HAWKESBURY-NEPEAN VALLEY: NSW SES DAM EMERGENCY ARRANGEMENTS

Annex G

Supporting document (NSW SES Response Arrangements for Hawkesbury-Nepean Valley) to the Hawkesbury-Nepean Flood Plan

Last Update: June 2020

CONTENTS

LIST OF TABLES

1 HAWKESBURY-NEPEAN DAM EMERGENCIES

There are a number of water supply reservoirs that could have some impacts within the Hawkesbury-Nepean Valley during dam emergencies including the Warragamba, Avon, Cataract, Cordeaux, Nepean and Mangrove Creek Dams.

Dam Safety Emergency Plans (DSEPs) have been prepared for each of these dams by the dam owners and should be followed during dam emergencies.

Emergencies at Warragamba Dam could have significant implications downstream in the area covered by this plan. As such the details of NSW SES response arrangements for dam emergencies at Warragamba Dam are further described in this annex.

Summary information about the Avon, Cataract, Cordeaux, Nepean and Mangrove Creek dams can also be found within Volume 2 of the relevant Local Flood Plans.

2 DETAILS OF THE DAM FAILURE WARNING SYSTEM FOR WARRAGAMBA DAM

This annex describes the downstream consequences and specific notification and warning arrangements for Warragamba Dam emergencies resulting from inundation of rainfall and runoff caused by weather events. It should be read in conjunction with the response arrangements detailed in the Hawkesbury-Nepean Flood Plan 2020-1.0.

For information in relation to dam failure warning systems resulting from 'Sunny Day' dam emergencies (defined as dam failure due to factors other than inflow floods), refer to the Warragamba Dam Safety Emergency Plan (DSEP) August 2019 (1) and the WaterNSW Dam Safety Emergency Plan Supporting Documentation August 2019.

2.1 INTRODUCTION

2.1.1 Warragamba Dam is built across the Warragamba River, 3.4 km upstream of the Nepean River junction, approximately 65 km West of Sydney. It is the primary water source for Sydney and the Blue Mountains. It has a catchment area of 9050km² and impounds Lake Burragorang, which is fed by the Cox's River and Wollondilly River and their tributaries, the Kowmung, Nattai and Wingecarribee rivers.

2.1.2 Warragamba Dam was completed in 1960 with a gated spillway. It was designed and constructed in accordance with prevailing engineering practice at the time and built to withstand floods with an AEP of 0.14 % (1 in 700 chance of happening in any year). Since then, flood estimation methods have improved, and dam design standards have changed. A review in the early 1980s found that the original spillway could not pass the volume of water

thought to be possible in the biggest floods (the Probable Maximum Flood – PMF).

2.1.3 The dam has now been upgraded to highest standards by constructing an auxiliary (bypass) spillway system. This new spillway consists of five small embankments known as fuse plugs. These are like individual earth and rock dam walls. Each fuse plug has a different crest height and they are designed to progressively overtop and erode away during a large flood where the original gated dam becomes so full that the original gated spillway capacity would be exceeded.

2.1.4 The combination of the original spillway gates and the auxiliary fuse plug spillway is expected to safely cater for extreme flood events. The fuse plugs would not begin to operate until a large flood of the magnitude of AEP 0.08 % (1 in 1200 chance of happening in any one year) is experienced. This means that by the time this level of flooding is reached, almost the entire valley downstream will have already been evacuated and the additional flood water that flows through the dam as the fuse plugs operate will have no impact on the evacuation process.

2.1.5 Warragamba Dam has been declared by Dam Safety NSW under the NSW Dams Safety Act 2015 and is categorised as an Extreme Consequence Category Dam by the NSW Dams Safety Committee.

There are currently no confirmed deficiencies in this dam that could lead to dam failure. However, although the dam is currently in good condition, an unsafe or emergency condition could still occur at any time due to extreme natural events. Dam failure from a cause not related to extreme natural events is always a possibility although the probability of occurrence is extremely low. (Refer to the Warragamba Dam DSEP and Supporting Documents for further information on dam emergencies not caused by natural weather conditions.)

2.2 DAM EMERGENCY SCENARIOS

2.2.1 Scenarios from the current 2015 dam break study used in the Warragamba Dam DSEP 2019 and considered for the purpose of the Hawkesbury-Nepean Valley Flood Emergency Plan include:

a. Probable Maximum Flood failure scenario

b. Flood triggered fuse plug failure.

2.2.2 In dam emergencies during flood conditions, warnings and evacuations would be occurring due to flooding. In those cases emergency services would be active and the public would be more prepared.

Probable Maximum Flood Failure Scenario

2.2.3 The PMF dambreak produces a water level of 84.57 m AHD at Wallacia, an increase of 20.5 m from the no dambreak scenario. Water levels begin to rise within half an hour and reach the peak approximately 4.5 hours after dambreak.

2.2.4 The flood wave reaches Penrith half an hour after dambreak and peaks after 3.5 hours. The incremental flood depth at Penrith is 10.4m, reaches a level of 42.43 m AHD.

2.2.5 At North Richmond and Windsor, the incremental flood depth is 4m, reaching a level of approximately 29 m AHD. Water levels begin to rise approximately 1 hour after dam failure and peak 16 hours after dambreak. Once the flood wave enters the Sackville gorge, the flood level steadily decreases, reaching a peak level of 16 m AHD at Webbs Creek.

2.2.6 To assess the maximum flood level possible due to concurrent flooding, the timing of the arrival of the Nepean inflow at Wallacia was lagged to coincide with the dam break flood wave. The effect is most significant at the dam and at Wallacia, with an increase in flood levels of 1.3m. Further downstream the effect is reduced when peak levels are dependent on floodplain storage.

Flood Triggered Fuse Plug Failure

2.2.7 The PMF inflow hydrograph was scaled down to reach the water level to just trigger failure of one, three and five fuse plugs to assess the incremental impact of each set of fuse plugs triggering.

2.2.8 The incremental depth increases from a single fuse plug failure scenario and all five fuse plugs failing is greatest at Wallacia, at almost 8m. The difference at Penrith and Windsor is 1.7m and 3m respectively.

2.3 NOTIFICATION PROCEDURES

2.3.1 The primary contact for dam emergency notification by the dam owner to the NSW SES is the NSW SES State Operations Centre which is staffed on a 24/7 basis.

2.3.2 The NSW SES State Operations Centre will subsequently notify the Hawkesbury-Nepean Incident Controller or the NSW SES Metro Zone On Call Officer (ZOCO) who will contact the relevant NSW SES Local Commanders. An alternate NSW State Emergency Operations Centre (SEOC) contact is available if this notification procedure was to fail.

2.3.3 A flow chart illustrating the notification arrangements for potential dam emergencies is shown in Attachment 1

2.4 WARNING

2.4.1 Dam emergency alerts will be issued by WaterNSW to NSW SES and are used to trigger appropriate response actions. Responses escalate as the alert level migrates from white to red. The conditions that define each of the alert levels (as identified in the DSEP 2019) are listed in Table 1 (see below).

2.4.2 The meaning of each alert level is as follows:

a. **White:** Preliminary alert to assist the NSW SES in its preparation. This is not a public alert. It indicates a potential issue/condition has been observed at the dam and is being investigated.

b. **Amber:** Alert level necessitating the warning of the population at risk to prepare for evacuation.

c. **Red:** Alert level requiring the immediate evacuation of the downstream population at risk.

2.4.3 Actions indicated as occurring at particular alert levels may be brought forward if the development of a flood warrants it.

Table 1: Warragamba Dam Emergency Alert levels

Alert	Defining Conditions - Flood
White Alert	Storage expected to exceed Full Supply Level (FSL) + 9.0m (RL = 125.72m AHD)
Amber Alert	Storage expected to exceed (FSL) + 11m (RL 127.72m AHD)
Red Alert	Storage expected to exceed Crest Road Level (RL 129.75m AHD)

Note: RL means reduced level (expressed in m AHD) referenced to a common datum.

2.4.4 The NSW SES will disseminate dam failure warnings to the public based on advice from WaterNSW.

2.4.5 WaterNSW staff will keep the NSW SES informed of the emergency, its severity and most likely consequences. The dam alerts will be activated in sequence as the storage level rises during the course of a major flood event and will be sent to the NSW SES as they occur.

2.4.6 The following tables outline the notification, warning and evacuation arrangements for dam emergencies at Warragamba Dam (Tables 2, 3 and 4).

Table 2: Notification, Warning and Evacuation Arrangements for a potential floodwater discharge from Warragamba Dam – White Alert

WHITE ALERT	
Flood:	Storage expected to exceed FSL (116.72m AHD) + 9.0m (RL 125.72m AHD); or
Stakeholder	**Arrangements and Actions**
Dam Owner (WaterNSW)	▪ Advise NSW SES State Operations Centre of White Alert Level being reached and provide regular updates on the situation at the dam.
SES OCC	▪ Receive notification from dam operator. ▪ Advise the Hawkesbury-Nepean Incident Controller and NSW Metro Zone. ▪ Advise SEOC.
NSW SES Metro Zone / or Incident Controller	▪ Receive notification from NSW SES SHQ. ▪ Advise NSW SES Local Commanders and NSW SES Units. ▪ Advise the Regional Emergency Management Officer (REMO), other agencies and functional areas. ▪ Consider the need for outside of area assistance for warning and evacuation operations.
NSW SES Local and Unit Commanders	▪ Confirm NSW SES Metro Zone HQ has been notified. ▪ Activate Local Flood Plans. ▪ Refer to Local Flood Plans for agencies to notify that the White Alert Level has been reached. (See Dam Failure Alert Notification Arrangements Flowchart – Attachment 1).
LEOCON/Other Agencies	▪ When requested by NSW SES Local Incident Controller, coordinate support.
People at Risk	▪ No action required. ▪ Some evacuations may be necessary due to mainstream riverine flooding.

Table 3: Notification, Warning and Evacuation Arrangements for a potential floodwater discharge from Warragamba Dam - Amber Alert

AMBER ALERT	
Defining Conditions:	Storage expected to exceed FSL (116.72m AHD) + 11.0m (RL 127.72 AHD).
Stakeholder	**Arrangements and Actions**
Dam Owner (WaterNSW)	▪ Advise NSW SES State Operations Centre of Amber Alert Level being reached and provide regular updates on the situation at the dam.
NSW SES OCC	▪ Receive notification from dam operator. ▪ Advise the NSW SES Sydney Hawkesbury-Nepean Incident Controller and NSW SES Metro Zone. ▪ Advise SEOC.
NSW SES Metro Zone / Incident Controller	▪ Notify NSW SES Local Incident Controller, NSW SES units and NSW SES LHQ. ▪ Provide NSW SES Flood Bulletins and Evacuation Warnings to the media. ▪ Coordinate provision of out of area assistance for warning and evacuation operations. ▪ Coordinate the notification of other agencies.
NSW SES Local Commanders	▪ Confirm NSW SES Metro Zone Headquarters has been notified. ▪ Coordinate the delivery of Evacuation Warning to at-risk residents. ▪ Coordinate the notification of other agencies as listed in the Local Flood Plans.
LEOCON/Other Agencies	▪ When requested by the NSW SES Incident Controller, coordinate support.
People at Risk	▪ Prepare homes for inundation, pack valuables, mementos and pets and prepare to evacuate. ▪ Notify NSW SES doorknockers if transport to evacuation centres will be required. ▪ Some evacuations may be necessary due to mainstream riverine flooding.

Table 4: Notification, Warning and Evacuation Arrangements for a potential floodwater discharge from Warragamba Dam - Red Alert

RED ALERT	
Defining Conditions:	Storage expected to exceed Crest Road Level (129.75m AHD)
Stakeholder	**Arrangements and Actions**
Dam Owner	▪ Advise NSW SES State Operations Centre of Red Alert Level being reached and provide regular updates on the situation at the dam.
SES OCC	▪ Advise NSW SES State Controller. ▪ Receive notification from dam operator. ▪ Advise the Hawkesbury-Nepean Incident Controller and NSW SES Metro Zone. ▪ Advise SEOC
NSW SES Metro Zone / Incident Controller	▪ Notify NSW SES Local Incident Controller, NSW SES Units and NSW SES Local Commanders. ▪ Advise the REMO. ▪ Coordinate the notification of other agencies. ▪ Confirm that residents immediately downstream of the dam have been notified of Red Alert Level being reached. ▪ Activate the Standard Emergency Warning Signal (SEWS) and ensure that Evacuation Orders are broadcast over the radio stations ▪ Coordinate provision of out of area assistance for evacuation operations. ▪ Ensure that evacuation centres are ready to receive evacuees. ▪ Coordinate transport of evacuees without their own vehicles.
NSW SES Local Commanders	▪ Confirm NSW SES State and Metro Zone Headquarters have been notified. ▪ Evacuate at-risk residents. ▪ Conduct Evacuation of downstream residents by doorknock and public address systems from emergency service vehicles.
LEOCON/Other Agencies	▪ When requested by the Hawkesbury-Nepean Incident Controller, coordinate support.
People at Risk	▪ Evacuate to friends and family or else to the nearest evacuation centre or assembly area.

Table 5: Dam Emergency Alert Cancellation

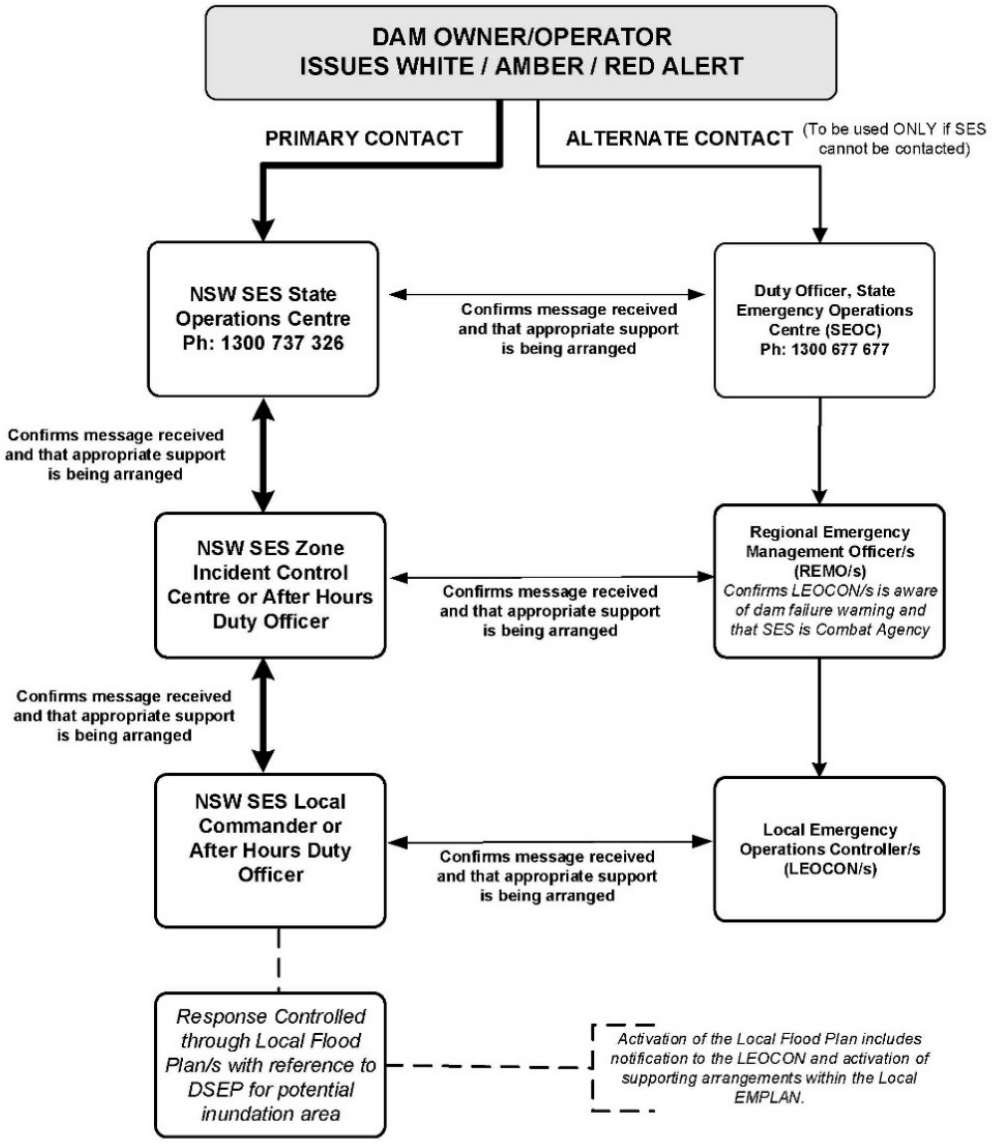
DAM EMERGENCY ALERT CANCELLATION	
Defining Conditions:	Dam owner assesses threat and advises whether the risk has passed.
Stakeholder	**Arrangements and Actions**
Dam Owner	▪ Advise NSW SES State Operations Centre of the outcome of the risk assessment by the dam owner.
SES OCC	▪ Receive notification from dam operator. ▪ Advise the Hawkesbury-Nepean Incident Controller and NSW SES Metro Zone. ▪ Advise SEOC.
NSW SES Metro Zone / Incident Controller	▪ Following risk assessment of the dam by the dam owner, decide in consultation with State Controller whether to issue an 'All Clear'. ▪ Issue 'All Clear' message to NSW SES Local Incident Controller, NSW SES units, NSW SES Local HQ and NSW SES State HQ. ▪ Advise the REMO that 'All Clear' has been issued. ▪ Issue 'All Clear' message via media including radio stations internet (e.g. Facebook, Twitter). ▪ Coordinate issue of 'All Clear' message at evacuation centres or by phone/doorknock. ▪ Deliver 'All Clear' message to other agencies and functional areas
NSW SES Local Commanders	▪ Coordinate issue of 'All Clear' message at the local level (e.g. by phone/doorknock). ▪ Deliver 'All Clear' message to other agencies as necessary.
LEOCON/Other Agencies	▪ When requested by the Hawkesbury-Nepean Incident Controller, coordinate support.
People at Risk	▪ Stay home, return home or await further advice.

LIST OF REFERENCES

1. WaterNSW *Warragamba Dam Safety Emergency Plan.* s.l. : WaterNSW, August 2019.

ATTACHMENT 1

NSW SES Notification Arrangements for Potential Dam Failure



NOTES: (As at 1 May 2019)

1. Dam owners should only contact the SEOC if the NSW SES State Operations Centre (SOC) cannot be contacted.
2. The first priority for notification is to contact the NSW SES State Operations Centre. If unavailable, contact the SEOC. At each level, the contacted agency should notify the alternate contact at the same level, before making contact further down the line.
3. The triple zero (000) number for emergency services should only be used if both the NSW SES and the SEOC cannot be contacted, as it is likely the triple zero (000) operators will have difficulty dealing with the very unusual case of potential or actual dam failure.
4. Dam owners should send their Draft DSEP to the NSW SES for review of the emergency management arrangements (nswses.communityplanning@ses.nsw.gov.au).