

# **The Maitland Flood of 2007**

## **Operation of the Hunter Valley Flood Mitigation Scheme and the Maitland City Local Flood Plan**

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### **Abstract:**

On 8 and 9 June 2007, extreme weather in the Hunter Valley caused unprecedented flash flooding in Newcastle, grounding of the coal ship Pasha Bulker, and the largest Hunter River flood for 36 years.

The Hunter Valley has a history of floods, the most notable being the February 1955 event which devastated the City of Maitland and floodplains of the Hunter. It led to construction of the Hunter Valley Flood Mitigation Scheme – 170 kilometres of levees and flood control structures designed to prevent a recurrence of the 1955 disaster. The scheme is managed as a partnership between the Hunter-Central Rivers Catchment Management Authority and the Department of Environment and Climate Change, with funding also provided by the Australian and local governments.

The scheme was tested during the 2007 Queen's Birthday long weekend, when with little warning, a significant flood equating approximately to a 5% AEP event threatened to again inundate the City of Maitland.

The works have been continually maintained and refurbished in preparation for flood events, however the Maitland scheme had not operated since 1971. Few people had first hand experience of that flood, and public understanding of how the flood control structures function was not high.

Whilst the initial prediction was for an event similar to the 1971 flood – also approximately equating to a 5% AEP flood, the often quoted adage "No two floods are the same" applied this weekend.

This paper reports of the origins of the 2007 flood, the accuracy of flood predictions, activation of the State Emergency Service Maitland City Local Flood Plan – involving evacuation of over 4,000 people, and operation of the flood mitigation scheme.

The paper will discuss what worked, what can be improved, and lessons which can be applied in other flood prone towns.

## **Introduction:**

The mixed blessings of the floodplain habitation are known only too well in the Hunter Valley. The massive flood in 1949, followed by an even larger and more destructive flood in 1955 bought national recognition to Maitland as “the flood capital of NSW”. The 1955 flood resulted in the loss of 14 lives, hundreds of homes and businesses destroyed or flooded, and thousands of farms devastated. The estimated cost in present day terms is in excess of \$600 million.

The flood history of the Hunter is the main reason for the formation in 1950 of the Hunter Valley Conservation Trust, which has evolved into the present day Hunter-Central Rivers Catchment Management Authority (CMA). Following the 1955 flood, legislation was enacted to allow for the construction, maintenance and financing of a coordinated system of flood mitigation works in a partnership between the Trust and the NSW Government. Operation of the Hunter Valley Flood Mitigation Scheme continues today as a partnership between the CMA and the Department of Environment and Climate Change (DECC). A key component of the scheme is a system of levees, spillways and floodways designed to protect Maitland from another 1949 size flood.

## **Background:**

On Wednesday 6 June 2007 rain began falling in the Upper Hunter, increasing in intensity until Friday 8 June. In some parts of the upper catchment average rainfall intensity over the three days exceeded that of the 1955 flood.

The rainfall resulted from an East Coast Low - a typical winter flood producing weather pattern. Indeed while Hunter floods can occur at any time, large floods have frequently occurred in June, including 1820 (a flood perhaps larger than 1955), 1930, 1949 and 1971 (the latter two floods of approximately 1 in 20 year recurrence interval, or 5% annual exceedance probability (AEP)).

On Saturday 9 June the Bureau of Meteorology’s flood warning centre predicted a flood at Maitland of similar size to the 1971 flood.

## **The Maitland Flood Mitigation Scheme:**

Reviews of the 1955 flood determined that it is not practical to use levee banks to confine all floods within the river channel. The design of the present Maitland flood mitigation scheme utilises natural floodways, Oakhampton on the west of Maitland and Bolwarra on the east of Maitland, to pass major floods around the city. Spillways built into the levee banks upstream of Maitland were designed to come into operation in a 5% AEP flood. The water flows over a series of control structures, designed to reduce scouring velocities, on each side of the city. When the floodwaters rise sufficiently a ring levee to the south of Maitland will overtop, and low lying residential and business premises will become submerged. Similarly low lying parts of the suburb of Lorn, to the east of Maitland, will eventually become inundated. In a rapid rise flood this can take as little as 12 hours. Until 2007 the Maitland floodways had previously only operated once – in 1971, not long after their construction.

The scheme is operated and maintained in a partnership between DECC and the CMA, with additional funding provided by Maitland City Council. In 2003 as part of the scheme's ongoing maintenance and rehabilitation program the Maitland levee was reconstructed at a cost of \$8 million, with funds provided by all levels of government and the CMA.

### **Limitations of the Mitigation Scheme:**

The scheme is designed to provide protection to the Maitland central business district and to the village of Lorn, from the impact of high velocity floodwaters flowing directly from the Hunter River. When the spillways commence overtopping, local roads will become cut and eventually Maitland and Lorn will become isolated. In the event of a major flood most of Maitland and Lorn will be inundated. For another flood similar to that of 1955, Maitland should not experience the same destructive high velocity flood flows, but still achieve actual flood levels similar to those reached in the 1955 event.

The movement into Maitland of many residents and business people with little or no flood experience, the lack of recent large floods, and a misconception that the levee banks protect against all floods have resulted, for some people, in a false sense of security, and a lack of flood preparedness. For this reason the CMA in partnership with the SES and local community, have developed a flood education strategy for Maitland and the lower Hunter. The strategy was about to be implemented when the 2007 flood intervened. A separate paper "Building Community Capacity for Flood Safety in Maitland and the Hunter Valley" is being presented at this conference.

### **Maitland City Local Flood Plan:**

Since the mitigation scheme cannot be relied upon to provide protection against all levels of possible flooding and cannot be guaranteed not to fail through means other than overtopping, flooding still poses a risk to residents living in Maitland. To ensure flood emergency responses can be effectively controlled and coordinated in the event of flooding, the SES has led the preparation of a flood emergency plan for the Maitland City Local Government Area.

The Maitland City Local Flood Plan, which was last reviewed in 2002 is a sub plan of the Local Disaster Plan and was prepared under the SERM Act 1989, SES Act 1989, State Displan and State Flood Plan. The plan is holistic in its scope containing arrangements for the preparedness, response and recovery. The Plan covers all magnitudes of flooding and contains specific sections relating to evacuation, warning, rescue, resupply and property protection.

The process of developing the Plan was conducted in a consultative manner to ensure that all key stakeholders were involved in the planning process. Consultation is important to ensure stakeholders are aware of and have some ownership of the plan, especially any responsibilities.

To prepare the Plan, it was necessary to develop knowledge of the flood risk and the flood mitigation scheme, this involved information being passed from the CMA and DECC to the SES regarding the nature of the scheme and how it operates. When preparing flood emergency plans the SES will commonly seek information from levee owners, including:

- Description of each levee, detailing: location; construction type; and the communities protected.
- The following heights relative to the relevant flood warning gauge; and the AEP of the respective heights:
  - Levee Design Height
  - Overtopping heights of levee low points
  - Levee Spillway heights
  - Imminent Failure Height
- Likely locations of levee overtopping and the sequence of overtopping and flooding (these outputs should be presented in a spatial format, accompanied by a description).
- Size of the population; the number of residential and commercial properties; and critical infrastructure affected by levee over-topping or failure. This output should be expressed in relation to a variety of flood magnitudes, including a worst case scenario.
- Scope for additional development in areas protected by levees, considering the size of available zoned land.
- The height relative to the relevant flood warning gauge that any backwater flooding commences impacting upon urban areas behind each levee and the pattern of inundation.
- Once over-topped the length of time taken to fill the basin area behind each levee and the pattern (evolution) and behaviour of inundation.
- Details of ground profile (topography) inside each levee and the height of potential high points of land relative to the relevant flood warning gauge.
- Location of any parts of each levee which need to be closed other than drains (eg. gates for roadways and railways) and the height relative to the relevant flood warning gauge that action must be completed by.
- Knowledge of any critical issues including structural integrity affecting each levee.

Further information regarding SES flood emergency planning is described in Gissing, Morgan and Ronan (2006).

### **SES Response to Flood Situation:**

The SES led and coordinated flood operations within the Maitland City Local Government Area as well as many other areas which were affected by the weather event, including Singleton, Raymond Terrace, Newcastle, Lake Macquarie, Wyong, Gosford and Sydney. The following table provides a summary of the sequences in which events occurred and what actions were taken by the SES and other emergency services.

Condition	Action	Other concurrent operations in other areas
Flood Watch issued (1726 7/6/07)	<p>SES issues Flood Bulletin to media advising of the possibility of flooding and for the community to be aware of the situation</p> <p>SES revised operational readiness to control and coordinate flood operations</p> <p>SES monitors situation</p>	Rainfall occurring over the lower sections of the Hunter River catchment.
Severe Weather Warning for Flash Flood Flooding issued (2150 7/6/07)	<p>SES issues public safety messages advising caution.</p> <p>SES continues to monitor the situation.</p>	<p>Rainfall occurring over the lower sections of the Hunter River catchment.</p> <p>Large waves begin to cause coastal erosion.</p>
Flood Warnings issued for Major flooding at the Maitland (Belmore Bridge) Gauge (0800 9/6/07)	<p>SES issues Flood Bulletins warning the community of the situation and advising public safety precautions such as:</p> <ul style="list-style-type: none"> <li>○ Farmers should relocate farm animals to higher ground and move pumps</li> <li>○ People living in communities along the Hunter River should keep an active watch on the situation</li> <li>○ Rural properties should prepare for potential isolation.</li> <li>○ Motorists should not drive through flood water</li> </ul> <p>Areas outside the levee system advised to be prepared to evacuate.</p>	<p>Severe weather has occurred across the Hunter Valley, Newcastle Lake Macquarie, Wyong, Gosford and Sydney areas. The SES is responding to requests for assistance from the public due to flood and storm damage.</p> <p>The Pasha Bulka has run aground at Nobby's beach.</p> <p>Over 300 people have been rescued from flood waters in Newcastle.</p> <p>Flood Warnings are current for the: Hunter River, Wyong River, Tuggerah Lake, Paterson/Williams Rivers, Lake Macquarie and the Nepean/Hawkesbury Rivers.</p>
Flood Warning predicting peak near 11.3 metres at the Maitland (Belmore	SES issues advice to areas outside the levee system to evacuate and for residents	Residents outside the Singleton Levee evacuated to within Singleton.

Condition	Action	Other concurrent operations in other areas
Bridge) Gauge (1400 9/6/07)	<p>in South Maitland, Central Maitland and Lorn to be prepared to evacuate and maintain a vigilant watch on the situation.</p> <p>Operational readiness to conduct evacuations within Maitland increased.</p>	<p>Evacuations in Wyong</p> <p>SES coordinates response to storm and flood damage within Newcastle, Lake Macquarie, Wyong, Gosford and Sydney.</p>
Flood Warning predicting 11.4 at the Maitland (Belmore Bridge) Gauge (1300 10/6/07)	<p>SES issues advice to residents of South Maitland, Central Maitland and Lorn to evacuate (approximately 4000 people).</p> <p>Resources redirected from storm damage response to assist with evacuation operations.</p> <p>Sandbagging of businesses in the Maitland CBD.</p>	<p>SES conducting planning for possible evacuations around Raymond Terrace and Hexham.</p>
Oakhampton Spillway begins to operate – 1900 hrs 10/6/07.	<p>Evacuations continue, approximately 300 SES volunteers and other emergency service personnel involved.</p>	<p>Operational readiness increased to conduct evacuations downstream of Maitland.</p>
River level peaks at 10.7 metres and begins to fall.	<p>Approximately 700 people have registered at evacuation centres.</p> <p>SES issues All Clear for South Maitland, Central Maitland and Lorn.</p>	<p>SES advises residents and business owners in Hexham to be prepared to evacuate.</p>

The evacuation of Maitland was the largest component of the flood response in the Maitland area. The decision to evacuate was made based upon the likely consequences of the predicted flood levels and the subsequent risk to life flooding would have posed. The decision by the SES was reached in consultation with DECC, the CMA, Maitland City Council and other emergency services, after considering a range of variables and uncertainties.

### **Review of Flood Mitigation Scheme Performance;**

The initial prediction by the Bureau of Meteorology was for an event similar to the 1971 flood – a 5% AEP flood. While few people had operational knowledge of that event, the flood and operation of the scheme had been thoroughly studied and modelled. Based on the early Bureau of Meteorology predictions the June flood should have just brought the Maitland spillways into operation, and flooding should not have significantly impacted on Maitland or Lorn.

However, by mid morning on Sunday 10 June unexpectedly high river levels upstream of Maitland caused the Maitland flood level predictions to be revised upwards. By midday, instead of a one in 20 year, or 5% AEP flood, Maitland was expecting a flood approaching a one in 50 year, or 2% AEP size.

A flood of this greater volume would have serious implications for Maitland – the ring levee would be overtopped, and the village of Lorn would be partially flooded. The integrity of bridges when exposed to expected high debris loads was uncertain, and the flood mitigation structures, while regularly maintained, had never experienced a flood of this size.

By 7pm on Sunday 10 June the Oakhampton spillway commenced discharging water from the river. The spillway operated as planned – but several hours earlier than predicted.

At 3am Monday 11 June the river peaked at Maitland. The Oakhampton spillway continued to discharge throughout the night and during Monday, however the predicted peak at Maitland was not achieved, and the Bolwarra spillway barely operated.

While the timing of events was not as predicted, the Maitland mitigation scheme did operate as planned, and all properties within the levee were protected.

At the time of writing, the technical review of the flood is not complete, however the following observations are worthy of note:

- The flood gradient appears to have been steeper than previously observed or predicted by modelling, resulting in early operation of the Oakhampton spillway. The recent increase in riparian vegetation upstream of Maitland appears to have affected the velocity and gradient
- The amount of flood debris conveyed to Maitland was considerably less than expected for a flood of this size. The increased riparian vegetation cover appears to have retained much debris which would otherwise be washed downstream
- Damage to flood mitigation structures was limited to two locations, and did not compromise the integrity of the scheme
- The difference between predicted and actual flood peaks is still being investigated, but is mostly likely due to rainfall timing and patterns – no two floods are alike.

## **Review of Flood Plan Performance:**

Much of the successful decision making in regards to the evacuation of Maitland was related to the strong partnerships between the SES, DECC, Maitland City Council and the CMA. These partnerships ensured that the SES had developed a knowledge of the mitigation scheme and its operation and was able to call upon the technical knowledge of DECC and the CMA during the event. It is essential that all owners of flood mitigation schemes develop a thorough knowledge of their scheme and supply the SES with the information it requires. Without this information emergency planning and decision making will be severely impaired due to an inadequate appreciation of the flood environment.

## **Take home message:**

The benefits of the continued investment in the Maitland levee system were demonstrated over the June 2007 long weekend. Maitland central business district and Lorn suffered no direct flood damage – without the system Maitland would have experienced another 1949 disaster.

But larger floods will occur and the community must be prepared to respond. Emergency plans must be maintained for all communities protected by levees; detailing evacuation arrangements to be undertaken when floodwaters threaten to overtop or cause levee failure. Communities protected by levees should also receive ongoing community education to maintain their awareness of flooding and promote actions to take in preparing for, and in response to flooding.

## **References**

Gissing, A. Morgan, M & Ronan, C. (2007) Planning for the Inevitable – Emergency Planning for Floods in NSW. Presented at: 47<sup>th</sup> NSW Floodplain Management Authorities Conference Gunnedah, 2007. [Available Online] [www.ses.nsw.gov.au](http://www.ses.nsw.gov.au)