1. Catchment Overview

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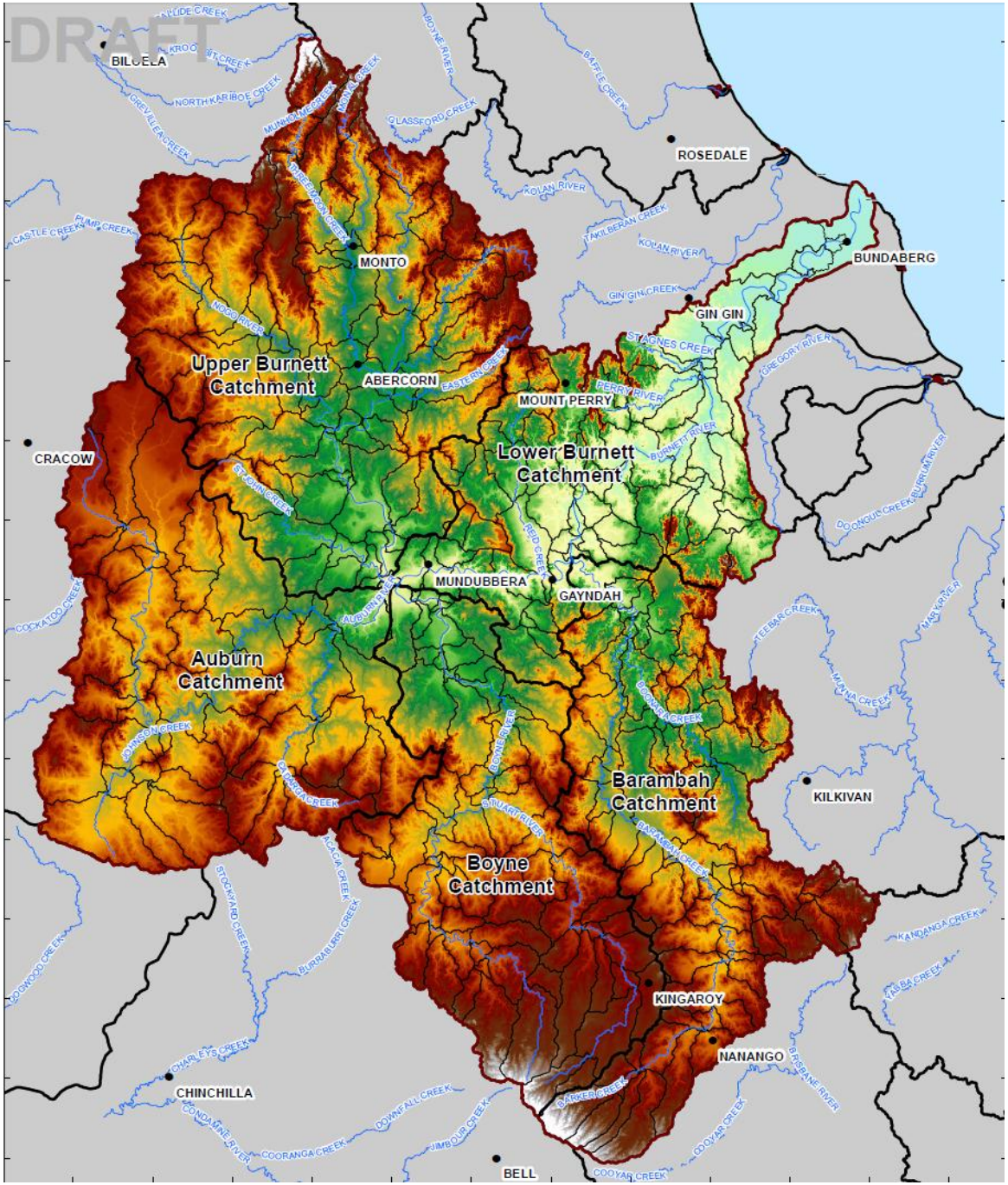
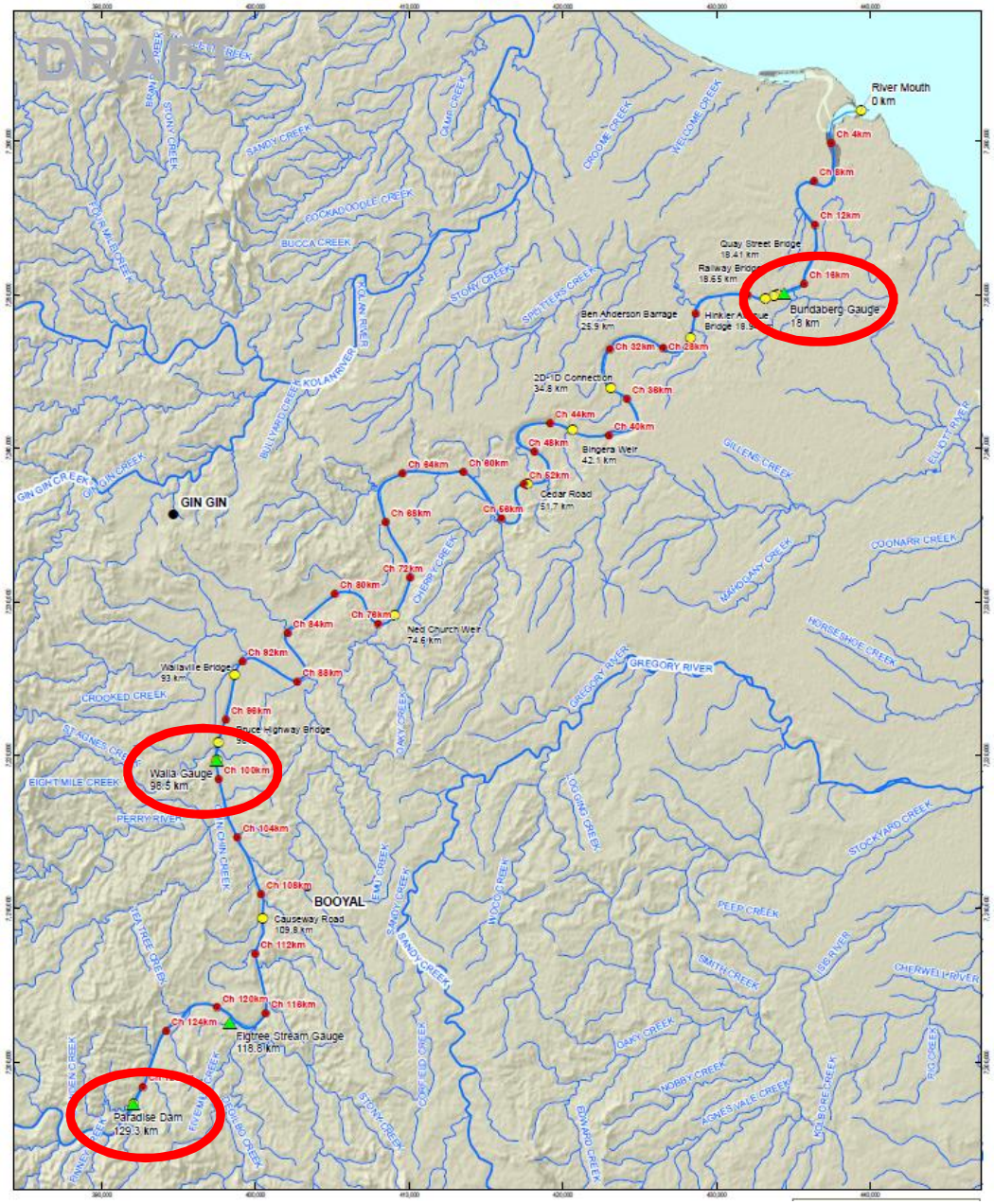


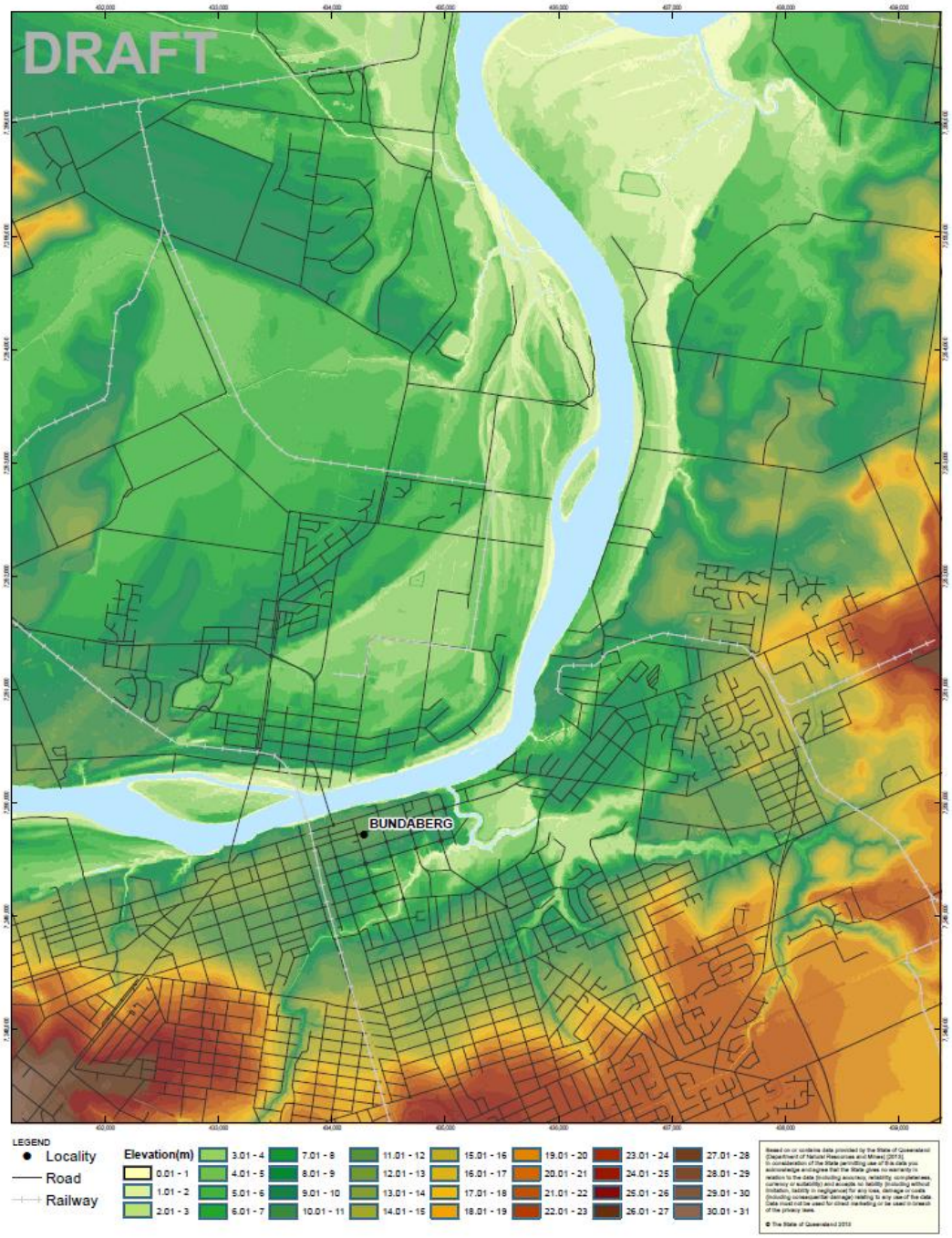
Catchment Overview

- A=33,000km^2
- 5 major sub-catchments
- Major rivers:
  - Burnett River
  - Auburn River
  - Boyne River
  - Nogo River &
  - Barambah Creek
- <5% of catchment downstream of Paradise Dam
- Storage capacity of Paradise Dam relatively small (<10%) compared to flood runoff volume in 2013 event
- Cumulative impact of dams on natural catchment (pre-dam) conditions flow rates during large events <10%



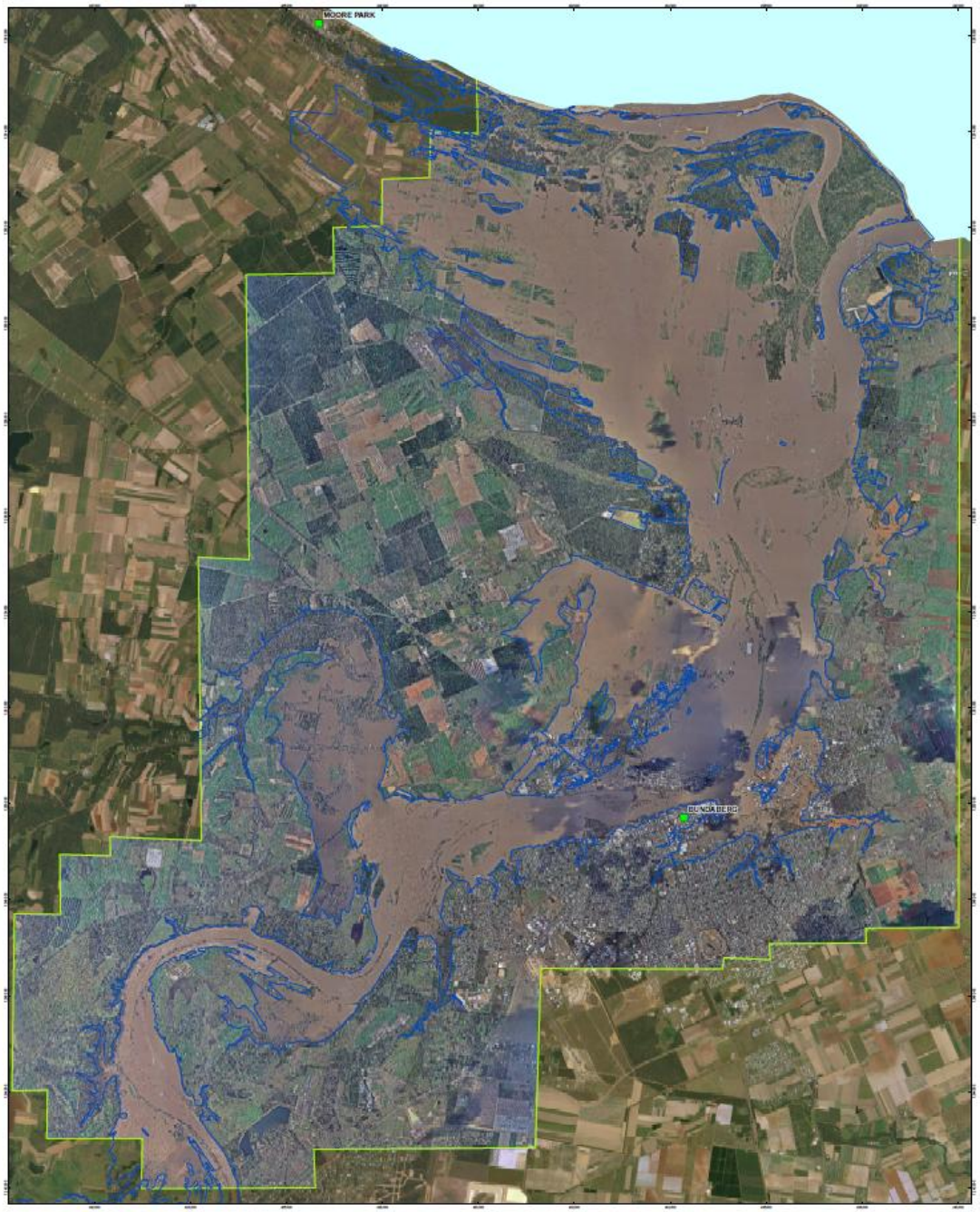
Key Features:

- Paradise Dam
- Walla stream gauge
- Figtree stream gauge
- Bundaberg stream gauge
- St Agnes Creek & Perry River



Bundaberg city Floodplain:

- Low lying nature of North Bundaberg
- North Bundaberg natural levee
- Backwater areas



2013 Flood Extent

- **Conveyance Areas**
- **Backwater Areas**

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Size of Jan 2013 Flood

Flow Rate of 2013 Event =16,500 m3/s

(Approximately ¼ of this through North Bundaberg)

Volume of 2013 Flood = 3,000 GL

(1GL = 1, 000,000,000 L)

Volume of 2013 Flood
= 1.3 million Olympic Swimming Pools

Volume of 2013 Flood
= 10 x Volume of Paradise Dam

Volume of 2013 Flood
= 3 to 5 x Volume Sydney Harbour

Notes:

- **Volume of Paradise Dam = 300GL**
- **Volume of Sydney Harbour = 560GL**

2. Flood Study & Mapping Project

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Flood Modelling and Mapping Study Objectives:

- Develop calibrated flood models of the Burnett River system (Paradise Dam to River Mouth)
- Assess design flood events (e.g. the 1 in 50yr to 1 in 500yr events)
- Prepare flood level, depth, velocity, hazard and emergency maps;
- Sensitivity Analysis.

How did we model the Burnett catchment ?

2 different types of numerical models were developed:

- A hydrologic model: used to estimate the rainfall runoff process. Outputs: flow rate hydrographs.

- A hydraulic model: used to simulate the dynamic propagation of flood flows across a floodplain. Outputs: Flood extents, levels, depths and velocities.

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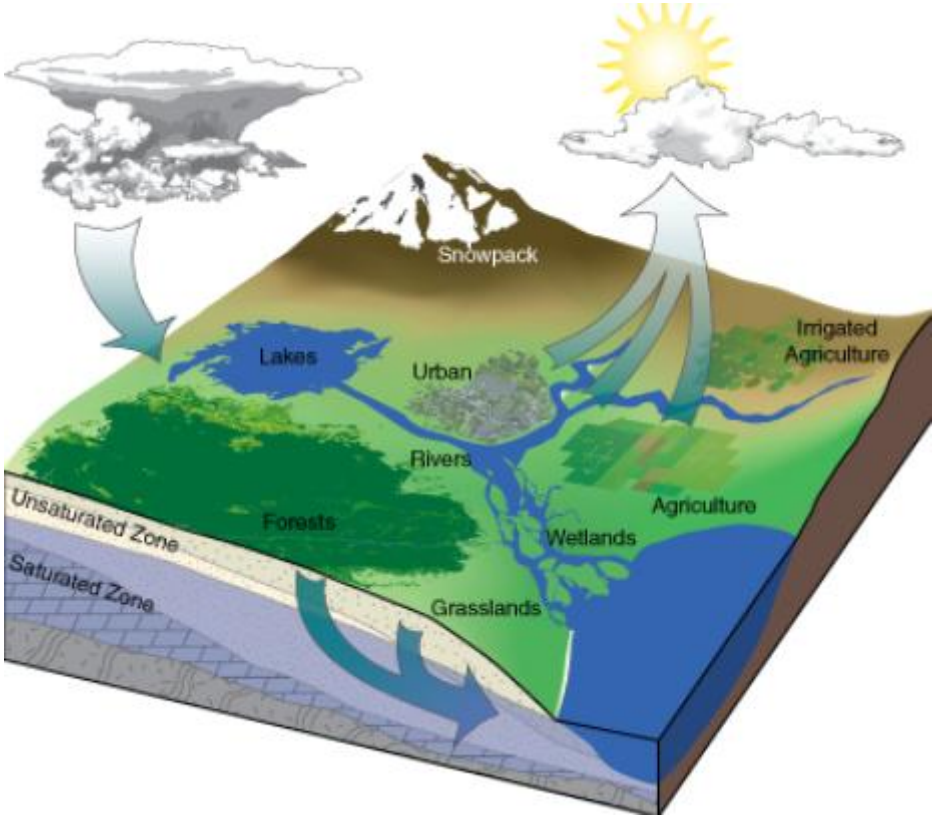
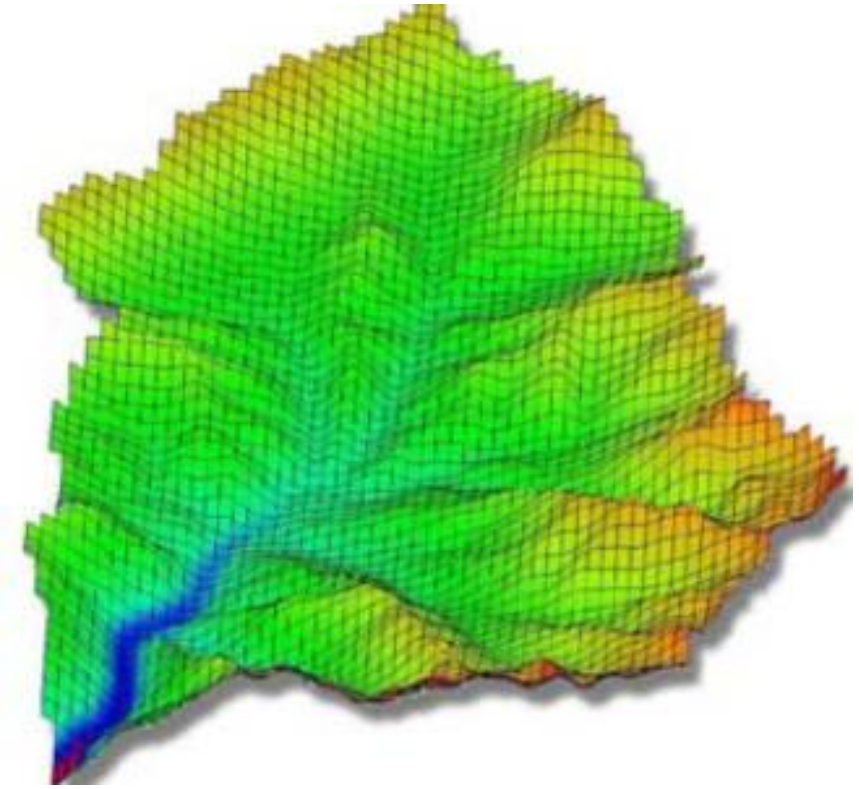
Flood Models





Hydrologic Model (Flows)

Hydraulic Model (Levels, Extents, Depths Velocities, Hazard)

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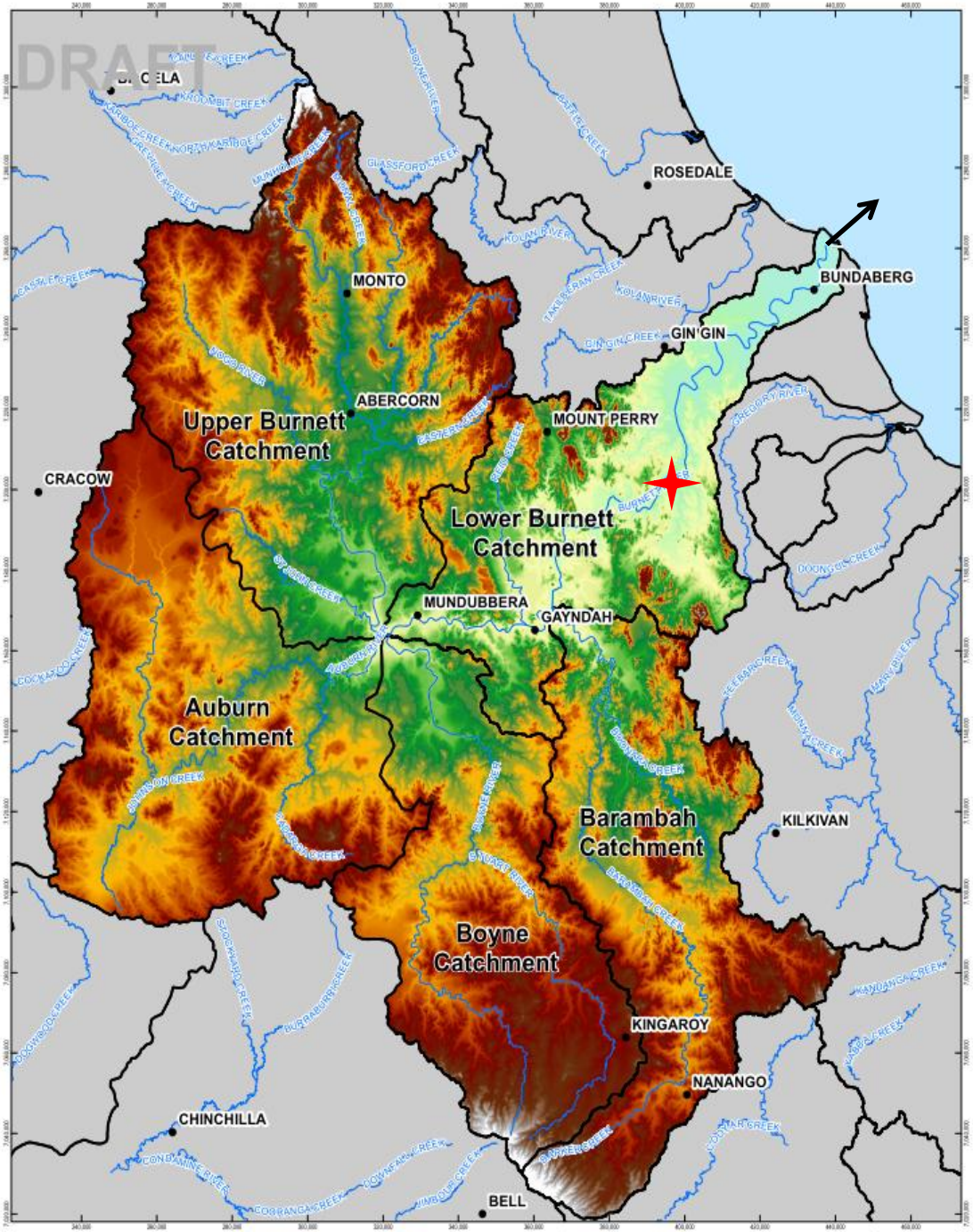
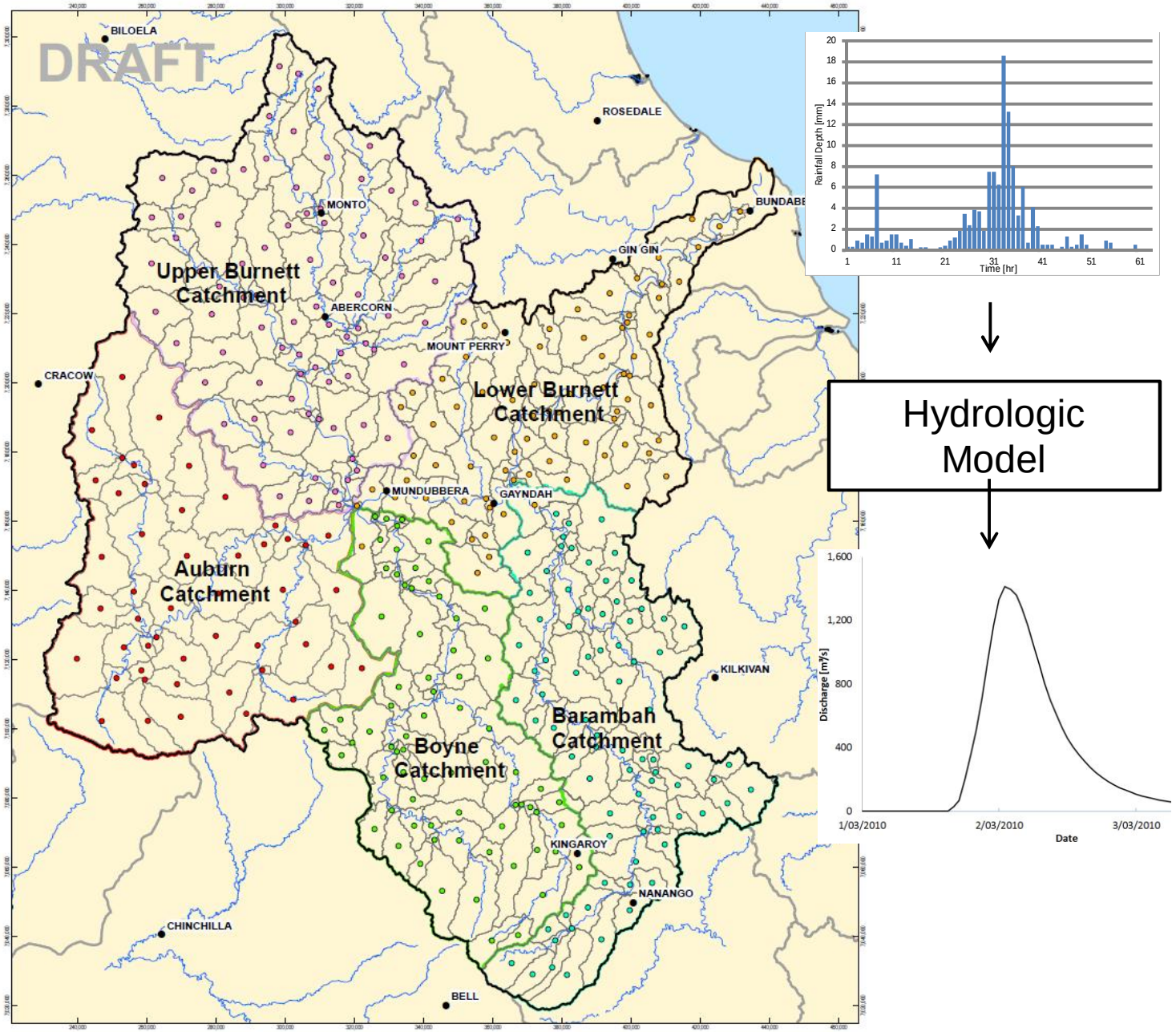
Hydrologic Modelling



Hydrologic Model

Hydrologic Model

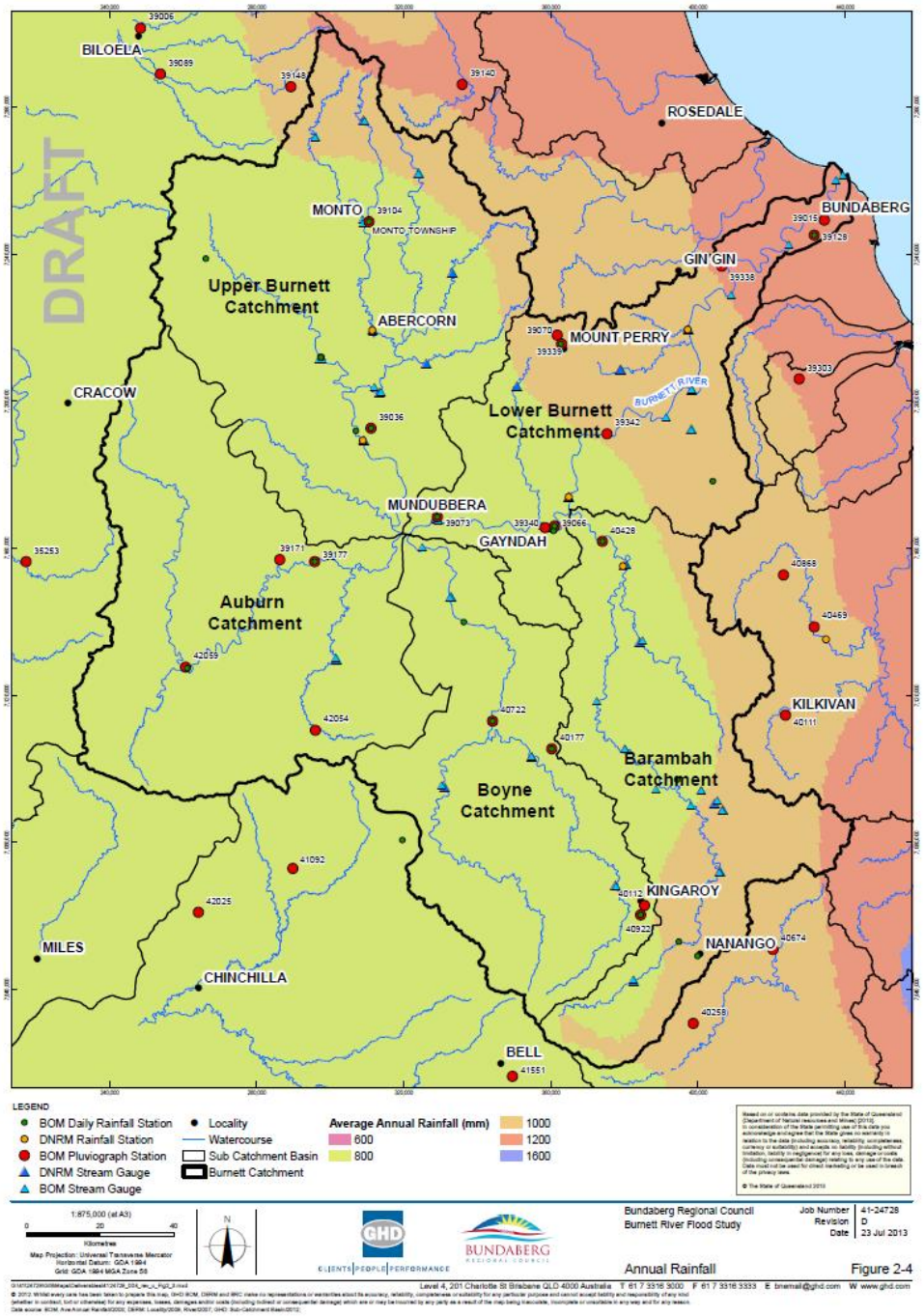


- 300 sub-catchments
- Each sub-catchment defined by:
- Area, Slope, Roughness, soil conditions
- Spatial & Temporal Rainfall Pattern
- Rainfall-in

↓

Flow Rate-out

Rainfall Gauges



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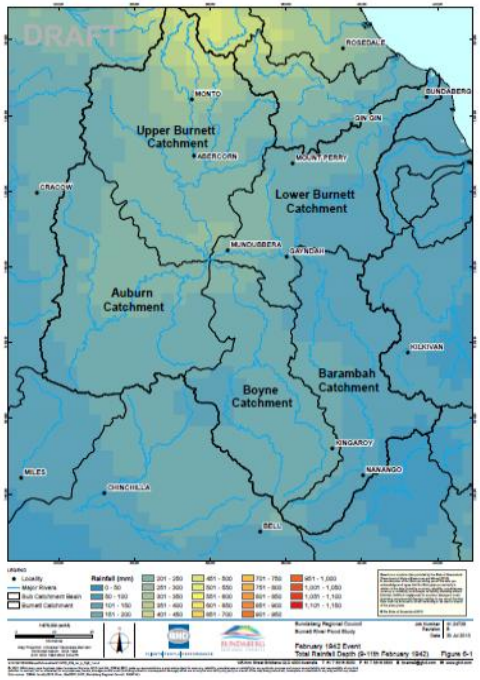
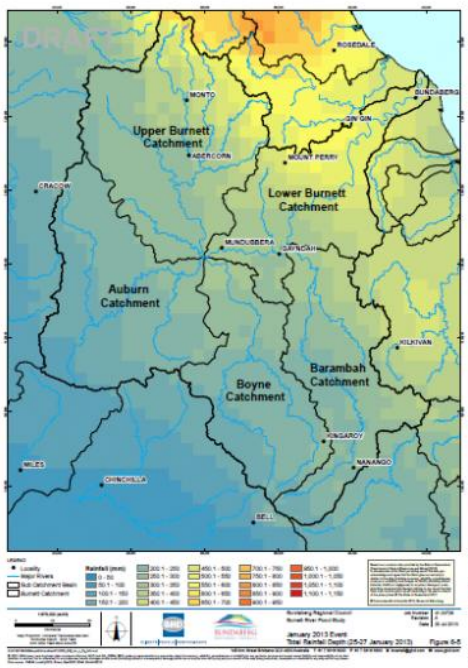
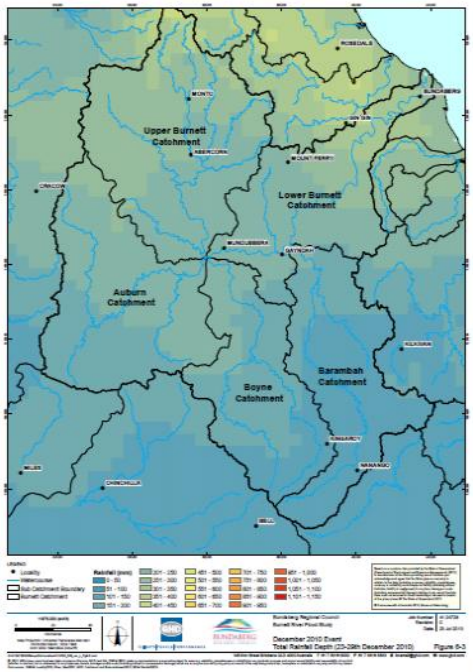
Calibration to Historical Events



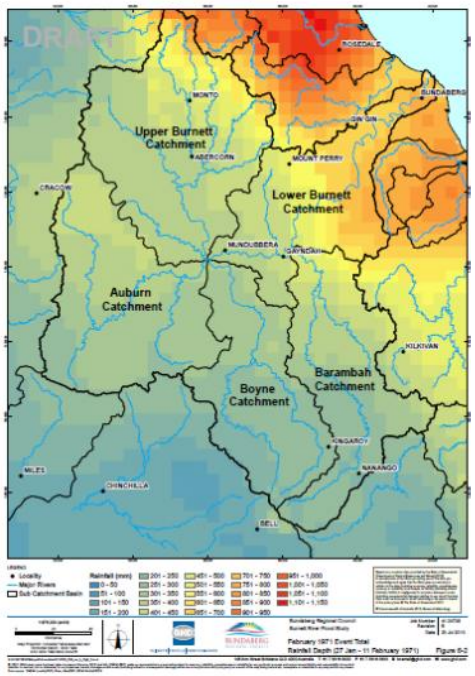
Feb 1942



Feb 1971



Dec 2010
&
Jan 2011



Jan 2013

Calibration to Historical Events

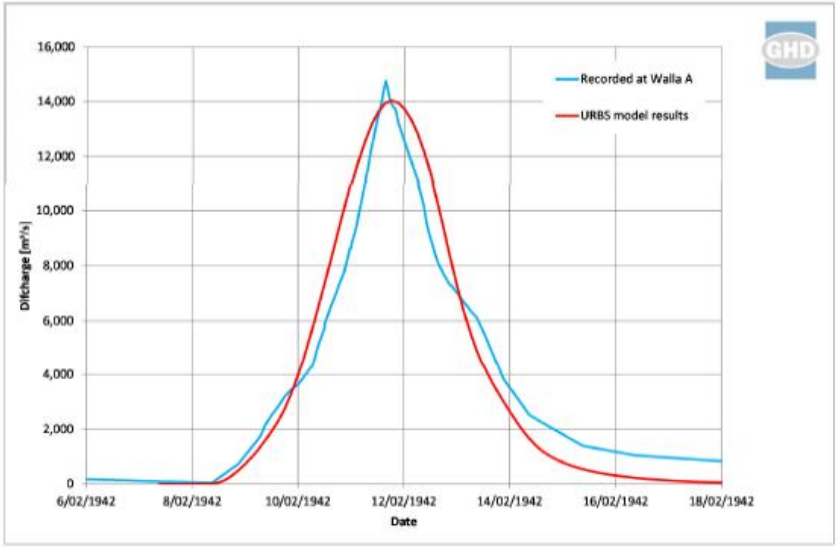


Figure 6-6 Comparison of Recorded and Modelled Flow Hydrographs at Walla, February 1942

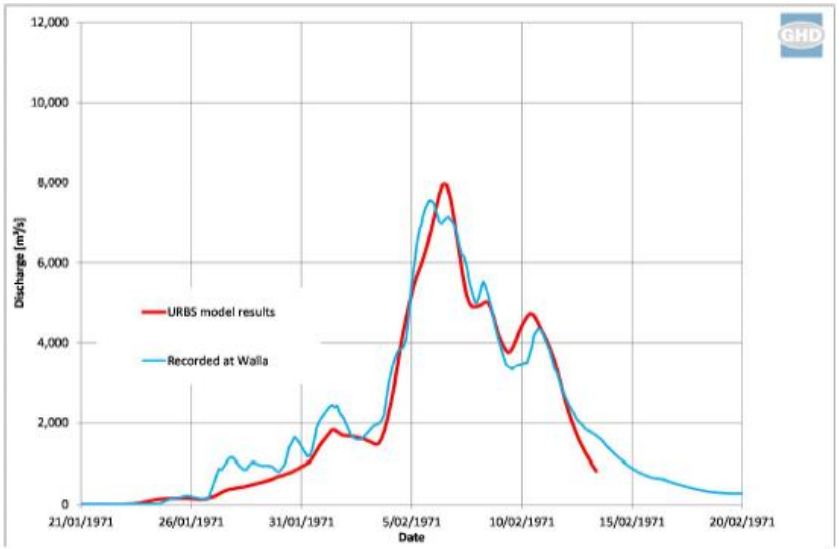


Figure 6-7 Comparison of Recorded and Modelled Flow Hydrographs at Walla, February 1971

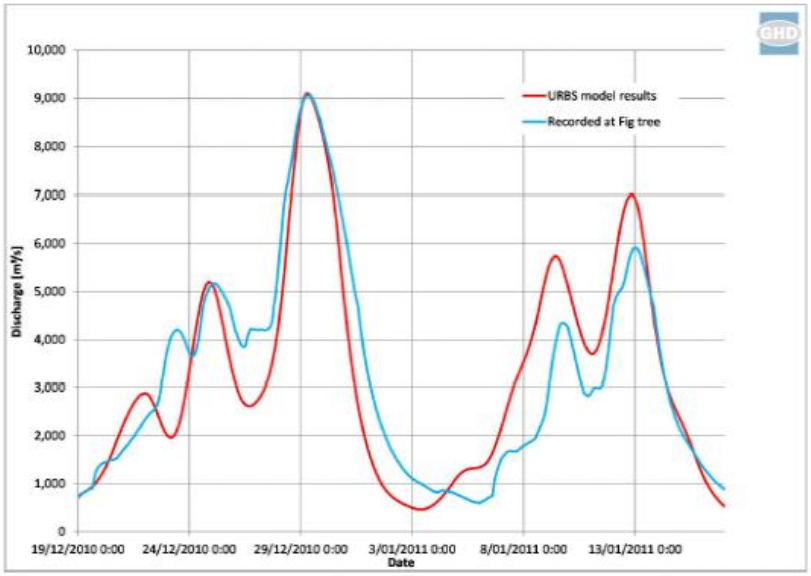


Figure 6-8 Comparison of Recorded and Modelled Flow Hydrographs at Figtree, December 2010-January 2011

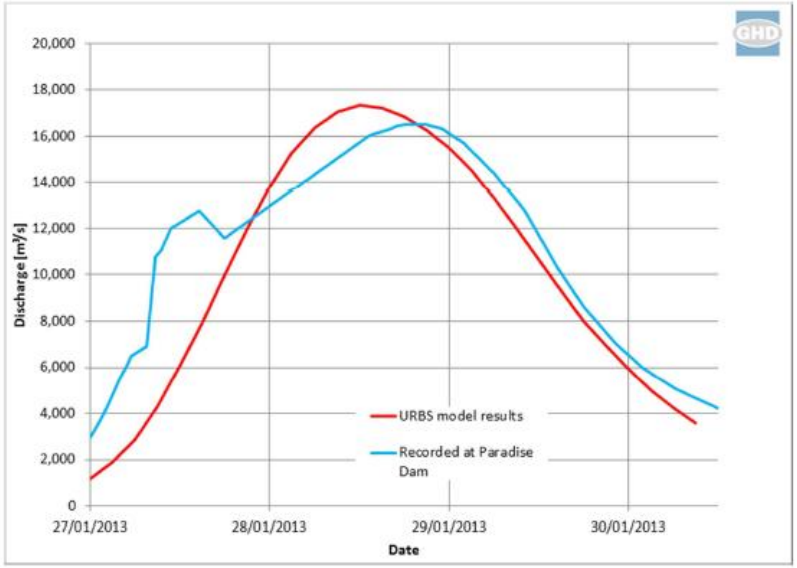


Figure 6-9 Comparison of Recorded and Modelled Flow Hydrographs at Paradise Dam , January 2013

Design Event Analysis

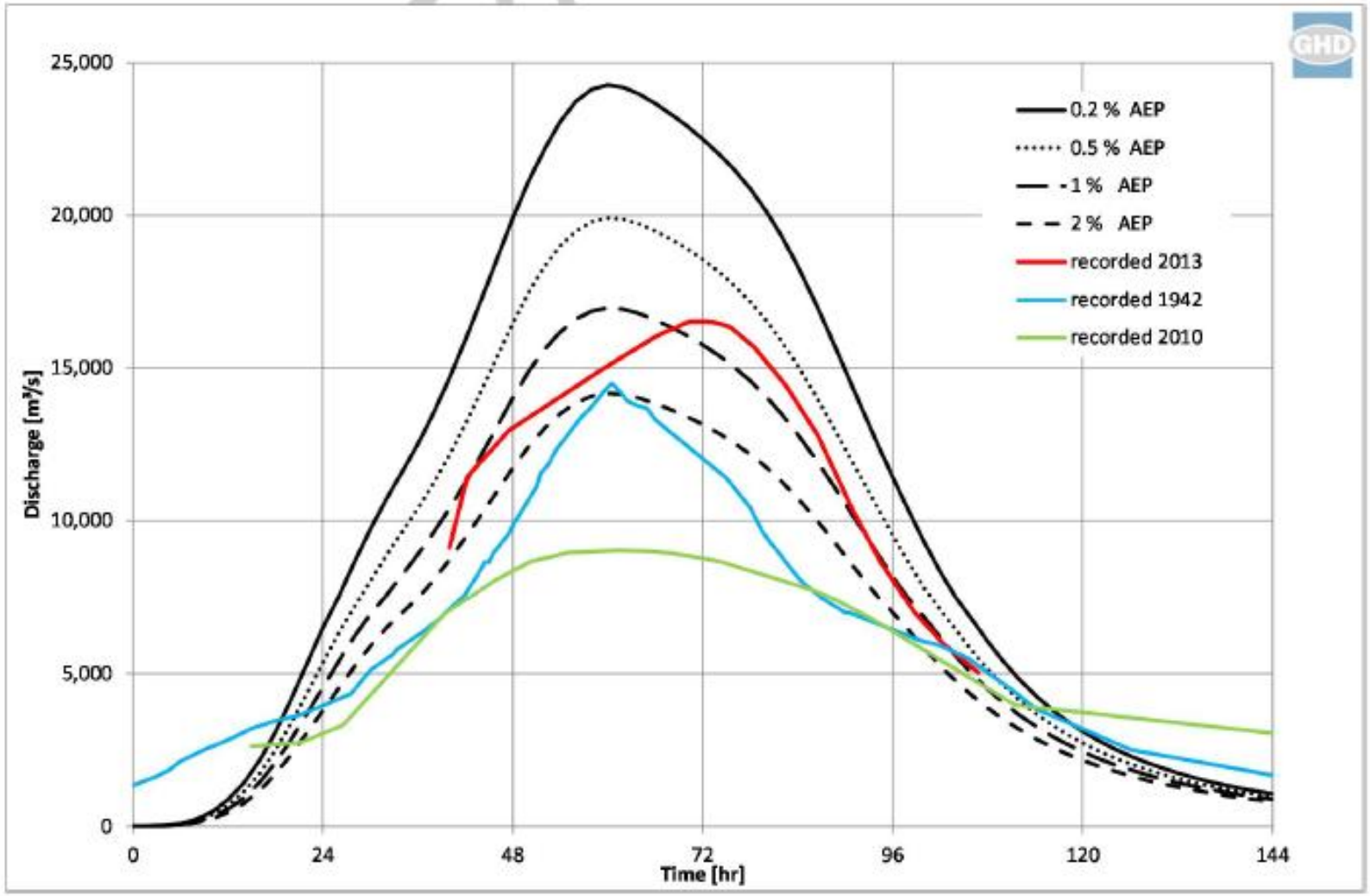


Figure 9-2 Adopted Design Event Hydrographs

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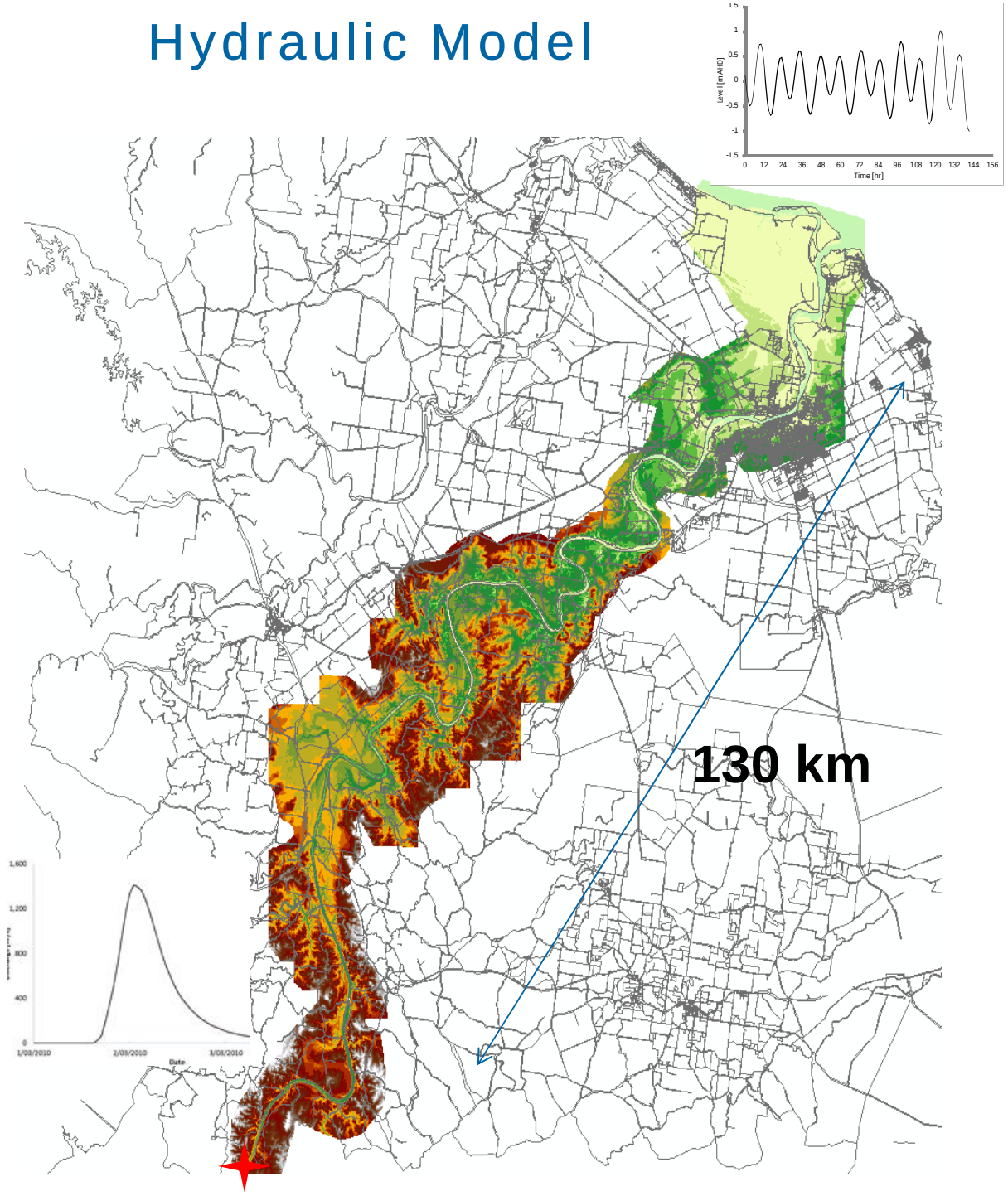
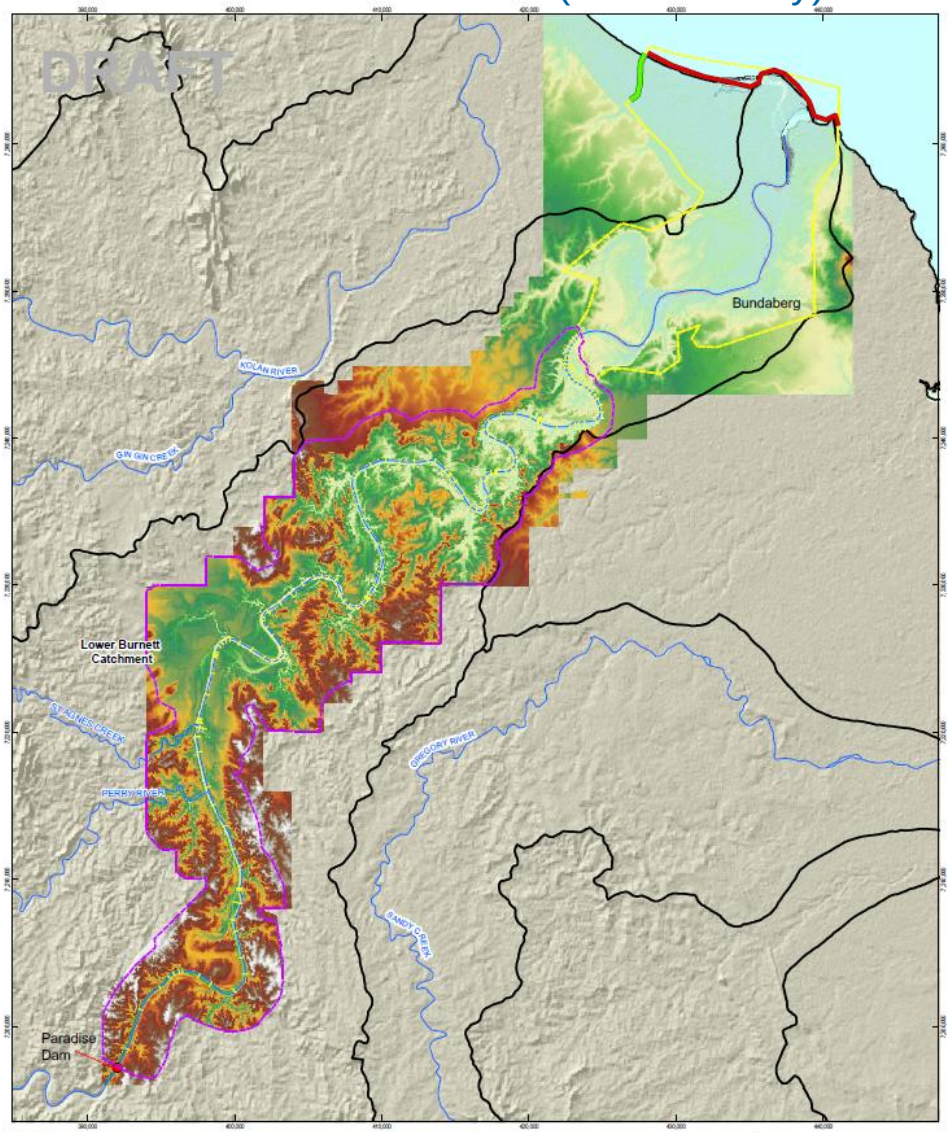
Hydraulic Modelling

Hydraulic Model

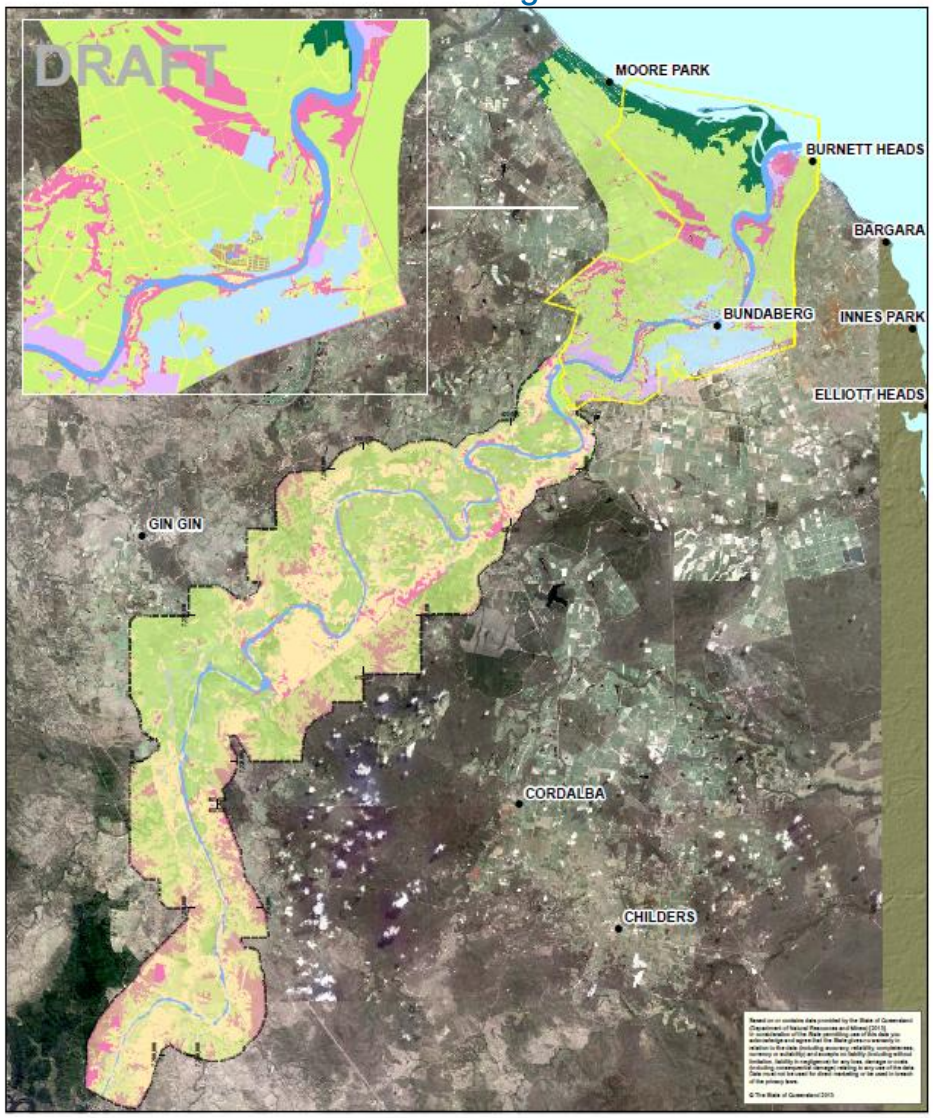


- 2 dimensional dynamic hydraulic model
- 3D DEM represented by a 15 m grid cell
- Upstream boundary uses inflow hydrograph from hydrological model
- Downstream tidal boundary
- Flood characteristic such as flood level, velocity & hazard in the 2D model area are determined numerically at each time step
- Nested Model

River & Ground Levels (from survey)



Ground Roughness



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1942 Event

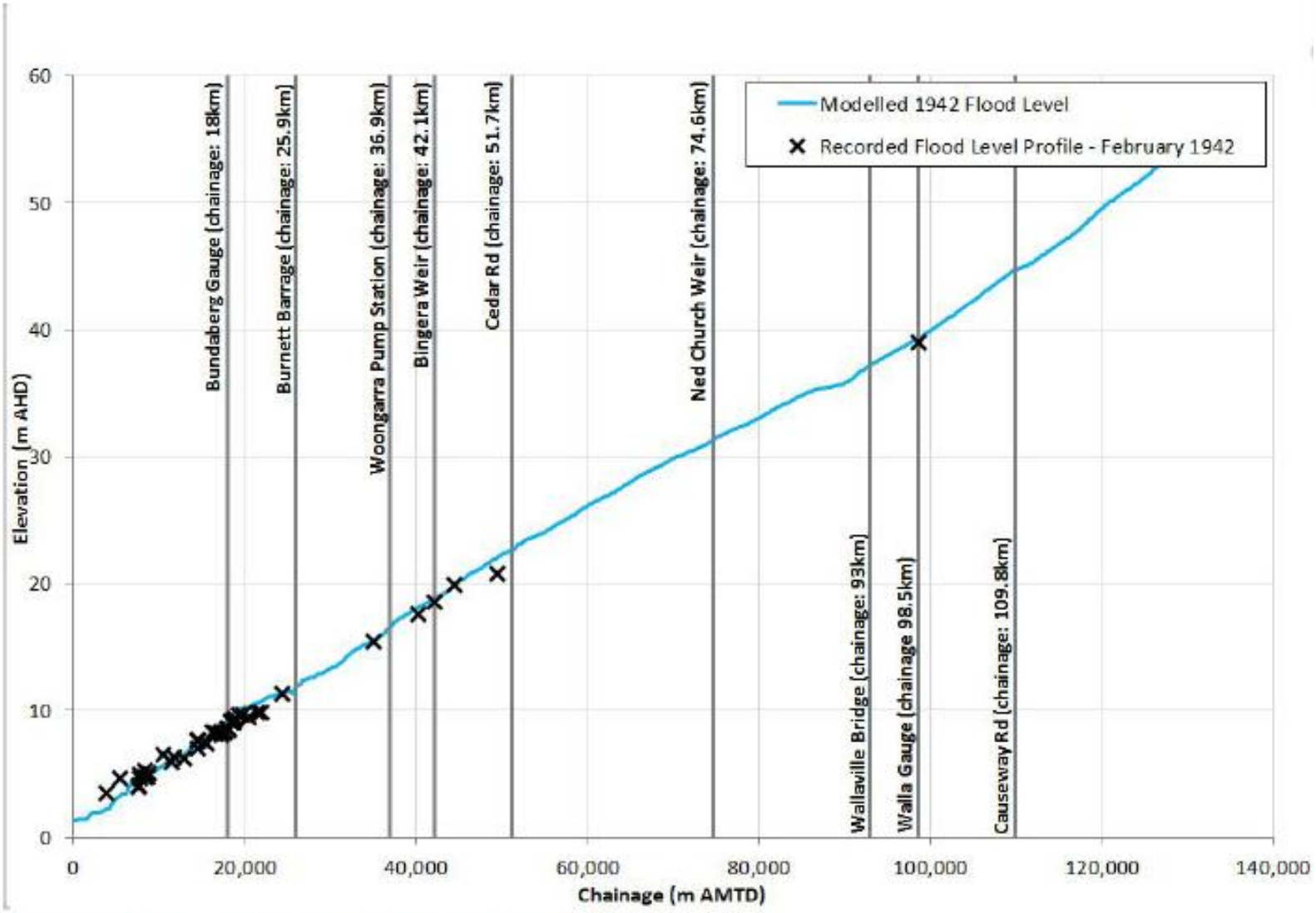

Figure 8-10 Longitudinal Flood Profile, February 1942

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1971 Event

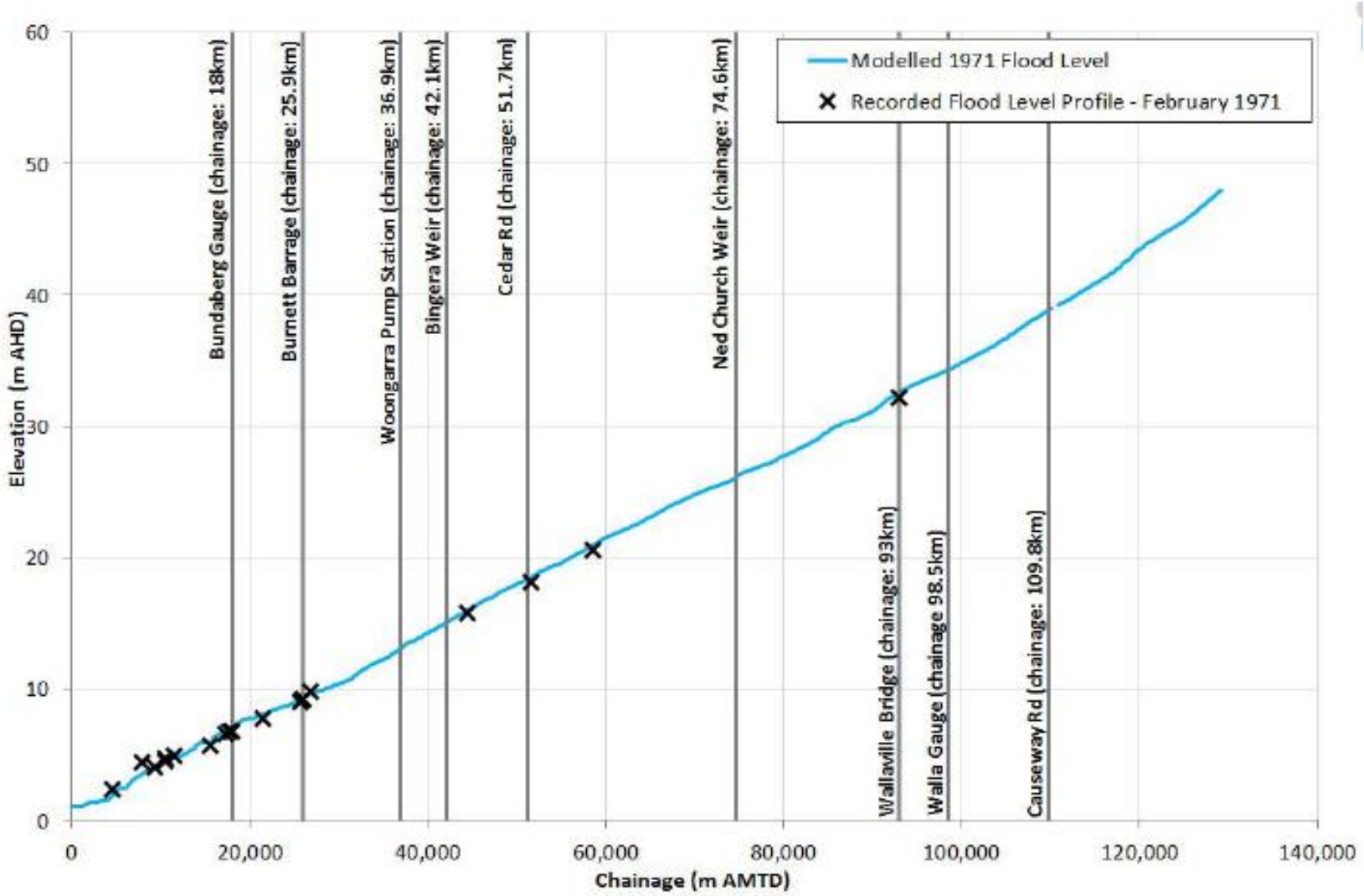

Figure 8-4 Longitudinal Flood Profile, February 1971

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2010 Event

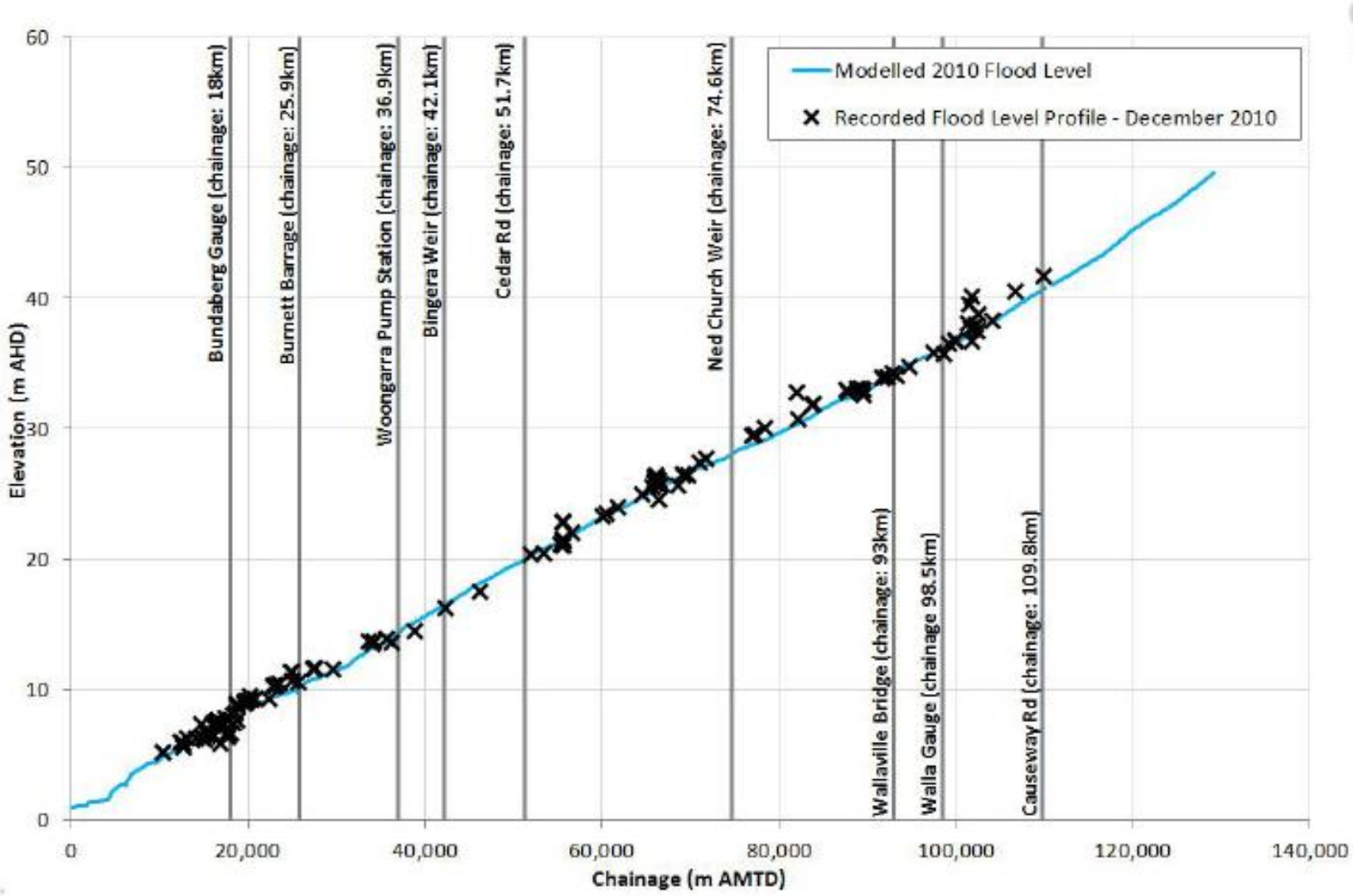

Figure 8-6 Longitudinal Flood Profile, December 2010

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2013 Event

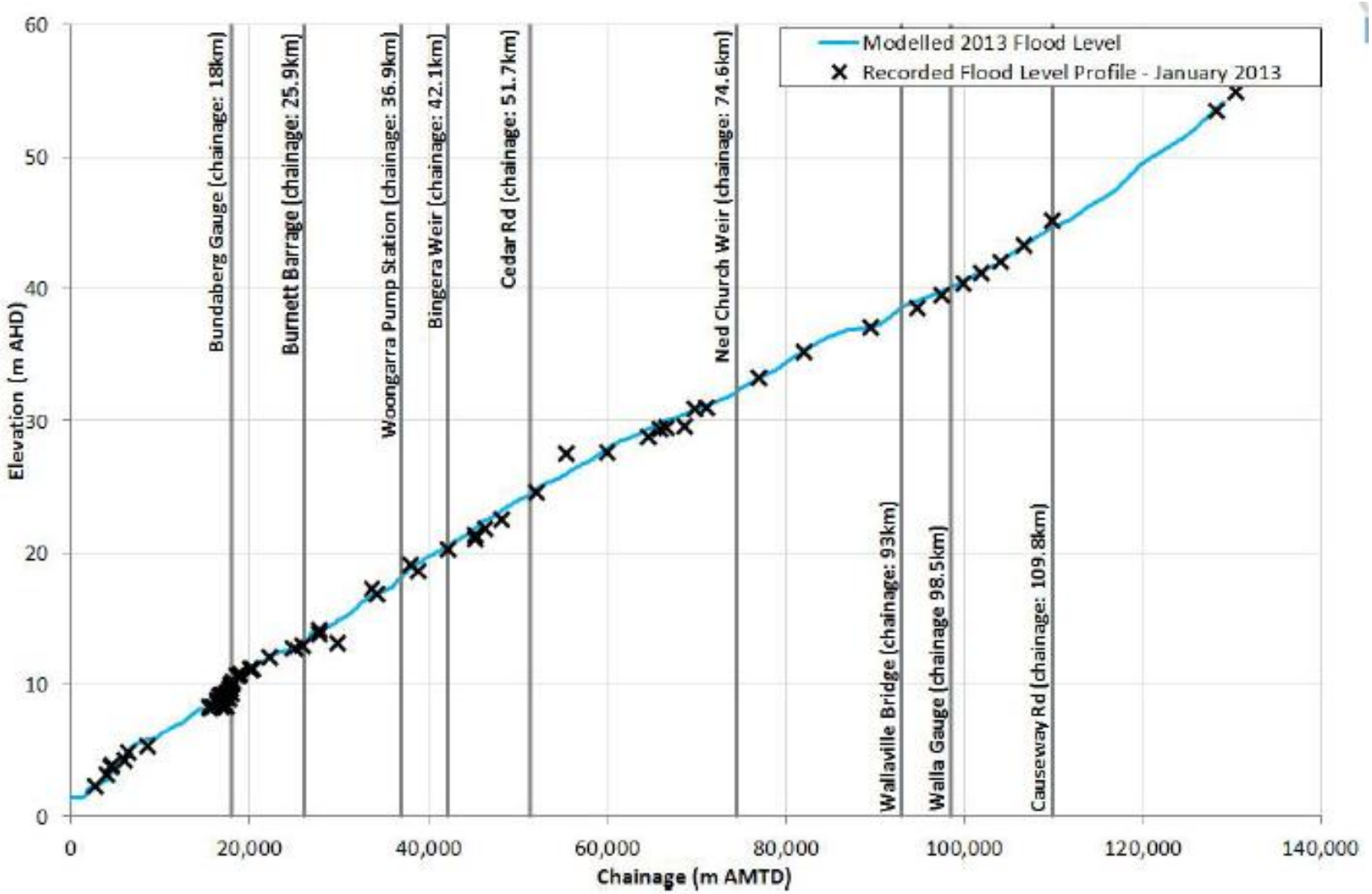

Figure 8-2 Longitudinal Flood Profile, January 2013

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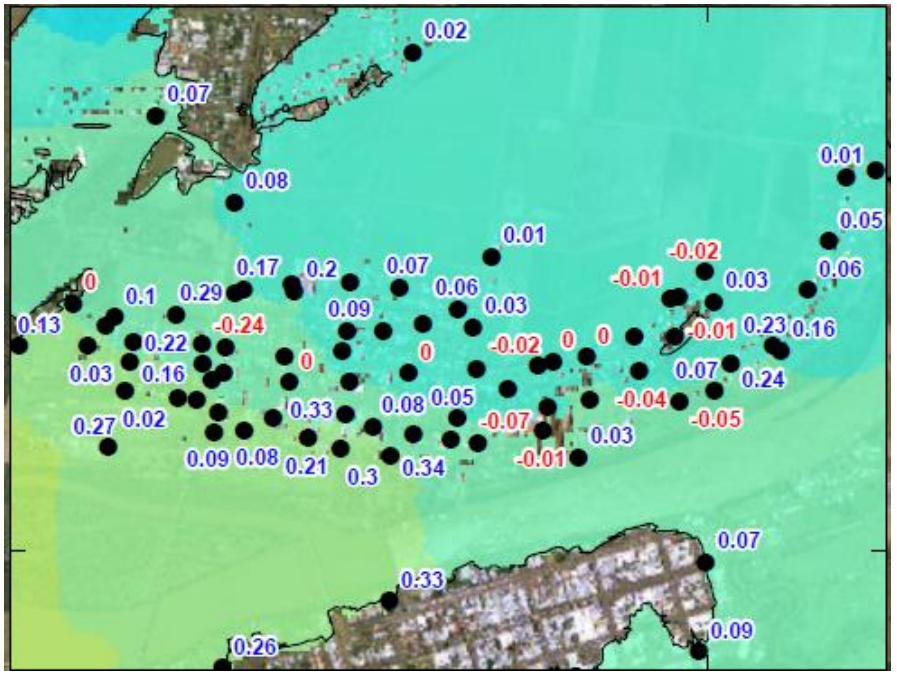
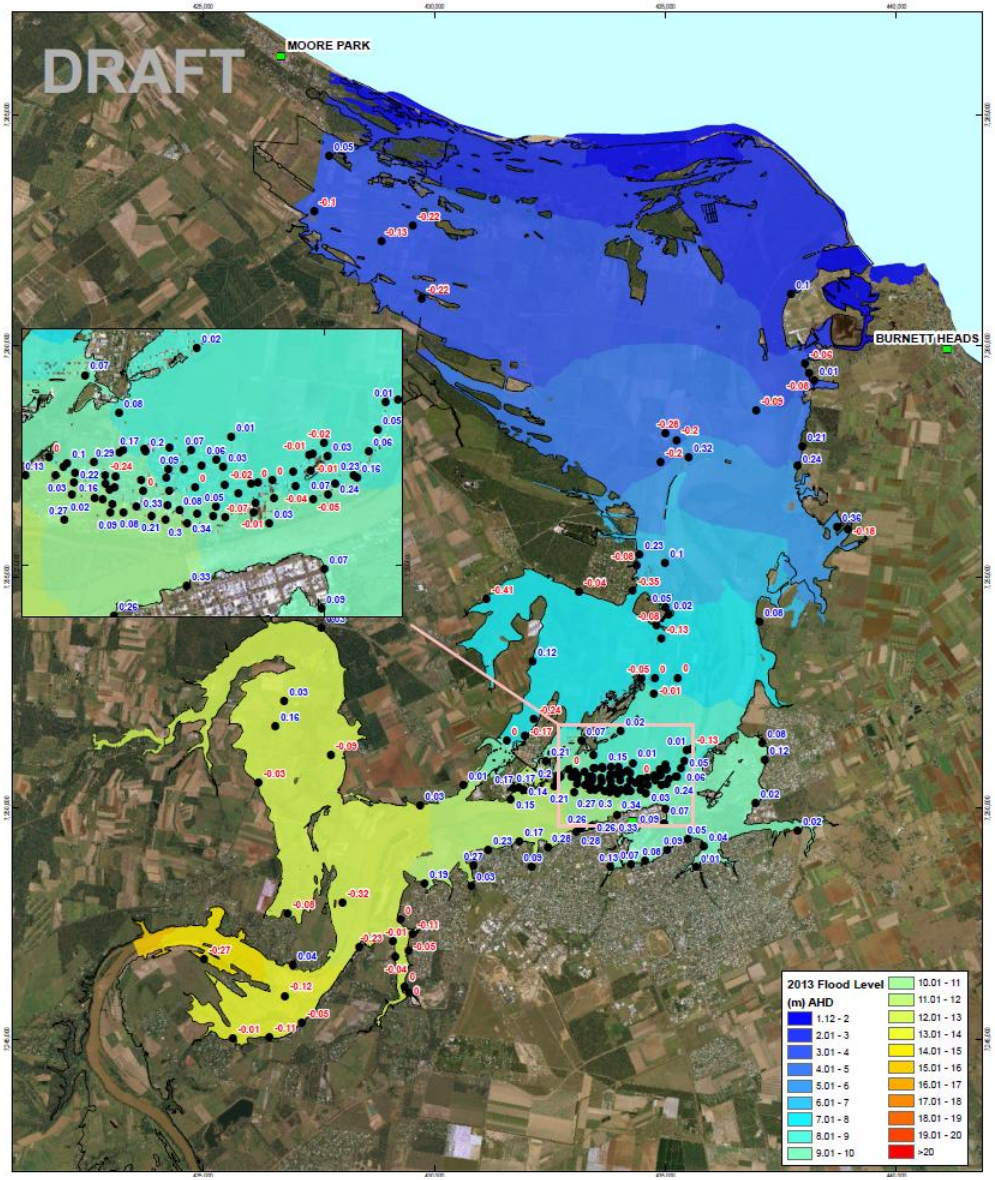
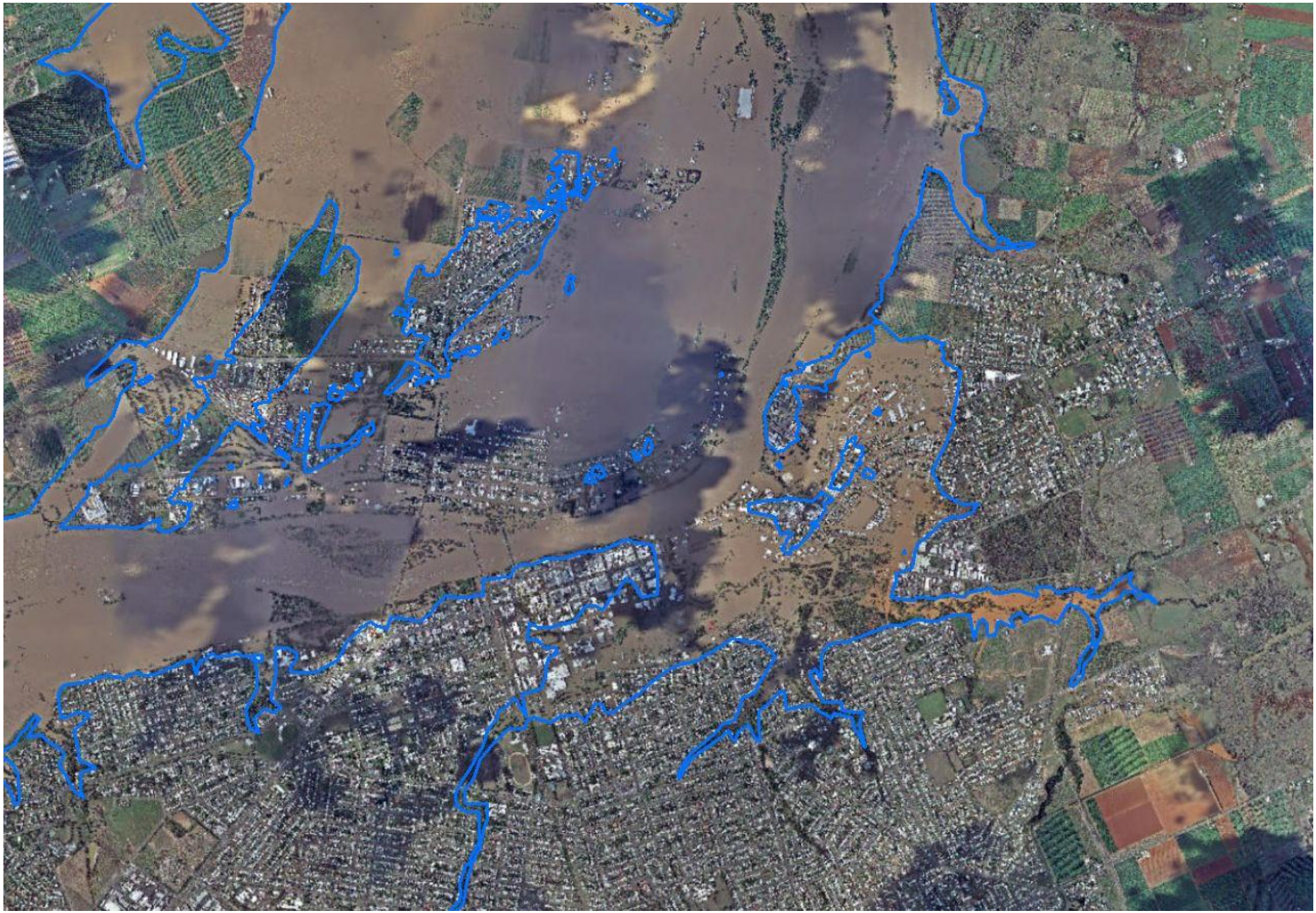
2013 Event Flood Level Differences







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2013 Flood Animation

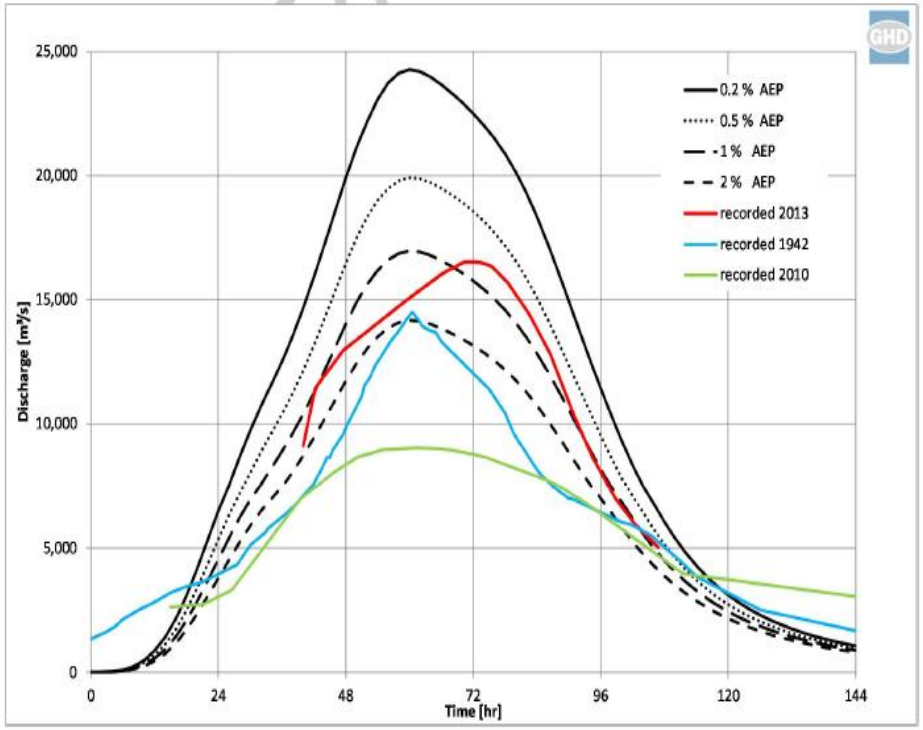
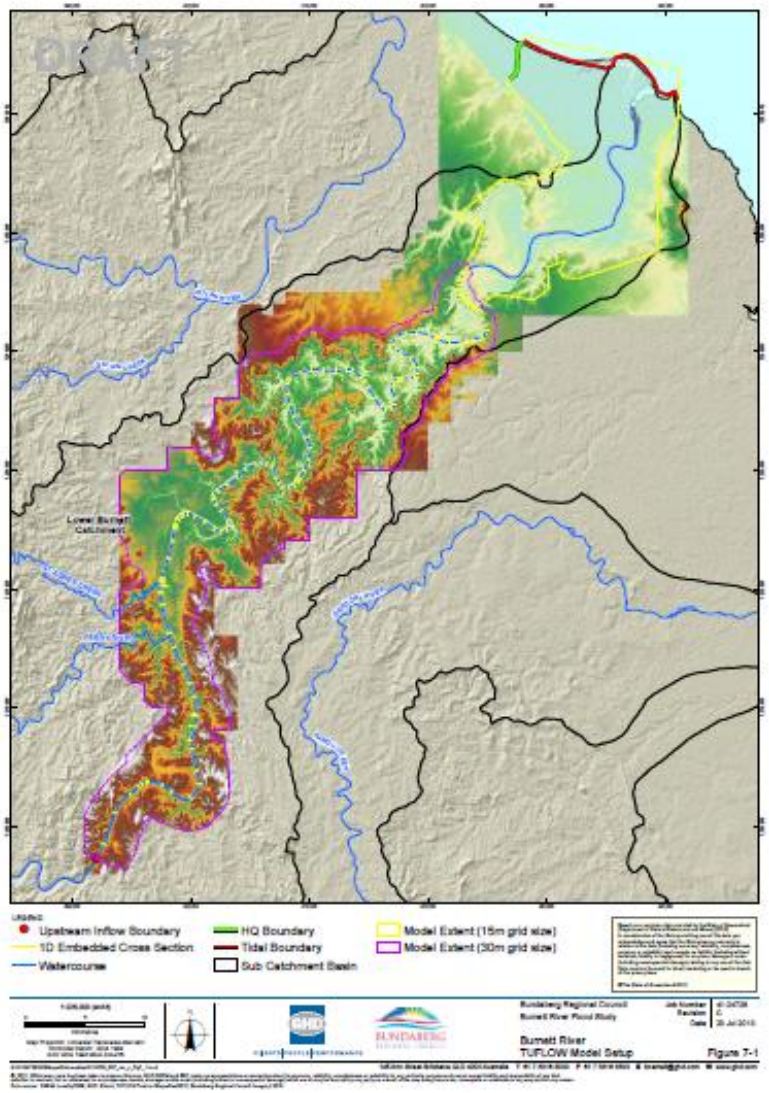


Figure 9-2 Adopted Design Event Hydrographs



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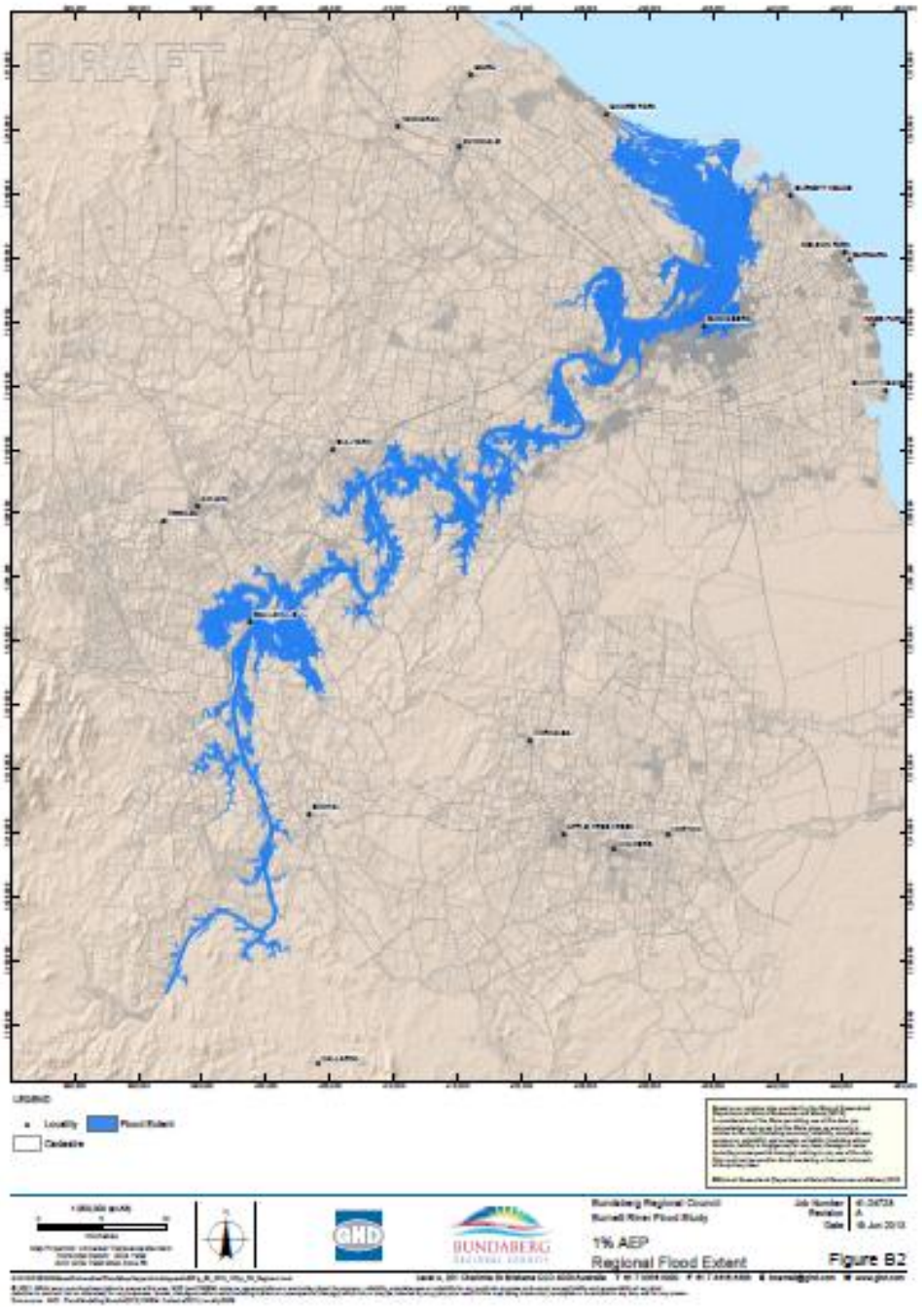
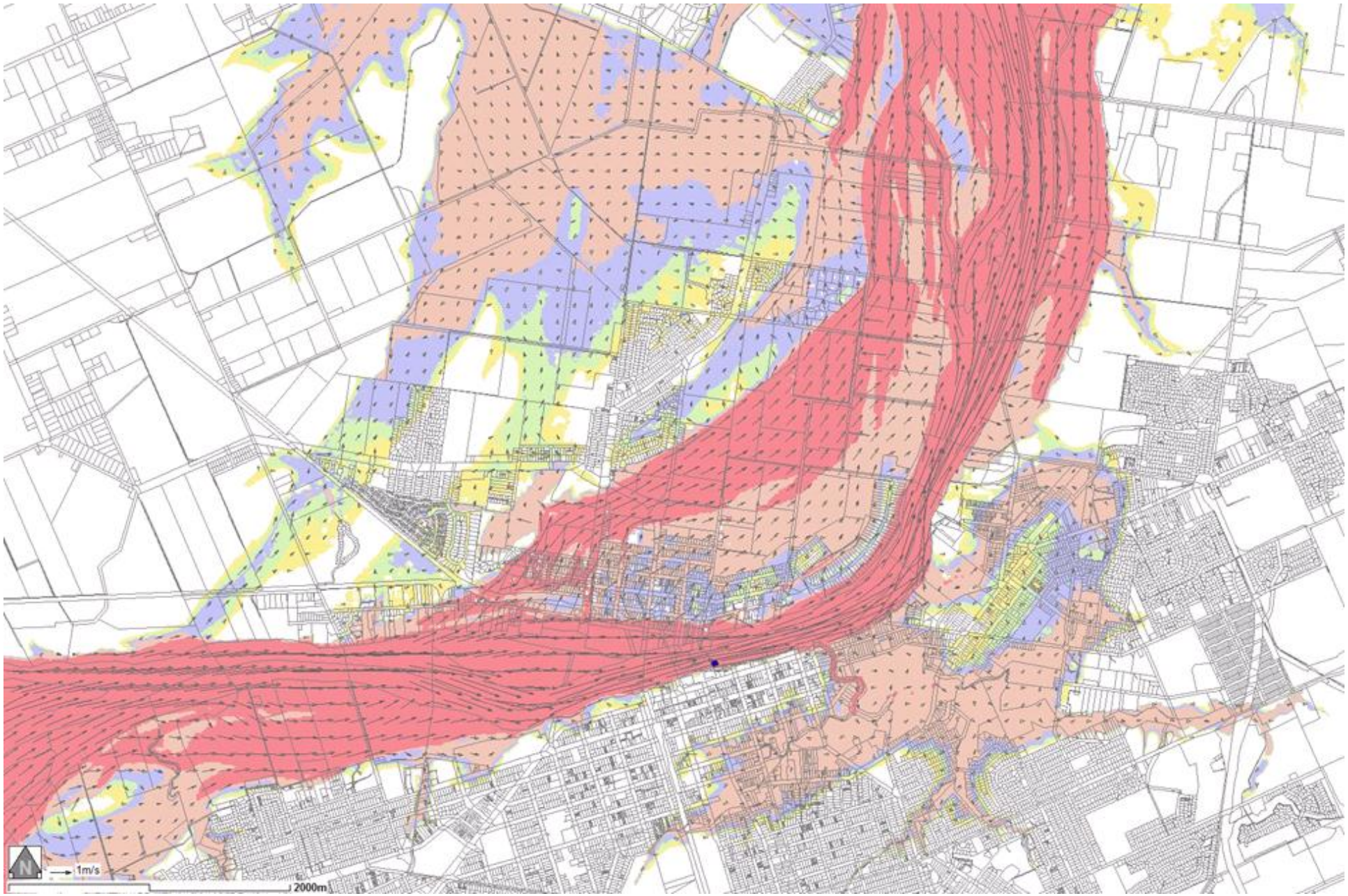
- Design Event
- Flood Extents,
- Flood Levels
- Flood Depths
- Flood Velocities
- Flood Hazard





1% AEP Design Event Flood Vectors

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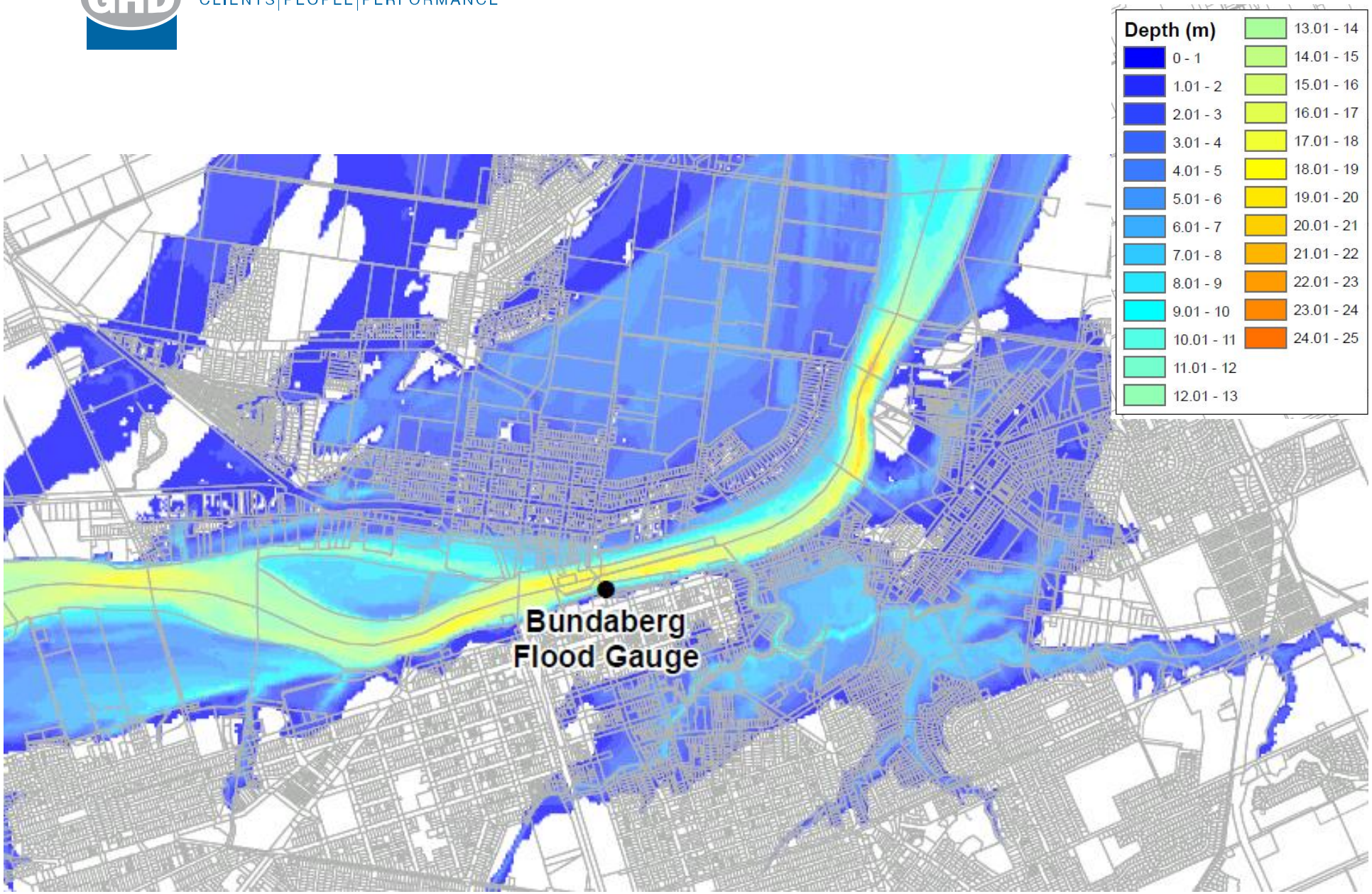
1% AEP Flood Depths



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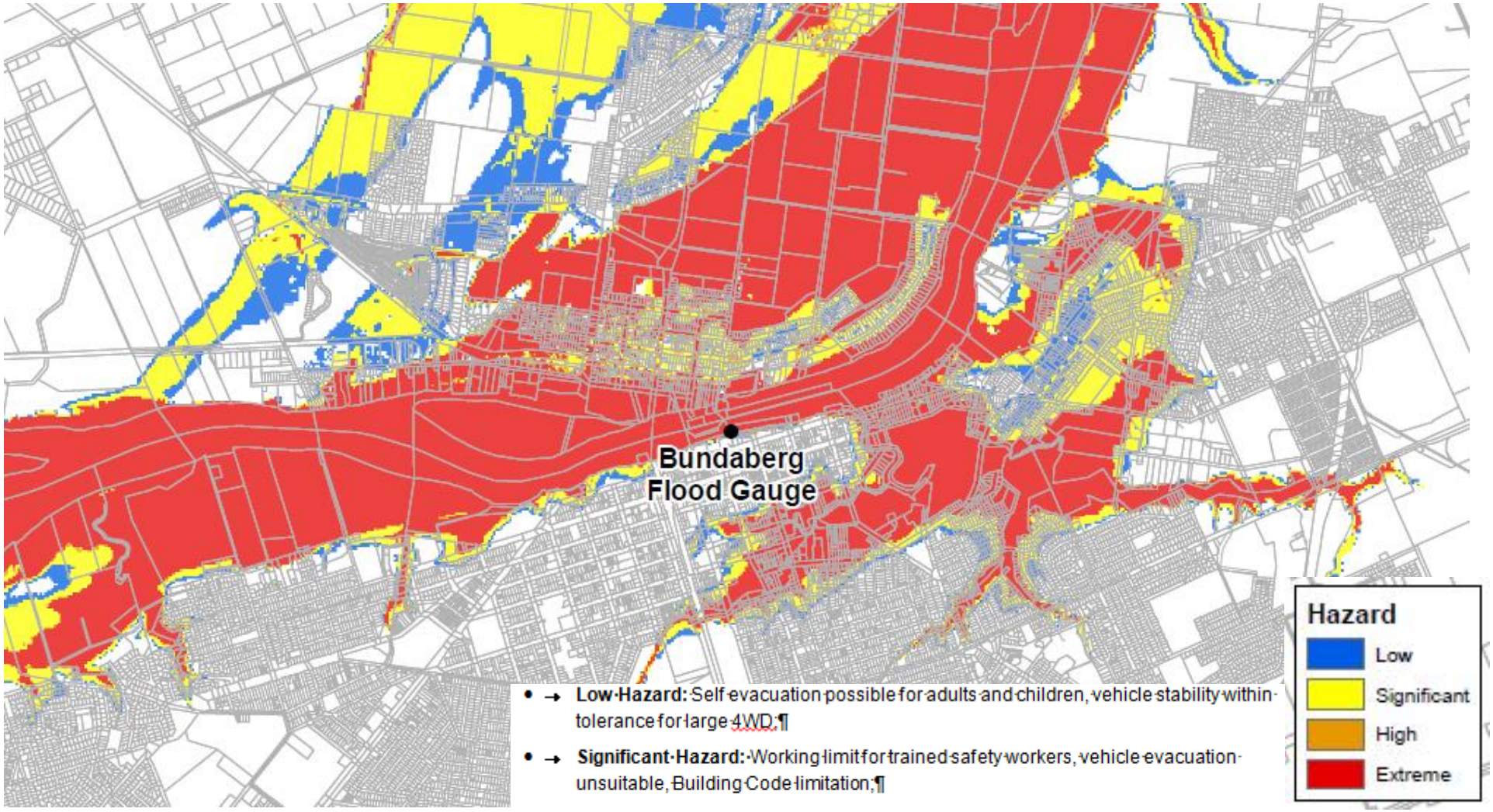
2013 Like Event Design Event Flood Hazard



- → **Low·Hazard:** Self·evacuation·possible for·adults·and·children, vehicle·stability·within· tolerance for·large·4WD;¶
- → **Significant·Hazard:** ·Working·limit for·trained·safety·workers, vehicle·evacuation· unsuitable, Building·Code·limitation;¶
- → **High·Hazard:** Limit·of·uncompromised·stability for·adults·(dangerous to·most);·and¶
- → **Extreme·Hazard:** In·excess·of·known·stability·limits.¶

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Sensitivity Analysis

- Rainfall Patterns
- Soil Loss Rates
- Dam Levels
- River Bed Levels
- Tide
- Climate Change

- Floodplain Management Measures (e.g. levees, dredging etc)

3. Floodplain Action Plan

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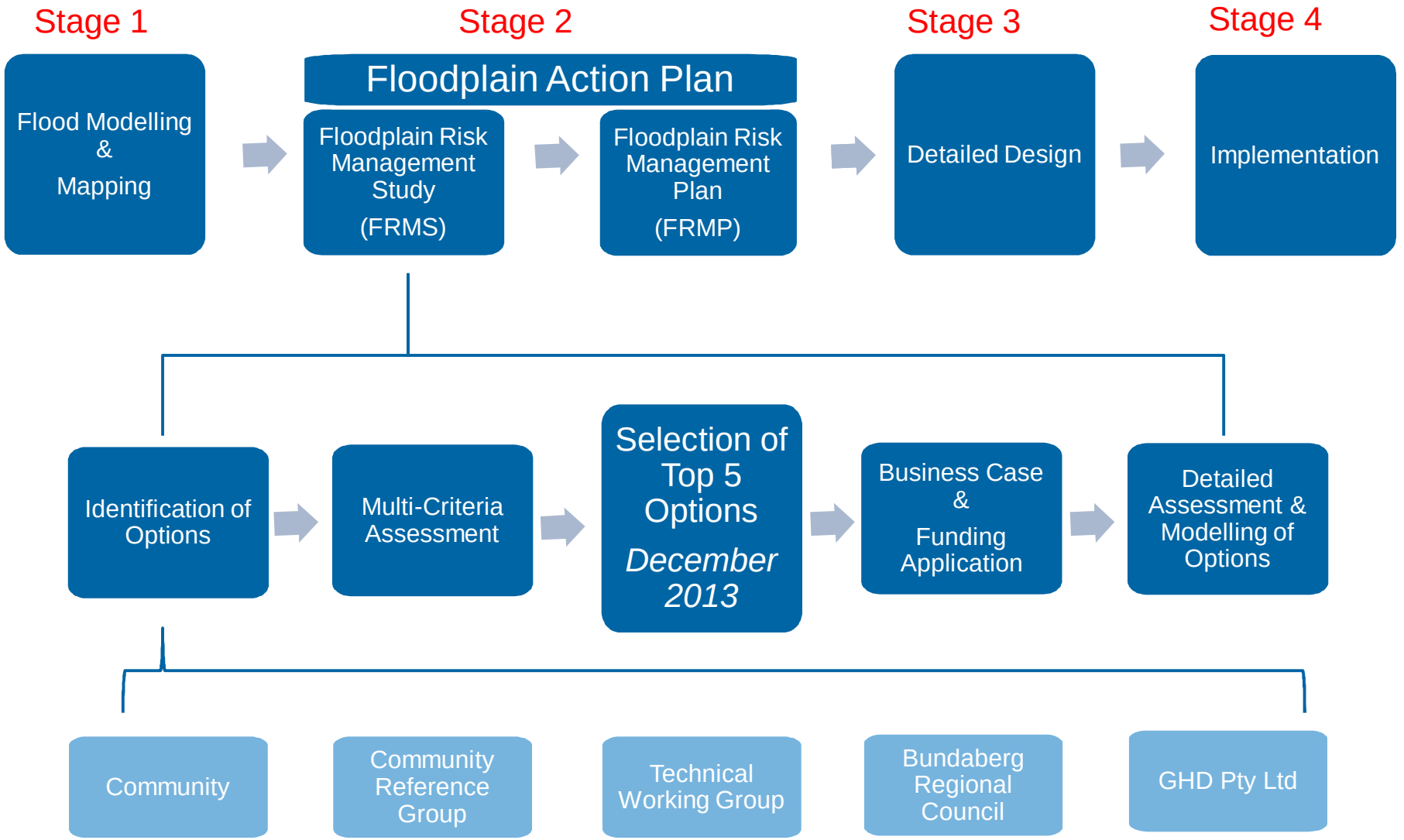
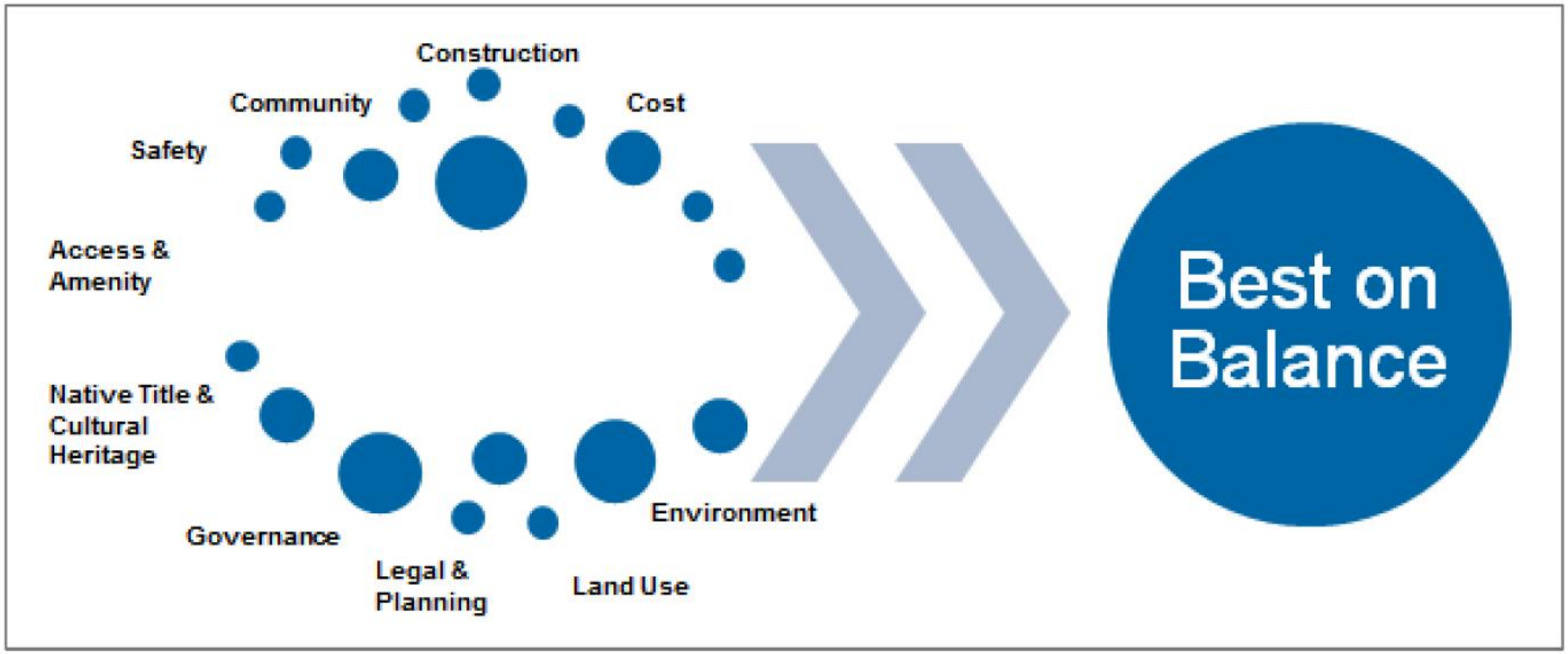
Floodplain Action Plan - The Process



Multi Criteria Analysis (MCA) Process

A process for a non-biased rigorous assessment of floodplain management options.



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Floodplain Management Measures

Floodplain Management Measure	Aim
Land Use Planning Controls	Keeping people away from water
Structural Mitigation	Keeping water away from people
Development and Building Controls	Reducing the risk of inundation and amount of damage when the DFE event is exceeded
Flood Emergency Measures	Improving Flood Warning Systems Teaching people what to do

Best Practice Recommendations

The completion of a FRMS and development of a FRMP is consistent with a number of recommendations in the recent **Queensland Flood Commission of Inquiry** including:

Recommendation 2.12 Councils in floodplain areas should, resources allowing, develop comprehensive floodplain management plans that accord as closely as practicable with best practice principles;

The undertaking of such a comprehensive FRMS and FRMP is also consistent with the best practice floodplain management philosophies inherent in the following guidelines:

Floodplain Management Australia: Best Practice Principles, Standing Committee on Agriculture and Resource Management (SCARM Report 73, 2000);

The draft guideline produced by the Queensland Reconstruction Authority *Planning for stronger, more resilient floodplains: Part 2;* Managing the Floodplain, Emergency Management Australia Manual 19, Attorney-General's
Department, 1999.

Natural Hazards in Australia: Identifying Risk Analysis Requirements, National Flood Risk Advisory Group, 2007.

NSW Floodplain Development Manual: The management of flood liable land, NSW Department of Infrastructure, Planning and Natural Resources April 2005

4. Key Outputs

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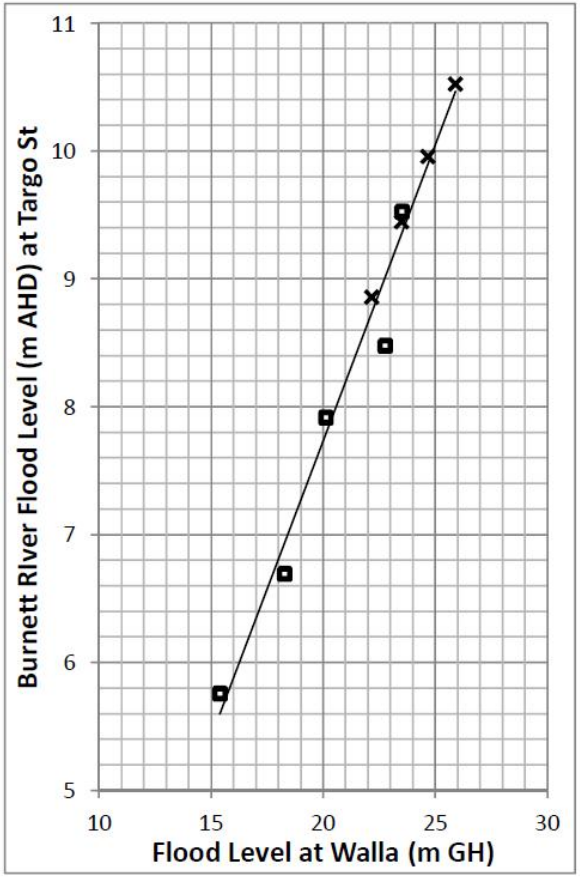
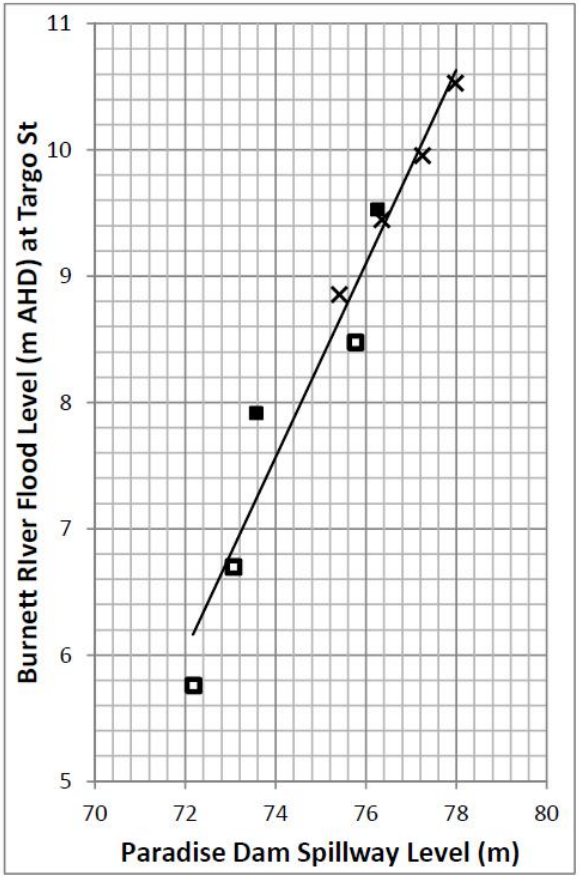
Key Outputs

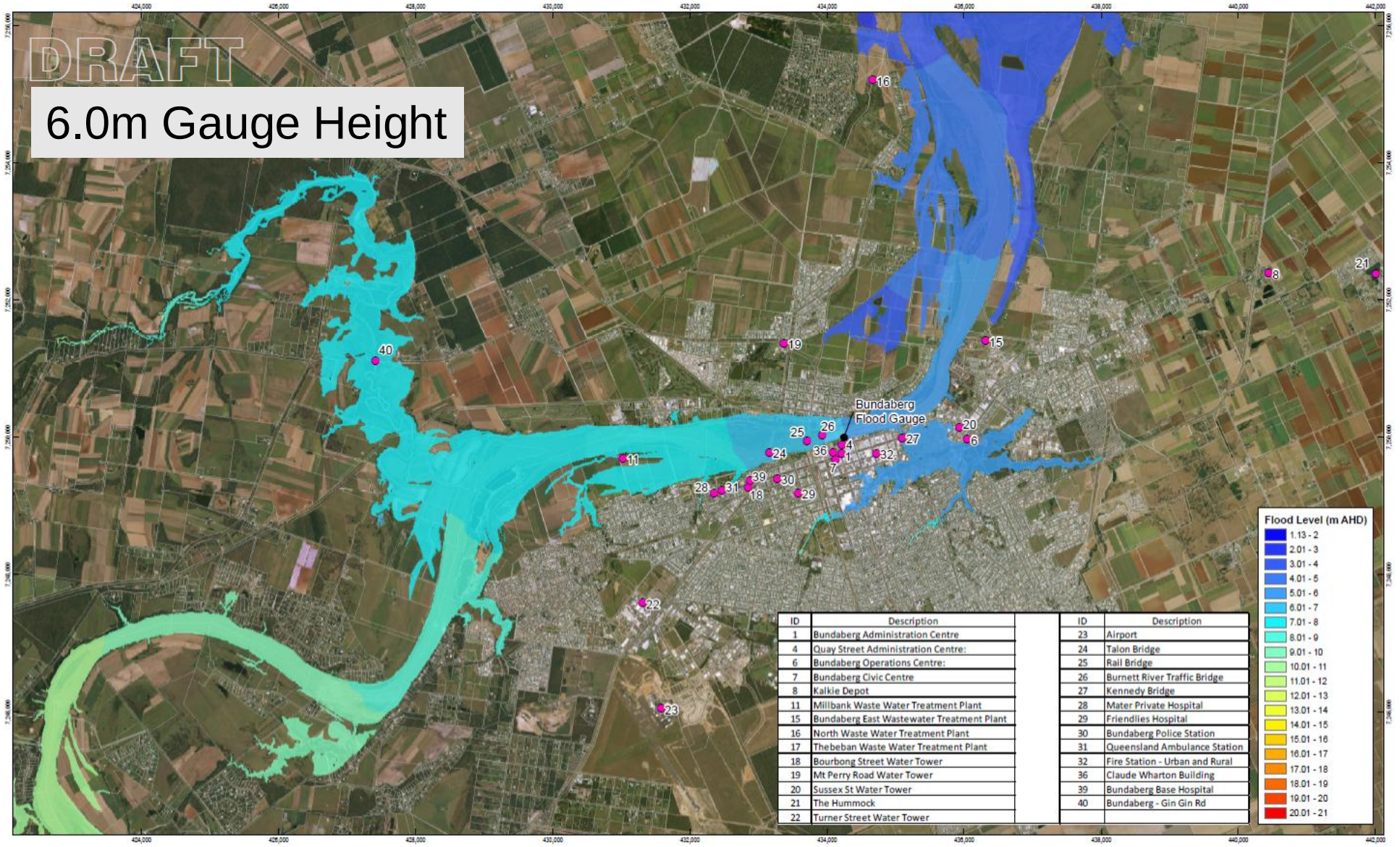
In addition to determining the Top 5 Options:

- Flood Models to test floodplain management options, future developments etc
- Flood Level (& Depth) Warning Maps (at Incremental Gauge Heights) & Fact Sheet
- Flood Time to Peak Maps and Graphs;
- Evacuation Maps (illustrating main evacuation routes)
- Flood Risk Maps (illustrating areas with different levels of flood hazard)
- Improved Property Flood Search Database
- Guidelines for mitigating flood induced scour on dwellings

Flood Warning Maps - Gauge Relationships

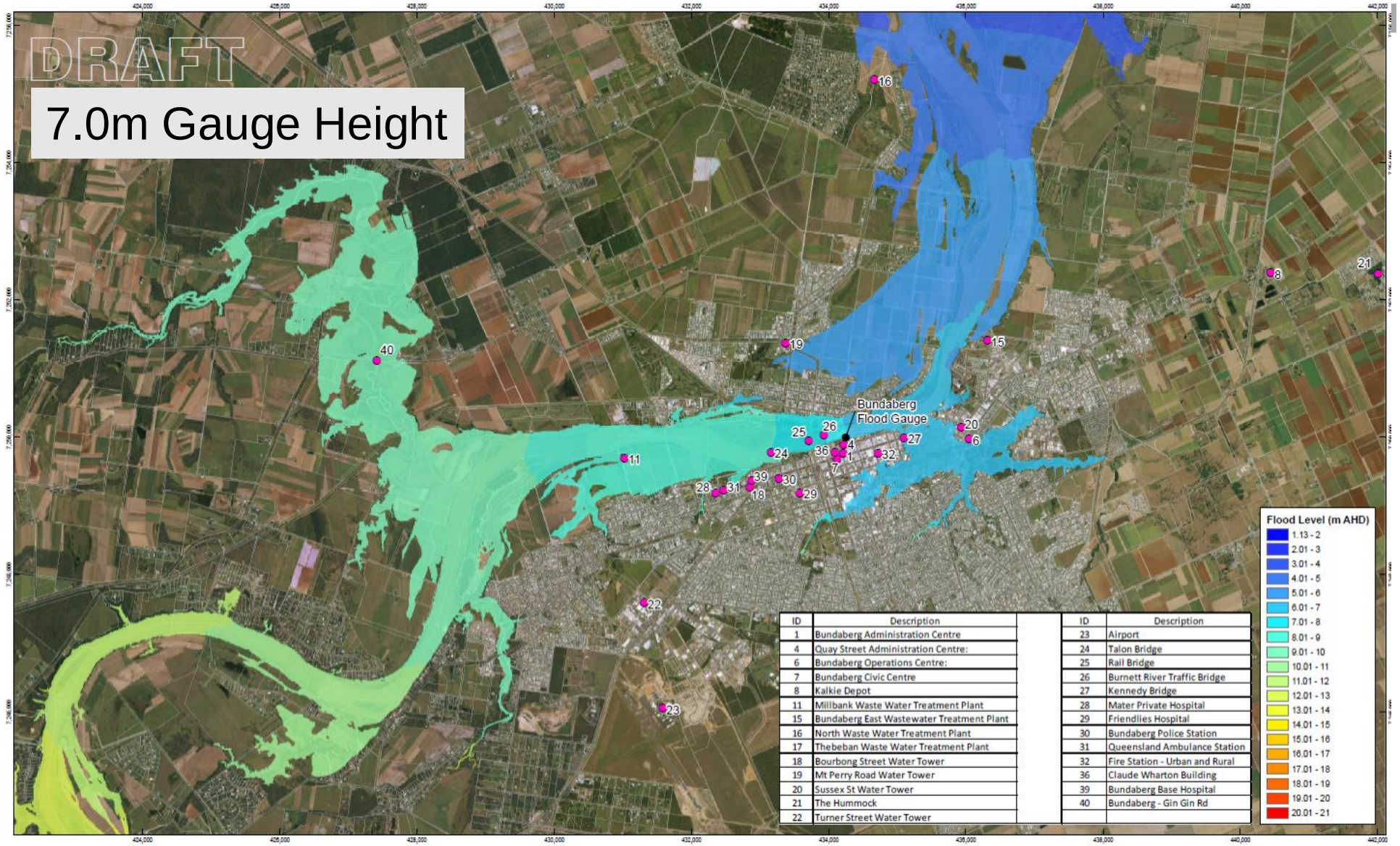






ID	Description
1	Bundaberg Administration Centre
4	Quay Street Administration Centre:
6	Bundaberg Operations Centre:
7	Bundaberg Civic Centre
8	Kalkie Depot
11	Millbank Waste Water Treatment Plant
15	Bundaberg East Wastewater Treatment Plant
16	North Waste Water Treatment Plant
17	Thebeban Waste Water Treatment Plant
18	Bourbong Street Water Tower
19	Mt Perry Road Water Tower
20	Sussex St Water Tower
21	The Hummock
22	Turner Street Water Tower

ID	Description
23	Airport
24	Talon Bridge
25	Rail Bridge
26	Burnett River Traffic Bridge
27	Kennedy Bridge
28	Mater Private Hospital
29	Friendlies Hospital
30	Bundaberg Police Station
31	Queensland Ambulance Station
32	Fire Station - Urban and Rural
36	Claude Wharton Building
39	Bundaberg Base Hospital
40	Bundaberg - Gin Gin Rd



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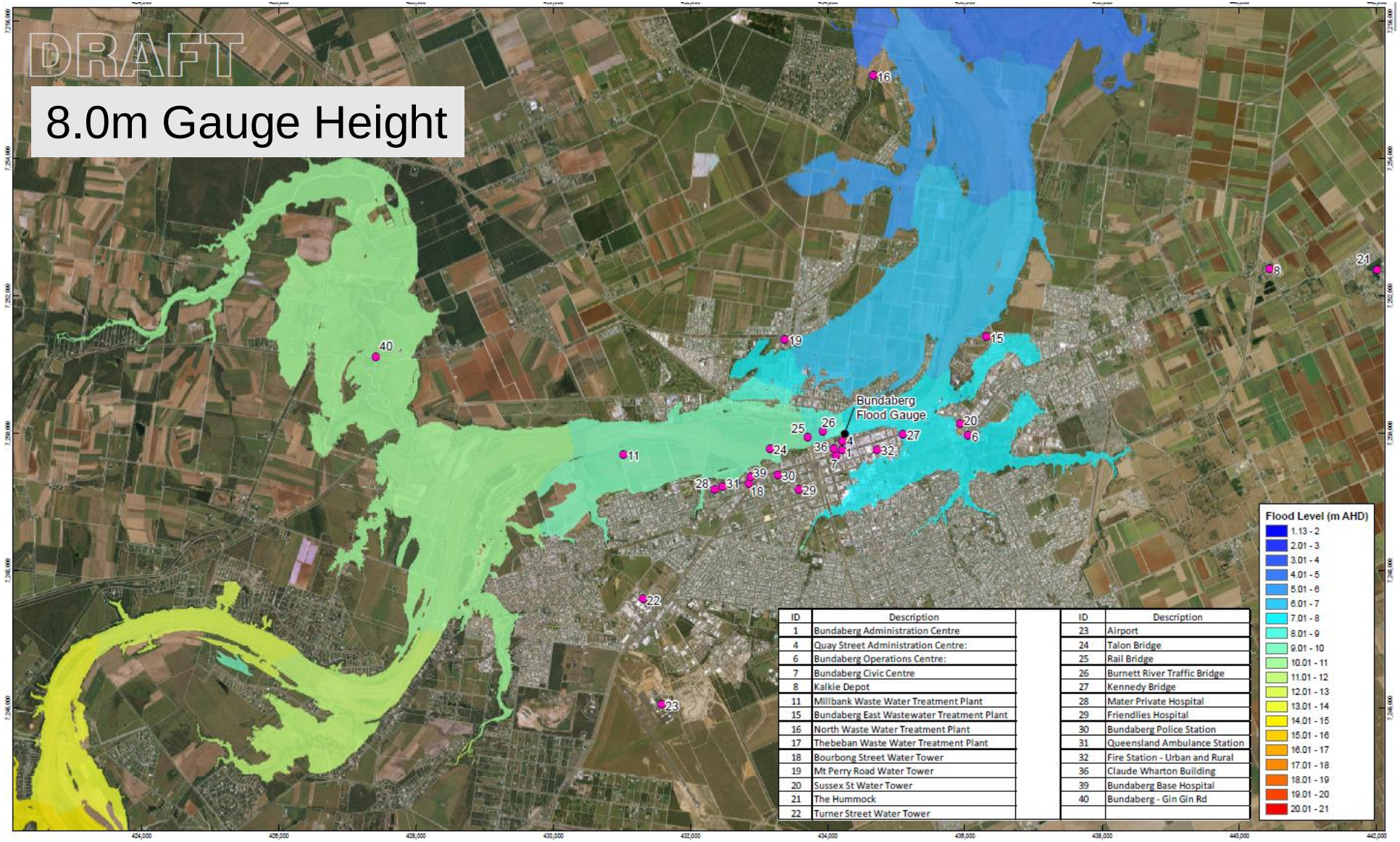

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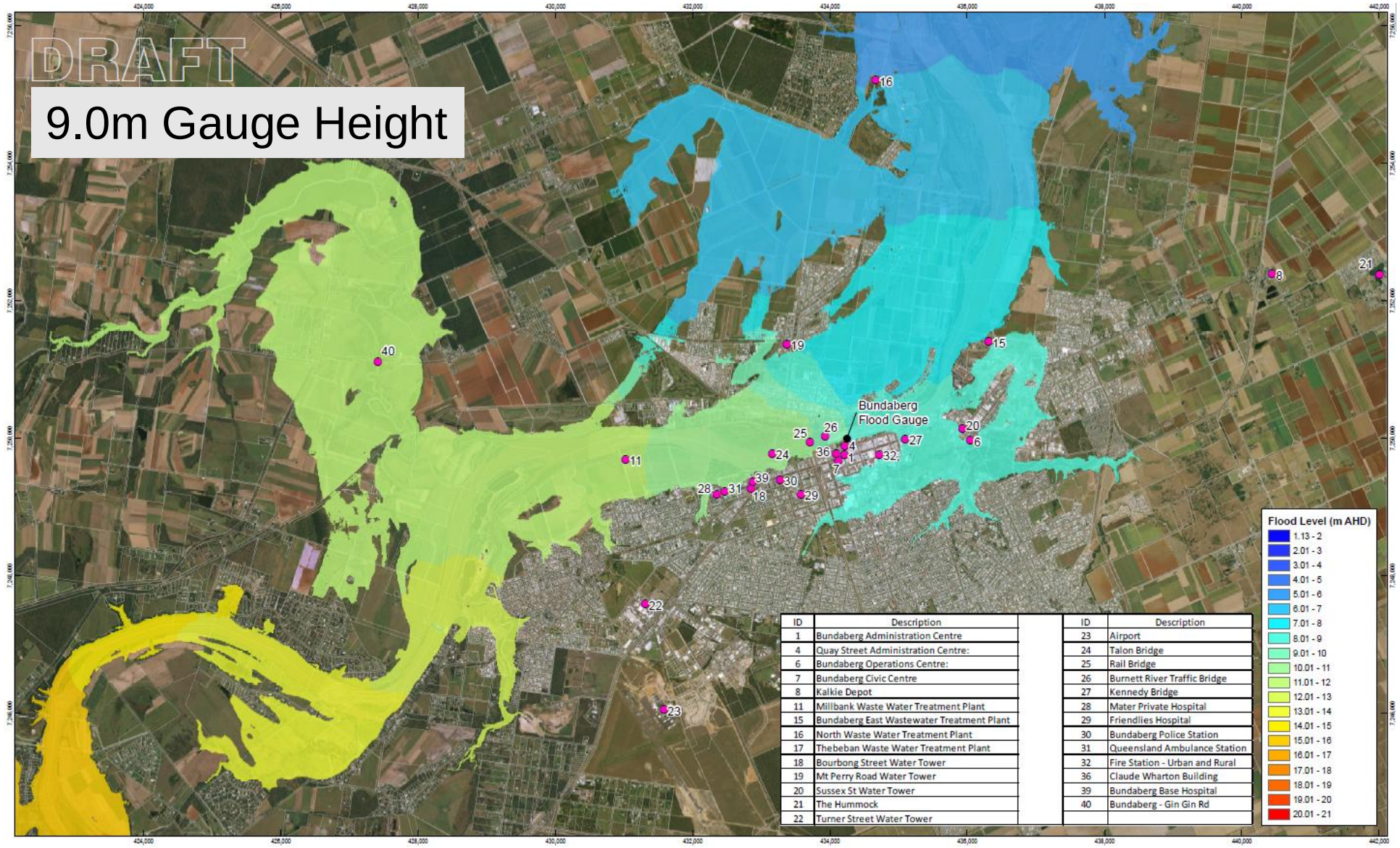
36	Claude Wharton Building
39	Bundaberg Base Hospital
40	Bundaberg - Gin Gin Rd

DRAFT

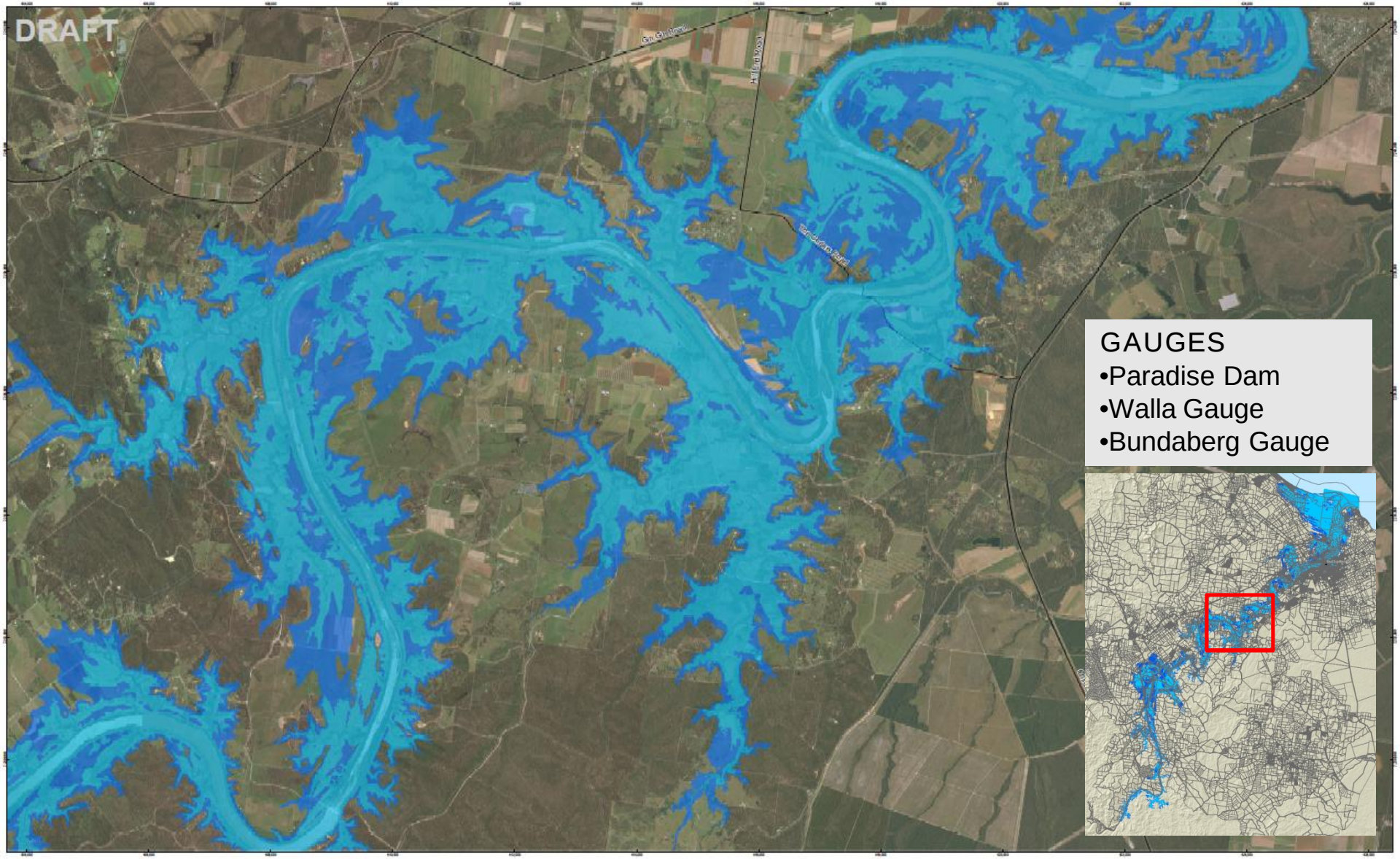
9.0m Gauge Height



ID	Description
1	Bundaberg Administration Centre
4	Quay Street Administration Centre:
6	Bundaberg Operations Centre:
7	Bundaberg Civic Centre
8	Kalkie Depot
11	Millbank Waste Water Treatment Plant
15	Bundaberg East Wastewater Treatment Plant
16	North Waste Water Treatment Plant
17	Thebeban Waste Water Treatment Plant
18	Bourbong Street Water Tower
19	Mt Perry Road Water Tower
20	Sussex St Water Tower
21	The Hummock
22	Turner Street Water Tower

ID	Description
23	Airport
24	Talon Bridge
25	Rail Bridge
26	Burnett River Traffic Bridge
27	Kennedy Bridge
28	Mater Private Hospital
29	Friendlies Hospital
30	Bundaberg Police Station
31	Queensland Ambulance Station
32	Fire Station - Urban and Rural
36	Claude Wharton Building
39	Bundaberg Base Hospital
40	Bundaberg - Gin Gin Rd

In Progress – Incremental Maps Upstream



1:20,000 @ A0
0 1 2
Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND
Road
Cadastre
0.5 Incremental Surfaces
9m
11m

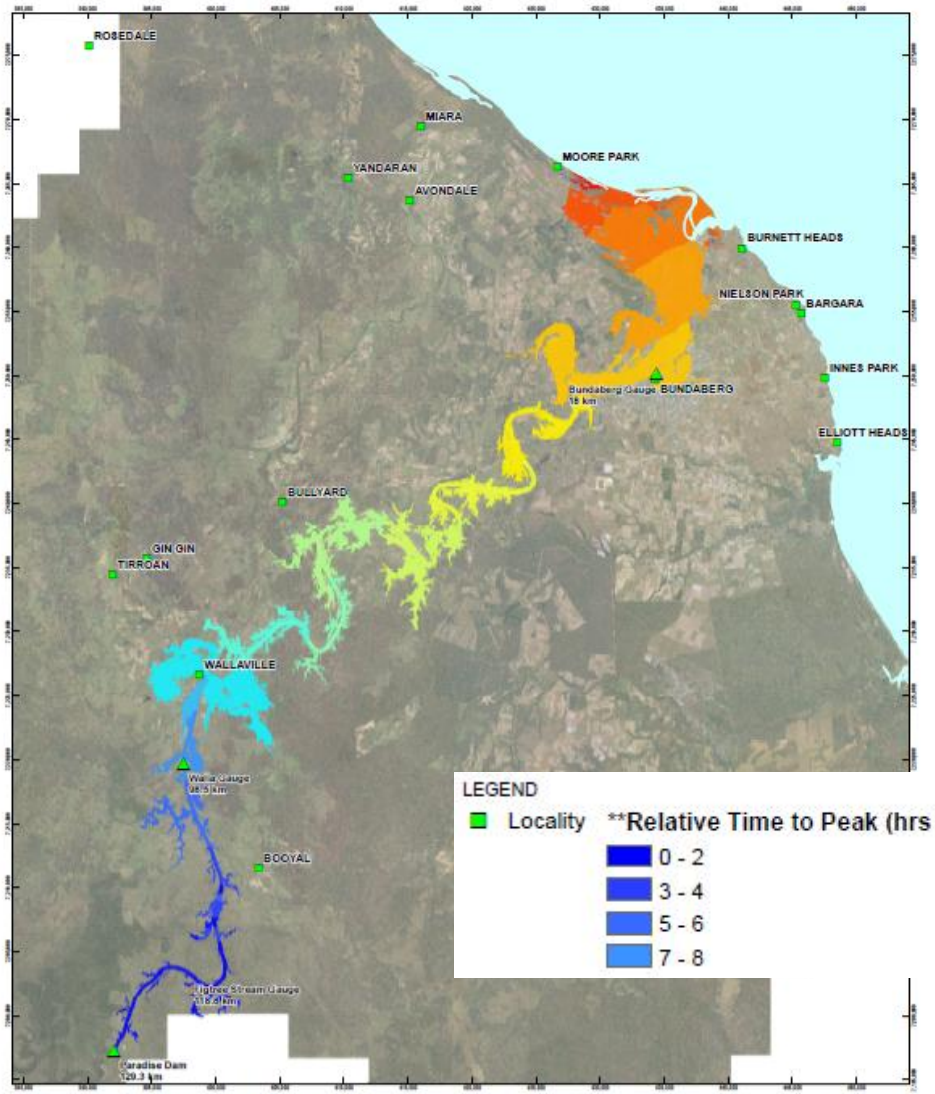
Bundaberg Regional Council
Burnett River Flood Study

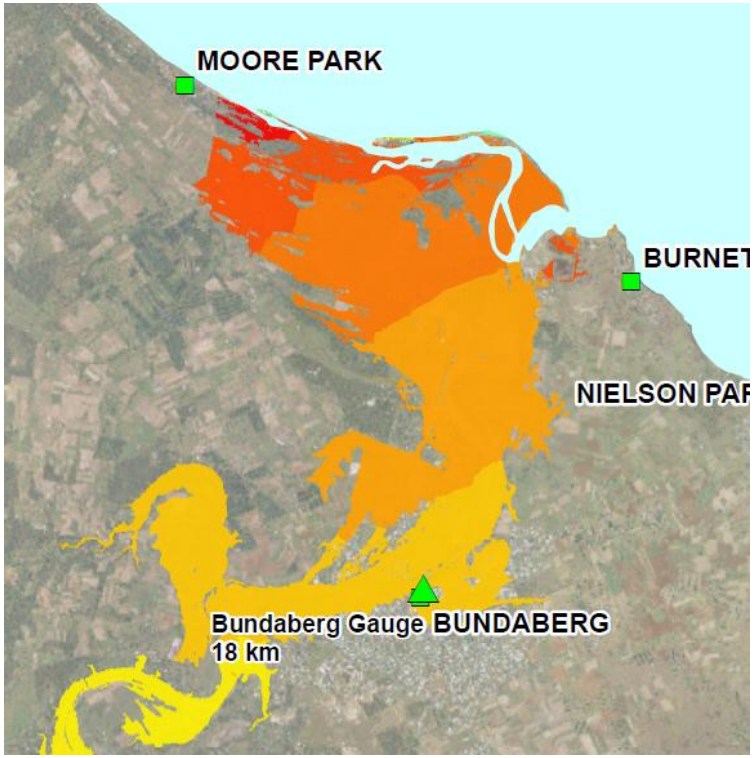
Job Number 41-24728
Revision A
Date 26 Sep 2013

Incremental Flood Map

Figure 8

Flood Warning – Time to Peak Maps





BUNDABERG
REGIONAL COUNCIL

DRAFT Improving Dwelling Resilience to Flood Induced Scour - Guidelines for Footing Design

For

Dwellings Constructed within a Flood Hazard Area.

Bundaberg Regional Council

April 2013

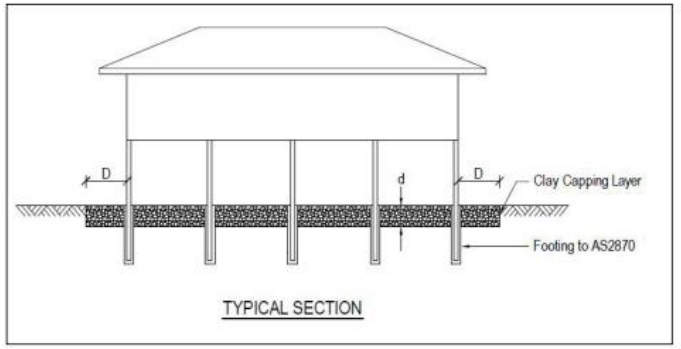


Figure 1.0 Typical Section

Based on the outcomes of the site scour risk assessment additional construction parameters can be selected from Table 1.0 below:

Table 1

Erosion Mat Details		
Scour Risk Factor	D (mm)	Cut Off Wall
NIL	N/A	N/A
LOW	1500	Yes
MED	2000	Yes
HIGH	Erosion Mat not suitable for scour risk factor HIGH or EXTREME	
EXTREME		

Typical details pertaining to the cut off walls, edge beams and post / stump details are indicated in figures 3.0, 4.0 and 5.0 below:

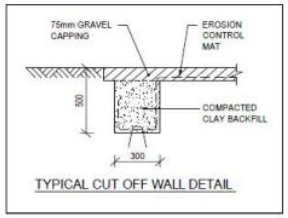


Figure 3.0 Typical Cut Off Wall Detail

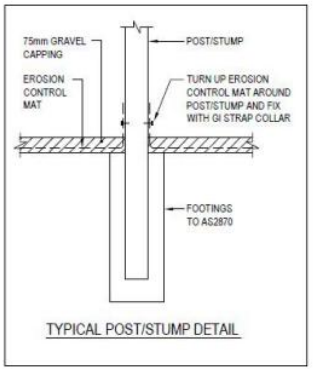


Figure 4.0 Typical Post / Stump Detail

4. Information Boards

BUNDABERG REGIONAL COUNCIL

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