

# Waikato and Waipa Rivers Flood Event 6-16 July 2002



## Final Technical Report

Prepared by:  
Adam Munro

For:  
Environment Waikato  
PO Box 4010  
HAMILTON EAST

ISSN: 1172-4005

12 August 2002

Document #: 769890



Peer reviewed by:  
Scott Fowlds

Signature



Date 22/10/2002

Approved for release by:  
Brendon Morris

Signature



Date 22/10/2002



# Table of Contents

1	INTRODUCTION	1
2	HYDROLOGICAL INFORMATION	1
2.1	Rainfall	1
2.2	Severe Weather Warnings (SWW)	2
2.3	River Level and Flow Information	2
3	FLOOD WARNINGS	3
4	COMMUNITY GATE OPERATIONS	3
4.1	Gate Open/Closure Times	4
5	THE WAIKATO HYDRO SYSTEM	4
5.1	Lake Taupo Management	7
5.2	Karapiro Outflows	7
6	FLOOD MANAGEMENT STRATEGIES ADOPTED	8
7	ENVIRONMENT WAIKATO'S RESPONSE	9
8	FLOOD SCHEME PERFORMANCE	10
8.1	Background	10
8.2	The Scheme Design	10
8.3	River and Protection Scheme Performance	11
8.4	Flood Profiles	12
8.4.1	Flood Event 1998	12
8.4.2	Flood Event 2002	13
8.4.3	Performance	13
8.4.4	Comments	13
8.5	Remedial Works	13
8.5.1	Waikato District Assets	13
8.5.2	Franklin District Assets	13
8.5.3	Environment Waikato Assets	13
8.6	Costs and Funding	14
8.7	Approximate Areas Inundated	14
8.8	Summary of River and Protection Scheme Performance	14
8.9	Operational Improvements	15
8.9.1	Flood Warning Network Review	15
8.9.2	Comments by area	15
9	SUMMARY OF IMPACTS	18
10	LOCAL INITIATIVES	18
11	WHERE TO FROM HERE	19
12	SUMMARY AND CONCLUSIONS	19
	APPENDIX A: SEVERE WEATHER WARNINGS	21
	APPENDIX B: MEDIA RELEASES	26
	Flood Team Ready for Wet Weekend	26
	More Rain Predicted for Soaked Waikato	26
	Flood Teams Gear Up for Another Wet Week	27
	Flood Team Watches River Over Night	27
	More Rain Worries Flood Managers	28
	Council Makes Use of Weather Break	28

Council Moves Water as River Peaks Drop	29
Flood Scheme Holding as More Rain Looms	29
Uncertain Forecast for Weekend Rain	30
Heavy Rain A Concern for Mercer, Coromandel	31
Fine Weather Gives Break for Flooded Waikato	31
<b>APPENDIX C: TPD DIVERSION MATRIX (GUIDELINE ONLY)</b>	<b>33</b>
Factor	33
Key criteria	33
Rising/falling	33
Options	33
Maximum	33
Average	33
<b>APPENDIX D: WAIKATO AND WAIPA RIVER FLOOD PROFILES</b>	<b>34</b>

## Table of Figures

Figure 1: The location and operating design of the Lower Waikato Community Gates.	4
Figure 2: Inflow and outflow sequences recorded between Taupo and Lake Karapiro.	8
Figure 3: Flooded farmland at Mercer. Inset: Waikato River levels recorded at Ngaruawahia, Rangiriri and Mercer (bottom to top respectively). The 'box' indicates the effect of a last minute rainstorm which coincided with the primary peak.	9
Figure 4: Erosion prevention works being installed on the Deroles stopbank, which was damaged from wave effects.	12

# 1 Introduction

This report examines the key aspects of the “**Waikato and Waipa Rivers Flood Event of 6-16 July 2002**”. It has been produced as part of Environment Waikato’s internal reporting requirements.

The report provides a comprehensive overview of the flood event that resulted in very high river levels in the western and southern parts of the region as a result of heavy and persistent rain in the six weeks prior to the main event. The opportunity has been taken to pull together a wide range of information and findings from both internal and external sources, including:

- Hydrological data (rainfall totals and river levels)
- Flood Management Strategies
- Environment Waikato (EW) Response
- Key decision points
- Performance of the Flood Warning Network and Protection Scheme
- Comparison to previous events
- Lessons learnt (opportunities for improvement)

Recommendations (where to from here) follow at the rear of the report.

## 2 Hydrological Information

### 2.1 Rainfall

Rainfall recorded in this event was not considered exceptional. It was the cumulative effect of successive north to northwest rainfall bands passing over the region in the six weeks prior to the main event that saturated soils and raised river levels above normal. The majority of the rainfall fell in the western and southern parts of the region (Table 1).

**Table 1: Regional Rainfall Totals**

<b>Location (numbers correlate to map below)</b>	<b>Event Total 1 – 13 July</b>	<b>July Mean</b>	<b>+ / - Mean</b>
1. Ngaroma	240 mm	225 mm	+ 7%
2. Te Kuiti	156 mm	156 mm	equal
3. Kawhia	177 mm	149 mm	+ 19%
4. Hamilton	97 mm	123 mm	- 20%
5. Te Aroha	170 mm	150 mm	+ 13%
6. Maungakawa	130 mm	153 mm	- 15%
7. Mangatangi*	225 mm	235 mm	- 4%
8. Pinnacles	306 mm	490 mm	- 37%

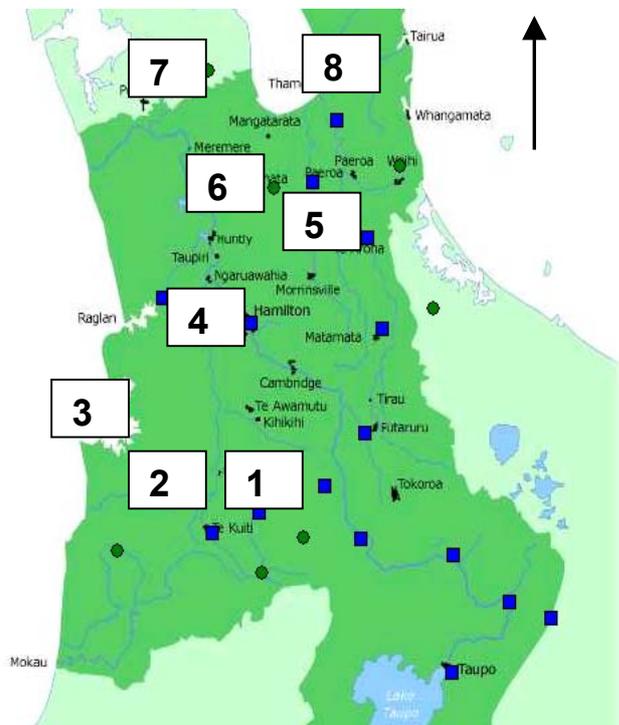
*\*90 mm of the event total was attributable to an 11<sup>th</sup> hour rainstorm (on 12 July).*

## July Climate Update

According to the July climate update from NIWA, rainfall in the northern and eastern regions of the North Island was well above normal (as were river flows). Flooding occurred at Te Awamutu on 5 July, Te Kuiti and Mangakino on 8 July, and Mercer on 12 July when the Waikato River flooded farmland already saturated by weeks of wet weather.

## August to October Climate Outlook

An El Nino event in the tropical Pacific is now in place, but its duration and magnitude still remain uncertain. It is likely to be much weaker than the 1997/98 episode when there was lower than normal rainfall in many east coast areas, and severe drought in some localities. At this stage it is not possible to predict what this El Nino event will have on the New Zealand climate in spring. However, rainfall is expected to be near normal over much of the country, but may be above average in eastern North Island regions (same for river flows).



## 2.2 Severe Weather Warnings (SWW)

Severe Weather Warnings (SWW) are released by the MetService when, in the opinion of duty forecasters, rainfall totals from approaching rainfall systems are expected to exceed certain criteria (e.g. 100mm in 24 hours).

There were over eight weather watches and/or warnings released during this event (Appendix A). They generally predicted a large area of thundery rain and showers to pass over the region from the eastern Tasman Sea and it was expected to bring further bursts of heavy rain to already saturated catchments.

Aside to the warnings, regular contact was made between Environment Waikato's Emergency Management duty officers and the lead forecasters at MetService. The Auckland weather radar was also used to full advantage so staff could pin point where the rain was falling in real time.

## 2.3 River Level and Flow Information

Very high river levels were sustained in the Waipa and lower Waikato Rivers over a long duration (Table 2). This was due to successive rainfall storms, saturated catchments, and already swollen river levels. The Waipa River was responsible for well over half the peak flows recorded at Ngaruawahia.

*Right: The Waikato and Waipa Rivers meeting at Ngaruawahia.*



Except for hampering clean up and remedial work operations associated with the Weather Bomb event (which occurred on June 21), no major problems or issues were reported on the Waihou and Waitoa Rivers - which were also above alarm in this event.

**Table 2: River Level Data Summary**

River	Site Name	Peak Level	Mean Level	Peak Flow (cumecs)	Return Period	+ / - 1998
<b>Mangaokewa</b>	Te Kuiti	52.02 m	48.67 m	100	5 – 10 yr	- 0.70 m
<b>Waipa</b>	Otewa	4.57 m	2.12 m	240	10 yr	- 0.58 m
	Otorohanga	33.21 m	28.74 m	380	20 – 50 yr	- 0.17 m
	Whatawhata	18.95 m	11.06 m	745	10 – 20 yr	- 0.61 m
	Puniu	13.50 m	9.56 m	180	2 - 5 yr	- 0.48 m
<b>Waikato</b>	Hamilton	15.32 m	12.90 m	560	5 yr	- 1.39 m
	Ngaruawahia	12.88 m	9.95 m	1170	20 yr	- 0.90 m
	Huntly	10.39 m	7.74 m	1190	20 yr	- 0.85 m
	Rangiriri	8.34 m	6.14 m	1160	20 yr	- 0.72 m
	Mercer*	5.55 m	2.58 m	1380	50 yr	- 0.60 m
<b>Mangatangi</b>	Lower Weir*	-	-	12	-	-
	SH2	12.65 m	-	74	-	-
<b>Mangatawhiri</b>	Lower Weir*	2.09 m	-	62	-	-
<b>Waihou</b>	Te Aroha	9.93 m	8.11 m	135	<Mean annual	- 0.78 m
<b>Waitoa</b>	Mellon Road	8.26 m	6.27 m	40	Mean annual	- 0.26 m

- The flow at Mercer increased from what would have been a 20 year event to that of a 50 year event due to an 11<sup>th</sup> hour rainstorm which dumped another 90 mm over the lower catchment.

\* Data kindly provided by Watercare Services Limited.

### 3 Flood Warnings

Approximately 45 alarms were issued by Environment Waikato’s flood warning system in this event. Alarms are triggered when pre-determined rainfall intensities or river levels are exceeded. The system then automatically notifies the incumbent Level 1 Emergency Management Officer (EMO) and/or external customers via pager, fax, or email. The EMO then acts according to a set of procedures as defined within the Flood Warning Procedures Manual and the Flood Rules (in consultation with MRP).

Key recipients included district councils, landowners and key agencies. The first warning was issued on Thursday 4 July, with the last one issued on Saturday 13 July. About 12 media releases (Appendix B) were issued in support of the warnings (in some cases up to three a day).

No major problems with the flood warning system were reported. However, predictions of flood peak travel times were made difficult due to continuing rainfall, long travel times and slow attenuating peaks.

### 4 Community Gate Operations

The Te Onetea, Lake Waikare, and the Whangamarino Control gates (Figure 1) all performed well and were opened and closed in accordance with flood management guidelines. As a general rule, the Lake Waikare (northern outlet) and Whangamarino

control gates are closed when the level of the Waikato River is greater than the water level in the Whangamarino wetland. Closing the gates is necessary to prevent backflow from the river into the wetland. Under 'normal' flow conditions, when the river level is below the wetland level, the gates remain open and natural through flow occurs between Lake Waikare, the Whangamarino and the Waikato River.

The Lake Waikare and Whangamarino gates are closed and opened in unison. However, while the Whangamarino gate is opened as soon as the river level drops below the wetland level, the Lake Waikare gates are opened and closed to control lake levels between R.L. 5.5 m and 5.65 m, depending on the season as set in a protocol. Figure 1 below shows the location of the community gates and water flow directions through the system.

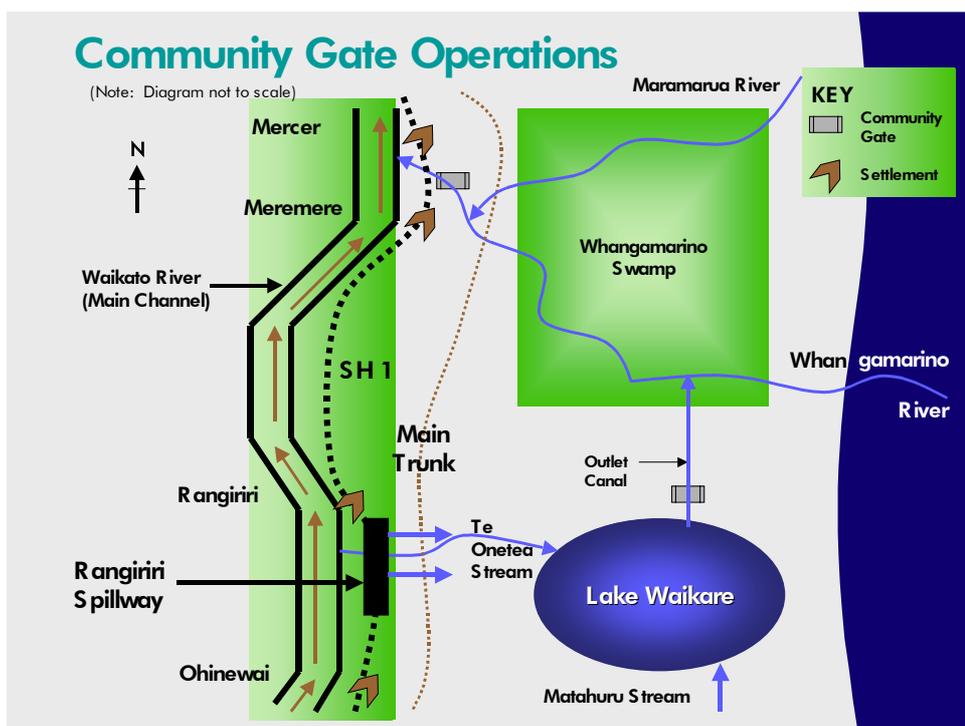


Figure 1: The location and operating design of the Lower Waikato Community Gates.

## 4.1 Gate Open/Closure Times

The Whangamarino Control and Lake Waikare Gates were closed on Monday 8 July and re-opened at 8am on Sunday 14 July when the Waikato River level and the Whangamarino wetland level were equal – and were continuing to fall. The Te Onetea Gate closed automatically on Saturday 6 July when the Waikato River level exceeded 7.0 metres (RL). It didn't re-open until Tuesday 30 July when the level of Lake Waikare stabilised (that is, its level was consistently below the Waikato River level at Rangiriri).

The Rangiriri spillway did not operate in this event (although the Waikato River level came to within 0.4 m of its operating level of 8.81 m). The spillway was therefore closely monitored by the roading authorities due to adjacent road works associated with the construction of the Waikato Expressway.

## 5 The Waikato Hydro System

The Waikato River is the longest river in New Zealand (425 km) and drains about 14,250 km<sup>2</sup> of catchment over the central parts of the North Island. Mighty River Power (MRP) owns and operates the Waikato hydro system for the purposes of generating

electricity. The Waikato hydro system consists of the Taupo control gates, eight hydro dams, and nine power stations.

Lake Taupo represents the main storage facility for the system. The Taupo control gates regulate the flow of water down the Waikato River, allowing water to be stored in the lake and released down the river to meet generation requirements and/or for flood management purposes. In this event, Environment Waikato and Mighty River Power (MRP) worked together daily to ensure that (on balance) lake levels and river flows were minimised as much as possible over the entire catchment.

The following schematic depicts an overview of the Waikato/Waipā catchments between Lake Taupo and Mercer, including the operational components of the hydro system and the Lower Waikato Waipā Control Scheme. Peak flows recorded during this event are also presented.