MEMORANDUM

To Allana Mosely Hester Van Zijl Moreton Bay Regional Council

From Donnie Carroll and Carl Wallis

Date 31 January 2023

Subject IFD Sensitivity – Redcliffe - RFD 2022

Our ref 22020180_RED_IFD_M06_V01.docx

1 INTRODUCTION

This memo provides an overview of the methodology and results for the IFD Sensitivity Analysis modelling for the Redcliffe catchment. The Australian Rainfall and Runoff Datahub provides the following description of the revised localised IFD datasets:

The release of significantly improved Intensity-Frequency-Duration (IFD) design rainfall data in 2016 brought opportunity to renew understanding of Australian floodplains, and consequently create safer and stronger communities. However, several councils in SEQLD noted localised nuances in rainfall distribution and severity not reflected by the 2016 IFD data. A suite of new localised IFD data was hence commissioned for four local government areas (LGA), being the Lockyer Valley, Ipswich, Moreton Bay LGAs, and one other area, herein termed the LIMB 2020 IFDs.

The LIMB 2020 IFDs were informed by additional council sub-daily rainfall gauge data, and were developed using methods that placed higher weighting on this data. The method additionally placed enhanced focus on elevation. The developed localised IFDs resulted in a reduction in local biases across all AEPs, durations and areas, compared to the 2016 IFDs.

The LIMB 2020 IFDs come in three formats;

1. *High resolution; gridded LIMB 2020 IFD output at fine resolution (0.005°)*
2. *BOM resolution; gridded LIMB 2020 IFD output aligned to resolution of BOM 2016 IFDs (0.02479°)*
3. *Envelope of BOM 2016 IFDs / LIMB 2020 IFDs; maximum of the two IFDs (resolution aligned to BOM 2016 IFDs)*

MBRC have commissioned Water Technology to use the Redcliffe WBNM and TUFLOW models to simulate both the high resolution and enveloped IFD datasets and assess the sensitivity of the models to the respective datasets. The outcome of this work will support the decision on which IFDs to use for all other minor basins.

2 METHODOLOGY

The methodology adopted to undertake the IFD sensitivity analysis included:

- Obtain enveloped and high resolution LIMB 2020 IFD datasets for each subcatchment in the Redcliffe WBNM model.
- Simulate the catchment hydrology for both IFD datasets within the StormInjector software for the following design storm events:
  - 10%, 1% and 0.1% (1 in 1,000 year) AEP.

- All durations up to and including 2 hour.

- Select critical storms at each POI based on WBNM results for both IFD datasets i.e. the storms selected were different for each dataset. (see Table 1 showing selected storms for 1% AEP event)
- Run all events in TUFLOW for unblocked and blocked structures and create maximum enveloped grids.
- Compare mean peak flow at each POI and maximum enveloped peak water level grids across the Redcliffe catchment.

Table 1 1% AEP Critical storm comparison (same storms in red)

POI	High Resolution		Enveloped IFD	
	Duration	TP	Duration	TP
RCE001_01082	1.50 hour	5329 (TP9)	1.50 hour	5329 (TP9)
RCE001_01440	1.50 hour	5321 (TP3)	1.50 hour	5321 (TP3)
RCE003_00071	1.50 hour	5324 (TP5)	45 min	5211 (TP6)
RCE004_00173	1.50 hour	5324 (TP5)	30 min	5095 (TP1)
RCE008_00000	1.50 hour	5206 (TP2)	45 min	5194 (TP5)
RCE008_00454	45 min	5194 (TP5)	25 min	5214 (TP9)
RCE009_00000	45 min	5194 (TP5)	45 min	5194 (TP5)
RCE010_00000	1.50 hour	5321 (TP3)	1.50 hour	5321 (TP3)
RCE010_00265	1.50 hour	5321 (TP3)	45 min	5194 (TP5)
RCE025_00000	1.50 hour	5206 (TP2)	45 min	5194 (TP5)
RCN002_00777	1.50 hour	5321 (TP3)	45 min	5211 (TP6)
RCN007_00000	6 hours	5433 (TP7)	6 hours	5433 (TP7)
RCN016_00223	1 hour	5265 (TP6)	30 min	5095 (TP1)
RCS001_00906	1.50 hour	5321 (TP3)	1.50 hour	5321 (TP3)
RCS001_01556	1.50 hour	5321 (TP3)	1.50 hour	5321 (TP3)
RCS001_02198	1.50 hour	5321 (TP3)	45 min	5194 (TP5)
RCS009_00065	1.50 hour	5329 (TP9)	1.50 hour	5329 (TP9)
RCS010_00195	1.50 hour	5206 (TP2)	1.50 hour	5206 (TP2)
RCS027_00089	30 min	5239 (TP9)	15 min	5139 (TP6)
RCE001_00000	2 hours	5323 (TP2)	2 hours	5323 (TP2)
RCN001_00000	1.50 hour	5324 (TP5)	1.50 hour	5324 (TP5)
RCN001_01427	1.50 hour	5321 (TP3)	45 min	5211 (TP6)
RCS001_00000	1.50 hour	5324 (TP5)	1.50 hour	5324 (TP5)

3 RESULTS

Table 3 presents the summarised results of the mean peak flow at each POI for the respective IFD datasets. Appendix A provides the peak difference in water levels for the 10%, 1% and 0.1% (1 in 1,000 year) AEP events.

4 DISCUSSION

The IFD sensitivity modelling undertaken has not shown a consistent increase or decrease in flows/peak water levels across the Redcliffe catchment for the different IFD datasets. Some generic commentary on the results include:

- The different IFD datasets correlated to generally similar durations and temporal patterns being selected. For the Redcliffe catchment there was an overlap of critical storms for 12 out the 23 POIs in the 1% AEP event.
- Mean peak flows extracted at each POI are generally within 5% for the respective IFD datasets throughout the catchment. Table 2 outlines the number of locations outside of a 5% tolerance noting that for rarer events a larger difference in peak flow was observed.

Table 2 Number of POI locations with 5% difference in mean peak flow

Event	Number of POIs outside of 5% mean peak flow (23 total POIs)
10%	2
1%	4
0.01%	5

- The 10% AEP event was the least sensitive to the IFD dataset chosen with minimal changes in peak water levels. The 0.01% AEP event showed the largest difference in peak water levels although this difference was generally within 50 mm with isolated locations up to 100 mm.
- The enveloped IFD dataset had higher peak flows/water levels in small tributaries where the critical duration was less than 30 minutes. This was caused by enveloped IFD datasets having higher intensities for the short durations (< 30 minutes). This difference in rainfall intensities for very short durations corresponded to less than 50 mm increase for peak water levels.
- The high resolution IFD datasets generally had higher peak flows/water levels in the larger tributaries although this was also generally within 50 mm.

Ultimately the difference in peak water levels which is the final outcome of a flood study was not shown to significantly change depending on the IFD dataset chosen. The differences of peak flows generally being within 5% and peak water levels generally being within 50 mm as shown in the results is within the bounds of uncertainty in the context of a regional flood study. Based on the results documented herein it is recommended to implement the High Resolution IFD dataset as it does not appear to reduce flood levels significantly and is at a more suitable resolution for application to subcatchments throughout the MBRC region.

Table 3 **IFD sensitivity peak flow summary**

POI	10% AEP			1% AEP			0.01% AEP		
	HR	ENV	Diff (%)	HR	ENV	Diff (%)	HR	ENV	Diff (%)
RCE001_01082	11.1	10.7	-3.10%	21.1	20.8	-1.50%	31	30.6	-1.50%
RCE001_01440	13.8	13.8	0.00%	22.5	22.1	-1.70%	34.2	34.5	0.80%
RCE003_00071	12.5	12.5	0.30%	20.1	20.4	1.70%	30.9	32.5	4.90%
RCE004_00173	2.8	2.9	4.00%	4	4.5	13.50%	6.1	7	15.10%
RCE008_00000	9.5	9.6	1.40%	14.3	15.2	6.50%	22	23.5	7.00%
RCE008_00454	7	7.1	1.40%	10.3	11.1	7.30%	15.9	17.4	9.20%
RCE009_00000	6.7	6.6	-0.60%	10.1	10.6	4.40%	15.7	16.4	4.40%
RCE010_00000	6.3	6.3	1.10%	10.6	10.5	-0.60%	16.1	16.5	2.50%
RCE010_00265	5.9	6	2.10%	9.5	9.5	0.80%	14.4	14.9	3.90%
RCE025_00000	5.5	5.5	0.70%	6.7	6.9	2.50%	8.8	8.9	0.70%
RCN002_00777	16.5	16.5	0.00%	25.7	26.7	4.00%	39.8	41.8	5.00%
RCN007_00000	4.6	4.6	-1.50%	11.5	11.3	-1.60%	17.3	17	-1.50%
RCN016_00223	3.9	3.2	-17.80%	5.9	5.1	-12.30%	9.1	7.9	-13.00%
RCS001_00906	24.1	24.4	1.00%	41.4	41.7	0.70%	63.8	64.3	0.70%
RCS001_01556	18.8	18.9	0.50%	31.8	32	0.50%	49.2	49.8	1.20%
RCS001_02198	7	7	0.00%	11.4	11.5	1.10%	18	18.6	3.70%
RCS009_00065	12.1	12.2	1.20%	16.4	16.3	-0.70%	21.1	21.1	-0.20%
RCS010_00195	6.8	6.8	0.00%	7.9	7.9	-0.60%	10.3	10.1	-1.80%
RCS027_00089	0.4	0.5	7.10%	0.6	0.7	16.70%	0.9	1.1	18.70%
RCE001_00000	21	21.3	1.00%	35.3	36.1	2.20%	53.7	53.1	-1.20%
RCN001_00000	91.3	93.6	2.60%	156.1	161.8	3.70%	237.8	238.5	0.30%
RCN001_01427	38.5	39.9	3.70%	61.7	64.2	4.10%	93.2	96.4	3.40%
RCS001_00000	39.4	40.6	3.10%	68.2	70.7	3.60%	104.4	104.7	0.20%

APPENDIX A PEAK FLOOD LEVEL DIFFERENCE MAPS

Legend

Peak level difference (m)

- <= -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- > 0.3

N

Scale: 1:25,000 0 250 500 750 1,000 m

Enveloped minus HR IFD Sensitivity 10% AEP

Project: 22020180_MBRC_RFD_Major_Model_Update_BRI_RED

Client: MBRC

Details	Rev	Description	Drawn	Checked	Date
Original Size A3	1	Draft	KES	DC	11/07/2022
Projection: GDA/MGA94 Zone 56					
Imagery Source: Google Earth 2019					
Local Authority: Moreton Bay Regional Council					

WATER TECHNOLOGY
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Workspace: R:\Jobs\22020180_MBRC_RFD_Major_Model_Update_BRI_RED\Spatial\Workspaces\KS_working.qgz

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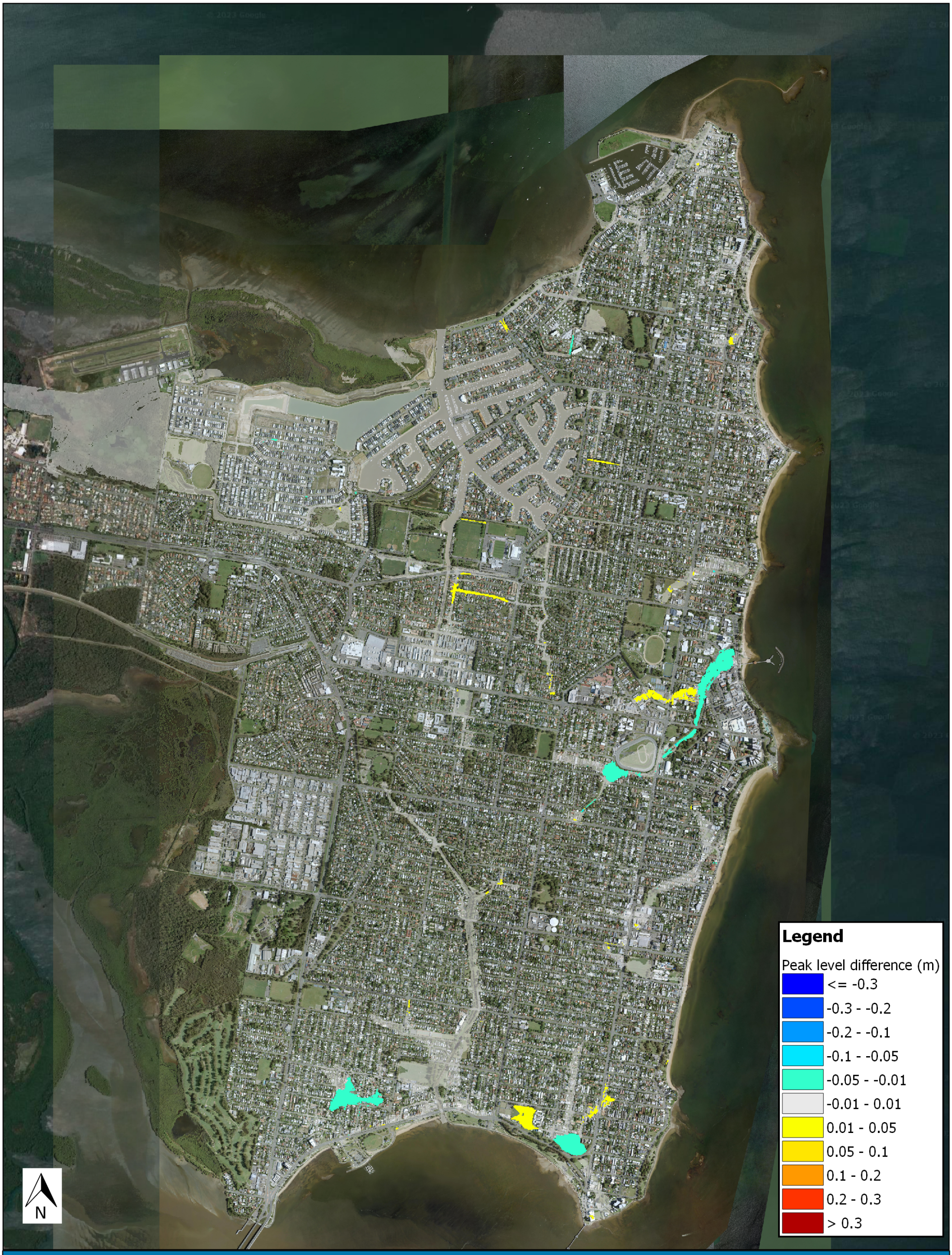

Scale: 1:25,000 0 250 500 750 1,000 m

Enveloped minus HR IFD Sensitivity 1% AEP

Project: 22020180_MBRC_RFD_Major_Model_Update_BRI_RED

Client: MBRC

Details	Rev	Description	Drawn	Checked	Date
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Workspace: R:\Jobs\22020180_MBRC_RFD_Major_Model_Update_BRI_RED\Spatial\Workspaces\KS_working.qgz

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Legend

Peak level difference (m)

- <= -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- > 0.3

N

Scale: 1:25,000 0 250 500 750 1,000 m

Enveloped minus HR IFD Sensitivity 0.01% AEP

Project: 22020180_MBRC_RFD_Major_Model_Update_BRI_RED

Client: MBRC

Details	Rev	Description	Drawn	Checked	Date
Original Size A3	1	Draft	KES	DC	11/07/2022
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Workspace: R:\Jobs\22020180_MBRC_RFD_Major_Model_Update_BRI_RED\Spatial\Workspaces\KS_working.qgz

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