

Narrabri Floodplain Risk Management Study and Plan


Volume 1: Supplementary Flood Study - Namoi River, Mulgate Creek and Long Gully

Addendum 1 - February 2020 Validation

Narrabri Shire Council

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1 Introduction

1.1 OVERVIEW

Narrabri and surrounds experienced heavy rainfall in early February 2020. Localised intense rainfall northeast of Narrabri resulted in flooding of Horsearm Creek and Doctors Creek. WRM Water & Environment Pty Ltd (WRM) have been commissioned by Narrabri Shire Council (NSC) to validate the recently completed hydrologic and hydraulic models developed of the local Narrabri creek catchments (WRM, 2019) to the available data for the February 2020 event.

1.2 ADOPTED APPROACH

This report should be read in conjunction with the Supplementary Flood Study (WRM, 2019) and 2016 flood study (WRM, 2016). The approach adopted to assess the February 2020 event is consistent with the Supplementary Flood Study (WRM, 2019). That is the available rainfall data was simulated through the hydrological model to produce catchment discharge hydrographs. These discharge hydrographs were simulated through the hydraulic model to derive the predicted flood levels and flood extents, which was compared to anecdotal flood data provided by the community.

1.3 REPORT STRUCTURE

The report is structured as follows:

- Section 2 describes the available data for the February 2020 event;
- Section 3 describes modelling of the February 2020 event; and
- Section 4 is a list of references.

2 February 2020 event

2.1 OVERVIEW

Narrabri and surrounds experienced heavy rainfall in early February 2020. Localised intense rainfall northeast of Narrabri resulted in flooding of Horsearm Creek and Doctors Creek. With the region having experienced years of drought the Namoi River and Narrabri Creek were not flowing at the time of the February 2020 event. The influx of Doctors Creek flow into Narrabri Creek reportedly caused Narrabri Creek to flow backwards.

2.2 RECORDED DATA

2.2.1 Daily rainfall data

The Bureau of Meteorology (BoM) rainfall station network is sparse around Narrabri. Table 2.1 shows the daily rainfalls recorded at four rainfall stations in the vicinity of the study area over the four days to 0900 hours on 10 February 2020. The rainfall totals in Table 2.1 show great variation in rainfall around Narrabri with localised areas of intense rainfall, particularly during the 24 hours to 0900 hours on 9 February.

Table 2.1 - Recorded daily rainfalls for the February 2020 event

Station name	Station No.	Daily rainfall (mm) to 0900 hours			
		7 Feb	8 Feb	9 Feb	10 Feb
Turrawan	55058	9.0	10.0	52.0	3.5
Narrabri (Mollee)	53026	3.8	4.2	38.4	27.2
Narrabri (Murrumbilla)	54149	4.8	38.4	52.8	4.8
Narrabri Airport AWS	54038	4.6	18.4	72.8	8.0

2.2.2 Sub-daily rainfall data

Sub-daily rainfalls for February 2020 were provided by the Oz Forecast network of automatic weather stations (AWS). Figure 2.1 shows the network of sub-daily rainfall stations, while Figure 2.2 shows the recorded rainfalls across the network. The rainfall records show intense rainfall in the Mulgate Creek catchment early on the morning of 8 February, with sustained rainfall at almost all rainfall stations between 10am and 3pm on 8 February.

2.2.3 Water level data

Recorded water level data is available for the Narrabri Creek at Narrabri stream gauge. Figure 2.3 shows the recorded water level data leading up to and following the February 2020 flood event. The recorded water level data shows that there was no flow in Narrabri Creek until around 6am on 8 February. Water level slowly rose about 1 metre between 6am and 2pm, while from 2pm to around 5.30pm water levels rapidly rose a further 3 metres.

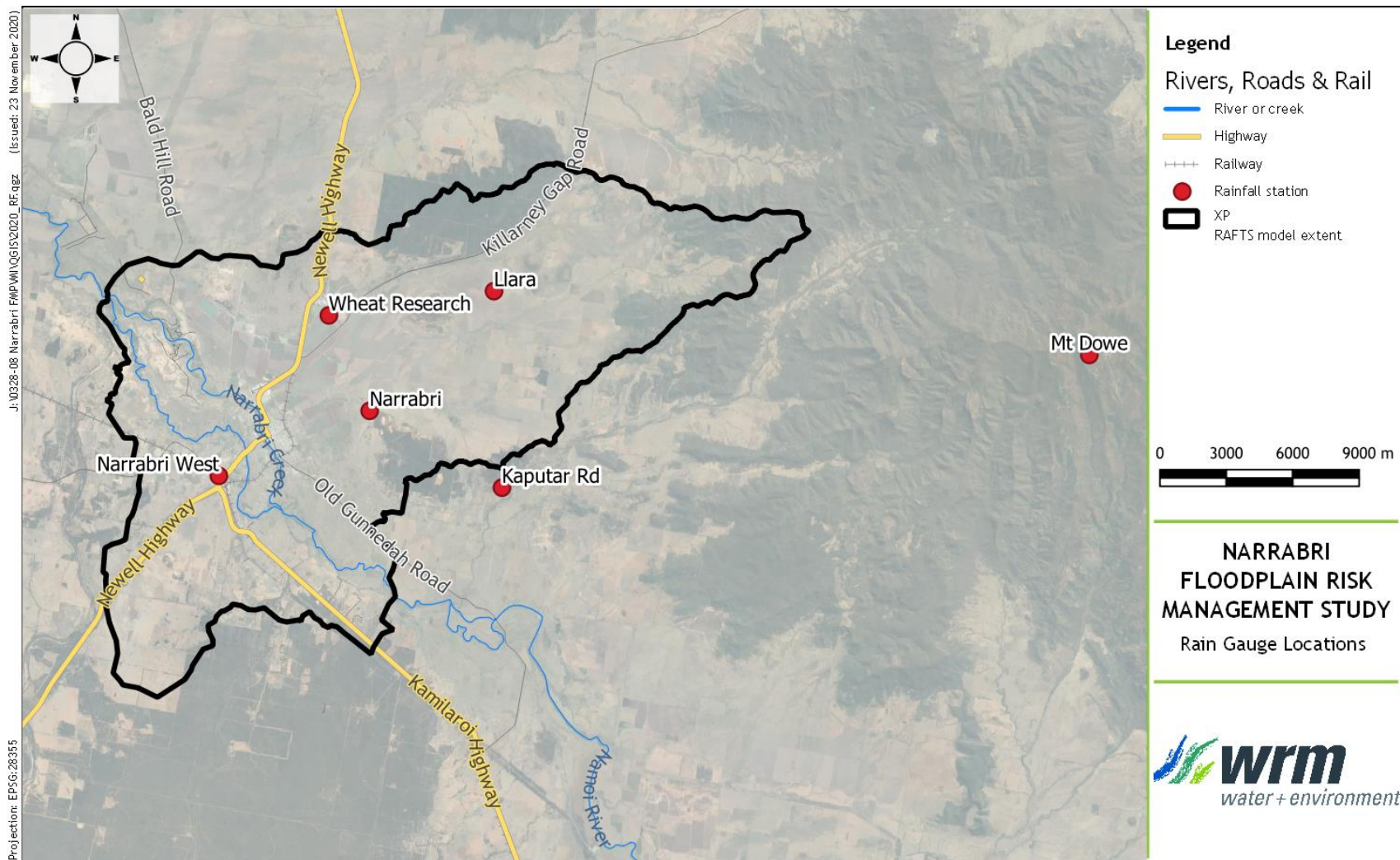


Figure 2.1 - Sub-daily rainfall station locations

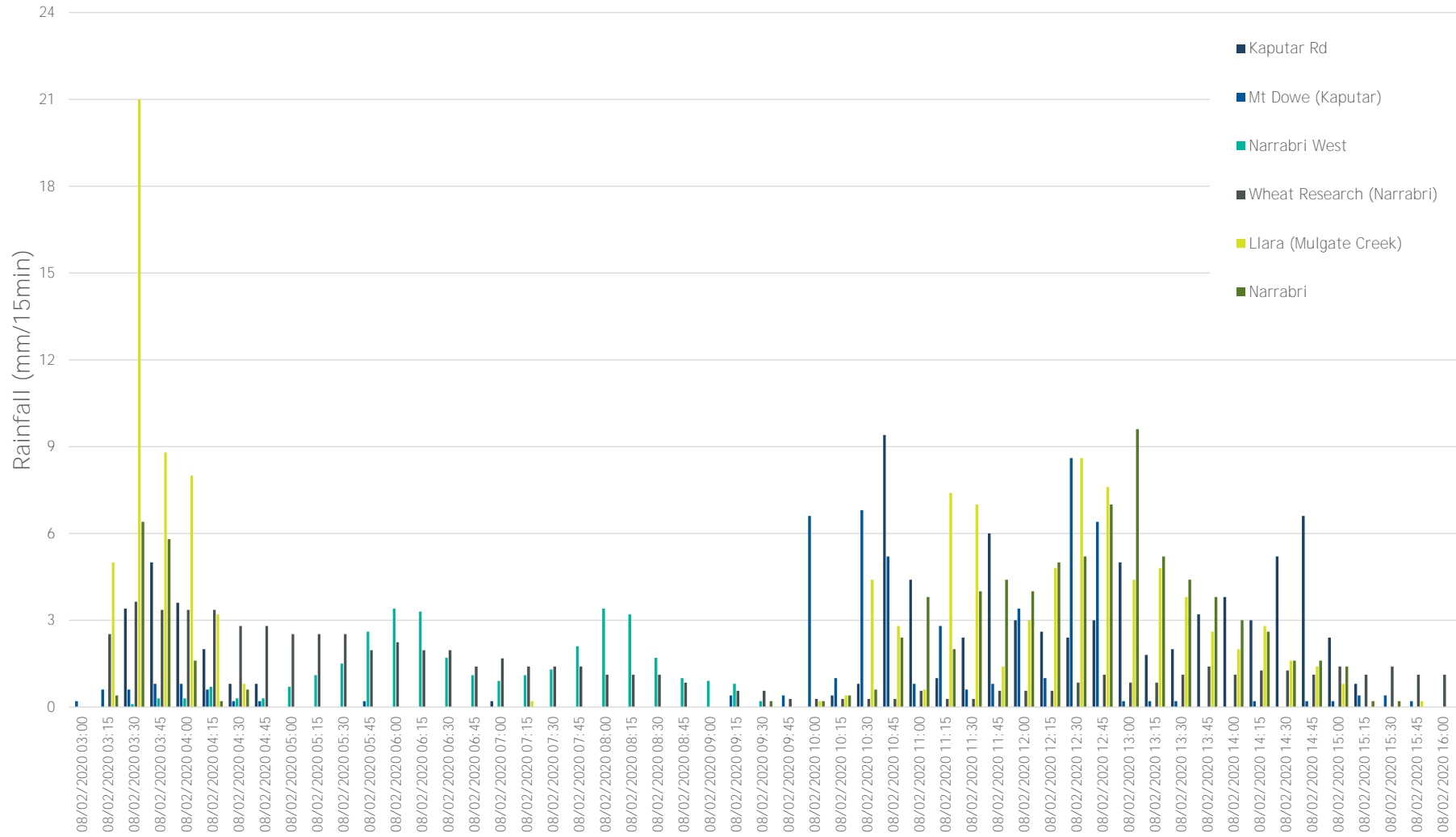


Figure 2.2 - Recorded 15 minute rainfalls (Source: Oz Forecast)

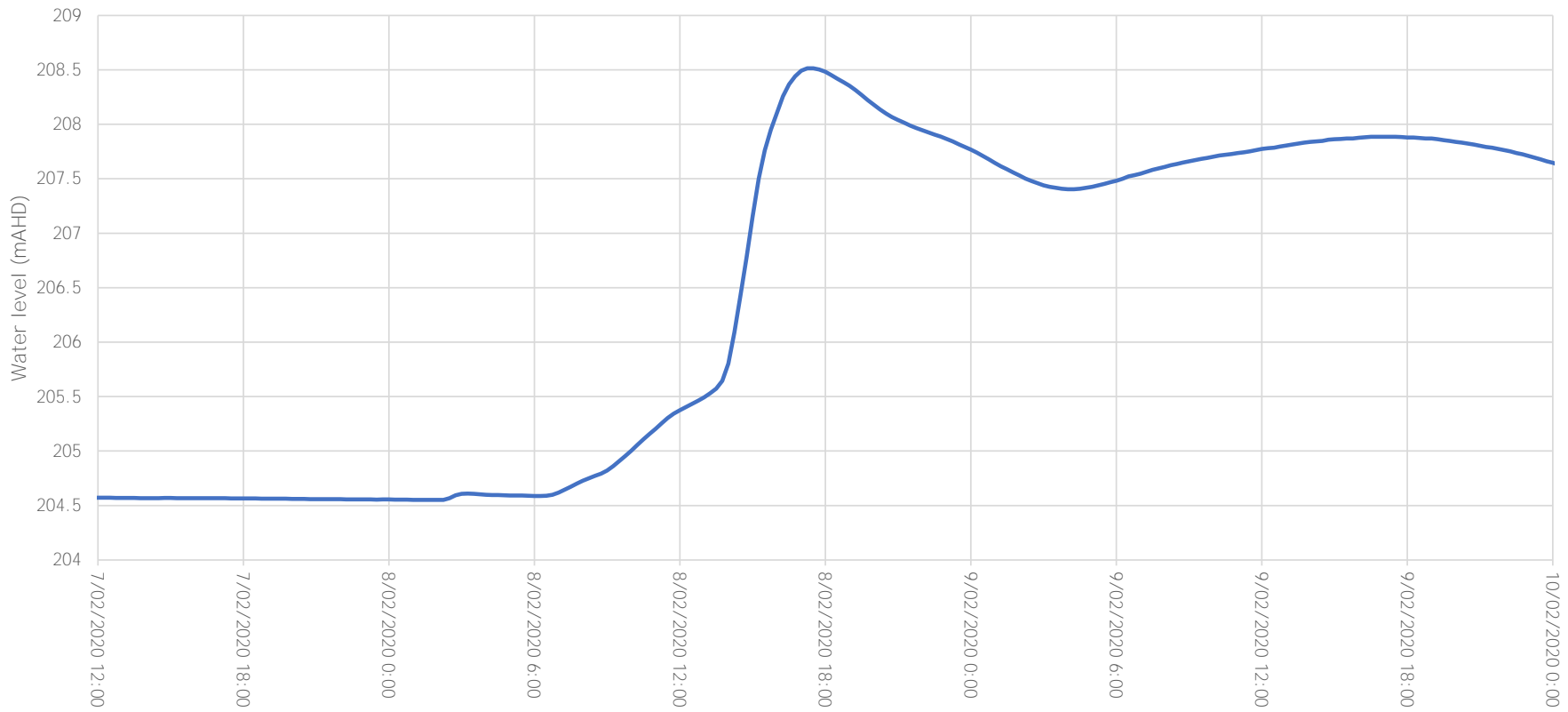


Figure 2.3 - Recorded Narrabri Creek water level

2.3 COMMUNITY SURVEY

A community survey was distributed with NSC rate notices in April 2020, a copy of which is provided in Appendix A. A total of 57 responses to the community survey were received, which is an excellent response. 18 of the responses were from properties that experienced some form of flooding during February 2020. A number of photographs and videos of inundation during February 2020 were also supplied with survey responses, while further photographs were sourced from local media and social media (see Figure 2.4 and Figure 2.5).



Figure 2.4 - Photograph looking southeast along Reid Street (Source: The Courier [photograph originally supplied by Tom Puts])



Figure 2.5 - Still from video looking east over the Newell Highway bridge over Doctors Creek (Source: YouTube [ballangarry YouTube channel])

The community survey responses were fairly consistent with most flood affected properties reporting:

- inundation for between 1 and 5 hours (some properties experienced inundation for longer periods);
- peak inundation occurring between 3pm and 6pm on 8 February;
- little to no warning of flooding; and
- water levels rose extremely quickly.

The majority of survey responses from flood affected properties were from residents and commercial enterprises in close vicinity to Horsearm Creek. Multiple survey responses made mention of stormwater inlets surcharging, while two responses made mention of some form of man-made **“dam” on Horsearm Creek upstream of Narrabri reportedly** influencing flood behaviour.

3 Model validation

3.1 OVERVIEW

The hydrologic model (XP-RAFTS) of local catchments draining to Narrabri and hydraulic (MIKE-FLOOD) model of Narrabri and surrounds was used to simulate the February 2020 flood event.

The purpose of model validation was to match as close as possible the predicted and recorded flood behaviour across the floodplain in Narrabri using the consistent set of model parameters previously adopted for model calibration and design flood estimation.

3.2 XP-RAFTS AND MIKE-FLOOD MODELLING

Each XP-RAFTS subcatchment was assigned rainfall recorded at the nearest sub-daily rainfall station shown in Figure 2.1 distributed on a 15 minute basis.

An initial loss of 46 mm and a continuing loss of 1.1 mm/hr were adopted for the simulation based on the adopted design event losses given in the Supplementary Flood Study (WRM, 2019). Antecedent rainfall conditions were dry prior to the February 2020 event with 34 mm recorded at the Narrabri Airport gauge in the four days prior to 8 February (but extremely dry conditions prior to this).

The XP-RAFTS discharge hydrographs were used to represent the local catchment flows in the MIKE-FLOOD model. A constant inflow of 6 m³/s was input into the Namoi River at the **upstream end of the hydraulic model to represent the “puddle” of water in the Namoi** River and Narrabri Creek at the start of the event. Local catchment flows draining into the Namoi River (from Bullawa Creek) were not included.

3.3 RESULTS

Figure 3.1 shows the predicted peak flood depths and extents for the February 2020 flood event. The MIKE-FLOOD results show:

- no overflows from channels and watercourses south and west of the Namoi River and Narrabri Creek;
- extensive inundation and overflows from Horsearm Creek, Mulgate Creek and Doctors Creek;
- inundation from Horsearm Creek not extending west of the rail line; and
- a **“wave” of water entering Narrabri Creek and moving upstream (and downstream)** from Doctors Creek.

Table 3.1 compares the model results to the anecdotal flooding information provided during the community survey process. The locations of the anecdotal information are shown in Figure 3.1.

Anecdotal reports of no flooding are not tabulated in Table 3.1. All anecdotal reports of no flooding were reproduced in the hydraulic model. Note that the hydraulic model does not include the stormwater pipes and was therefore not able to replicate the flooding behaviour at the properties to the west of the rail (ID 5, 6, 7, 8, 10, 11, 14). However a comparison of peak flood levels in Horsearm Creek at the pipe outlets confirm that the stormwater pipes would have surcharged and inundated the properties as observed by the respondents.

Two responses from the community survey reported some form of man-made **“dam”** on Horsearm Creek upstream of Narrabri that reportedly influenced flood behaviour. There was insufficient detail on the size, placement and timing of the removal of this structure to effectively model this in the hydraulic model. However, flood levels and extents along

Horsearm Creek are reasonably well reproduced without any representation of this reported structure.

Table 3.1 - Comparison of anecdotal flood information and modelling results, February 2020 event

ID	Anecdotal information	Modelling results	Comment
1	-0.4 m yard inundation	-0.25 m yard inundation	Consistent
2	-0.6 m yard inundation with above floor level flooding	-0.31 m yard inundation	Consistent but low
3	-0.6 m yard inundation with above floor level flooding	-0.28 m yard inundation	Consistent but low
4	-0.6 m yard inundation with above floor level flooding	-0.23 m yard inundation	Consistent but low
5	-0.3 m yard inundation with above floor level flooding	No inundation ^{*2}	Inconsistent
6	-0.45 m yard inundation	No inundation ^{*2}	Inconsistent
7	-0.25 m yard inundation	No inundation ^{*1}	Consistent
8	-0.3 m yard inundation	No inundation ^{*1}	Consistent
9	-0.5-1.6 m yard inundation	-0.1-1.7 m yard inundation	Consistent
10	-0.3 m yard inundation	No inundation ^{*2}	Inconsistent
11	-0.6 m yard inundation	No inundation ^{*2}	Inconsistent
12	-1.2 m yard inundation	>1.0 m yard inundation	Consistent
13	Yard inundation	-0.1-0.7 m yard inundation	Consistent
14	-0.02 m yard inundation	No inundation ^{*1}	Consistent

^{*1} levels in Horsearm Creek were sufficiently high to cause backflow through the stormwater pipe network onto the property

^{*2} levels in Horsearm Creek were sufficiently high to cause backflow through the stormwater pipe network onto the streets surrounding the property

Note: An additional 4 survey responses reported flooding, however these four either provided no address or an address outside of the model extent. Survey responses from properties that reported no flooding are not shown in the table above, but are plotted in purple in Figure 3.1.

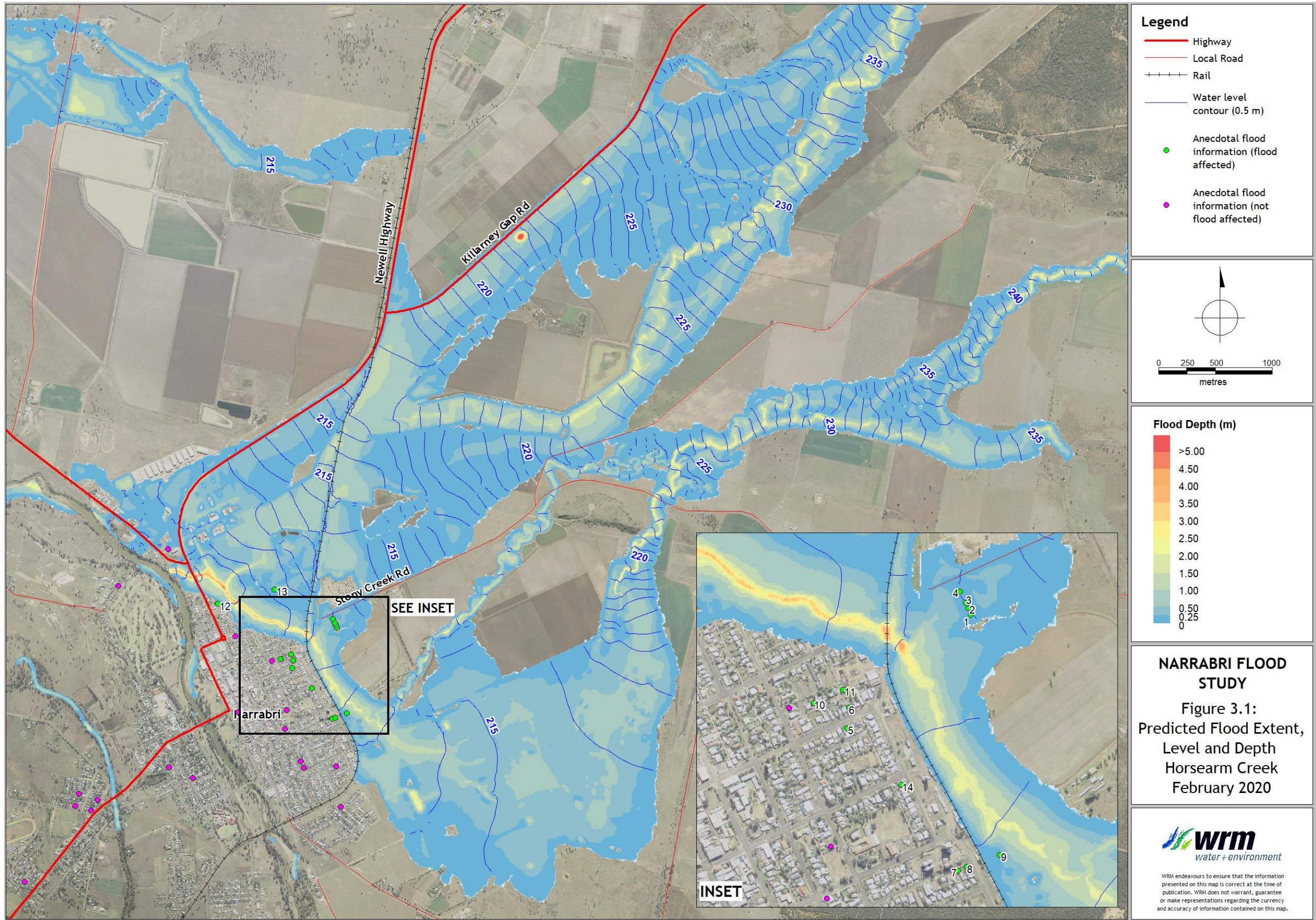


Figure 3.1 - Predicted Horsearm Creek flood extent, levels and depths, February 2020 event

3.4 DISCUSSION

Overall, the Supplementary Flood Study model has been successfully validated against the February 2020 data. A reasonably good representation of the depth and extent of the February 2020 flood was predicted along Horsearm Creek and Doctors Creek. Predicted flood extents along lower Mulgate Creek appear to be moderately overestimated.

Predicted peak flood levels are in reasonable agreement but on average marginally lower than the anecdotal data. The timing of peak flood levels in the hydraulic model were much later than reported timing from the community survey. An alternative model setup was tested to try and reproduce the extreme drought conditions (i.e. lack of vegetation) at the time of the February 2020 flood event to improve the flood peak timing. The extreme drought conditions model setup using a Manning's 'n' value of 0.04 for the floodplain compared to 0.08 in WRM (2019) produced similar flood levels and extents along Horsearm Creek and reduced levels and extents along Mulgate Creek (compared to Figure 3.1). The timing of peak flooding was much improved in the extreme drought conditions model setup. Results from the extreme conditions model setup have not been provided in this report as this model setup is relevant only to conditions at the start of 2020 and hence are not appropriate for use for other calibration or design simulations. Notwithstanding, the peak flood depths and extents were not significantly different to those predicted using the model parameters adopted for the Supplementary Flood Study (WRM, 2019). Further, the lack of catchment vegetation due to the extreme drought was likely not representative of typical conditions. On this basis, the extreme drought conditions model parameters are not recommended for design event modelling.

4 References

- Oz Forecast, 2020 Oz Forecast (Australian weather data), Oz Forecast, 2020, <<https://ozforecast.com.au/>>.
- The Courier, 2020 *'A welcome deluge across the Narrabri Shire'*, The Courier, February 2020, <<https://narrabricourier.com.au/2020/02/11/a-welcome-deluge-across-the-narrabri-shire/>>.
- WRM, 2016 ***'Narrabri Flood Study: Namoi River, Mulgate Creek and Long Gully'***, Report prepared for Narrabri Shire Council by WRM Water & Environment Pty Ltd, QLD, December 2016.
- WRM, 2019 *'Narrabri Floodplain Risk Management Study and Plan: Volume I: Supplementary Flood Study - Namoi River, Mulgate Creek and Long Gully'*, report prepared for Narrabri Shire Council by WRM Water & Environment, June 2019.
- YouTube (ballangarry), 2020 ***'narrabri creek 2020'***, YouTube, ballangarry YouTube channel, posted February 8 2020, <<https://www.youtube.com/watch?v=P5YRSIQOaIA&feature=youtu.be>>.



Appendix A Community survey form

NARRABRI FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN NEWSLETTER

To all Narrabri residents and business owners,

As part of Narrabri Shire Council's (NSC) commitment to providing a flood resilient community, NSC is preparing the Narrabri Floodplain Risk Management Study and Plan (the Plan). The Plan will be a comprehensive assessment of the flood risk in Narrabri from both the Namoi River and the local catchments of Mulgate/Horsearm Creek and Long Gully.

To date, the Plan has:

- Derived design flood levels across Narrabri from both the Namoi River and the local catchments of Mulgate/Horsearm Creek and Long Gully to set floor levels for future planning applications.
- Assessed a range of options, such as levees and constructed channels to mitigate or partially mitigate flooding in Narrabri.
- Analysed the flood hazards across Narrabri for a range of large and small flood events to help understand where it would not be appropriate to allow future development.

FEBRUARY 2020 HORSEARM/MULGATE CREEK RAINFALL EVENT

The recent rainfall event in Horsearm and Mulgate Creek provides an opportunity to validate the flood models that underly the Plan. We need your help to collect data for the event.

Your response is sought to complete the questionnaire attached. If you do not have the information or do not wish to answer a question, please proceed to the next item.

Kindly send your response to this questionnaire directly to the Consultant by 5:00pm on Friday 29 May 2020 at the address provided below:

Greg Roads
WRM Water and Environment
PO Box 10703
Brisbane Adelaide Street
QLD 4000
or
email: groads@wrwater.com.au

Should you have any questions please contact Narrabri Shire Council on (02) 6799 6866.

Questionnaire

1.	<p>Was your property (house/workplace) inundated in the February 2020 rainfall event?</p> <p>Please provide street address for the house/workplace. (if yes, continue to question 2)</p>	<input type="checkbox"/> yes <input type="checkbox"/> no <hr/> <hr/> <hr/>
2.	<p>How deep was the water in your yard?</p>	<p>_____ centimetres</p>
3.	<p>How deep was the water above floor level?</p>	<p>_____ centimetres, or <input type="checkbox"/> Below floor level</p>
4.	<p>How long did the water stay in your property? (from start of inundation to drain off)</p>	<input type="checkbox"/> Less than 1 hour <input type="checkbox"/> Approx 1-5 hours <input type="checkbox"/> More than 5 hours
5.	<p>Approximately what time did the water peak?</p>	<hr/> <hr/>
6.	<p>Did you remain at your property or evacuate?</p>	<hr/> <hr/>
7.	<p>Was adequate warning provided prior to the water arriving? Please provide comment on the flood warning.</p>	<input type="checkbox"/> yes <input type="checkbox"/> no <hr/> <hr/> <hr/>
8.	<p>Has your property experienced previous flooding? If yes, when?</p>	<hr/> <hr/> <hr/>
9.	<p>Do you have any photographs (or videos) of the rainfall event that would be useful for the consultant to understand the area inundated or other effects and are you willing to provide copies?</p> <p><input type="checkbox"/> Yes (please email or provide a contact for the consultant to arrange for a copy to be made) <input type="checkbox"/> No</p>	
10.	<p>Do you consider that flooding of your property has been made worse by works on other properties, or by the construction of roads or other structures?</p> <p><input type="checkbox"/> Yes (please provide further details, sketch and attach pages if necessary) <input type="checkbox"/> Unsure <input type="checkbox"/> No</p>	