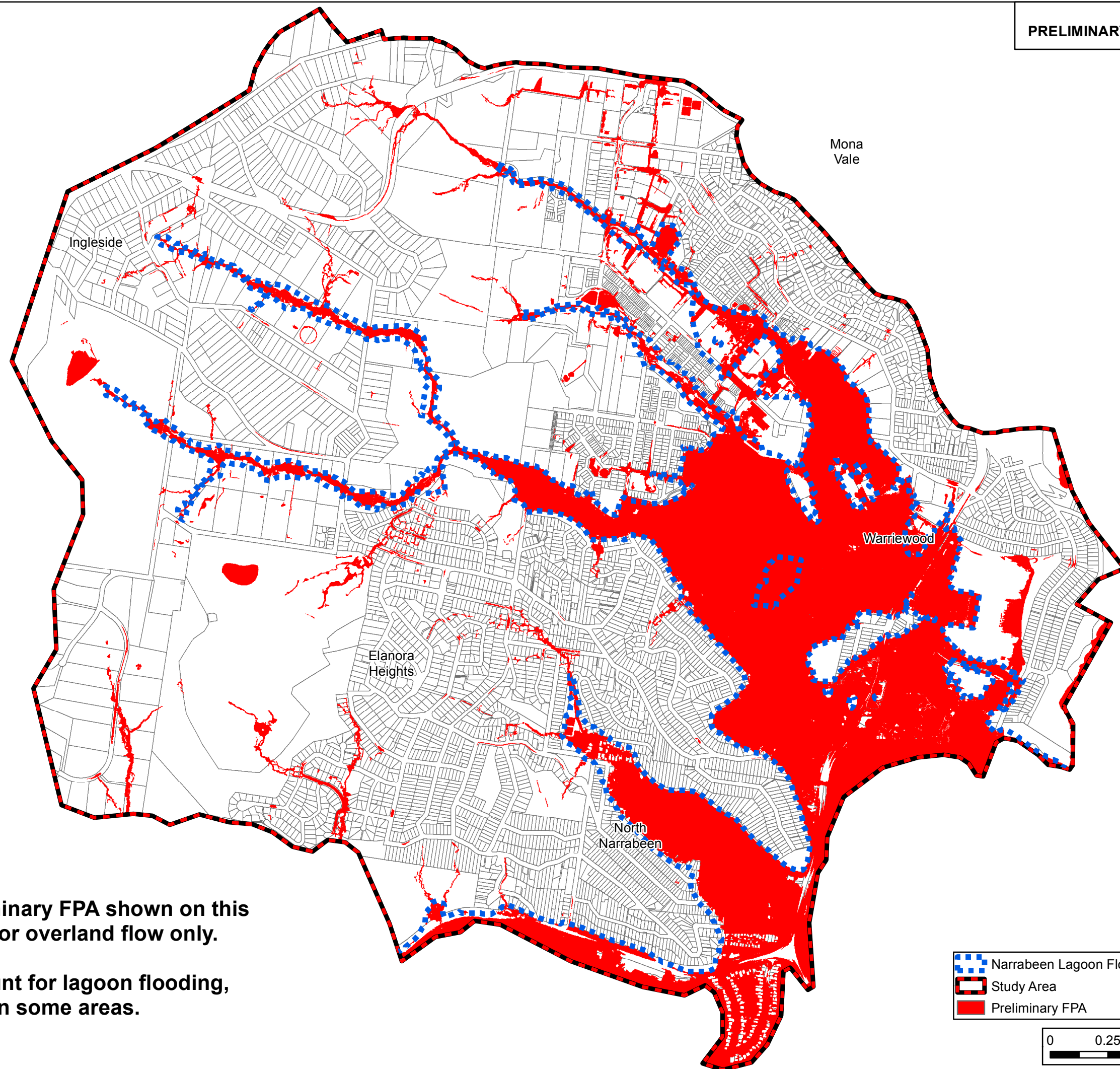


FIGURE B27
RISK TO LIFE (AEMI HAZARD)
PMF EVENT



- Study Area**
- Hydraulic 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 and vehicles. Buildings require special engineering design and construction
 - H6 - Not suitable for people, vehicles and buildings

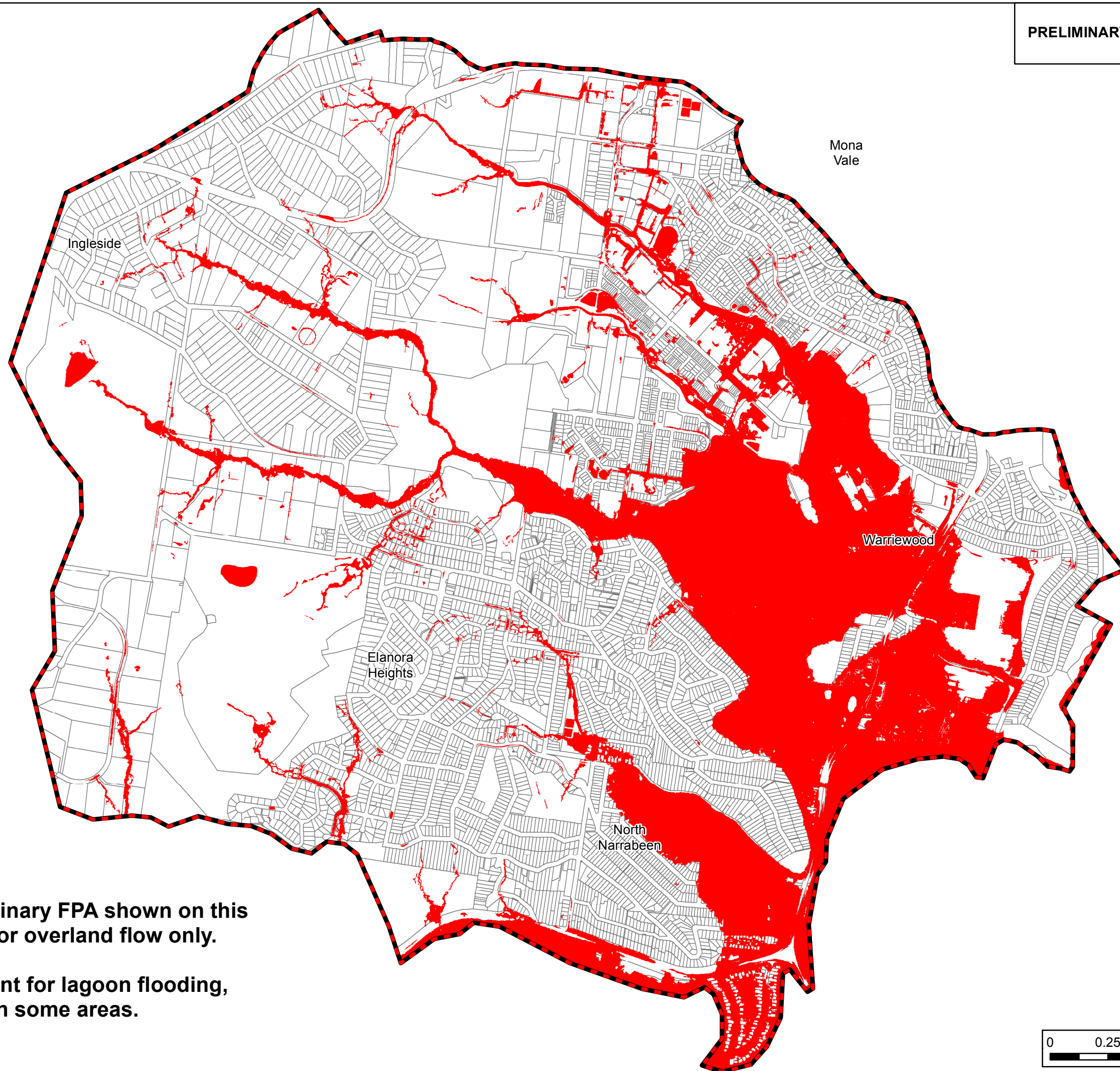
0 0.25 0.5 0.75 1 km



Note - The Preliminary FPA shown on this figure accounts for overland flow only.

It does not account for lagoon flooding, which is critical in some areas.

FIGURE B29
PRELIMINARY FLOOD PLANNING AREA
0.4 m SEA LEVEL RISE



Note - The Preliminary FPA shown on this figure accounts for overland flow only.

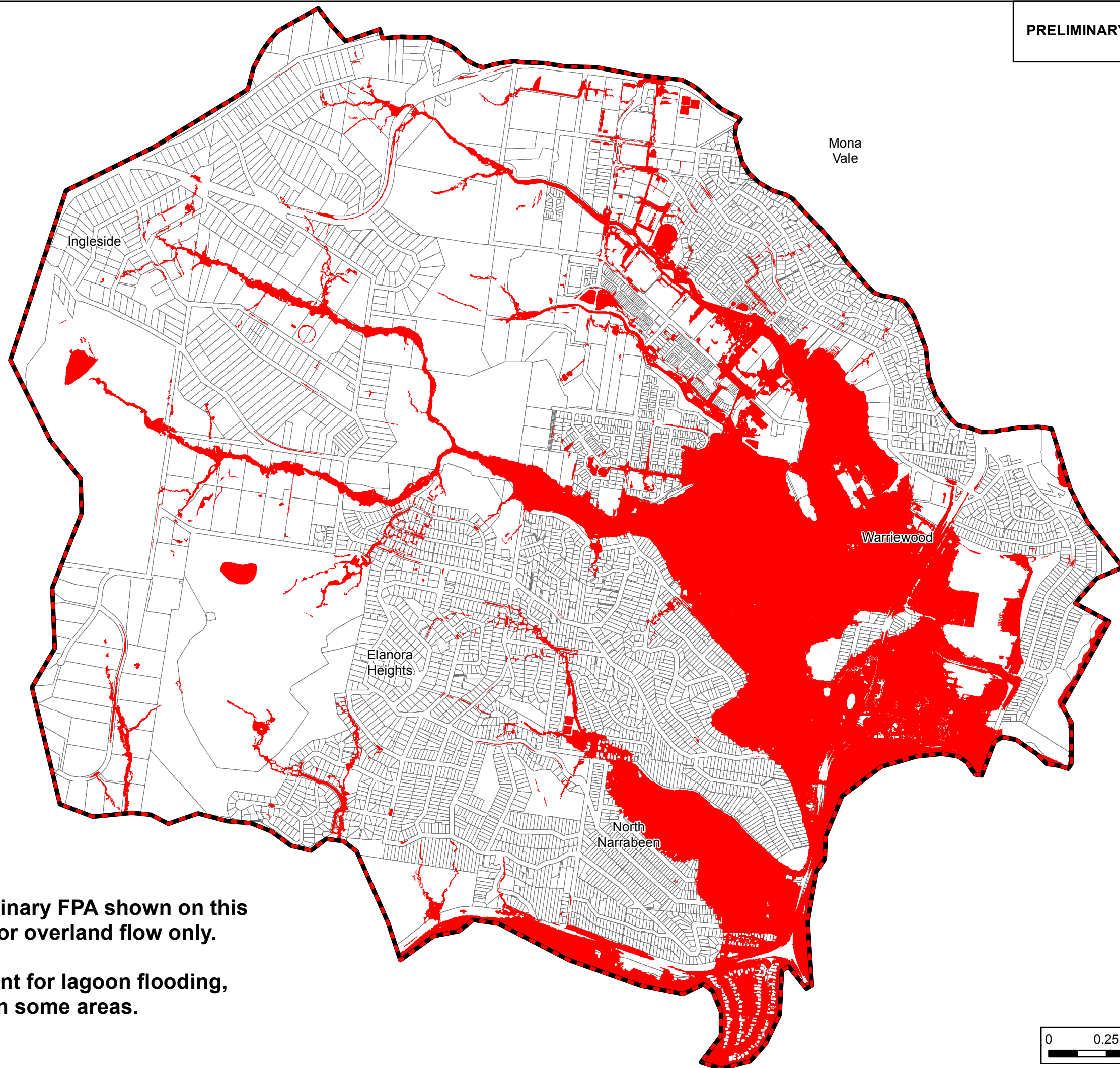
It does not account for lagoon flooding, which is critical in some areas.

Study Area
Preliminary FPA

0 0.25 0.5 0.75 1 km



FIGURE B30
PRELIMINARY FLOOD PLANNING AREA
0.9 m SEA LEVEL RISE



Note - The Preliminary FPA shown on this figure accounts for overland flow only.

It does not account for lagoon flooding, which is critical in some areas.

Study Area
Preliminary FPA

0 0.25 0.5 0.75 1 km



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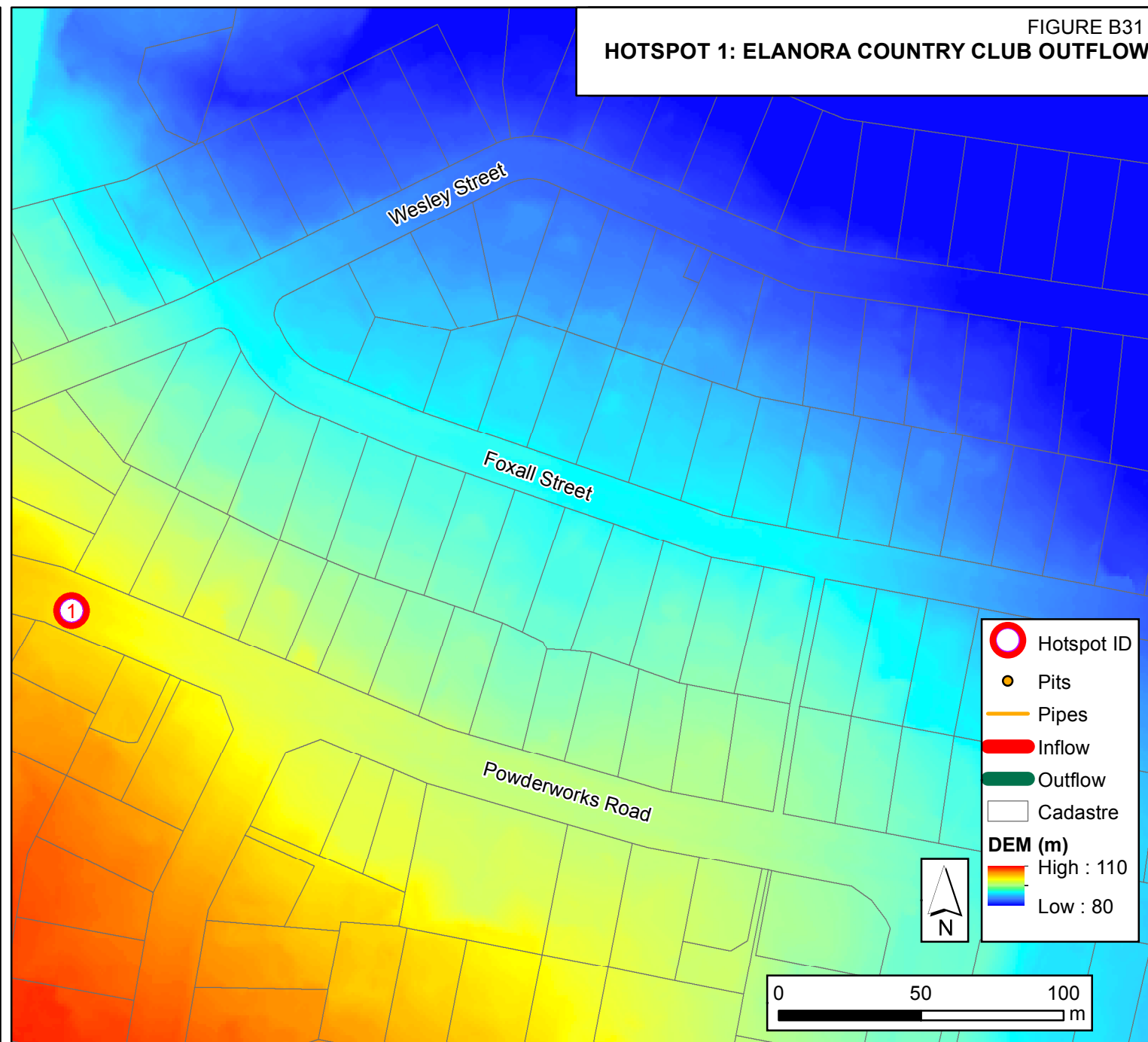
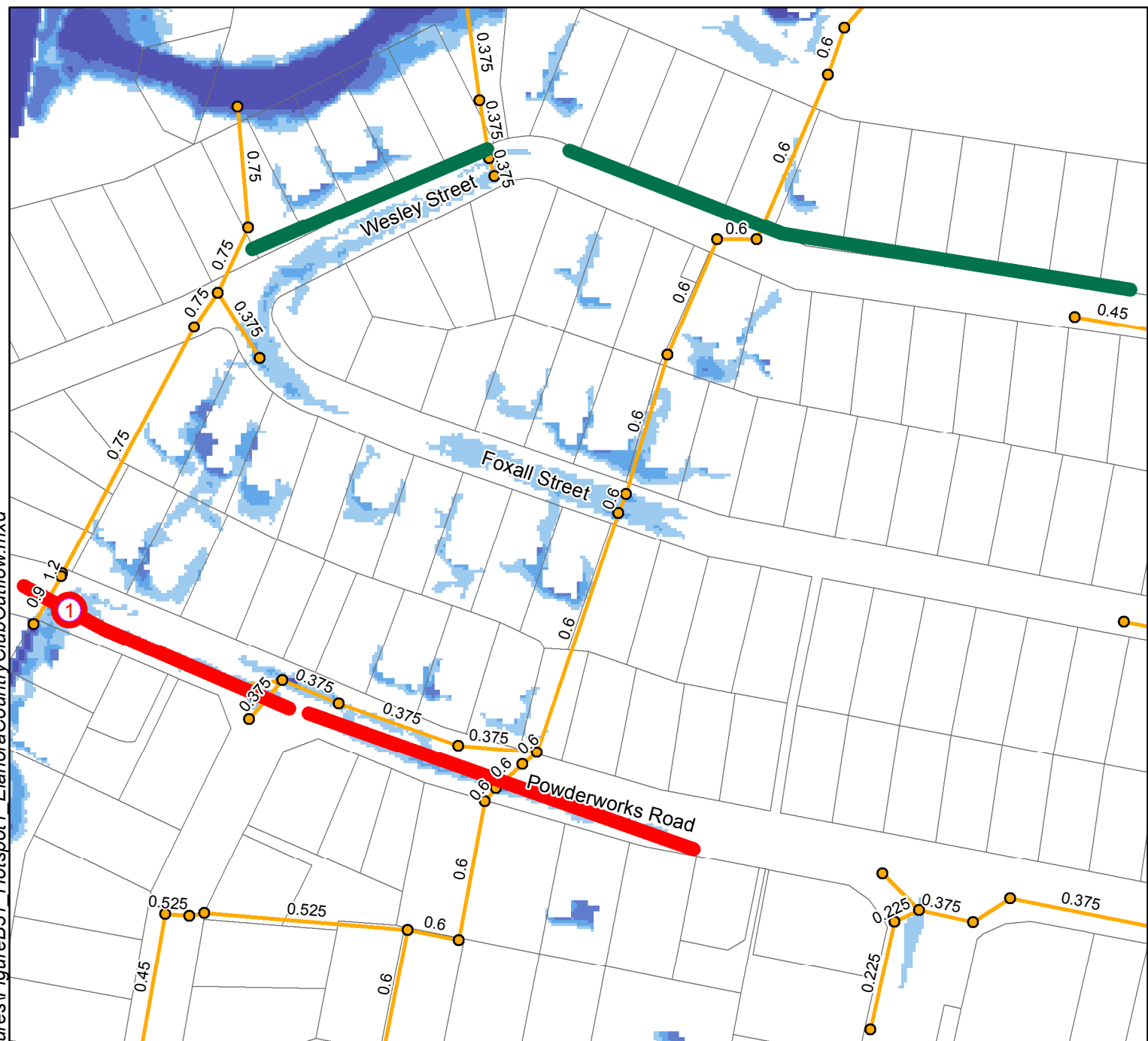
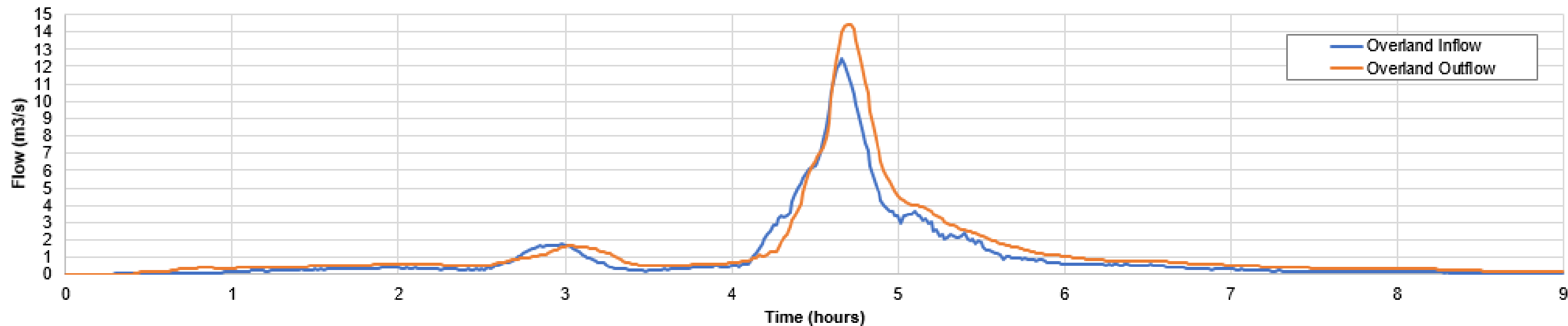
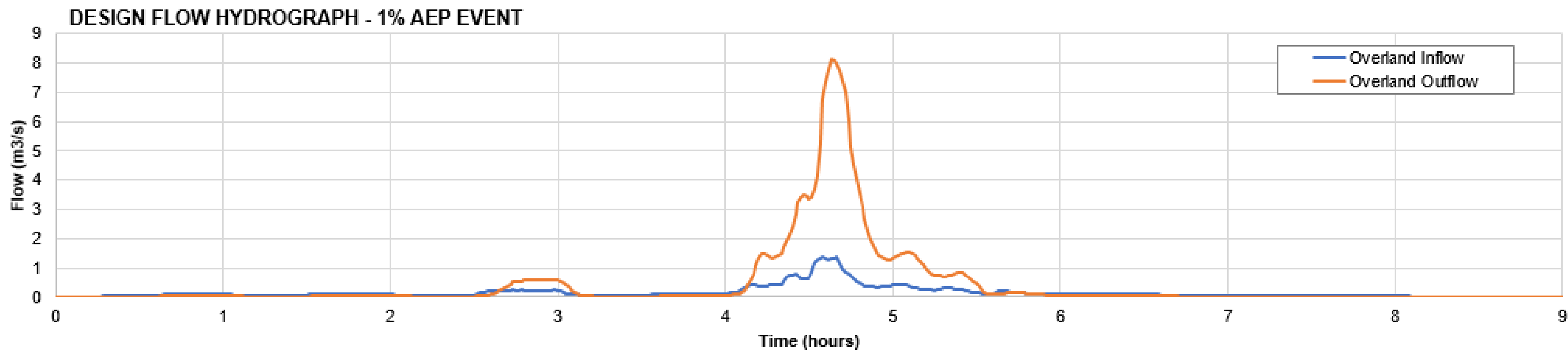
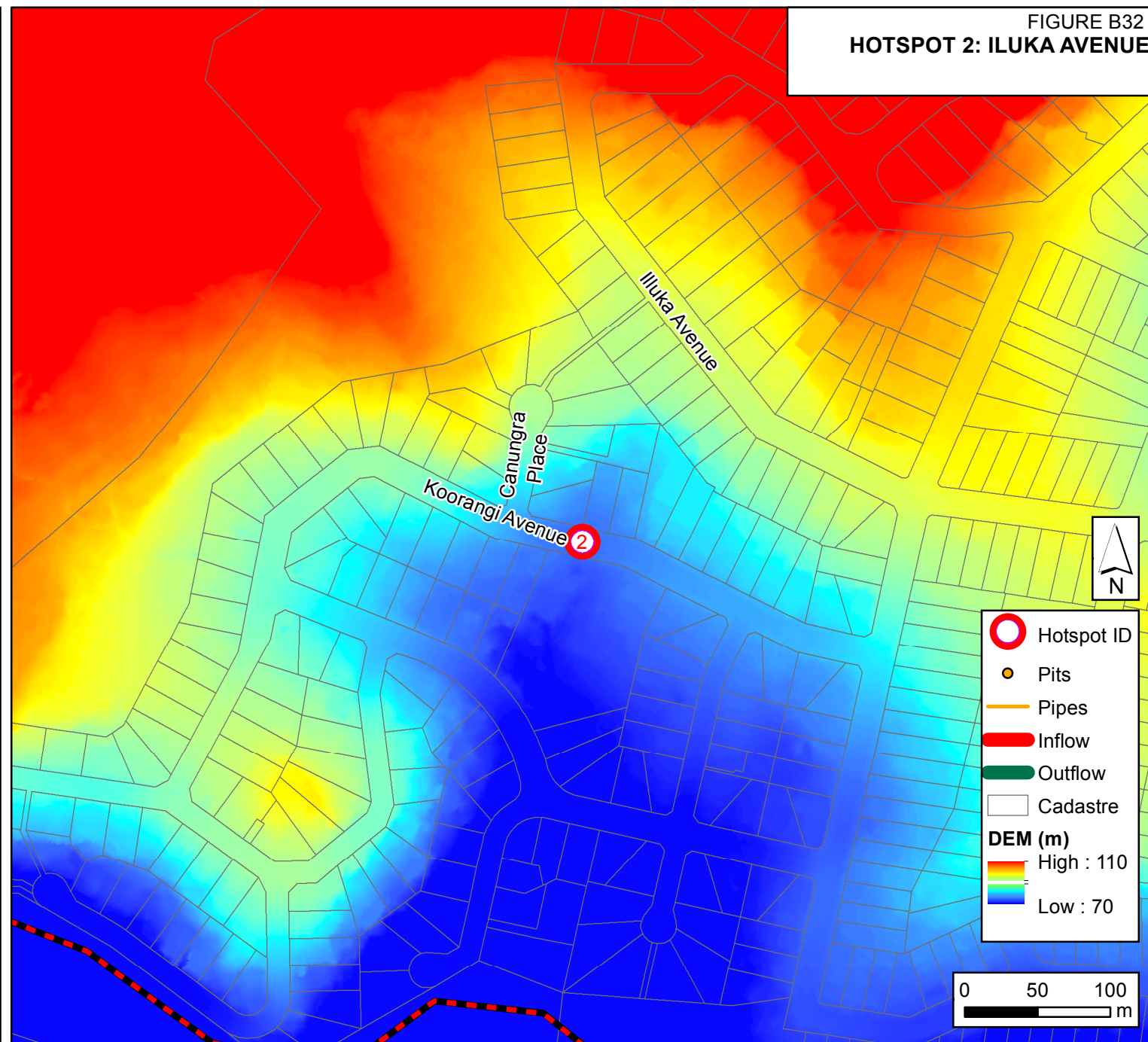
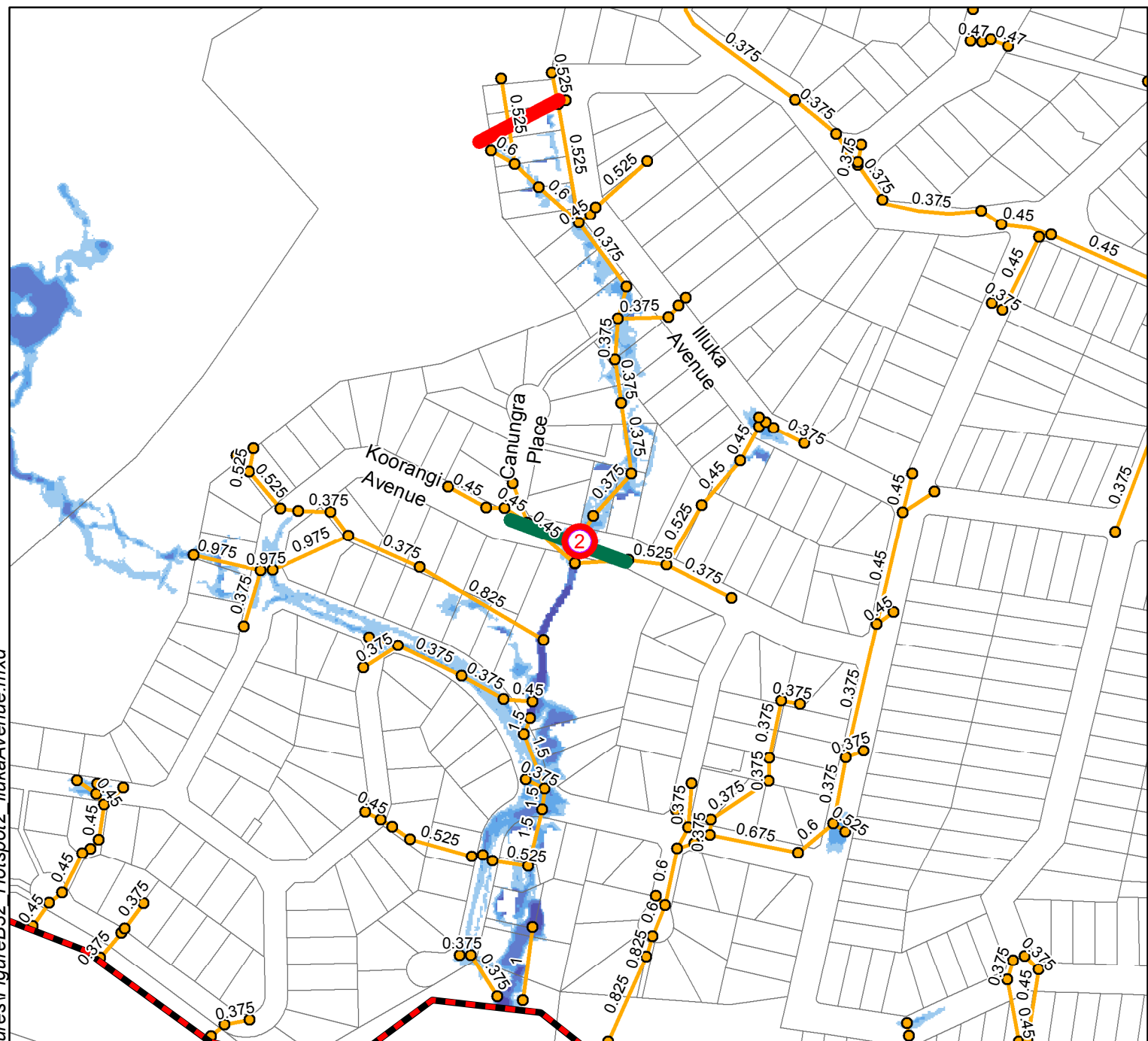


FIGURE B31
HOTSPOT 1: ELANORA COUNTRY CLUB OUTFLOW

DESIGN FLOW HYDROGRAPH - 1% AEP EVENT



J:\Jobs\116059\ArcGIS\ArcMap\Report_Figures\AppendixB_Figures\FigureB32_Hotspot2_IlukaAvenue.mxd



J:\Jobs\116059\ArcGIS\ArcMap\Report_Figures\AppendixB_Figures\FigureB33_PipedUSNareenCreek.mxd

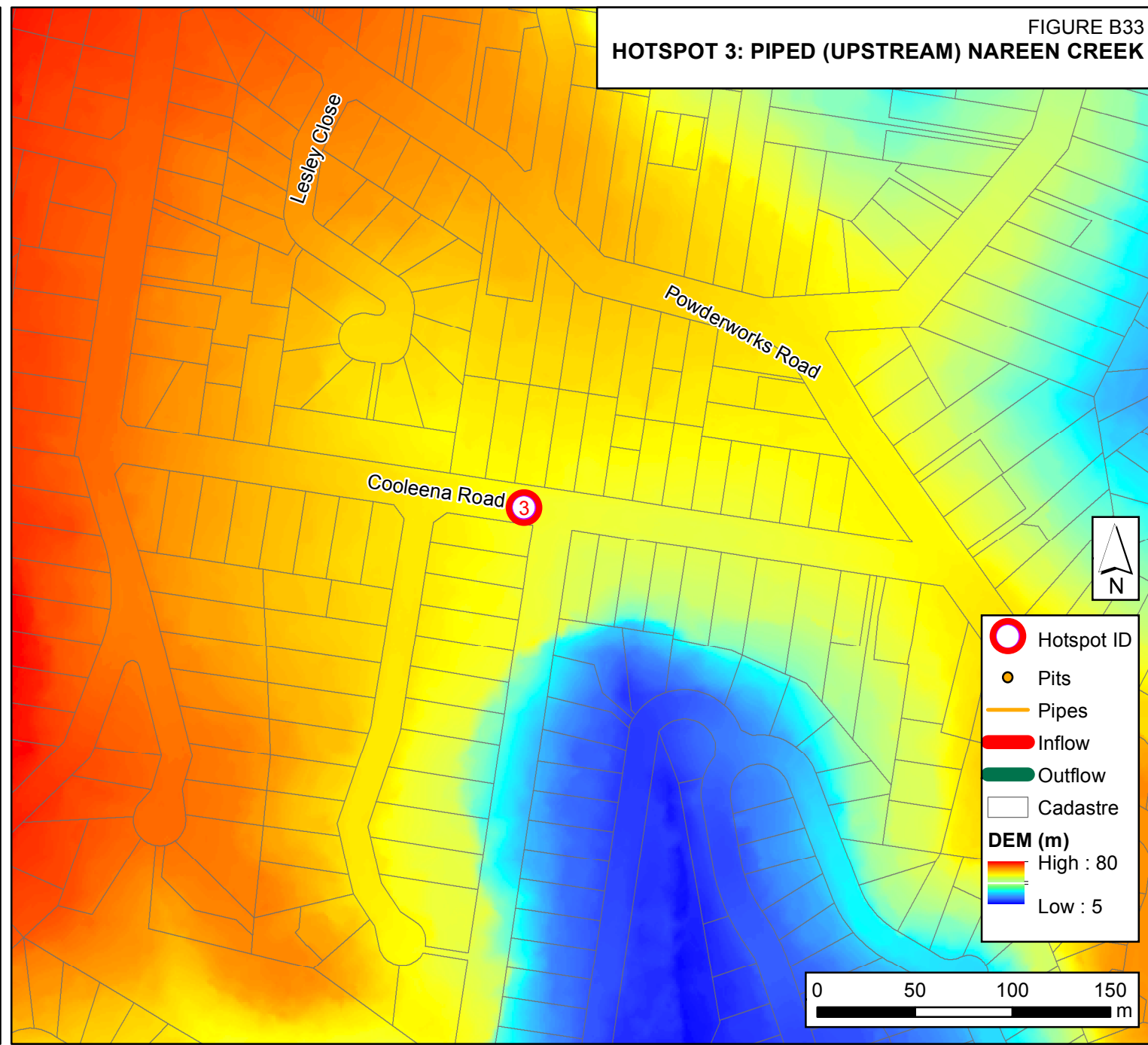
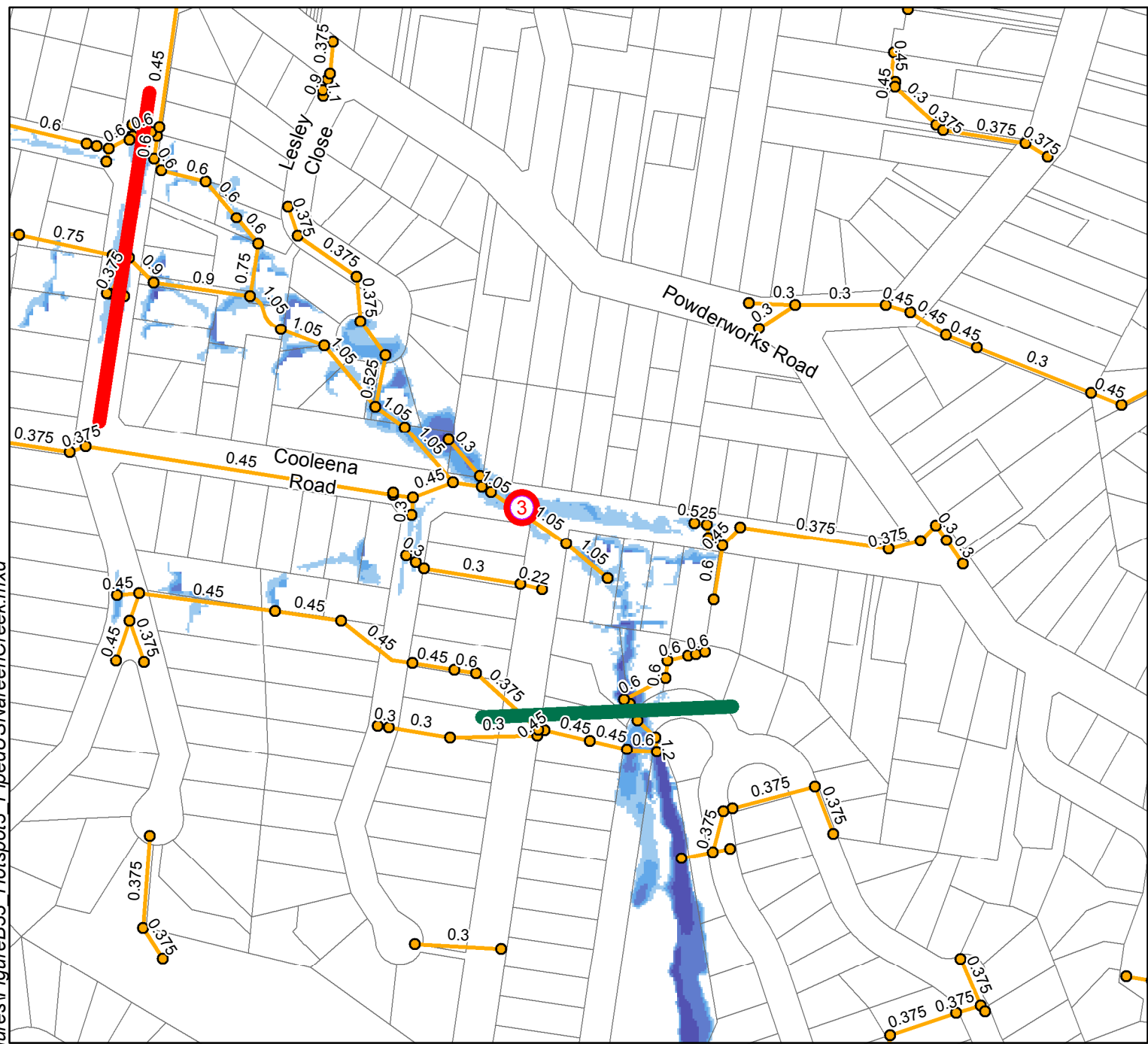
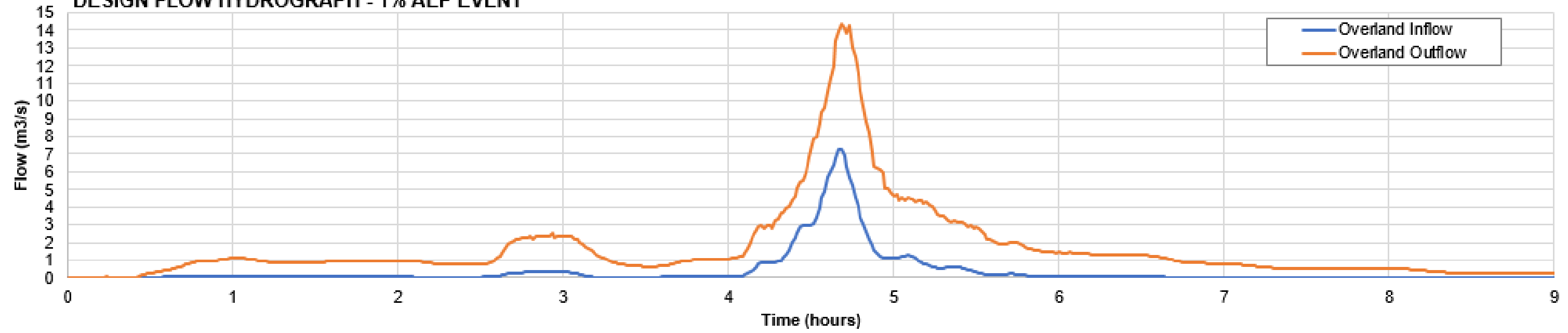


FIGURE B33
HOTSPOT 3: PIPED (UPSTREAM) NAREEN CREEK

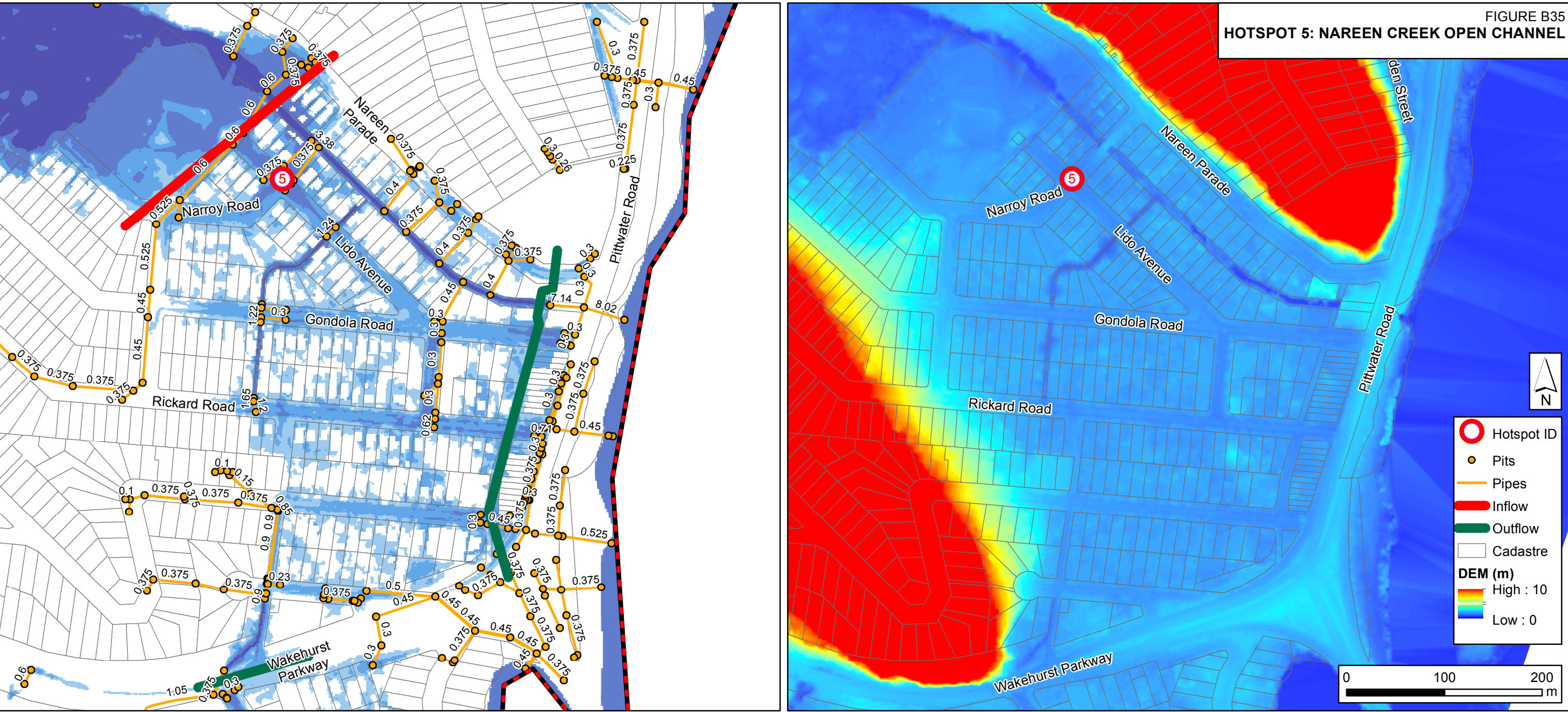
DESIGN FLOW HYDROGRAPH - 1% AEP EVENT



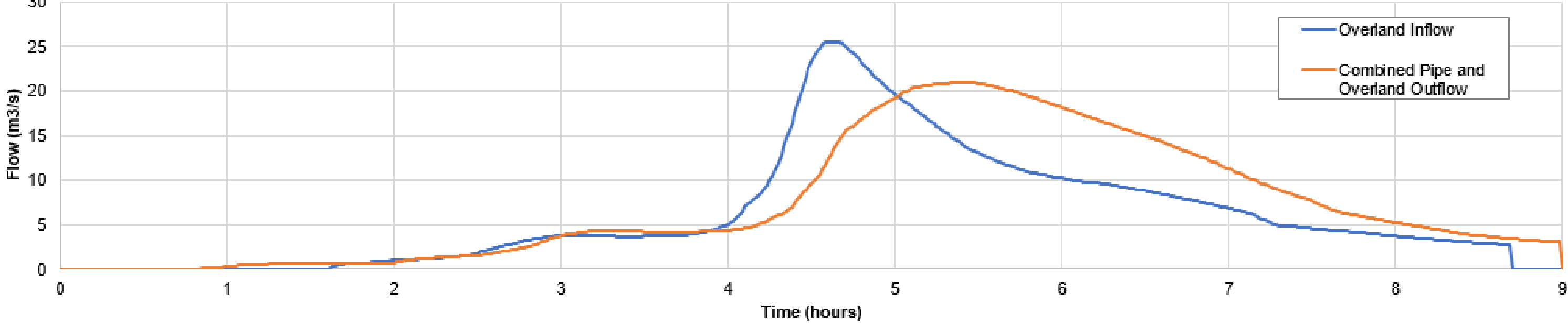
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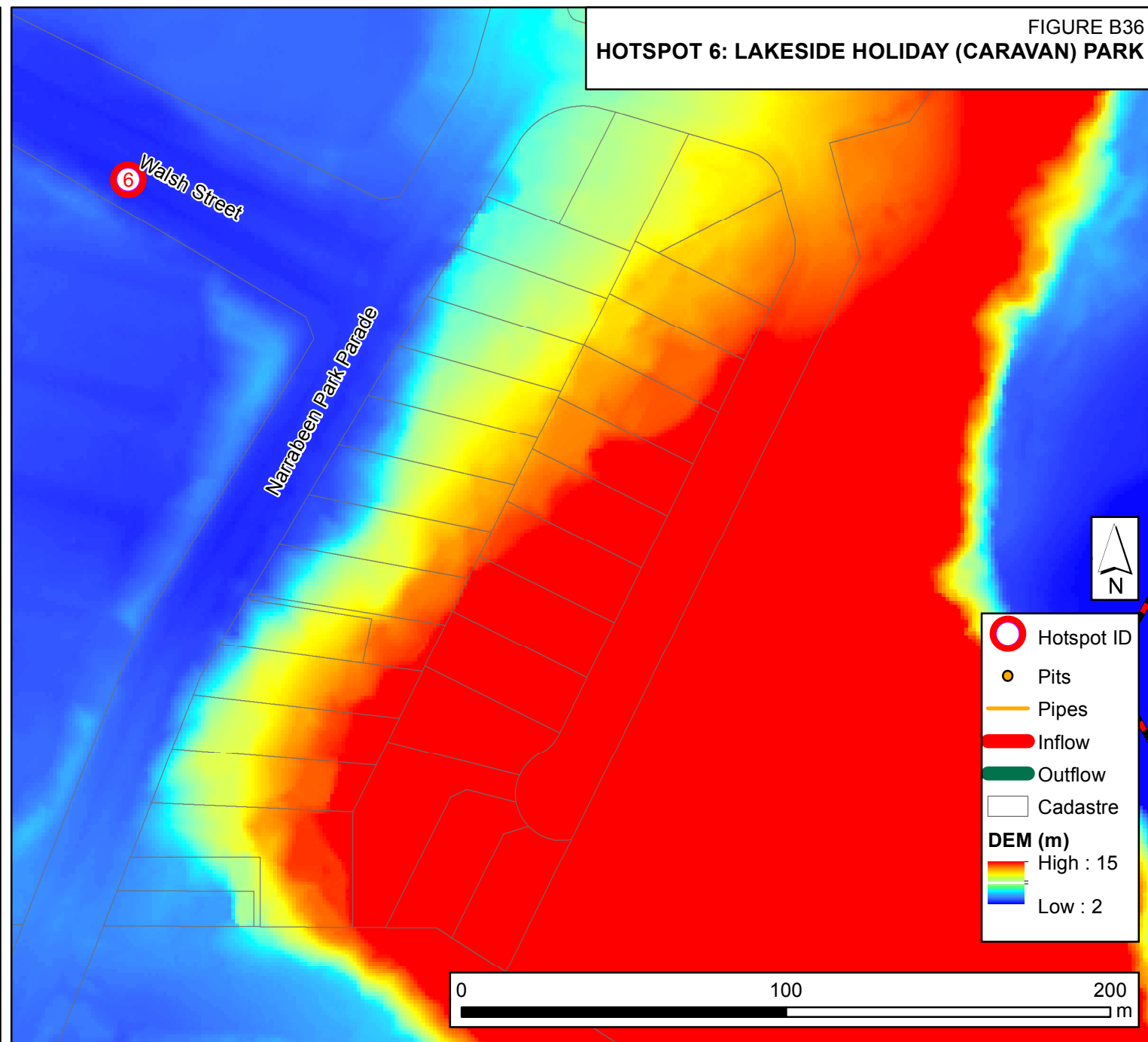
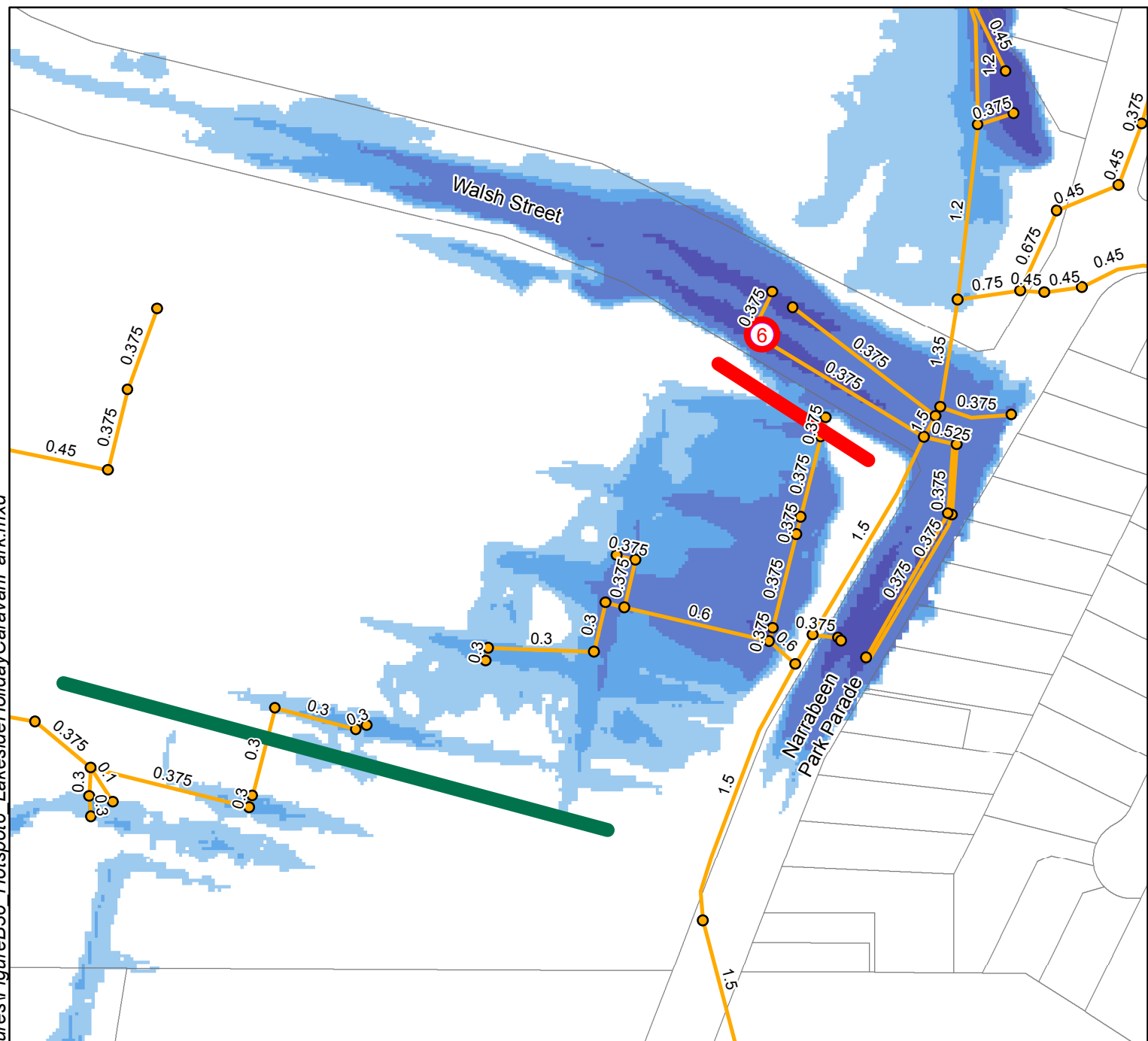
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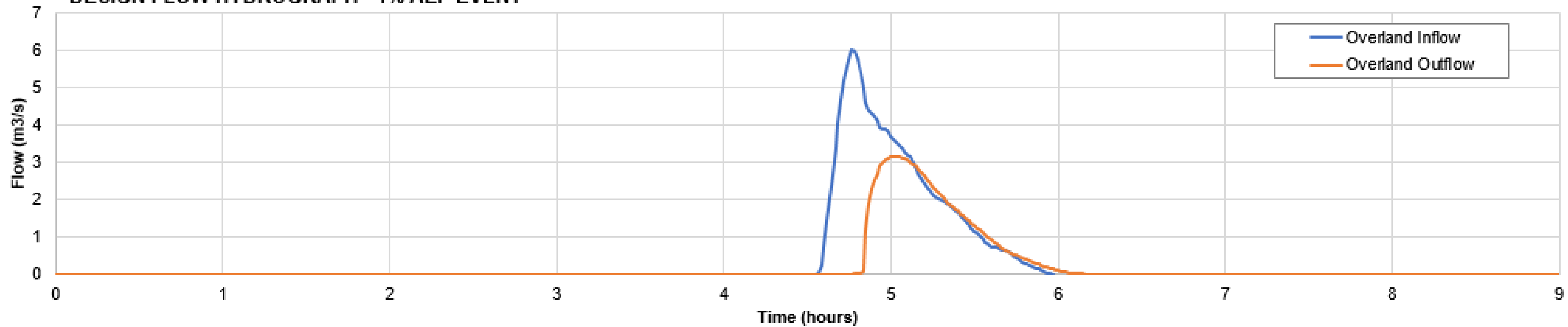
DESIGN FLOW HYDROGRAPH - 1% AEP EVENT



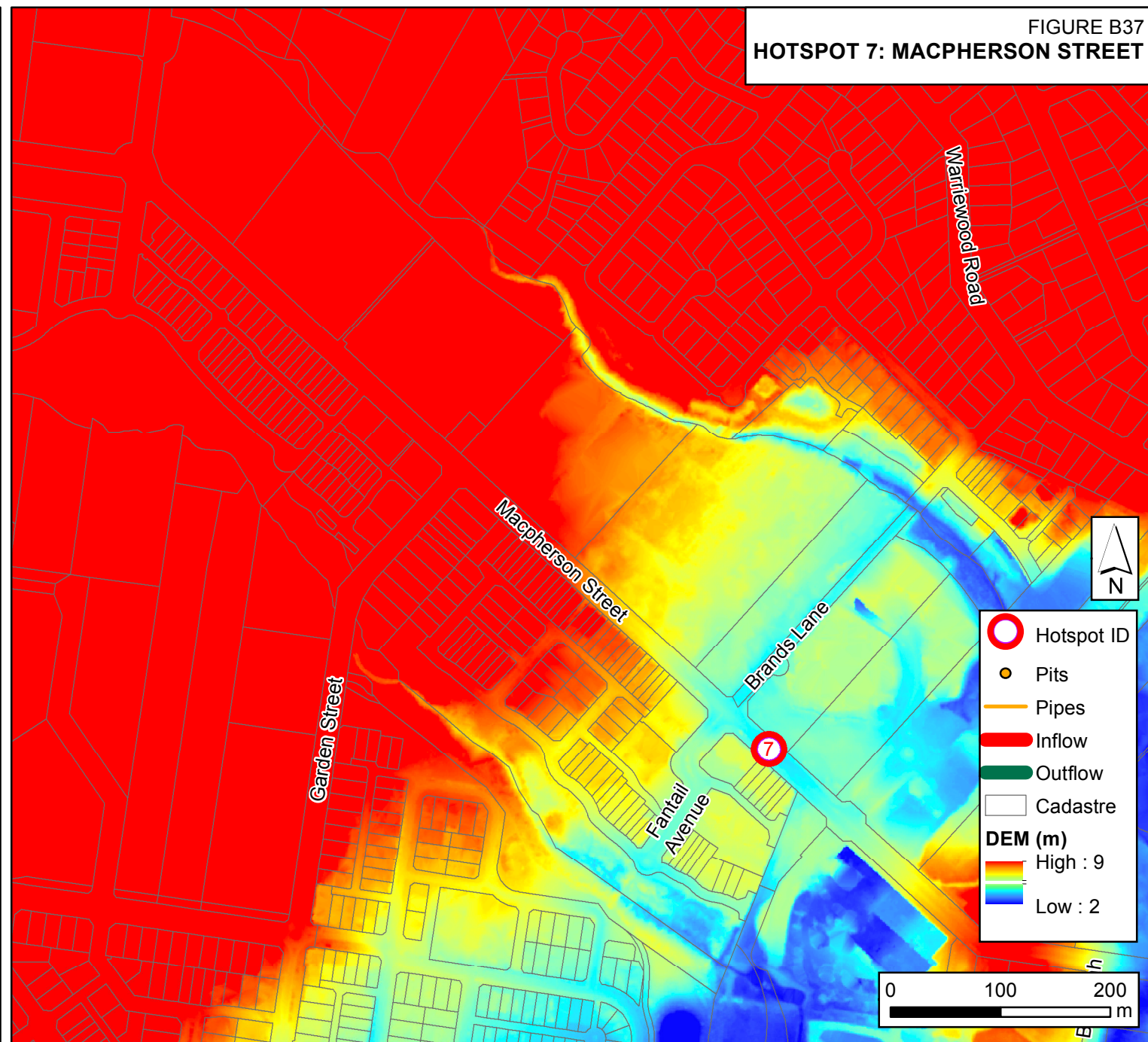
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DESIGN FLOW HYDROGRAPH - 1% AEP EVENT



J:\Jobs\116059\ArcGIS\ArcMap\Report_Figures\AppendixB_Figures\FigureB37_Hotspot7_MacPhersonStreet.mxd



DESIGN FLOW HYDROGRAPH - 1% AEP EVENT

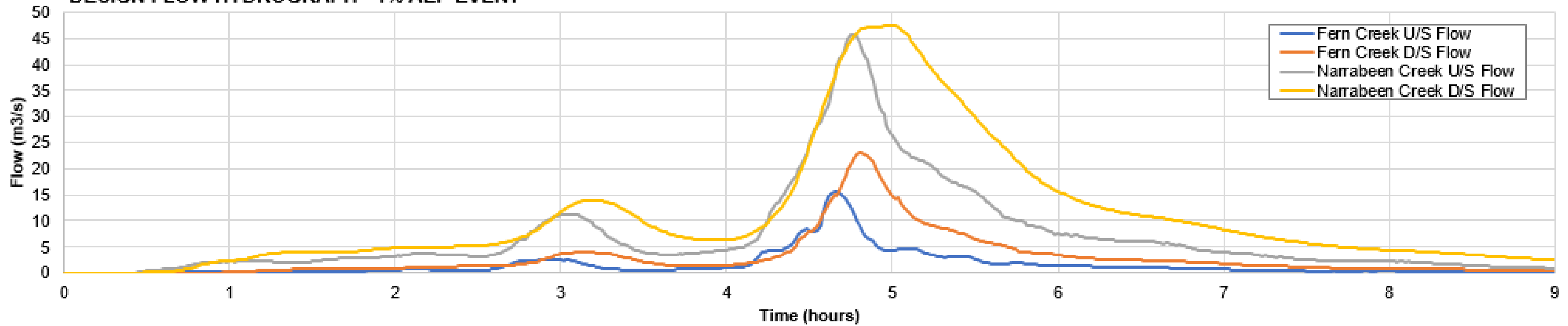
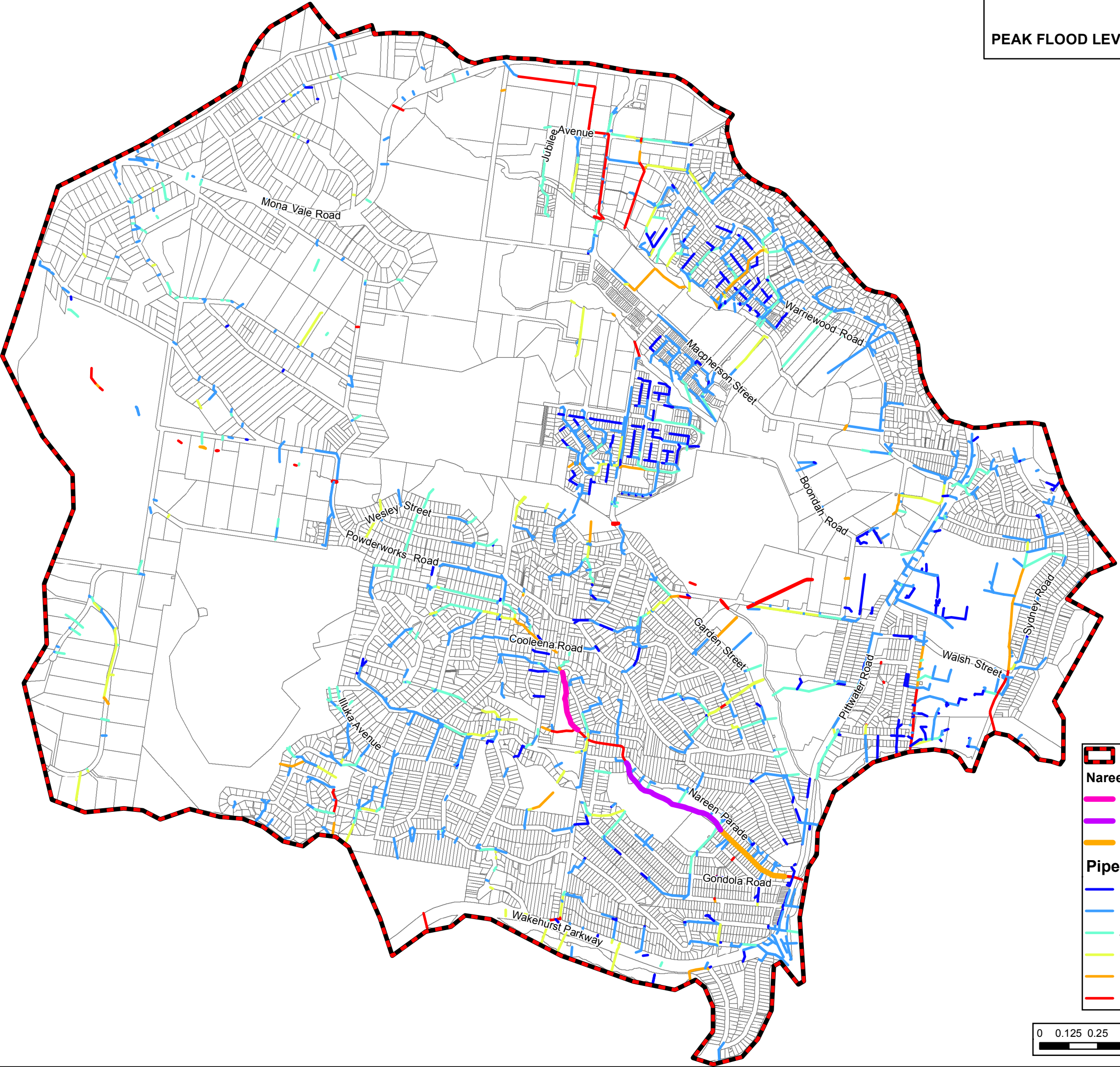


FIGURE B38A
NAREEN CREEK
PEAK FLOOD LEVEL PROFILE LOCATIONS



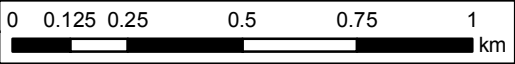
Study Area

Nareen Creek Profile Locations

- Upstream of Tatiara Cr
- Nareen Creek Wetlands
- Nareen Creek Open Channel

Pipe diameter (mm)

- < 300
- 300 - 450
- 450 - 600
- 600 - 900
- 900 - 1200
- > 1200



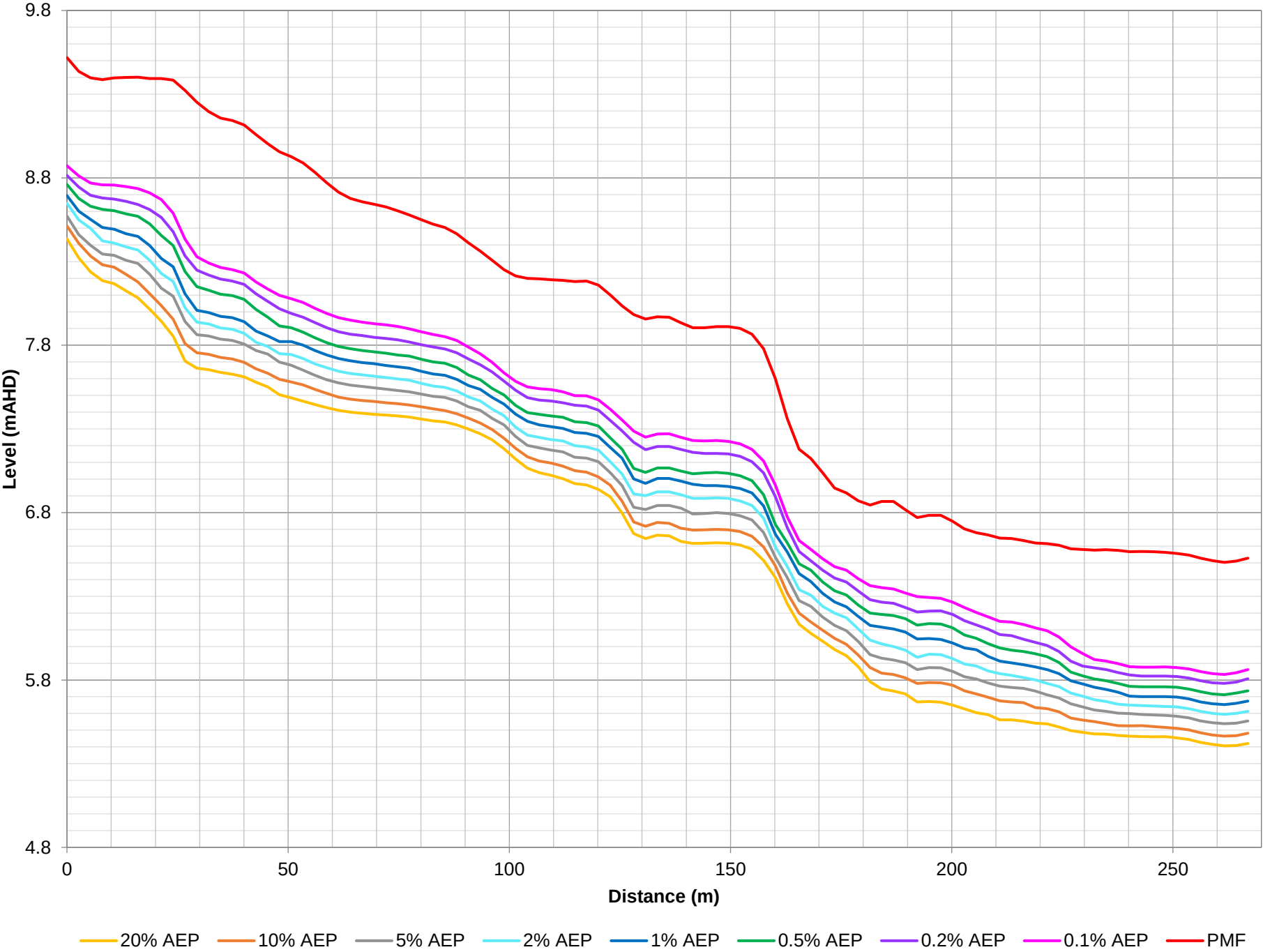


FIGURE B38B
NAREEN CREEK
PEAK FLOOD LEVEL PROFILE
UPSTREAM OF TATIARA CRESCENT
NARRABEEN LAGOON (NORTH)

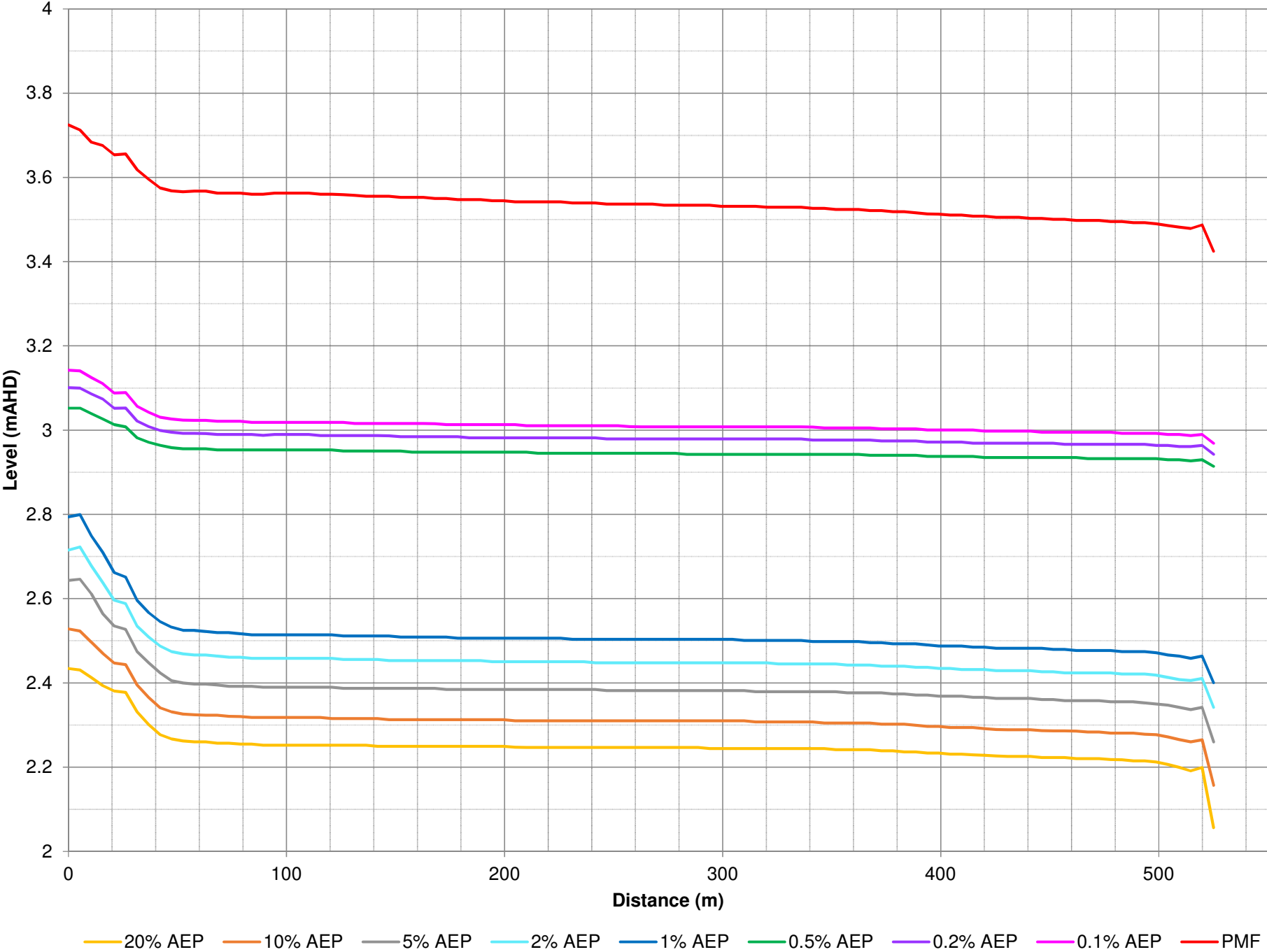


FIGURE B38C
NAREEN CREEK
PEAK FLOOD LEVEL PROFILE
NAREEN CREEK WETLANDS
NARRABEEN LAGOON (NORTH)

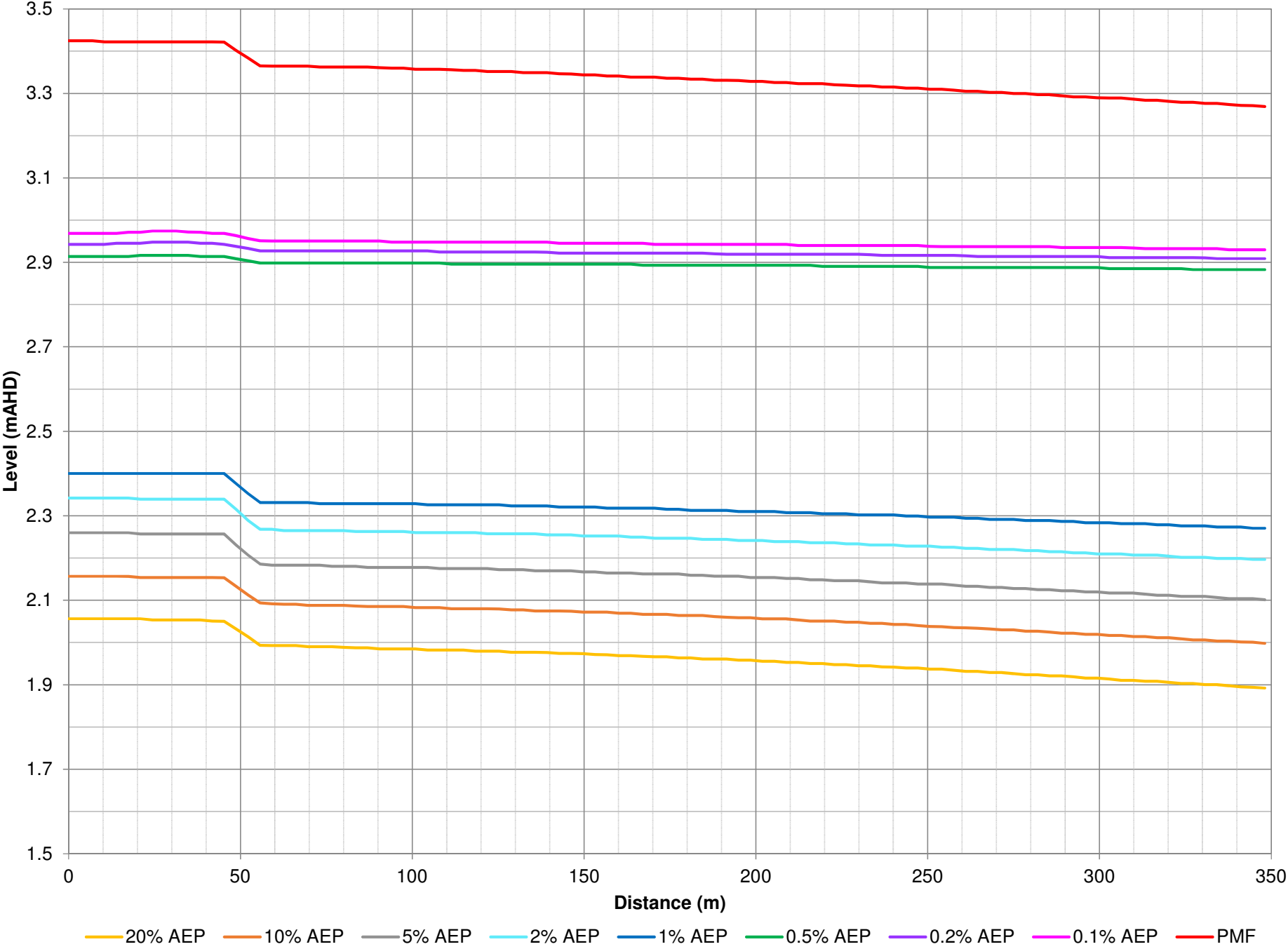


FIGURE B38D
NAREEN CREEK
PEAK FLOOD LEVEL PROFILE
NAREEN CREEK OPEN CHANNEL
NARRABEEN LAGOON (NORTH)

APPENDIX C.Flood Emergency Response Information



FIGURE C1
SES FLOOD EMERGENCY RESPONSE CLASSIFICATIONS

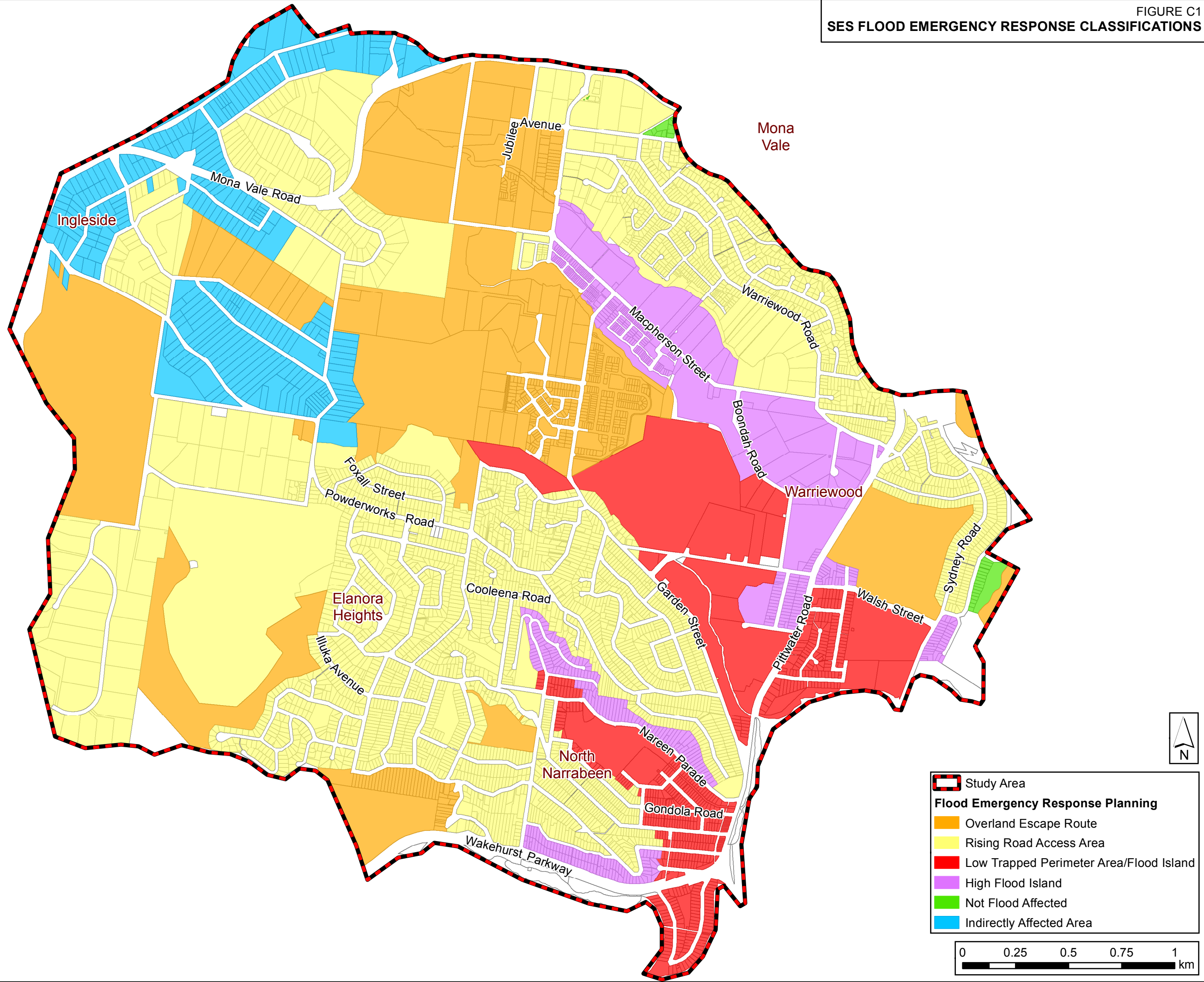
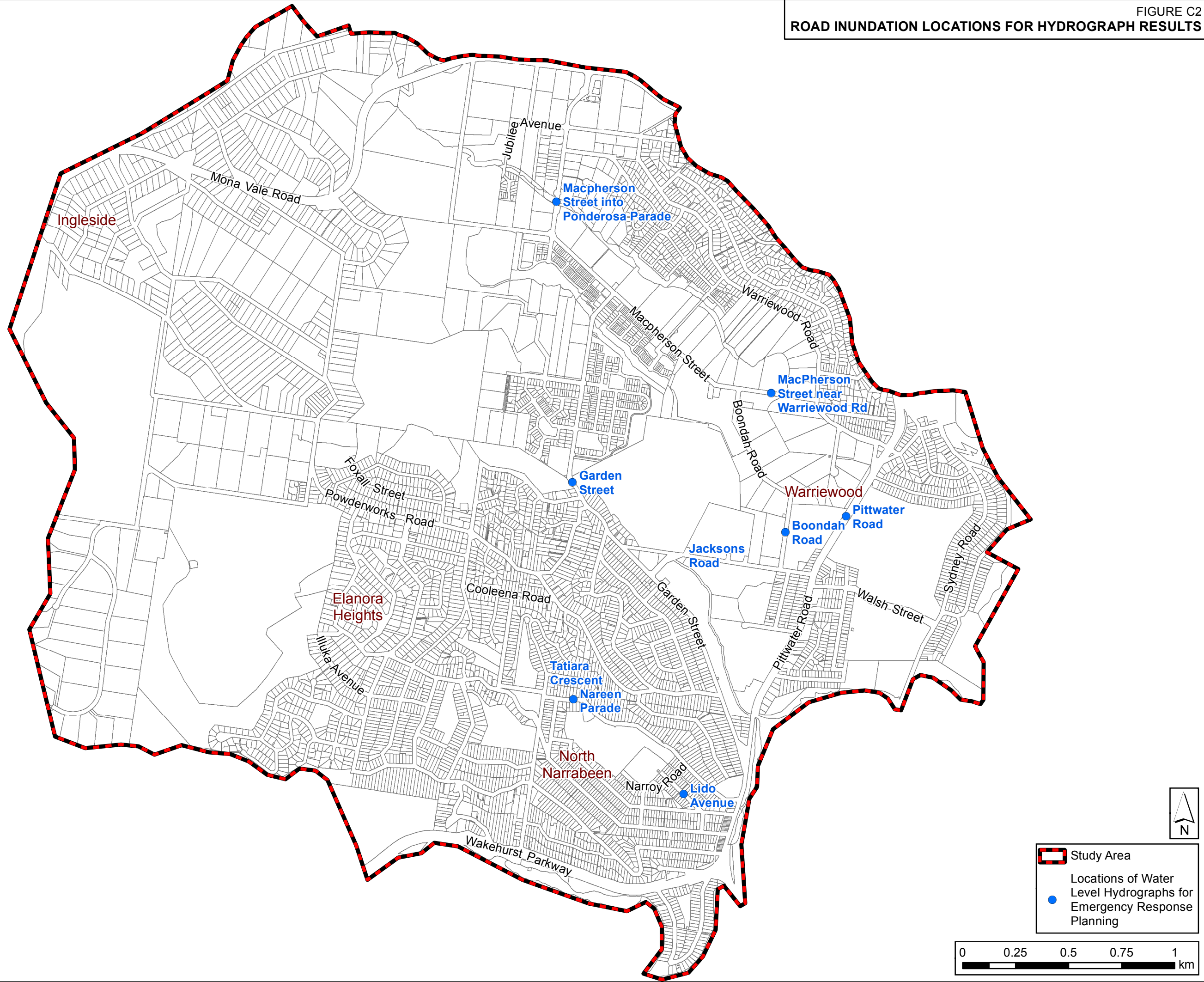


FIGURE C2
ROAD INUNDATION LOCATIONS FOR HYDROGRAPH RESULTS



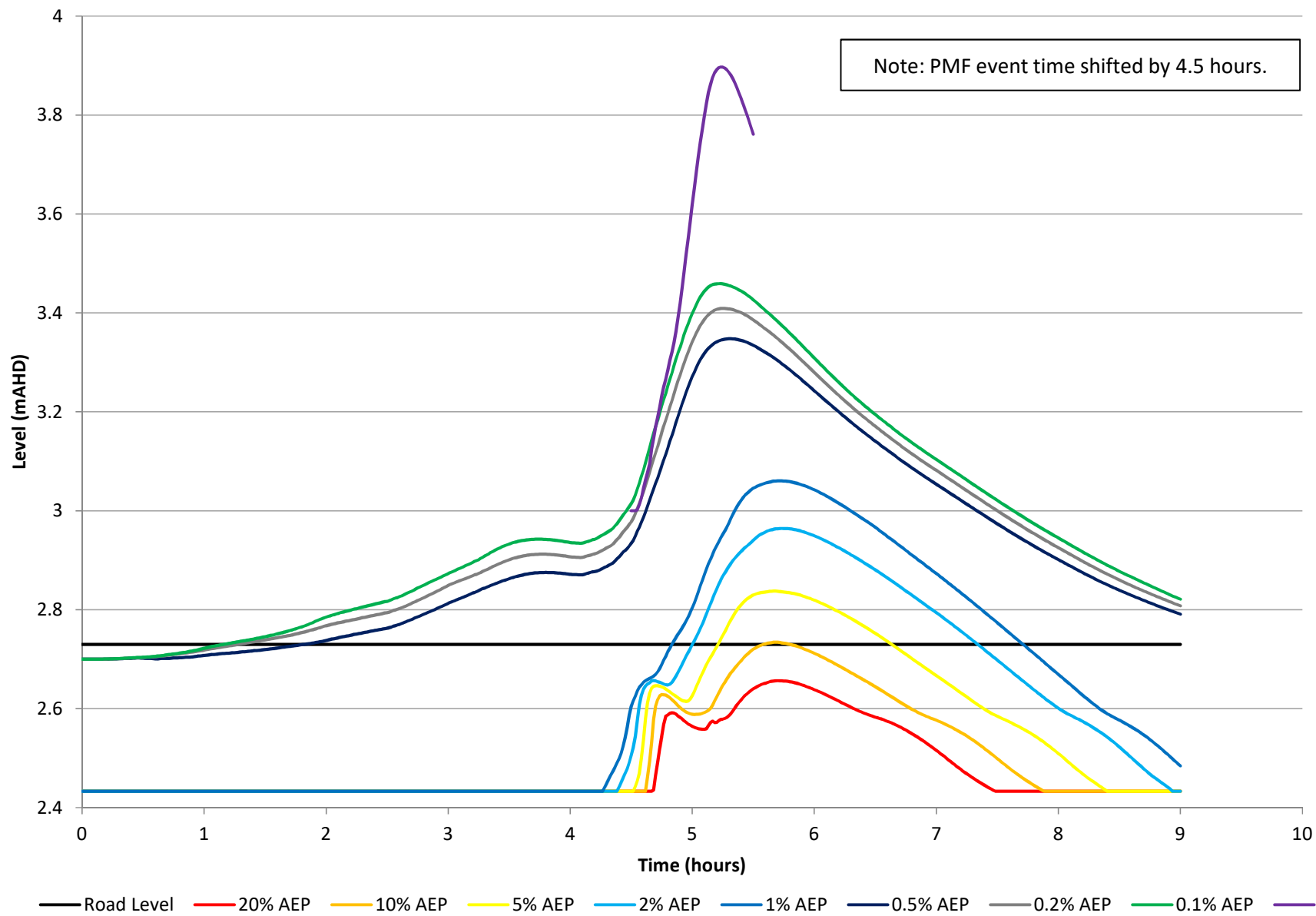


FIGURE C3
FLOOD LEVEL HYDROGRAPH
PITTWATER ROAD

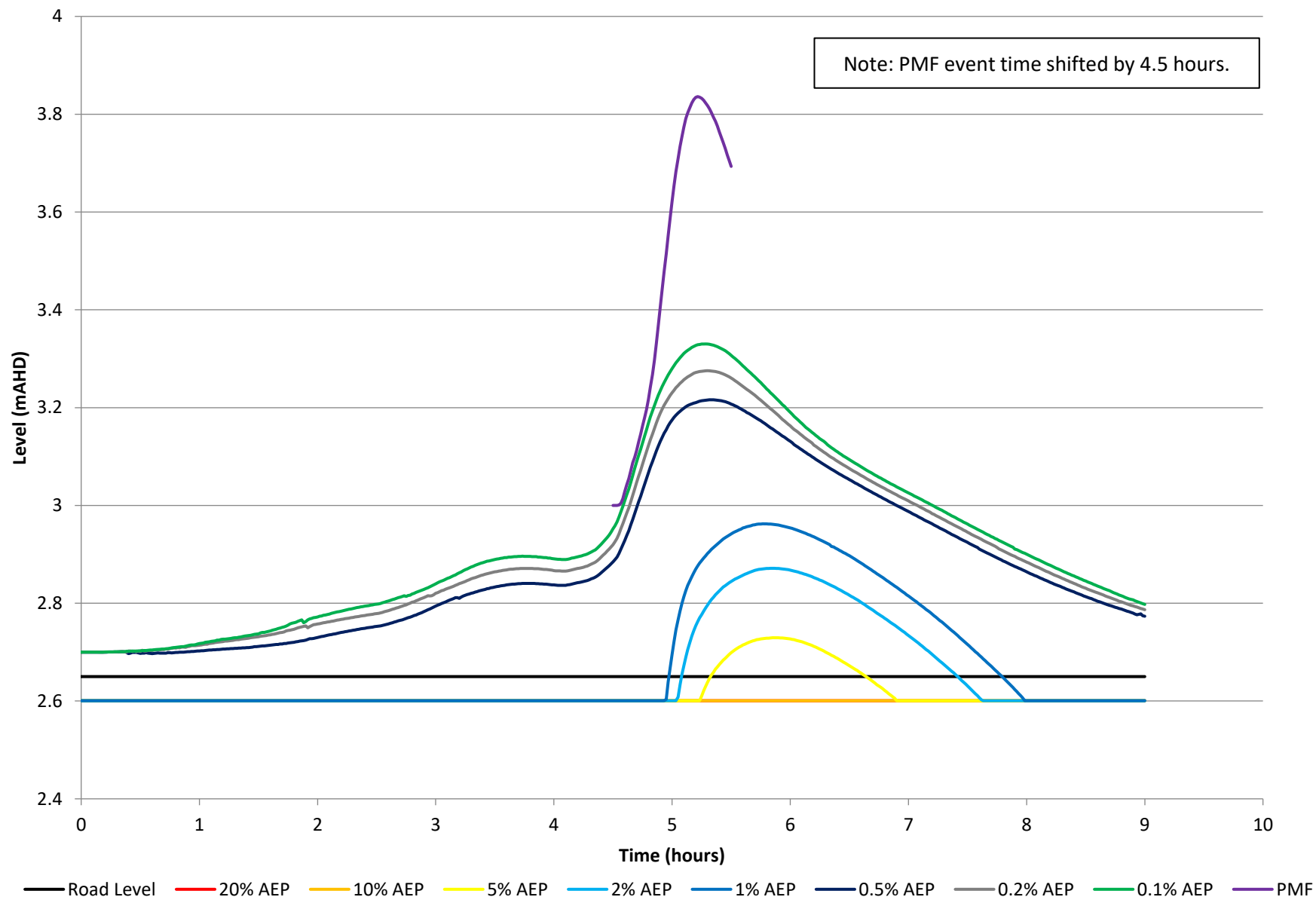


FIGURE C4
FLOOD LEVEL HYDROGRAPH
JACKSONS ROAD

J:\Jobs\116059\TUFLOW\results\SESAssessment\OvertoppingProfiles.xlsx

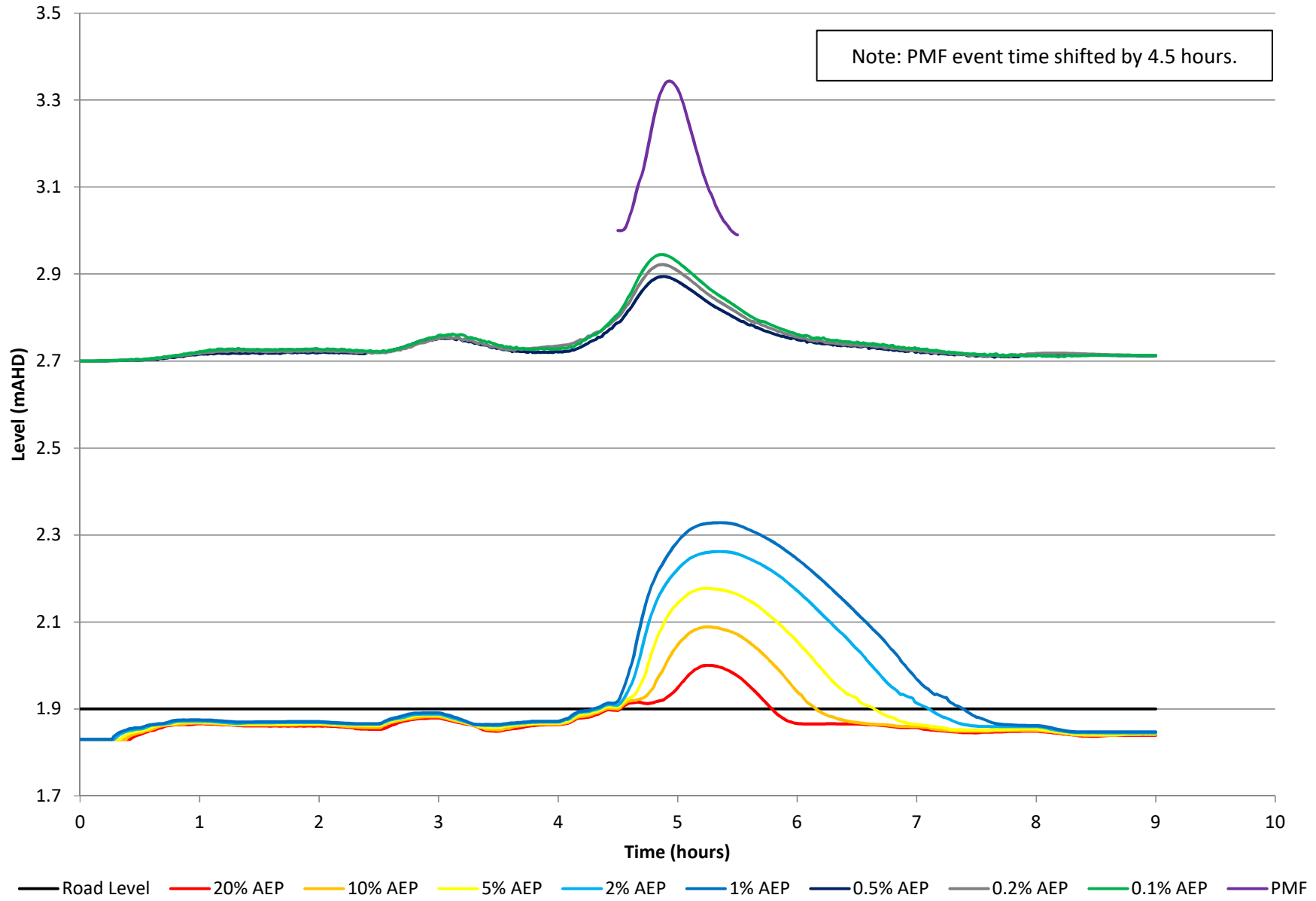


FIGURE C5
FLOOD LEVEL HYDROGRAPH
LIDO AVENUE

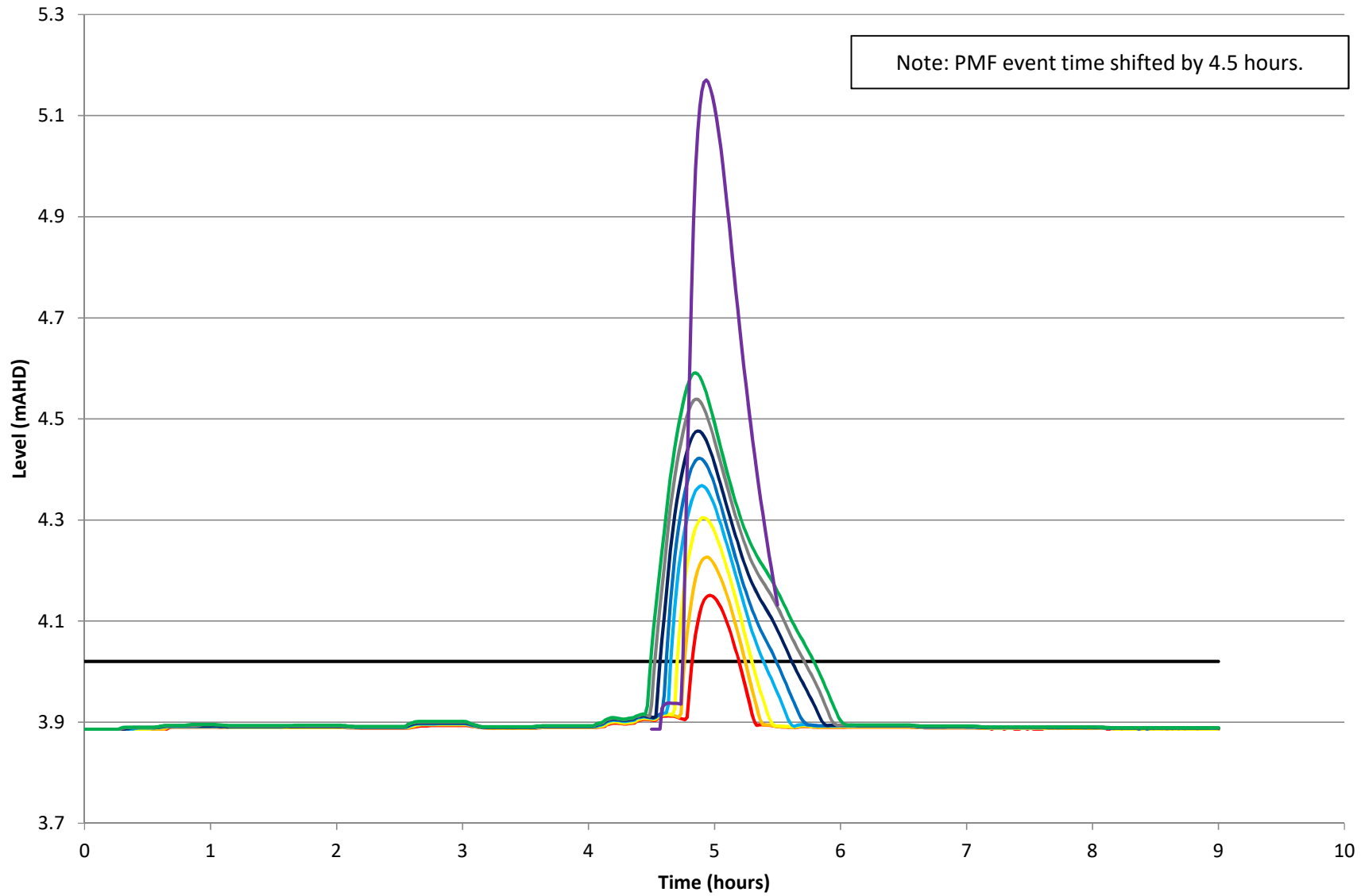


FIGURE C6
FLOOD LEVEL HYDROGRAPH
GARDEN STREET

J:\Jobs\116059\TUFLOW\results\SESAssessment\OvertoppingProfiles.xlsx

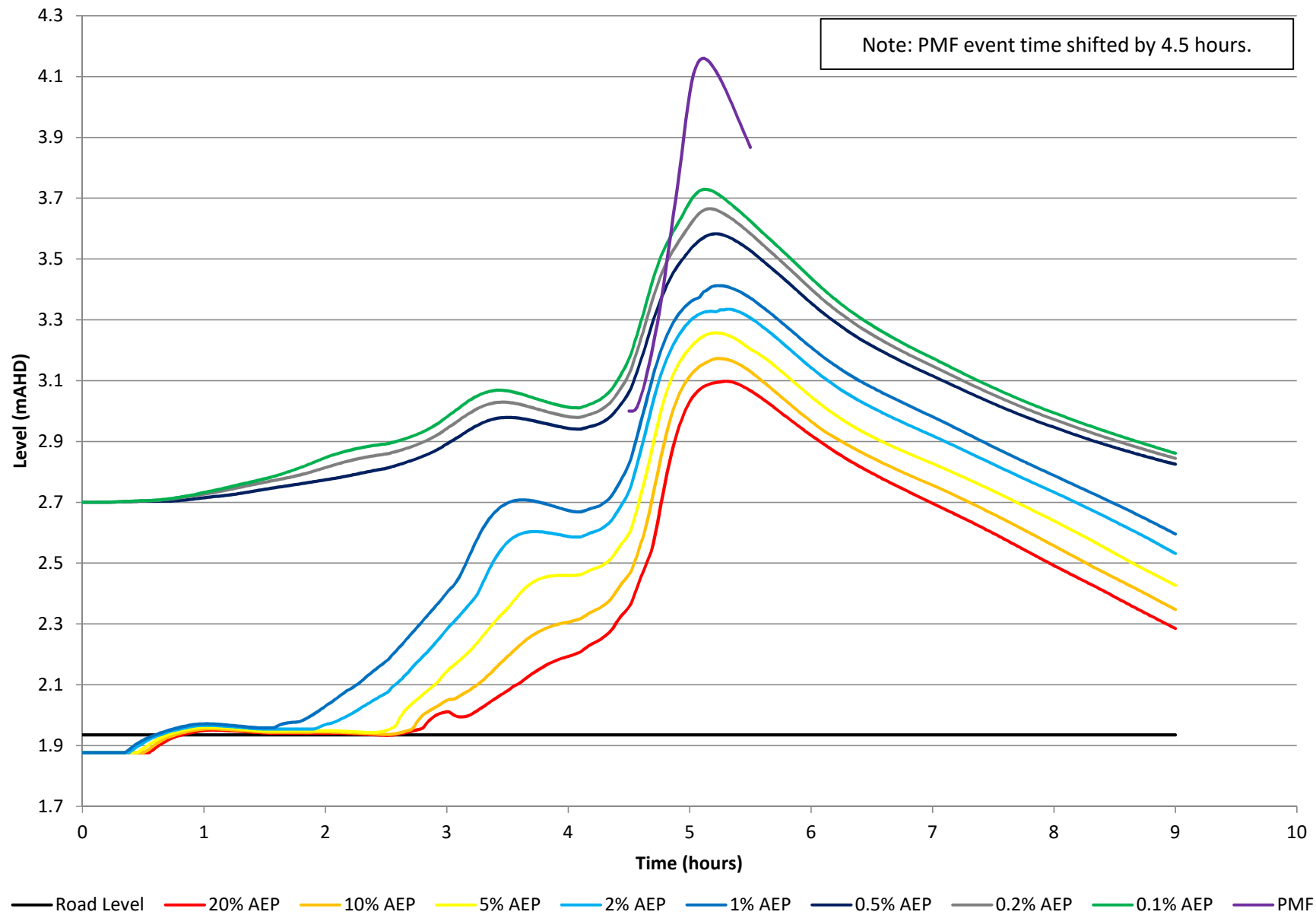


FIGURE C7
FLOOD LEVEL HYDROGRAPH
MACPHERSON STREET NEAR WARRIEWOOD ROAD

J:\Jobs\116059\TUFLOW\results\SESAssessment\OvertoppingProfiles.xlsx

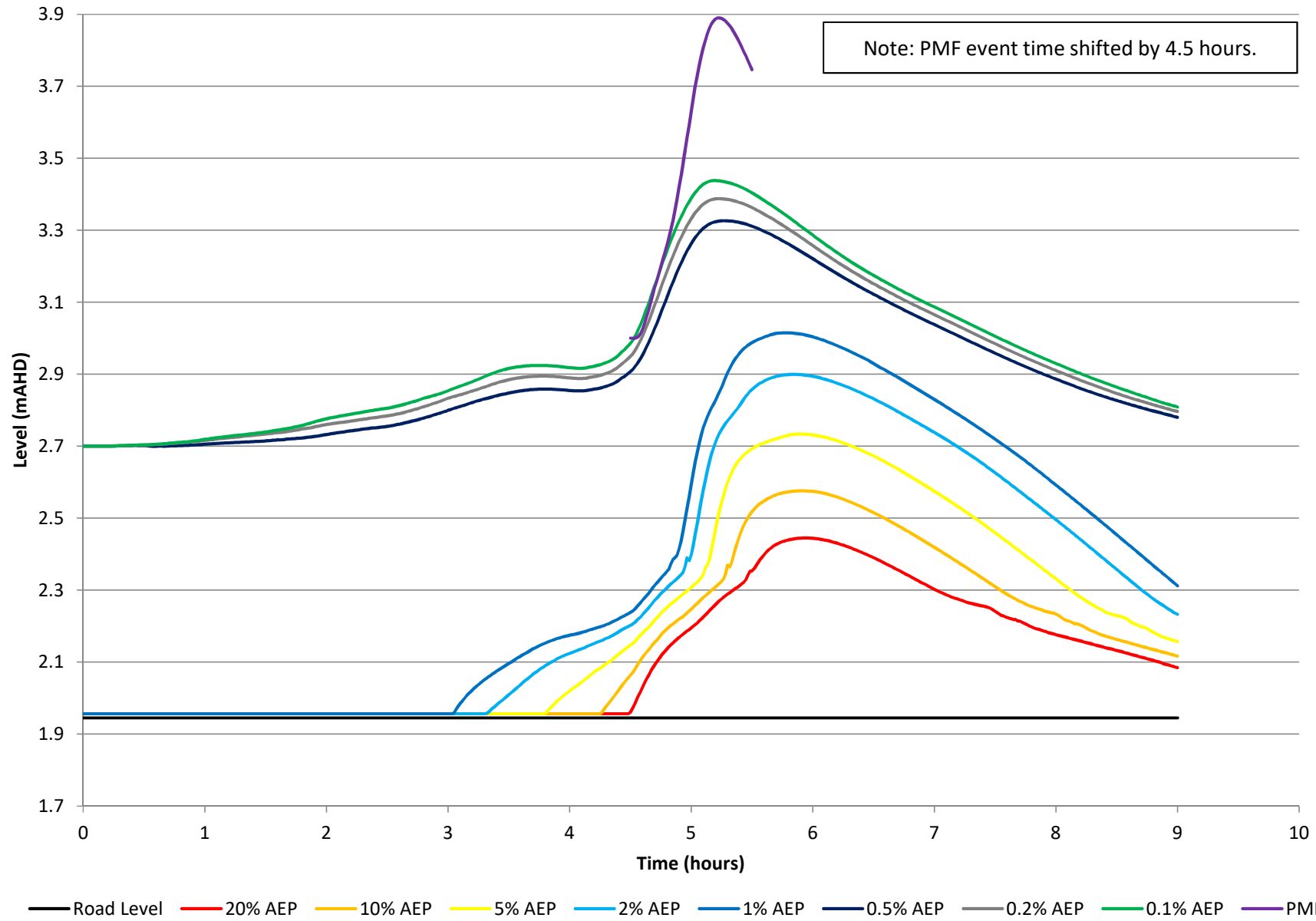


FIGURE C8
FLOOD LEVEL HYDROGRAPH
BOONDAH ROAD

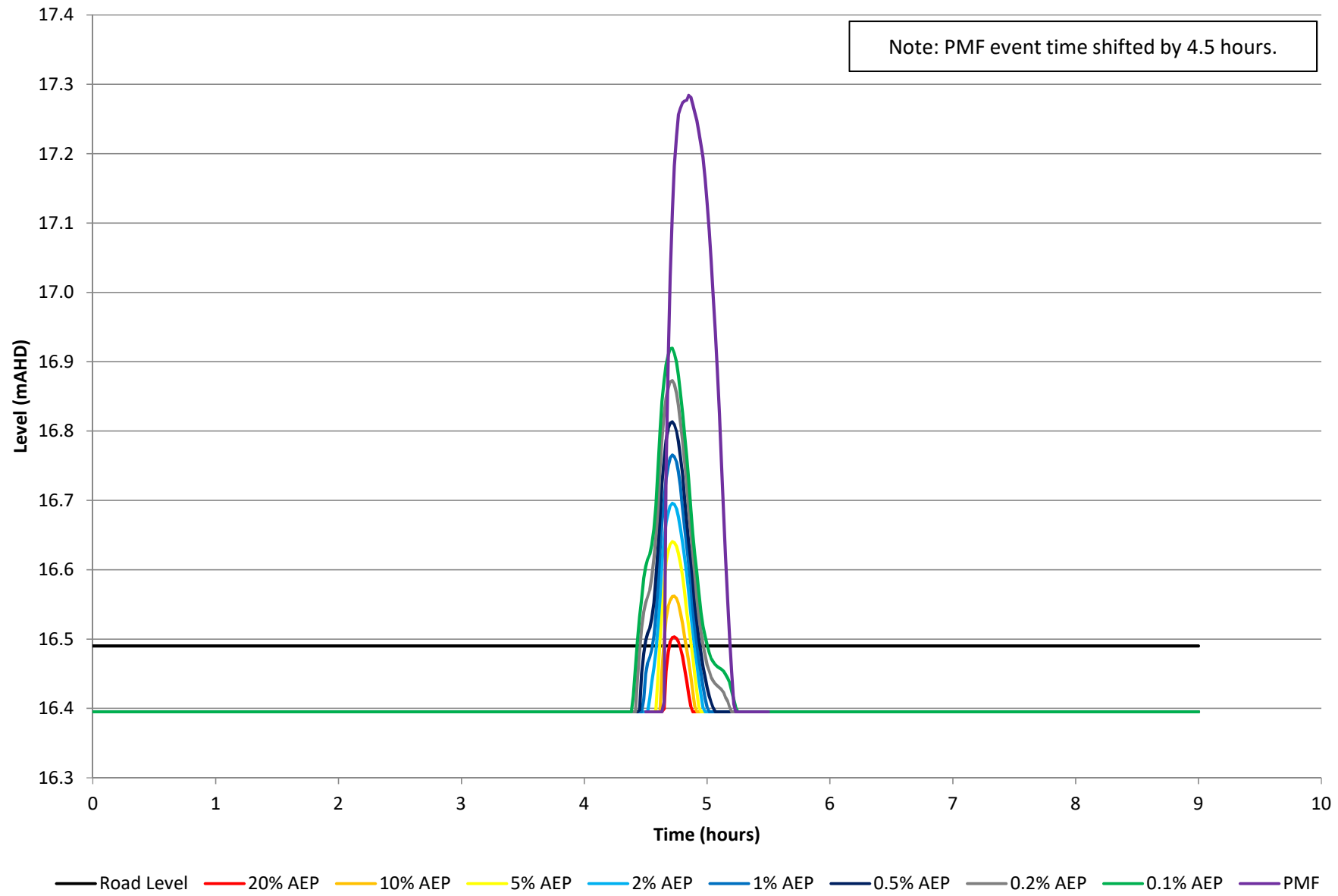


FIGURE C9
FLOOD LEVEL HYDROGRAPH
MACPHERSON STREET INTO PONDEROSA PARADE

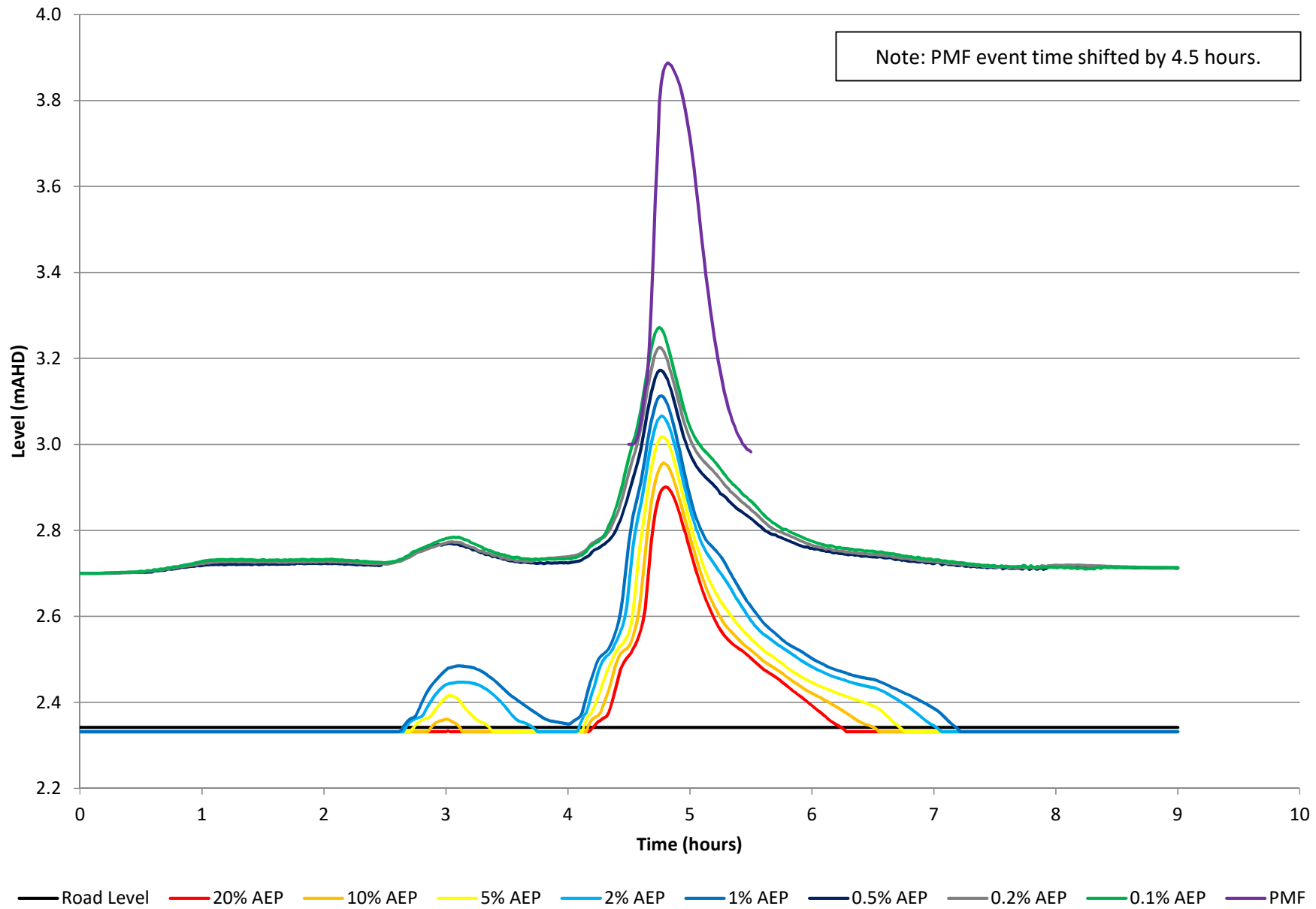


FIGURE C10
FLOOD LEVEL HYDROGRAPH
NAREEN PARADE

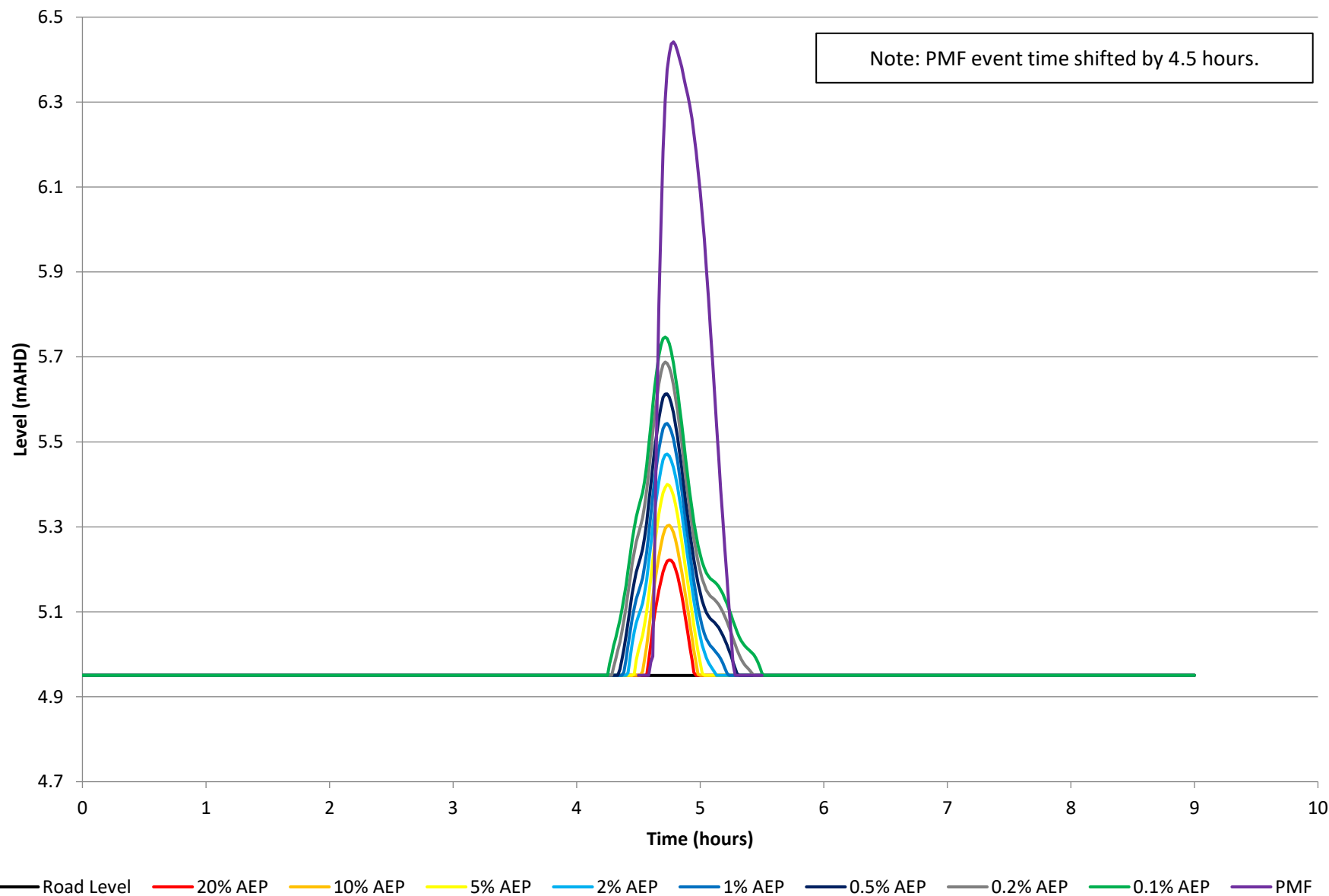
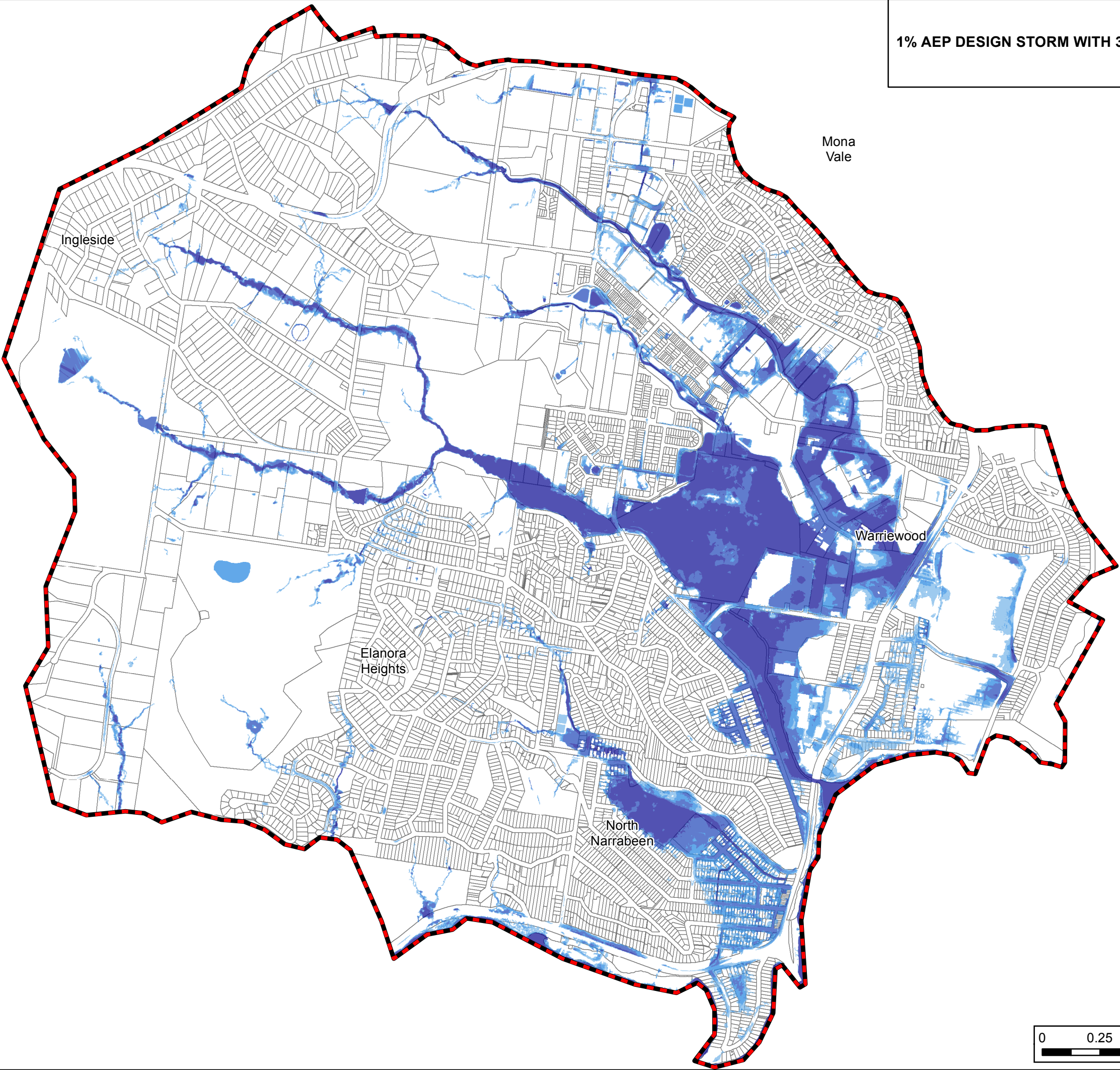


FIGURE C11
FLOOD LEVEL HYDROGRAPH
TATIARA CRESCENT

APPENDIX D.Climate Change Sensitivity Mapping



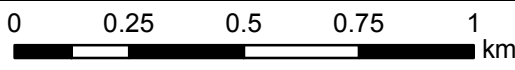
FIGURE D1
SEA LEVEL RISE
1% AEP DESIGN STORM WITH 30% RAINFALL INCREASE
PLUS 0.9 m SLR
PEAK FLOOD DEPTHS



 Study Area

Depth (m)

	0.00 to 0.15
	0.15 to 0.30
	0.30 to 0.50
	0.50 to 1.00
	> 1.00



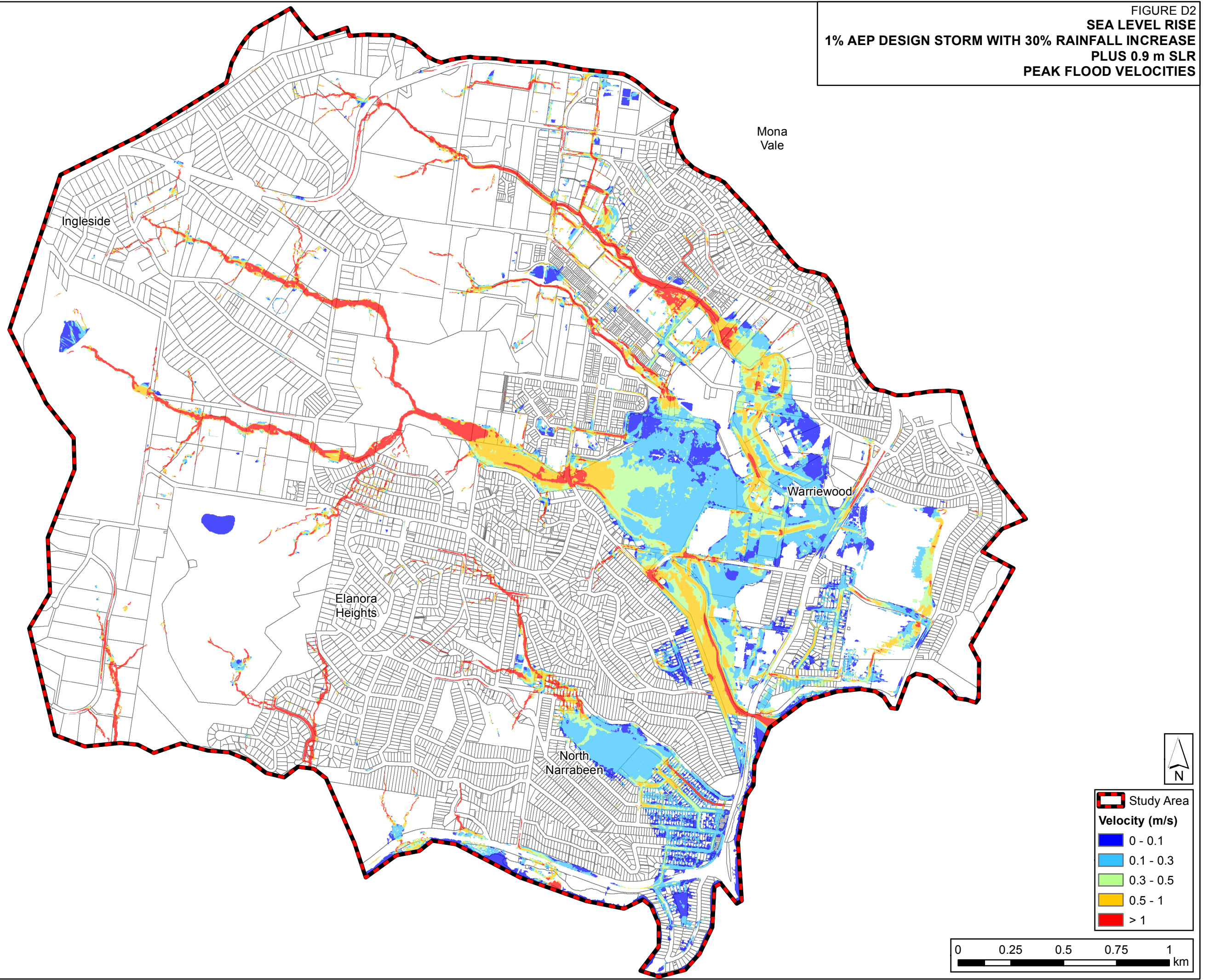


FIGURE D3
SEA LEVEL RISE
PMF STORM WITH 30% RAINFALL INCREASE
PLUS 0.9 m SLR
PEAK FLOOD DEPTHS

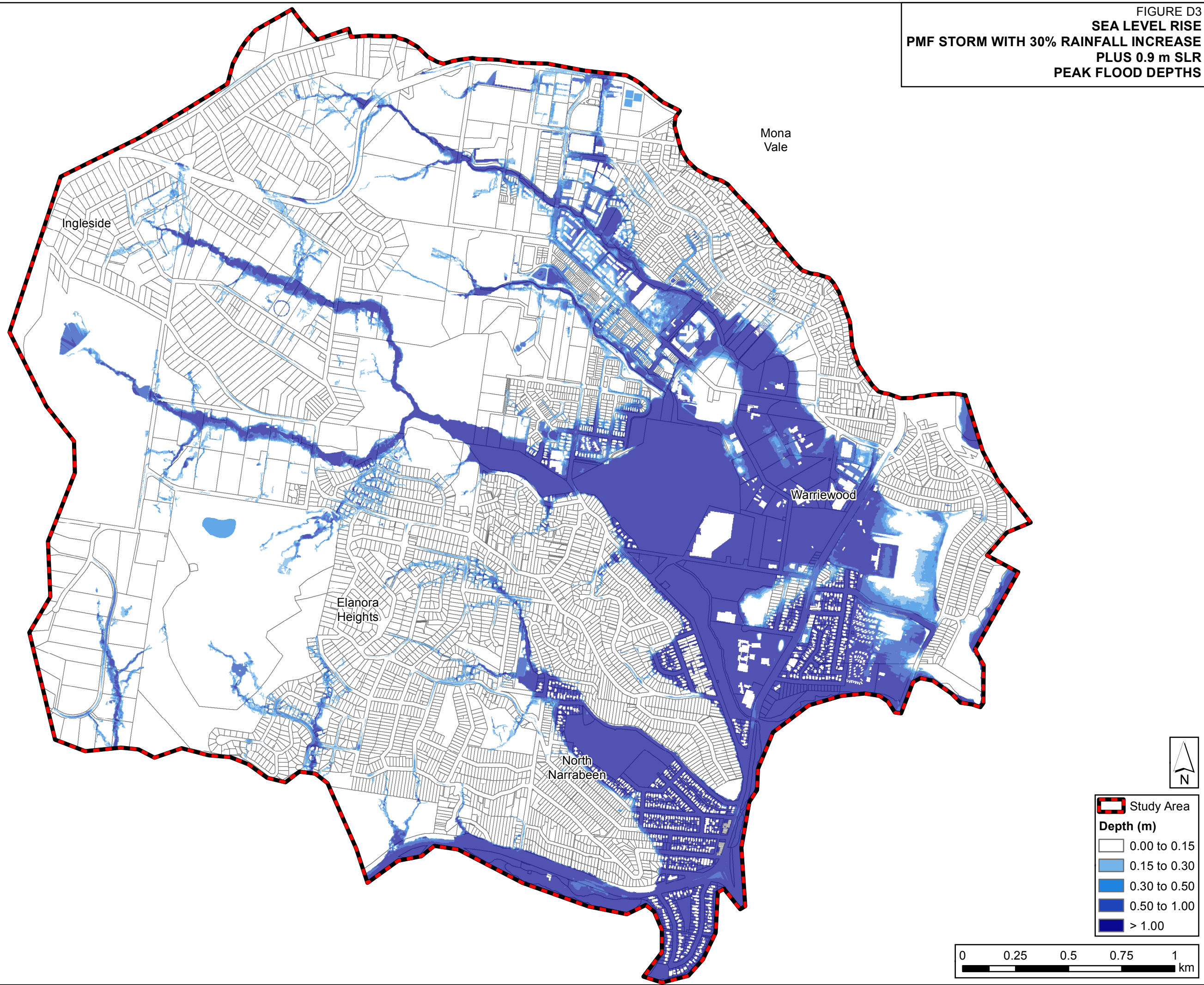


FIGURE D4
SEA LEVEL RISE
PMF STORM WITH 30% RAINFALL INCREASE
PLUS 0.9 m SLR
PEAK FLOOD VELOCITIES

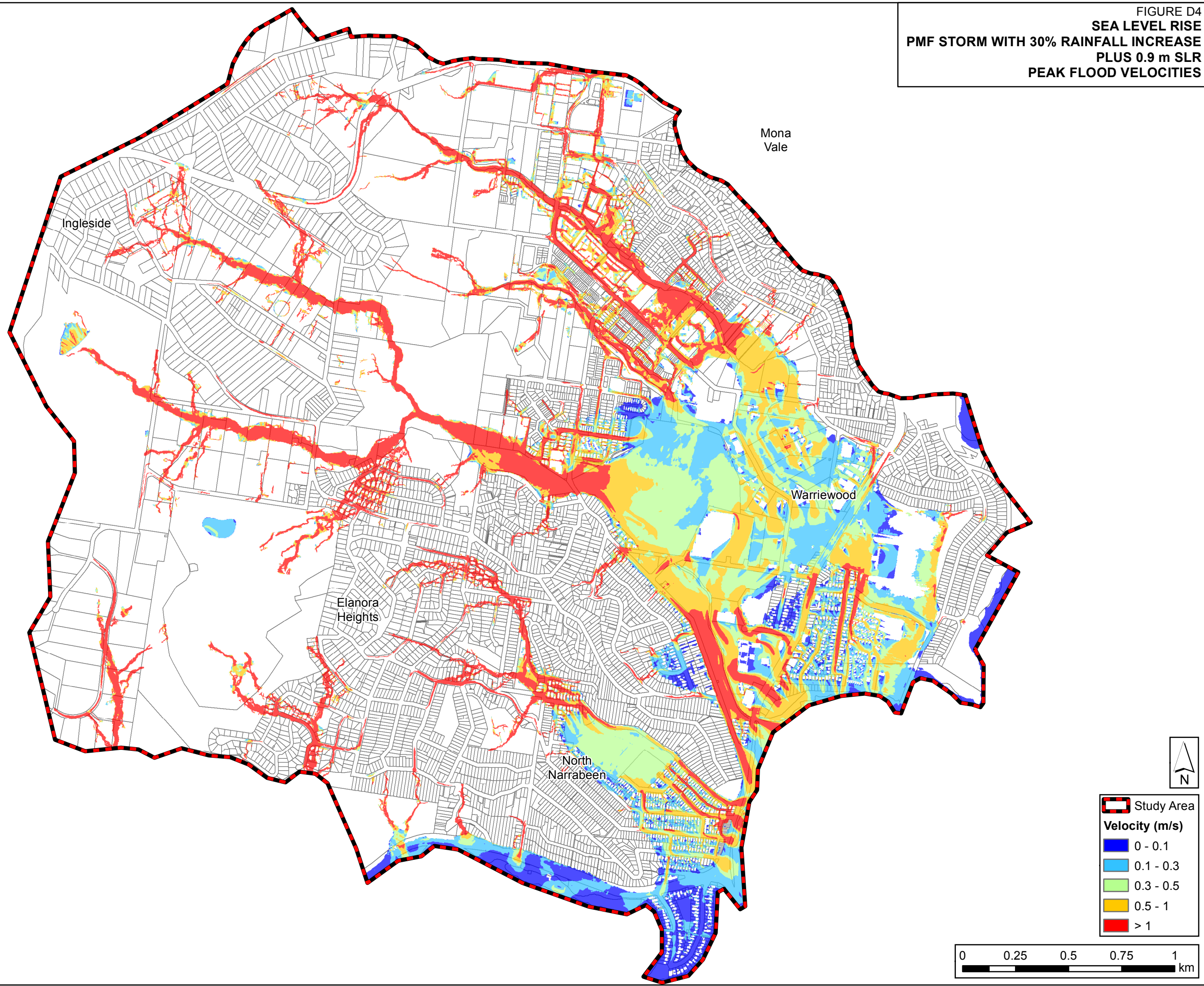


FIGURE D5
SEA LEVEL RISE
PEAK FLOOD LEVEL DIFFERENCE
1% AEP DESIGN STORM PLUS 0.9 m SLR
VS 1% AEP DESIGN STORM

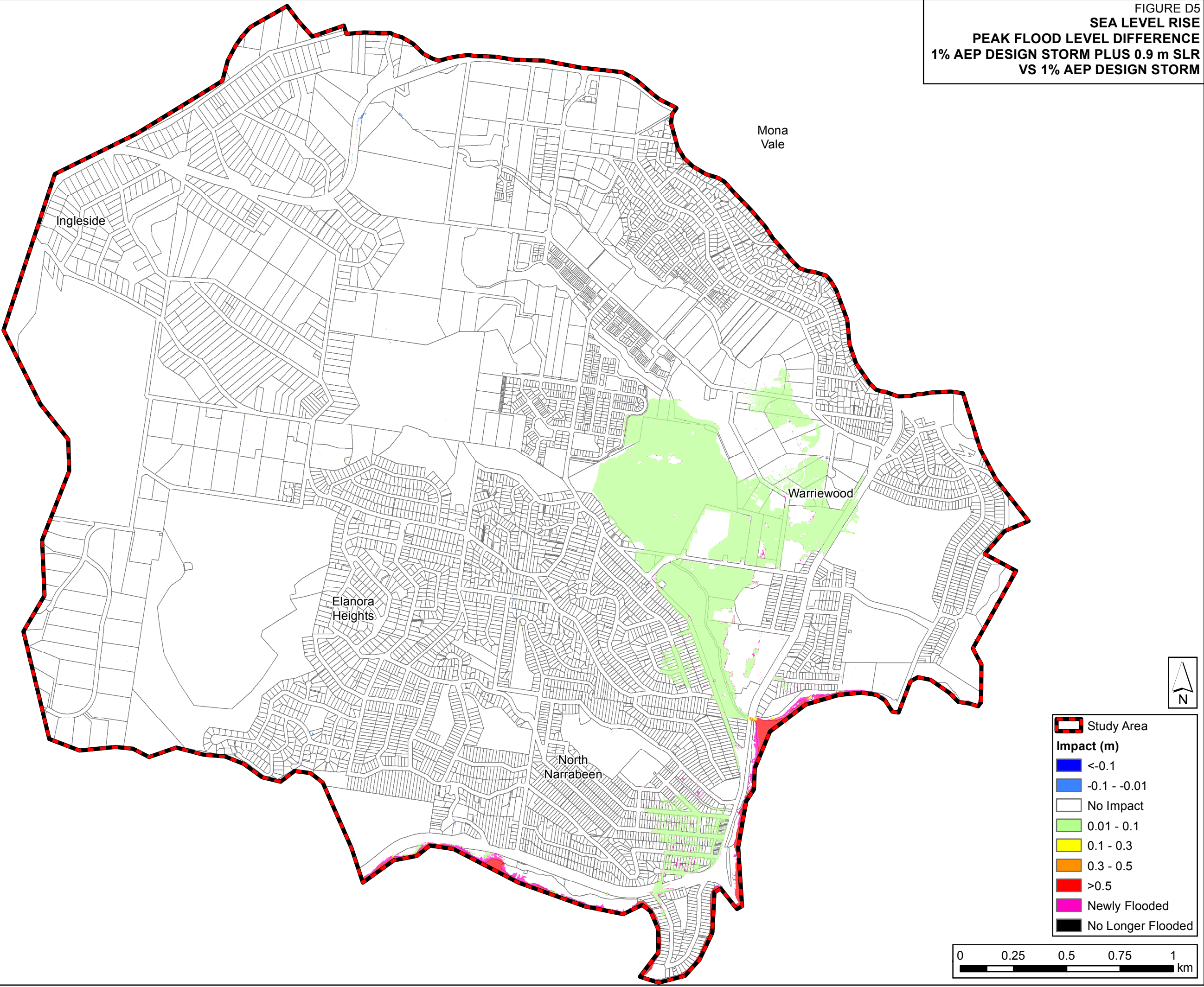
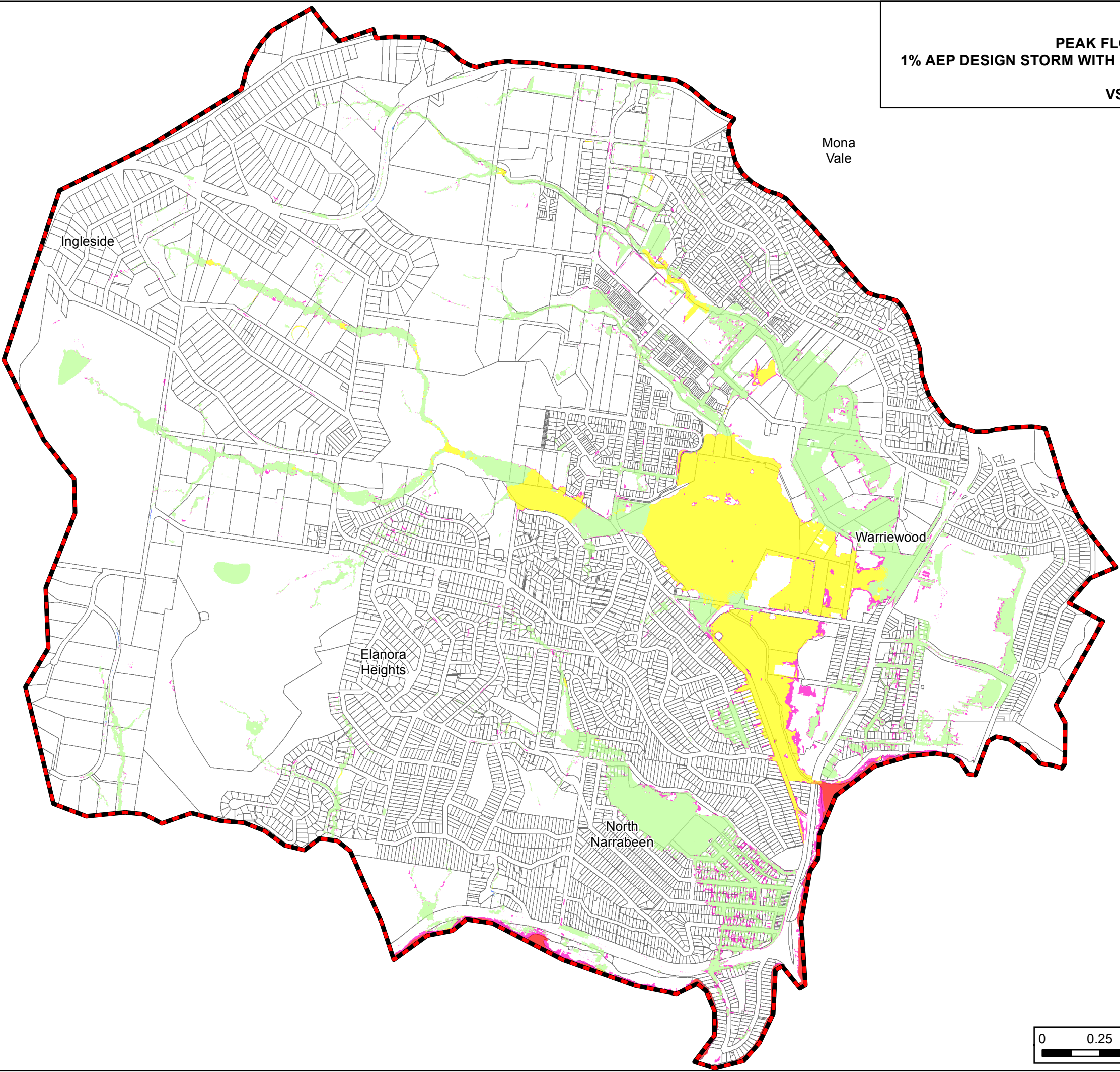


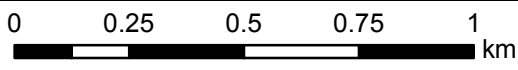
FIGURE D6
SEA LEVEL RISE
PEAK FLOOD LEVEL DIFFERENCE
1% AEP DESIGN STORM WITH 10% RAINFALL INCREASE
PLUS 0.9 m SLR
VS 1% AEP DESIGN STORM



 Study Area

Impact (m)

-  <-0.1
-  -0.1 - -0.01
-  No Impact
-  0.01 - 0.1
-  0.1 - 0.3
-  0.3 - 0.5
-  >0.5
-  Newly Flooded
-  No Longer Flooded



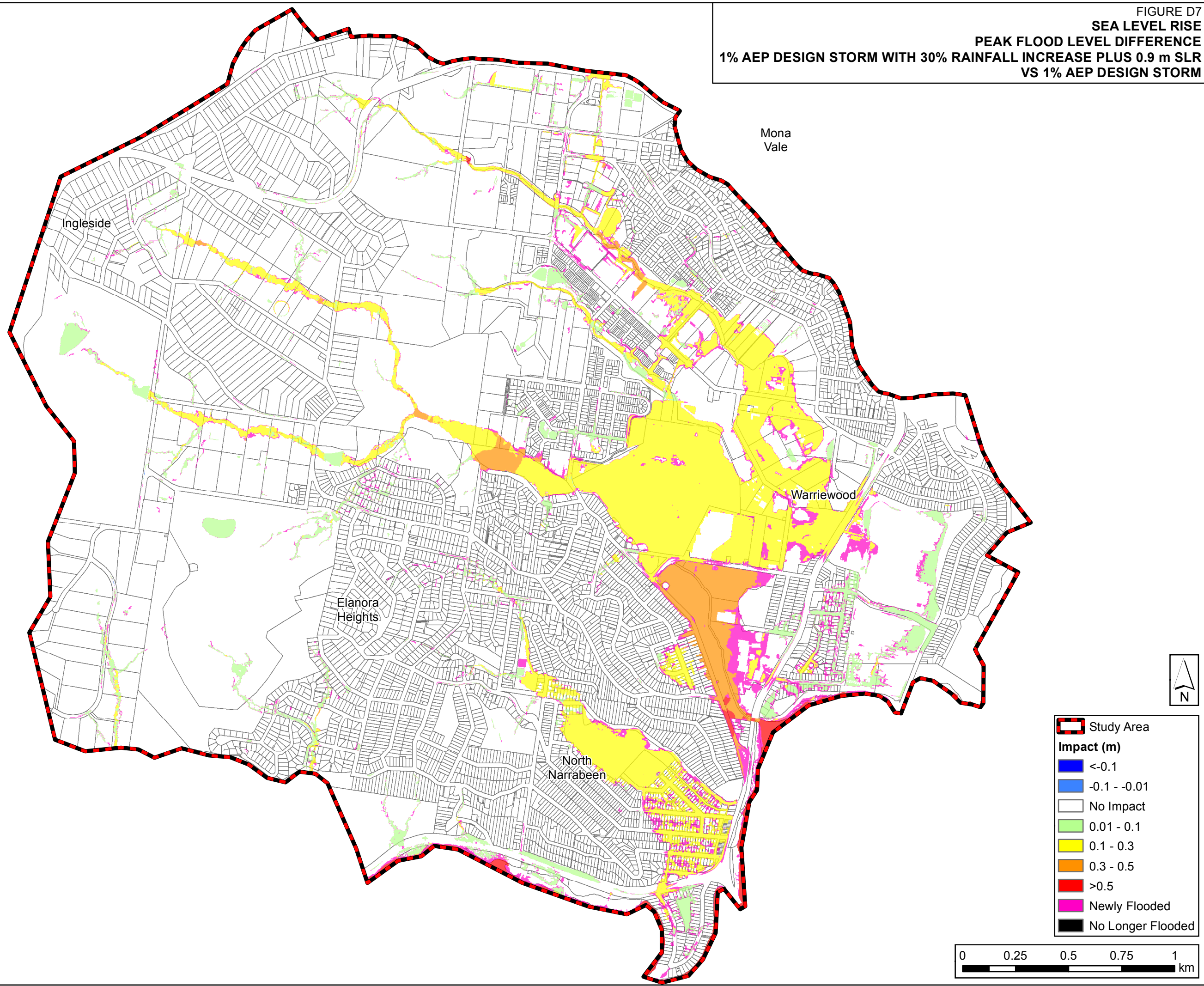


FIGURE D8
SEA LEVEL RISE
PEAK FLOOD LEVEL DIFFERENCE
PMF PLUS 0.9 m SLR VS PMF

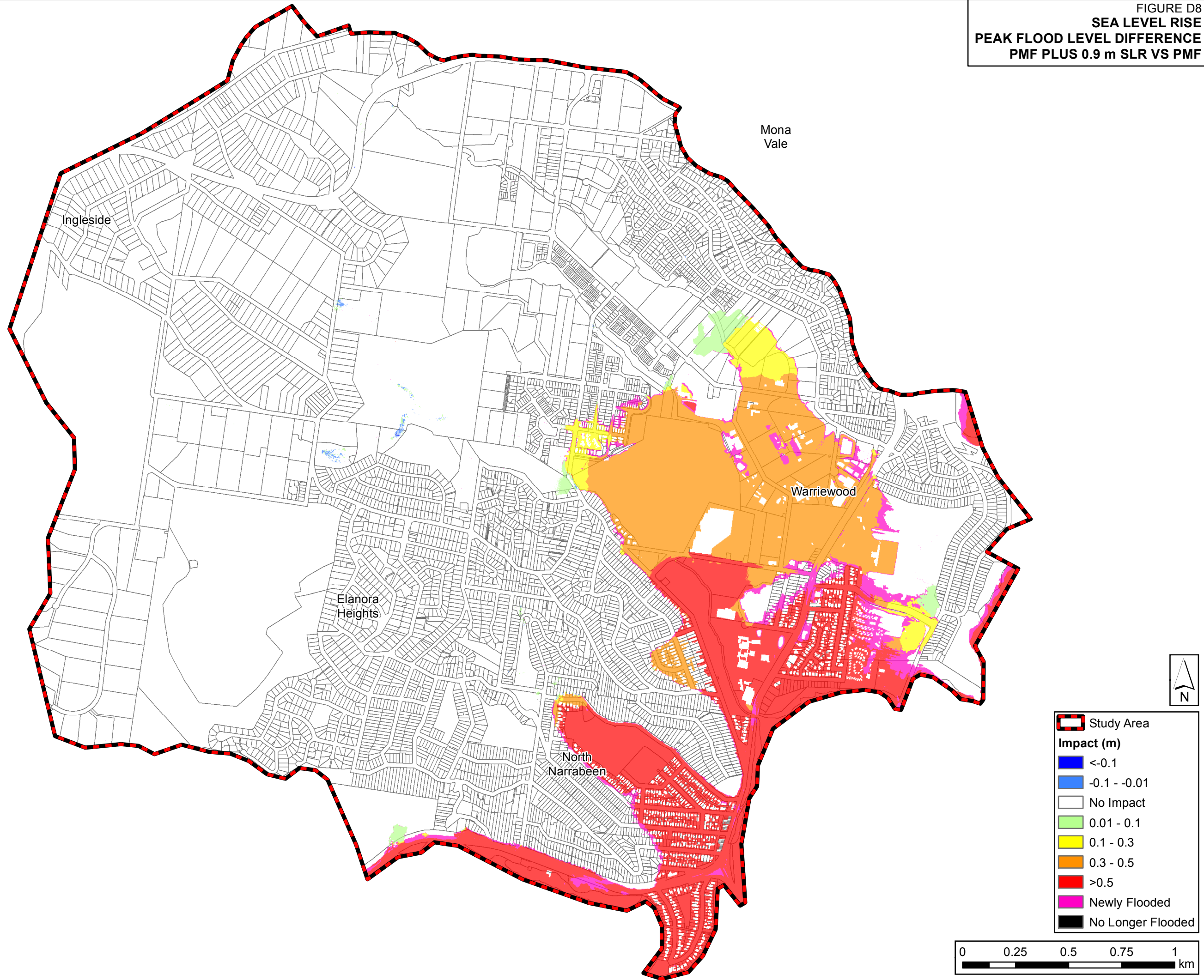


FIGURE D9
SEA LEVEL RISE
PEAK FLOOD LEVEL DIFFERENCE
PMF WITH 10% RAINFALL INCREASE PLUS 0.9 m SLR
VS PMF

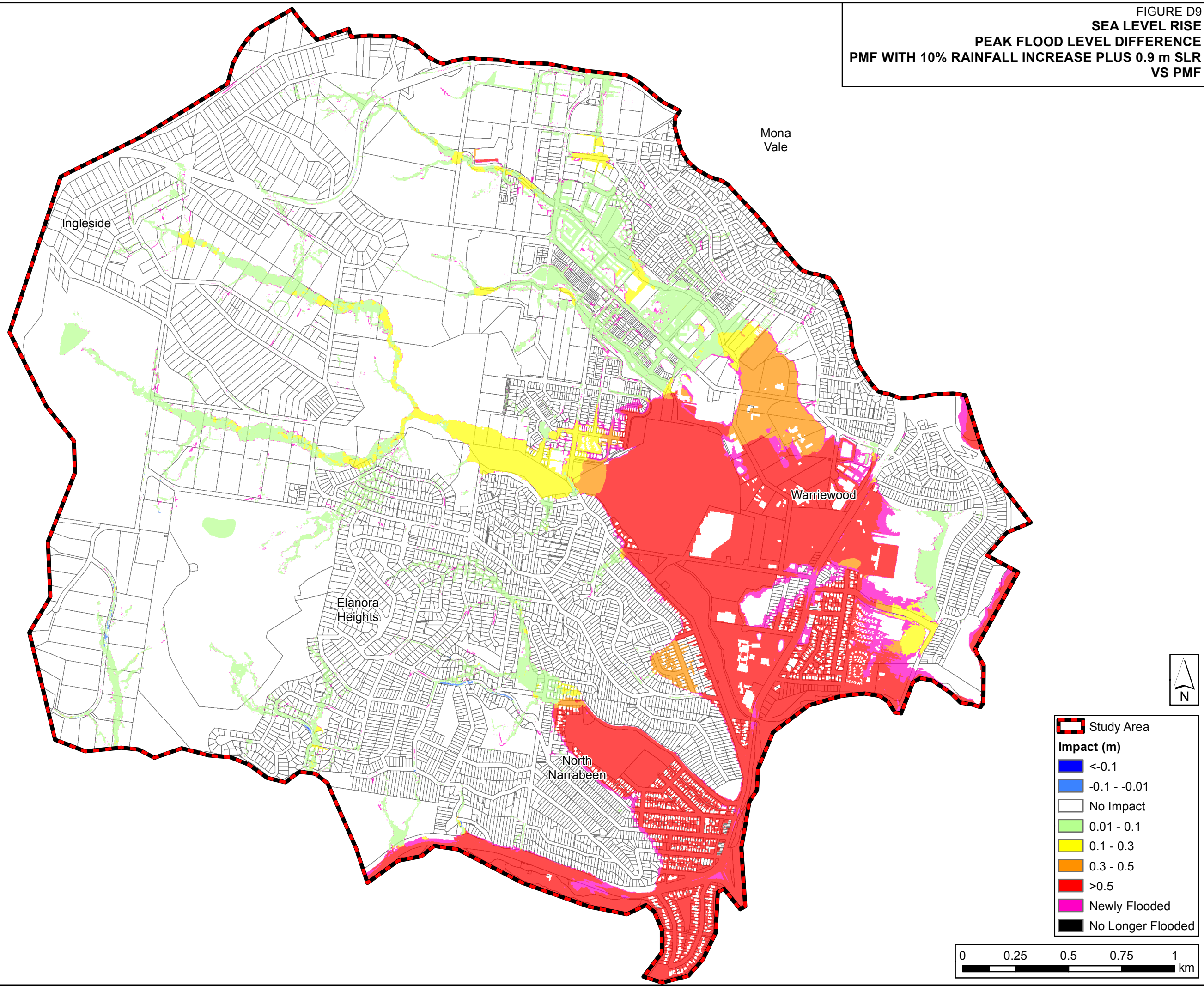
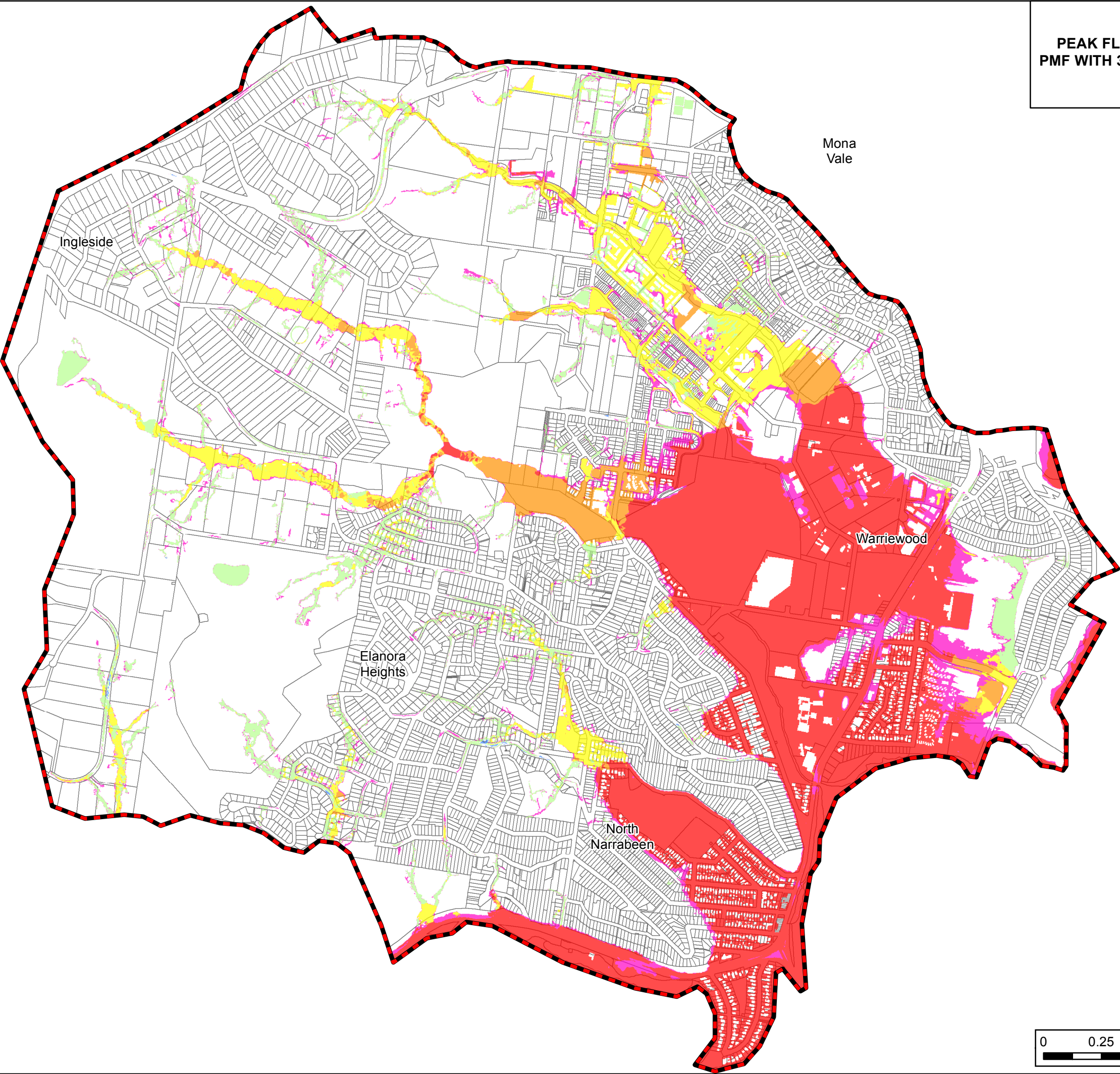


FIGURE D10
SEA LEVEL RISE
PEAK FLOOD LEVEL DIFFERENCE
PMF WITH 30% RAINFALL INCREASE
PLUS 0.9 m SLR
VS PMF



- Study Area
- Impact (m)
- <-0.1
 - 0.1 - -0.01
 - No Impact
 - 0.01 - 0.1
 - 0.1 - 0.3
 - 0.3 - 0.5
 - >0.5
 - Newly Flooded
 - No Longer Flooded