

Emergency management of SunWater's dam portfolio in the 2010-11 Queensland floods

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SunWater Limited

SunWater owns 23 referable dams and operates a further two dams for other owners. The dams are located across Queensland from Texas and St George in the South to the Atherton Tablelands in the north to Mt Isa in the west.

During the period December 2010 to February 2011 there were several significant rainfall events across Queensland. The first occurred in late December 2010, the second in mid January 2011 and third in early February 2011. Generally it was the most significant rainfall event in Queensland since the 1970's.

22 Emergency Action Plans were activated simultaneously by SunWater. Eleven dams experienced a flood of record during the events.

This paper will discuss what has been learnt from these events including the optimisation of management structures for a dam owner with a large portfolio of dams: review of O&M Manuals including the adequacy of backup systems: relationships with the State disaster management framework: the value of rigorous communication protocols: managing fear and a general lack of understanding in the community: and the value of being prepared.

Keywords: *Emergency Management, Floods, .*

1 Background

SunWater and its subsidiary company Burnett Water Pty Ltd own 23¹ referable storages consisting of 18 Category 2 dams and 5 Category 1² dams under the Water Supply (Safety and Reliability) Act 2008 and Water Act 2000. Three of the 23 referable storages are pumped storages that are not located on a watercourse and generally do not flood. One referable dam is a weir which is completely submerged during major floods.

Four of SunWater's dams have gated spillways. The gates store water above the fixed crest and for all of SunWater's gated dams full supply level (FSL) is near the top of the gates with little freeboard. The gates are operated to maintain the storage level close to FSL during a flood event. The gates are not designed to regulate flood flows other than to match the spillway discharge to the rate of inflow to the storage. The four dams with gated spillways are Callide, Coolmunda, EJ Beardmore and Leslie.

The other 15 major dams have ungated or uncontrolled spillways. This means that when inflows occur the storage level raises. When the storage level exceeds the FSL the spillway will commence to discharge. The rate of discharge is a function of the height of the storage above the fixed crest, the width of the spillway and the flow characteristics of the design.

¹ Claude Wharton Weir has an inflatable crest control device that is temporarily out of commission. This reduces the number to 22 by agreement with DERM

² Category 1 Population at risk (PAR) 2 to 100, Category 2 PAR more than 100

In addition to the dams SunWater owns, the following storages are managed under facility management contracts:

- Glenlyon Dam – (Category 2 dam) for the Border Rivers Commission
- Scrivener Dam – (Equivalent to a category 2 dam) for the National Capital Authority
- Ross River Dam – (Category 2 dam) for the Townsville City Council

1.1 Objectives

The purpose of this paper is to outline the record flood events across SunWater's portfolio of dams during the 2010-11 wet season and the lessons learnt from these events. These lessons will drive further improvements in planning, communication and emergency response.

2 Overview of 2010-11 wet season weather events in Queensland

The following passages are reproduced courtesy of the Bureau of Meteorology Special Climate Statement #24

“The period from late November 2010 to mid January 2011 was extremely wet through much of eastern Australia. Six major rain events affected large parts of the eastern states during this period, resulting in widespread flooding on many rivers culminating in severe flooding (including river and flash flooding) in Brisbane and nearby areas of south-east Queensland and northern New South Wales during the second week of January. Other significant floods affected the Fitzroy, Burnett and Condamine-Balonne catchments in Queensland in late December and early January.

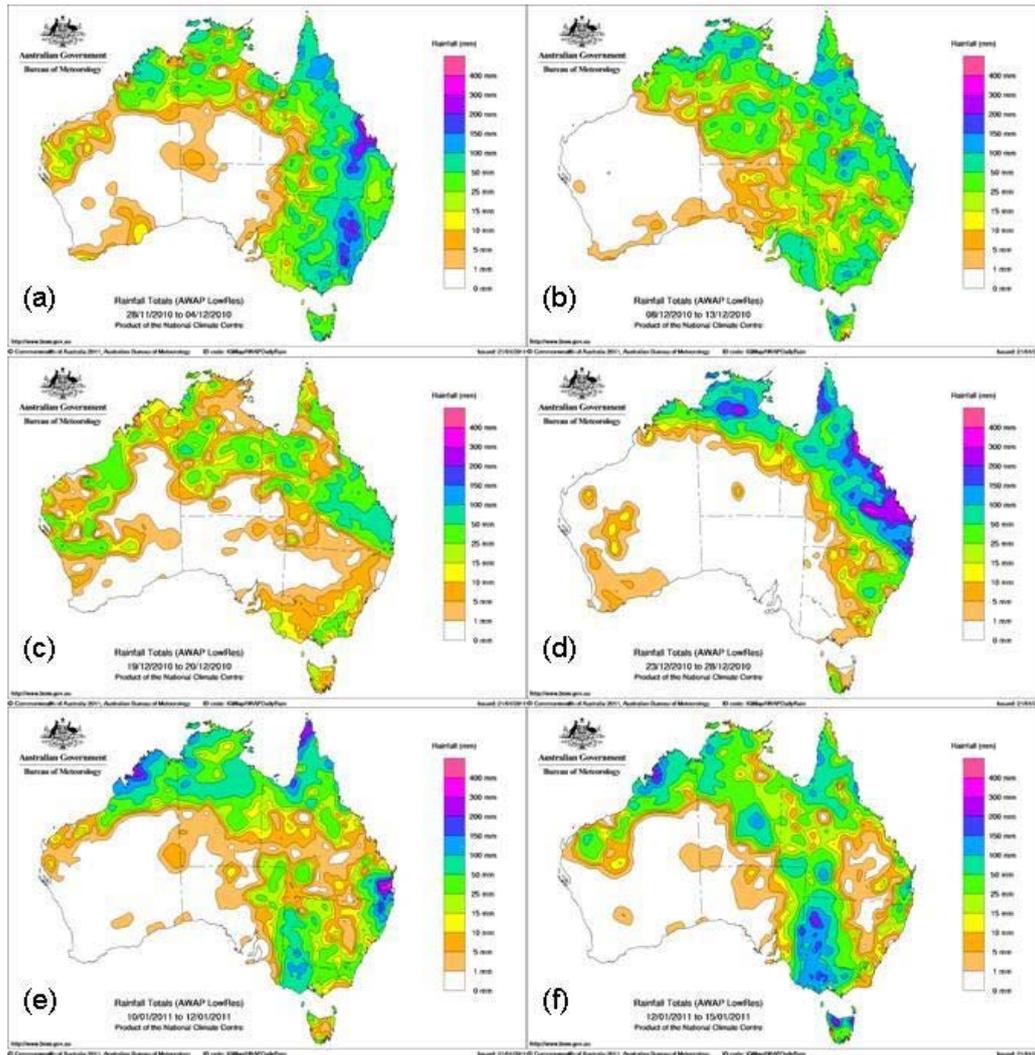


Figure 2-1 Australian rainfall totals for the periods:³

- (a) 28 November to 4 December,
- (b) 8 to 13 December,
- (c) 19 to 20 December,
- (d) 23 to 28 December,
- (e) 10 to 12 January and
- (f) 12 to 15 January.

³ Source Bureau of Meteorology

“The flooding, in terms of extent, impact and severity, was amongst the most significant in Australia’s recorded history. It was the wettest December on record for Queensland and for eastern Australia as a whole, the second-wettest for the Murray-Darling Basin, the sixth-wettest for Victoria and the eighth-wettest for New South Wales. For Australia as a whole it was the third-wettest December on record. This followed an extremely wet spring, the wettest on record for Queensland, New South Wales, eastern Australia and the Murray-Darling Basin, meaning many catchments were already wet before the flooding rain. It was Australia’s wettest July to December on record.

There were six major rain events during late November to mid January, concentrated on the periods:

- 28 November to 4 December,
- 7 to 13 December,
- 19 to 20 December,
- 23 to 28 December,
- 10 to 12 January (in southeast Queensland),
- 12 to 15 January (in Victoria, South Australia and Tasmania).”⁴

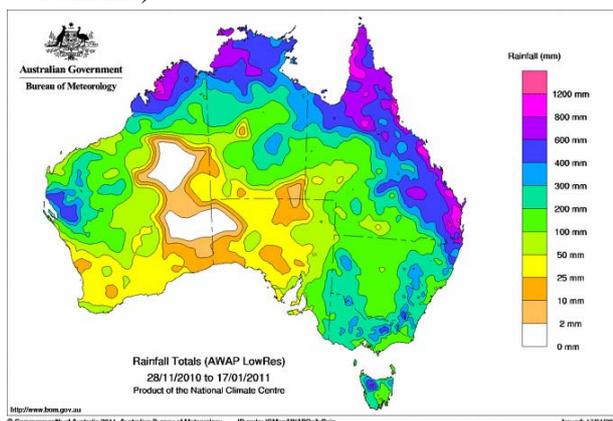


Figure 2-2 Total rainfall for the period 28 November 2010 – 17 January 2011⁵

2.1 Communities affected by 2010/11 flooding

Figure 2-3 identifies the communities that were significantly affected by flooding during the 2010-11 wet season. The list is limited to those communities in close proximity to SunWater water supply schemes or the dams operated by SunWater. It should be noted that a number of communities are not immediately downstream of a dam and therefore not significantly impacted by flows passing through a dam.

Communities affected by flooding 2010-11	Dam	SunWater Water Supply Scheme
Emerald Comet	Fairbairn	Nogoa Mackenzie
Bundaberg	Paradise	Bundaberg
Eidsvold	Wuruma	Upper Burnett
Mundubbera	Wuruma & Boondooma	Upper Burnett & Boyne River & Tarong
Gayndah		
Murgon	Bjelke-Petersen	Barker Barambah
Warwick	Leslie	Upper Condamine
St George	EJ Beardmore	St George
Dirranbandi		
Inglewood	Coolmunda	Macintyre Brook
Townsville	Ross River	N/A
Goondiwindi	Glenlyon	N/A
Chinchilla	Not immediately below a dam	Chinchilla Weir
Rockhampton		Lower Fitzroy
Maryborough		Lower Mary River
Theodore		Dawson Valley
Moura		
Baralabah		

Figure 2-3 Communities affected by flooding in close proximity to SunWater water supply schemes

2.2 Performance of SunWater Dams during 2010-11 Wet Season

All of SunWater dams are designed principally for water supply purposes. Peter Faust Dam has also been designed to provide both water supply and passive flood mitigation. No other SunWater dam has a purpose built flood mitigation role. However all dams attenuate flood flows to some degree.

SunWater’s dams are designed to pass very large rainfall events. Events that far exceed the rainfall that was experienced during the 2010-11 wet season. A sample of the design rainfall events for SunWater dams is shown in Figure 2-4. Whilst some of SunWater’s dams will require a future upgrade to pass extreme events, all of SunWater’s dams can pass very rare events⁶. The rainfall experienced over the 2010-11 wet season in the catchments for SunWater’s dams was up to the range of 400mm to 600mm for the major inflow events (refer Figure 2-2). Whilst this level of rainfall was significant it was well short of the extreme rainfall events used for design.

The SunWater dams performed to design expectations during the recent events. Whilst there was some erosion damage downstream of some spillways, overall there was little damage.

Figure 2-5 outlines the magnitude of the flood events at SunWater dams. The total storage volume of major dams in SunWater’s portfolio is 6,400GL. The total inflow to SunWater’s dams over the wet season was 37,200GL. Many dams received total inflows well in excess of their storage volume. Beardmore Dam received almost 82 times its total storage volume. 11 dams in the portfolio experienced a flood of record.

⁴ Bureau of Meteorology Special Climate Statement #24

⁵ Source Bureau of Meteorology

⁶ The Dam Safety Guidelines on Acceptable Flood Capacity identify that the Annual Exceedence Probability flood for dams ranges from 1 in 10,000 years to 1:10,000,000 years

Dam	Duration (hr)	Rainfall (mm)
Fairbairn	96	1,070
Peter Faust	120	3,300
Teemburra	36	2,320
Fred Haigh	72	2,160
Boondooma	36	890

Figure 2-4 Sample of Design Rainfall for SunWater dams

	Dam	Storage Volume (ML)	Peak Inflow (cumecs)	Peak Discharge (cumecs)	Flood Historic Rank for Dam	Total inflow as % of Storage Volume
Major Dams	1 Burdekin Falls	1,860,000	17,136	9,177	5	843%
	2 Fairbairn	1,301,000	6,422	4,323	1	217%
	3 Fred Haigh	562,000	1,879	721	1	123%
	4 Peter Faust	491,400	752	83	1	44%
	5 Tinaroo Falls	438,900	270	154	10	89%
	6 Paradise	300,000	9,300	9,126	1	2492%
	7 Boondooma	204,200	2,036	1,623	1	530%
	8 Wuruma	165,400	2,309	1,525	1	244%
	9 Teemburra	147,500	325	90	2	90%
	10 Callide	136,300	934	20	1	87%
	11 Bjelke-Petersen	134,900	2,600	1,600	1	530%
	12 Eungella	112,400	698	263	3	139%
	13 Julius	107,500	621	252	>10	129%
	14 Leslie	106,200	832	855	1	131%
	15 Cania	88,500	2,109	134	1	125%
	16 EJ Beardmore	81,700	3,335	3,335	2	8175%
	17 Coolmunda	69,000	712	675	6	188%
	18 Kinchant	62,800				
	19 Kroombit	14,600	394	387	1	653%

Figure 2-5 Summary of 2010-11 Flood events at SunWater dams

3 Emergency Management Frameworks

3.1 Roles and Functions of Various Agencies in Emergency Management

Queensland has a tiered disaster management arrangement. It is based on local, district and state levels. The structure enables a progressive escalation of support and assistance through each tier as required. The Australian Government is also included in the arrangements as a fourth level, recognising that Queensland may need to seek Federal support in times of disaster.⁷

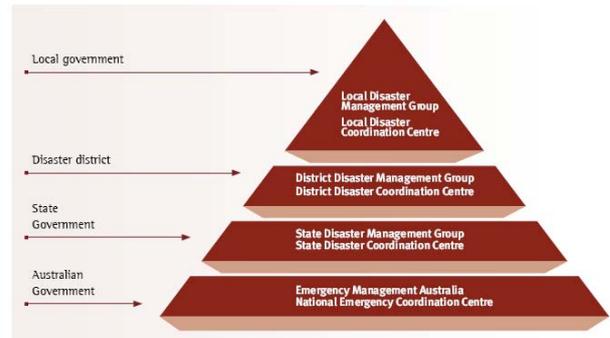


Figure 3-1 Queensland's tiered disaster management arrangements

3.1.1 Players in emergency management

The Australian National Committee on Large Dams (ANCOLD) published a standard covering the function, development and content of emergency action plans (EAPs) for dams in 1994. The ANCOLD Guidelines was revised and republished in August 2003⁸.

Chapter 8 of the ANCOLD Guidelines deal with dam safety emergency planning. The ANCOLD Guidelines note that two types of emergency plans might be required. The first is a dam safety emergency plan (DSEP) (otherwise known as an EAP), which is developed by the dam owner. A separate disaster plan is developed by an appropriate State or local emergency management agency⁹.

The ANCOLD Guidelines outline the objectives of a DSEP. A DSEP for a dam will:

- Identify emergency conditions, which could endanger the integrity of a dam and require immediate action;
- Prescribe procedures, which should be followed by the dam owner and operating personnel to respond to and mitigate these emergency conditions at the dam; and
- Provide timely warning to appropriate emergency management agencies for their implementation of protection measures for downstream communities¹⁰.

The ANCOLD Guidelines note that a disaster plan should be developed (by an appropriate State or local emergency management agency) for the protection of communities downstream of a dam¹¹.

The ANCOLD Guidelines is based on the premise that:

- The dam owner will operate the dam, act to mitigate any emergency condition and keep emergency management agencies informed¹²; and

⁸ Guidelines on Dam Safety Management August 2003 ANCOLD.

⁹ Guidelines on Dam Safety Management August 2003 ANCOLD, p37.

¹⁰ Guidelines on Dam Safety Management August 2003 ANCOLD, p37.

¹¹ Guidelines on Dam Safety Management August 2003 ANCOLD, s 8.3 p 38

¹² Guidelines on Dam Safety Management August 2003 ANCOLD, s8.2 p37-38

- The State or local emergency agencies will manage the event in the community, keep the community informed and manage any evacuations¹³.

The ANCOLD Guidelines is consistent with the Queensland State disaster management framework. Under the State framework, the Local Disaster Management Group (LDMG) would be the appropriate emergency management agency referenced in the ANCOLD Guidelines in most cases.

The ANCOLD Guidelines' requirements are reflected in Chapter 9 of the Queensland Dam Safety Management Guidelines, February 2002, DNRM (now DERM) (the DERM Guidelines). The ANCOLD and DERM Guidelines have a very high degree of correlation. The DERM Guidelines prescribe that activities below or beyond the dam are to be contained within the counter disaster plan, which should be prepared and operated by the appropriate local disaster coordination committee¹⁴.

The Commonwealth, through the Attorney-General's Department, has published the Australian Emergency Manuals Series. This series has been developed to assist disaster management and delivery of support services. Manual 23 of this series is titled Emergency Management Planning for Floods Affected by Dams, July 2009. This manual is consistent with both the ANCOLD and DERM Guidelines. The manual notes that emergency management agencies have the responsibility to develop emergency management plans, community warning systems and evacuation plans¹⁵. The manual notes that both dam owners and emergency management agencies operate within a framework of risk management. The dam owners apply this approach to flood operations and dam safety, while emergency management organisations apply it to community safety¹⁶.

The Queensland Government District Disaster Management guidelines note that District Disaster Management Groups (DDMG), in the Queensland disaster management arrangements, are established to provide a whole-of-government planning and coordination capability to support local governments in disaster management.¹⁷ The Operational Planning Guidelines for Local Disaster Management

Groups(LDMG)¹⁸ identifies the role of the LDMG during an event as coordination of support to response agencies, reconnaissance and impact assessment, and provision of public information.

Figure 3-2 below is a graphical representation of the lines of communication for emergency management organisations in respect to flood emergencies. SunWater's role in those communications is described in section 3.1.1.2 below.

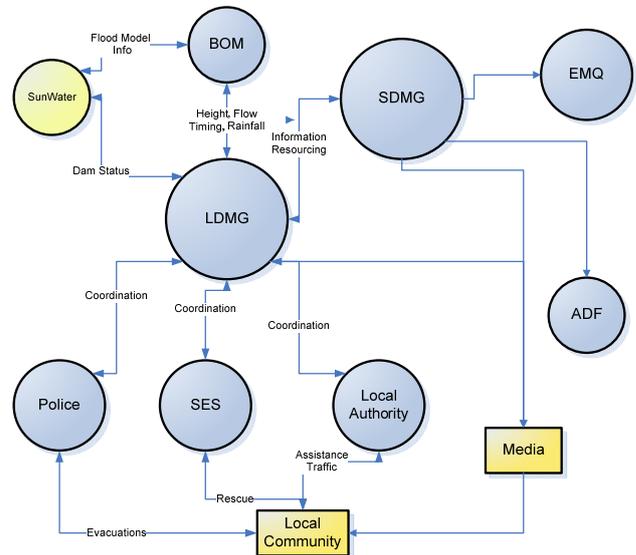


Figure 3-2 SunWater's role in the emergency management framework (DDMG omitted for clarity)

3.1.1.1 Local Disaster Management Group (LDMG) role

The Local Disaster Management Group (LDMG) is a group established for each Local government area in the State to carry out a number of functions relating to disaster management, the primary ones of which are:

- Develop emergency management plans, community warning systems and evacuation plans;
- Reconnaissance and impact assessment;
- Manage the event in the community;
- Keep the community informed;
- Manage any evacuations; and,
- Coordination of support to response agencies;

3.1.1.2 SunWater's role

During flood events SunWater undertakes the following activities:

- Monitor water inflows into the dam and notify stakeholders as per the EAP;

¹³ Guidelines on Dam Safety Management August 2003 ANCOLD, s8.3, p38

¹⁴ Queensland Dam Safety Management Guidelines February 2002 DNRM s9.1, p37.

¹⁵ Manual 23: Emergency Management Planning for Floods Affected by Dams, July 2009, Australian Emergency Manuals Series Australian Government Attorney-General's Department, p13.

¹⁶ Manual 23: Emergency Management Planning for Floods Affected by Dams, July 2009, Australian Emergency Manuals Series Australian Government Attorney-General's Department, p9.

¹⁷

<http://www.disaster.qld.gov.au/publications/pdf/District%20Disaster%20Management%20Guidelines.pdf>.

¹⁸

<http://www.disaster.qld.gov.au/publications/pdf/Operational%20Planning%20Guidelines%20for%20Local%20Disaster%20Management%20Groups.pdf>.

- provide regular updates to LDMG;
- pass water inflows through the dam's spillway or outlet works in accordance with established operational guidelines and manage and maintain water levels in gated dams.; and,
- Undertake predictive flood modelling for selected dams and liaise with BOM to share information and ensure the veracity of the modelling. The SunWater modelling is not catchment wide and is limited to dam inflows and outflows. SunWater uses the information for operational purposes. The BOM modelling is catchment wide. BOM has the responsibility to provide the modelling predictions to the emergency management groups.

4 SunWater's approach to Emergency Management

SunWater's approach to emergency management is consistent with ANCOLD guidelines and The Queensland Government district disaster management guidelines. Figure 4-1 provides an overview of SunWater's approach. The approach includes a clear line of accountability for decision making. The dam duty officer (DDO) is located at the dam site and is the primary decision maker. The DDO is supported by a regionally based emergency event coordinator (EEC). The decision makers are supported by staff in the flood operations centre (FOC) (refer 4.2) who provide modelling results and inflow predictions. Both the FOC and the decision makers are supported by at least five very experienced dam engineers who are registered professional engineers of Queensland (RPEQs). The RPEQs provide technical oversight and advice on dam performance and trouble shooting.

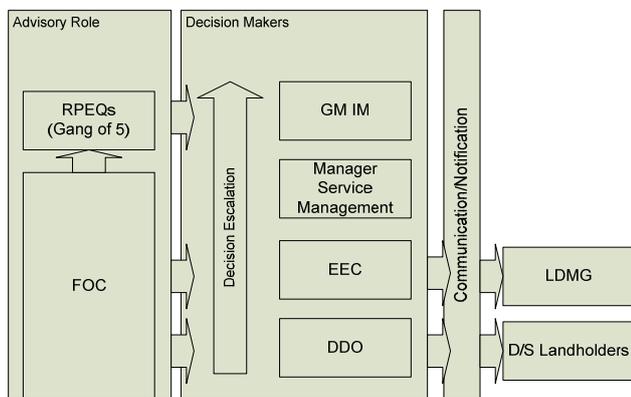


Figure 4-1 SunWater's emergency management framework

4.1 Dam EAPs

SunWater dams are designed for extreme flood events that are far larger than the events experienced over the 2010-11 wet season. However, Emergency Action Plans (EAPs) have been developed for all of SunWater's dams. The EAPs have a clear set of actions, responsibilities and communications that are to be undertaken under a range of emergency scenarios.

The SunWater dam EAPs are consistent with the State Emergency Management framework and national guidelines described above. The EAPs are premised on

SunWater operating and managing an emergency event at the dam and keeping the LDMG informed. The EAP structure is based on the premise that the LDMG will use the information on an event gathered from SunWater and others to assess, determine and coordinate the actions of various agencies.

The emergency scenarios explicitly considered in the EAPs include:

- Flood Operation
- Rapid Drawdown (rapid drop in water level within the storage)
- Sunny Day Failure (Earthquake or Piping)
- Chemical /Toxic Spill
- Terrorist Activity

The EAPs also provide a framework whereby those with lead accountability are provided with technical advice from senior and experienced engineering staff. The latest EAP version also outlines predictive flood modelling from the Flood Operations Centre (FOC) for certain high hazard dams.

The EAPs are provided to the relevant LDMG. SunWater discusses the plans with local coordinators prior to the wet season. The controlled documents are reviewed and updated regularly. Notification and communication lists are updated annually and distributed to those listed organisations in the EAPs including the LDMG.

4.2 Flood Operations Centre (FOC) for SunWater Dams

SunWater has maintained a flood operations centre for a number of years. Prior to the 2010-11 wet season the FOC generally provided services for externally owned dams. Services were provided for Seqwater (Wivenhoe, Somerset, North Pine), Ross River and Scrivener dams. These are all gated dams with significant populations at risk. Since the 2010-11 wet season, Seqwater has established a separate FOC for its operations. The SunWater FOC is located in a secure room in SunWater's head office. The room has independent and redundant power supplies, communication and computer networks. The FOC has gathered rainfall and runoff data prior to and during events to run rainfall/runoff flood routing models. The models are used to monitor automatic systems (where they exist), inform decisions regarding gate operations and provide information to DDOs and EEC who then pass relevant information onto disaster management groups.

Prior to 2010 SunWater did not generally utilise a real time flood modelling service for its portfolio of dams because SunWater did not provide an active flood mitigation service. Gated dams mostly operated in an automatic mode¹⁹ and SunWater had engineering staff located in each region. One of the lessons from the February 2008 Fairbairn dam flood²⁰ was that there was a

¹⁹ EJ Beardmore dam gates are a manual system

²⁰ February 2008 was the flood of record for Fairbairn. This has since been exceeded in December 2010

community and LDMG expectation that SunWater had more information available for its dams and could work more closely with the Bureau of Meteorology (BOM) on flood predictions.

In 2010 SunWater developed runoff routing models for a number of its dams. The modelling of the dams was prioritised by reference to criteria such as hazard rating, population at risk, frequency of flooding and type of structure. Technical staff use the models with flow data from the BOM to provide a prediction of the height and time of the peak discharge from the dam. This is aimed at assisting the dam duty officer (DDO) on dam operations and the emergency event coordinator (EEC) in discussions with LDMG. SunWater is moving towards a virtual FOC model rather than a dedicated flood room. A virtual FOC means one whereby the models are installed on a laptop that can download data over the web from almost any location.

The FOC operated successfully over the 2010-11 wet season for the following SunWater operated dams:

- Burdekin Falls
- Fairbairn
- Tinaroo Falls
- Paradise
- EJ Beardmore
- Coolmunda
- Ross River

The FOC also services Fred Haigh and Scrivener dams.

4.3 Crisis Management

The EAPs for SunWater’s dams are designed to deal with incidents, emergencies and crisis at a specific dam. Since 2007 SunWater has also had in place a formal incident, emergency, crisis and disaster management framework. During 2010 SunWater undertook a review of that framework. The review considered performance and outcomes from previous events.

In December 2010 SunWater published the 2011 edition of the Crisis Handbook. The handbook provides a structure for a crisis management team (refer to Figure 4-2) and roles for each member of that team.

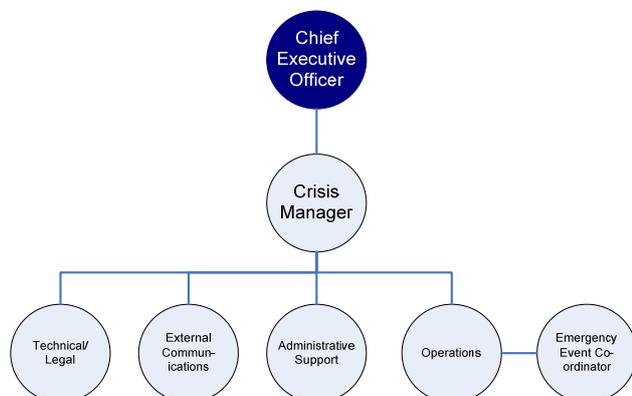


Figure 4-2 SunWater crisis management team

The Crisis Handbook includes:

- A listing of emergency contact numbers;
- Definition of SunWater’s emergency response framework;
- Key SunWater contacts including senior managers and subject matter experts;
- A tool kit of forms for use by crisis team members during an event;
- Duty cards for each member of the crisis team.

The handbook was provided to all staff along with necessary instruction prior to the 2010 Christmas holiday period.

5 2010-11 Wet season preparation

A significant amount of SunWater’s infrastructure is located in areas prone to frequent and/or large flood events. SunWater routinely undertakes preparations in advance of the wet season. Preparations prior to the 2010-11 wet season included:

- Development and release of Issue 3 of the Tinaroo Falls dam EAP. Issue 3 includes a number of improvements such as clearer roles and responsibilities following a recent restructure of SunWater, inclusion of the FOC role and an emergency response framework consistent with the most recent Crisis Handbook for the organisation;
- The dams operating under Issue 2 of the EAPs were issued with a supplementary notice prior to the wet season to clarify roles and responsibility;
- All EAP notification and Communication Lists were updated and issued;
- Briefings were conducted with a number of LDMGs;
- A number of staff training and awareness exercises were conducted;
- Rosters for all EEC, DDO and other roles were redeveloped and issued;
- Executive, senior management and the Board chair were put through an EAP awareness training exercise;
- Routine preparatory maintenance of critical equipment which included
 - Servicing & Testing of generators;
 - Full stock of fuel supplies;
 - Preparation of temporary staff accommodation and supplies;
 - Testing of Gates and SCADA systems;
 - Placement of an additional emergency backup generator for spillway gates at EJ Beardmore Dam; and,
 - Development and issue of a revised Crisis Handbook was developed and issued (refer section 4.3).

5.1 EAP Review Procedure

The dam safety regulator notes that an EAP should be reviewed for adequacy at least every five years as part of

the comprehensive five yearly inspection²¹ and “Telephone contact details should be reviewed and updated at least on an annual basis”²².

SunWater has developed and implemented procedures to ensure that dam EAPs are reviewed regularly and kept current. The following is a summary of the actions taken for each dam:

- Regional operations staff review and update the notification and emergency communication list (the N&EC list) annually,²³
- Engineering staff review the dam EAP as part of the annual inspection²⁴. The inspection team will confirm that the current version of the EAP is available at the dam. The inspection team considers whether or not the instructions are adequate and, through inquiry, confirm that the instructions are understood by the dam staff. The findings of the review are documented in the annual inspection report for the dam;
- Engineering staff conduct a full scenario EAP exercise as part of the five yearly comprehensive inspections²⁵. The aim of the exercise is to check the accuracy and relevance of the EAP and train staff. The findings of the review are documented in the dams five yearly comprehensive dam safety inspection report;
- Regional staff review a dam’s EAP following any emergency event at a dam. The review identifies any issues that arose during the event and opportunities for improvement. The findings of the review are included in the emergency event report²⁶;
- Dam safety staff periodically conduct a comprehensive review of the EAPs across SunWater’s portfolio. These reviews may be triggered by changes to roles and responsibilities within SunWater, results of scenario exercises, such as an externally facilitated emergency exercise in 2007 for Leslie and Coolmunda Dams, or changes to legislation or national guidelines. These reviews usually result in a reissue of EAPs across the portfolio as evidenced by the following new EAP issues:
 - Issue 1 between 1992 and 1995;
 - Issue 2 between 2006 and 2008; and
 - Issue 3 (currently in progress).

These review processes are guided by the ANCOLD and DERM Guidelines. SunWater has developed and implemented a number of internal standards to ensure that these guidelines are understood and implemented. The internal standards assign clear responsibilities for each process. SunWater has developed systems to ensure that

each process is assigned to a responsible person, is scheduled and completed.

6 Lessons from the 2010-11 Wet Season

6.1 In-house Review

SunWater undertook a review of the flood events across Queensland. The review found that:

- The EAP was generally adequate; however some updating is required to reflect current reporting arrangements within SunWater. The amendments to these documents are in progress. Issue 3 of the EAPs will be released before the next wet season;
- A review of the gate opening sequence specified in the O&M Manual of gated structures could provide operators with more information on discharge rates for each gate opening step. SunWater has reviewed and republished all of the O&M Manuals across the portfolio;
- Loss of mains power caused operational problems and there was a lack of awareness by energy providers of criticality to dam operations. In one case a dam operator was only allowed to get past fallen power lines by leveraging off a family connection in the energy utility;
- Some difficulties were experienced with continuity of telecommunication networks. The potential introduction of additional NextG telecommunications in addition to land lines is being investigated;
- Site facilities for staff require some improvement where staff were on duty and isolated for prolonged periods. Facilities will be improved before the next event;
- Additional upstream gauging station at some dams may be required;
- Expanding SunWater’s use of an SMS messaging service to include notification of nominated landholders in the EAP could streamline communication of an EAP event. This option is under investigation and if feasible will be implemented before the end of 2011 (refer 6.2.3);
- Inconsistent of understanding of SunWater’s role by some LDMGs (refer 6.4);
- Lack of knowledge of dam operations and functions in the community (refer 6.2.5 and 6.2.2); and,
- Lack of a strategy to effectively manage misinformation on social networks.

6.2 Communication

6.2.1 EAP Notifications

The ANCOLD and DERM Guidelines establish a number of principles with respect to notification and emergency communication under an EAP. These principles include:

- Establish and resource a warning/communication system for the timely notification to operating

²¹ Queensland Dam Safety Management Guidelines February 2002 DNRM s9.7, p44.

²² Queensland Dam Safety Management Guidelines February 2002 DNRM s9.7, p44.

²³ SOP01, SunWater DS02 and DERM Condition DS13.

²⁴ SunWater DS02 and DS10 and DERM Condition DS10.

²⁵ Queensland Dam Safety Management Guidelines February 2002 DNRM s9.7, p44.

²⁶ DERM DS13 and SunWater DS02

personnel and emergency authorities of impending and actual emergencies²⁷;

- Local emergency management authorities are to provide for the protection of communities downstream of a dam²⁸;
- The number of persons to be notified by each responsible individual should be kept to a minimum and use of news media should be pre-planned to the greatest possible extent²⁹;
- It is usually recommended that any one individual should not be responsible for contacting more than three or four other parties³⁰;
- The following parties should be considered for inclusion in the notification listings or flowchart³¹:
 - Dam owner;
 - Local emergency management officials (DDMG and LDMG);
 - Appropriate state emergency agencies;
 - Residents and property owners located immediately downstream of the dam within the boundary of potential inundation where available warning time is very limited³²;
 - Local governments that may be affected;
 - Operators of other dams that may be affected;
 - Managers and operators of recreation facilities that may be affected; and
 - Bureau of Meteorology.
- The decision as to who needs to be contacted will depend on the scale and timing of the potential impacts³³.

The adoption of these principles is evident on the N&EC list in the EAPs for SunWater's dams. Each EAP includes contacts for counter disaster groups such as LDMG and/or DDMG, police, SES and local councils. Landholders immediately downstream (if any) of the dam with very limited warning time are also identified. Some EAPs contemplate the use of media outlets to minimise the number of communications with maximum affect.

²⁷ *Guidelines on Dam Safety Management* August 2003 ANCOLD, p38 s8.4.

²⁸ *Guidelines on Dam Safety Management* August 2003 ANCOLD, p38 s8.3.

²⁹ *Guidelines on Dam Safety Management* August 2003 ANCOLD, p39-40 s8.5.

³⁰ Queensland Dam Safety Management Guidelines February 2002 DNRM s9.4, p39.

³¹ Queensland Dam Safety Management Guidelines February 2002 DNRM s9.4, p39-40.

³² Also referenced in *Manual 23: Emergency Management Planning for Floods Affected by Dams*, July 2009, Australian Emergency Manuals Series Australian Government Attorney-General's Department, p18 where warning time is less than that available through emergency management system.

³³ Queensland Dam Safety Management Guidelines February 2002 DNRM s9.4, p40.

6.2.2 Internet Communications

SunWater has recently prepared a publication entitled *Dam Management during Floods*. This document is available on the front page of the SunWater website and deals with a number of the questions that commonly arose during the recent flood events. The aim of this document is to increase awareness on how SunWater dams are operated during flood events. The publication provides information on topics, such as:

- Are SunWater dams safe?
- Are SunWater dams designed to stop floods?
- Can SunWater release water to stop flooding?
- Don't dams physically stop water going downstream?
- When does SunWater make releases?
- During a flood event, how does SunWater advise people that a dam is spilling or releases are being made?
- Does releasing water have any other impacts?
- The actions taken by SunWater during a flood event; and
- Where to seek information about:
 - Flood warnings;
 - Flood level forecasts;
 - Flood damage, road closures and crowd control; and
 - Disaster relief.

6.2.3 SMS

SunWater began to trial the use of a SMS messaging service to provide irrigation customers with notifications of interruptions to service, for example, pipebreaks. This SMS service was trialled in our Bundaberg and St George offices from July 2009. With the successful trial of this service it was fully implemented when the Customer Support functions were centralised to Brisbane (in about July 2010).

There were some limitations observed through the trial and subsequent release of the SMS service across all water supply schemes. These included:

- Not all customers have provided SunWater with mobile phone contact details. Estimates are that approximately 50% of our customers have a mobile phone listed as a primary contact number; and
- Although the service is able to work on landlines if the phone is answered by answering machine, the first part of the message is lost as the message plays immediately when the machine picks up, which is when the answering machine message is being played. So there is a possibility that the person receiving the message on return to the house is unable to understand the message.

An SMS messaging service was introduced to improve communication with customers and enable messages to be sent more efficiently. Previously with water supply breakdowns the only way to contact customers was to phone each customer individually.

The initial impetus for introducing SMS messaging was to improve communication with customers regarding operational matters. The driver has not been emergency (EAP) communications. A lesson from the recent floods is that SMS may streamline some EAP communications. Investigations are now underway to ascertain if this type of communication could be effectively utilised in these types of events. It is intended to introduce SMS messaging, if and where appropriate, prior to the next wet season.

6.2.4 Email Messaging

SunWater does utilise email messaging in response to customer enquiries, for example, delivery of non-urgent shutdown notices and for non-urgent EAP status updates. This form of communication is seen as lacking currency and urgency as many of our customers do not access emails daily. It is for this reason that EAPs are noted with the instruction that "All contacts required by the EAP are expected, in the first instance, to be by voice (phone) with email only used to confirm or provide additional details." Email distribution lists have been developed for many of SunWater's dams. However, these are generally only used to provide status updates. Email is still seen as a supporting communication tool but not a primary communication tool in emergency situations. SunWater does not intend to change this operating protocol.

6.2.5 Media and Social Networks

SunWater uses media to distribute information quickly and widely. Prior to the wet season SunWater proactively engages with media outlets to raise awareness and understanding of dam operations. During flood events SunWater issues planned media statements to disseminate information regarding dam status to the broader community. This approach worked effectively, particularly with local ABC radio.

One of the lessons from the 2010-11 wet season was an awareness of a general lack of understanding in the local community about how dams operate. On several occasions when there were large dam discharges, rumours appeared on social networking about dam failures. Some mass media outlets picked up these stories as fact and rebroadcast them on TV and radio.

Another theme that appeared on social networking sites was a view that dam owners had failed in their responsibilities to the community. There was a common view that dam owners should have emptied dams before the wet season to prevent flooding. This view again demonstrated a general lack of understanding of how water supply dams are designed to operate.

This form of misinformation diverted significant resources during the events. When SunWater became aware of these rumours the Queensland Police "mythbuster" site on "Facebook" was a useful tool to address misinformation. SunWater is looking into building a presence on social networks to address these rumours and perceptions more quickly. One option that is considered to be of value is to engage a commercial

provider to actively monitor social networks for key words and phrases.

6.3 Bureau of Meteorology Relationship

The Bureau of Meteorology (BoM) has access to a significant number of SunWater operated weather stations, stream flow gauges and storage level gauges.

The data is sent via file transfer protocol (FTP) to the BoM's flood section. The data is routinely sent every two hours from 1:30am to 11pm each day. During the 2010/11 floods SunWater increased the frequency to an hourly data transfer at the request of the BoM. An increase in frequency such as this is common during flood events.

During flood events SunWater's FOC collaborates with BoM. During the 2010-11 wet season most of the collaboration centred on flooding in the Balonne River around St George and Beardmore Dam. The collaboration included numerous phone calls and emails between SunWater and BoM staff. SunWater staff provided an overview of flood modelling and details of gate operations, flows and tailwater levels at Beardmore Dam. SunWater staff also provided extrapolations of rating tables developed as part of SunWater's predictive flood modelling. BoM provided SunWater with information on their model predictions and rating tables derived from their modelling.

In addition to data published on the BoM public web site, the BoM provides information through a registered users page on their web site. BoM upload output files of their predictive catchment flood models for various catchments across the State. The SunWater FOC has access to this page. The information supplements SunWater's modelling and is an information source that assists in ratifying the SunWater model results.

SunWater has always had a positive and cooperative relationship with BoM. The relationship has fostered a free exchange of information over a number of years. A strong relationship between dam operators and the Bureau is essential

6.4 Local Disaster Management Group Relationship

Beardmore Dam, experienced the largest flood since the dam was constructed in March 2010. As a precaution SunWater mobilised a number of senior staff to St George during this event. These staff, along with St George based staff established a working relationship with the St George LDMG and attended the LDMG meetings during that flood event. A similar event occurred at Fairbairn Dam near Emerald in 2008. Again SunWater staff were active participants of the LDMG.

There were two improvements from the March 2010 event at St George and the 2008 event at Emerald. The first was the importance of the LDMG understanding the role of SunWater in emergency management. The second was that the LDMG benefited from having SunWater involved in regular LDMG meetings. The result in the involvement in LDMG meetings was that there was

clarity of roles and the LDMG was better informed to respond and manage the flood event.

SunWater's internal standards identify a number of actions for regional staff. Two of those actions relate to ensuring that there is a good relationship with LDMGs. The first action is to facilitate meetings with concerned parties, such as the counter disaster group. The second task is to ensure that there is a linkage between the EAP and counter disaster plans.

SunWater regional staff attended meetings with a number of LDMGs prior to the 2010-11 wet season. The intention of these meetings was to raise awareness of the EAPs and develop a working relationship between SunWater and the LDMG.

The quality of relationships with LDMGs across the State and their understandings of EAPs is not consistent. The relationship between SunWater and the LDMG has worked best and has been most effective when there has been early and regular contact between SunWater and the LDMG. The relationship with LDMGs, such as St George and Central Highlands, is strong and those LDMGs have a clear understanding of the EAPs. In other areas the understanding of the respective roles of the LDMG and SunWater is not well understood.

SunWater accepts that more work is required to strengthen these relationships and ensure a consistently high standard across the State. Accordingly, since the 2010/2011 wet season flood events, SunWater regional staff have been instructed to make contact with LDMGs in their areas with the aim of improving communications and requesting that SunWater be invited to participate in LDMG meetings during future flood events.

The importance of good communications with the LDMG is demonstrated in the case of Ross River Dam. An extended power outage of approximately one week resulted in diesel supplies at the dam (a gated structure) running low. The LDMG ensured that the supply to the dam was moved up the priority list for emergency fuel supply to ensure continued operation.

The Queensland Government District Disaster Management guidelines note that Local Disaster Management Groups (LDMG) in the Queensland disaster management arrangements are established to provide coordination of support to response agencies, reconnaissance and impact assessment, and provision of public information.

The EAPs for SunWater's dams are consistent with the State Emergency Management framework described above. It is premised on SunWater operating and managing an emergency event at the dam and keeping the LDMG informed. The construct of the EAP is based on the premise that the LDMG will use the information on an event gathered from SunWater and others to assess, determine and coordinate the actions of various agencies. SunWater does not attempt to manage activities of other agencies elsewhere in the catchment

During the recent events the dams performed to expectations. The stream flows, although significant,

were not extreme in a dam safety sense. If circumstances had been more extreme or serious operational problems had been experienced, SunWater staff would have given primacy to protection of life and safety of the dam. The focus of SunWater staff should not be diverted from this priority. It is for this reason that SunWater supports the Queensland Government District Disaster Management framework. In the frame work SunWater provides the necessary communications to LDMG and/or DDMG who take the lead in provision of information to the public and media. SunWater focuses on operating and managing the safety of the dam.

The LDMG model described above was not as mature as it could be with respect to the relationship with SunWater and some LDMGs. In some cases the relationship functioned on an "as-needs" enquiry basis. Some LDMG had not included SunWater in formal operational meetings. The information provided to some LDMGs did not appear to be disseminated to appropriate parties in all cases. SunWater found it necessary to communicate to individual agencies rather than that information being managed by LDMG.

The Queensland disaster management framework is premised on the DDMG/LDMG as responsible for providing "one voice" to the community and coordinating actions and resources. The risk of mixed messages is evidenced in some media coverage with multiple organisations presenting sometimes conflicting views.

6.5 Queensland Floods Commission of Inquiry

The Queensland Government established an independent Commission of Inquiry to examine the unprecedented flood disaster that impacted 70 per cent of the state. The Commission has issued an interim report with 175 recommendations for the urgent consideration of State Government, disaster management agencies, local government and dam operators. The recommendations relevant to dam operations generally³⁴ and emergency response are reproduced below:³⁵

3.5 Every person who is required to work under a local disaster management plan should be familiar with the plan before the next wet season.

3.6 Every local government should publish its disaster management plan (and relevant sub-plans) on its website before the next wet season.

4.15 Each local disaster management group should include in its meetings a representative of the operator of any dam upstream of its region which contributes water to flooding.

4.16 Dam operators should plan to contact people identified by their emergency action plans about dam outflow in sufficient time for them to be able to respond to the information.

³⁴ Recommendations specific to Seqwater have been excluded from this paper

³⁵ <http://www.floodcommission.qld.gov.au/publications/interim-report>

4.17 Dam operators should ensure each emergency action plan includes a clear statement as to the frequency of, and circumstances in which, warnings will be issued to people listed in the emergency action plan.

4.18 Dam operators should assess the effectiveness of using SMS and/or email as a bulk instantaneous communication to all people on the notification list while individually contacting those whom it is essential to inform immediately.

4.20 The operator of each dam should, upon request, provide to any person on the notification list in the emergency action plan an explanation of the arrangements as to the type and frequency of communications required by that plan.

4.21 Operators of dams should assess their current compliance with the DERM Queensland Dam Safety Management Guidelines (February 2002), the ANCOLD Guidelines on Dam Safety Management (August 2003), and the Australian Government Emergency Management Planning for Floods Affected by Dams (2009) and if appropriate, comply with those guidelines.

4.22 Operators should include in their emergency action plan a description of the type of information that will be provided to those on the notification list.

4.23 Operators of dams should publicise, in a newspaper circulating in the local area and by posting a notice on its website every year before the wet season, the opportunity for local

residents immediately downstream of a dam to be included on the existing notification list, and:

- consider whether an applicant for notification is so close to the dam that the warning time before water from the dam affects them is less than that available through the emergency management system
- consider whether they can be effectively notified by SMS or email
- if it is necessary to contact the applicant personally, agree with him or her a mode for that communication.

4.24 The operator of any referable dam and the local disaster management group should develop a common understanding as to their respective roles in a flood event and the type and frequency of information the dam operator will provide to it and local residents.

These recommendations are generally consistent with SunWater's view and current operating practices. However SunWater has a program in place to ensure that it fully implements the improvements identified during the 2010-11 wet season floods.