

# **NEW SOUTH WALES**



## **STATE FLOOD SUB PLAN**

**A SUB PLAN  
OF THE NEW SOUTH WALES  
DISASTER PLAN (DISPLAN)**

# AUTHORISATION

This New South Wales State Flood Sub Plan is a sub-plan of the State Disaster Plan (DISPLAN). It has been prepared in accordance with the provisions of the State Emergency Service Act 1989 (as amended) and is authorised by the State Emergency Management Committee in accordance with the provisions of the State Emergency and Rescue Management Act 1989 (as amended).

The plan was produced by the New South Wales State Emergency Service following extensive stakeholder consultation and was endorsed at the 69<sup>th</sup> meeting of the State Emergency Management Committee on the 5<sup>th</sup> of June 2008.



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# GLOSSARY

**Annual Exceedance Probability (AEP):** the chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood level (height) has an AEP of 5%, there is a 5% chance (that is, a one-in-20 chance) of such a level or higher occurring in any one year (see also Average Recurrence Interval).

**Australian Height Datum (AHD):** a common national surface level datum approximately corresponding to mean sea level.

**Average Recurrence Interval (ARI):** the long-term **average** number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods reaching a height as great as, or greater than, the 20 year ARI flood event will occur **on average** once every 20 years.

**Catchment (river basin):** the land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.

**Design flood (or flood standard):** a flood of specified magnitude that is adopted for planning purposes. Selections should be based on an understanding of flood behaviour and the associated flood risk, and take account of social, economic and environmental considerations. There may be several design floods for an individual area depending on the requirement.

**Essential services:** those services that are considered essential to public safety and organised communities. Such services include electricity, gas, water, sewerage, sanitation, telecommunications and waste collection.

**Flash flooding:** flooding which is sudden and often unexpected because it is caused by sudden local or nearby heavy rainfall. It is sometimes defined as flooding which occurs within six hours of the rain that causes it.

**Flood:** relatively high water level which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences.

**Flood classifications:** locally-defined flood levels used in flood warnings to give an indication of the severity of flooding (minor, moderate or major) expected. These levels are used by the State Emergency Service and the Australian Government Bureau of Meteorology in flood bulletins and flood warnings.

**Flood intelligence:** the product of collecting, collating, analysing and interpreting flood-related data to produce meaningful information (intelligence) to allow for the timely preparation, planning and warning for and response to a flood.

**Flood liable land:** land susceptible to flooding by the Probable Maximum Flood (PMF) event. This term also describes the maximum extent of a **floodplain** which is an area of a river valley, adjacent to the river channel, which is subject to inundation in floods up to this event.

**Flood of record:** Maximum observed historical flood.

**Flood Sub Plan:** a plan that deals specifically with flooding and is a sub-plan of a Disaster Plan. Flood Sub Plans describe agreed roles, responsibilities, functions, actions and management arrangements for the conduct of flood operations and for preparing for them. They are prepared at State, District and Local Government levels.

**Floodplain Risk Management Plan:** a plan developed in accordance with the principles and guidelines in the New South Wales Floodplain Development Manual. Such a plan usually includes both written and diagrammatic information describing how particular areas of flood prone land can be used and managed to achieve defined objectives.

**Floodway:** an area where a significant volume of water flows during floods. Such areas are often aligned with obvious naturally-defined channels and are areas that, if partially blocked, would cause a significant redistribution of flood flow which may in turn adversely affect other areas. They are often, but not necessarily, the areas of deeper flow or the areas where higher velocities occur.

**Flood Watch:** A Flood Watch is a notification of the potential for a flood to occur as a result of a developing weather situation and consists of short generalised statements about the developing weather including forecast rainfall totals, description of catchment conditions and indicates catchments at risk. The BoM will also attempt to estimate the magnitude of likely flooding in terms of the adopted flood classifications. Flood Watches are normally issued 24 to 36 hours in advance of likely flooding. Flood watches are issued on a catchment wide basis.

**Flood Warning:** A Flood Warning is a gauge specific forecast of actual or imminent flooding. Flood Warnings specify the river valley, the locations expected to be flooded, the likely severity of flooding and when it will occur.

**Geographic Information System (GIS):** a computerised database for the capture, storage, analysis and display of locationally defined information. Commonly, a GIS portrays a portion of the earth's surface in the form of a map on which this information is overlaid.

**Local overland flooding:** inundation from local runoff making its way to a river or drain.

**Major flooding:** flooding which causes inundation of extensive rural areas, with properties, villages and towns isolated and/or appreciable urban areas flooded.

**Minor flooding:** flooding which causes inconvenience such as closing of minor roads and the submergence of low-level bridges. The lower limit of this class of flooding, on the reference gauge, is the initial flood level at which landholders and/or

townspeople begin to be affected in a significant manner that necessitates the issuing of a public flood warning by the Australian Government Bureau of Meteorology.

**Moderate flooding:** flooding which inundates low-lying areas, requiring removal of stock and/or evacuation of some houses. Main traffic routes may be flooded.

**Peak height:** the highest level reached, at a nominated gauging station, during a particular flood event.

**Probable Maximum Flood (PMF):** the largest flood that could conceivably be expected to occur at a particular location, usually estimated from probable maximum precipitation. The PMF defines the maximum extent of flood prone land, that is, the floodplain. It is difficult to define a meaningful Annual Exceedance Probability for the PMF, but it is commonly assumed to be of the order of  $10^4$  to  $10^7$  (once in 10,000 to 10,000,000 years).

**Runoff:** the amount of rainfall which ends up as stream flow, also known as 'rainfall excess' since it is the amount remaining after accounting for other processes such as evaporation and infiltration.

**Sector:** The organisational level having responsibility for operations with a defined area or having a specific functional responsibility.

**Stage height:** a level reached, at a nominated gauging station, during the development of a particular flood event.

**SES State Controller:** The person who is the operational head of the SES.

**Stream gauging station:** a place on a river or stream at which the stage height is routinely measured, either daily or continuously, and where the discharge is measured from time to time so as to develop a relationship between stage and discharge which is referred to as a rating curve.

# ABBREVIATIONS

<b>AIIMS</b>	Australasian Inter-agency Incident Management System
<b>AEP</b>	Annual Exceedance Probability
<b>AHD</b>	Australian Height Datum
<b>ALERT</b>	Automated Local Evaluation in Real Time
<b>AVCG</b>	Australian Volunteer Coast Guard
<b>AWRC</b>	Australian Water Resources Council
<b>BoM</b>	Australian Government Bureau of Meteorology
<b>DCF</b>	Dam Crest Flood
<b>DISPLAN</b>	Disaster Plan
<b>DECC</b>	Department of Environment and Climate Change
<b>DSC</b>	Dams Safety Committee
<b>DSEP</b>	Dam Safety Emergency Plan
<b>DWE</b>	Department of Water and Energy
<b>EOCON</b>	Emergency Operations Controller
<b>GIS</b>	Geographic Information System
<b>MAA</b>	Mutual Aid Agreement
<b>MoU</b>	Memorandum of Understanding
<b>PMF</b>	Probable Maximum Flood
<b>PMR</b>	Private Mobile Radio
<b>PSTN</b>	Public Switched Telephone Network
<b>RTA</b>	Roads and Traffic Authority
<b>RVCP</b>	Royal Volunteer Coastal Patrol
<b>SEOC</b>	State Emergency Operations Centre

<b>SEOCN</b>	State Emergency Operations Controller
<b>SES</b>	State Emergency Service
<b>SEWS</b>	Standard Emergency Warning Signal
<b>UHF</b>	Ultra High Frequency
<b>VRA</b>	Volunteer Rescue Association

# **PART 1 - OUTLINE AND SCOPE**

## **1.1 Aim**

- 1.1.1 The aim of this plan is to set out the arrangements for the emergency management of flooding in New South Wales.

## **1.2 Authority**

- 1.2.1 This Plan is written and issued under the authority of the State Emergency and Rescue Management Act 1989 (SERM Act 1989) and the State Emergency Service Act 1989 (SES Act 1989). It has been endorsed by the NSW State Emergency Management Committee.

## **1.3 Activation**

- 1.3.1 This plan does not require activation as the arrangements herein are always active.
- 1.3.2 State DISPLAN is active at all times in the anticipation of the need to coordinate support and resources requested by combat agencies (including the SES).

## **1.4 Scope**

- 1.4.1 The Plan sets out the emergency management aspects of prevention; preparation; response and initial recovery arrangements for flooding and the responsibilities of agencies and organisations with regards to these functions.
- 1.4.2 The Plan notes the existence of the problem of coastal erosion caused by severe weather. The management system for dealing with episodes of coastal erosion is described in the New South Wales State Storm Plan
- 1.4.3 The Plan notes the existence of the threat posed by tsunami to NSW coastal communities. The arrangements for the emergency management of tsunami are contained within the State Tsunami Emergency Sub Plan.
- 1.4.4 This Plan must be read in conjunction with:
- a. The New South Wales State Disaster Plan (DISPLAN), of which the State Flood Sub Plan is a sub-plan;
  - b. The New South Wales State Storm Plan, which covers arrangements relating to severe storm events; and
  - c. NSW Floodplain Development Manual.
- 1.4.5 In the event of secondary emergencies caused by flooding, the secondary emergency will be managed in accordance with the relevant DISPLAN arrangements. The SES will work with the EOCON at the appropriate level to ensure that response operations are coordinated and consistent with the

objectives of the SES operation. This includes appropriate briefings and situation reports to and from the relevant EOCON and agencies involved in the management of the secondary emergency.

1.4.6 The following Plans and arrangements are referred to in this plan:

- a. State DISPLAN
- b. SES Flood Sub Plans (Regional and Local)
- c. Agriculture and Animal Services Supporting Plan
- d. AMPLAN
- e. Energy and Utility Services Functional Area Supporting Plan (EUSPlan)
- f. Environmental Services Functional Area Supporting Plan (ENVIROPLAN)
- g. Hazardous Materials / Chemical, Biological and Radiological Emergency Sub Plan (Hazmat/CBR Plan)
- h. Healthplan
- i. Major Structural Collapse Plan
- j. NSW State Emergency Service and NSW Fire Brigades Mutual Aid Agreement
- k. NSW State Emergency Service and NSW Rural Fire Service Memorandum of Understanding
- l. Welfare Services Functional Area Supporting Plan

## **1.5 Area Covered by the Plan**

1.5.1 This Plan covers all of New South Wales, including Lord Howe Island.

## **1.6 Floods and Their Potential Impacts**

1.6.1 A description of flooding and potential impacts as a consequence of flooding is presented in Annex A of this Plan.

# **PART 2 - RESPONSIBILITIES**

## **2.1 Introduction**

- 2.1.1 General responsibilities of emergency services and supporting agencies (including functional areas) are set out in the State DISPLAN. Some specific responsibilities as they relate to flooding are expanded upon in the following paragraphs.
- 2.1.2 Lists of participating organisations which form part of functional areas can be found in State DISPLAN.

## **2.2 State Emergency Service:**

- 2.2.1 The State Emergency Service is the designated Combat Agency for controlling floods, and to coordinate the rescue, evacuation and welfare of affected communities (DISPLAN, 2006 and SES Act, 1989).
- 2.2.2 The State Emergency Service is to protect persons from dangers to their safety and health, and to protect property from destruction or damage, arising from floods (SES Act, 1989).
- 2.2.3 For floods generally:
- 2.2.4 Prevention
  - a. Provide emergency management advice to councils in relation to the management of land which is subject to flooding;
  - b. Contribute to the deliberations of Floodplain Risk Management Committees established by councils;
- 2.2.5 Preparedness
  - a. Contribute to the identification of flood problems, specifically in relation to emergency management matters including warning, evacuation, rescue and resupply functions;
  - b. Develop and maintain flood intelligence systems for the full range of flood types and severities;
  - c. Lead in the preparation, maintenance and exercising of Flood Sub Plans at State, Region and Local levels;
  - d. Ensure that SES Controllers, operations centre staff and field staff are appropriately trained and equipped for flood-related tasks;
  - e. Ensure that appropriate agencies, organisations and officers are aware of and ready for tasks related to their agreed flood responsibilities;

- f. Prepare, coordinate and deliver awareness and educational materials and programs regarding flooding;
- g. Prepare prewritten Flood Bulletins for key gauges, flash flood environments and for areas downstream of deficient dams;
- h. Prepare systems for the communication of warnings and public information regarding flooding;
- i. Define and continually review the state's flood warning requirements in conjunction with the Flood Warning Consultative Committee, councils, the owners of dams classified as deficient and flood-affected communities;

#### 2.2.6 Response

- a. Control flood operations;
- b. Coordinate the responses of agencies supporting flood operations;
- c. Ensure that relevant Emergency Operations Controllers and supporting agencies are briefed on flood operations, including relevant flood and dam failure warnings;
- d. Respond to indications of potential dam failure when Dam Failure Warning Systems are activated;
- e. Assist in the development of official flood warnings by providing data to the BoM from the SES network of river height gauges and those private gauges to which it has access;
- f. Coordinate the development and communication of SES Flood Bulletins to at risk communities, including:
  - Augmentation of official BoM flood warnings by assessing the likely consequences of flooding at the predicted heights and suggesting appropriate actions for people in areas expected to be affected and disseminating this information;
  - Livestock and Equipment Warnings when there is evidence of rises in levels below minor flood heights, and disseminate these within Region Flood Bulletins;
  - Local Flood Advices for communities for which the BoM does not issue official flood warnings, and disseminate these within Region Flood Bulletins;
- g. Coordinate reconnaissance of areas likely to be affected by floods;
- h. Coordinate the resupply of isolated communities and properties;
- i. Coordinate the evacuation and immediate welfare of people at risk;

- j. Coordinate flood rescue operations;
- k. Coordinate operations to protect property;
- l. Provide an information service to the community regarding flooding;
- m. Assist councils to organise temporary repairs or improvements to levees;
- n. Assist the NSW Police Force, RTA and councils with road closure and traffic control operations;
- o. Assist the Agriculture and Animals Services Functional area with fodder supply operations;
- p. Depending upon the scale of the event establish a Joint Media Information Centre as near as is practicable to the areas affected by flooding;
- q. Coordinate the collection of flood intelligence and post impact data and make it available to recovery agencies;
- r. Establish a spatial information group if required to coordinate the collection; analysis; mapping and distribution of spatial information regarding flooding;
- s. Provide Situation Reports incorporating the activities of supporting agencies to all agencies listed under this Plan and to all state level supporting operations centres and relevant members of parliament;
- t. Provide information to Treasury on damage to public infrastructure for the purpose of Natural Disaster Relief and Recovery Arrangements;
- u. Provide immediate welfare support to evacuees;

#### 2.2.7 Recovery

- a. Ensure that initial recovery operations are commenced;
- b. Coordinate the conduct of after action reviews / debriefs following flood operations;
- c. Ensure any recovery coordinating committee is briefed regarding the flood response phase and that appropriate information is provided to appropriate recovery agencies; and
- d. Participate in recovery committees as required.

### **2.3 Agriculture and Animal Services Functional Area:**

- 2.3.1 Activate the Agriculture and Animal Services Supporting Plan as required and coordinate the provision of required services which may include:

- a. Supply and delivery of emergency fodder
  - b. Advice on dealing with dead and injured farm animals
  - c. Financial, welfare and damage assessment assistance to flood affected farm people
  - d. Operation of animal shelter compound facilities for the domestic pets and companion animals of evacuees
- 2.3.2 Activate the State Food Industry Emergency Sub Plan as required and through the NSW Food Authority coordinate the provision of the required services;

## **2.4 Ambulance Service of NSW:**

- 2.4.1 Activate NSW AMPLAN if required;
- 2.4.2 Assist the SES with the warning and/or evacuation of at risk communities (in particular elderly and/or infirm people);
- 2.4.3 Assist the SES with the monitoring / reconnaissance of flood prone areas;
- 2.4.4 Coordinate the deployment of ambulance resources to locations if access is expected to be lost in consultation with the SES;
- 2.4.5 Assist in repatriation of non-ambulatory persons; and
- 2.4.6 Assist the SES with flood rescue operations.

## **2.5 Australian Government Bureau of Meteorology:**

- 2.5.1 Assist the SES in the exercising of Flood Sub Plans;
- 2.5.2 Act as the flood prediction agency;
- 2.5.3 Develop warning systems in conjunction with the SES and other state and local agencies;
- 2.5.4 Collect, collate and analyse rain and river data;
- 2.5.5 Provide near real time rainfall and river level data on the internet;
- 2.5.6 Contribute to flood education programs;
- 2.5.7 Formulate and issue official forecasts and warnings for:
  - a. River basins (Flood Watches);
  - b. Key locations on rivers and creeks (Preliminary Flood Warnings and Flood Warnings);

- c. Weather Forecast Districts (Regional Severe Thunderstorm Warnings and Severe Weather Warnings) and the Newcastle/Sydney/Wollongong area (Severe Thunderstorm Warnings); and
- d. Coastal areas (large waves and storm surges).

2.5.8 Assist councils with the development of warning services for flash flooding.

## **2.6 Australian Volunteer Coast Guard (AVCG):**

- 2.6.1 Assist the SES with the warning and/or evacuation of at risk communities;
- 2.6.2 Assist the SES by providing communications personnel;
- 2.6.3 Assist the SES with property protection tasks including sandbagging; and
- 2.6.4 Assist the SES with flood rescue operations (note: that operations involving AVCG vessels will typically be restricted to navigable waters on coastal estuaries and lakes).

## **2.7 Communication Services Functional Area:**

- 2.7.1 Coordinate the restoration of telephone facilities damaged by flooding;
- 2.7.2 Coordinate additional telecommunications support for the SES Headquarters as required; and
- 2.7.3 Assist the SES to identify infrastructure at risk of flooding for incorporation into planning and intelligence.

## **2.8 Councils of Local Government Areas:**

- 2.8.1 The responsibilities for Local Governments are agreed to in Local Flood Sub-Plans. The following is a list of typical responsibilities which may be included:
  - a. Maintain and operate flood mitigation works and advise the SES regarding their operation;
  - b. Assist the SES with flood education programs;
  - c. Provide the SES with information on the local flood threat and its effects including flood studies and floodplain risk management studies;
  - d. Participate in SES-led flood emergency planning meetings, to assist in the preparation of Flood Sub-Plans;
  - e. Assist the SES to determine local flood warning requirements;
  - f. Assist the SES in flood response operations, which may include:
    - property protection tasks including sandbagging;

- warning and/or evacuation of residents and other people in flood liable areas; and
  - resupply of isolated properties.
- g. Maintain, and operate council-owned flood warning systems;
  - h. Manage and protect council-owned infrastructural facilities during floods;
  - i. Close and reopen council roads (and other roads nominated by agreement with the RTA) and advise the SES, the NSW Police Force and people who telephone the council for road information;
  - j. Provide advice to the SES and the Health Services Functional Area during floods about key council managed infrastructure such as sewerage treatment and water supply;
  - k. Ensure flooded premises are fit and safe for reoccupation and assess any need for repair or demolition; and
  - l. Assist the SES to provide filled sandbags and filling facilities to residents and businesses in urban and village areas in which flooding is expected.

## **2.9 Department of Education and Training NSW:**

- 2.9.1 Liaise with the State Emergency Service and arrange for the early release of students whose travel arrangements are likely to be disrupted by flooding and/or road closures (or where required, for students to be moved to a suitable location until normal school closing time);
- 2.9.2 Pass information to school bus drivers/companies and/or school principals on expected or actual impacts of flooding;
- 2.9.3 Assist with the coordination of the evacuations of schools;
- 2.9.4 Ensure that evacuation plans for flood liable schools have arrangements for flooding; and
- 2.9.5 Provide space in schools for evacuation centres where necessary.

## **2.10 Department of Environment and Climate Change:**

- 2.10.1 Provide specialist policy, engineering and scientific advice to councils and the SES on flood-related matters including assistance with:
  - a. the identification of flood problems; and
  - b. the preparation of Floodplain Management Plans and flood mitigation schemes.

- 2.10.2 Ensure that the SES has access to relevant studies regarding flooding, including Flood Studies and Floodplain Risk Management Studies;
- 2.10.3 Assist the SES in the exercising of Flood Sub Plans;
- 2.10.4 Maintain the Hunter Valley Flood Mitigation Scheme;
- 2.10.5 Advise the SES about conditions which may lead to coastal flooding or retarded river drainage near the coast;
- 2.10.6 Coordinate the collection of post event flood data, in consultation with the SES;
- 2.10.7 Assist the Department of Water and Energy in fulfilling its responsibilities in rural areas of the Murray Darling Basin designated under Part 8 of the Water Act 1912 or under the regulations of the Water Management Act 2000 and the licensing of flood control works (earthworks, embankments and levees which can affect the distribution of floodwaters) in these areas; and
- 2.10.8 Close and evacuate at risk camping grounds in National Parks managed areas.

## **2.11 Department of Primary Industries (Forests)**

- 2.11.1 Close and evacuate at risk camping grounds in State Forest managed areas.

## **2.12 Department of Water and Energy:**

- 2.12.1 Collect and maintain flood data including data relating to flood heights, velocities and discharges;
- 2.12.2 Provide the Bureau of Meteorology and SES real-time or near real-time access to river height gauges and height data for the development of official flood warnings;
- 2.12.3 Provide flow rating charts for river height gauges; and
- 2.12.4 Manage the approval process under the Water Act 1912 and Water Management Act 2000 for flood control works (earthworks, embankments and levees which can affect the distribution of floodwaters) including:
  - a. Assessment and approval of flood mitigation works;
  - b. Issue and renewal of licenses for flood control works; and
  - c. Objection and appeal processes to ensure the protection of the interests of all landholders and other stakeholder groups.

## **2.13 Energy and Utility Services Functional Area:**

- 2.13.1 Implement the Energy and Utilities Services Functional Area Supporting Plan;

- 2.13.2 Where required, coordinate energy and utility services emergency management planning, preparation, response and recovery, including the restoration of services following a flood event;
- 2.13.3 Coordinate advice to the SES of any need to disconnect electricity, gas, water or wastewater services;
- 2.13.4 Assist the SES to identify infrastructure at risk of flooding for incorporation into planning and intelligence;
- 2.13.5 Identify interdependencies between flooding and utility services due to secondary impacts of flooding and advise the SES;
- 2.13.6 Assist the SES with advisory notices relating to hazards from utility services during flooding; and
- 2.13.7 Coordinate with utilities on restoration of services, including advisory notices relating to estimated time for restoration and mandatory safety checks prior to reconnection. Advise the SES and the relevant recovery committee and coordinator of the timetable for restoration.

## **2.14 Engineering Services Functional Area:**

- 2.14.1 Provide engineering advice regarding the integrity of damaged structures;
- 2.14.2 Assist the SES with damage assessment;
- 2.14.3 Assist the SES and councils with the assessment and operation of flood protection levees when requested;
- 2.14.4 Assist with property protection, including the construction or repair of levees; and
- 2.14.5 Coordinate the restoration of critical public facilities.

## **2.15 Environmental Services Functional Area:**

- 2.15.1 Implement the Environmental Services Functional Area (Enviroplan) Supporting Plan if required; and
- 2.15.2 Activate the Hazmat/CBR Emergency Sub Plan if required.

## **2.16 Health Services Functional Area:**

- 2.16.1 Activate Healthplan if required;
- 2.16.2 Ensure that appropriate business continuity plans are developed for essential health infrastructure and are activated during floods;
- 2.16.3 Provide medical support to the SES;

- 2.16.4 Establish health surveillance in affected areas;
- 2.16.5 Assess potential public health risks that either acutely endanger the health of human populations or are thought to have longer term consequences;
- 2.16.6 Provide environmental health advice;
- 2.16.7 Provide public health warnings and advice to affected communities; and
- 2.16.8 Assist the SES with the warning and evacuation of hospitals.

### **2.17 Manly Hydraulics Laboratory:**

- 2.17.1 Provide the Bureau of Meteorology and SES with real-time access to data from stream and rain gauges; and
- 2.17.2 Provide real-time off-shore ocean data when storm surge conditions exist.

### **2.18 Owners of Prescribed Dams:**

- 2.18.1 Provide the SES State Headquarters with Dam Safety Emergency Plans;
- 2.18.2 In the case of prescribed dams which are also deficient, assist the SES in planning to warn and evacuate people at risk of dam failure and maintain and operate any special Dam Failure Warning Systems which are installed;
- 2.18.3 Assist the SES with flood education programs;
- 2.18.4 (Owners of gated dams only): Provide information to the BoM and the SES on storage levels and actual and prospective water releases and their likely impacts on downstream river levels;
- 2.18.5 (Owners of gated dams only): Advise the downstream community of prospective and actual water releases; and
- 2.18.6 Notify SES of potential or actual dam failures.

### **2.19 NSW Dams Safety Committee:**

- 2.19.1 Advise the SES on dams which are deficient to the point that there is a significant risk of failure. This is done by maintaining an up-to-date list of prescribed dams, their consequence categories and an assessment of deficiencies and providing a new list to the SES State Headquarters whenever the Committee changes the status of a dam;
- 2.19.2 Assist the SES in prioritising deficient dams for flood planning purposes; and
- 2.19.3 Ensure that dam owners provide the SES with information to allow flood planning to be carried out for the purpose of warning and/or evacuating people at risk from dam failure.

## **2.20 NSW Fire Brigades:**

- 2.20.1 Meet the agreed arrangements described in the NSW SES/NSWFB MAA;
- 2.20.2 Identify and notify the SES of any locations at risk of fire (within NSW Fire Brigades prescribed Fire Districts) or hazmat that pose a significant threat to surrounding populations due to the impact of a flood for incorporation into SES flood intelligence and planning;
- 2.20.3 Assist the SES with the warning and/or evacuation of at risk communities;
- 2.20.4 Assist the SES with the monitoring / reconnaissance of flood prone areas;
- 2.20.5 Assist the SES with the resupply of isolated communities and/or properties;
- 2.20.6 Assist the SES with property protection tasks including sandbagging;
- 2.20.7 Provide resources for pumping flood water out of buildings and from low-lying areas;
- 2.20.8 Assist with cleanup operations, including the hosing out of flood affected properties;
- 2.20.9 Coordinate the deployment of fire resources to communities within NSW Fire Brigades fire districts if access is expected to be lost in consultation with the SES;
- 2.20.10 Assist the SES with flood rescue operations;
- 2.20.11 Provide staff to support a spatial information group established by the SES;  
and
- 2.20.12 Activate the Hazmat/CBR Emergency Sub Plan if required.

## **2.21 NSW Maritime Authority:**

- 2.21.1 Assist the SES with the warning and/or evacuation of at risk communities; and
- 2.21.2 Assist the SES with flood rescue operations.

## **2.22 NSW Police Force:**

- 2.22.1 Assist the SES with the warning and/or evacuation of at risk communities;
- 2.22.2 Assist the SES with the monitoring / reconnaissance of flood prone areas;
- 2.22.3 Assist the SES with property protection tasks including sandbagging;
- 2.22.4 Assist the SES with flood rescue operations;
- 2.22.5 Conduct road and traffic control operations in conjunction with council and/or RTA; and

2.22.6 Coordinate the security of supply lines and evacuated and damaged areas.

### **2.23 NSW Rural Fire Service:**

- 2.23.1 Meet the agreed arrangements described in the NSW SES/NSW RFS MOU;
- 2.23.2 Identify and notify the SES of any locations at risk of fire (within prescribed Rural Fire Districts) that pose a significant threat to surrounding populations due to the impact of a flood for incorporation into SES flood intelligence and planning;
- 2.23.3 Assist the SES with the monitoring / reconnaissance of flood prone areas;
- 2.23.4 Assist the SES with the warning and/or evacuation of at risk communities;
- 2.23.5 Assist the SES with property protection tasks including sandbagging;
- 2.23.6 Provide resources for pumping flood water out of buildings and from low-lying areas;
- 2.23.7 Provide back-up radio communications;
- 2.23.8 Assist with cleanup operations, including the hosing out of flood affected properties;
- 2.23.9 Deploy fire resources to communities within Rural Fire Service Fire Districts if access is expected to be lost in consultation with the SES;
- 2.23.10 Assist the SES with the resupply of isolated communities and/or properties;
- 2.23.11 Provide staff to support a spatial information group established by the SES;  
and
- 2.23.12 Assist the SES with the provision and management of aircraft.

### **2.24 Public Information Services Functional Area:**

- 2.24.1 Assist the SES in the establishment and operation of a Joint Media Information Centre.

### **2.25 State Emergency Operations Centre (SEOC):**

- 2.25.1 Display wherever practicable Bureau of Meteorology weather and flood warnings without change on the State Emergency Operations Centre and emergency NSW websites;
- 2.25.2 Notify State Emergency Management Committee Members of the existence of weather and flood warnings, or SES bulletins;
- 2.25.3 Distribute SES situation reports to the State Emergency Operations Controller, State Emergency Management Committee members and Australian Government departments;

2.25.4 Facilitate and process requests made to the SEOCON for Commonwealth assistance; and

2.25.5 Support the SEOCON in coordinating support to the SES and/or other agencies.

### **2.26 State Emergency Operations Controller:**

2.26.1 Monitor flood operations; and

2.26.2 If requested to do so, coordinate support to the SES and/or other agencies.

### **2.27 Royal Volunteer Coastal Patrol:**

2.27.1 Assist the SES with the warning and/or evacuation of at risk communities;

2.27.2 Assist the SES by providing communications personnel;

2.27.3 Assist the SES with property protection tasks including sandbagging; and

2.27.4 Assist the SES with flood rescue operations.

### **2.28 Surf Life Saving NSW:**

2.28.1 Assist the SES with the warning and/or evacuation of at risk communities;

2.28.2 Provide space in Surf Life Saving facilities for evacuation centres where required; and

2.28.3 Assist the SES with flood rescue operations.

### **2.29 Sydney Catchment Authority**

2.29.1 For the Hawkesbury-Nepean and Shoalhaven rivers, provide to the SES and Bureau of Meteorology:

a. Flow rating charts for river height gauges;

b. Real-time or near real-time access to river height gauges and height data for the development of official flood warnings; and

c. Real-time or near real-time advice and information from dams and hydrometeorological stations during floods.

### **2.30 Transport Services Functional Area:**

2.30.1 Assist the SES with the resupply of isolated communities and/or properties; and

2.30.2 Assist with the coordination of transport for evacuation purposes.

2.30.3 The Roads and Traffic Authority will:

- a. Close and reopen RTA roads affected by flood waters and advise the SES of their status;
- b. Facilitate the safe reliable access of emergency resources on RTA managed roads;
- c. Assist the SES with identification of road infrastructure at risk of flooding;
- d. Manage traffic; and
- e. Assist the SES with the communication of warnings and information provision to the public through variable message signs.

2.30.4 The State Rail Authority will close and reopen railway lines affected by flood waters and advise the SES.

### **2.31 Welfare Services Functional Area:**

2.31.1 Establish and manage evacuation and recovery centres; and

2.31.2 Administer the Personal Hardship and Distress component of the NSW Disaster Relief Scheme established to provide financial assistance to people affected by emergencies.

### **2.32 Volunteer Rescue Association (VRA):**

2.32.1 Assist the SES with the warning and/or evacuation of at risk communities;

2.32.2 Assist the SES with flood rescue operations;

2.32.3 Assist the SES with the monitoring / reconnaissance of flood prone areas;

2.32.4 Assist the SES with the resupply of isolated communities and/or properties;  
and

2.32.5 Assist the SES with property protection tasks including sandbagging.

# **PART 3 - MITIGATING FLOODING AND MANAGING FLOODPLAINS**

## **3.1 General**

- 3.1.1 Actions to minimise the risk to life and to reduce property damage can be undertaken by carefully managing floodplains. These actions help to ensure that the use of floodplain land is not at odds with the nature of the flood hazard and allows for sustainable use of the land.
- 3.1.2 The arrangements for managing flood prone land in New South Wales are detailed in the State Government's Flood Prone Lands Policy and the Floodplain Development Manual (2005) which covers floodplain management matters gazetted under the Local Government Act 1993.
- 3.1.3 The SES is to be represented on relevant floodplain risk management committees established by local councils.
- 3.1.4 The SES will encourage councils to ensure emergency management considerations are accounted for in land use planning for flood liable areas. The SES and DECC have published Floodplain Risk Management Guideline 14 (SES Requirements from the Floodplain Risk Management Process) to inform councils and other bodies of the SES's requirements from flood studies and floodplain risk management studies.

## **3.2 The Floodplain Management Authorities of New South Wales**

- 3.2.1 The Floodplain Management Authorities of New South Wales is an association of councils of local government areas (including county councils and catchment management authorities with flood mitigation responsibilities) and management trusts directly involved in floodplain management activities. The Authorities' aim is to facilitate the reduction of flooding and flood liability on life and property in the state by coordinating the implementation, ongoing operations and maintenance of effective floodplain management processes and procedures.
- 3.2.2 The DECC, the Department of Planning and the SES are advisory members of the Floodplain Management Authorities of New South Wales.

# **PART 4 - PREPARING FOR FLOODS**

## **4.1 Introduction**

4.1.1 This Part deals with preparations for actual flood events. Preparation must be done by:

- a. Agencies and organisations which have responsibilities before and during or in the recovery from floods, and
- b. Communities which are liable to the effects of flooding.

4.1.2 As the combat agency for flooding, the SES is required to take the lead in planning for the occurrence of floods. This includes the following functions:

- a. Developing and maintaining flood intelligence systems;
- b. Preparing and maintaining Flood Sub Plans (including reviews and exercises);
- c. Training SES Controllers, operations centre and field staff;
- d. Ensuring that appropriate agencies, organisations and officers are aware of and ready for their responsibilities; and
- e. Working to assist communities to understand the flood threat in their area and know how to protect themselves and their property from it.

## **4.2 Flood Intelligence**

4.2.1 Flood intelligence describes flood behaviour and its effects on the community. Flood effects include:

- a. Inundation (leading to a need for evacuation, property protection and/or rescue);
- b. Isolation (creating risk to life and the need for resupply and/or rescue); and
- c. Disruption to community activities (for example because of the loss of electricity supply or transport routes).

4.2.2 Flood intelligence is obtained by gathering and assessing information, over the full range of possible flood types and severities, so that the likely effects of developing floods can be assessed. Intelligence is used to facilitate operational decision making and the provision of warnings and information to agencies and the public.

- 4.2.3 The existence of a flood intelligence system will enable the SES to determine (from predicted flood heights and an understanding of community needs and characteristics) the likely impacts of flooding, what actions will need to be taken by response agencies and what information and advice should be provided to community members.
- 4.2.4 To meet this requirement, the SES will develop and maintain:
- a. Information about the potential effects of flooding on communities at risk; and
  - b. Community characteristics (including the social and demographic nature of flood prone communities).
- 4.2.5 Networks of volunteer readers and flood observers are sometimes necessary to supplement the information provided in Flood Warnings and to supply information on flood impacts when floods are actually occurring.
- 4.2.6 An internet based flood intelligence system is maintained by the SES. Information contained within the flood intelligence system will be shared with supporting agencies as needed.

### **4.3 Flood Emergency Planning**

- 4.3.1 The basis for SES Planning is detailed in the SES Act, 1989, SERM Act, 1989 and DISPLAN, 2006.
- 4.3.2 There is a requirement for the development and maintenance of a Flood Sub Plan for:
- a. The State of New South Wales;
  - b. Each SES Region; and
  - c. Each council area with a significant flood problem. In some cases the flood problems of more than one council area may be addressed in a single plan or the problems of a single council area may be addressed in more than one.
- 4.3.3 In some circumstances, special state-level arrangements may be necessary for very severe floods likely to lead to large-scale evacuations, for example the Hawkesbury Nepean Flood Emergency Sub Plan.
- 4.3.4 Annex B lists the Local Flood Sub Plans which exist or are to be prepared in New South Wales and indicates which river, creek and/or lake systems are to be covered in each plan.

### **4.4 Review of Emergency Plans**

- 4.4.1 The arrangements contained in the State Flood Sub Plan are to be reviewed when there are changes which alter agreed plan arrangements. Otherwise, this Plan is to be reviewed no less frequently than every five years.

- 4.4.2 The arrangements contained in SES Region Flood Sub Plans and Local Flood Sub Plans are to be reviewed:
- a. After each flood operation;
  - b. When significant changes in land use or community characteristics occur;
  - c. When new information from flood studies becomes available;
  - d. When flood control or mitigation works are implemented or altered; and
  - e. When there are changes which alter agreed plan arrangements.
- 4.4.3 In any event, SES Region Flood Sub Plans and Local Flood Sub Plans are to be reviewed no less frequently than every five years.

## **4.5 Briefing of SES, Supporting Emergency Services and Functional Areas**

- 4.5.1 The SES Director General (for the State Flood Sub Plan), SES Region Controllers (for SES Region Flood Sub Plans) and SES Local Controllers (for Local Flood Sub Plans) are responsible for ensuring:
- a. That the SES, Supporting Emergency Services and Functional Areas are briefed on Flood Sub Plan contents after each revision; and
  - b. Through briefings and/or exercises, the arrangements contained in Flood Sub Plans are regularly brought to the notice of all participants. Assistance in the compilation of flood exercise scenarios will be provided by the BoM and the DECC.

## **4.6 Coordination of Flood Emergency Planning**

- 4.6.1 The SES State Headquarters is responsible for the state wide coordination of this flood planning process. The contact officer is the Manager of Planning.

## **4.7 Fire and Hazmat Planning**

- 4.7.1 Flooding can result in secondary incidents of fire and hazardous materials. Locations at risk of fire during flooding which may pose a significant threat to surrounding populations should be identified by the NSW Fire Brigades and NSW Rural Fire Service. NSW Fire Brigades are to identify any land based locations which may pose a risk of hazmat. The SES is to be notified of those facilities that pose a significant threat for incorporation into SES flood intelligence and planning.

## **4.8 Skill Development**

- 4.8.1 The SES is responsible for ensuring that SES personnel involved in flood operations are appropriately trained for their expected management roles and

response tasks. Appropriate skills include those relating to controlling flood operations and carrying out tasks in the field including evacuation and rescue.

## **4.9 Community Education**

- 4.9.1 As the combat agency, the SES has a primary responsibility for public awareness about how people can protect themselves and their property against floods. To do this the SES will require assistance from other agencies, particularly local government councils, dam owners and the Bureau of Meteorology in the development and delivery of materials

# PART 5 - FLOOD WARNING

## 5.1 Introduction

- 5.1.1 This Part describes warning arrangements and a process aimed at their future ongoing development.
- 5.1.2 A flood warning service is provided by the Australian Government Bureau of Meteorology (the official flood prediction agency) (see Annex C for details). The SES augments the Bureau's predictions with additional information and provides some further warning services. Other agencies assist in planning warning services and by providing data for forecasting purposes when floods are occurring.
- 5.1.3 Some councils, with BoM and SES assistance, have developed flash flood warning services in their own areas.
- 5.1.4 Dam Failure Warning Systems and accompanying arrangements have been established for communities below some dams which have been classed as deficient.
- 5.1.5 It must be recognised that all flood warnings are based on predictions of flood severity and therefore contain the possibility of variation. Special care must be taken to note the possible consequences of error when predictions imply flood levels close to the tops of levees, the heights at which evacuation routes close, the crests of dams or other critical heights.

## 5.2 Flood Warning Products

- 5.2.1 Warnings services may be more limited for remote and unpopulated areas where data may not be available for effective monitoring and prediction.
- 5.2.2 The BoM issues the warning products shown below:
  - a. **Regional Severe Thunderstorm Warnings** – The BoM issues Severe Thunderstorm Warnings whenever severe thunderstorms are occurring in an area or are expected to develop or move into the area during the ensuing few hours. The warnings describe the area under threat and the particular hazards likely to be associated with the thunderstorms including flash flooding. These warnings are distributed widely to the media and emergency services, and are available to the public via the internet and various telephone and fax based services. An image is available with the warning on the internet to show in a map format the area at risk. This service is provided for all parts of NSW.
  - b. **Severe Thunderstorm Warnings – Sydney/Newcastle/Wollongong – (Cell - Based)**. When severe thunderstorms are actually occurring or are about to move into, the heavily populated region around Sydney, Newcastle and Wollongong, the Bureau of Meteorology will issue a

more detailed Severe Thunderstorm Warning for people in the affected region. High quality, full-time weather radar coverage in this area allows these warnings to describe the current location of individual thunderstorms, and the places likely to be affected within the next 30 to 60 minutes. Again, an image is available with the warning showing in map format the location of the severe thunderstorms and their forecast tracks. The more detailed warnings are available for Sydney, Newcastle, Wollongong and surrounds. These warnings are distributed widely to the media and emergency services, and are available to the public via the internet and various telephone and fax based services.

- c. **Severe Weather Warnings** are issued when severe weather is expected to affect land-based communities within the next 24 hours; and
- it is not directly the result of severe thunderstorms; and
  - it is not covered by tropical cyclone or fire weather warnings.

Severe Weather Warnings aim to provide advance notice of very heavy rainfall leading to flash flooding or storm surge which is sometimes exacerbated by abnormally high tides.

Severe Weather Warnings are distributed to the media by the BoM and are available to the public via the internet and various telephone and fax based services.

- d. **Flood Watches.** These are targeted at large catchments and can provide up to 24-36 hours advance warning of large-scale weather systems that have the potential to cause flooding. They are issued prior to Flood Warnings for most river valleys that are covered by flood warning services. Generally, the exceptions are the Murray (below Hume Dam), Barwon-Darling, Paroo, Warrego, Culgoa and lower Macintyre rivers which have relatively long warning lead times after the flood-producing rain has fallen. Flood Watches are not distributed directly to the media by the BoM and must be incorporated in Region Flood Bulletins released by the SES. Flood Watches are published on the BoM website.
- e. **Preliminary Flood Warnings.** These warnings usually predict which **class** of flooding (minor, moderate or major) will occur rather than providing quantitative forecasts. They are the first in a series of warnings and will typically be followed by more detailed flood warnings. These products are disseminated directly to media outlets by the BoM and are published on the BoM website.
- f. **Flood Warnings.** These normally predict flood heights (in metres and centimetres at a gauge) which will be reached at a location at a specified time in the future. After the issuing of a Preliminary Flood Warning, Flood Warnings are renewed at frequent intervals until the relevant stream drops to below the minor flood level. Flood Warnings are not distributed directly to the media by the BoM and must be incorporated

in Region Flood Bulletins and released by the SES. Flood warnings are published on the BoM website.

5.2.3 The SES issues the following warning products:

- a. **Livestock and Equipment Warnings.** These are issued when there is evidence of significant rises in stream levels to below minor flood heights. The SES may seek advice from the BoM on likely rises.
- b. **Local Flood Advices.** These are issued on the basis of localised valley watch information for locations for which the BoM does not issue Flood Warnings. They normally predict which class of flooding (minor, moderate or major) will occur, and must not contradict any Flood Warnings provided by the BoM for other gauges on the same river. Local Flood Advices are to be clearly identified as being issued by the SES.

### 5.3 Warning Requirement

5.3.1 The state's flood warning requirement is set out in Annex C.

5.3.2 For the locations listed in Annex C for which official flood warnings are provided, the BoM seeks to predict heights as follows:

- a. Stage heights likely to be reached as a flood rises and before the likely peak can be forecast;
- b. Peak heights; and
- c. Heights at which flood waters enter towns or villages, evacuation routes are cut and town and village levees are overtopped.

5.3.3 Warnings are also provided in relation to:

- a. Flash flooding (provided by the BoM as Severe Thunderstorm and Severe Weather Warnings);
- b. Flooding from storm induced large waves (provided by the BoM as Severe Weather Warnings);
- c. Releases from gated dams. Advice on the impacts of such releases is provided by the owners of these dams. The distribution of information about routine operational releases is the responsibility of dam owners. When releases occur during flood events and minor flood levels are likely to be exceeded at downstream locations, BoM flood warnings will be issued;
- d. Local overland and creek flooding. Generalised warnings can be provided by the BoM if rainfall information indicates the possibility of such flooding. The SES will seek to verify the flooding through local Flood Watch networks and, if appropriate, by seeking satellite images of affected areas and carrying out physical surveillance.

## **5.4 Review of Warning Requirement**

- 5.4.1 The SES will maintain a continuous review of the state's flood warning requirement, specifically by re-examining after floods and during the process of revising Local Flood Sub Plans the flood height classifications and warning time requirements listed. Changes to flood height classifications will be made only after:
- a. Consultation with the affected community (including via its local council) and the BoM; and
  - b. Official notification of the changes by council through local media.

## **5.5 Development of Improved Flood Warning Services**

- 5.5.1 Co-operative arrangements between Federal, State and Local Governments have established a Flood Warning Consultative Committee to advise government agencies on the development of flood warning services in New South Wales.
- 5.5.2 The members of the Flood Warning Consultative Committee are:
- a. The Australian Government Bureau of Meteorology (Chair);
  - b. The State Emergency Service;
  - c. The Department of Environment and Climate Change;
  - d. The Department of Water and Energy;
  - e. The Local Government and Shires Association of New South Wales;
  - f. The Sydney Catchment Authority; and
  - g. The Floodplain Management Authorities of New South Wales.

## **5.6 Flash Flood Warning Services**

- 5.6.1 For flash flood catchments (defined as catchments in which less than six hours may elapse between heavy rainfall and flooding), the BoM provides general warning services, including:
- a. Severe Thunderstorm Warnings
  - b. Severe Weather Warnings
  - c. Flood Watches
- 5.6.2 These services are typically issued for a much larger region, or catchment, that includes the local flash flood site. These warnings can be augmented by real-

time information from local weather radars, automatic weather stations and existing rainfall and river gauges.

5.6.3 For flash flood catchments the BoM provides technical assistance with establishing local flash flood warning systems operated by councils. This input allows a limited amount of warning to be given using rainfall-runoff relationships and forecast rainfall, with rainfall and river level information being received either in real time through radio or telephone telemetry systems or in near real time through the internet, computer networks, facsimile or other medium. The BoM may also develop flood thresholds and/or forecasting techniques based upon flood information and studies.

5.6.4 Some Local Councils have developed flash flood warning systems in consultation with the Bureau of Meteorology. Areas with local flash flood warning systems include:

- a. Myall River – Bulahdelah
- b. Camden Haven - Kendall
- c. Dumaresq Creek - Armidale
- d. Brunswick River Valley
- e. Coffs Creek – Coffs Harbour
- f. Cooma
- g. Cootamundra and Stockinbingal
- h. Molong
- i. Scone
- j. Woolli
- k. Woronora
- l. Lower Cooks River

## **5.7 Dam Failure Warning Systems**

5.7.1 Dam Failure Warning Systems have been installed by the owners of some dams with significant deficiencies in order to provide advance notice of conditions under which failure could occur. As emergency planning for potential dam failure proceeds, further Dam Failure Warning Systems for deficient dams including gauges, sensors and telemetry may be established.

5.7.2 Arrangements governing the operation of such systems, the notification of downstream emergency managers and the warning of communities at risk must be developed in consultation with the SES.

## **5.8 Issue and Dissemination of Flood Warning Products and Related Information**

- 5.8.1 To avoid the possibility of conflicting information being provided to communities, flood warning information provided by the SES to media outlets is normally issued by SES Region Headquarters after consultation with appropriate SES Local Controllers. However, SES Region Controllers may allow specified SES Local and Unit Controllers to perform this function where specific circumstances indicate this to be appropriate.
- 5.8.2 SES Region Headquarters issue flood information, including flood warnings, to media outlets in Flood Bulletins. These Bulletins must include verbatim the first paragraph of the predictions section of the latest warning issued by the BoM. Flood Bulletins will also include, as appropriate:
- a. What the predicted height means in terms of areas likely to be flooded and the depth and nature of the expected flooding;
  - b. Local Flood Advices;
  - c. Advice on what actions people should take to protect themselves and their property (and indicating appropriate time frames for these actions);
  - d. Areas of danger to be avoided;
  - e. The data section of the latest flood warning issued by the BoM. Note that:
    - If later river and rainfall gauge readings are available, they may be inserted with the time of reading;
    - Data can be condensed to include key sites only;
    - Additional gauges of local importance may be inserted; and
    - Locally-accepted names may be used for gauges, but only if the SES State Headquarters and the BoM are aware of the local name.
  - f. Roads currently closed, roads which may become closed, and roads which will not be closed;
  - g. Contact details for SES units in the event of assistance being required; and
  - h. Contact details for obtaining road information.
- 5.8.3 The SES will pre-write Flood Bulletins for key warning gauges, flash flood environments and for areas downstream of deficient dams.
- 5.8.4 The SES will deliver flood warning information directly when possible, rather than via the media. Methods of warning that may be utilised include:

- a. mobile and fixed public address systems;
- b. two-way radio;
- c. telephone (including SMS and automatic dial where available) and fax;
- d. doorknocking;
- e. mobile and fixed sirens;
- f. variable message signs; and
- g. internet.

## **5.9 Liaison and the Adjustment of Flood Warnings**

- 5.9.1 Following the issuing of any BoM warning products, the SES State Headquarters is to maintain regular contact with the BoM until the flood potential has passed.
- 5.9.2 During floods, close liaison between the BoM and appropriate SES Region and Local Controllers is to occur. Initial contact should be through the appropriate SES Region Controller. If Region Controllers have local information which indicates a need for the BoM to adjust river height predictions they are to advise the BoM without delay so that adjustments may be negotiated.

## **5.10 Standard Emergency Warning Signal**

- 5.10.1 The Standard Emergency Warning Signal (SEWS) may be used over radio and television stations to alert people to the dangers of approaching or current flooding. Its use must be limited, however, to very severe conditions (for example involving evacuation, especially when time is limited and urgent action is necessary).
- 5.10.2 Copies of the SEWS are held by major radio stations, television stations and at SES Region Headquarters. They are held at selected Local SES Headquarters in areas in which a potential dam-failure or flash flood threat exists. The SEWS can also be downloaded from the emergency NSW website ([www.emergency.nsw.gov.au](http://www.emergency.nsw.gov.au)).
- 5.10.3 SES Region Controllers are authorised to seek its utilisation by appropriate radio and television stations when conditions such as those outlined above apply, but must report to SES State Headquarters when the Signal is to be or has been used. The SES State Headquarters will then inform the State Emergency Operations Centre.

# **PART 6 - CONCEPT OF OPERATIONS**

## **6.1 Principles of Operations**

6.1.1 The following principles are to apply during flood operations:

- a. The SES is the combat agency for dealing with floods and members of the Police Force, other emergency service organisations and other agencies are required to recognise the authority of emergency officers appointed under the SES Act, 1989.
- b. Real-time flood management is coordinated by the SES as the combat agency but the nature of the flood threat is such that many other agencies and organisations (including non-government and private sector organisations) must play a part as must the people at risk.
- c. To ensure that local knowledge is available for operations, local resources should be utilised whenever possible.
- d. If local SES and other local resources are insufficient or likely to be exhausted, additional SES resources may be deployed by the appropriate SES Region Headquarters. If further SES resources are required from other Regions they will be deployed by the SES State Headquarters.
- e. Resources from supporting agencies may be requested directly by the SES at any level (local, regional or state) or under DISPLAN arrangements. Emergency Operations Controllers will be responsible, when requested, to coordinate this additional support and are to be responsive to the requirements of SES Controllers.
- f. Control and coordination of flood operations are carried out at the lowest effective level. However, control and coordination may be assumed at the SES Region and State levels for whole operations or for the performance of particular functions, after consultation with the relevant controllers.
- g. Other agencies are to assist the SES in accordance with arrangements laid down in this State Flood Sub Plan, SES Region Flood Sub Plans and Local Flood Sub Plans.
- h. The State Emergency Operations Centre (SEOC) will monitor flood operations and keep members of the State Emergency Management Committee informed by distributing SES Situation Reports. It will assist the SEOC to coordinate support to the SES.
- i. The SES will manage liaison officers in accordance with Section 322 and the concept of emergency operations of State DISPLAN.

- j. The SES uses the Australasian Inter-agency Incident Management System (AIIMS) as a basis for operational management.
  - k. Agencies with access to real-time information relevant to flood operations are to supply it to the SES.
- 6.1.2 The activities undertaken when floods are likely or occurring to protect life and property are many. They include:
- a. The monitoring of flood levels;
  - b. The monitoring and operation of structures designed to keep floods out of populated areas;
  - c. The monitoring of people who are at risk;
  - d. The provision of warnings, information and advice to communities;
  - e. Assistance with property protection by way of sandbagging and the lifting or transporting of furniture, personal effects, commercial stock and caravans;
  - f. Assistance with the protection of essential infrastructure;
  - g. The direction of pre-deployment of resources;
  - h. The relocation and management of livestock and domestic pets;
  - i. The conduct of search and rescue activities;
  - j. The conduct of evacuation operations;
  - k. Disaster victim identification and registration;
  - l. The response to fire and hazmat incidents;
  - m. The resupply of communities and individual households which are cut off from normal means of supply;
  - n. The securing of evacuated areas;
  - o. The provision of welfare support for evacuees;
  - p. The management of vehicle traffic including the closing of roads which are or will become dangerous to travel on;
  - q. The treatment of sick and injured people;
  - r. The management of potential health hazards associated with flooding;
  - s. The pumping out of flood waters from premises;
  - t. The maintenance of electrical safety; and

- u. The provision of fodder to farm animals.

## **6.2 Defence Assistance**

- 6.2.1 Arrangements for Defence Assistance to the Civil Community are detailed within State DISPLAN.

## **6.3 Communications**

- 6.3.1 The SES uses the Public Switched Telephone Network (PSTN) as the primary means of communication between State, Region and Unit Operations Centres, provided telephone services are operating.
- 6.3.2 The SES also uses terrestrial cellular telephone and satellite telephone networks as supplements to the PSTN.
- 6.3.3 The SES operates on the Government Radio Network where it provides coverage and on UHF PMR (Ultra High Frequency Private Mobile Radio) systems elsewhere in the frequency range of 450-470 MHz.
- 6.3.4 Supporting agencies are expected to utilise their own internal communications systems when supporting the SES in flood operations. When possible, the SES will provide linking communications as necessary.

# **PART 7 - RESPONSE**

## **7.1 Control**

- 7.1.1 As the combat agency for floods the SES is required to control the overall emergency response to floods.

## **7.2 Start of Response Operations**

- 7.2.1 Flood response operations will begin:
  - a. On receipt of a BoM Preliminary Flood Warning; Flood Warning; Severe Weather Warning for flash flooding or storm surge; or a Severe Thunderstorm Warning for flash flooding;
  - b. On receipt of a dam failure alert; or
  - c. When other evidence leads to an expectation of flooding.

## **7.3 SES State Operations Centre Actions**

- 7.3.1 Operate a 24/7 communications centre to enable agencies to contact the SES;
- 7.3.2 Notify the SEOC when the SES State Operations Centre opens;
- 7.3.3 Monitor Local and Region level flood operations and assume control if necessary;
- 7.3.4 Coordinate multi-Region response operations;
- 7.3.5 Coordinate the deployment of SES resources between Regions;
- 7.3.6 Arrange for the supply to requesting Regions of State and Federal resources in accordance with the arrangements detailed in the State DISPLAN;
- 7.3.7 Ensure that the Government, the State Emergency Operations Controller, appropriate Emergency Service Organisation Controllers and Functional Area Co-ordinators at State level and the community are informed about response operations through a system of regular Situation Reports and Media Releases;
- 7.3.8 Provide advice to SES Regions regarding flood intelligence and management strategies;
- 7.3.9 If required establish Joint Media Information Centre; and
- 7.3.10 If required establish Spatial Information Group.

## **7.4 Operations Management**

### **Strategy**

- 7.4.1 The Australasian Inter-agency Incident Management System (AIIMS) will form the basis for operational management.
- 7.4.2 Control of operations will be implemented at the lowest effective level within the SES.

### **Actions**

- 7.4.3 The controlling SES Headquarters (Local, Region or State) will control resources from within the SES and resources provided by participating agencies.
- 7.4.4 Resources from supporting agencies may operate as single resource/teams tasked by SES or as strike teams or task forces (under their own command).
- 7.4.5 The SES Operations Controller, in consultation with participating agencies, will determine the sector and division breakdown of the area affected in accordance with the principles of the AIIMS. An outline of the AIIMS is available from the AIIMS handbook.
- 7.4.6 Mixed or single service strike teams or task forces may be allocated to Sectors.

## **7.5 Liaison**

### **Strategy**

- 7.5.1 Effective liaison is to be established between the SES and supporting agencies.

### **Actions**

- 7.5.2 Liaison will be managed in accordance with sections 321 and 322 and the concept of emergency operations of State DISPLAN.
- 7.5.3 Supporting agencies are to be prepared to provide liaison officers to SES State, Region and Local headquarters as required. Liaison officers are to be capable of providing immediate advice on the capabilities and current status of the resources of their agency and must have the authority to commit the resources of their parent agencies. It will not always be necessary for liaison officers to be deployed if reliable communications are available between the controller of the operation (SES) and the commanders of the supporting agencies. The decision rests with the SES State Controller (Source: State DISPLAN).
- 7.5.4 The SES State Controller will ensure consultation with the SEOCN and SEOC is ongoing throughout response operations.

## **7.6 Warning**

### **Strategy**

- 7.6.1 Inform the community regarding the potential impacts of a flood and what actions to undertake in preparation for flooding.

## **Actions**

- 7.6.2 BoM to provide flood warning services in accordance with the State's Flood Warning Requirements and provide warning products to the SES.
- 7.6.3 SES will communicate warning information through the development and dissemination of SES Flood Bulletins, which will incorporate:
- a. BoM flood warning products;
  - b. Dam failure warnings;
  - c. Local Flood Advices; and
  - d. Livestock and Equipment Warnings
- 7.6.4 Media are encouraged to broadcast SES Flood Bulletins.

## **7.7 Flood Intelligence and Reconnaissance**

### **Strategy**

- 7.7.1 The SES will maintain and operate a flood intelligence system. The Flood Intelligence System will be the primary means by which flood consequences can be pro-actively identified.
- 7.7.2 Reconnaissance will be conducted to develop a holistic assessment of the actual impact of a flood.

### **Actions**

- 7.7.3 SES to coordinate monitoring and reconnaissance of flood prone areas.
- 7.7.4 SES to coordinate the collection, collation, analysis, interpretation and dissemination of flood intelligence.

## **7.8 Evacuation**

### **Strategy**

- 7.8.1 Evacuations will take place when there is a risk to public safety. Circumstances may include:
- a. Evacuation of people when their homes or businesses are likely to flood.
  - b. Evacuation of people who are unsuited to living in isolated circumstances, due to flood water closing access.
  - c. Evacuation of people where essential energy and utility services have failed or where buildings have been made uninhabitable.

### **Actions**

- 7.8.2 SES will control evacuations.

- 7.8.3 SES will liaise with the Welfare Services Functional Area regarding the establishment of evacuation centres and the welfare of affected communities, at the earliest opportunity.
- 7.8.4 Wherever possible, evacuation operations must be pre-planned as part of normal flood planning. However, a need for evacuation may arise at short notice in situations which may not have been identifiable during the planning process. In such circumstances the main considerations to be considered will be:
- a. The characteristics of the area to be evacuated and the probable duration of the evacuation operation;
  - b. The numbers of people to be evacuated, the amount of time available before inundation occurs or evacuation routes are cut, those who should go early, the destinations of the evacuees and their welfare requirements;
  - c. Resources required (staffing, transport, supplies, equipment, communications and the security of the area to be evacuated);
  - d. The means by which the evacuation will be carried out, taking into account the delivery of warnings, the probable extent of self-evacuation, assembly areas, transport arrangements, the control and timing of movement, reception and welfare needs and registration requirements;
  - e. The dissemination of decisions about and details of the evacuation to all agencies involved in managing the evacuation in consultation with the relevant EOCON; and
  - f. The need to keep evacuees informed about reception arrangements and when they will be able to return to their homes.
- 7.8.5 In large-scale evacuations, whether at short notice or planned in advance, considerable support will be required from Emergency Operations Controllers in order to gain access to additional resources for the purpose of managing traffic control, evacuation centres, security and other tasks related to evacuation operations.
- 7.8.6 The SES will advise the community of the requirements to evacuate. The SES will issue an Evacuation Warning when the intent of an SES Operations Controller is to warn the community of the need to prepare for a possible evacuation. The SES will issue an Evacuation Order when the intent of the SES Operations Controller is to instruct a community to immediately evacuate in response to an imminent threat.
- 7.8.7 NSW Health will allocate medical resources as required to evacuation centres.
- 7.8.8 SES Operations Controllers will carefully consider risks involved when evacuating people, particularly in flash flood environments where shelter in place may be regarded as a safer strategy.

## **7.9 Disaster Welfare**

### **Strategy**

- 7.9.1 Maintain the welfare of communities and individuals affected by the impact of a flood.

### **Actions**

- 7.9.2 The Welfare Services Functional Area will manage evacuation centres for affected residents and travellers.
- 7.9.3 The Welfare Services Functional Area is to activate the Welfare Services Functional Area Supporting Plan if required to coordinate disaster welfare services to communities affected.
- 7.9.4 SES will provide immediate welfare for evacuees where required but will hand the responsibility over to the Welfare Services Functional Area as soon as possible. In these cases the SES will brief the Welfare Services Functional Area at the earliest opportunity regarding the assistance provided.
- 7.9.5 Details of all residents assisted must be available to the Welfare Services Functional Area as early as possible so that they can conduct follow-up visits.

## **7.10 Resupply of Isolated Towns and Villages**

### **Strategy**

- 7.10.1 Minimise disruption upon the community by resupplying towns and villages which have become isolated as a consequence of flooding.

### **Actions**

- 7.10.2 The SES is responsible for the coordination of the resupply of isolated communities. If flood predictions indicate that areas are likely to become isolated, SES Local Controllers should advise businesses (normally through councils) that they should stock up. Advice of impending isolation should also be included in Flood Bulletins.
- 7.10.3 When isolation occurs, storekeepers will be expected to place orders on suppliers where they have a line of credit and to instruct those suppliers to package their goods and deliver them to points designated by the SES.
- 7.10.4 Normal practice is for vetting committees to be established by councils to ensure that only essentials are ordered. It is often difficult for these committees to determine what constitute essential items. The best criteria are:
- a. Businesses requesting supplies are not using the flood as a means of restocking free of charge; and
  - b. No resupply aircraft should have spare capacity.
- 7.10.5 The SES is prepared to deliver mail to isolated communities but may not be able to do so according to normal Australia Post timetables.

7.10.6 The SES will assist hospitals with the resupply of linen and other consumables, by arranging suitable transport within flooded areas.

## **7.11 Resupply of Isolated Properties**

### **Strategy**

7.11.1 The SES will ensure supplies are maintained to property owners by coordinating the resupply of properties which have become isolated as a consequence of flooding.

### **Actions**

7.11.2 The resupply of isolated properties is a common requirement during floods.

7.11.3 Resupply can be difficult to coordinate because requests can emanate from a variety of sources. Property holders may:

- a. Call their supplier(s) direct;
- b. Place orders with the SES (this is not to be encouraged due to operational priority);
- c. Place orders through the Welfare Services Functional Area;
- d. Place orders through friends.

7.11.4 The principles to be applied are:

- a. The SES will coordinate resupply and will establish a schedule but property holders are responsible to arrange payment except as specified below;
- b. The Welfare Services Functional Area will liaise with the SES concerning property holders who place orders with them. They will include people in necessitous circumstances who receive resupply at no cost. The Welfare Service Functional Area has a well developed system for this situation, including a standard list of approved resupply items;
- c. In the event that a property holder seeks resupply through the SES and claims or is considered to be in necessitous circumstances, he or she is to be referred to the Welfare Services Functional Area;
- d. Local suppliers will liaise with SES regarding delivery of resupply items to the designed loading point; and
- e. Local suppliers are responsible for packaging resupply items for delivery.

## **7.12 Rescue**

### **Strategy**

7.12.1 The SES will coordinate rescue of people from floods

## **Actions**

- 7.12.2 The SES will perform flood rescue.
- 7.12.3 The SES may request other agencies to undertake flood rescues on behalf of the SES. Assisting agencies must supply information regarding rescues performed to the SES.

## **7.13 Fire and Hazmat**

### **Strategy**

- 7.13.1 Protect the community from incidents involving fire and hazardous materials

### **Actions**

- 7.13.2 NSW Fire Brigades and the NSW Rural Fire Service will respond to fire incidents in accordance with their Acts and Displan.
- 7.13.3 NSW Fire Brigades will control hazmat incidents occurring on land or in inland waters and activate the Hazmat/CBR Emergency Sub Plan if required.

## **7.14 Property Protection**

### **Strategy**

- 7.14.1 Protect the property of residents and businesses at risk of flood damage.

### **Actions**

- 7.14.2 The SES is the responsible agency for the coordination of operations to protect property.
- 7.14.3 Property may be protected by:
- a. Sandbagging to minimise entry of water into buildings
  - b. Lifting or moving of household furniture
  - c. Lifting or moving commercial stock and equipment
- 7.14.4 The SES maintains stocks of sandbags and a small amount of the Pallet Barrier System.

## **7.15 Protection and Restoration of Essential Services and Heritage Assets**

### **Strategy**

- 7.15.1 Minimise disruption to the community by ensuring supply of essential energy and utility services.

### **Actions**

- 7.15.2 Local facilities needing protection from flood waters, including electrical substations, sewerage facilities, water supply, telephone exchanges, levees, schools, hospitals, heritage assets, dams and road and rail infrastructure should

be identified in Local Flood Sub Plans. The SES will provide help with protective activities where possible.

7.15.3 Energy and Utility Services Functional Area will coordinate the restoration of essential energy and utility services (not including telecommunications).

7.15.4 Communications Services Functional Area to coordinate the restoration of telecommunications.

7.15.5 The Engineering Services Functional Area will coordinate the restoration of critical public buildings for example hospitals.

## **7.16 Health Response**

### **Strategy**

7.16.1 Ensure coordinated health services are available to and accessible by the flood affected communities.

### **Actions**

7.16.2 Treat sick and injured people, including the provision of pre-hospital care and transport by Ambulance Service of NSW.

7.16.3 Provide and coordinate immediate mental health support to persons both directly and indirectly affected.

7.16.4 Assess public health risks.

7.16.5 Provide environmental health advice

7.16.6 All matters relating to the primary production, manufacturing, processing and handling of all food from “paddock/ocean” to retail, inclusive of all restaurants, food services and catering businesses should be referred to the NSW Food Authority through the Agriculture and Animal Services Functional Area.

## **7.17 Management of Animals**

### **Strategy**

7.17.1 Maintain the welfare of animals affected by the impact of a flood.

### **Actions**

7.17.2 Matters relating to the welfare of livestock, pets, companion animals and wildlife (including feeding and rescue) are to be referred to the Agriculture and Animal Services Functional Area.

7.17.3 Requests for emergency supply and/or delivery of fodder to stranded livestock, or for livestock rescue, are to be passed to the Agriculture and Animal Services Functional Area.

## **7.18 Media and Public Information Management**

### **Strategy**

7.18.1 Provide timely and accurate information to the community.

### **Actions**

- 7.18.2 The SES will coordinate media and public information management strategies.
- 7.18.3 The SES operates an on call media officer system to deal with routine media management.
- 7.18.4 In the case of a large flood operation a Joint Media Information Centre will be formed at the direction of SES State Headquarters and positioned near to the impact area and coordinated by the SES. The SES is responsible for setting up and equipping the unit.
- 7.18.5 Media Officers from all major participating agencies will be requested to staff the unit, which will be under SES control.
- 7.18.6 The Public Information Services Functional Area will assist the SES with the establishment and operation of the Joint Media Information Centre.
- 7.18.7 If necessary the SES will establish and operate a public enquiry centre or request the NSW Police Force to do so as detailed in State DISPLAN.

## **7.19 Information Management**

### **Strategy**

7.19.1 Information relating to flooding will be collected, collated, analysed, mapped (where appropriate) and distributed.

### **Actions**

- 7.19.2 All participating agencies will accurately record and report information relevant to their activities to the appropriate SES control facility. Information will then be distributed by the SES in the form of Situation Reports.
- 7.19.3 The SES will establish and operate a Spatial Information Group to coordinate the collection, collation, analysis, mapping and distribution of spatial information. Products from this group will be disseminated to the Joint Media Information Centre, SEOC and other agencies involved in the response and recovery operations.
- 7.19.4 The SES State Operations Centre will provide Situation Reports to all agencies listed under this Plan and to all state level supporting operations centres. These Situation Reports are to detail activities of supporting agencies.
- 7.19.5 Supporting agencies must report activities to the relevant SES control facility to ensure that Situation Reports provide information regarding the overall flood response operation.

## **7.20 Logistics**

### **Strategy**

7.20.1 Maintain resources to ensure operational effectiveness.

### **Actions**

7.20.2 If local SES and other local resources are insufficient or likely to be exhausted, additional SES resources (people and equipment) within the relevant SES Region may be deployed by the appropriate SES Region Headquarters. If further SES resources are required from other Regions, they will be deployed by the SES State Headquarters.

7.20.3 The SES may request support directly from a supporting agency whilst keeping the appropriate Emergency Operations Controller informed or request the relevant Emergency Operations Controller to coordinate support to it.

7.20.4 If it is likely that State resources will be exhausted or insufficient for particular tasks, Commonwealth assistance will be requested through the SEOCON.

7.20.5 SES Out-of-area teams and other emergency services will normally be placed under the operational control of local SES units for tasking purposes.

7.20.6 As far as possible, supporting agencies are to provide their own logistic support in consultation with SES where appropriate.

# **PART 8 - RECOVERY OPERATIONS**

## **8.1 Introduction**

- 8.1.1 Recovery operations will be initiated and conducted as outlined in Part 6 of State DISPLAN.
- 8.1.2 There will often be a need for emergency services to assist in the recovery phase.

## **8.2 SES Assistance with Recovery Functions**

- 8.2.1 Concurrently with response operations, the SES is responsible for ensuring that the evacuation and immediate welfare of affected persons is coordinated. This requires early and close liaison with the Welfare Services Functional Area.
- 8.2.2 The SES will:
  - a. Provide information to flood-affected people on safety matters and the restoration of belongings which have been in contact with flood waters;
  - b. Provide impact information to recovery agencies;
  - c. Assist with clean-up operations after floods (if sufficient volunteers are available); and
  - d. Assist with the return of evacuees to their homes (if sufficient volunteers are available).
- 8.2.3 SES Controllers should brief the following on details of the flood operation:
  - a. Any Recovery Coordinating Committee;
  - b. The Welfare Services Functional Area; and
  - c. Relevant Emergency Management Committees.
- 8.2.4 SES Controllers should participate in recovery committees as required.

# **ANNEX A - FLOOD THREAT IN NEW SOUTH WALES**

## **General**

1. Floods occur frequently in New South Wales. In terms of average annual dollar damage to infrastructure, property and production, and probably also in terms of deaths and injuries to human beings, flooding constitutes the most serious natural hazard faced by the community in this state.
2. In an average year, a small number of deaths are recorded during floods within the state, and occasionally there are multiple deaths in an individual flood episode. There have been several flood events in the state's history in which more than twenty people have died. One flood at Gundagai in 1852 caused the deaths of 89 people and the floods on the Hunter River and in the state's north-west in 1955 also resulted in a large death toll. Nationally between 1788 and 2003 some 2300 people died as a consequence of floods.
3. In terms of total economic costs incurred by floods, the average annual losses within NSW (between 1967 and 1999) have been estimated as 166 million dollars (2007 prices). In years of unusually severe flooding, the total cost may be two to four or more times this value as was the case in 1954, 1955, 1956, 1974, 1975, 1976, 1984, 1990, 1998, 2000, 2001 and 2007. Even during periods of drought there have been significant and costly episodes of flooding.
4. Substantial community assets are exposed to the flood threat. More than 100,000 urban properties in the state are believed to be at risk of inundation in 1% AEP (Annual Exceedance Probability) flood events, and to this number must be added an unknown but large number of rural properties which are similarly exposed.
5. It has been estimated that the total potential damage exposure from flooding in the state, in terms of all assets exposed (private and public, residential, commercial, industrial, agricultural, infrastructural and other), may approximate \$50 billion.
6. Even low-level floods, which occur relatively frequently in the state's flood liable areas, usually cause some damage and result in economic losses and inconvenience. Floods reaching high levels are less common but invariably have more serious consequences and affect more property, more infrastructural assets and more people.
7. Many floods necessitate the evacuation of people to safety. There are areas from which evacuation is a relatively common occurrence, and cases in which entire communities (including whole towns and suburbs) have had to be evacuated.
8. Extreme floods are rare but can be catastrophic in their impacts. In this context it should be noted that very few flood prone areas in New South Wales have experienced floods of severities approaching Probable Maximum Flood (PMF)

proportions since European settlement, although some events of 0.5-0.8 PMF have occurred during the very short period of flood records in the state.

9. Floods much higher than have been experienced in recorded history should be expected to occur at some stage in the future. It is these very severe floods which are the most likely to result in great damage, risk to human life on a substantial scale and the evacuation of large numbers of people. Such floods will be more dangerous in terms of depth and velocity conditions than lesser ones, and they will be outside the experience of floodplain communities. As a result, people cannot be expected to know how to deal with them.
10. Because of the growth in population and economic activity in flood liable areas, floods occurring in the future which are of equal magnitude to the worst previously recorded in European history are likely to be more severe in their impacts than those earlier floods. A flood on the Nepean-Hawkesbury River equal to the size of the flood of 1867, for example, would necessitate the evacuation of some 40,000 people and cause much more serious damage than occurred in 1867.

## Causes and Types of Flooding

11. Flooding may be defined, in an emergency management context, as an overflowing or influx of water from its normal confines onto land not usually submerged and which as a consequence threatens human life, property or activity. In the New South Wales context there are four potential mechanisms which may cause flooding:
  - a. **Heavy rainfalls**, which cause the banks of rivers and creeks to be overtopped, result in overflows from lakes, detention basins and stormwater drains, cause local overland flooding, or result in releases or spills from dams. Heavy falls of rain constitute by far the most common cause of flooding in the state.
  - b. **Storm surges**, which are temporary raisings of sea level above the astronomical tide. These are caused by deep low-pressure systems located off the coast and result in sea water invading low-lying areas along the coast. This flood mechanism is relatively uncommon, but its effects are usually exacerbated by 'rainfall' flooding occurring at the same time or soon afterwards and caused by the same weather system.
  - c. **Tsunami**, resulting from undersea earthquakes, landslides, meteorite impacts or volcanic activity. The arrangements for the emergency management of tsunami are contained in the State Tsunami Emergency Sub Plan.
  - d. **Dam failure**, which is very rare but can be catastrophic in its consequences. It may cause flooding in excess of PMF proportions and inundate areas well above the limits of floodplains.

## Characteristics of 'Rainfall' Flooding in Different Areas of the State

12. 'Flash' flooding occurs very soon after the rain which causes it and in the same general area. It can occur anywhere in the state when the intensity of the rainfall overwhelms natural or artificial drainage systems. Such flooding commonly occurs from stormwater drains in built-up areas, on the headwaters of rivers and on short creeks. Less frequently, it happens over large areas of the state's inland.
13. Flash flooding is especially a problem in the larger urban areas of Sydney, Newcastle, the Central Coast and Wollongong and in near-coastal environments where communities have developed on and immediately below steep escarpments (such as at Coffs Harbour). Such flooding usually abates very quickly but in steeply-sloping areas can be of dangerously high flow velocities. In the low-lying, flat, western parts of the state, the results of local overland flooding from heavy rain can last for long periods with virtually no flow of water towards main rivers.
14. 'Riverine' flooding differs in characteristics between the coastal and inland areas of the state. Most of the coastal streams are short and of relatively steep gradient, floods rise quickly, flows can be of high velocity and inundation even on the low-lying floodplains near the coast proper usually lasts only for days. On the very extensive Murray-Darling river system west of the Great Dividing Range, floods downstream of the headwaters reaches rise and travel relatively slowly. Flooding can occur long after heavy rain and at great distances from the location of the rainfall. Vast areas of land can be inundated for weeks or months on end, and flood waters can take months to evaporate or travel out of the state. They can travel for long periods virtually as large lakes.
15. Flooding on the lower reaches of coastal streams and around the lakes along the coast can be worsened by tidal conditions and storm surges.

## Weather Systems and Flooding

16. There are many different types and origins of flood-producing weather systems and different parts of the state are affected by different kinds of weather activity in different seasons of the year. The state's flood-producing mechanisms are complex and there is no single clear-cut flood season. Rather, different regions have general tendencies towards flooding at particular times of the year. As a rule, the northern parts of the state have more frequent flooding during the summer and autumn months than at other times while the south experiences most of its flooding in winter and spring.
17. The heavy rain which produces flooding in New South Wales may come from any of the following kinds of weather system:
  - a. **Inland Troughs**
    - Inland troughs, often within an associated low pressure cell, that direct moist air from the tropical north of the Australian

continent, have been responsible for several of the most severe floods in inland northern and central NSW and the Hunter Valley. A few such systems have also extended further south to cause floods in the Murrumbidgee catchment.

- Troughs are an elongated area of low pressure, but are not closed, like low pressure cells. On synoptic charts they typically appear as “U”, or trough, shaped isobars.
- Examples of historical flooding as a consequence include:
  - ◆ February 1955 – record flooding in the Hunter, Gwydir, Namoi, Macquarie and Castlereagh and major flooding along the Macintyre and Darling Rivers.
  - ◆ January 1971 to February 1971 - major flooding along the Macintyre, Gwydir, Culgoa, Hunter and Darling Rivers. Gunnedah experienced its 4th highest flood.
  - ◆ August 1974 – major flooding along the Murrumbidgee and Lachlan rivers. Wagga Wagga experienced its 3<sup>rd</sup> highest flood. As the system moved eastwards major flooding also developed in the Nepean Hawkesbury and Shoalhaven catchments. Moderate flooding also occurred along the Bega and Moruya Rivers.
  - ◆ April 1990 – record flooding at Nyngan and major flooding along the Castlereagh, Lachlan, Macquarie, Darling, Paroo, Warrego and Namoi Rivers.
  - ◆ February 1992 – major flooding in the Bogan, Hunter, Nepean Hawkesbury, Namoi and Moruya catchments.
  - ◆ November 2000 – major flooding along the Namoi, Gwydir, Macintyre, Macquarie and Darling Rivers.

b. **Tropical and Ex-Tropical Cyclones**

- Most damage from tropical cyclones affecting Australia’s east coast occurs in coastal areas of northern and central Queensland. Occasionally, however, the severe effects of a cyclone extend further south into north eastern NSW. One of the worst such storms struck northern NSW on 20 February 1954. This storm had lost little of its intensity when it struck the state, causing 26 deaths.
- Usually tropical cyclones lose some of their intensity when they reach the cooler southern waters and are labelled “ex-tropical”.

- Such systems generally cause flooding in New South Wales only a small number of times in a decade, but on occasions the flooding is very severe.
- Examples of historical flooding as a consequence include:
  - ◆ February 1954 – record major flooding at Murwillumbah and Lismore. Major flooding was experienced along the NSW coast down to the lower Hunter.
  - ◆ January 1974 Tropical Cyclone Wanda – major flooding in the Tweed, Richmond Wilsons and Clarence catchments. A weakening Cyclone Wanda crossed the Queensland coast on 24 January about 150 kilometres north of Brisbane. It caused massive flooding in Brisbane.
  - ◆ March 1974 Ex-Tropical Cyclone Zoe – major flooding along the NSW coast from the Tweed to the Macleay with near record major flooding at Lismore.
  - ◆ February 1990 Tropical Cyclone Nancy – crossed the NSW Coast near Byron Bay as a category 2 cyclone before moving seaward again. Flooding occurred along the NSW coast from the Tweed to the Georges with major flooding in the Manning, Hunter and Hastings catchments. Five people drowned in northern NSW.

**c. East Coast Lows**

- Cyclones which develop outside the tropics are called extra-tropical cyclones or, when developing off the NSW coast, “East Coast Lows”. They are about the same size as tropical cyclones but occur further south and are usually not quite as intense. Most major riverine floods along the NSW coast have been caused by East Coast Lows. Some East Coast Lows, for example, August 1949 and February 1956, were inland lows before moving off the NSW coast. The heavy rainfall from these systems often extends west of the Great Dividing Range to produce major flooding along the Macquarie (particularly Bathurst) and Lachlan Rivers. Occasionally flooding also occurs in the upper Murrumbidgee catchment, including the Queanbeyan and Molonglo Rivers.
- East Coast Lows also produce gale force winds, storm surges, dangerous surf conditions and coastal erosion.
- Examples of historical flooding as a consequence include:

- ◆ August 1949 – major flooding in the Macleay, Hunter, Hastings and Gwydir catchments. At Kempsey, 6 lives were lost, 35 houses were destroyed, 300 houses were uninhabitable and 2000 people were left homeless. The damage bill in the Macleay Valley alone exceeded \$200 million, in present dollar values. Various flood studies for the NSW mid-north coast also refer to severe storm surge effects during this flood.
- ◆ June 1950 – major flooding in the Clarence, Bellinger, Nambucca, Macleay, Hastings, Manning, Hunter and Macintyre catchments. Record flooding was experienced along the Bellinger and Nambucca Rivers.
- ◆ February 1956 - this was an inland low before moving off the NSW coast. Major flooding occurred in the Macintyre, Namoi, Gwydir, Bellinger, Nambucca, Nepean Hawkesbury, Georges and Shoalhaven catchments. The Georges River at Liverpool had its 5<sup>th</sup> highest flood – the level was over 1 metre higher than the major 1986 and 1988 floods.
- ◆ March 1978 – major flooding in the Tweed, Manning, Hunter and Nepean Hawkesbury catchments. Taree experienced its 2<sup>nd</sup> highest flood.
- ◆ March 2001 – major flooding in the Bellinger, Nambucca, Clarence, Macleay, Manning and Lower Hunter catchments.
- ◆ June 2007 – a series of five East Coast lows within the month caused flooding in the Hunter, Georges, Myall, Tuggerah Lakes, Wyong, Lake Macquarie, Hawkesbury Nepean and Karuah catchments. The most severe storm occurred on the 8<sup>th</sup> and 9<sup>th</sup> of June. Flooding affected Singleton, Maitland, Raymond Terrace, Newcastle, Lake Macquarie and Wyong, with several thousand properties experiencing flood inundation. In response to forecasts of major flood levels at Maitland 4000 people were evacuated. Eight people died as a consequence of flooding, with many more rescued from critical conditions.

d. **Cold Fronts**

- Cold fronts themselves are a relatively poor source of moisture. However, when they interact with the warmer air in the Tasman Sea, they provide a trigger for rain. Moisture for these systems is fed in from the Coral and Tasman seas. Widespread rainfall often results from these cold fronts, particularly during May to October, although the amount of rain is variable. The

cumulative effect of several fronts over the winter period can often lead to major flooding along the Macquarie, Lachlan, Murrumbidgee and Murray Rivers, as the catchments can become increasingly saturated from relatively modest rainfall totals.

- Examples of historical flooding as a consequence include:
  - ◆ June 1952 - record major flooding at Forbes (Lachlan) and major flooding in the Macquarie, Murrumbidgee and Upper Murray catchments.
  - ◆ October 1975 – major flooding occurred along the Lachlan, Murrumbidgee and Murray Rivers. Flood levels along the lower Murray River at Echuca were the highest for nearly 60 years (6<sup>th</sup> highest flood) during this flood.
  - ◆ October 1993 - major flooding along the Murray and Lachlan Rivers. Widespread major flooding occurred in northern Victoria, including record flooding at Benalla.

e. **Deep Easterly Flow and Surface Trough**

- Deep easterly flow, in combination with a surface trough and/or upper low pressure system, brings in moisture from the Pacific Ocean or Tasman Sea to the NSW coast. The area where the trough line touches the coast is where the heaviest rain is likely to occur.
- Examples of historical flooding as a consequence include:
  - ◆ August 1998 – major flooding at Wollongong. This event, which came one week after a major east coast low, caused Warragamba Dam to fill and spill.
  - ◆ June 2005 – major flooding in the Tweed, Brunswick and Wilsons (Lismore) catchments. Record major local flooding occurred in parts of the Brunswick and Tweed catchments, with over 500 millimetres of rain falling over a 48 hour period in some parts.

f. **Thunderstorms**

- Unlike the other flood producing weather systems described, the scale of thunderstorms on their own is relatively small and usually leads to local flash flooding, rather than major widespread main river flooding. However, large scale flood producing weather systems can also generate thunderstorms which will typically result in much higher local rainfall totals than the regional average.

- Thunderstorm activity occurs frequently in New South Wales, especially during the months from October to March.
- For NSW it is estimated that about half of flash flooding is due to thunderstorms alone. The other half is caused by major flood producing weather systems (that may also have embedded thunderstorms) where flash flooding develops ahead of riverine flooding.
- Occasionally thunderstorms bands are very slow moving, so that one area receives prolonged heavy rainfall. Alternatively, successive thunderstorms may move over the same area, called the “train” effect, which can lead to high rainfall totals that have resulted in local flash flooding as well as main river flooding.

### **Dam-Failure Flooding**

18. This flood-producing mechanism is extremely rare except for the case of very small farm dams whose failure causes only limited and very localised flooding. Several significant dams in New South Wales have been identified as being ‘deficient’ as their spillway capacities are insufficient to pass their design floods. Hence, during very severe floods their walls may be overtopped leading to a strong chance of failure. Such severe flooding, however, should be recognised as being rare and that dam owners have programs in place to enhance dams so that they can safely pass their design floods.
19. In a few cases, dams are known to lack structural integrity and could fail because of piping (internal erosion of the wall) or because of severe earthquake activity. Such failures could occur in the absence of heavy rain and are known as ‘sunny day’ modes of failure.
20. Failures of dam operating equipment may also occur, including failures of gates or spillway operating mechanisms. In some such cases, sudden and unplanned releases may result and cause flooding downstream.

### **Flood Frequency and Periodicity**

21. Long-term flood records indicate that flooding in New South Wales is highly irregular in the temporal sense. Long periods can occur with little flooding at all, but sequences of frequent and severe floods on individual rivers have also been experienced. In many parts of the state the latter half of the nineteenth century produced repeated flooding, some of the events very serious, while the first half of the twentieth century saw relatively few floods in most areas.
22. The 1950s were years of very frequent flooding in many regions, with the Hunter valley experiencing half of the most serious floods in its recorded history between 1949 and 1956 and the Murrumbidgee River also being in flood on several occasions during this period. The early and middle 1970s also saw frequent and widespread flooding, some of it severe. In general, the period since 1950 has been one of more frequent flooding in New South Wales than the period between 1900 and 1950.

23. Variations in flood frequency may be related to values of the Southern Oscillation Index (SOI), strong and persistent negative levels (El Niño) being linked to drought conditions and a below-average occurrence of flooding in eastern Australia while strong and persistent positive levels (La Niña) tend to be associated with wetter periods and more frequent flooding.
24. The five wettest years on record have all occurred during periods of La Niña and virtually all major widespread floods have occurred in years when La Niña conditions have prevailed. There is also a strong correlation between the transition from negative to positive SOIs and major floods occurring in NSW.
25. There are, however, other factors that influence rainfall. Floods can occur during El Niño periods and droughts have occurred during periods of La Niña. However, the chance of having floods during El Niño periods is less than during La Niña periods. Such floods are typically smaller events due to the prevailing dry conditions.

### **Impacts of Climate Change**

26. Climate change modelling suggests that there are likely to be reductions in average annual rainfall, but an increase in the intensity of rainfall events when they do occur. Hence, creating a future rainfall regime characterised by longer dry spells interrupted by heavier rainfall events.
27. The frequency of coastal flooding may increase as a consequence of sea level rise and the potential increased frequency of storm surge events.

### **The Consequences of Flooding**

28. Floods bring many benefits as well as costs. Their positive impacts include the triggering of environmental processes which benefit native plants, fish and animals, often with consequent economic benefits.
29. The negative impacts of flooding are numerous and a wide range of actions is necessary if individuals and communities are to minimise the damage and inconvenience which floods can bring. The three key risks that flooding poses to the community are:
  - a. Inundation of property, farmland, infrastructure and roads;
  - b. Isolation of properties and/or communities due to the flooding of access roads; and
  - c. Indirect effects as a consequence of infrastructure damage or disruption.
30. All three key risks pose a threat to life and property. These risks can necessitate emergency management actions such as warning, evacuation, resupply, rescue and property protection.

## ANNEX B - THE REQUIREMENT FOR FLOOD SUB PLANS

SES REGION FLOOD SUB PLANS REQUIRED	RIVER BASINS (or parts thereof) COVERED	LOCAL FLOOD SUB PLANS REQUIRED (Council Areas)
Central West	212 Hawkesbury 412 Lachlan 421 Macquarie	Bathurst Regional
		Blayney Shire
		Cabonne Shire
		City of Lithgow
		Oberon
		Orange City
Clarence- Nambucca	204 Clarence 205 Bellinger	Bellingen Shire
		Coffs Harbour City
		Clarence Valley
		Nambucca Shire
Far West	421 Macquarie 422 Barwon 423 Warrego 424 Paroo 425 Darling	Bourke Shire
		Brewarrina Shire
		Broken Hill City
		Central Darling
		Unincorporated
Illawarra- South Coast	212 Hawkesbury 214 Wollongong Coast 215 Shoalhaven 216 Clyde 217 Moruya 218 Tuross 219 Bega 220 Towamba	Bega Valley
		Eurobodalla Shire
		Shellharbour City / Kiama
		Shoalhaven City
		Wingecarribee Shire
		Wollongong City
Lachlan	412 Lachlan 421 Macquarie	Bland Shire
		Cowra Shire
		Forbes Shire
		Lachlan Shire
		Parkes Shire
		Weddin Shire
Hunter	209 Karuah 210 Hunter 211 Lake Macquarie 212 Hawkesbury 419 Namoi 421 Macquarie	Cessnock City
		Dungog Shire
		Great Lakes
		Lake Macquarie City
		Maitland City
		Newcastle City
		Port Stephens
		Upper Hunter Shire
		Muswellbrook Shire
		Singleton
Macquarie	210 Hunter 212 Hawkesbury 416 Border 417 Moonee 418 Gwydir 419 Namoi 420 Castlereagh 421 Macquarie	Coonamble Shire
		Dubbo City
		Gilgandra Shire
		Mid-Western Regional
		Narromine Shire
		Walgett Shire
		Warren Shire
		Warrumbungle Shire
		Wellington

<b>SES REGION FLOOD SUB PLANS REQUIRED</b>	<b>RIVER BASINS (or parts thereof) COVERED</b>	<b>LOCAL FLOOD SUB PLANS REQUIRED (Council Areas)</b>
Murray	409 Murray 410 Murrumbidgee 412 Lachlan 413 Benanee 425 Darling 426 Lower Murray	Albury City Balranald Shire Berrigan Shire Corowa Shire Deniliquin / Conargo Greater Hume Shire Jerilderie Shire Murray Shire Tumbarumba Shire Urana Shire Shire of Wakool Wentworth Shire
Murrumbidgee	409 Murray 410 Murrumbidgee 412 Lachlan	Carrathool Shire Coolamon Shire Cootamundra Shire Griffith City Gundagai Shire Hay Shire Junee Shire Leeton Shire Lockhart Shire Murrumbidgee Shire Narrandera Shire Temora Shire Tumut Shire Wagga Wagga City
Namoi	204 Clarence 206 Macleay 208 Manning 210 Hunter 418 Gwydir 419 Namoi	Armidale-Dumaresq Narrabri Shire Tamworth Regional Uralla Shire Walcha
North West	204 Clarence 418 Gwydir	Glen Innes Severn Shire Gwydir Shire Inverell Shire Moree Plains Shire Tenterfield Shire
Oxley	206 Macleay 207 Hastings 208 Manning 209 Karuah	Gloucester Shire Port Macquarie Hastings Kempsey Shire Greater Taree City Camden Haven
Richmond Tweed	201 Tweed 202 Brunswick 203 Richmond 204 Clarence	Ballina Shire Byron Shire Kyogle Lismore City

<b>SES REGION FLOOD SUB PLANS REQUIRED</b>	<b>RIVER BASINS (or parts thereof) COVERED</b>	<b>LOCAL FLOOD SUB PLANS REQUIRED (Council Areas)</b>
Richmond Tweed (cont)		Richmond Valley
		Tweed Shire
Southern Highlands	212 Hawkesbury 215 Shoalhaven 222 Snowy 410 Murrumbidgee 412 Lachlan	Bombala
		Cooma-Monaro Shire
		Goulburn Mulwaree
		Palerang
		Queanbeyan City
		Upper Lachlan Shire
		Yass Valley
Sydney Northern	211 Macquarie- Tuggerah Lakes 212 Hawkesbury 213 Sydney Coast	Gosford City
		Shire of Hornsby
		Manly / Warringah / Pittwater
		Ryde City
		Wyong Shire
Sydney Southern	212 Hawkesbury 213 Sydney Coast/ Georges R	Bankstown City
		Camden
		Campbelltown City
		Canterbury City
		Fairfield City
		Hurstville City
		Kogarah Municipal
		Liverpool City
		Marrickville
		Rockdale City
		Sutherland Shire
		Wollondilly Shire
Sydney Western	212 Hawkesbury 213 Sydney Coast	Auburn
		Shire of Baulkham Hills
		Blacktown City
		Blue Mountains City
		City of Canada Bay
		Hawkesbury City
		Holroyd City
		Parramatta City
Penrith City		

## ANNEX C - PROVISION OF AND REQUIREMENTS FOR FLOOD WARNING (INCLUDING FLOOD CLASSIFICATIONS, WARNING TIMES REQUIRED AND KEY STATISTICS)

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
201 Tweed	Tweed	Murwillumbah (201902)	3.0	4.0	4.8	6 hours notice required of heights 3.5-6.5 metres.  12 hours notice required of heights 6.6 metres and above (only 6 hours generally available).	Yes	
		Tumbulgum (201432)					No	Yes
		Chinderah (Barneys Point; 201426)	1.3	1.7	2.0		Yes	
202 Brunswick	Brunswick	Billinudgel (202400)	2.5	3.0	3.5	Flash flood warning system in place (See note 1)	Yes	Yes
		Mullumbimby (Federation Bridge; 202402)	2.5	3.5	4.5	Flash flood warning system in place (See note 1)	Yes	
203 Richmond	Richmond	Wiangaree (203005)	11.0	15.5			Yes	
		Kyogle (203900)	12.0	14.4	16.0	6 hours notice required of heights 13.0 metres and above.	Yes	
		Casino (203004)	9.2	12.2	15.0	6 hours notice required of heights 9.2 metres and above.	Yes	
		Coraki (203403)	3.4	5.0	5.7	24 hours notice required of heights 3.8 metres and above.	Yes	
		Bungawalbyn Junction (203908)	3.0	4.5	5.0	24 hours notice required of heights 4.5 metres and above.	Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
203 Richmond (cont)	Richmond (cont)	Woodburn (203412)	3.2	3.7	4.2	12 hours notice required of heights 4.0 metres and above.	Yes	
		Broadwater (203415)	2.0	2.5	3.0		No	Yes
		Cabbage Tree Island					No	Yes
		Wardell (203416)					No	Yes
		Ballina (203421)					No	Yes
	Wilson's	Lismore (203904)	4.2 (AHD)	7.2 (AHD)	9.7 (AHD)	12 hours notice required of heights 10 metres and above	Yes	
	Bungawalbyn Creek	Bungawalbyn Creek (10060)					No	Yes
	Busby's Creek	Rappville (203905)					No	Yes
	Deep Creek	Leeville (203029)					No	Yes
	Teven Creek	Teven (203039)					No	Yes
	Emigrant Creek	Tintenbar					No	Yes
Sandy Creek	Ellengowan					No	Yes	
204 Clarence	Clarence	Copmanhurst (204903)					No	Yes
		Grafton (Prince St; 204904)	2.1	3.6	5.4	6 hours notice required of heights 3.6-8.1 metres.  24 hours notice required of heights 8.2 metres and above (only 12 hours generally available).	Yes	
		Ulmarra (204905)	2.1	3.4	4.9	6 hours notice required of heights 3.4-5.7 metres.  24 hours notice required of heights 5.8 metres and above	Yes	
		Maclean (204410)	1.6	2.2	2.5	6 hours notice required of heights 2.2-3.2 metres.  24 hours notice required of heights 3.3 metres and above.	Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
204 Clarence (cont)	Clarence (cont)	Yamba (204454)				Warning system required.	No	Yes
						Flood classification levels to be determined.		
205 Bellinger	Orara	Glenreagh (204906)	4.0	7.0	10.0	6 hours notice required of heights 5.8 metres and above.	Yes	
		Coutts Crossing (204909)	5.0	9.0	12.0		No	Yes
	Bellinger	Thora (205002)	3.0	4.3	5.8	3 hours notice required of heights 3.0 metres and above.	Yes	
		Bellinghen (205900)	3.7	6.7	8.2	6 hours notice required of heights 4.9 metres and above.	Yes	
		Repton (205403)	2.0		3.0		Yes	
	Kalang	Urunga (205407)	1.5	2.0	2.4		Yes	
	Woolli River	Woolli				Flash flood warning system in place (See note 1)	Yes	
Coffs Creek	Coffs Creek Hwy Bridge (205439)				Flash flood warning system in place (See note 1)	Yes		
Nambucca		Bowraville (205006)	5.5	5.8	10.1	3 hours notice required of heights 5.5 metres and above.	Yes	
		Macksville (Princess St; 205416)	1.7	2.1	2.6	6 hours notice required of heights 2.0-2.9 metres. 12 hours notice required of heights 3.0 metres and above (only 6-9 hours generally available).	Yes	Yes
206 Macleay	Dumaresq	Armidale (Stephens Bridge; 206032)	2.9			Flash flood warning system in place (See note 1)	Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
206 Macleay (cont)	Macleay (cont)	Georges Creek (206024)	6.0	8.0	10.0	6 hours notice required of heights 8.0 metres and above.	Yes	
		Bellbrook (206019)	6.5	10.5	13.5		Yes	
		Turners Flat (206011)					No	Yes
		Kempsey (Traffic Bridge; 206402)	4.5 (AHD)	5.7 (AHD)	6.6 (AHD)	12 hours notice required of heights 4.5-5.6 metres.  24 hours notice required of heights 5.7 metres and above (only 15 hours generally available).	Yes	
		Smithtown (206406)					No	Yes
207 Hastings	Hastings	Kindee Bridge (207004)	3.0	5.5	7.6	6 hours notice required of heights 8.7 metres and above.	Yes	
		Wauchope (207401)	2.5	4.3	5.5	6 hours notice required of heights 2.5-5.4 metres.  12 hours notice required of heights 5.5 and above.	Yes	
		Port Macquarie (Settlement Point; 207418)	1.2	1.5	1.7	12 hours notice required of heights 1.2 metres and above.	Yes	
		Camden Haven	Kendall (Logans Crossing; 207428)	7.0	-	-	Flash flood warning system in place (See note 1)	Yes
	Laurieton (North Haven; 207422)		1.0	1.5	1.7		Yes	
	208 Manning	Manning	Mt George (208901)	5.5	7.6	10.6		No

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
208 Manning (cont)	Manning (cont)	Wingham (208400)	4.9	8.9	11.9	12 hours notice required of heights 5.0-11.9 metres.  24 hours notice required of heights 12.0 metres and above (only 12 hours generally available).	Yes	
		Taree (Traffic Bridge) (208410)	1.8 (AHD)	2.4 (AHD)	3.7 (AHD)	12 hours notice required of heights 1.8-3.6 metres.  24 hours notice required of heights 3.7 metres and above (only 15 hours generally available).	Yes	
		Pampoolah					No	Yes
		Croki (208404)				Provisional BoM forecasting model available.	Yes	
		Harrington (Entrance) (208425)	1.9	2.2	2.8	Provisional BoM forecasting model available.	Yes	Yes
209 Karuah	Wallis Lake	Forster/Tuncurry	1.1			Yes		
	Myall	Buladelah (209460)	3.0			Flash flood warning system in place (See note 1)	Yes	
210 Hunter	Goulburn	Sandy Hollow (210031)					No	Yes
	Kingdon Ponds	Scone (210904)	3.2	3.5	3.7	Flash flood warning system in place (See note 1)	Yes	Yes
	Hunter	Aberdeen (210056)					No	Yes

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES	
			MINOR	MODERATE	MAJOR				
210 Hunter (cont)	Hunter (cont)	Muswellbrook (210002)	7.2	8.0	10.0	4 hours notice required of heights 7.2-9.9 metres.	Yes		
			5.5	6.9	8.0	12 hours notice required of heights 10.0 metres and above (only 9 hours generally available).	Yes		
			10.0	11.5	13.0	8 hours notice required of heights 8.0 metres and above. 6 hours notice required of heights 10.0-14.2 metres.	Yes		
		Maitland Bridge; 210458)	Belmore Terrace (210452)	5.9 (AHD)	8.9 (AHD)	10.5 (AHD)	24 hours notice required of heights 14.2 metres and above (only 18 hours generally available).	Yes	
				2.5	3.1	3.5	12 hours notice required of heights 5.9 to 7.1 metres.	Yes	
				1.9	2.9	3.8	24 hours notice of heights 7.1 metres and above. 6 hours notice required of heights 2.5-3.4 metres.	Yes	
		Wollombi Brook	Hexham (210448) Stockton (210456) Bulga (210028)	1.2	1.3	1.7	18 hours notice required of heights 3.5 metres and above.	No	Yes
				3.0	3.7	4.6		No	Yes
							12 hours notice required of heights 3.0 metres and above (only 9 hours generally available).	Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES	
			MINOR	MODERATE	MAJOR				
210 Hunter (cont)	Paterson	Gostwyck (Gostwyck Bridge; 210902)	9.1	10.7	12.2	12 hours notice required of heights 9.1 metres and above (only 9 hours generally available).	Yes		
		Paterson (210406)	6.1	7.6	9.1		No		
	Williams	Dungog (210903)	4.9	7.6	8.5		Yes		
		Glen Martin (Mill Dam Falls; 210010)	6.1	7.6	9.1	12 hours notice required of heights 6.1 metres and above (only 9 hours generally available).	Yes		
211 Macquarie/ Tuggerah Lakes	Dora Creek	Dora Creek					No	Yes	
	Wyong (Wyong Bridge)	Wyong (Bridge)	2.7	3.8	4.0		Yes		
	Tuggerah Lake	Tuggerah Lake	0.9	1.8	2.2		Yes		
	Lake Macquarie	Lake Macquarie	0.7	0.9	1.1		Yes		
212 Hawkesbury	Wollondilly	Goulburn (Marsden Weir)					No	Yes	
	Mulwaree	Goulburn (Lansdowne Bridge)					No	Yes	
	Nepean	Menangle (212904)		5.2	9.2	12.2		Yes	
		Camden (Weir; 212900)		6.8	8.3	13.8	12 hours notice required of heights 6.8 metres and above.	Yes	
		Wallacia (Weir; 212202)		5.0	8.7	11.0	12 hours notice required of 5.0 metres and above.	Yes	
		Penrith (Victoria Bridge; 212201)		3.9	7.9	10.4	6 hours notice required of heights 8.9-11.2 metres.  8 hours notice required of heights 11.3 metres and above.	Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
212 Hawkesbury (cont)	Nepean (cont)	Richmond (North Richmond Bridge; 212902)	4.3	8.4	11.0	6 hours notice required of heights 16.0-17.9 metres.  15 hours notice required of heights 18.0 metres and above.	Yes	
		Windsor (Windsor Bridge; 212903)	5.8	7.0	12.2	6 hours notice required of 9.6 metres if peak height expected to be greater than 16.0 metres.  15 hours notice required of 13.7 metres if peak height expected to be greater than 16.0 metres.	Yes	
		Sackville (Ferry; 212406)	4.6	7.3	9.7	18 hours notice required of 4.6 metres and above.	Yes	
		Lower Portland (212407)	4.6	6.1	7.6	18 hours notice required of heights 4.6 metres and above.	Yes	
		Wisemans Ferry (Webbs Creek; 212408)	-	3.5	4.2		Yes	
	Colo	Putty Road (212908)	2.7	5.7	10.7	12 hours notice required of heights 5.7 metres and above (only 9 hours generally available).	Yes	
	Farmers Creek	Lithgow					No	Yes
213 Sydney Coast Georges River	Narrabeen Lagoon	Narrabeen (Caravan Park; 213408)				Local flood warning system in place (operated by Warringah Council and Manly Hydraulics Laboratory).	No	
214 Wollongong Coast								

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
213 Sydney Coast Georges River  214 Wollongong Coast  (cont)	Georges	Liverpool (Weir; 213400)	2.0	3.0	4.5	6 hours notice required of heights 2.0-3.9 metres.  12 hours notice required of heights 4.0 metres and above (only 6 hours generally available).	Yes	
		Milperra (213405)	2.0	3.3	4.2	6 hours notice required of heights 2.0-3.9 metres and above.  12 hours notice required of heights 4.0 metres and above (only 9 hours generally available).	Yes	
		East Hills (Picnic Point; 213410)				Flood classification levels to be determined.	Yes	
	Woronora	Woronora (Bridge; 213904)	1.5	3.4	5.9	Local flash flood warning system in place. Forecast heights are promulgated in colour bands initiated at the following levels (Green = 1.5-2.2 metres; Blue = 2.3- 3.0 metres; Yellow = 3.1-3.8 metres; Red = 3.8 metres and above).	Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
213 Sydney Coast Georges River	Upper reaches of Cooks, Parramatta, Prospect Creek, Toongabbie Creek, remainder of Sydney Basin and Wollongong					Severe Thunderstorm Warnings and Severe Weather Warnings provided by BoM		
214 Wollongong Coast (cont)	Cooks	Lower Cooks				Flash flood warning system in place (See note 1)	Yes	
215 Shoalhaven	Shoalhaven	Nowra (215903)	2.3 (AHD)	3.3 (AHD)	4.3 (AHD)	Classification levels are expressed in m AHD.  6 hours notice required of heights 2.3-3.2 metres.  9 hours notice required of heights 3.3-4.2 metres.  12 hours notice required of heights 4.3 metres and above.	Yes	
216 Clyde	Clyde River	Terara (215905)  St Georges Basin  Sussex Inlet				Flood classifications to be determined. Warnings provided when minor flood level expected to be exceeded at Nowra.  Flood warning system under development	Yes	
217 Moruya	Moruya	Wamban (217002) Moruya (217900)	4.4 2.0	6.2 2.6	8.0 3.2	Flood warning system under development	Yes Yes	
219 Bega	Bega	Bega (Bega North; 219900)	4.6	7.0	8.0	6 hours notice required of heights 2.6 metres and above.	Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
222 Snowy	Bombala	Bombala (222905)	3.0	5.0	8.0	Warnings issued in conjunction with the Victorian BoM	Yes	
401 Upper Murray	Murray	Biggara (401012)	2.0	2.6	3.0	Snowy Mountains Authority (Khancoban) advises of outflows likely to cause flooding.	Yes	
		Bringenbrong (401001)	3.0	3.4		Warnings issued in conjunction with BoM Victoria office.		
409 Murray Riverina	Murray	Jingellic (401201)	4.0	5.5	7.0	Snowy Mountains Authority (Khancoban) advises of outflows likely to cause flooding.	Yes	
		Albury (409001)	4.3	4.9	5.5	Warnings issued in conjunction with BoM Victoria office.	Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES	
			MINOR	MODERATE	MAJOR				
409 Murray Riverina (cont)	Murray (cont)	Corowa (409002)	3.8	5.9	8.6	12 hours notice required of heights 3.8-5.9 metres.  24 hours notice required of heights 6.0 metres and above (only 15 hours generally available).  Flood warnings not provided if minor flood level exceeded only as result of releases to meet normal water demand from Hume Dam.	Yes		
			6.4	6.7	7.8				
		Yarrawonga Weir d/s (409025) Mulwala Tocumwal (409202)	6.4	6.7	7.3		Yes		
		Moama (Echuca; 409200)	93.1 (AHD)	93.6 (AHD)	94.4 (AHD)		Yes		
		Torrumbarry Weir (409219)	7.3	7.6	7.8		Yes		
		Barham (409005)	5.5	5.8	6.1		Yes		
		Swan Hill (409204)	4.5	4.6	4.7		Yes		
		Wakool Junction (414200)	8.8	10.5	11.5		Yes		
		Boundary Bend (414201)	8.0	8.5	9.0		Yes		
		Euston (Weir; 414203)	9.1	9.8	10.3		Yes		
		Mildura (Weir; 414202)	36.0	37.5	38.5		Yes		
		Wentworth (Weir; 425992)	7.3	7.9	9.1		Yes		
		Edward	Demiliquin (409003)	4.6	7.2	9.4		Yes	
			Stevens Weir (409023)	5.5	5.8	6.6		Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES	
			MINOR	MODERATE	MAJOR				
409 Murray Riverina (cont)	Edward (cont)	Moulamein (409014)	4.6	5.2	6.1		Yes		
410 Murrumbidgee	Cooma	Cooma Creek Cooma Back Creek				Flash flood warning system in place (See note 1)	Yes		
	Queanbeyan	Queanbeyan (Queens Bridge; 410999)	4.2	7.4	8.2		Yes		
	Molonglo	Burbong (410705)	1.6	2.2	2.8	6 hours notice required of heights 2.5 metres and above.	Yes		
		Oaks Estate (410729)	4.6	5.8	6.4	6 hours notice required of heights 4.6 metres and above.	Yes		
	Tumut	Tumut (410006)	2.0	2.6	3.7		No	Yes	
	Muttama Creek	Cootamundra Shire				Flash flood warning system in place (See note 1)	Yes	Yes	
	Burke Creek	The Rock					No	Yes	
	Murrumbidgee	Gundagai (410004)		6.1	7.6	8.5	12 hours notice required of heights 6.1 metres and above.	Yes	
		Wagga Wagga (410001)		7.3	9.0	9.6	12 hours notice required of heights 7.3-8.9 metres.  24 hours notice required of heights 9.0-9.5 metres.  30 hours notice required of heights 9.6 metres and above.	Yes	
Narrandera (410005)			6.7	7.3	8.2	5 days notice required of heights 6.7 metres and above (only 3 days generally available).	Yes		

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES	
			MINOR	MODERATE	MAJOR				
410 Murrumbidgee (cont)	Murrumbidgee (cont)	Darlington Point (410021)	5.5	7.0	7.3	7 days notice required of 5.5 metres.	Yes		
		Yanco					No	Yes	
		Carathool (410078)	7.0	7.5	8.5	10 days notice required of heights 7.0 metres and above.  DECC advises of releases from Barren Box Swamp.	Yes		
		Hay (410002)	6.5	7.5	8.0	10 days notice required of heights 6.5 metres and above.	Yes		
		Balranald (Weir d/s; 410130)	6.7	6.9	7.1	10 days notice required of heights 6.7 metres and above.	Yes		
	Yass	Yass (410026)						Yes	
	Boggy Creek	Ganmain					No	Yes	
412 Lachlan	Belubula	Canowindra (412009)	4.0	4.5	5.5		Yes		
	Mandagery Creek	Eugowra (412904)	8.0	-	9.0		Yes		
	Lachlan	Cowra (412002)		8.5	10.7	13.4	6 hours notice required of heights 8.5 metres and above.	Yes	
		Nanami (412057)		7.4	9.7	10.7	6 hours notice required of heights 7.4-10.6 metres.  12 hours notice required of heights 10.7 metres and above.	Yes	
		Forbes (Iron Bridge; 412901)		8.8	9.5	10.4	12 hours notice required of heights 8.8-10.3 metres.  24 hours notice required of heights 10.4 metres and above.	Yes	
		Cottons Weir (412004)		3.5	5.3	6.6		Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
412 Lachlan (cont)	Lachlan (cont)	Jemalong (Weir d/s; 412036)	7.2	7.5	7.7	2 days notice required of heights 7.2 metres and above.	Yes	
		Condobolin (412006)	5.2	5.9	6.7	2 days notice required of heights 5.2 metres and above.	Yes	
		Euabalong (412903)	6.4		6.8	3 days notice required of heights 5.8 metres and above.	Yes	
		Lake Cargelligo (412011)	1.5	1.9	2.0		No	Yes
		Hillston (Weir; 412039)	2.4	2.8	3.0		Yes	
		Booligal (Weir; 412005)	2.4				Yes	
	Bland Creek	Stockinbingal				Flash Flood Warning System in place (See note 1)	Yes	Yes
	Mirrool Creek	Beckom					No	Yes
		Ardlethan					No	Yes
		Barellan					No	Yes
416 Border Rivers	Severn	Ashford (Severn River; 416006)	2.2	4.0	6.0		Yes	
	MacIntyre	Inverell (416009)	3.0	4.3	5.2		Yes	
		Yetman (416058)	5.0	7.6	9.1		Yes	
		Boggabilla (416002)	5.0	11.5	12.0		Yes	
		Goondiwindi (416201)	3.5	6.1	8.5		Yes	
		Boomi					No	Yes
418 Gwydir	Horton	Rider (418015)					No	Yes
	Gwydir	Bundarra (Bridge; 418900)	8.0	9.1	10.7		Yes	
		Bingara (418010)	5.5	7.6	9.1	12 hours notice required of heights 5.5 metres and above.	Yes	
		Gravesend (418013)	6.1	9.4	12.0	12 hours notice required of heights 6.1 metres and above.	Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
418 Gwydir (cont)	Gwydir (cont)	Pallamallawa (418001)	6.0	9.5	10.4	12 hours notice required of heights 6.0 metres and above.	Yes	
		Yarraman Bridge (418004)	4.0	6.5	7.0	12 hours notice required of heights 5.5-6.9 metres.  24 hours notice required of heights 7.0 metres and above.	Yes	
	Mehi	Moree (418002)	5.5	7.6	8.8	12 hours notice required of heights 5.5-6.9 metres.  24 hours notice required of heights 7.0 metres and above.	Yes	
419 Namoi	Peel	Tamworth (Bridge; 419009)	3.0	4.2	6.0	6 hours notice required of heights 3.0 metres and above.	Yes	
		Carroll (419909)	8.2	8.8	9.3	18 hours notice required of flooding.	Yes	
	Manilla	Manilla (419022)	6.1	9.7	10.7	7 hours notice required of heights 6.1 metres and above.	Yes	
	Mooki	Breeza (419027)	-	3.9	4.8		No	Yes
	Namoi	Gunnedah (419001)	7.3	7.6	7.9	24 hours notice required of heights 7.3 metres and above.	Yes	
		Narrabri (Narrabri Creek; 419003)	4.9	6.4	6.7		Yes	
		Wee Waa (Glencoe; 419900)	5.3	6.4	6.7		Yes	
		Bugilbone (419021)	4.9	5.5	-		Yes	
		Goangra (419026)	5.5	6.7	7.8		Yes	
420 Castlereagh	Castlereagh	Coonabarabran (420013)					No	Yes
		Mendooran (420004)	2.4	5.0	9.0		Yes	
		Gilgandra (420001)	5.0	6.4	7.9		Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
420 Castlereagh (cont)	Castlereagh (cont)	Coonamble (420005)	-	4.9	5.2		Yes	
421 Macquarie	Macquarie	Bathurst (Stanley St; 421908)	3.0	4.5	5.7	3 hours notice required of heights 3.0-5.6 metres.  9 hours notice required of heights 5.7 metres and above.	Yes	
		Wellington (Bridge; 421003) (Macquarie River)	4.0	9.1	12.2		Yes	
		Wellington (Bell River) (421008)	3.4	5.9	8.4		Yes	
		Geurie					No	Yes
		Dubbo (421001)	5.5	7.9	11.0		Yes	
		Narromine (421006)	5.5	9.1	13.7		Yes	
		Warren (421014)	7.5	8.5	9.0		Yes	
	Molong Creek	Molong (421050)				Flash flood warning system in place (See note 1)	Yes	
	Bogan	Peak Hill (421076)	2.5	4.6	6.0		Yes	
		Dandaloo (421083)	4.1	5.2	6.0		Yes	
		Mudall (421905)	2.7	3.0	3.6		Yes	
		Nyngan (421138)	-	3.5	4.2		Yes	
		Mulgawarrina (421902)	4.2	5.0	5.5		Yes	
Gongolgon (421023)	0.8	1.0	1.3		Yes			
422 Barwon	Culgoa	Brenda (422015)	4.9	5.5	5.9	3 days notice required of heights 5.9 metres and above.	Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES	
			MINOR	MODERATE	MAJOR				
422 Barwon (cont)	Culgoa (cont)	Weilmoringle (422017)	5.2		5.8	2 days notice required of heights 5.6-6.1 metres. 3 days notice required of heights 6.2 metres and above.	Yes		
		Kennebree (422006)	4.7	-	5.8	2 days notice required of heights 6.1-6.4 metres. 3 days notice required of 6.5 metres and above.	Yes		
	Narran	New Angledool (422928)	1.8	2.0	2.3	2 days notice required of heights 2.8 metres and above.	Yes		
	Bokhara	Gooodooga (422014)	2.7	3.4	4.2	2 days notice required of heights 3.7 metres and above.	Yes		
		Bokhara (Goodwins; 422005)	2.0	2.6	3.5		No	Yes	
		Barwon	Mungindi (416001)	6.1	6.7	7.2		Yes	
	Warrego	Warrego	Mogil Mogil (422004)	7.5	-	8.3		Yes	
			Collarenebri (422003)	5.8	7.9	8.5		Yes	
			Walgett (422001)	10.5	12.0	12.5		Yes	
			Brewarrina (422002)	6.4	7.0	9.5	3 days notice required of heights 10.0 metres and above. 24 hours notice required of heights 2.0 metres and above. 24 hours notice required of heights 2.0 metres and above.	Yes	
		Barrington No 2 (423004)	2.8	3.8	5.0		Yes		
		Enngonia (423903)	2.0	2.5	3.0		Yes		

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
423 Warrego (cont)	Warrego (cont)	Ford's Bridge Bywash (423002)	1.7	2.3	3.2	24 hours notice required of heights 2.3-3.0 metres.  2 days notice required of heights 3.1 metres and above.	Yes	
424 Paroo	Paroo	Hungerford (424901)	1.0	1.5	2.0		Yes	
		Willara Crossing (424002)				Warnings issued when minor flood level expected to be exceeded at Hungerford.	Yes	Yes
		Wanaaring (424001)	2.4	3.3	4.0	2 days notice required of heights 4.0-4.8 metres.  3 days notice required of heights 4.9 metres and above.	Yes	
425 Darling	Darling	Bourke (425003)	9.0	10.7	12.2	3 days notice required of heights 13.2 metres and above.	Yes	

RIVER BASIN	WATERCOURSE	REFERENCE AREA (gauge name, where different, and AWRC number in brackets)	FLOOD CLASSIFICATION LEVELS (in metres)			NOTES	FLOOD WARNINGS PROVIDED BY BoM	LOCAL FLOOD ADVICES PROVIDED BY SES
			MINOR	MODERATE	MAJOR			
425 Darling (cont)	Darling (cont)	Louth (425004)	8.6	9.2	10.0	2 days notice required of heights 13.6-13.9 metres.  3 days notice required of 14.0 metres and above.	Yes	
		Tilpa (425900)	9.0	9.7	10.3	2 days notice required of heights 12.2-13.2 metres.  3 days notice required of 13.3 metres and above.	Yes	
		Wilcannia (425002)	9.0	9.7	10.4	2 days notice required of heights 10.0-11.9 metres.  3 days notice required of heights 12.0 metres and above.	Yes	
		Menindee (Flood Gauge; 425001)	8.5	9.1	9.7	2 days notice required of heights 8.8 metres and above.	Yes	
		Pooncarie (425005)	6.8	7.6	8.7		Yes	
		Burtundy (425007)	6.1	-	7.7		Yes	

Note 1 – Operational support provided by the Bureau of Meteorology’s NSW Flood Warning Centre which provides site specific advice on likely flash flooding. Due to the fast catchment response times the reliability of this warning service is not as high as that provided for sites along the other major streams listed in Annex C. For most flash flood locations the advice from the Bureau of Meteorology will be on the likelihood of flooding rather than specific river level predictions.

Notice times required are based on estimates of the time needed for a community to respond to floods of given levels. Note that as forecasting targets these requirements may not be able to be met for all floods. For example, floods resulting from rainfall near the forecasting point will respond more quickly than floods developing in the headwaters and the required notice may not be able to met. Where the required lead time is significantly greater than the time which is generally available, the BoM needs to incorporate predicted rainfall in its predictive modelling. This has the effect of increasing the risk of forecast errors because it is not technically possible to predict short-term rainfall intensity accurately on a catchment basis.

# MAP 1 - COASTAL RIVER BASINS



