MOOGERAH DAM
EMERGENCY ACTION PLAN

Expires: September 2023

Approved by the delegate of the Chief Executive, Department of Natural Resources, Mines and Energy until 1 September 2023

September 2019
### QUICK REFERENCE GUIDE

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<thead>
<tr>
<th>Dam Hazard</th>
<th>Alert</th>
<th>Lean Forward</th>
<th>Stand Up</th>
<th>Stand Down</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flood Event (Section 7.1)</strong></td>
<td>Reservoir level equal to or greater than 154.9m AHD and BoM expected to issue Flood Warnings across SEQ.</td>
<td>Flood of Record: Reservoir level equal to or greater than 158.7m AHD</td>
<td>Extreme Flood Level: Reservoir level equal to or greater than 159.5m AHD</td>
<td>Reservoir Level below Full Supply Level of 154.9m AHD</td>
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<tr>
<td><strong>Significant Increase in Seepage or New Area of Seepage (Section 7.2)</strong></td>
<td>Earthquake of Magnitude 3 or higher detected in the vicinity of the dam or; Significant new or increased seepage areas identified at the dam or; Seepage areas containing earth material identified at the dam.</td>
<td>Seepage is increasing or earth material evident in the seepage is increasing and; The increases cannot be controlled.</td>
<td>Dam failure is considered possible via an identified failure mechanism.</td>
<td>Seepage through the Dam is controlled and; No indicators of potential Dam failure are present.</td>
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<tr>
<td><strong>Structural Damage to Dam (Section 7.3)</strong></td>
<td>Earthquake of Magnitude 3 or higher detected in the vicinity of the dam or; New structural damage or movement areas identified at the Dam.</td>
<td>A Terrorist Threat or Incident is reported at the Dam Site or; New structural damage or movement areas have not stabilised and are demonstrating indications of continued worsening.</td>
<td>New structural damage or movement areas indicate some potential for a structural failure of the Dam.</td>
<td>Dam embankment is stable and; No potential indicators of potential Dam failure are present.</td>
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<thead>
<tr>
<th>Agency</th>
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<tr>
<td>Seqwater</td>
<td>Storage Supervisor</td>
<td>Moogerah Dam</td>
</tr>
<tr>
<td>Seqwater</td>
<td>Principal Engineer Dam Safety</td>
<td>Flood Operations Centre, Brisbane</td>
</tr>
<tr>
<td>Seqwater</td>
<td>Principal Engineer Dam Safety</td>
<td>Flood Operations Centre, Ipswich</td>
</tr>
<tr>
<td>Department of Natural Resources, Mines and Energy</td>
<td>Director of Dam Safety</td>
<td>Brisbane</td>
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<td>Queensland Fire and Emergency Services</td>
<td>Duty Officer</td>
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<td>Ipswich City Council</td>
<td>Local Disaster Coordinator</td>
<td>Ipswich</td>
</tr>
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<td>Scenic Rim Regional Council</td>
<td>Local Disaster Coordinator</td>
<td>Scenic Rim</td>
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<td>Queensland Police Service</td>
<td>Executive Officer, Ipswich</td>
<td>Ipswich</td>
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<td></td>
<td>District Disaster Management</td>
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<tr>
<td></td>
<td>Group</td>
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<td>Queensland Police Service</td>
<td>Executive Officer, Logan</td>
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<td>Group</td>
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## Revision Status

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<td>3</td>
<td>September 2011</td>
<td>Revision 3</td>
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<tr>
<td>4</td>
<td>August 2012</td>
<td>Revision 4</td>
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<td>5</td>
<td>November 2013</td>
<td>Revised and updated in accordance with new guidelines from the Department of Natural Resources, Mines and Energy</td>
</tr>
<tr>
<td>6</td>
<td>October 2014</td>
<td>Revised following discussions with the Department of Natural Resources, Mines and Energy and other stakeholders</td>
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<td>7</td>
<td>September 2016</td>
<td>Revision 7</td>
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<td>8</td>
<td>December 2016</td>
<td>Revision 8</td>
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<tr>
<td>9</td>
<td>June 2018</td>
<td>Revision 9</td>
</tr>
<tr>
<td>9.1</td>
<td>September 2019</td>
<td>Annual review and non-substantive amendments made.</td>
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<th>Annual Exceedance Probability</th>
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<tr>
<td>AHD</td>
<td>Australian Height Datum</td>
</tr>
<tr>
<td>ANCOLD</td>
<td>Australian National Committee on Large Dams</td>
</tr>
<tr>
<td>BoM</td>
<td>Bureau of Meteorology</td>
</tr>
<tr>
<td>DDMG</td>
<td>District Disaster Management Group</td>
</tr>
<tr>
<td>DNRME</td>
<td>Department of Natural Resources, Mines and Energy</td>
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<tr>
<td>EAP</td>
<td>Emergency Action Plan</td>
</tr>
<tr>
<td>ERP</td>
<td>Emergency Response Plan</td>
</tr>
<tr>
<td>FSL</td>
<td>Full Supply Level</td>
</tr>
<tr>
<td>FOC</td>
<td>Flood Operations Centre, Seqwater</td>
</tr>
<tr>
<td>LDC</td>
<td>Local Disaster Coordinator</td>
</tr>
<tr>
<td>LDMG</td>
<td>Local Disaster Management Group</td>
</tr>
<tr>
<td>LGA</td>
<td>Local Government Area</td>
</tr>
<tr>
<td>ML</td>
<td>Megalitre</td>
</tr>
<tr>
<td>PAR</td>
<td>Population At Risk</td>
</tr>
<tr>
<td>PMF</td>
<td>Probable Maximum Flood</td>
</tr>
<tr>
<td>PMP</td>
<td>Probable Maximum Precipitation</td>
</tr>
<tr>
<td>PMPDF</td>
<td>Probable Maximum Precipitation Design Flood</td>
</tr>
<tr>
<td>QFES</td>
<td>Queensland Fire and Emergency Services</td>
</tr>
<tr>
<td>SDCC</td>
<td>State Disaster Coordination Centre</td>
</tr>
</tbody>
</table>

The controlled version of this document is registered. All other versions are uncontrolled.
DEFINITIONS

For the purposes of this document:

- **Dam Hazards** as defined by the *Water Supply (Safety and Reliability) Act 2008* include both Downstream Release Hazards and Dam Failure Hazards.

- A **Downstream Release Hazard** is associated with natural flooding and a release of water from the Dam caused by water that has flowed naturally into the Dam, filling it and making the Dam overflow. A Downstream Release Hazard is not associated with a potential failure of the Dam Structure.

- A **Dam Failure Hazard** is associated with an uncontrolled release of water from the Dam caused by a failure of the Dam Structure. A Dam Failure Hazard could occur either during a period of natural flooding or when no natural flooding is occurring (Sunny Day Failure). If a Dam Failure Hazard occurs during a period of natural flooding, the flood impacts downstream of the dam cause by the Dam failure will be worsened by the natural flooding.

- A **Sunny Day Failure** of the Dam is a failure of the Dam Structure that occurs when no natural flooding is occurring.

- **Emergency Events** as defined by the *Water Supply (Safety and Reliability) Act 2008* includes any Downstream Release Hazard Event or Dam Safety Emergency Event where an operational state of LEAN FORWARD is reached based on the triggers defined in this EAP. Dam Safety Emergency Event triggers are associated with the potential of a Dam Failure Hazard.

- **Disaster Management Agency** is an agency with a management role in responding to an Emergency Event. Disaster Management Agencies include Local Disaster Management Groups, District Disaster Management Groups and Queensland Fire and Emergency Services.
1 INTRODUCTION

The risk of a structural failure at any dam owned by Seqwater is very low. Seqwater does not expect that a catastrophic dam failure event will ever occur at any Seqwater dam. As described below, Seqwater is committed to maintaining a comprehensive dam safety management program aimed at ensuring the continued safe and reliable operation of all of its dams. However because the consequences of a dam failure event are high, this Emergency Action Plan has been prepared with the following aims:

- To allow Seqwater to respond quickly to potential emergency incidents as soon as they are identified and to undertake targeted and effective intervention actions to prevent the situation developing into an emergency event.
- To allow Seqwater to provide appropriate and effective warnings in relation to dam safety emergency incidents and events, including flood events.

This Plan is supported by the following Seqwater internal programs and plans that support the maintenance of ongoing structural safety of each Seqwater dam and also ensure that Seqwater can respond effectively to any emergency event impacting on its water supply infrastructure:

- Seqwater Dam Safety Inspection and Surveillance Program.
- Seqwater Dam Portfolio Risk Assessment Program.
- Seqwater Dam Portfolio - Routine Scheduled Maintenance and Capital Refurbishment Program.
- Emergency Response Plan (prepared in accordance with the provisions of the Water Act 2000).

Seqwater is committed to correcting any identified potential dam safety issues at all of its dams and ensuring that its dams both remain safe, and efficiently fulfil their intended purpose.

1.1 Seqwater Dam Safety Policy Statement

Seqwater is committed to ensuring the continued safe operation of its dams, by managing its dams in accordance with the Queensland Dam Safety Management Guidelines and the ANCOLD Guidelines on Dam Safety Management.
1.2 Dam Safety - Staff Development and Training

Dam operations personnel within Seqwater receive appropriate dam safety training based on a combination of practical exercises and classroom instruction. This includes site exercises and “on the job” training in the operation and maintenance of large dams, and training seminars covering the dam safety management practices recommended by ANCOLD and the Queensland Dam Safety Regulator. In relation to their responsibilities associated with the management of Seqwater’s dams, the training ensures that dam operations personnel understand the purpose and detail of the following:

- the equipment at the dam and the location of controls, tools and keys required to properly operate the dam;
- the Emergency Action Plan;
- the Standard Operating Procedures;
- the Operation and Maintenance Manuals;
- the Flood Operations Procedures.
- the dam safety routine inspection and surveillance procedures including proper practices for collecting and recording dam safety instrumentation data.

1.3 Dam Safety Documentation

Seqwater requires the following documentation to be available for each of its dams to support the Emergency Action Plan:

- Investigation, Design, and Construction Documentation including the Data Book and (if available), the Design Report.
- As-Constructed Details including plans and drawings.
- Standing Operating Procedures.
- Operations and Maintenance Manuals.
- Dam Inspection and Evaluation Reports.
- Dam Safety Reviews.
- Manual of Flood Mitigation (required only for gated spillway dams).
- Flood Operations Procedures.
1.4 Dam Safety Inspection and Surveillance

1.4.1 Surveillance Policy

Seqwater undertakes dam surveillance in accordance with the recommendations contained in the ANCOLD Guidelines on Dam Safety Management. This is considered best practice for the management of large dams in Australia. This relates to both routine visual inspection of the dams and also the gathering and analysis of data from dam safety instrumentation installed at the dams. Seqwater undertakes the following inspections at each of its dams on a continual basis.

1.4.2 Annual and Five Year Comprehensive Inspections

Seqwater schedules and completes Annual and Five Yearly Inspections at its dams in accordance with dam safety conditions issued by the Queensland Government. These inspections are undertaken by a team lead by a suitably qualified and experienced Dam Safety Engineer. The inspections are conducted in accordance with the Queensland Dam Safety Management Guidelines and the ANCOLD Guidelines on Dam Safety Management. Copies of the inspection reports are provided to the Dam Safety Regulator for independent review once the inspections are completed.

1.4.3 Dam Safety Review

Seqwater schedules and completes Dam Safety Reviews for its dams in accordance with dam safety conditions issued by the Queensland Government. The reviews are conducted in accordance with the Queensland Dam Safety Management Guidelines and the ANCOLD Guidelines on Dam Safety Management. Copies of the Dam Safety Review reports are provided to the Dam Safety Regulator.

1.4.4 Dam Safety Routine Inspection

Routine visual inspection is undertaken at Seqwater dams to identify and report on conditions of interest for dam safety. These inspections are undertaken by the staff responsible for day to day operations at the dams as part of their routine duties at the dam. The frequency of inspection is dependent on dam hazard and consequence category and is in accordance with ANCOLD guidelines. The normal frequency for routine inspections at Moogerah Dam is daily.
All routine inspection reports are completed in written hardcopy and sent electronically to Seqwater’s Principal Engineer for Dam Safety for review. Any reported anomalies or unusual observations are investigated by a suitably qualified Dam Safety Engineer.

1.4.5 Dam Safety Instrumentation Data Gathering and Analysis

Dam Safety Instrumentation is used to monitor the structural performance of a dam. This instrumentation monitors a range of dam safety parameters that vary from dam to dam but can include rainfall, storage level, seepage, pore pressure and uplift pressure, surface movement, internal movement and post tensioning. Frequency of data gathering is dependent on dam hazard and consequence category and is undertaken in accordance with ANCOLD guidelines.

All gathered instrumentation data is provided electronically to Seqwater’s Principal Engineer for Dam Safety. The data is then graphed and analysed by a suitably qualified Dam Safety Engineer and any anomalies are investigated by a suitably qualified Dam Safety Engineer.

The instrumentation installed at Moogerah Dam includes the following:

- Electronic water level recorder to continuously monitor lake level.
- Standpipe Piezometers and uplift drains to monitor water pressure in the dam foundations.
- Surface settlement points to measure structural movement at the dam.

1.5 Flood Event Modelling

Seqwater maintains hydrologic models to forecast inflows into its dams and to estimate peak lake levels during flood events. These models can use rainfall forecast information provided by the Bureau of Meteorology for prediction purposes. This rainfall forecast information is supplied to Seqwater automatically in a digital format as soon as it is released for use by the Bureau. To compliment this process, Seqwater holds direct discussions with the Duty Meteorologists at the Bureau during flood events to allow improved interpretation of the rainfall forecast information provided.
1.6 Earthquake Monitoring

Seqwater receives Earthquake Notifications in real time directly from Geoscience Australia as earthquakes are detected. The Notifications provide an indication of Earthquake Magnitude by a number that characterizes the relative size of an earthquake based on the maximum motion recorded by a seismograph. An indication of the relationship between Earthquake Magnitude and potential impacts (in accordance with the Mercalli Intensity Scale) is shown in the table below.

<table>
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<tr>
<th>Earthquake Magnitude</th>
<th>Typical Maximum Modified Mercalli Intensity</th>
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<tr>
<td>1.0-3.0</td>
<td>I</td>
</tr>
<tr>
<td>3.0-3.9</td>
<td>II-III</td>
</tr>
<tr>
<td>4.0-4.9</td>
<td>IV-V</td>
</tr>
<tr>
<td>5.0-5.9</td>
<td>VI-V</td>
</tr>
<tr>
<td>6.0-6.9</td>
<td>VII-IX</td>
</tr>
<tr>
<td>7.0 and higher</td>
<td>VIII or higher</td>
</tr>
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### Abbreviated Modified Mercalli Intensity Scale

<table>
<thead>
<tr>
<th>Intensity</th>
<th>Description</th>
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<tbody>
<tr>
<td>I</td>
<td>Not felt except by a very few under especially favorable conditions.</td>
</tr>
<tr>
<td>II</td>
<td>Felt only by a few persons at rest, especially on upper floors of buildings.</td>
</tr>
<tr>
<td>III</td>
<td>Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.</td>
</tr>
<tr>
<td>IV</td>
<td>Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.</td>
</tr>
<tr>
<td>V</td>
<td>Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.</td>
</tr>
<tr>
<td>VI</td>
<td>Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.</td>
</tr>
<tr>
<td>VII</td>
<td>Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.</td>
</tr>
<tr>
<td>VIII</td>
<td>Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.</td>
</tr>
<tr>
<td>IX</td>
<td>Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.</td>
</tr>
<tr>
<td>X</td>
<td>Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.</td>
</tr>
<tr>
<td>XI</td>
<td>Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.</td>
</tr>
<tr>
<td>XII</td>
<td>Damage total. Lines of sight and level are distorted. Objects thrown into the air.</td>
</tr>
</tbody>
</table>


The actions undertaken by Seqwater following receipt of an Earthquake Notification from Geoscience Australia are described in Sections 7.2 and 7.3.
2 NOTIFICATION ARRANGEMENTS

2.1 Engagement Framework

In accordance with the provisions of the *Water Supply (Safety and Reliability) Act 2008*, Seqwater must prepare, implement and maintain an Emergency Action Plan (EAP) for Moogerah Dam. This EAP addresses these requirements.

The EAP is implemented under Seqwater’s Emergency Response Plan which has been prepared in accordance with the provisions of the *Water Act 2000*. The Emergency Response Plan provides a framework to coordinate incident and emergency management and response across the entire South East Queensland water supply chain, including incidents and emergencies at Seqwater’s dams. The purpose of the Emergency Response Plan is to:

- Provide the foundation for effective emergency management;
- Provide the framework to manage incidents for which impacts may disrupt continuity of drinking water supply, including infrastructure for water supply; and
- Provide for ‘all-hazards’ emergency management response.

The Emergency Response Plan does not provide detailed site-specific or situation-specific actions for particular incidents or emergencies as that information is provided by numerous other Seqwater documents including this EAP. Specifically this EAP provides response actions for Moogerah Dam should the following situations occur at the dam:

- Dam safety incidents or emergencies;
- Dam overflows.

Specific descriptions of dam safety incidents / emergencies relevant to this EAP are contained in Section 7.
2.2 Management Structure

The framework for how Seqwater engages with emergency management stakeholders including Disaster Management Groups during emergencies is contained in the Emergency Response Plan. The Emergency Response Plan is supported by the Seqwater Emergency Management Manual (Man-00276) which defines the arrangements, roles and responsibilities of the Emergency Management Team.

The management structure used by Seqwater to manage an emergency, including dam safety emergencies, is shown in Figure 1.1.

Figure 1.1 – Seqwater Emergency Management Structure

The generic intent of roles, responsibilities and functions of Seqwater Emergency Management Teams and Incident Management Teams are described in the Seqwater Emergency Management Manual (Man-00276). For this EAP further specific
information on the agency roles and responsibilities of the Dam Safety Regulator and Local Disaster Management Group(s) is described in Section 4.

2.2.1 Roles for Dam Safety Incidents and Emergencies

When a potential dam safety incident is initially identified by a Seqwater staff member, it is immediately reported to Seqwater’s Duty Emergency Advisor via Seqwater’s 24/7 incident and emergency hotline by phoning (07) 3270 4040.

If the incident or emergency is considered to be a terrorist act, Queensland Police Service will also be notified via Triple Zero (000).

Once the potential incident is reported and verified, an Incident Management Team Leader is appointed by the Duty Emergency Advisor using the Dam Safety Incident Roster. Prior to the Incident Management Team Leader being appointed, normal operational arrangements apply to the management of the site. An Emergency Manager will also be appointed from the Incident Roster when the incident is reported if judged necessary by the Incident Management Team Leader.

Further details of the requirements of these roles are:

- **Emergency Manager** - The Emergency Manager is a suitably experienced Senior Seqwater Manager who will take responsibility for the overall management of Seqwater’s response to the emergency including:
  - directing the actions to be undertaken by Seqwater at the dam site;
  - determining the emergency condition level, and;
  - providing suitable notifications to stakeholder agencies and the public.

  During a dam safety emergency, the Emergency Manager can be contacted by phoning (07) 3270 4040.

- **Incident Management Team Leader** - The Incident Management Team Leader is an experienced Dam Safety Engineer. On-site response at the dam is managed by an Incident Management Team Leader who also provides advice to the Emergency Manager in relation to:
  - Appropriate frequency of site inspection.
  - Requirement to mobilise an operator to site for continuous monitoring.
Moogerah Dam
Emergency Action Plan

- Actions required on site to ensure public safety.
- Physical intervention actions to ensure the structural safety of the dam.
- Escalation of emergency condition level.
- Likelihood of a dam breach leading to release of water and consequent increased hazard to people downstream.

If the Incident Management Team is formed prior to the appointment of an Emergency Manager, the Incident Management Team Leader will undertake the role of the Emergency Manager until an Emergency Manager is appointed. During a dam safety emergency, the Incident Management Team Leader can be contacted by phoning (07) 3270 4040.

2.2.2 Roles for Seqwater Dam Release Notification Service

Rainfall events can cause overflows at the dam and trigger notification of potential downstream release hazard. Similar overflow events and corresponding notifications (refer Section 2.3) occur frequently at multiple Seqwater dams. In this context, downstream release hazard notifications while at ALERT status (refer Table 7.2) are generally routine, are not an incident for Seqwater’s Emergency Response Plan and rarely impact on public safety.

The roles to perform the routine (non-incident) downstream release hazard notifications for this EAP are undertaken by:

- Seqwater’s Duty (On-Call) Communications Advisor is responsible for issuing the public notifications in accordance with Seqwater’s Dam Release and Spilling Communication Procedure Document (PRO-00598); and

- Seqwater’s Duty (On Call) Senior Flood Operations Engineer is responsible for providing technical advice to the Duty (On-Call) Communications Advisor.

The Duty Senior Flood Operations Engineer is responsible for monitoring dam overflows and escalating response in accordance with Section 7 of this EAP if necessary.
2.3 Notification Details

This EAP requires Seqwater to issue notifications for downstream release hazards and potential or actual dam safety emergency events. A summary of these notification requirements is outlined in the Tables below.

**DOWNSTREAM RELEASE HAZARD - OPERATIONAL STATE IS STAND DOWN**
(BoM not expected to issue Flood Warnings across South East Queensland)

<table>
<thead>
<tr>
<th>Situation</th>
<th>Step</th>
<th>Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>BoM not expected to issue Flood Warnings across South East Queensland.</td>
<td>1</td>
<td>Who: Seqwater Dam Release Notification Service subscribers. How: Dam Release Notification service (See Section 2.3.1). Subscribers can choose to receive email, and/or SMS text to mobile and/or recorded message to landline telephone.</td>
</tr>
<tr>
<td>This situation is not a potential dam failure emergency</td>
<td>2</td>
<td>Who: General Public. How: Information on Seqwater webpage and social media.</td>
</tr>
</tbody>
</table>

**DOWNSTREAM RELEASE HAZARD - OPERATIONAL STATE IS ALERT**
(BoM expected to issue Flood Warnings across South East Queensland)

<table>
<thead>
<tr>
<th>Situation</th>
<th>Step</th>
<th>Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset of potential downstream release hazard.</td>
<td>1</td>
<td>Who: QFES, DNRME, relevant Disaster Management Groups and other government and non-government stakeholders. How: Talking point updates issued a minimum of twice daily.</td>
</tr>
<tr>
<td>BoM commence issuing relevant flood warnings for the river downstream of the dam.</td>
<td>2</td>
<td>Who: Seqwater Dam Release Notification Service subscribers. How: Dam Release Notification service (See Section 2.3.1). Subscribers can choose to receive email, and/or SMS text to mobile and/or recorded message to landline telephone.</td>
</tr>
<tr>
<td>This situation is not a potential dam failure emergency</td>
<td>3</td>
<td>Who: General Public. How: Until the management of the Weather Event impacts are taken over by a Disaster Management Agency, Seqwater will issue Media releases/statements a minimum of twice daily and will hold a daily media conference/briefing if requested to do so by media organisations. Once a Disaster Management Agency takes over the management of the event, Seqwater will revert to being a support agency and will provide information in accordance with directions received.</td>
</tr>
</tbody>
</table>
## DAM SAFETY EMERGENCY EVENT - OPERATIONAL STATE IS ALERT

<table>
<thead>
<tr>
<th>Situation</th>
<th>Step</th>
<th>Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>A new event has impacted the Dam. The event is associated with water</td>
<td>1</td>
<td>Who QFES, DNRME, relevant Disaster Management Groups and other government</td>
</tr>
<tr>
<td>seepage, physical damage or the occurrence of an earthquake. The impacts</td>
<td></td>
<td>and non-government stakeholders.</td>
</tr>
<tr>
<td>of the event on the structural safety of the dam are not fully understood,</td>
<td></td>
<td>How Talking point updates issued a minimum of daily unless it is agreed that</td>
</tr>
<tr>
<td>but the dam is not expected to be at any risk of failure (refer to</td>
<td></td>
<td>less frequent updates are appropriate.</td>
</tr>
<tr>
<td>Sections 7.2, 7.3 and 7.4)</td>
<td></td>
<td>This situation is not a potential dam failure emergency</td>
</tr>
</tbody>
</table>

*This situation is not a potential dam failure emergency*
## DOWNSTREAM RELEASE HAZARD OR DAM SAFETY EMERGENCY EVENT OPERATIONAL STATE IS LEAN FORWARD

<table>
<thead>
<tr>
<th>Situation</th>
<th>Step</th>
<th>Who</th>
<th>Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood Overflow trigger in table 7.2 or flood of record predicted at the dam, or; A Terrorist Act is reported at the Dam Site, or; Significant Seepage or Structural Damage has been identified resulting in a Lean Forward Alert Level in accordance with Sections 7.2, 7.3 and 7.4.</td>
<td>1</td>
<td>Who (Terrorist Act Only)</td>
<td>Queensland Police Service – This notification is for a Terrorist Act only.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How</td>
<td>Telephone call 000. The purpose of this initial notification is to report the Terrorist Act to Police.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Who</td>
<td>Priority 1 contact for Local Council or Local Disaster Management Group defined in contact register - Appendix A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How</td>
<td>Telephone call. The purpose of this initial notification is to provide a situation brief and agree on the arrangements for further reporting and incident management. The agreed arrangements will depend on how the flood event or emergency situation is predicted to develop.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Who</td>
<td>If Step 2 above cannot be contacted then subsequent priority contacts in contact register - Appendix A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How</td>
<td>Telephone call. The purpose of this initial notification is to provide a situation brief and identify any requirements for additional incident management arrangements not currently in place.</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Who</td>
<td>OFES, DNRME, relevant Disaster Management Groups and other government and non-government stakeholders.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How</td>
<td>Talking point updates issued a minimum of twice daily.</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Who (Flood Events Only)</td>
<td>Near PAR (Note 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How</td>
<td>If dam outflows are predicted to cause flooding of residences within the area defined as containing the Near PAR (Note 1), Seqwater will contact the Disaster Management Agency responsible for managing the impacts of the flood event downstream of the dam and discuss and agree on appropriate notification arrangements, including message content, for the Near PAR. If required, Seqwater’s available personnel and communications resources will assist the responsible Disaster Management Agency to provide these notifications.</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Who</td>
<td>General Public</td>
</tr>
</tbody>
</table>
**DOWNSTREAM RELEASE HAZARD OR DAM SAFETY EMERGENCY EVENT**  
**OPERATIONAL STATE IS LEAN FORWARD**

<table>
<thead>
<tr>
<th>Situation</th>
<th>Step</th>
<th>Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Flood Events Only)</td>
<td>How</td>
<td>Until the incident has escalated to a potential dam failure emergency or the management of the potential impacts of the incident is taken over by a Disaster Management Agency, Seqwater will issue Media releases/statements a minimum of twice daily for flood events and will hold a daily media conference/briefing if requested to do so by media organisations. Once a Disaster Management Agency takes over the management of the potential impacts of the incident, Seqwater will provide information in accordance with directions received.</td>
</tr>
</tbody>
</table>

7 | Who | General Public. |
| How | Information on Seqwater’s webpage and via social media. |

**DOWNSTREAM RELEASE HAZARD OR DAM SAFETY EMERGENCY EVENT**  
**OPERATIONAL STATE IS STAND UP and Dam failure is possible but unlikely within the next 12 hours**

**This situation is an Emergency.**

<table>
<thead>
<tr>
<th>Situation</th>
<th>Step</th>
<th>Notification and guidance on actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood level may overtop the dam (refer to table in Section 7.1) or; Significant seepage that may cause the dam to fail has been identified (refer to table in Section 7.2) or; Structural damage that may cause the dam to fail has been identified (refer to table in Section 7.3 and 7.4).</td>
<td>1</td>
<td>Who</td>
</tr>
<tr>
<td></td>
<td>How</td>
<td>Telephone call. Request or confirm that SDCC Watch Desk (QFES) will immediately issue the Watch and Act message (in Section 2.3.4) to the public under the Emergency Alert to advise of the possible safety risks associated with a dam failure situation. If Emergency Alert is unavailable, the lead agency managing the emergency will direct the stakeholder response.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Who</td>
</tr>
<tr>
<td></td>
<td>How</td>
<td>Multi-agency telephone conference. Notify the involved Local Disaster Management Groups that the Watch and Act Emergency Alert has been activated by SDCC Watch Desk (QFES) under request by Seqwater. An email record of the multi-agency telephone conference will be sent to the involved Local Disaster Management Groups.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Who</td>
</tr>
<tr>
<td></td>
<td>How</td>
<td>Situation Report updates will be issued a minimum of twice daily or at the frequency required by the Disaster Management Agency responsible for managing the impacts of the potential dam failure event.</td>
</tr>
</tbody>
</table>
DOWNSTREAM RELEASE HAZARD OR DAM SAFETY EMERGENCY EVENT
OPERATIONAL STATE IS STAND UP and
Dam failure is either currently occurring or likely within the next 12 hours

<table>
<thead>
<tr>
<th>Situation</th>
<th>Step</th>
<th>Notification and guidance on actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood level may overtop the dam (refer to table in Section 7.1) or;</td>
<td>1</td>
<td>SDCC Watch Desk (QFES)</td>
</tr>
<tr>
<td>Significant seepage that may cause the dam to fail has been identified (refer to table in Section 7.2) or;</td>
<td></td>
<td>Telephone call. Request or confirm that SDCC Watch Desk (QFES) will immediately issue the Warning message (in Section 2.3.4) to the public under the Emergency Alert to advise of the high public safety risks associated with the likely dam failure situation. If Emergency Alert is unavailable, the lead agency managing the emergency will direct the stakeholder response.</td>
</tr>
<tr>
<td>Structural damage that may cause the dam to fail has been identified (refer to table in Section 7.3 and 7.4).</td>
<td>2</td>
<td>Local Disaster Management Groups defined in contact register – Appendix A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multi-agency telephone conference. Notify the involved Local Disaster Management Groups that the Warning Emergency Alert has been activated by SDCC Watch Desk (QFES) under request by Seqwater. An email record from the multi-agency telephone conference will be sent to the involved Local Disaster Management Groups.</td>
</tr>
<tr>
<td>This situation is an Emergency.</td>
<td>3</td>
<td>Undertake Step 3 of the Stand Up Notification Table on the previous page.</td>
</tr>
</tbody>
</table>

Note 1: Near PAR is persons potentially impacted in the first hour of a dam failure event as defined in the Dam Failure Hazard Inundation Maps in Section 8.

Note 2: The PAR will be notified based on the polygon boundaries located on Seqwater’s Disaster Management Portal. The General Public will be notified under the procedure within Seqwater’s Communication Protocol. After the steps outlined above, the situation will be managed by following Seqwater’s Emergency Response Plan.
2.3.1 Seqwater Dam Release Notification Service

Moogerah Dam is as an uncontrolled spillway dam. Seqwater does not have any scope for modifying the outflow from Moogerah Dam when the dam fills and overflows.

Seqwater provides a free Dam Release Notification Service to residents living downstream of dams and for any other interested parties. This free notification service provides subscribers with notifications by their choice of email, SMS/text messages to mobile phones, or recorded messages to telephone landlines. These notifications are issued to inform the subscriber that an overflow from the dam is commencing or about to commence; or that overflows have reached a level where they may pose a hazard to the safety of persons or property downstream of the dam (downstream release hazard).

Seqwater has widely promoted and continues to promote the Dam Release Notification Service. Details of this service are available on Seqwater's website (www.seqwater.com.au).

It is important to understand that Dam Release Notifications from Seqwater are advice of the outflows from the dam. There may be other sources of water contributing to flooding in waterways and floodplains downstream of the dam. It is also important to be aware that these notifications are not indicating that there is a definite downstream release hazard, but rather that the dam is overflowing and operating normally and that safety hazards downstream of the dam are possible because the dam is spilling.
Dam Release Notifications do not provide information on river levels, or predictions about areas that may be inundated by flood waters in a flood event. Subscribers to the service should consider information available from other sources which may include:

- Details of road closures, inundation flood mapping and information regarding any evacuation arrangements, from Local Councils and Disaster Management Groups;
- Information on river levels and flooding from the BoM. Seqwater issues a notification to subscribers when the BoM commence issuing relevant flood warnings for areas downstream of the dam. Seqwater does not issue further dam release notifications while the BoM are issuing flood warnings. The reasons for this are:
  - The BoM are the lead agency for the provision of flood warning information to the public. Flood Warning information issued by other agencies that can be seen to be in competition with Flood Warning information issued by the BoM has the potential to create public confusion during an emergency event.
  - Flooding downstream of the dam will be caused by a combination of dam outflows and flow contributions from other sources. These flow contributions from other sources are not assessed or estimated by Seqwater. Therefore the BoM are better placed than Seqwater to advise the public on flooding downstream of the dam once the BoM commence issuing Flood Warnings.
- Emergency services warnings, including from Police and Queensland Fire and Emergency Services.

### 2.3.2 Local Disaster Management Group Dam Overflow Notifications

Seqwater monitors dam outflows and advises impacted Local Councils (Contact Register contained in Appendix A) of flooding at the dam at the LEAN FORWARD trigger level in Table 7.2. Local Councils may also be advised of status of flooding at the dam at levels below the trigger specified in Table 7.2 in accordance with pre-agreed protocols with the Council. In some situations when the Seqwater Flood Operations Centre is mobilised and if time and resources are available, predicted peak dam levels and outflow can also be provided however the provision of this information cannot be guaranteed.

The notification to the Local Councils will be made as a telephone call as a first priority.
2.3.3 Notifications Associated with a Potential Dam Failure

If a situation is identified that has the potential to cause or contribute to a dam failure emergency condition at the dam, Seqwater will provide appropriate notifications and inter-agency coordination to Local Councils and Disaster Management Stakeholders. The triggers for these notifications are contained in Section 7 of this EAP. Seqwater will provide these notifications and two-way communication in accordance with the Emergency Response Plan. The Emergency Response Plan provides for verbal communication (typically teleconference) supplemented with written requests and situation reports. Dam failure emergencies can develop rapidly. The need for direct verbal communication for expediency of response should be assumed unless a situation specific assessment identifies sufficient time is available for alternative communication.

If a situation arises where the failure of the dam is considered possible, Seqwater or the Agency managing the overall emergency response will liaise directly with State Disaster Coordination Centre (SDCC) to issue appropriate notifications to persons located downstream of the dam using the Emergency Alert. This system is the national telephone based emergency warning system that sends messages to a nominated area:

- a voice message of up to 35 seconds to all identified landline telephone services based on their physical location, and
- a text message of up to 160 characters to all identified mobile phone services based on their physical location and/or billing address.

(Further details of the Emergency Alert can be found at [http://www.disaster.qld.gov.au/](http://www.disaster.qld.gov.au/)).

The Emergency Alert has the ability to import digital spatial data files (polygons in Google Earth KML format) that define a particular geographic area for the issue of an Emergency Alert. For a dam safety emergency associated with potential or actual dam failure, these polygons are defined by Seqwater and extend over the Dam Failure Hazard Inundation Maps shown in Section 8. The polygons are not defined exactly to the extents of Dam Failure Inundation Maps because the QFES specifications for Emergency Alert polygons require simplified area definition for expediency of use the Emergency Alert.
Polygons in Google Earth KML format for the Emergency Alert have been uploaded to reside directly within the Emergency Alert for immediate use by SDCC Watch Desk if needed for a dam failure emergency. Initiation of the Emergency Alert is the system used by Seqwater to warn populations at risk near to the dam of the likely hazards associated with the onset of a potential dam failure.

The initiating agency responsible for direct liaison with the SDCC if the Emergency Alert is to be used will depend on the speed of development of the emergency situation. If a potential dam failure situation develops relatively quickly (e.g. a matter of hours) and notification is required before the managing Emergency Response Agency can be mobilised, liaison with the SDCC and initiation of notifications using the Emergency Alert will be the responsibility of Seqwater. If a dam failure situation has developed at a slower rate (e.g. a matter of days), liaison with the SDCC and initiation of notifications using the Emergency Alert will be undertaken by the managing Emergency Response Agency, with advice from Seqwater. If the situation is not clear, the decision on how a notification will be initiated and liaison with the SDCC is the responsibility of the Emergency Manager (see Section 2.2).

Once a notification is initiated from the Emergency Alert, consequent management measures undertaken by the SDCC Watch Desk will be event-dependent but will normally include:

- Informing others of the notification, with primary considerations being: media (particularly local radio), through Queensland Fire and Emergency Services (QFES) Media and Corporate Communications.
  - LDC of LDMG and LGA.
  - Minister’s Office;
- Ensuring, together with Telstra, that the use of the System does not adversely affect the telecommunications network;
- Ensuring pre-prepared websites have relevant information; and
- Establishment of a system to measure the effectiveness of the Campaign and other messages on the ground.
2.3.4 Content of Notification Messages

The content of notification messages sent out in a real time dam safety emergency will depend on many factors. These factors include:

- The type of emergency situation encountered.
- Whether localised or widespread flooding is occurring in conjunction with the dam safety emergency.
- The location and state of local evacuation centres.
- The state, condition and capacity of transport routes likely to be used for evacuation.
- The estimated time to dam failure.

Because some of these factors depend upon disaster management arrangements that would be put in place by Local Disaster Management Groups, Seqwater is working with these Groups to develop a range of appropriate specific messaging in readiness for a range of potential dam safety emergency events and scenarios. However in a real time emergency situation, messaging will primarily focus on providing the following information:

- The nature of the emergency.
- The area impacted by the emergency.
- The expected time that the impacts will commence.
- Instructions to evacuate to or remain in a safe area.
Accordingly, Seqwater has formulated the following messages that can be used as starting points by Disaster Management Agencies for formulating a “situation appropriate” message in real time during an emergency event. These messages have been pre-approved by the QFES and reside directly within the Emergency Alert for immediate use by QFES if needed for a dam failure emergency.

<table>
<thead>
<tr>
<th>Incident/Event</th>
<th>Voice Message</th>
<th>Text Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watch and Act (STAND UP Scenario 1)</td>
<td>This is a Flood Watch and Act message from S E Q water. Major issue detected at, Moogerah Dam which may lead to a dam failure emergency. Be on standby and prepare for evacuation, away from Warrill Creek and Moogerah Dam in the Event of dam failure. You should warn neighbours. For more information listen to local radio or visit <a href="http://www.disaster.qld.gov.au">www.disaster.qld.gov.au</a>. For flood assistance contact the State Emergency Service on 1 3 2 500.</td>
<td>Watch&amp;Act.Moogerah Dam possibility of dam failure. Prepare to evacuate away from Warrill Creek. Warn others. Listen to radio or visit <a href="http://www.disaster.qld.gov.au">www.disaster.qld.gov.au</a>.</td>
</tr>
<tr>
<td>Warning (STAND UP Scenario 2)</td>
<td>Emergency. Emergency. This is a Dam Failure Warning from S E Q water. Moogerah Dam is at imminent risk of failure. Move immediately to high ground, away from Warrill Creek and Moogerah Dam. You should warn neighbours. For more information listen to local radio or visit <a href="http://www.disaster.qld.gov.au">www.disaster.qld.gov.au</a>. For flood assistance contact the State Emergency Service on 1 3 2 500.</td>
<td>Emergency.Moogerah Dam imminent failure risk. Move immediately from Warrill Creek to high ground. Warn others. Radio or visit <a href="http://www.disaster.qld.gov.au">www.disaster.qld.gov.au</a>.</td>
</tr>
</tbody>
</table>
3 BASIC DETAILS OF THE DAM

<table>
<thead>
<tr>
<th>Population at Risk</th>
<th>Sunny Day Failure: 340 Flood: 430</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure Impact Rating</td>
<td>2</td>
</tr>
<tr>
<td>Dam Owner</td>
<td>Seqwater</td>
</tr>
<tr>
<td>Name of Reservoir</td>
<td>Lake Moogerah</td>
</tr>
<tr>
<td>Year Complete</td>
<td>1961</td>
</tr>
<tr>
<td>Location</td>
<td>Reynolds Creek near Boonah</td>
</tr>
<tr>
<td>Water Course</td>
<td>Reynolds Creek</td>
</tr>
<tr>
<td></td>
<td>Latitude: 28° 1'46.85&quot;S</td>
</tr>
<tr>
<td></td>
<td>Longitude: 152°32'58.96&quot;E</td>
</tr>
<tr>
<td>Purpose</td>
<td>Irrigation and Town Water</td>
</tr>
<tr>
<td>Type of Construction</td>
<td>Mass concrete double curvature dam</td>
</tr>
<tr>
<td>Outlet Works</td>
<td>Concrete ogee spillway with flip bucket dissipater</td>
</tr>
<tr>
<td>Catchment Area</td>
<td>228 km²</td>
</tr>
<tr>
<td>FSL</td>
<td>154.91 m AHD</td>
</tr>
<tr>
<td>Full Supply Capacity</td>
<td>83,765 ML</td>
</tr>
<tr>
<td>Surface Area at FSL</td>
<td>818.8 ha</td>
</tr>
<tr>
<td>Main Dam Crest</td>
<td>160.72 m AHD</td>
</tr>
<tr>
<td>Main Dam Embankment Length</td>
<td>219 m</td>
</tr>
<tr>
<td>Maximum Height of Main Dam Embankment</td>
<td>37.7 m</td>
</tr>
<tr>
<td>Width at Top of Main Dam Embankment</td>
<td>3.0 m</td>
</tr>
<tr>
<td>Spillway Crest</td>
<td>154.91 m AHD</td>
</tr>
<tr>
<td>Spillway Length</td>
<td>25.9 m</td>
</tr>
<tr>
<td>Peak Water Level as a Result of PMF</td>
<td>163.88 m AHD</td>
</tr>
<tr>
<td>Spillway Capacity</td>
<td>740 m³/s</td>
</tr>
<tr>
<td>Maximum Outflow as a Result of PMF²</td>
<td>3,590 m³/s</td>
</tr>
<tr>
<td>AEP of Spillway Capacity</td>
<td>1 in 10,000</td>
</tr>
<tr>
<td>Regulator valves</td>
<td>2 x 600 mm cone dispersion valves</td>
</tr>
<tr>
<td>Mean annual pan evaporation</td>
<td>150 mm (BOM average)</td>
</tr>
<tr>
<td>Mean annual rainfall</td>
<td>906 mm at 040014 Beaudesert</td>
</tr>
<tr>
<td>Hydroelectric Facilities</td>
<td>Nil</td>
</tr>
<tr>
<td>Maximum Historic Storage Level</td>
<td>158.74 m AHD – Jan 2013</td>
</tr>
<tr>
<td>Comment</td>
<td>Moogerah Dam provides irrigation supply to riparian landholders along Reynolds Creek and, through a series of diversions, also supplies water to Warrill Creek and Warrill Valley farmers.</td>
</tr>
</tbody>
</table>

1 Seqwater Dams Portfolio Risk Assessment Report, Moogerah Dam, 2013 (Weighted Total PAR)
2 Aurecon Hydrology Report, Moogerah Dam AFC Safety Design, September 2012
### 4 ROLES AND RESPONSIBILITIES

The following table shows the relevant entities with dam safety incident responsibilities.

<table>
<thead>
<tr>
<th>AGENCIES</th>
<th>RESPONSIBILITIES</th>
</tr>
</thead>
</table>
| Seqwater | • Prepare, implement and maintain an Emergency Action Plan for Moogerah Dam in accordance with the provisions of the *Water Supply (Safety and Reliability) Act 2008* and prepare, implement and maintain an Emergency Response Plan in accordance with the provisions of the *Water Act 2000*.  
• Maintain an ongoing Incident and Emergency Roster in accordance with the Emergency Response Plan.  
• For all incidents, Seqwater will appoint an Incident Management Team in accordance with the Emergency Response Plan. The Incident Management Team will undertake emergency response at the dam site including site control, manage public safety at the dam, undertake physical intervention actions that aim to prevent an uncontrolled release of water and, until an Emergency Manager is appointed, provide all dam overflow and dam safety notifications in accordance with Section 1. If the Emergency progresses to a point that requires appointment of an Emergency Manager (see Section 6), the Incident Management Team will also provide advice and recommendations to the Emergency Manager on the provision of notifications and the Emergency Condition Level.  
• Once the incident progresses to a point that requires appointment of an Emergency Manager (see Section 6), Seqwater will appoint an Emergency Manager to manage Seqwater’s overall emergency response and to undertake appropriate liaison and engagement with local, district and state disaster management groups and other stakeholder agencies in accordance with the Emergency Response Plan. The Emergency manager will also provide all dam overflow and dam safety notifications in accordance with Section 1 and provide advice to stakeholders on the need for downstream evacuations. |
<table>
<thead>
<tr>
<th>Dam Safety Regulator (DNRME)</th>
<th>• Provide regulatory input during a dam safety emergency in accordance with the requirements of the Water Supply (Safety and Reliability) Act 2008.</th>
</tr>
</thead>
</table>
| Councils of the City of Ipswich and the Region of Scenic Rim (Local Disaster Management Groups) | • Exercise primary responsibility for disaster response and management within its boundaries, in accordance with the Queensland Disaster Management Act 2003.  
• Deploy all appropriate resources to contribute to response and recovery during the dam safety emergency, until its resources are fully committed.  
• Mobilise disaster response assistance from other relevant Disaster Response Agencies, as appropriate during the emergency. |

A Contact Register for these and other stakeholder agencies is included in Appendix A.
5 AREA MAP AND SITE ACCESS ARRANGEMENTS

All-weather access is available to the dam via Lake Moogerah Road.
6 DRAWING OF THE STORAGE CATCHMENT AREA
7 EMERGENCY EVENTS AND ACTION LIST

The following events define the triggers for dam safety incidents, emergencies and notifications. Emergency Event Reports are prepared for the following trigger events.

- Extreme Flood Event - Reservoir Level exceeds a “Lean Forward” Emergency Condition Level shown in Section 7.1 and a structural safety condition requiring further investigation is identified.
- Significant increase in seepage or new area of seepage
- Significant structural damage to the dam.

Continuous remote lake level monitoring is available at Moogerah Dam via a radio telemetry system (ALERT). Levels are monitored at Seqwater’s Flood Operations Centre which mobilises to 24/7 operations during flood events in accordance with the requirements of Table 7.1.

In addition to this, Seqwater undertakes routine Dam Safety Inspections at Moogerah Dam in accordance with ANCOLD Guidelines. These routine inspections are designed to identify the onset of a potential emergency event and inspection frequency is increased as appropriate once a dam safety incident trigger is encountered. Options for continuous monitoring of site conditions by Seqwater staff are available (see Section 5 for site access arrangements) and will be activated if required.

The action lists for each of the dam safety trigger events are shown in the sections below. The decision as to the level of activation of the EAP will be taken by the Emergency Manager on the advice of the Leader of the Incident Management Team. If an Emergency Manager has not been appointed, the decision will be taken by the Leader of the Incident Management Team.

A Dam Safety Risk Assessment undertaken in accordance with ANCOLD Guidelines has been completed for the Moogerah Dam. The failure modes that remained after the risk assessment screening process, their initiating events, and the section of this document under which these failure modes would be managed if a dam safety incident trigger associated with the failure mode is encountered, is summarised in Table 7.1.
Table 7.1 – Moogerah Dam Identified Structural Failure Modes

<table>
<thead>
<tr>
<th>FAILURE MODE DESCRIPTION</th>
<th>INITIATING EVENT</th>
<th>RELEVANT SECTION OF EMERGENCY ACTION PLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion of downstream toe</td>
<td>Flood</td>
<td>Use Section 7.1 at flood commencement. Move to Section 7.3 should any new structural damage or movement areas on the Dam Embankment be identified through the routine inspection processes undertaken during the flood event.</td>
</tr>
<tr>
<td>Scour of thrust blocks</td>
<td>Flood</td>
<td>Use Section 7.1 at flood commencement. Move to Section 7.3 should any spillway damage with the potential to impact the Dam Embankment be identified through the routine inspection processes undertaken during the flood event.</td>
</tr>
</tbody>
</table>
7.1 Flood Event

The structural performance of the dam is monitored by regular routine site inspection from the commencement of the flood event. Any issues associated with structural performance as a result of these inspections are sent to the Senior Flood Engineer on duty for evaluation and appropriate action.

If the “Lean Forward” Emergency Condition Level as outlined in Table 7.2 is reached, the initial action is to register an incident by phoning 07 3270 4040. These actions are managed by the Senior Flood Engineer on duty.

Once the incident is registered, an Incident Management Team (IMT) will be formed by the Seqwater Incident Roster Duty Manager to monitor the flood event on a 24/7 basis. The IMT will be coordinated from Seqwater’s Flood Operations Centre and the leader of the IMT will be the Senior Flood Engineer on duty.

While the Emergency Condition Level is at the “Lean Forward” condition, the incident will be managed by the Incident Management Team. However if the Emergency Condition Level is escalated to “Stand Up”, then an Emergency Manager will be appointed and a structure for the management of the Dam Safety Emergency by Seqwater as described in Section 2.2 will be established.

The dam is of mass concrete construction that can withstand some overtopping. The dam crest level is 160.72 metres AHD. A structural failure of the dam becomes likely once the lake level reaches 161.7 metres AHD.
Table 7.2 - Notification Trigger Levels

<table>
<thead>
<tr>
<th>Level (m AHD)</th>
<th>Description</th>
<th>Emergency Condition Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;154.91</td>
<td>Dam Level below Full Supply  Level</td>
<td>STAND DOWN</td>
</tr>
<tr>
<td>154.91</td>
<td>Spillway Level</td>
<td>ALERT (Consider Increased On-site Monitoring)</td>
</tr>
<tr>
<td>158.74</td>
<td>Flood of Record+</td>
<td>LEAN FORWARD^ (Consider Continuous On-site Monitoring)</td>
</tr>
<tr>
<td>159.50</td>
<td>Extreme Flood Level</td>
<td>STAND UP* (Continuous On-site Monitoring)</td>
</tr>
</tbody>
</table>

* This Emergency Condition Level relates to preparing for and undertaking evacuations associated with a potential failure of Moogerah Dam due to flood overtopping.

^ Seqwater’s Flood Operations Centre will operate on a 24/7 basis to monitor water levels and catchment conditions once the “Lean Forward” Emergency Condition Level is reached. This condition also triggers the need for the completion and submission of a report to the Dam Safety Regulator in accordance with the requirements of the Water Supply (Safety and Reliability) Act.

* If hydrologic modelling indicates that the Flood of Record is likely to be reached, the “Lean Forward” Emergency Condition Level should be activated.

Table 7.3 - Design Flood Estimates
(Source: Aurecon Hydrology Report, Moogerah Dam AFC Safety Design, September 2012)

<table>
<thead>
<tr>
<th>AEP (1 in …)</th>
<th>Peak Inflow (m³/s)</th>
<th>Peak Outflow (m³/s)</th>
<th>Peak Storage Level (m AHD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>590</td>
<td>210</td>
<td>157.47</td>
</tr>
<tr>
<td>100</td>
<td>690</td>
<td>260</td>
<td>157.82</td>
</tr>
<tr>
<td>500</td>
<td>920</td>
<td>380</td>
<td>158.65</td>
</tr>
<tr>
<td>1,000</td>
<td>1,030</td>
<td>440</td>
<td>159.07</td>
</tr>
<tr>
<td>5,000</td>
<td>1,330</td>
<td>610</td>
<td>160.11</td>
</tr>
<tr>
<td>10,000</td>
<td>1,480</td>
<td>710</td>
<td>160.62</td>
</tr>
<tr>
<td>50,000</td>
<td>1,910</td>
<td>1,260</td>
<td>161.64</td>
</tr>
<tr>
<td>100,000</td>
<td>2,210</td>
<td>1,540</td>
<td>161.99</td>
</tr>
<tr>
<td>500,000</td>
<td>2,770</td>
<td>2,310</td>
<td>162.79</td>
</tr>
<tr>
<td>1,000,000</td>
<td>3,110</td>
<td>2,670</td>
<td>163.12</td>
</tr>
<tr>
<td>4,400,000 PMPDF</td>
<td>4,120</td>
<td>3,590</td>
<td>163.88</td>
</tr>
</tbody>
</table>
The following table provides a guide to appropriate actions that would be undertaken by the Incident Management Team and the Emergency Manager during a flood event.

<table>
<thead>
<tr>
<th>INCIDENT MANAGEMENT TEAM</th>
<th>EMERGENCY MANAGER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NORMAL OPERATIONS</strong></td>
<td><strong>No Emergency Manager is appointed during normal dam operations.</strong></td>
</tr>
<tr>
<td>‣ Regular site monitoring and dam safety inspections are undertaken in accordance with Standing Operating Procedures.</td>
<td></td>
</tr>
<tr>
<td>‣ Any anomalies arising from routine monitoring and inspection that are considered to have the potential to threaten the structural safety of the dam are to be reported by phoning 07 3270 4040.</td>
<td></td>
</tr>
<tr>
<td><strong>EMERGENCY CONDITION LEVEL (Alert)</strong></td>
<td><strong>No Emergency Manager is appointed at the “Alert” Emergency Condition Level.</strong></td>
</tr>
<tr>
<td>‣ An Incident Management Team will not be formed until the Emergency Condition Level reaches “Lean Forward”.</td>
<td></td>
</tr>
<tr>
<td>‣ Regular site monitoring and dam safety inspection will continue as normal. Increased on-site dam safety monitoring will be considered based on the predicted size of the flood event.</td>
<td></td>
</tr>
<tr>
<td>‣ Any anomalies arising from routine monitoring and inspection that are considered to have the potential to threaten the structural safety of the dam are to be reported by phoning 07 3270 4040.</td>
<td></td>
</tr>
<tr>
<td><strong>EMERGENCY CONDITION LEVEL (Lean Forward)</strong></td>
<td>While the Emergency Condition Level is at the “Lean Forward” condition, the incident will be managed by the Incident Management Team. However if the Emergency Condition Level is escalated to “Stand Up”, then an Emergency Manager will be appointed and a structure for the management of the Dam Safety Emergency by Seqwater as described in Section 2.2 will be established.</td>
</tr>
<tr>
<td>‣ Mobilise Flood Operations Centre to 24/7 operations.</td>
<td></td>
</tr>
<tr>
<td>‣ Establish an Incident Log to record all significant events.</td>
<td></td>
</tr>
<tr>
<td>‣ Monitor the situation by using the real time ALERT system to constantly monitor the dam water level and catchment rainfall in real time, and by using hydrologic models to predict future dam water levels.</td>
<td></td>
</tr>
<tr>
<td>‣ Consider implementing continuous on-site dam safety monitoring.</td>
<td></td>
</tr>
<tr>
<td>‣ Direct site staff to take manual water level readings when required to verify ALERT system readings.</td>
<td></td>
</tr>
<tr>
<td>‣ Undertake stakeholder and public notifications in accordance with Section 2.</td>
<td></td>
</tr>
<tr>
<td>‣ Provide daily update reports to the Seqwater Incident Roster Duty Manager.</td>
<td></td>
</tr>
<tr>
<td>‣ Escalate the Emergency Condition Level as appropriate in accordance with observed site conditions.</td>
<td></td>
</tr>
</tbody>
</table>
**INCIDENT MANAGEMENT TEAM**

- Use the Incident Log to record all significant events.
- Monitor the situation by using the real-time ALERT system to constantly monitor the dam water level and catchment rainfall in real time, and by using hydrologic models to predict future dam water levels.
- Implement continuous on-site dam safety monitoring if possible.
- Direct site staff to take manual water level readings when required to verify ALERT system readings.
- Obtain expert dam safety advice and technical assistance as required.
- Organise and manage any required remedial works on site.
- Provide update reports to the Emergency Manager as directed.
- Provide advice on the likelihood of dam failure and the need for downstream evacuations.

**EMERGENCY CONDITION LEVEL**

**Stand Up**

- Use the Incident Log to record all significant events.
- Monitor the situation by using the real-time ALERT system to constantly monitor the dam water level and catchment rainfall in real time, and by using hydrologic models to predict future dam water levels.
- Implement continuous on-site dam safety monitoring if possible.
- Direct site staff to take manual water level readings when required to verify ALERT system readings.
- Obtain expert dam safety advice and technical assistance as required.
- Organise and manage any required remedial works on site.
- Provide update reports to the Emergency Manager as directed.
- Provide advice on the likelihood of dam failure and the need for downstream evacuations.

**FINAL ACTIONS**

- If the Emergency Condition Level has reached Lean Forward or Stand Up prepare and submit an appropriate Incident Report to DNRME in accordance with the requirements of the Water Supply (Safety and Reliability) Act.
- Once satisfied that the incident is resolved, close the incident in accordance with the requirements of the Emergency Response Plan.

**EMERGENCY MANAGER**

- Manage Seqwater’s emergency response, including the provision of appropriate ongoing notifications (including advice in relation to the need for downstream evacuations) to stakeholders and the public, in accordance with the Emergency Response Plan and the notification requirements of Section 2.
7.2 Significant Increase in Seepage or New Area of Seepage

If a significant increase in seepage or a significant new area of seepage is identified, the initial action is to register an incident by phoning 07 3270 4040. When registering such an incident, the following table should be used as a guide to determining Emergency Condition Level.

<table>
<thead>
<tr>
<th>Trigger Conditions</th>
<th>Emergency Condition Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake of Magnitude 3 or higher detected in the vicinity of the dam.</td>
<td>ALERT (Increased On-site Monitoring)</td>
</tr>
<tr>
<td>Significant new or increased seepage areas identified at the Dam.</td>
<td></td>
</tr>
<tr>
<td>Seepage areas containing earth material identified at the Dam.</td>
<td></td>
</tr>
<tr>
<td>Seepage is increasing or earth material evident in the seepage is increasing, and</td>
<td>LEAN FORWARD (Continuous On-site Monitoring)</td>
</tr>
<tr>
<td>the increases cannot be controlled.</td>
<td></td>
</tr>
<tr>
<td>Dam failure is considered possible via an identified failure mechanism.</td>
<td>STAND UP (Commence Public Warnings/Evacuations)</td>
</tr>
<tr>
<td>Seepage through the Dam is controlled. No indicators of potential Dam failure are</td>
<td>STAND DOWN</td>
</tr>
<tr>
<td>present.</td>
<td></td>
</tr>
</tbody>
</table>

Once the incident is registered, an Incident Management Team (IMT) will be formed by the Seqwater Incident Roster Duty Manager to manage the physical response on site, and advise on emergency condition level and the likelihood of a significant downstream release hazard. The leader of the IMT will be an experienced Dam Safety Engineer.

While the Emergency Condition Level is at the “Alert” condition, the incident will be managed by the Incident Management Team. However if the Emergency Condition Level is escalated to either “Lean Forward” or “Stand Up”, then an Emergency Manager will be appointed and a structure for the management of the Dam Safety Emergency by Seqwater as described in Section 2.2 will be established.

The following table provides a guide to appropriate actions that would be undertaken by the Incident Management Team and the Emergency Manager in these circumstances.

<table>
<thead>
<tr>
<th>INCIDENT MANAGEMENT TEAM</th>
<th>EMERGENCY MANAGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Regular site monitoring and dam safety inspections are undertaken in accordance with Standing Operating Procedures.</td>
<td>▶ No Emergency Manager is appointed during normal dam operations.</td>
</tr>
<tr>
<td>▶ Any anomalies arising from routine monitoring and inspection that are considered to have the potential to threaten the structural safety of the dam are to be reported by phoning 07 3270 4040.</td>
<td></td>
</tr>
</tbody>
</table>
### INCIDENT MANAGEMENT TEAM

- Establish an Incident Log to record all significant events.
- If an Earthquake of Magnitude 3 or higher was the trigger for moving to the "Alert" Emergency Condition Level, undertake a routine dam safety inspection as soon as practical, including a check on whether the dam safety instrumentation readings have moved into a state that indicates the potential development of a structural dam safety issue. No further action is required if no new seepage or damage is detected during this inspection.
- Increase the frequency of on-site dam safety monitoring.
- Monitor the situation by estimating the rate of seepage flow, observing the clarity of the seepage flow, making notes and taking photographs and determining if the new condition is related to a potential structural failure mechanism at the dam.
- Provided it is safe to do so, undertake regular dam safety inspections and instrumentation readings.
- Organise and manage any required remedial works on site.
- Provide daily update reports to the Seqwater Incident Roster Duty Manager.
- Escalate the Emergency Condition Level as appropriate in accordance with observed site conditions.

### EMERGENCY MANAGER

- While the Emergency Condition Level is at the "Alert" condition, the incident will be managed by the Incident Management Team. However if the Emergency Condition Level is escalated to either “Lean Forward” or “Stand Up”, then an Emergency Manager will be appointed and a structure for the management of the Dam Safety Emergency by Seqwater as described in Section 2.2 will be established.
## INCIDENT MANAGEMENT TEAM

- Use the Incident Log to record all significant events.
- Implement continuous on-site dam safety monitoring.
- Monitor the situation by estimating the rate of seepage flow, observing the clarity of the seepage flow, making notes and taking photographs and determining if the new condition is related to a potential structural failure mechanism at the dam.
- Provided it is safe to do so, undertake regular dam safety inspections and instrumentation readings.
- Obtain expert dam safety advice and technical assistance as required.
- Organise and manage any required remedial works on site.
- Provide update reports to the Emergency Manager as directed.
- Escalate the Emergency Condition Level as appropriate in accordance with observed site conditions.
- Provide advice on the likelihood of dam failure and the need for downstream evacuations.

## EMERGENCY CONDITION LEVEL

<table>
<thead>
<tr>
<th><strong>EMERGENCY CONDITION LEVEL</strong></th>
<th><strong>INCIDENT MANAGEMENT TEAM</strong></th>
<th><strong>EMERGENCY MANAGER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lean Forward (Lean Forward)</td>
<td>Use the Incident Log to record all significant events.</td>
<td>Manage Seqwater’s emergency response, including the provision of appropriate ongoing notifications (including advice in relation to the need for downstream evacuations) to stakeholders and the public, in accordance with the Emergency Response Plan and the notification requirements of Section 2.</td>
</tr>
<tr>
<td>Stand Up (Stand Up)</td>
<td>As previous emergency condition level.</td>
<td>As previous emergency condition level.</td>
</tr>
</tbody>
</table>

## FINAL ACTIONS

- If the Emergency Condition Level has reached Lean Forward or Stand Up prepare and submit an appropriate Incident Report to DNRME in accordance with the requirements of the Water Supply (Safety and Reliability) Act.
- Once satisfied that the incident is resolved, close the incident in accordance with the requirements of the Emergency Response Plan.
7.3 Structural Damage to Dam

If structural damage to the dam is identified, the initial action is to register an incident by phoning 07 3270 4040. Section 7.4 provides a list of potential indicators of structural damage to the Dam. Structural damage to the dam can be caused in many ways including earthquake, explosion, vandalism, or large objects crashing into the dam or reservoir. Structural damage can be identified through visual inspection or by examining instrumentation data that is collected for the dam on a regular basis in accordance with ANCOLD guidelines.

When registering a structural damage incident, the following table should be used as a guide to determining Emergency Condition Level.

<table>
<thead>
<tr>
<th>Trigger Conditions</th>
<th>Emergency Condition Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake of Magnitude 3 or higher detected in the vicinity of the dam.</td>
<td>ALERT (Increased On-site Monitoring)</td>
</tr>
<tr>
<td>New structural damage or movement areas identified at the Dam.</td>
<td></td>
</tr>
<tr>
<td>A Terrorist Threat or Incident is reported at the Dam Site.</td>
<td>LEAN FORWARD (Continuous On-site Monitoring)</td>
</tr>
<tr>
<td>New structural damage or movement areas have not stabilised and are demonstrating</td>
<td></td>
</tr>
<tr>
<td>indications of continued worsening.</td>
<td></td>
</tr>
<tr>
<td>New structural damage or movement areas indicate some potential for a structural</td>
<td></td>
</tr>
<tr>
<td>failure of the Dam.</td>
<td>STAND UP (Commence Public Warnings/Evacuations)</td>
</tr>
<tr>
<td>Dam embankment is stable. No potential indicators of potential Dam failure are</td>
<td>STAND DOWN</td>
</tr>
<tr>
<td>present.</td>
<td></td>
</tr>
</tbody>
</table>

Once the incident is registered, an Incident Management Team (IMT) will be formed by the Seqwater Incident Roster Duty Manager to manage the physical response on site, and advise on emergency condition level and the likelihood of a significant downstream release hazard. The leader of the IMT will be an experienced Dam Safety Engineer.

If the registered incident is a Terrorist Threat or Act, the incident will be managed by the Queensland Police Service.

While the Emergency Condition Level is at the “Alert” condition, the incident will be managed by the Incident Management Team. However if the Emergency Condition Level is escalated to either “Lean Forward” or “Stand Up”, then an Emergency Manager will be appointed and a structure for the management of the Dam Safety Emergency by Seqwater as described in Section 2.2 will be established.

The following table provides a guide to appropriate actions that would be undertaken by the Incident Management Team and the Emergency Manager in these circumstances.
<table>
<thead>
<tr>
<th>NORMAL OPERATIONS</th>
<th>INCIDENT MANAGEMENT TEAM</th>
<th>EMERGENCY MANAGER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>▶ Regular site monitoring and dam safety inspections are undertaken in accordance with Standing Operating Procedures.</td>
<td>▶ No Emergency Manager is appointed during normal dam operations.</td>
</tr>
<tr>
<td></td>
<td>▶ Any anomalies arising from routine monitoring and inspection that are considered to have the potential to threaten the structural safety of the dam are to be reported by phoning 07 3270 4040.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EMERGENCY CONDITION LEVEL (Alert)</th>
<th>INCIDENT MANAGEMENT TEAM</th>
<th>EMERGENCY MANAGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Establish an Incident Log to record all significant events.</td>
<td></td>
<td>While the Emergency Condition Level is at the “Alert” condition, the incident will be managed by the Incident Management Team. However if the Emergency Condition Level is escalated to either “Lean Forward” or “Stand Up”, then an Emergency Manager will be appointed and a structure for the management of the Dam Safety Emergency by Seqwater as described in Section 2.2 will be established.</td>
</tr>
<tr>
<td>▶ If an Earthquake of Magnitude 3 or higher was the trigger for moving to the “Alert” Emergency Condition Level, undertake a routine dam safety inspection as soon as practical, including a check on whether the dam safety instrumentation readings have moved into a state that indicates the potential development of a structural dam safety issue. No further action is required if no new seepage or damage is detected during this inspection.</td>
<td>▶ Increase the frequency of on-site dam safety monitoring.</td>
<td></td>
</tr>
<tr>
<td>▶ Monitor the situation by estimating the rate of change to the new structural damage or movement areas, making notes and taking photographs, and determining if the new condition is related to a potential structural failure mechanism at the dam.</td>
<td>▶ Monitor the situation by estimating the rate of change to the new structural damage or movement areas, making notes and taking photographs, and determining if the new condition is related to a potential structural failure mechanism at the dam.</td>
<td></td>
</tr>
<tr>
<td>▶ Provided it is safe to do so, undertake regular dam safety inspections and instrumentation readings.</td>
<td>▶ Provided it is safe to do so, undertake regular dam safety inspections and instrumentation readings.</td>
<td></td>
</tr>
<tr>
<td>▶ Organise and manage any required remedial works on site.</td>
<td>▶ Organise and manage any required remedial works on site.</td>
<td></td>
</tr>
<tr>
<td>▶ Provide daily update reports to the Seqwater Incident Roster Duty Manager.</td>
<td>▶ Provide daily update reports to the Seqwater Incident Roster Duty Manager.</td>
<td></td>
</tr>
<tr>
<td>▶ Escalate the Emergency Condition Level as appropriate in accordance with observed site conditions.</td>
<td>▶ Escalate the Emergency Condition Level as appropriate in accordance with observed site conditions.</td>
<td></td>
</tr>
</tbody>
</table>
## INCIDENT MANAGEMENT TEAM

- Use the Incident Log to record all significant events.
- Implement continuous on-site dam safety monitoring.
- Monitor the situation by estimating the rate of change to the new structural damage or movement areas, making notes and taking photographs, and determining if the new condition is related to a potential structural failure mechanism at the dam.
- Provided it is safe to do so, undertake regular dam safety inspections and instrumentation readings.
- Obtain expert dam safety advice and technical assistance as required.
- Organise and manage any required remedial works on site.
- Provide update reports to the Emergency Manager as directed.
- Escalate the Emergency Condition Level as appropriate in accordance with observed site conditions.
- Provide advice on the likelihood of dam failure and the need for downstream evacuations.

## EMERGENCY CONDITION LEVEL

**Lean Forward**

- As previous emergency condition level.

**Stand Up**

- As previous emergency condition level.

## FINAL ACTIONS

- If the Emergency Condition Level has reached Lean Forward or Stand Up prepare and submit an appropriate Incident Report to DNRME in accordance with the requirements of the Water Supply (Safety and Reliability) Act.
- Once satisfied that the incident is resolved, close the incident in accordance with the requirements of the Emergency Response Plan.
7.4 Potential indicators of structural damage to the dam

There are many potential indicators of structural damage to a dam. The significance of these will depend on the particular event and the circumstances at the dam. If new instances of any of the following indicators are discovered at Moogerah Dam, the actions listed in Section 7.3 should be followed.

<table>
<thead>
<tr>
<th>Problem</th>
<th>General Characteristic</th>
<th>When and What to Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation Failure</td>
<td>Sliding, rotation, or settlement of part of or entire dam.</td>
<td>During routine inspections and after earthquakes inspect for evidence of foundation movement or displacement immediately adjacent to the dam.</td>
</tr>
<tr>
<td>Slide in downstream or upstream slope</td>
<td>Slide in the downstream or upstream face.</td>
<td>During routine inspections and after heavy or long periods of rainfall look for cracks or scarps near the crest and bulges at the toe.</td>
</tr>
<tr>
<td>Flow slide</td>
<td>Collapse and flow of soil around the storage periphery.</td>
<td>During routine inspections and after heavy or long periods of rainfall look for material displacement around the storage rim.</td>
</tr>
<tr>
<td>Gullying</td>
<td>No rock protection or vegetation cover on embankment batters or poor drainage.</td>
<td>During routine inspections and after heavy or long periods of rainfall inspect embankment (and if present, saddle dam) batters for damage to rock protection or vegetation cover.</td>
</tr>
<tr>
<td>Landslide</td>
<td>Mass movement of soil or rock from slopes and valley walls around the storage.</td>
<td>During routine inspections and after earthquakes look for material displacement.</td>
</tr>
<tr>
<td>Damage to structural concrete</td>
<td>Movement or cracking of structural concrete.</td>
<td>During routine inspections, after earthquakes and when mechanical problems such as burst pipes occur – look for any movement or cracking of structural concrete.</td>
</tr>
<tr>
<td>Failure of appurtenant structures or operating equipment</td>
<td>Loss of ability to supply water or discharge floods safely.</td>
<td>After detecting an operational anomaly identify and investigation cause.</td>
</tr>
<tr>
<td>Loss of storage contents</td>
<td>Excessive loss from the storage and / or occasionally increased seepage or increased groundwater levels near the storage.</td>
<td>During routine monitoring look for environmental changes such as vegetation damage, salt scalds, etc</td>
</tr>
</tbody>
</table>

The controlled version of this document is registered. All other versions are uncontrolled.
<table>
<thead>
<tr>
<th>Problem</th>
<th>General Characteristic</th>
<th>When and What to Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toe erosion</td>
<td>Erosion of embankment toe by spillway discharge or diversion flows.</td>
<td>During routine inspections and after heavy or long periods of rainfall inspect embankment toe.</td>
</tr>
<tr>
<td>Wave erosion</td>
<td>Beaching or notching of the upstream face of the embankment by waves generated over long periods of strong wind.</td>
<td>During routine inspections and during or after periods of strong wind inspect upstream face of embankment and saddle dam.</td>
</tr>
<tr>
<td>Spillway damage</td>
<td>Damage to the spillway, dissipater or areas downstream of the spillway.</td>
<td>During routine inspections and during or after spillway overflows inspect the spillway and areas downstream of the spillway for damage or unusual flow patterns.</td>
</tr>
<tr>
<td>Major mechanical or electrical failures.</td>
<td>Mechanical or electrical failures can impact on the operation of infrastructure at the dam.</td>
<td>Report all mechanical and electrical failures impacting dam infrastructure.</td>
</tr>
</tbody>
</table>
8 DAM FAILURE HAZARD INUNDATION MAPS

The following maps provide an indication of potential flood inundation from a failure of the Dam. Determining the extent of this flood inundation involves complex modelling techniques that contain considerable uncertainties. Accordingly, in a potential dam failure scenario it is recommended that all areas within the Probable Maximum Flood (PMF) failure extent be evacuated, with evacuation priority given to areas close to the Dam.

Google Earth (.kml) files showing PMF and Sunny Day Failure inundation extents are available to Disaster Management Groups as a component of this Emergency Action Plan. Because these files can generally be used more effectively than hardcopy maps, it is recommended that these files are used by Disaster Management Groups as the primary source of dam failure inundation information.

The maps have been developed to assist emergency event planning and evacuation. The purpose of the maps is to provide a guide that allows Disaster Management Groups to understand the potential area that may be impacted by a dam failure scenario.

A dam failure may cause considerable damage to the road network downstream of the Dam due to extreme flood level rise, high velocity, and debris that could potentially be generate from the failure. Therefore, for Emergency Planning purposes, it should be assumed that all roads within the Dam Failure inundation extents on the following maps would be rendered unserviceable should a failure of the Dam occur.

The maps do not define property flood risks and do not in any way relate to flooding potential associated with natural flood events that do not involve a failure of the Dam. Property flood risk is generally defined by flood studies and associated land use planning controls prepared by and made available to the public by Local Governments.

The maps do not define the probability of a flood or the probability of dam failure. As previously stated in this Plan, dam failure risk at all Seqwater dams is very low.

The “Time to Flood” extents shown on the maps should be regarded as an indication only. This is because in an actual dam failure scenario “Time to flood” extents will be heavily influenced by factors that cannot be predicted with any degree of certainty.
Moogerah Dam
Probable Maximum Flood Failure
and Sunny Day Failure
Overview

Legend
- Sunny Day Failure Line
- Major Roads
- Major Waterway
- Map Grid
- Water Storage

Time to Flood
- 0-1 hr
- 1-2 hrs
- 2-3 hrs
- 3-6 hrs
- 6-12 hrs
- >12 hrs

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Moogerah Dam
Probable Maximum Flood Failure and Sunny Day Failure
Map 1

Legend
- Sunny Day Failure Line
- Major Road
- Street
- Water Storage

Time to Flood
- 0-1 hr
- 1-2 hrs
- 2-3 hrs
- 3-6 hrs
- 6-12 hrs
- >12 hrs

Km

Scale 1:35,000 @ A3

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Date: 19/09/2016
Moogerah Dam
Probable Maximum Flood Failure
and Sunny Day Failure
Map 2

Legend
Sunny Day Failure Line
Major Road
Street
Water Storage

Time to Flood
0-1 hr
1-2 hrs
2-3 hrs
3-6 hrs
6-12 hrs
>12 hrs

Scale 1:35,000 @ A3

Km
0 0.5 1 1.5 2

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Moogerah Dam
Probable Maximum Flood Failure
and Sunny Day Failure
Map 3

Legend
- Sunny Day Failure Line
- Major Road
- Street
- Water Storage

Time to Flood
- 0-1 hr
- 1-2 hrs
- 2-3 hrs
- 3-6 hrs
- 6-12 hrs
- >12 hrs

Km
Scale 1:35,000 @ A3

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Moogerah Dam
Probable Maximum Flood Failure
and Sunny Day Failure
Map 4

Legend

<table>
<thead>
<tr>
<th>Time to Flood</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1 hr</td>
<td></td>
</tr>
<tr>
<td>1-2 hrs</td>
<td></td>
</tr>
<tr>
<td>2-3 hrs</td>
<td></td>
</tr>
<tr>
<td>3-6 hrs</td>
<td></td>
</tr>
<tr>
<td>6-12 hrs</td>
<td></td>
</tr>
<tr>
<td>&gt;12 hrs</td>
<td></td>
</tr>
</tbody>
</table>

Km
Scale 1:35,000  @ A3

Date: 19/09/2016

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Moogerah Dam
Probable Maximum Flood Failure and Sunny Day Failure
Map 5
Scale 1:35,000  @ A3

Legend
- Sunny Day Failure Line
- Major Road
- Street
- Water Storage
- Time to Flood
  - 0-1 hr
  - 1-2 hrs
  - 2-3 hrs
  - 3-6 hrs
  - 6-12 hrs
  - >12 hrs

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Moogerah Dam
Probable Maximum Flood Failure
and Sunny Day Failure
Map 6

Legend
- Sunny Day Failure Line
- Major Road
- Street
- Water Storage

Time to Flood
- 0-1 hr
- 1-2 hrs
- 2-3 hrs
- 3-6 hrs
- 6-12 hrs
- >12 hrs

Scale: 1:35,000 @ A3
Km

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Probable Maximum Flood Failure
and Sunny Day Failure
Map 8

Moogerah Dam

Legend

Sunny Day Failure Line
Major Road
Street
Water Storage

Time to Flood
0-1 hr
1-2 hrs
2-3 hrs
3-6 hrs
6-12 hrs
>12 hrs

Scale 1:35,000 @ A3

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Moogerah Dam
Probable Maximum Flood Failure
and Sunny Day Failure
Map 9

Legend
- Sunny Day Failure Line
- Major Road
- Street
- Water Storage

Time to Flood
- 0-1 hr
- 1-2 hrs
- 2-3 hrs
- 3-6 hrs
- 6-12 hrs
- >12 hrs

Scale 1:35,000 @ A3

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Moogerah Dam
Probable Maximum Flood Failure
and Sunny Day Failure
Map 10

Legend

- Sunny Day Failure Line
- Major Road
- Street
- Water Storage

Time to Flood

- 0-1 hr
- 1-2 hrs
- 2-3 hrs
- 3-6 hrs
- 6-12 hrs
- >12 hrs

Km

Scale 1:35,000 @ A3

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Moogerah Dam
Probable Maximum Flood Failure and Sunny Day Failure
Map 11

Legend
- Sunny Day Failure Line
- Major Road
- Street
- Water Storage

Time to Flood
- 0-1 hr
- 1-2 hrs
- 2-3 hrs
- 3-6 hrs
- 6-12 hrs
- >12 hrs

Scale 1:35,000  @ A3

Km

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Moogerah Dam
Probable Maximum Flood Failure
and Sunny Day Failure
Map 12

Time to Flood

Legend

Sunny Day Failure Line

Major Road

Street

Water Storage

0-1 hr

1-2 hrs

2-3 hrs

3-6 hrs

6-12 hrs

>12 hrs

Scale 1:35,000 @ A3

Km

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Moogerah Dam
Probable Maximum Flood Failure
and Sunny Day Failure
Map 13

Legend
- Sunny Day Failure Line
- Major Road
- Street
- Water Storage

Time to Flood
- 0-1 hr
- 1-2 hrs
- 2-3 hrs
- 3-6 hrs
- 6-12 hrs
- >12 hrs

Km

Scale 1:35,000 @ A3

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9 DOWNSTREAM RELEASE HAZARD MAPS

The following maps provide an indication of potential flood inundation close to the Dam that may occur due to the maximum possible spillway flow from the Dam. These maps are indicative of maximum downstream release for a situation that is not dam failure. These maps do not show the maximum possible flooding downstream of the Dam because such flooding can be influenced by sources of floodwater that are not part of the dam release. Such sources include run-off generated from localised flash flooding generated from unpredictable high intensity rain storms occurring downstream of the Dam.

These maps do not replace approved flood maps for the area that have been published by a Local Government Authority, Disaster Management Group, State Government Agency, or Federal Government Agency. However the maps can be used as a guide to potential flooding due to outflow from the Dam in the absence of approved flood maps.

9.1 Purpose and Exclusions

The following downstream release hazard maps have been produced to identify the maximum areas likely to be affected by a downstream release hazard which is associated with natural flooding and a release of water from the dam caused by water that has flowed naturally into the dam.

In practice, the occurrence of a downstream release hazard does not automatically generate an emergency event for the Dam, and it does not mean that there are concerns for the structural safety of the Dam or that emergency intervention is required at the dam. In the vast majority of cases, the occurrence of a downstream release hazard is an indication that sufficient rainfall has fallen to cause flooding. Generally this flooding would be worse if the Dam had not been constructed.

Dam hazards that specifically threaten the structural safety of the Dam are defined in Section 7 and the relevant maps for these potential dam failure emergency events are in Section 8.
9.2 Relevance of Downstream Release Hazard Maps

Spillway flows from the Dam can combine with other downstream flows to produce an emergency situation for people and property downstream of the Dam (for example an event or disaster as defined in the Disaster Management Act 2003). This EAP does not define the disaster or emergency situation response actions required for downstream flooding of this nature.

The following maps provide an indication of the potential hazard area that may be impacted by downstream releases from the Dam. In the absence of more detailed flood maps, these maps can be used to assist Disaster Management Groups and the public for identifying areas that may be potentially impacted by dam releases.

The emergency response to flooding within these areas is led by Local Disaster Management Groups, with a range of agencies (including Seqwater) supporting these Groups in accordance with the Emergency Management Assurance Framework, IGEM 2014. Seqwater’s contribution is made primarily by providing information on the nature of the hazard arising from releases from the Dam. The following maps assist in providing that information.

As noted above and in Section 2.3, when using these maps it is important to understand that the maps do not identify all possible downstream flooding scenarios. Downstream flooding could be significantly different to that shown in the maps due to the particular circumstances of each flood event. Some examples include:

- Flooding at the Dam and no other floodwaters joining downstream of the Dam – which means the downstream flooding is entirely due to the Dam overflow;
- No flooding at the Dam and flooding occurs downstream from inflows due rain downstream of the dam or rain and flows on tributary catchments that join downstream of the dam – which means that the Dam is not contributing to flooding; and
- Flooding at the Dam and downstream flooding is more than Dam overflow due to inflows from rain downstream of the dam or rain and flows on tributary catchments that join downstream of the dam – which means that the dam is partially contributing to flooding.

Because of these numerous combinations of contribution to downstream flooding, these maps should not to be used as an alternative to published flood maps, but rather should be used to support other flood map information.
9.3 Downstream Release Hazard Map Limitations of Accuracy

Determining the extent of Dam outflow flood inundation involves complex modelling techniques that contain considerable uncertainties. The map accuracy is limited by:

- Accuracy of topographic survey;
- Accuracy of modelling methods;
- Omissions of hydraulic structures; and
- Omission of any changes to channel and floodplain conditions (e.g. land development) that occurred after the time of the survey information used to produce the maps.

The maps do not define property flood risks.
The maps do not define the probability of a flood.
The maps only show the maximum spillway flow. The maps do not show the minimum downstream release hazard flow for conditions when the downstream release hazard (dam overflow) notification is issued as defined in Section 2.3 in this EAP.

9.4 Available Flood Intelligence of Actual Dam Release During Events for Local Councils And Disaster Management Groups

In addition to the information contained in this EAP, Disaster Management Agencies can obtain real time information on dam levels to determine dam outflows for all Seqwater’s un-gated dams during flood events directly and on a continuous basis using hardware and software available through the Bureau of Meteorology. Please contact Seqwater for further information.
Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Overview

Legend
- Major Roads
- Major Waterway
- Moogerah_GridIndexFeatures2
- Indicative Flood Extent
- Water Storage

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Moogerah Dam Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 1

Legend

Major Road
Street
Indicative Flood Extent
Water Storage

Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 1

Scale 1:35,000 @ A3

Km

0 0.5 1 1.5 2

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Moogarah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 2

Legend

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>Major Road</td>
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</tr>
<tr>
<td>Street</td>
<td></td>
</tr>
<tr>
<td>Indicative Flood Extent</td>
<td></td>
</tr>
<tr>
<td>Water Storage</td>
<td></td>
</tr>
</tbody>
</table>

Scale 1:35,000 @ A3

Km

0 0.5 1 1.5 2

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Date: 19/09/2016
Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 5

Legend
- Major Road
- Street
- Indicative Flood Extent
- Water Storage

Scale 1:35,000  @ A3

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Date: 19/09/2016

Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure

Map 5

Legend
- Major Road
- Street
- Indicative Flood Extent
- Water Storage

Scale 1:35,000  @ A3

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Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 8

Legend

- Major Road
- Street
- Indicative Flood Extent
- Water Storage

Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 8

Km

Scale 1:35,000 @ A3

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Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 9

Legend
- Major Road
- Street
- Indicative Flood Extent
- Water Storage

Map scale: 1:35,000

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Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 9

Date: 19/09/2016

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Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 10

Legend
- Major Road
- Street
- Indicative Flood Extent
- Water Storage

Scale 1:35,000 @ A3

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Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 11

Scale 1:35,000 @ A3

Legend
- Major Road
- Street
- Indicative Flood Extent
- Water Storage

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Path: Z:\Data_Management_Plan\MAPS\ESRI\MXDs\Modelling\Flood_Maps_2016_August\20160830_Moogerah_DCFNF_A3_Landscape.mxd
Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 11

Scale 1:35,000 @ A3
Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure

Map 12

Scale 1:35,000 @ A3

Legend
- Major Road
- Street
- Indicative Flood Extent
- Water Storage

Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure

Map 12

Scale 1:35,000 @ A3

Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure

Map 12

Scale 1:35,000 @ A3

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Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 13

Legend

Major Road
Street
Indicative Flood Extent
Water Storage

Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 13

Scale 1:35,000 @ A3

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Moogerah Dam
Downstream Release Hazard Inundation Extents
Maximum Dam Release for Scenario Without Dam Failure
Map 13

Scale 1:35,000 @ A3

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Appendix A and B have been redacted

APPENDIX A - Contact Register
APPENDIX C - General Arrangement Plans
APPENDIX D - STORAGE AND DISCHARGE CURVES