The 2011 Queensland Floods

Bill Syme
FMA Conference, San Diego
September 2011

Why were Qld Floods Surprising?

Different types
• Flash floods
• Long duration floods
• Repeat floods (Dalby 5 times!)

Severity
• Significant number of locations experienced greater than 1 in 100 year rainfall

Geographical extent
• North Queensland to NSW
• Coastal areas and inland
• Rural areas, towns and cities
Flash Flooding – Toowoomba

Within an hour of rainfall, creeks of Toowoomba had risen several metres.
The flood wave travelled 6km through the CBD in 30 mins.
The street drainage system was designed for a 2-5 year rainfall event
Major sheet and roadway flow as well as creek flooding
Catchment increasingly urbanised – faster and less attenuated runoff

Flash Flooding – Helidon

22 minutes!
Long Duration River Flooding
Goondiwindi

14th January 2011: Predicted 10.8
Reached 10.65m
Levee crest at 11m

Questions Arising

Flood Forecasting and Warnings
  Were the forecasts accurate and the warnings useful?

Community Preparedness
  Did we know what to do?

Operation of Somerset and Wivenhoe Dams
  Did the operation of the flood gates reduce flooding?

Emergency Management
  How did we go managing the emergency?

Development Controls
  Did our planning controls reduce the risk to lives and damage to property?

Design and Location of Infrastructure
  Were our emergency services and key transport routes fully functional?
Flood Forecasting and Warnings

The Bureau of Meteorology (BoM) issues forecasts predominantly as predicted levels at gauges. These forecasts are relayed to the community via the web/phone and the media who must quote verbatim.

Number one criticism was that many (most?) people did not know what a flood gauge height meant:
- Does 5.5m mean we get flooded? – no idea
- When do we lose access? – no idea
- Should we raise or remove our possessions? – no idea

The accuracy of the forecasts not great, but at least they tended to be conservative!

Key recommendation from inquiry is to use a hydraulic model for forecasting (only a hydrologic model was used).

Community Preparedness

In many areas very poor
- People in general had little idea of what to do
- Those that experienced previous floods much more astute

If we were a prepared community would we have had this...
and this?

Brisbane Flooding
11,900 houses & 2,500 businesses with above floor flooding
2,100 roads inundated
100,000 homes without power
6th largest flood in recorded history

[abc.net.au], [SEQwater]

Without Wivenhoe?
Levels in City approx 2m higher
14,000 additional properties affected
[abc.net.au]
Operation of Dams

Somerset Dam
Stanley River
Flows into Wivenhoe

Wivenhoe Dam
Brisbane River
Built post-1974 flood

Both dams equipped with radial gates to be operated during a flood

Figure 5.2.1 SEQWater Report

Peak discharge coincides with peaks of Lockyer Creek and Bremer River
Discharges increase around 9am 11/1

Figure 9.1.2 – Wivenhoe Dam inflow and release summary for the January 2011 Flood Event
SEQWater Report
13 hours before increasing discharges

5 hours before increasing discharges
Could the second peak have been forecasted better?

Should releases have started earlier?

Would it have made much difference?
Wivenhoe Dam

Provided substantial flood mitigation

Questions over timing of releases prior to and during the second flood peak

Highly effective at reducing flood peaks but did the presence of the dam give residents and decision makers a false sense of security...

The larger the flood the more ineffective the dam...

Questions over effect of dam on design flood levels for development controls
Emergency Management

General opinion is the floods were handled well (given the extent)
Strong and compassionate leadership by key politicians
Outstanding effort by rescue personnel
However, 35 people died with some still missing presumed dead
Government acting on recommendations from Inquiry

Post flood clean-up carried out with great community spirit

The Toowoomba Chronicle

Post-flood streets lined with rubbish...
Development Controls

Example house in Rocklea, Brisbane

After the 2011 flood, Brisbane City Council relaxed height restrictions in flood-prone areas and have raised minimum floor level to above 2011 levels...
Brisbane: Comparison to Planning Levels

1974 Flood (pre-Wivenhoe) higher than 2011

Review of Infrastructure Emergency Services

Main Transport Corridors

Location of Hospitals, Police, Fire, Ambulance

Rockhampton Airport

Police
## Scorecard

### Flood Forecasting and Warnings
Were the forecasts accurate and the warnings useful? ★★★☆☆

### Community Preparedness
Did we know what to do? ★☆☆☆☆

### Operation of Somerset and Wivenhoe Dams
Did the operation of flood gates reduce flooding in Ipswich & Brisbane? ★★★★☆

### Emergency Management
How did we go managing the emergency? ★★★★★

### Development Controls
Did our planning controls reduce the risk to lives and damage to property? ★★★☆☆

### Design and Location of Infrastructure
Were our emergency services and key transport routes fully functional? ★★★☆☆

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## Where to From Here?

Queensland needs to adopt national best-practice guidelines for flood planning and management  
NSW Flood Risk Management approach an excellent example  
(NSW has pursued a very active flood management program for over 30 years)  
Queensland’s guidelines ~15 pages (including bushfires!)  
NSW’s guidelines ~200 hundred pages!

Invest in the Future – Invest in Flood Management
**NSW Flood Risk Management Process**

- **Collect Data**
- **Define Existing Flood Behaviour**
- **Investigate Management Measures**
- **Flood Risk Management Plan**
- **Implement Management Plan**

**Steering Committee**

**Flood Modification Measures**

**Property Modification Measures**

**Response Modification Measures**

**Risk Based Approach**

Take into account:
- ALL events (not just the 100 year event)
- Warning times
- Hazard level
- Uncertainties
- Climate Change

Flash flood areas should have different controls than areas of long-duration river flooding

Use extreme events for evacuation planning and emergency management
### Development Control Matrix

#### DEVELOPMENT WITHIN A RESIDENTIAL AREA

<table>
<thead>
<tr>
<th>Controls</th>
<th>Development Type</th>
<th>100 Year Hazard</th>
<th>500 Year Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Low Hazard</td>
<td>High (Depth) Hazard</td>
</tr>
<tr>
<td>Fill Level</td>
<td>New Development</td>
<td>No Min</td>
<td>No Min</td>
</tr>
<tr>
<td></td>
<td>Emergency Services</td>
<td>PMF Flood Level</td>
<td>PMF Flood Level</td>
</tr>
<tr>
<td>Floor Level</td>
<td>Habitable Building</td>
<td>100y level +0.5m</td>
<td>100y level +0.5m</td>
</tr>
<tr>
<td></td>
<td>Ancillary Building (eg shed)</td>
<td>10y level +0.3m</td>
<td>10y level +0.3m</td>
</tr>
<tr>
<td></td>
<td>Emergency Services</td>
<td>PMF Level</td>
<td>PMF Level</td>
</tr>
</tbody>
</table>

### Property Modification Measures

#### Development Control Matrix Example

**Example – Mechanics Garage**

- High Hazard Depth
- Rare Extreme Hazard
- Floor Level F2 Required
- Floor Level = 59.3mAHD

### TABLE 2-3: RESIDENTIAL, COMMERCIAL AND INDUSTRIAL DEVELOPMENT WITHIN URBAN AREAS

<table>
<thead>
<tr>
<th>Device</th>
<th>Development / Modification Type</th>
<th>Flood Hazard Category</th>
<th>C: Compromise</th>
<th>A. Floodproof</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Commercial or Industrial Building</td>
<td>N/A</td>
<td>F3</td>
<td>F3</td>
<td>F3</td>
</tr>
<tr>
<td>New Habitable Building</td>
<td>N/A</td>
<td>F2</td>
<td>F2</td>
<td>F2</td>
</tr>
<tr>
<td>New Other Community Service (School, etc) (Special Protection from the flood event)</td>
<td>N/A</td>
<td>F5</td>
<td>F5</td>
<td>F5</td>
</tr>
<tr>
<td>Existing Flare</td>
<td>N/A</td>
<td>F4</td>
<td>F4</td>
<td>F4</td>
</tr>
<tr>
<td>New Emergency Services (pHospitall, etc) (Critical Infrastructure) (Special Protection from the flood event)</td>
<td>N/A</td>
<td>F3</td>
<td>F3</td>
<td>F3</td>
</tr>
</tbody>
</table>

**FMA Conference, San Diego, USA, Sep 2011**
Flood Warnings

Gauge heights
– let’s make them mean something!

TUFLOW populates each property with information on warning time and gauge heights for when:
✓ access is cut-off;
✓ ground flooding occurs; and
✓ flooding above floor level will occur.
Once you have identified at risk buildings...

Send messages to residents and businesses

Critical gauge heights for each building placed somewhere permanent (eg. inside the electricity box)

Occupants / Owners can make an informed decision on the action to take

Very difficult in areas with flash flooding and little warning time – need greater focus on development controls to not have people in the firing line

Flood Totems
The Next Step on from Gauge Heights

LinksResponse Modification Measures
Help solves communication problems
Being trialled in Innisfail, North Queensland
Flood Totems
The Next Step on from Gauge Heights

More palatable to real estate agents and landowners
Cornerstone for flood warnings
Link to gauge height forecasts
Indicates likelihood of inundation
Easier to communicate to the community
Household/Business Diagrams (eg. place in electricity box)
Many others...

Community Preparedness

Raise awareness
(probably not necessary in Queensland right now!)

Flood evacuation plans
  Businesses
  Coordination by councils
  Educate residents

Continuous community consultation and reminders essential
In Conclusion

Our Qld communities and businesses could have been much better prepared
Forecasted gauge heights were of little meaning to most
Qld’s approach to flood risk management and planning tends to be reactive rather than proactive (some councils excepted)
Qld needs to proactively pursue a flood risk management process
Qld can learn a lot from the NSW Flood Risk Management process and elsewhere

Thank You