

# Main City & North Wagga Levee Upgrade Project

Eunony  
2015



Detailed design &  
alternatives for North Wagga

# Overview

- Background
- What's been done so far
- Where we're up to
- Detailed Design
- Flood modelling
- North Wagga Options
- Discussion and feedback



# Introduction

## **Wagga Wagga City Council**

Heinz Kausche- Director Infrastructure Services

Alex Fenwick- Manager Engineering

Lauren Fitzgerald- Community Engagement Officer

## **NSW Public Works**

Fred Spain- Manager, Clients & Project Delivery



# Background

- Long term project
- Recent experiences
- Complex decisions



What's been done to date?



2007

- Geotechnical Survey

2008

- Topographical Survey
- Aerial Laser Survey

2009/10

- Detailed Flood Modelling

2010

- Preliminary Environmental Planning Review
- Levee Design Level Report
- Freeboard Analysis Report

2011/12

- Concept Design Report



2012/13

- Community Engagement

2013

- Review of Environmental Factors

2013/14

- Revised Flood Model

2014/15

- Investigation and detailed design
  - Detailed Geotechnical Investigation
  - Detailed Topographical Investigation
  - Property Investigation and Dilapidation Assessment
  - Utilities Investigation
  - Preliminary Design Report



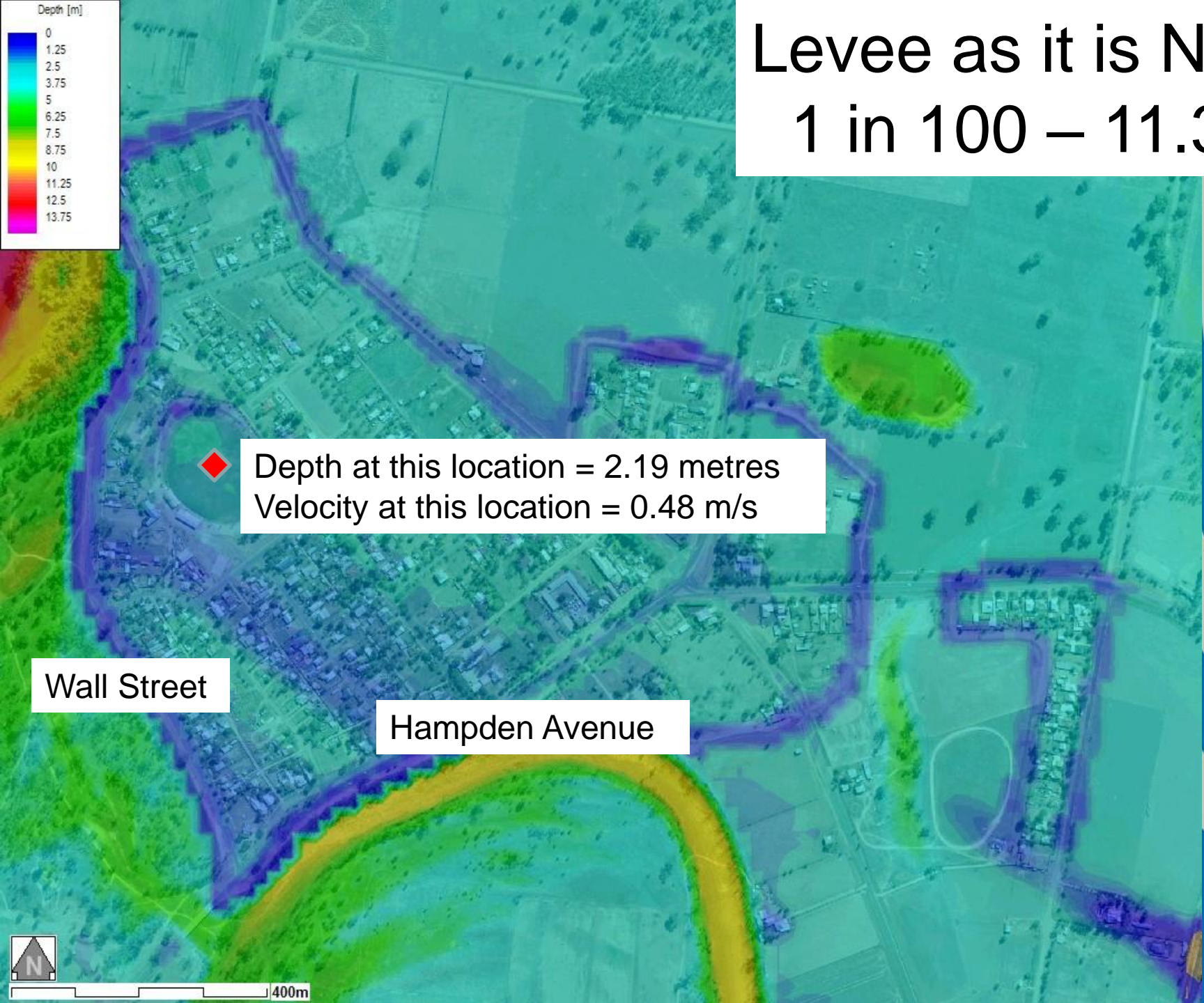
# Modelling





# Levee as it is NOW

## 1 in 100 – 11.3m



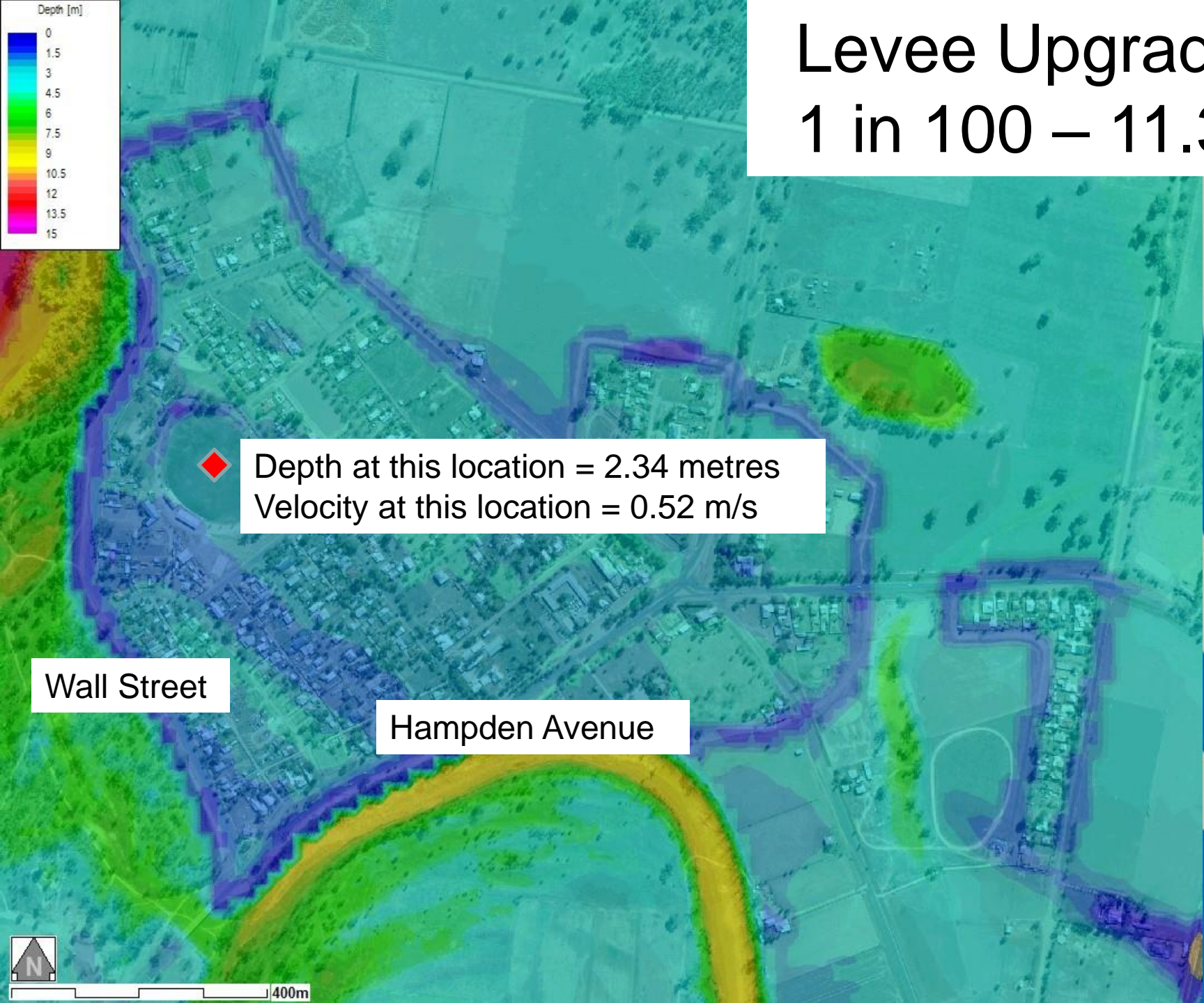
Depth at this location = 2.19 metres  
Velocity at this location = 0.48 m/s

Wall Street

Hampden Avenue



# Levee Upgraded 1 in 100 – 11.3m



Where are we up to?



## NOW

- Community Engagement
- Investigation and Detailed Design
- Investigation on alternatives for North Wagga
- Third Party Impact Assessment

## NEXT

- 9 April 2015: application for Flood Plain Management grants due
- May 2015 Collating community feedback
- July 2015: Report to Council for decision on Main City and North Wagga Levees

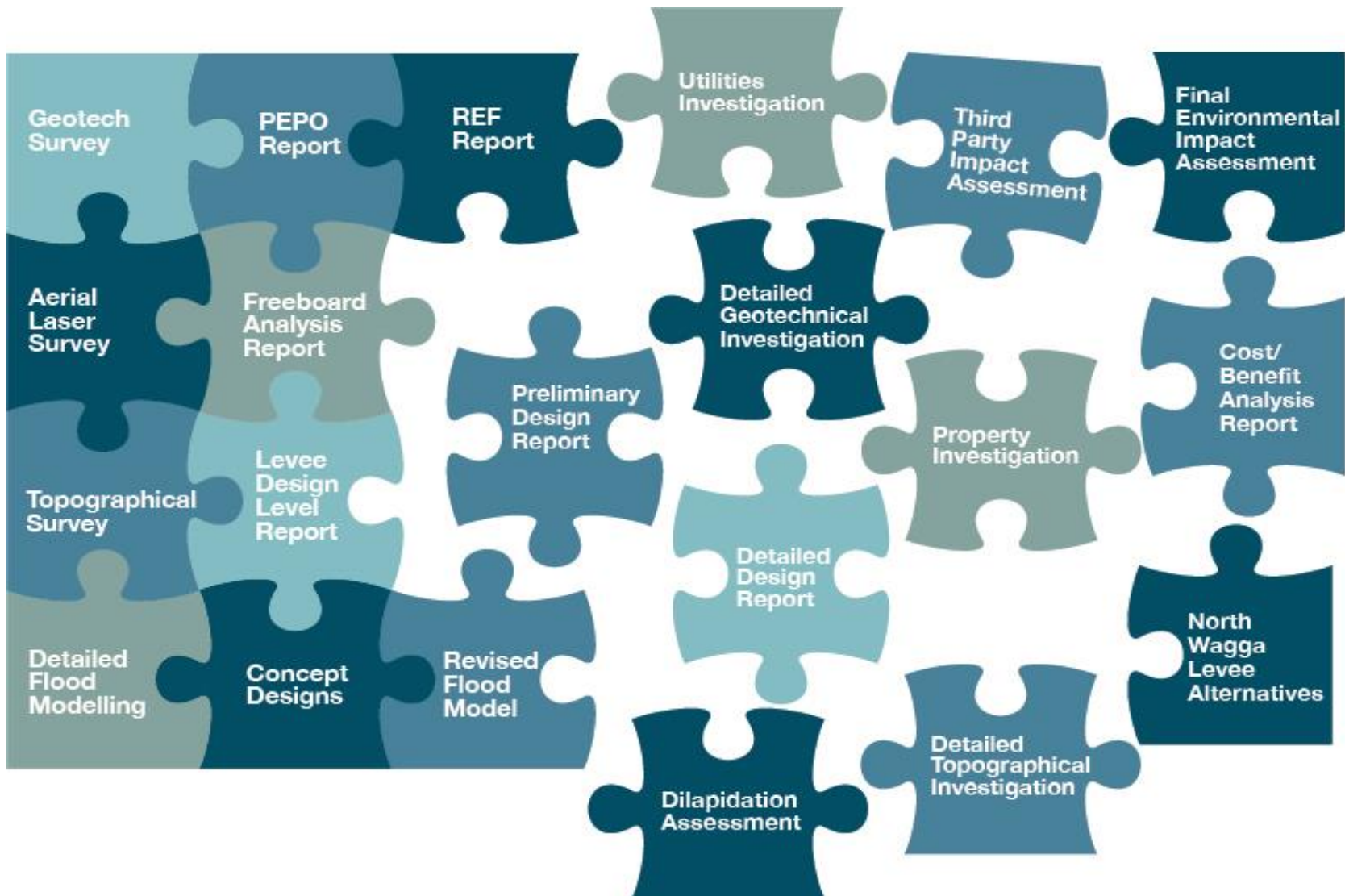
## BEYOND

- Action on decisions made about flood management



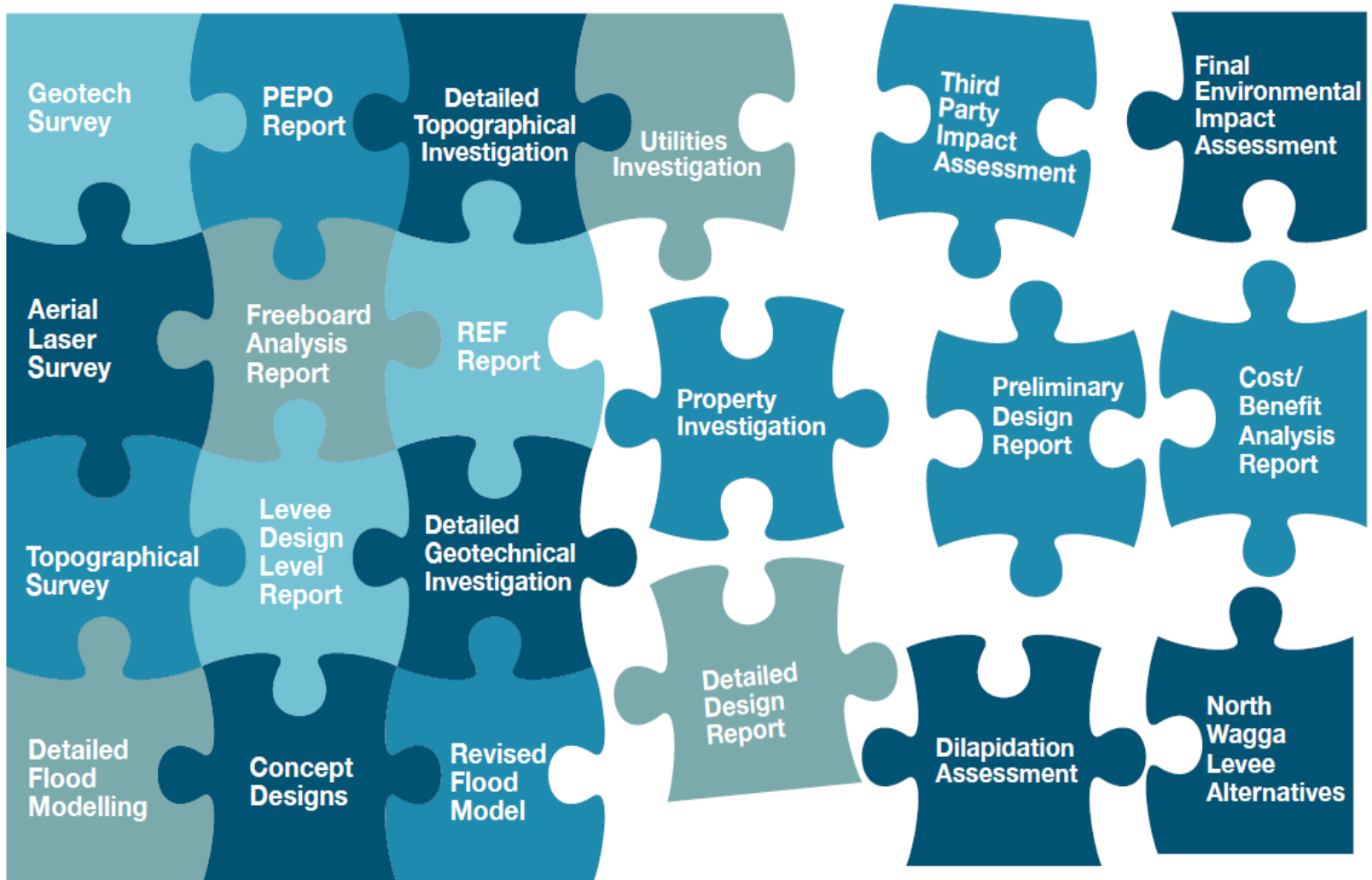
# The pieces coming together

2014



# The pieces coming together

2015



# Detailed Design



# Main City Levee

1 in 100 year level of protection  
(1% AEP)

- How high – approximately 0.9m higher
- How wide – maximum approx. 1-2m inside
- Materials – Earth and some Sheet Piles





# North Wagga Levees

1 in 20 year level of protection  
(5% AEP)

- How high – approximately 0.9m higher
- How wide – maximum approx. 1-2m inside
- Materials – Earth (and perhaps sheet pile)



# Terrestrial Laser Scanning Survey

METADATA & DISCLAIMER

## WAGGA WAGGA LEVEES TRUIVIEW - OVERALL MAP

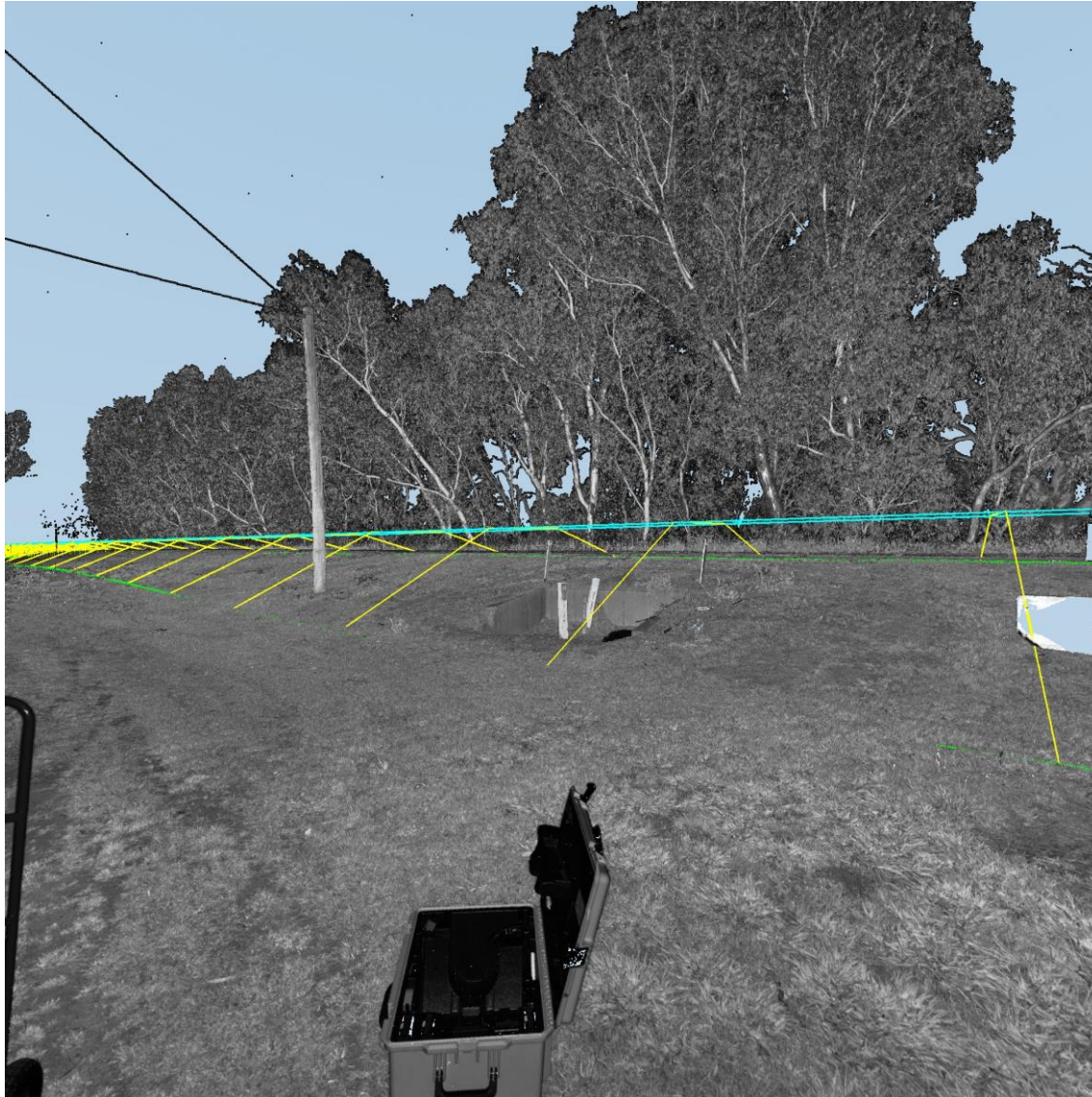


Public Works



Wagga Wagga  
City Council





# Terrestrial Laser Scanning Survey



# Modelling

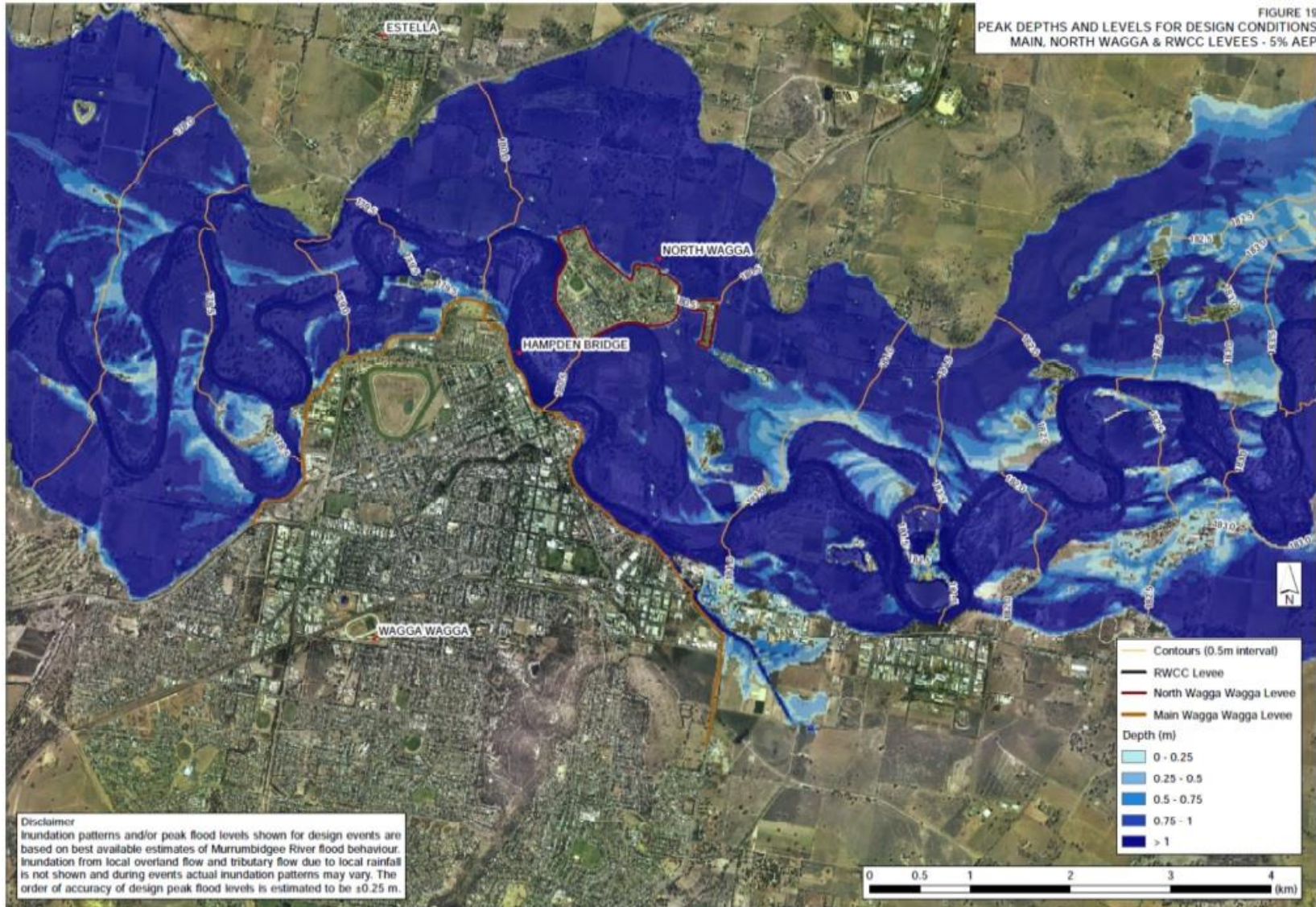


# Modelling

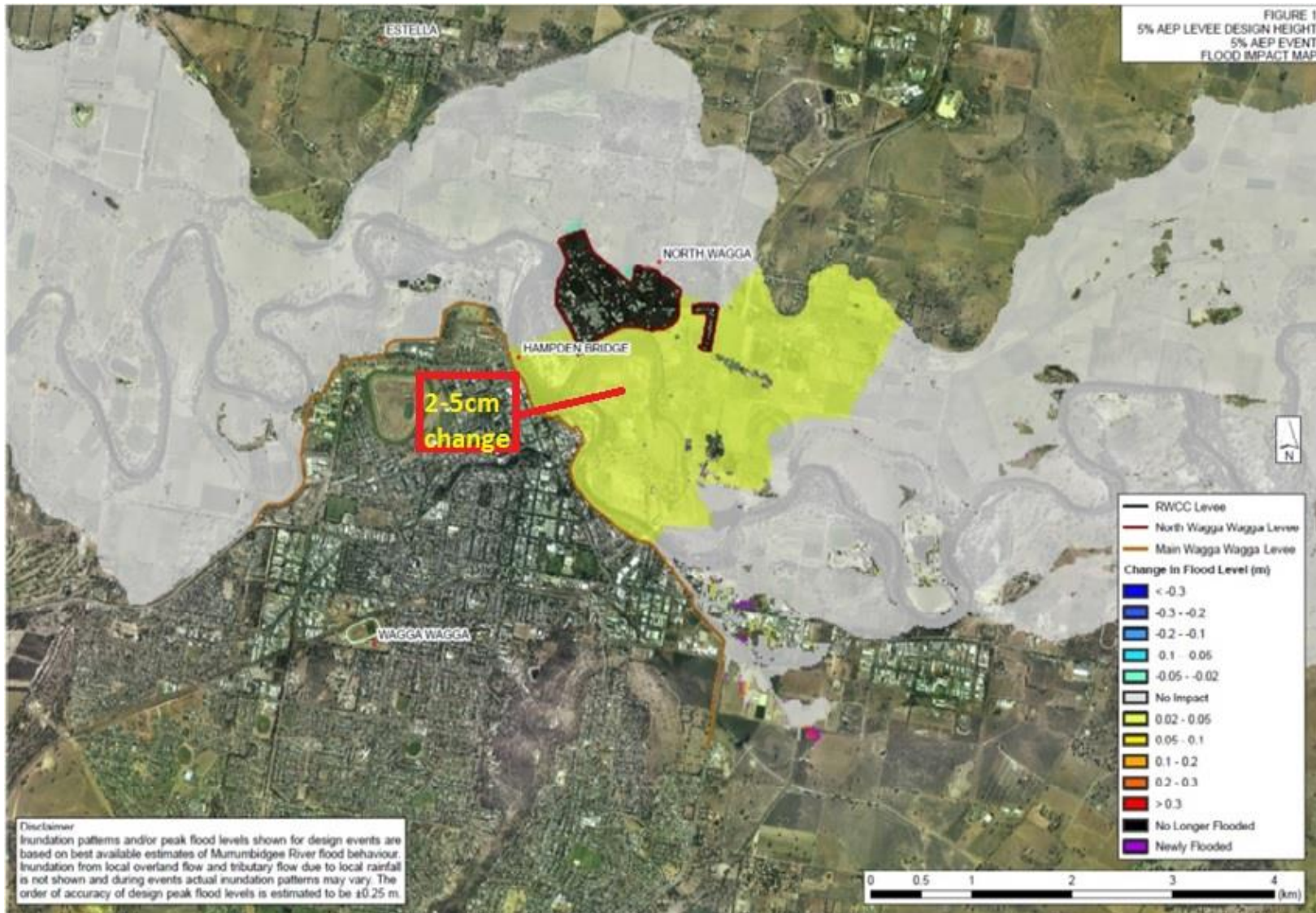
- Main City Levee: 1 in 100 year level of protection
- North Wagga Levees: 1 in 20 year level of protection



# Depths in a 1 in 20 year flood event



# Change in a 1 in 20 year flood event



# QUESTIONS?

- Detailed design
- Floodplain modelling





# North Wagga Options



# North Wagga Options

**May 2013**

*Receive a further report on other options for providing flood protection for North Wagga residents and commercial operators in response to feedback from the community including:*

- maintain the levees at their current level of protection and take no further action*
- raising the North Wagga levee to a 1 in 20 year level of protection*
- raising the North Wagga levee higher than a 1 in 20 year level of protection*
- removing the existing North Wagga levees*
- relocation of the village from the floodplain*
- raising residences in North Wagga*
- raising houses in Mill and East Street that are protected by North Wagga levee two*
- voluntary purchase for properties in North Wagga*



# Assessing the options

North Wagga Wagga Levee  
Options and Third Party Impacts

-NSW Public Works



# Assessing the Options

- Cost of implementing the option
- Impact on floodplain
- Estimated average annual damages for some options
- Pros and cons



# Costs

There are two types of costs:

- Capital (upfront) cost;
- Ongoing (recurring) costs.



# Average Annual Damages (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 Annual Damages can be thought of as a Self-Insurance Policy. That is, it is the amount of money that would have to be set aside each and every year to be drawn upon as needed to pay for flood damages when they occur in the future.



# Maintain the North Wagga levees at their current level of protection and take no further action

The levee system currently provides protection up to a 9.9m river height at North Wagga.

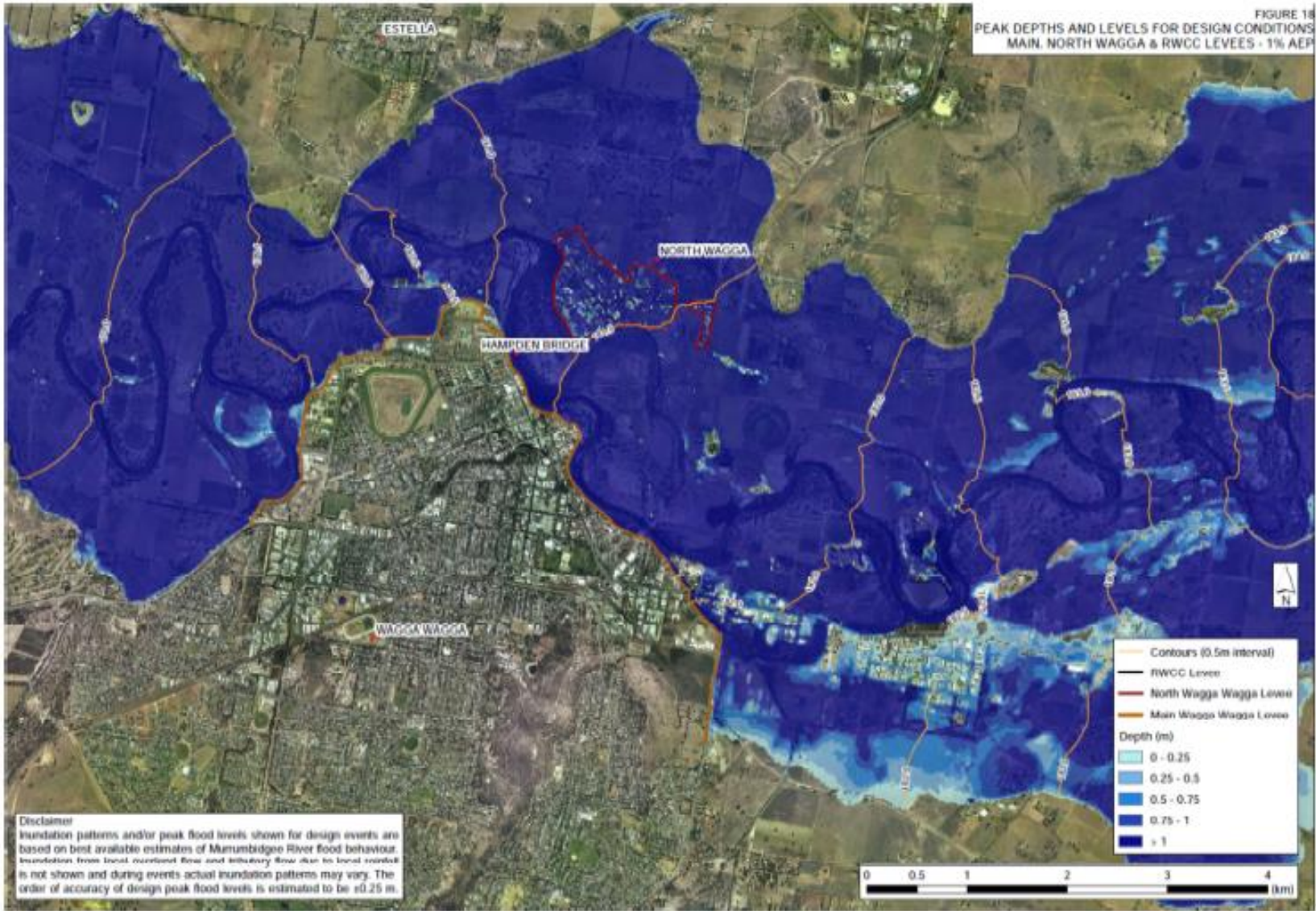
River heights are measured at the old Hampden Bridge gauge

- 1 in 20 equates to a height of 10.3m
- 1 in 100 equates to a height of 11.3m.

**Capital cost estimate: \$0**



# Maintain the North Wagga levees at their current level - 1 in 100 year flood event





# Maintain the North Wagga levees at their current level of protection and take no further action

**Average annual damages: \$1.204M**

Pros	Cons
Lowest capital cost	Increased damages compared to other options
.	



# Questions?



# Raising the North Wagga levees to a 1 in 20 year level of protection

This option is the basis of the detailed design currently being undertaken for the North Wagga Levee system upgrade.

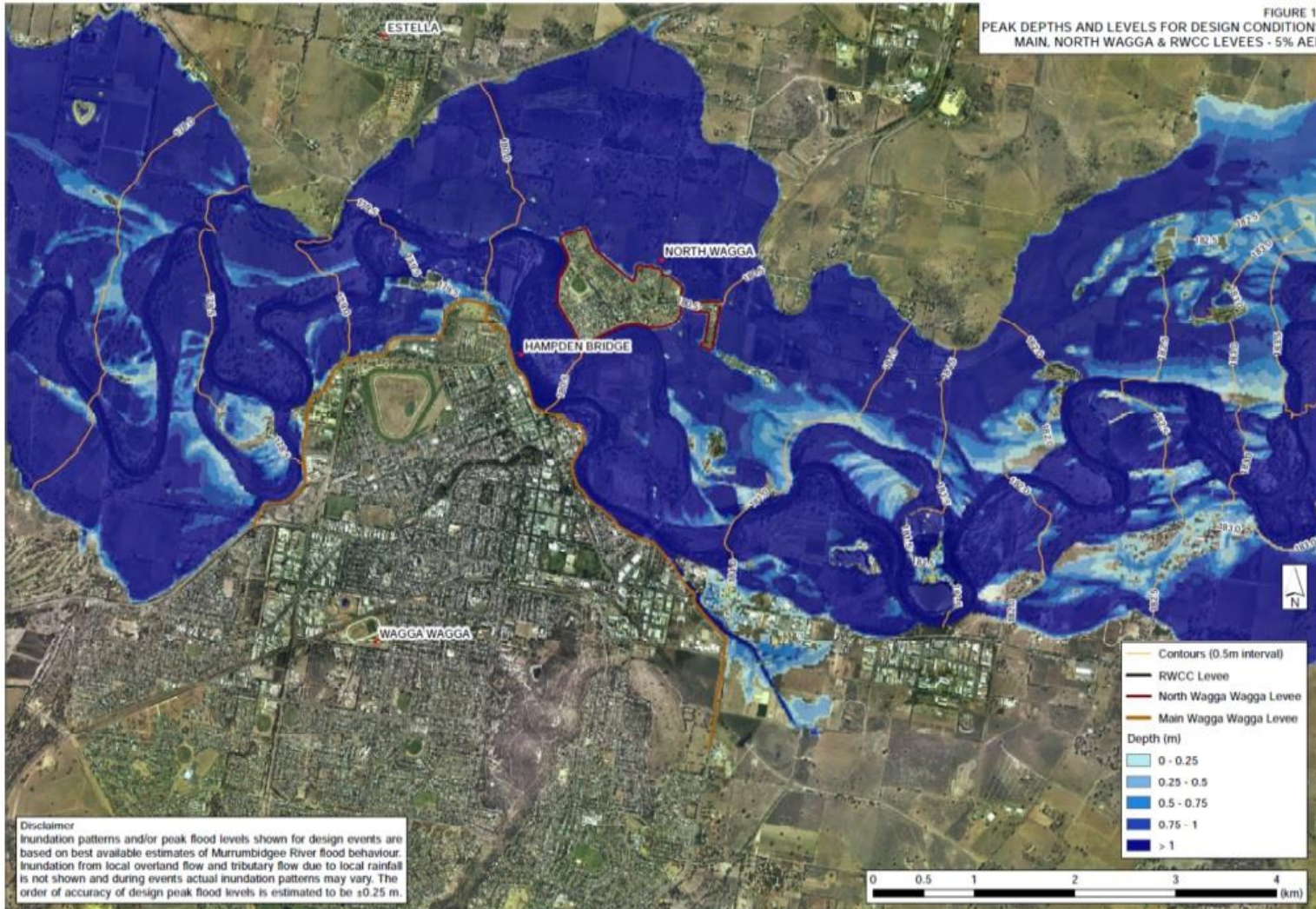
**Capital cost estimate: \$4.8M**

a) North Wagga Wagga levee: approximately \$3.35M

b) Levee Two: approximately \$1.45M



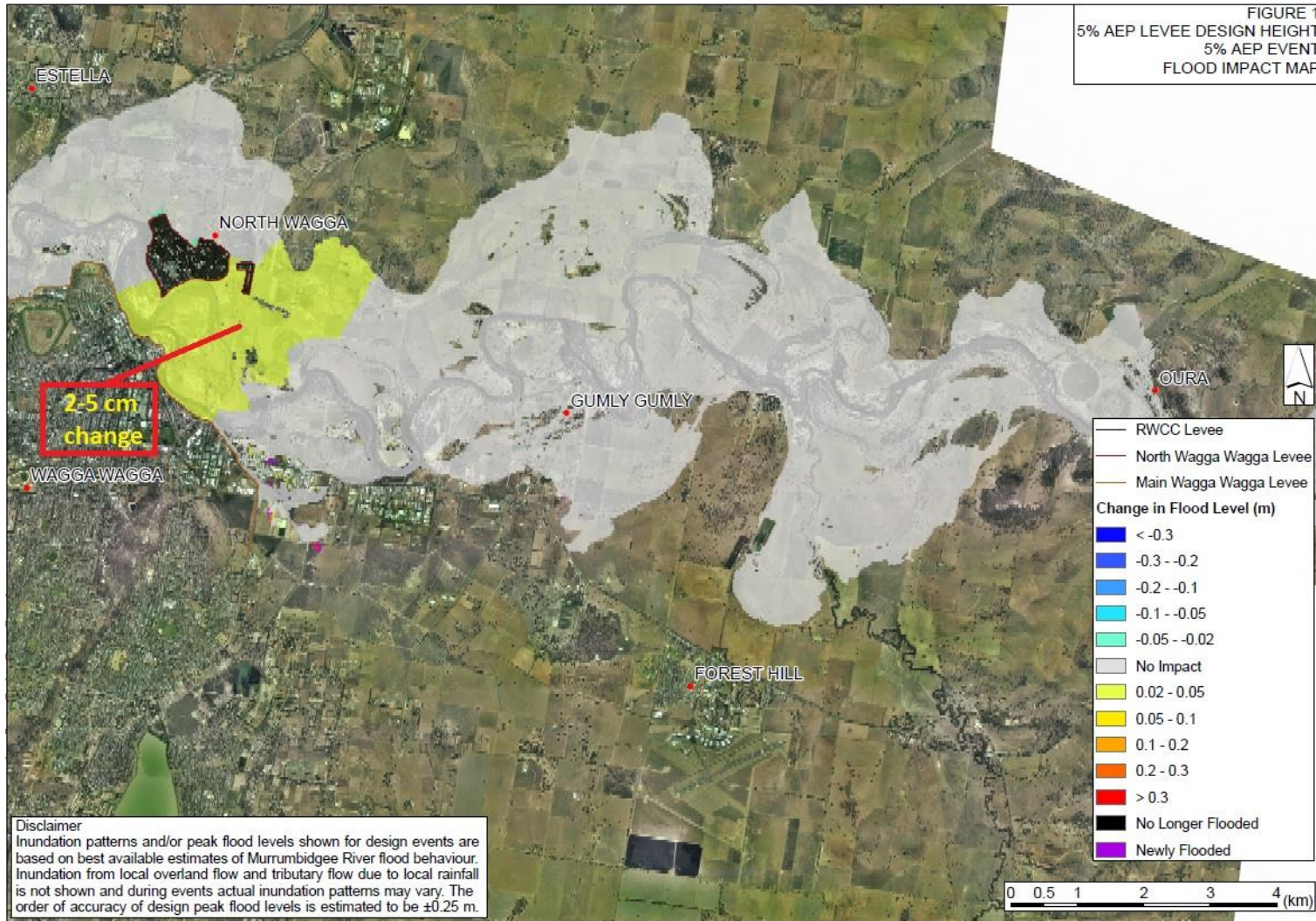
# Raising the North Wagga levee to a 1 in 20 year level of protection



1 in 20 year flood event



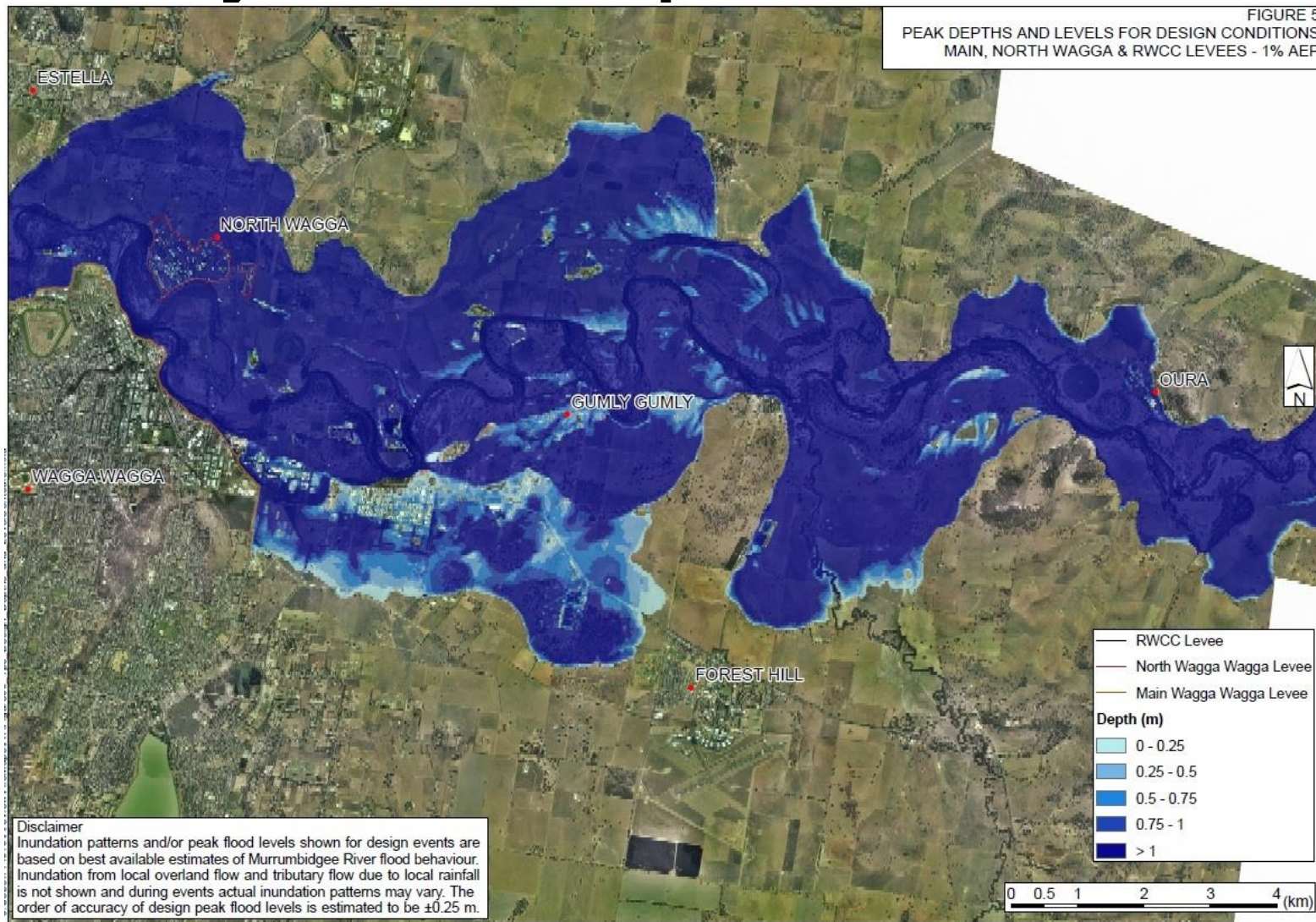
# Raising the North Wagga levee to a 1 in 20 year level of protection



1 in 20 year flood event



# Raising the North Wagga levee to a 1 in 20 year level of protection



1 in 100 year flood event



# Raising the North Wagga levee to a 1 in 20 year level of protection

**Annual Average Damages: \$689K**

Pros	Cons
Provides additional level of protection over current level.	Does not provide protection against flooding above a 1 in 20 year flood event
Provides the same level of protection that was designed for previously.	



# Questions?

Relating to the option of raising the North Wagga levee to a 1 in 20 year level of protection





# Raising the North Wagga levees to higher than a 1 in 20 year level of protection

The scenario used to inform this option is an upgrade of the levee system to a 1 in 100 year level of protection.

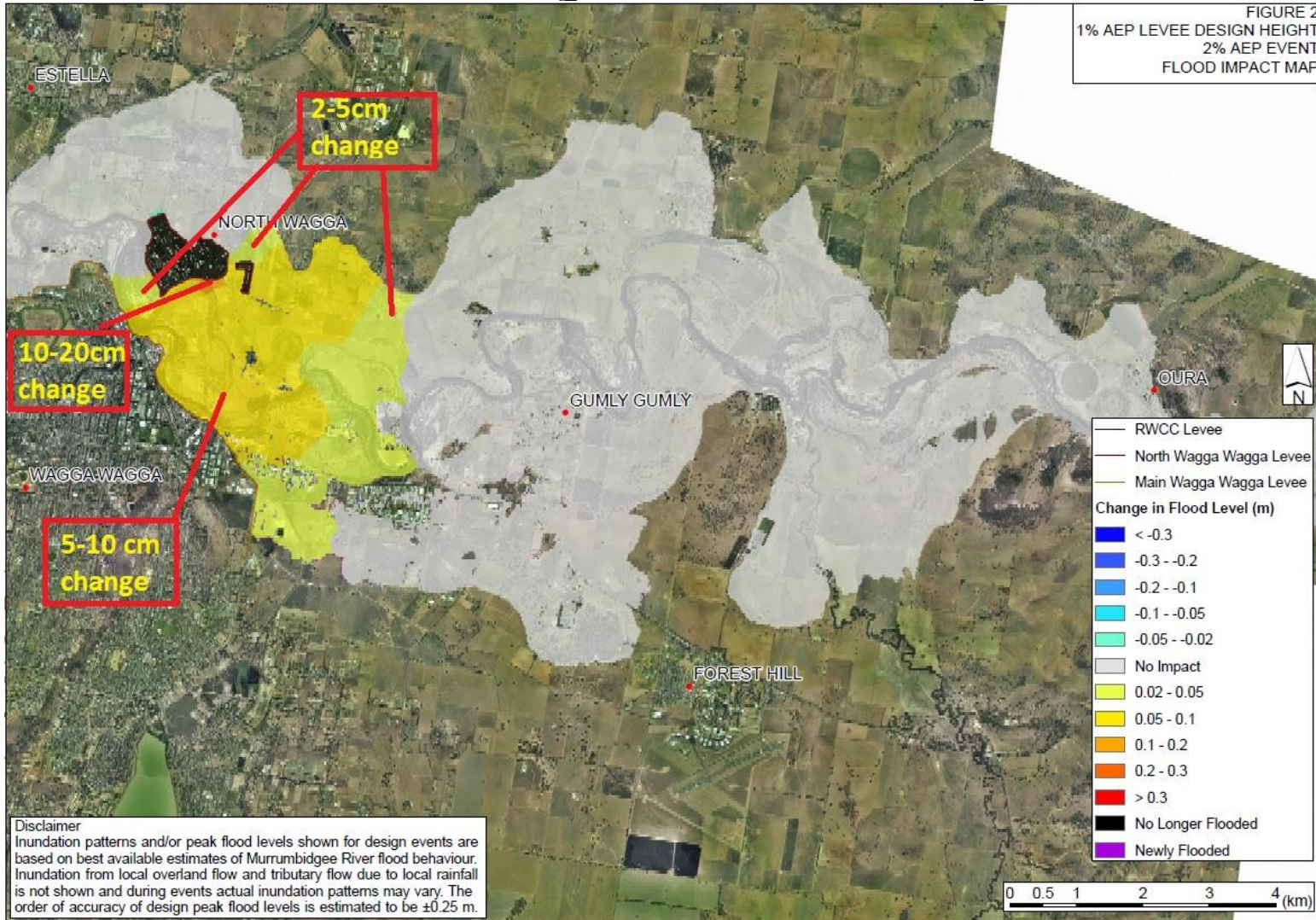
This will also require an increase in height of the Main City Levee.

**Capital cost estimate: \$6.81M**

- a) North Wagga Wagga levee: approximately \$4.13M
- b) Levee Two: approximately \$1.62M
- c) Main City Levee: approximately \$1.06M



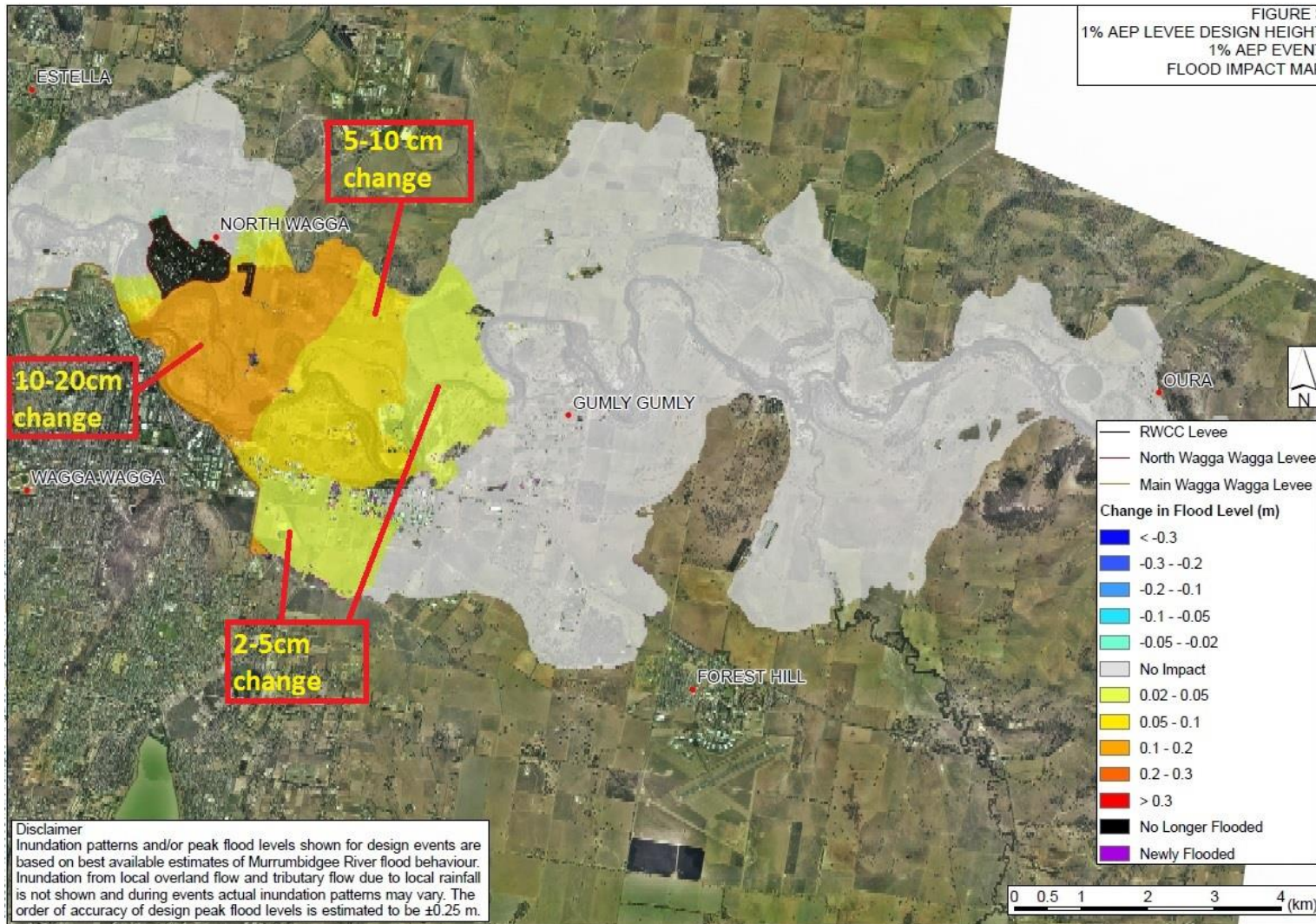
# Raising the North Wagga levees to higher than a 1 in 20 year level of protection



1 in 50 year flood event



# Raising the North Wagga levees to higher than a 1 in 20 year level of protection



1 in 100 year flood event



# Raising the North Wagga levees to higher than a 1 in 20 year level of protection

- Annual Average Damages: \$149K\*

Pros	Cons
Provides similar level of protection as the Main Levee.	Loss of amenity with the levee being 0.9m – 1.0m higher than the 1 in 20 design height.
Has one of the lowest Average Annual Damages.	Increased pressure to allow the construction of new houses on vacant blocks.  Issues associated with evacuating North Wagga in the event of a flood that is larger than a 1 in 100 year flood event.  Results in an increased height and cost of upgrading the Main City Levee.

\*A 1 in 100 level of protection has been used to inform this scenario



# Questions?

Relating to the option of raising the North Wagga levee to a higher than 1 in 20 year level of protection



# Remove the North Wagga levees

Involves the removal of the North Wagga levee system.

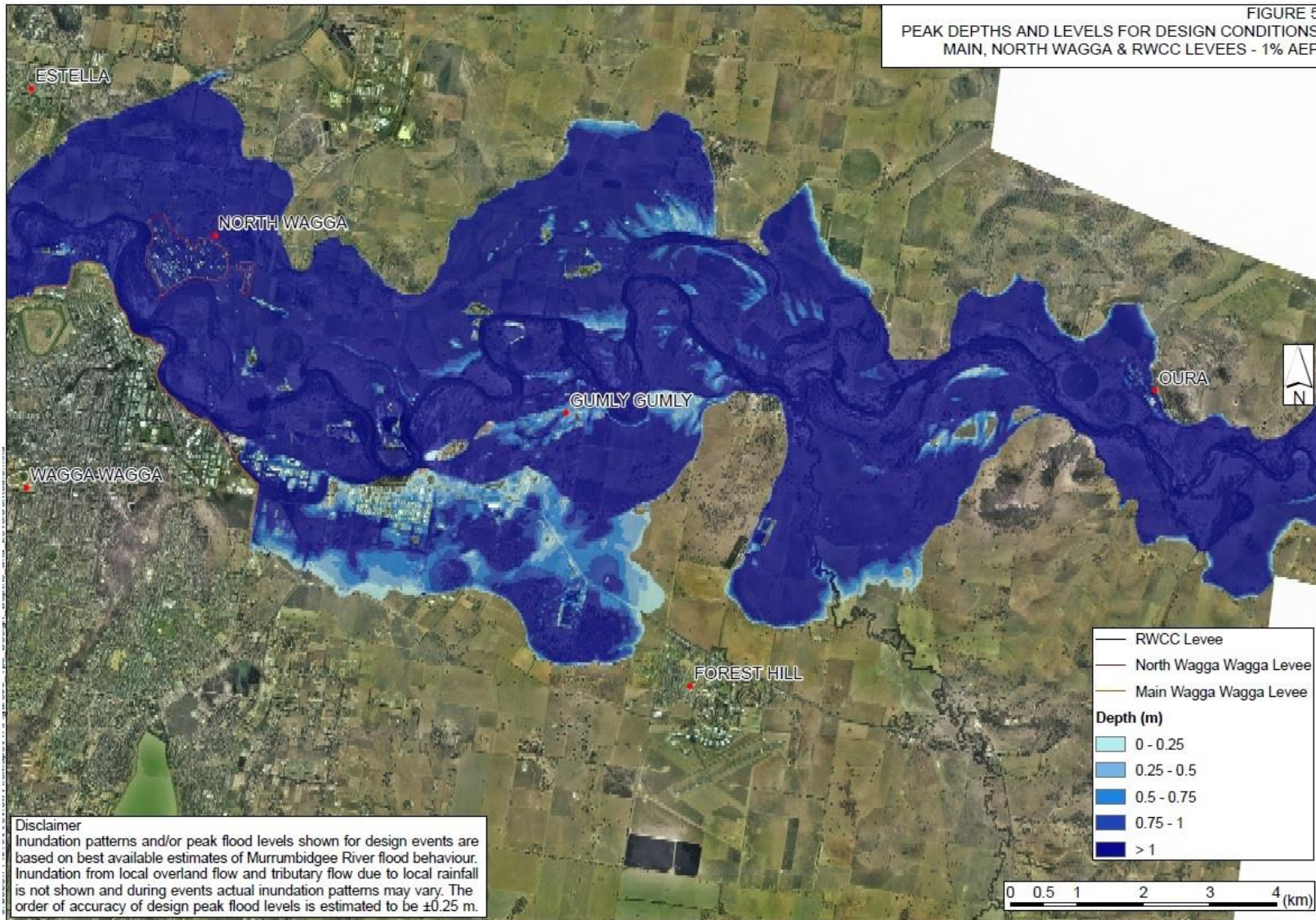
Other controls would have to be considered if this option were to be pursued (eg house raising, relocation, voluntary acquisition).

**Cost estimate: \$395K**



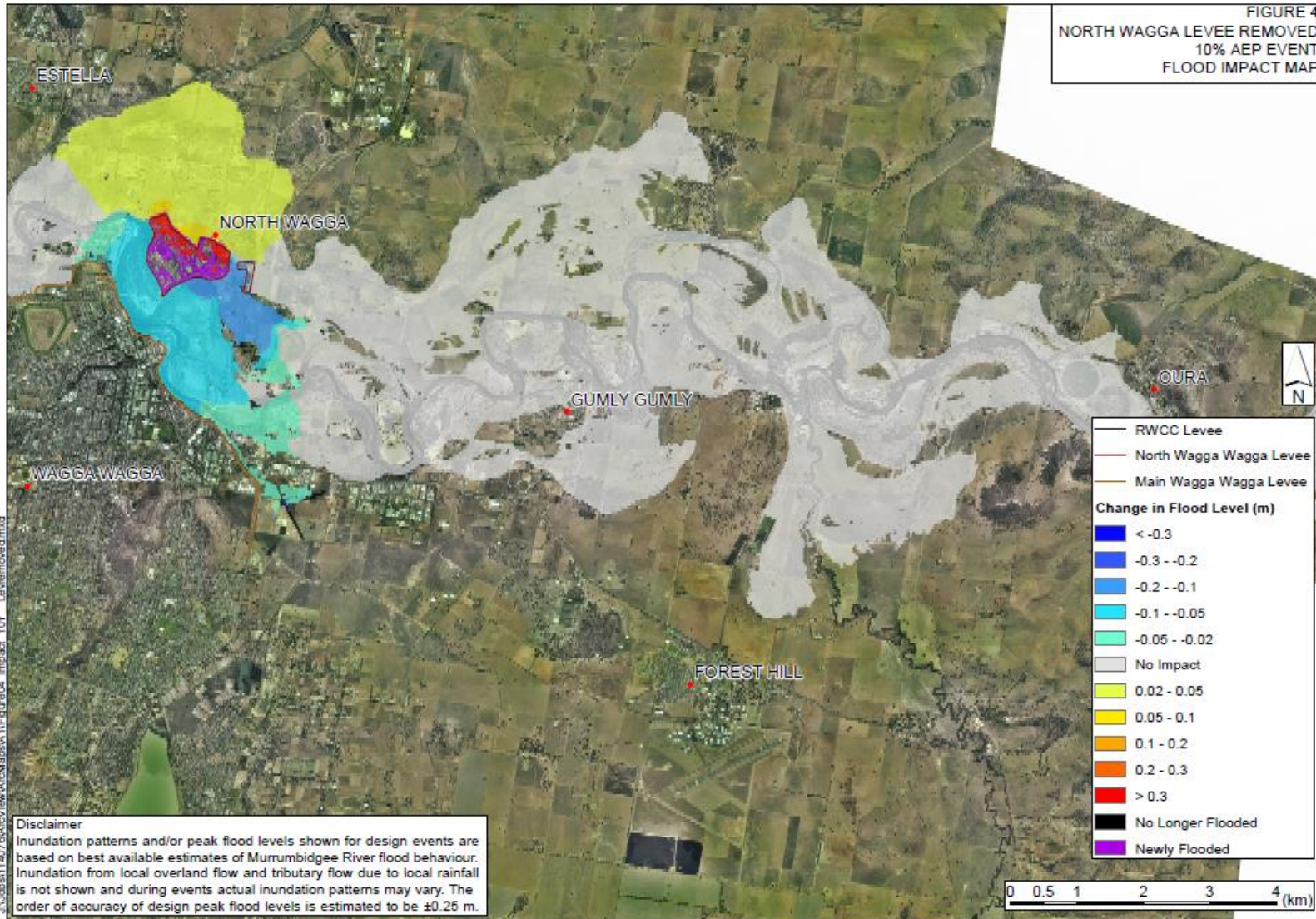
# Remove the North Wagga levees

## 1 in 100 year flood event



# Remove the North Wagga levees

## Change in depth for 1 in 10 year flood event



1 in 10 year flood event





# Remove the North Wagga levees

- **Annual Average Damages: \$1.5M**

Pros	Cons
Has one of the lowest capital cost	Provides no flood protection Has the highest Average Annual Damages



# Questions?

Relating to the option of removing the  
North Wagga levees



# Relocation of the village from the flood plain

This option is based on the complete relocation of North Wagga village to a flood free location.

The costs for this option are based on the construction of a new suburb of equal size and does not include the cost of land, relocation of existing buildings, construction of new buildings and demolition of existing buildings in North Wagga.

**Capital cost estimate: \$93.5M**



# Relocation of the village from the flood plain

**Annual Average Damages: \$0**

Pros	Cons
Has the lowest annual average damages	Has the highest capital cost Would be a major disruption



# Questions?

Relating to the option of relocating North Wagga from the flood plain



# Raising houses in North Wagga

This option involves raising all buildings that may be raised to above the 1 in 100 year flood level.

In the analysis an allowance has been made for demolition and reconstruction to above the 1 in 100 year flood level for buildings that cannot be raised.

**Capital cost estimate: \$16.85M**



# Raising houses in North Wagga

Pros	Cons
<p>Dwellings are out of flood waters</p>	<p>Some dwellings cannot be raised</p> <p>Those dwellings that cannot be raised would require the construction of new raised dwellings</p> <p>Damage to other property and facilities would still occur</p> <p>More difficult for elderly or disabled people to access dwellings</p> <p>Cost greater than the cost of levee raising</p>



# Raising houses in East and Mill Street only

Similar analysis method and pros and cons to the previous option, but on a smaller scale.

**Capital cost estimate: \$1.65M**





# Questions?

Relating to the option of raising houses  
in North Wagga



# Voluntary purchase for properties in North Wagga

There are a number of ways this option could be implemented, and time limits could be imposed for this scheme.

**Implementation cost estimate: \$37.2M**

The average annual damages cannot be calculated as it is unknown how many dwellings will be purchased, how many homes owners will take up the offer for this to be done etc.

Pros	Cons
	Very expensive
	Damages can occur while waiting for properties to be voluntarily sold.



# Questions?

Relating to the option of voluntary  
purchase of property



# Summary of North Wagga Options

Option	Capital Cost	Average Annual Damages
Maintain North Wagga Levees and take no further action	\$0	\$1.2M
<b>Raise to a 1 in 20 yr level of protection</b>	<b>\$4.8M</b>	<b>\$689K</b>
Raise to a 1 in 100 yr level of protection	\$6.81M	\$149K
<b>Remove the existing North Wagga levees</b>	<b>\$395K</b>	<b>\$1.5M</b>
Relocation of the village from the floodplain	\$93.5M	\$0
<b>Raising residences in North Wagga</b>	<b>\$16.85 M</b>	<b>N/A</b>
Raising residences in East and Mill Streets	\$1.65M	N/A
<b>Voluntary purchase</b>	<b>\$37.2M</b>	<b>N/A</b>



# Discussion



# Have your say

- Feedback form
- Online survey
- Let us come to you
  - Details in your information pack

**[wagga.nsw.gov.au/floodfutures](http://wagga.nsw.gov.au/floodfutures)**



Close

