Leichhardt Floodplain Risk Management Study and Plan

APPENDIX D

MITIGATION OPTION ASSESSMENTS SUB-CATCHMENT REPORTS - DRAFT

Cardno
Shaping the Future

Area 4 - Iron Cove Options Assessment

Leichhardt Flood Risk Management Study and Plan - DRAFT

NA49913094

Prepared for
Inner West Council

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1 Iron Cove Catchment Description

The majority of the Iron Cove catchment is located within the suburb of Rozelle. Overland flowpaths to the north of Balmain Road and Perry Street are primarily contained within Leichhardt Park, Rozelle Hospital and King George Park.

The overland flow in these areas impacts on existing infrastructure, such as the buildings within the Rozelle Hospital grounds. Significant ponding occurs around the electrical substation to the south east of King George Park, and this may have implications on the operation of this substation during a significant flood event. A small section of the King George Park tributary also affects properties south of Victoria Road.

The location of the Iron Cove Catchment within the study area is shown in **Figure 1-1**

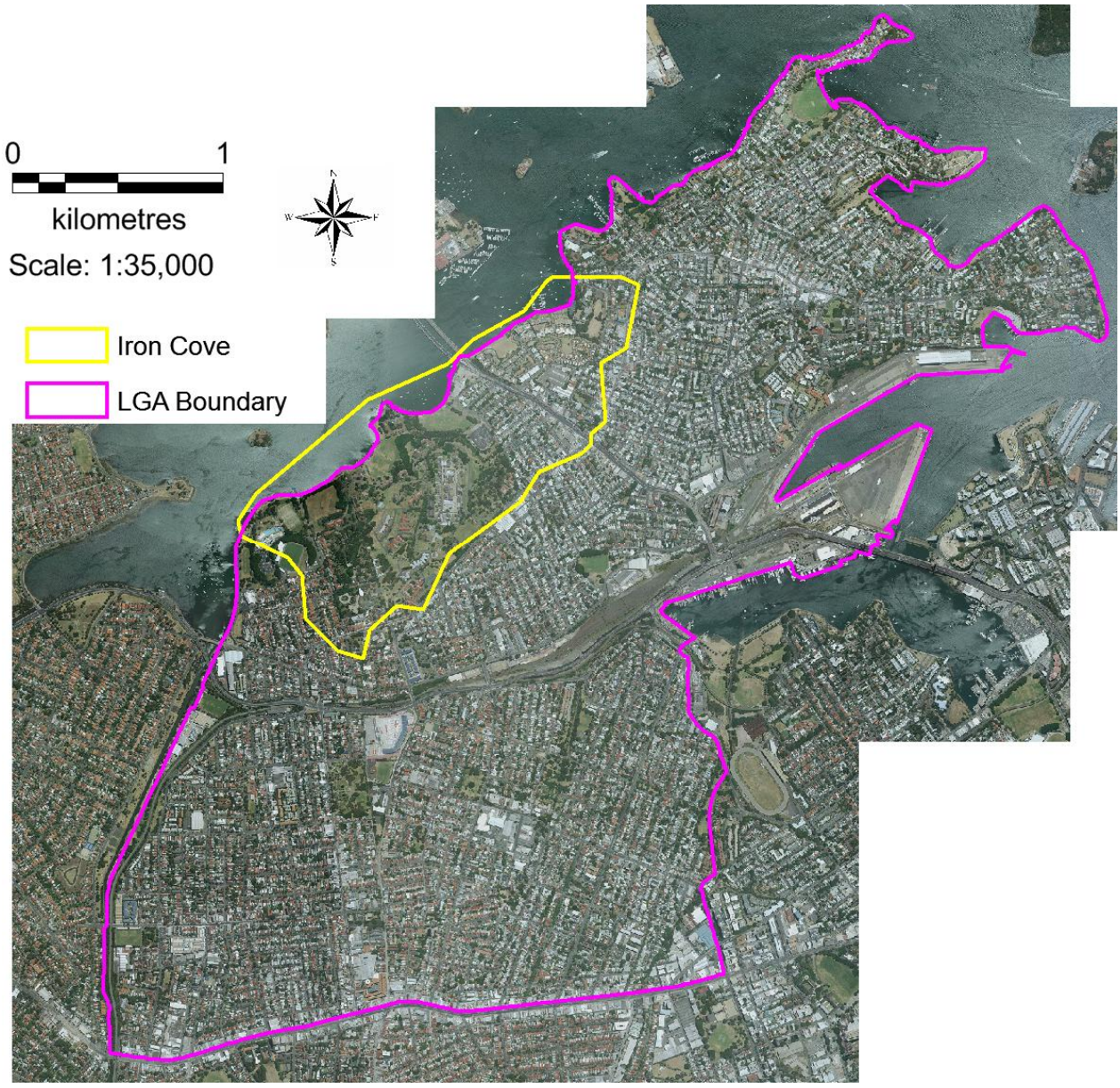

Figure 1-1 Iron Cove Catchment Location

2 Flood Mitigation Options Identification

2.1 Flood Modification Measures for Iron Cove

The existing flood behaviour within the Iron Cove catchment is detailed in the Leichhardt Flood Study (Cardno 2014). Based on the flood model results, historical information and engineering judgement, possible flood modification measures (i.e. structural measures) for the study area were identified.

The various management options were identified taking into consideration the:

- flood behaviour and flow in the 20 year ARI event;
- grade of pipe (upstream and downstream); and
- preliminary availability and location of easements.

Flood modification measures for the Iron Cove Catchment have been identified based on opportunities to connect with future upgrades and improvements.

2.2 Iron Cove Flood Mitigation Options

Within the Iron Cove catchment four sets of options were modelled. These are shown in **Table 2-1** and **Figure 2-1**. The 100yr, 20yr and 5yr ARI peak water level difference plots for each mitigation option are attached at the end of this appendix report.

Table 2-1 Iron Cove Mitigation Options

Option Description	Option Name	ID
Victoria Road Branch – Additional pipes from the Victoria Rd/Terry St intersection that drains into Iron Cove	Victoria Road Branch IC-FM1	IC-FM1
Manning Street Branch – Additional pipes that crosses Mannings St at three locations onto other street. Toelle St, Callan St and Springside St.	Manning Street Branch IC-FM2	IC-FM2
Glover Street Branch – Additional pipe along Glover St between Perry St and Church St.	Glover Street Branch IC-FM3	IC-FM3
Longview Street Branch – Additional pipes to drain flooding from the low point on Longview Street.	Longview Street Branch IC-FM4	IC-FM4

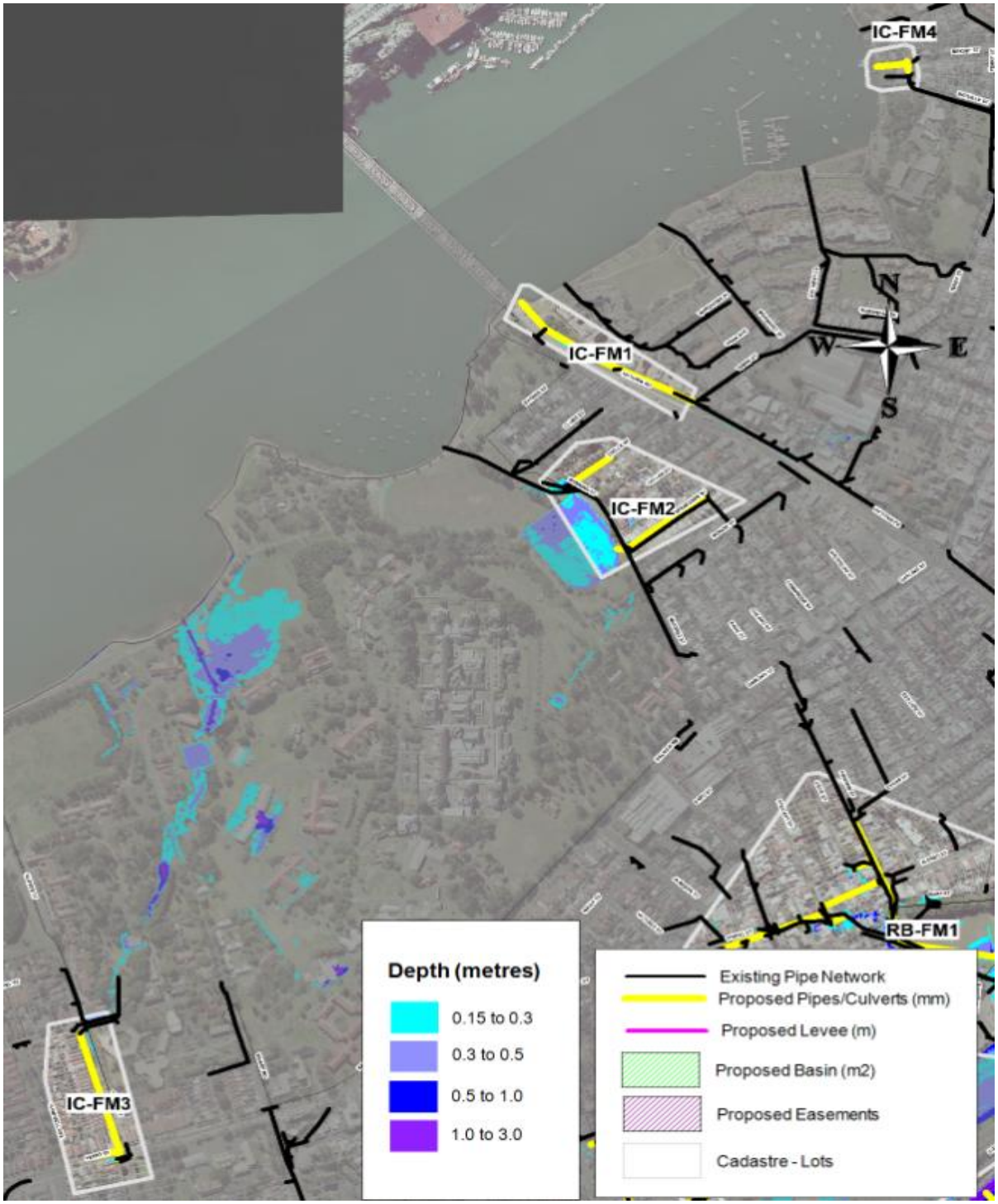

Figure 2-1 Iron Cove Mitigation Options Locations

2.2.1 Victoria Road Branch IC-FM1

IC-FM1 proposed an additional pipe along Victoria Road. The pipe starts from the Victoria Rd / Terry St intersection then drains into Iron Cove. The 750mm diameter pipe is 290m in length and is proposed to minimise the flooding on Victoria Road in a 20 year ARI storm event. Victoria Road is subjected to depths of around 0.25m due the 20 year ARI event.

A potential constraint for this measure includes the pipe construction along Victoria Road due to construction, services and traffic management requirements and costs.

RMS could potentially be responsible for funding all the works involved in this mitigation option.

2.2.2 Manning Street Branch IC-FM2

The Manning Street option proposes two sections of pipes. The pipes are proposed to be located along Toelle Street (450mm diameter) and Springside Street (600mm diameter). IC-FM2 aims to mitigate the flooding under existing conditions at Callan Street, Springside Street and potentially King George Park. An additional pipe (375mm diameter) from Balmain road to the electrical substation has also been proposed. The area impacted by the option is inundated with flood depths under existing conditions of around 1.6m in a 20 year ARI storm event.

2.2.3 Glover Street Branch IC-FM3

Two types of pipes (600mm diameter and 1050mm diameter) are proposed as part of the Glover Street Option. The pipes are proposed to run along Glover Street between Perry Street and Church Street.

Glover Street experiences flood depths in existing conditions of around 0.25m due to the 20 year ARI storm event.

Funding from RMS may be available for the transverse drainage works on Perry Street.

2.2.4 Longview Street Branch IC-FM4

This option proposes additional pipes (600mm diameter and 7500mm diameter) at Longview Street to mitigate flooding at the low point on Longview Street. The existing 600mm pipeline and the inlet system of pits have been identified to be undersized based on the modelled flows arriving at this location.

3 Mitigation Option Modelling Outcomes

The Iron Cove flood mitigation options were assed for the 5, 10, 20, 50 and 100 Year ARI design flood events, along with the PMF event.

The outcomes of the modelling are shown in the 5, 20, and 100 Year ARI water level difference plots attached at the end of this catchment report.

A summary of the impacts on flood behaviour for each option is provided below.

3.1 Victoria Road Branch IC-FM1

The mitigation option IC-FM1 has no discernible reduction in flood depths on Victoria Road in all the modelled design events. As such, no flood level impact mapping has been provided for this option.

3.2 Manning Street Branch IC-FM2

Duplicating the existing pipe downstream of Darling Street results in reductions of flood levels of up to 0.07m along Springside Street, Manning Street, at the electrical substation and King George Park.

The results indicate that properties along Springside Street would experience only minor decreases in water levels in the more frequent flood events.

3.3 Glover Street Branch IC-FM3

Mitigation option IC-FM3 shows a decreases in water levels along parts of Perry Street, Glover Street and Church Street in an order of 0.01m to 0.08m in all the modelled design events. Results indicate properties along Glover Street would experience decrease in water levels in frequent storms. However, these properties do not experience overfloor flooding under existing conditions, and flooding will not be removed from their properties completely. As such, there is no reduction in the flood damages for these events.

3.4 Longview Street Branch IC-FM4

Mitigation option IC-FM4 shows significant decrease in water levels on Longview Street. The water level decreases are up to 0.25m in a 100 Year ARI event at the low point on the street. Results indicate the benefits of this option are largely confined to the road with only limited benefits to private property.

There is a reduction of flood levels on one property of 0.16m. However, as this property does not experience overfloor flooding, the flood damages remain unchanged.

4 Economic Assessment of Flood Damages in the Iron Cove Catchment

4.1 Iron Cove Mitigation Options Damages Assessment

An assessment of damages for the existing condition in the Iron Cove Catchment is presented in the Floodplain Risk Management Study. The approach adopted for calculating the existing damages has been repeated for the modelling results from the mitigation options proposed for the Iron Cove catchment.

The economic flood damage results for each of the options and the existing scenarios are presented in **Table 4-1** to **Table 4-4**. The reductions in properties affected by overground and overfloor flooding, total damages and AAD are provided. Negative values represent increases from the existing scenario.

The total reduction in damaged properties and the associated reduction in damage costs for each mitigation strategy is summarised in **Table 4-5**. This table represents a summary of differences between existing and Mitigation scenarios presented in **Table 4-1** to **Table 4-4**.

The flood damages assessment is a useful tool for comparing the merits of various options, it is not a precise flood risk analysis tool and the limitation associated with the assessment should be considered when interpreting the results.

The following information should be considered when interpreting the damages data:

- Negative property or dollar values represent increases from the existing scenario.
- Where an option results in a reduction in flood depths there may not be any reduction in the flood damages where:
    - The reduction in flood depths or extent occur in open space or roadways; or
    - The reduction in flood depths occurs on properties that were not impacted by over floor flooding (i.e. the flooding on the property grounds is shallower but still exists).
- The flood damages are calculated at a discrete location on each property. This location is where the floor level and ground level survey was obtained from. As such, if the flooding occurs at another location on the property other than the survey point, this property will not register any damages with regards to this damages assessment.

Table 4-1 IC_FM1 Flood Damage Assessment Summary

Event / Property type	Properties with Overfloor Flooding		Properties with Overground Flooding		Estimated Total Damage ($ June 2016)	
	Existing Case	*Mitigation Case*	*Existing Case*	*Mitigation Case*	*Existing Case*	*Mitigation Case*
PMF Event						
Residential	3	3	5	5	$ 717,024	$ 712,085
Commercial	0	0	0	0	$ -	$ -
Industrial	1	1	1	1	$ 3,829	$ 3,829
PMF Total	**4**	**4**	**6**	**6**	**$ 720,852**	**$ 715,913**
100yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ 3,829	$ 3,829
100yr ARI Total	**0**	**0**	**0**	**0**	**$ 3,829**	**$ 3,829**
50yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ 3,829	$ 3,829
50yr ARI Total	**0**	**0**	**0**	**0**	**$ 3,829**	**$ 3,829**
20yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ 3,829	$ 3,829
20yr ARI Total	**0**	**0**	**0**	**0**	**$ 3,829**	**$ 3,829**
10yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ 3,829	$ 3,829
10yr ARI Total	**0**	**0**	**0**	**0**	**$ 3,829**	**$ 3,829**
5yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ 3,829	$ 3,829
5yr ARI Total	**0**	**0**	**0**	**0**	**$ 3,829**	**$ 3,829**
Total Annual Average Damage					**$ 4,925**	**$ 4,900**

Table 4-2 IC_FM2 Flood Damage Assessment Summary

Event / Property type	Properties with Overfloor Flooding		Properties with Overground Flooding		Estimated Total Damage ($ June 2016)	
	Existing Case	*Mitigation Case*	*Existing Case*	*Mitigation Case*	*Existing Case*	*Mitigation Case*
PMF Event						
Residential	39	39	48	48	$ 2,588,325	$ 2,573,259
Commercial	0	0	0	0	$ -	$ -
Industrial	2	2	2	2	$ 824,277	$ 822,573
PMF Total	**41**	**41**	**50**	**50**	**$ 3,412,602**	**$ 3,395,832**
100yr ARI						
Residential	7	7	7	7	$ 526,334	$ 524,750
Commercial	0	0	0	0	$ -	$ -
Industrial	1	1	1	1	$ 6,455	$ 4,237
100yr ARI Total	**8**	**8**	**8**	**8**	**$ 532,789**	**$ 528,988**
50yr ARI						
Residential	7	7	7	7	$ 507,283	$ 504,747
Commercial	0	0	0	0	$ -	$ -
Industrial	1	1	1	1	$ 5,693	$ 3,065
50yr ARI Total	**8**	**8**	**8**	**8**	**$ 512,975**	**$ 507,813**
20yr ARI						
Residential	7	7	7	7	$ 482,203	$ 479,334
Commercial	0	0	0	0	$ -	$ -
Industrial	1	1	1	1	$ 4,946	$ 2,602
20yr ARI Total	**8**	**8**	**8**	**8**	**$ 487,148**	**$ 481,935**
10yr ARI						
Residential	6	6	7	7	$ 429,189	$ 426,419
Commercial	0	0	0	0	$ -	$ -
Industrial	1	1	1	1	$ 4,190	$ 2,321
10yr ARI Total	**7**	**7**	**8**	**8**	**$ 433,380**	**$ 428,739**
5yr ARI						
Residential	4	4	5	5	$ 222,480	$ 219,957
Commercial	0	0	0	0	$ -	$ -
Industrial	1	1	1	1	$ 3,609	$ 3,609
5yr ARI Total	**5**	**5**	**6**	**6**	**$ 226,090**	**$ 223,566**
Total Annual Average Damage					**$ 129,856**	**$ 128,569**

Table 4-3 IC_FM3 Flood Damage Assessment Summary

Event / Property type	Properties with Overfloor Flooding		Properties with Overground Flooding		Estimated Total Damage ($ June 2016)	
	Existing Case	*Mitigation Case*	*Existing Case*	*Mitigation Case*	*Existing Case*	*Mitigation Case*
PMF Event						
Residential	32	32	43	43	$ 2,063,827	$ 2,048,696
Commercial	3	3	3	3	$ 1,243,585	$ 1,243,585
Industrial	0	0	0	0	$ -	$ -
PMF Total	**35**	**35**	**46**	**46**	**$ 3,307,412**	**$ 3,292,282**
100yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ -	$ -
100yr ARI Total	**0**	**0**	**0**	**0**	**$ -**	**$ -**
50yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ -	$ -
50yr ARI Total	**0**	**0**	**0**	**0**	**$ -**	**$ -**
20yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ -	$ -
20yr ARI Total	**0**	**0**	**0**	**0**	**$ -**	**$ -**
10yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ -	$ -
10yr ARI Total	**0**	**0**	**0**	**0**	**$ -**	**$ -**
5yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ -	$ -
5yr ARI Total	**0**	**0**	**0**	**0**	**$ -**	**$ -**
Total Annual Average Damage					**$ 16,535**	**$ 16,460**

Table 4-4 IC_FM4 Flood Damage Assessment Summary

Event / Property type	Properties with Overfloor Flooding		Properties with Overground Flooding		Estimated Total Damage ($ June 2016)	
	Existing Case	*Mitigation Case*	*Existing Case*	*Mitigation Case*	*Existing Case*	*Mitigation Case*
PMF Event						
Residential	3	3	5	5	$ 717,024	$ 714,154
Commercial	0	0	0	0	$ -	$ -
Industrial	1	1	1	1	$ 3,829	$ 3,843
PMF Total	**4**	**4**	**6**	**6**	**$ 720,852**	**$ 717,998**
100yr ARI						
Residential	0	0	0	0	$ -	$ 15
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ 3,829	$ 3,858
100yr ARI Total	**0**	**0**	**0**	**0**	**$ 3,829**	**$ 3,873**
50yr ARI						
Residential	0	0	0	0	$ -	$ 29
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ 3,829	$ 3,876
50yr ARI Total	**0**	**0**	**0**	**0**	**$ 3,829**	**$ 3,906**
20yr ARI						
Residential	0	0	0	0	$ -	$ 47
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ 3,829	$ 3,827
20yr ARI Total	**0**	**0**	**0**	**0**	**$ 3,829**	**$ 3,875**
10yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ 3,829	$ 3,829
10yr ARI Total	**0**	**0**	**0**	**0**	**$ 3,829**	**$ 3,829**
5yr ARI						
Residential	0	0	0	0	$ -	$ -
Commercial	0	0	0	0	$ -	$ -
Industrial	0	0	0	0	$ 3,829	$ 3,829
5yr ARI Total	**0**	**0**	**0**	**0**	**$ 3,829**	**$ 3,829**
Total Annual Average Damage					**$ 4,925**	**$ 4,914**

Table 4-5 Reduction in Damages Associated with Each Option

	Overfloor flooding properties reduction	Overground flooding properties reduction	Total Damage Reduction ($)	AAD Reduction ($)
IC-FM1				
PMF event	0	0	$ 4,939	$25
100yr ARI event	0	0	$ -	$0
50yr ARI event	0	0	$ -	$0
20yr ARI event	0	0	$ -	$0
10yr ARI event	0	0	$ -	$0
5yr ARI event	0	0	$ -	$0
Total				**$25**
IC-FM2				
PMF event	0	0	$ 16,770	$103
100yr ARI event	0	0	$ 3,801	$45
50yr ARI event	0	0	$ 5,163	$156
20yr ARI event	0	0	$ 5,213	$246
10yr ARI event	0	0	$ 4,640	$358
5yr ARI event	0	0	$ 2,524	$379
Total				**$1,286**
IC-FM3				
PMF event	0	0	$ 15,131	$76
100yr ARI event	0	0	$ -	$0
50yr ARI event	0	0	$ -	$0
20yr ARI event	0	0	$ -	$0
10yr ARI event	0	0	$ -	$0
5yr ARI event	0	0	$ -	$0
Total				**$76**
IC-FM4				
PMF event	0	0	$ 2,855	$14
100yr ARI event	0	0	-$ 44	-$1
50yr ARI event	0	0	-$ 77	-$2
20yr ARI event	0	0	-$ 46	-$1
10yr ARI event	0	0	$ -	$0
5yr ARI event	0	0	$ -	$0
Total				**$10**

4.2 Benefit to Cost Ratio of Options

The economic evaluation of each modelled measure was assessed by considering the reduction in the amount of flood damages incurred for the design events and by then comparing this value with the cost of implementing the measure.

Table 4-6 summarises the results of the economic assessment of each of the flood management options. The indicator adopted to rank these measures on economic merit is the benefit-cost ratio (B/C), which is based on the net present worth (NPW) of the benefits (reduction in AAD) and the costs (capital and ongoing), adopting a 7% discount rate and an implementation period of 50 years.

The benefit-cost ratio provides an insight into how the damage savings from a measure, relate to its cost of construction and maintenance:

- Where the benefit-cost is greater than 1 the economic benefits are greater than the cost of implementing the measure;

- Where the benefit-cost is less than 1 but greater than 0, there is still an economic benefit from implementing the measure but the cost of implementing the measure is greater than the economic benefit;
- Where the benefit-cost is equal to zero, there is no economic benefit from implementing the measure; and
- Where the benefit-cost is less than zero, there is a negative economic impact of implementing the measure.

Table 4-6 Summary of Economic Assessment of Flood Management Options

Option ID	Option Description	NPW of Reduction in AAD	NPW of Cost of Implementation	B/C Ratio	Economic Ranking
IC_FM1	Victoria Road Branch – Additional pipes from the Victoria Rd/Terry St intersection that drains into Iron Cove	$0	$1,580,000	0.00	4
IC_FM2	Manning Street Branch – Additional pipes that crosses Mannings St at three locations onto other street. Toelle St, Callan St and Springside St.	$13,000	$2,285,000	0.01	1
IC_FM3	Glover Street Branch – Additional pipe along Glover St between Perry St and Church St.	$1,000	$1,507,000	0.00	2
IC_FM4	Longview Street Branch – Additional pipes to drain flooding from the low point on Longview Street.	$0	$316,000	0.00	3

Iron Cove Mitigation Option Figures

Figure IC_FM2_5yr_WlDiff
Figure IC_FM2_20yr_WlDiff
Figure IC_FM2_100yr_WlDiff
Figure IC_FM3_5yr_WlDiff
Figure IC_FM3_20yr_WlDiff
Figure IC_FM3_100yr_WlDiff
Figure IC_FM4_5yr_WlDiff
Figure IC_FM4_20yr_WlDiff
Figure IC_FM4_100yr_WlDiff

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LEICHHARDT FRMS&P
IC_FM2 5YR ARI WL DIFF
MITIGATION LESS EXISTING
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03/2017

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IC_FM2_5yr_WlDiff
Drawing Number

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Revision

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INNER WEST COUNCIL
LEICHHARDT FRMS&P
IC_FM2 20YR ARI WL DIFF
MITIGATION LESS EXISTING
FIG_A4_5

Date
03/2017

Size
A3

IC_FM2_20yr_WIDiff
Drawing Number

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Revision

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INNER WEST COUNCIL
LEICHHARDT FRMS&P
IC_FM2 100YR ARI WL DIFF
MITIGATION LESS EXISTING
FIG_A4_6

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IC_FM2_100yr_WIDiff
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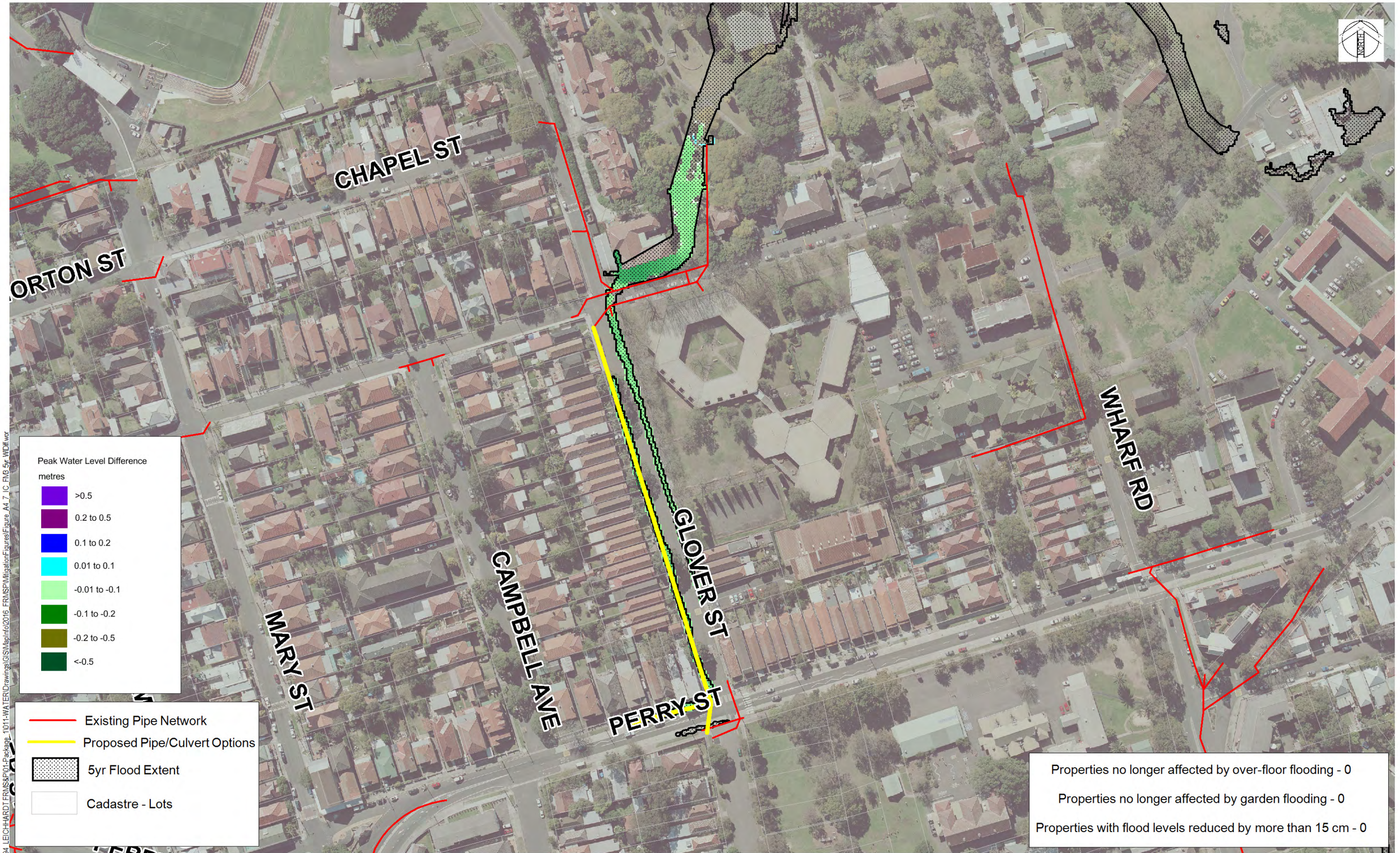

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INNER WEST COUNCIL
LEICHHARDT FRMS&P
IC_FM3 5YR ARI WL DIFF
MITIGATION LESS EXISTING
FIG_A4_7

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IC_FM3_5yr_WlDiff
Drawing Number

03
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INNER WEST COUNCIL
LEICHHARDT FRMS&P
IC_FM3 20YR ARI WL DIFF
MITIGATION LESS EXISTING
FIG_A4_8

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Size
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IC_FM3_20yr_WlDiff
Drawing Number

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INNER WEST COUNCIL
LEICHHARDT FRMS&P
IC_FM3 100YR ARI WL DIFF
MITIGATION LESS EXISTING
FIG_A4_9

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IC_FM3_100yr_WlDiff
Drawing Number

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INNER WEST COUNCIL
LEICHHARDT FRMS&P
IC_FM4 5YR ARI WL DIFF
MITIGATION LESS EXISTING
FIG_A4_10

Date
03/2017

Size
A3

IC_FM4_5yr_WIDiff
Drawing Number

03
Revision

DATE PLOTTED: 04-Nov-2016 BY: Matthew Prumm
FILE: N:\Projects\499\FY13\NA499713094_LEICHHARDT FRMS&P\01-Package_1\011-WATER\Drawings\GIS\MapInfo\2016_FRMSP\MitigationFigures\Figure_A4_11_IC_FM4_20yr_WlDiff.wor

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FIG_A4_11

Date
03/2017

Size
A3

IC_FM4_20yr_WlDiff
Drawing Number

03
Revision

DATE PLOTTED: 04-Nov-2016 BY: Matthew Prumm
FILE: N:\Projects\499\FY13\NA499713094_LEICHHARDT FRMS&P\01-Package_1\011-WATER\Drawings\GIS\MapInfo\2016_FRMSP\MitigationFigures\Figure_A4_12_IC_FM4_100yr_WIDiff.wor

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FIG_A4_12

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Size
A3

IC_FM4_100yr_WIDiff
Drawing Number

03
Revision