PLANNING AND ENVIRONMENT COMMITTEE 13 JUNE 2018	4

INDEPENDENT REVIEW INTO COPPERLODE FALLS DAM EMERGENCY ACTION PLAN ACTIVATION, 28 MARCH 2018

C Posgate | 5/1/1-02 | #5752655

RECOMMENDATION:

That Council;

1. **Notes the independent post incident review into Copperlode Falls Dam Emergency Action Plan; and**

2. **Agrees with the recommendations contained within the independent review; and**

3. **Receive quarterly updates on progress with the implementation of recommendations.**

EXECUTIVE SUMMARY:

Council requested a full and independent review of the flooding events which occurred between the 26th and 27th March 2018 as a result of ex-Tropical Cyclone Nora.

It was determined that in order to accurately assess the flooding events and Councils response, a number of independent reviews were required in specific areas to be addressed;

1. Forensic review of the Redlynch Valley rainfall event of 26 March 2018

2. Analysis of the flooding caused by the rainfall event over the balance of Cairns

3. Review of the Copperlode Dam Emergency Action Plan.

This reports deals only with the activation of Copperlode Falls Dam Emergency Action Plan which is informed by the review of the hydrological modelling of the dam spillway overflow conducted by GHD.

Separate reports will be provided to Councils for items one and two, however a holistic approach and interdependencies have been addressed across all three reports.

Ironside Risk Partners were engaged to undertake the independent review into the activation of the Copperlode Falls Dam Emergency Action Plan on 26 March 2018. The review focused on all aspects of the emergency response, including planning, execution, communication and outcomes.

The review highlights that Council Officers performed well during the event and discharged their responsibilities in relation to the event despite that the time of day and severe weather conditions making communications difficult.

There are opportunities for improvement and the review presents 41 recommendations that centre around streamlining processes and communication, creating clear consistent duty cards for officers and addressing activation and notification processes.

Council is committed to implementing recommendations made by Ironside Risk Partners to ensure the EAP informs good practice to protect public safety. Council will continue to progress the installation of an early warning system to notify the population at risk in the extremely unlikely event of a dam emergency. Community engagement will re-commence in August 2018, which will involve consultation with key stakeholders as well as general communications to the community regarding construction progress.

Council officers will provide regular reports via the Water & Waste Committee on the implementation status of these recommendations.

BACKGROUND:

Tropical Cyclone Nora hit the western side of the Cape York Peninsula at 11:25 on Saturday March 24 as a category 3 system. Nora was downgraded to a tropical low on Sunday 25 and the associated trough extended to Cairns causing widespread heavy rain. Cairns airport received 53mm, 217mm, and 32mm in the 24 hour periods from 9am 25 March.

The Copperlode Falls Dam catchment leading up to and including 27 March 2018 resulted in 628 millimetres of rain falling in the area of the dam and its spillway reaching a water height of 2.405 metres.

The Copperlode Falls Dad (CFD) Emergency Action Plan (EAP) has been developed and maintained along guidelines provided by the Department of Natural Resources, Mines and Energy (DNRME), the regulator for referable dams in Queensland. The CFD EAP was last reviewed and updated in October 2017 and was accepted by the DNRME Director Dam Safety.

COMMENT:

Event Response

There are 3 progressive stages of escalation relating to an event that triggers the EAP, ‘Alert’, Lean Forward’ and then finally ‘Stand Up’. Due to heavy rainfall in the catchment, the EAP was initially brought to ‘ALERT’ at 6.32am on Monday 26th by the Water and Waste. Further escalation was not required as the water level over the spillway peaked at 1.33m at 9.08am and dropped from that level to just below 1m at 5pm.

Escalation to ‘LEAN FORWARD’ then occurred at 11.00pm, nine minutes after the water level over the spillway reached 2m. Further escalation, to ‘STAND UP’ was not triggered, as the water level over the spillway did not exceed 3m. EAP ‘STAND DOWN’ was initiated at 9:55pm on Tuesday 27th when the dam fell to below 1m over the spillway and falling, with no likelihood of further immediate events.

Freshwater Creek Flooding

The extremely heavy rainfall on the night of the 26th March caused a significant flash flood in the Freshwater Creek area. While the scope of this report does not include a hydrological analysis, it does draw upon the post-event analysis done by GHD, which indicates that the timeline of events suggests that the water from the CFD spillway was not the primary cause of this flooding.

OPTIONS:

Option 1: (Recommended)

That Council;

1. Notes the independent post incident review into Copperlode Falls Dam Emergency Action Plan; and

2. Agrees with the recommendations contained within the independent review; and

3. Receive quarterly updates on progress with the implementation of recommendations

Option 2:

That Council notes the report and request additional independent review of the Copperlode Dam Emergency Action Plan.

CONSIDERATIONS:

Corporate and Operational Plans:

This report relates to the following strategic goal identified in Council's Corporate Plan: Liveability – ensure our community is prepared for disasters.

Statutory:

Council has statutory obligations under the *Disaster Management Act (2003)* for management of natural disasters such as floods and cyclones.

Policy:
There are no specific policies of Council relevant to this matter.

CONSULTATION:

Council Officers whose role requires actions under the Copperlode Dam Emergency Action Plan were consulted during the review as well as the CEO, Mayor, Divisional Councillor and the Dam Safety Regulator.

ATTACHMENTS:

Ironside Risk Partners Independent Review of the Emergency Action Plan and its application doing major weather event on 26 March 2018

Christine Posgate
General Manager Human Resources & Organisational Change

John Andrejic
Chief Executive Officer

IRONSIDE
RISK PARTNERS

Review of the EAP and its application during major weather event on 26 March 2018

Prepared for: Cairns Regional Council

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Document Classification

This document is classified Confidential.

Version Control

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Oliver Binz	11/4/2018	0.1	Initial Draft
Oliver Binz	4/5/2018	0.2	Draft for peer review
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Phil Hourigan	7/5/2018	0.4	Peer review
Oliver Binz	8/5/2018	1.0	First draft for review
Oliver Binz	14/5/2018	2.0	Minor updates and release of draft
Oliver Binz	28/5/2018	3.0	Release of final document

Document Content

1. Executive Summary

Cairns Regional Council (CRC) engaged Ironside Risk Partners (Ironside) to conduct a post incident review into how CRC applied the Emergency Action Plan and managed events at the Copperlode Falls Dam (CFD), brought to bear because of a severe rain event on 26 March 2018.

Post incident reviews provide a unique opportunity to assess the effectiveness of all aspects of the emergency response, including planning, execution, communication and outcomes.

1.1. Emergency Action Plan

The CFD Emergency Action Plan (EAP) has been developed and maintained along guidelines provided by the Department of Natural Resources, Mines and Energy (DNRME), the regulator for referable dams in Queensland. The CFD EAP was last reviewed and updated in October 2017 and was accepted by the DMRME Director Dam Safety.

The review of the CFD EAP through the lens of use and application by CRC action officers during the event highlighted several areas for possible improvement. Key recommendations for improvement of the EAP include:

- Improved internal communication protocols to improve the efficiency and effectiveness of communications and information flow. The EAP relies on one-to-one communication, which during a time critical event can lead to significant delays. The timing of the event (late at night) further exacerbated this issue. Ironside recommends the adoption of collaborative communication tools such as conference call facilities to significantly streamline communications and free up the action officers to perform other important actions.
- Responsibilities and actions which action officers are required to perform are not clearly articulated in a single section of the EAP. Action officers are required to read various sections and appendices to determine what actions are required. Ironside recommends the development of “Duty Cards” for each role. Duty cards will clearly list actions required during each phase of activation, as well as providing any additional guidance or checklists.
- The CFD EAP contains contact details for all action officers and other stakeholders, which may be required to be contacted during an event. Primary, secondary, and in some instances tertiary contact details are provided for each person. However, the EAP does not provide any information related to alternate contact persons. Ironside recommends including a list of backup personnel in the EAP.
- The Local Disaster Management Group (LDMG) is well trained and experienced at dealing with disasters and disaster preparedness, and should therefore be leveraged to its full potential. It is recommended that the LDMG is alerted as soon as the EAP is activated (ALERT) and the role of the LDMG fully integrated into the EAP response. The broader situational awareness and resources afforded the LDMG may provide additional decision-making support to CFD EAP action officers.

Additional recommendations related to the EAP are contained in the body of this report. A consolidated list of all recommendations made in this report are contained in Appendix A.

1.2. CRC Response

Ironside also reviewed how CRC officers performed their actions and discharged their responsibilities in relation to the event. Key findings and recommendations include:

- The time of day and severe weather made communications difficult. This was not aided by the communications protocols documented in the EAP (detailed above). While CRC action officers diligently and professionally discharged their duties, some communication was significantly delayed. Most notable, the Manager Marketing and Communications (MMC) was not alerted by the Manager Operations (MO) to the event until 12.23pm, over an hour after the EAP escalated to LEAN FORWARD. The Manager Operations had already made

and received 23 communications during that time. Ironside recommends improvement and streamlining of the communications protocol, including clear priorities for each action officer.

1.3. Population at Risk Notification

Notification of Population at Risk (PAR) is a critical requirement under the EAP, however no communications where made to PAR during this event. Examination shows there where several issues which led to PAR not being notified. These include:

- The rapid onset of the event followed by rapid easing, meant that by the time action officers considered alerting PAR, conditions where already improving. Consideration was given to the risk posed by the water spilling over the dam spillway, compared to the risk of potentially distressing residents and causing people to leave their homes during a severe weather event. Although a requirement in the EAP, the Local Disaster Coordinator (LDC), in consultation with the Manager Operations, made a conscious decision not to the alert PAR.
- The MMC did not to alert PAR, based on the recommendation of the MO. At the time the MMC received notification of the event from the MO, conditions where easing.

1.4. Other Recommendations

Additional recommendations include:

- The Copperlode Falls Dam Caretaker (CFDC) represents the eyes and ears of the emergency response team, and as such requires reliable communication tools on location. While CRC has made improvements in recent times, there are still reliability and accessibility issues. A review of available options is recommended.
- It is a requirement within the EAP to conduct annual exercises. While CRC has consistently met this requirement, an opportunity exists to significantly improve the effectives and value of these exercises. Effective exercises provide a unique opportunity to train, test and improve. A number of issues detailed in this report are likely to have been revealed and addressed as a result of more effective exercises.

1.5. Freshwater Creek Flooding

The extremely heavy rainfall on the night of the 26th March caused a significant flash flood in the Freshwater Creek area. While the scope of this report does not include a hydrological analysis, the timeline of events suggests that the water from the CFD spillway was not the primary cause of this flooding.

The Police Communications Centre received the first '000' call in relation to flooding in Redlynch at 10:59pm on 26 March 2018.

The CFD spillway level reached 2m at 10.51pm, 8 minutes before the first call was made to '000'. The Treatment Coordinator (TC) escalated the EAP to LEAN FORWARD at 11.03pm. GHD modelling shows that water from the spillway takes approximately 45-60 minutes to travel down Freshwater Creek to the vicinity of the Crystal Cascades Caravan Park.

The CFD water level continued to rise until it peaked at 2.4m above the spillway at approximately 11.45pm. Therefore, the maximum flow from the dam would have arrived at the caravan park between 12.30am and 12.45am on 27 March. Peak flooding Redlynch Valley Estate receded at approximately 11.30pm[1].

[1] *Independent Assessment Report Rainfall and Flooding Event of 26 March 2018 in Redlynch Valley Cairns Stage 1 Report (BMT)*

It is therefore a reasonable deduction that the water over the spillway was not the primary cause of the flash flooding experienced along Freshwater Creek. This is further supported by the fact that previous events with high water levels over the spillway (dam level reached 2.53m over the spillway during Cyclone Rona in February 1999) did not result in significant flooding on Freshwater Creek.

It was also determined that any PAR notifications resulting from the CFD EAP requirements would not have been received by residents in time to have provided warning prior to the flash flooding.

1.6. Summary

There are opportunities to significantly improve the EAP by streamlining processes and communication, creating clear and consistent duty cards and addressing activation and notification processes.

CRC officers performed well during the event. While there were delays in completing some tasks that led to some actions no longer being appropriate by the time officers came to address them, these delays were generally caused by the procedures used in the EAP.

2. Introduction

Cairns Regional Council (CRC) engaged Ironside Risk Partners (Ironside) to conduct a post incident review into how CRC managed events at the Copperlode Falls Dam (CFD), brought to bear because of a severe rain event on 26 March 2018.

2.1. Aim

The aim of the review was:

- To determine how CRC staff and management responded to the event;
- To determine the effectiveness of the CFD Emergency Action Plan (EAP);
- To determine which aspects of the response worked well;
- To determine those areas where there were issues;
- To identify areas for improvement; and
- To deliver the findings to CRC management with the objective of learning from the event and improving future responses to incidents at the CFD.

2.2. Scope

The scope of works was as follows:

- Review any related documentation from before, during and after the event;
- Conduct post-incident interviews with key stakeholders, including CRC management, staff, GHD engineers, Councillor Linda Cooper and the Mayor;
- Develop findings; and
- Deliver findings to CRC, with recommendations to improve future response to incidents.

2.3. Related Events

This review and report is focused on the events at the CFD, however, the rain that caused the rise in dam level, also caused localised flash flooding in parts of Redlynch. This review therefore also considers the relationship between the two events.

2.4. Background

Construction of CFD was completed on 25 March 1976. The dam is located 22km from Cairns along Lake Morris Road. The upper reaches of Freshwater Creek provide the dam with a catchment of 44km^2.

CFD is a 45m high and 122m long earth rock fill embankment with an impervious clay core. It has an un-gated spillway consisting of a concrete control crest structure and flip bucket located on the northern bank.

The CFD is considered a referable dam under the *Water Supply (Safety and Reliability) Act 2008*. This act is administered by the Department of Natural Resources, Mines and Energy (DNRME).

The CFD is owned and operated by the CRC.

2.5. Emergency Action Plan

As owner and operator of the CFD, CRC is required to develop and maintain an Emergency Action Plan (EAP) for the CFD.

The EAP must be reviewed annually and approved by the chief executive. Each revision must also be approved by DNRME and is then published on the DNRME website.

The *Emergency action plan for referable dam guideline 2017* (Published by DNRME) provides detailed guidance to dam owners and operators for the development of their EAPs.

2.6. Use of the CFD EAP

The description below refers to Probable Maximum Flood (RP2) or Probable Maximum Flood with and Overtopping Breach (RP3) event. (This review did not consider the Sunny Day Failure (RP1) event scenario.)

In the event of water overflowing the spillway the application of the EAP is triggered when the level reaches 1m over the dam spillway. At that time the activation level will be “ALERT”. Upon activation of the ALERT level, various stakeholders have specific actions they are required to perform. Depending on the situation, ALERT may also trigger the notification of Population at Risk (PAR).

If the level of water over the spillway exceeds 2m the activation level is escalated to “LEAN FORWARD”. The LEAN FORWARD state requires additional actions and involves a greater number of stakeholders. LEAN FORWARD triggers the notification of PAR.

If the level of water over the spillway exceeds 3m the activation level is escalated to “STAND UP”. STAND UP represents the highest level of escalation within the CFD EAP and requires PAR to be notified to evacuate the area.

When levels fall back below 1m over the spillway, the EAP de-escalates to “STAND DOWN”. STAND DOWN is focused on reviews and reporting. If communication was made with media or PAR during the active phases, the STAND DOWN phase requires the notification of the Media and PAR to inform the closure of the EAP.

It must be noted that the CFD EAP does not have any provision for managing the release of water from the dam, as the CFD is an ungated dam and does not provide the ability to actively manage flows over the spillway.

3. Description of Event

3.1. Timeline – 26th and 27th March 2018

This review centres on the events brought about by an unprecedented rainfall event in the CFD catchment area on the evening of the 26th March. The following timeline was created for the purposes of this report based on BOM data and CFD SCADA logs from the dam monitoring systems.

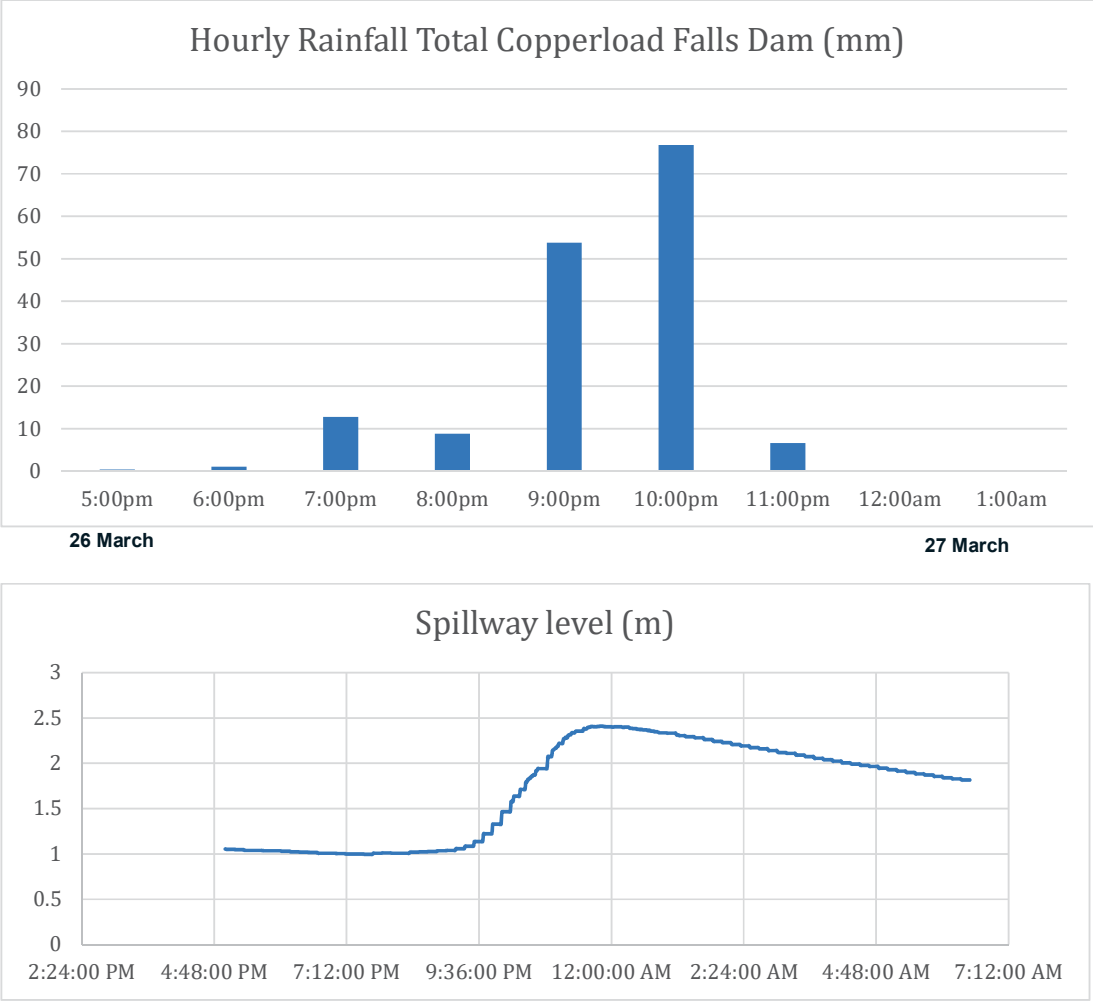

Figure 1: Copperload Falls Dam Spillway Level 5:00pm 26 March to 6:30am 27 March. Source BOM and CRC SCADA

3.2. EAP Activation Timeline

This section provides a high-level overview of events. It does not detail all the communications and activities that took place.

26 March 2018

6.28 am – The CFD Caretaker (CFDC) informs the Treatment Coordinator (TC) that the water level over the spillway had reached 1.26m.

6.32am – The EAP is activated and brought to ALERT level by the TC.

9.08am – Water was 1.33m over the spillway, however the rain had stopped, and the level had stopped rising.

5.00pm – CRC W&W continued to monitor levels throughout the day and by approximately 5.00pm the level over the spillway dropped below 1m (96cm). With the possibility of further rainfalls, the EAP was not stood down at this time.

5:09pm – BOM Flood Warning Number 3 - Barron River issued and advised river levels easing Barron River catchment downstream from Mareeba. River levels are expected to remain below the minor flood level during Monday.

6.38pm – Local Disaster Coordinator – LDC receives notification from the MO that the water level has reached 1.01m and that the EAP is activated. (LDC was not notified of the activation in the morning as it is not an EAP requirement.)

6:42pm – BOM Severe Weather Warning for heavy rain issued.

7:00pm – Rainfall levels increase significantly

8.00pm – The Australian Bureau of Meteorology (BoM) issued a Severe Weather Warning for damaging winds and heavy rainfall. Advised that heavy rain may lead to flash flooding about parts of the peninsular, Gulf Country, North Tropical Coast and Tablelands, Northern Goldfields and Upper Flinders and Herbert and Lower Burdekin forecast districts. Cairns was identified as a location that may be affected. Possible rainfall was estimated at 100-200mm over a 6 hour period, with some locally higher totals possible.

10.10pm – The CFDC advised the TC there had been 152mm (measured at the CFD spillway rain gauge) of rain at the dam since 7.00pm. Water level over the spillway had risen from 1.2m to 1.63. Conditions at the dam are torrential and there is significant lightning activity. Internet communication is becoming unreliable.

10.27pm – BOM Severe Weather Warning 1 for damaging winds and heavy rainfall issued. Noted extremely heavy rainfall over 100mm per hour occurring west of Cairns (included Copperload Alert BOM sensor). Warning included note that it may lead to flash flooding.

10.43pm – The TC advises the CFDC that the water level over the spillway has reached 1.9m (as measured by sensors at the spillway connected to the SCADA network).

10.44pm – The LDC receives a severe weather warning from the State Disaster Communication Centre.

10.51pm – Water level over spillway reaches 2.07m (information from SCADA)

10.58pm - MO calls General Manager Waste and Water (GMWW) to advise spillway at 1.9m and rising rapidly.

10.59pm – Brisbane Police Communications centre receives the first of 25 calls to 000 asking for assistance because of flooding in parts of the Freshwater Creek area and the Crystal Cascades Caravan Park.

11.00pm – The MO calls the TC to advise that level is now 2.1m over the spillway. The EAP is activated to LEAN FORWARD by the TC at 11:02pm.

11:25pm – MO calls GMWW to advise spillway at 2.1m.

11:30pm – GMWW calls CEO to advise of situation and EAP at LEAN FORWARD

11.45pm – Team Leader Water Treatment (TLWT) informs GMWW and MO that water level has reached 2.4m. Level has appeared to be have peaked.

27 March 2018

12:00am – General Manager Waste and Water (GMWW) called DNRME Duty Officer (Clair Stirling) to advise that the EAP had gone to LEAN FORWARD.

12:02am – CEO received call from GMWW to advise spillway at +2.4m after more than 200mm of rain. Asked about status of EAP. GMWW advised that rain had past and the spillway level was dropping. Asked if LDC had been advised which GMWW confirmed had been completed. Asked if PAR had been notified which GMWW advised had not been completed. GMWW also advised that recues had been conducted by SES and that two persons were missing.

12:02am – LDC received email from Cheryl-Lee Fitzgerald (QFES) titled 'EM FNR Email' advising they will advise on emergency accommodation requirements and that the Emergency Management Coordinator (EMC) was going to the Regional Operations Centre (ROC).

12:08am – LDC received CFD update from MO advising spillway was at 2.4m and stationary. Email notes that MO saw quick water rescues occurring near Rocks Caravan park.

12:18am – BOM Severe Weather Warning 1 for heavy rainfall and damaging winds issued. Stated that extreme rainfall rates had eased west of Cairns, but Severe Weather Warning remained in place.

12:20am – CRC Mayor received call from GMWW advising that the EAP had been activated to LEAN FORWARD.

12:20am – CEO called LDC to ask for information regarding the rescues at the Crystal Cascades Caravan Park.

12:23am – MMC received call from MO to advise spillway over 2m. MMC asked what actions to take and was advised that level was dropping so no action needed.

12:30am – GMWW called Chair LDMG to advise that the EAP had gone to LEAN FORWARD. Calls not answered so left message.

12:38am – CFDC emailed TC with Dam Inspection Report and photographs.

12:45am – GMWW, MO, TC and LDC discussed risks to PAR and decided that no alert was required as the situation had eased and the spillway level was falling.

12:57am – BOM issued Flood Warning 5 which advised moderate flood levels possible at Cairns Airport on Tuesday and that the severe weather warning for the catchment had been downgraded.

1:30am – CEO received call from LDC to advise that the two missing persons had been located.

1:34am – Chris Nielson (DRNME Regulator) sends SMS to GMWW acknowledging notification of EAP activation.

2:00am – CFDC conducted visual inspection of spillway. Level was noted as +2.11m.

5:00am – CEO spoke to LDC re notification of Chair of LDMG to ensure they were aware of LDMG meeting and would attend.

6:00am – LDMG meeting conducted.

4. Observations and Recommendations

This section details how CRC managed the event, and the effectiveness of the EAP. Where appropriate, recommendations are made for improvement of the response and/or the EAP.

4.1. Activation of the EAP

4.1.1. Description

Activation of the CFD EAP is initiated based on the height of the water going over the spillway. The EAP is activated and brought to "ALERT" at 1m above the spillway.

4.1.2. Observations

4.1.2.1. EAP

The EAP does not contain a clearly articulated activation process. Although the roles and responsibilities attached to various roles require specific actions once the spillway level exceeds 1m, the process for activation is not detailed within the document.

While "Activate and stand down the EAP" is listed as a responsibility for the TC in Table 3 Section 6 of the EAP, EAP activation is not listed as an action for the TC at ALERT level within the PMF (RP2 and RP3) Communication Protocol.

Figure 1 – Notification Flowchart Overview in Section 5 does not accurately reflect the notification process detailed throughout the EAP

The EAP does not require the notification of the Local Disaster Coordinator (LDC) at initial activation (1m above spillway). The LDC only needs to be notified once the activation level reaches "LEAN FORWARD" at 2m above the spillway.

4.1.2.2. CRC Response

Due to earlier heavy rainfall in the catchment, the EAP was initially activated by the MO at 6.32am. This was 4 minutes after being contacted by the CFD Caretaker (CFDC) contacted the Treatment Coordinator as required in the EAP *(PMF (RP2 & RP3) Communication Protocol).*

Water levels dropped for 8 hours following the activation of the EAP. When the level dropped below 1m (96cm) at 5.00pm, the EAP remained at ALERT due to the possibility of further rainfall.

It is noted that all action officers had ready access to the EAP in a number of formats and made use of it during the event.

4.1.3. Recommendations

1. Update the EAP to include a clear activation process and activation process diagram.
2. Consider the use of automated alerting of spillway levels to action officers using the SCADA sensors and network to minimise delays and improve situational awareness.[2]
3. Include "Activate EAP" as an activity for the TC at ALERT level.

[2] At the time of writing this report, the CRC W&W was already implementing a system to automatically alert the TC, MO and CFDC via SMS at specific threshold levels (0.5, 1.0, 1.5, 2.0, 2.5 and 3.0m) #5716727.

4.2. Activation and Escalation Levels

4.2.1. Description

Activation and escalation triggers of the CFD EAP correspond to specific levels of the water going over the spillway. The EAP specifies the following triggers for RP2 and RP3:

Level of water above spillway	Activation Level
1m	ALERT
2m	LEAN FORWARD
3m	STAND UP

In addition, there is a “Stand Down” trigger of “1m Above Spillway and Falling”.

4.2.2. Observations

4.2.2.1. EAP

Ironside was unable to determine how the trigger levels where initially determined and if they are appropriate when aligned with the required response for each level.

The EAP only states that the TC is responsible for the activation and escalation of the EAP. The EAP does not provide guidance as to the process for decision making and communicating further escalation to LEAN FORWARD or STAND UP to all action officers.

4.2.2.2. CRC Response

Due to heavy rainfall in the catchment, the EAP was brought to Alert at 6.32am on Monday 26th by the MO. Further escalation was not required as the water level over the spillway was peaked at 1.33m at 9.08am and dropped from that level to just below 1m at 5pm.

Escalation to LEAN FORWARD then occurred at 11.00pm, nine minutes after the water level over the spillway reached 2m.

Further escalation, to STAND UP was not triggered, as the water level over the spillway did not exceed 3m.

EAP STAND DOWN was initiated at 9:55pm on Tuesday 27th.

4.2.3. Recommendations

4. A review of the EAP trigger points is recommended. Considerations should include:
    a. The impact that various levels of water over the spillway have on the downstream community.
    b. The maximum rate the level of water over the spillway can rise.
    c. The time taken for the water to travel from the spillway to areas where there could be people or property at risk.
    d. The time required to issue a warning to residents and visitors in areas that may be affected.
    e. The time required for people to appropriately respond to any warnings.
    f. An appropriate buffer to allow for unforeseen delays.

5. The EAP should clearly define the process for escalation of the EAP.
6. Additional inputs for activation and escalation in addition to water level over the spillway should be considered.

4.3. Communication - Internal

4.3.1. Description

Since there are no means to control flows from the dam, the CFD EAP activities centre on the requirement to communicate with key stakeholders and, if required, warn the Population at Risk (PAR) of potential danger resulting from water spilling over the spillway or failure of the dam structure. This section considers only internal communication.

4.3.2. Observations

4.3.2.1. EAP

The EAP addresses and specifies all internal communication requirements.

The EAP does not provide clear guidance on the means used to communicate (i.e. email, phone, SMS, conference system).

Section 5 *Table 2: Notification Listing Contacts* provides first preference, second preference and third preference phone contact numbers for action officers and stakeholders requiring notification. The EAP does not provide alternative contact persons in the event of the primary person cannot be contacted.

The EAP does not provide clear guidance on what information needs to be communicated in each instance and when this is to be done by. Wording in the *PMF (RP2 & RP3) Communication Protocol* includes: “Provide updates”, “Provide regular updates”, “Notify”, “Provide information”.

Section 6.1.1 Internal Communication Methods refers to the communication of the EAP with various stakeholders. It does not provide guidance on how to conduct internal communications during an event.

Appendix 4 of the EAP provides a SITREP template (#4592362), however, it is only referred to once in *Table 3: Roles and Responsibilities* for use by the Treatment Coordinator. The wording in that instance is: “When the spillway is discharging at 1.0m and above provide SITREP as appropriate.”

At LEAN FORWARD, the EAP requires the LDC to notify the LDMG. LDMG notification is not required at ALERT.

4.3.2.2. CRC Response

CRC Action Officers performed well under difficult circumstances.

Communication was made more difficult due to the timing of the event (outside of core business hours and very late in the evening). Most CRC stakeholders were asleep when the EAP escalated to LEAN FORWARD.

The volume of phone calls, emails and SMSs during the event was considerable. All stakeholders were notified as required in the EAP, however in some instances the information was delayed. These delays resulted from the sheer volume of calls some action officers are required to make and the difficulty of reaching some stakeholders out of hours.

The LDC made a number of unsuccessful attempts to contact the Chair of the LDMG via his mobile phone. No attempt was made to contact the Deputy Chair.

4.3.3. Recommendations

7. The EAP currently relies on one to one communication, resulting an individual action officers having to make or receive large numbers of calls. (e.g. The MO initiated and received in excess of 46 communications within a 3-hour period) This process is inefficient and can lead to delays in the dissemination of important information. Ironside recommends the use of a conference system and coordinated conference calls where information can quickly and accurately be provided to all action officers.
8. Guidance within the EAP on the timeframes and information to be included in updates is limited. Ironside recommends creating clear guidelines on the frequency of updates and the information the updates should contain. Where appropriate templates should be utilised. Coupled with the use of conference facilities, information flows can be significantly streamlined.
9. The EAP should also include secondary contacts in the event the primary contact is not available.

4.4. Communication – External (Excluding PAR)

4.4.1. Description

Escalation of the CFD EAP to LEAN FORWARD requires the CRC to contact several external stakeholders including the QFES, the Mayor and the regulator.

4.4.2. Observations

4.4.2.1. EAP

At LEAN FORWARD the EAP stipulates that the GMWW contact the CEO CRC, Dam Safety Regulator and Mayor of Cairns. Contact phone numbers are provided in *Figure 1 – Notification Flowchart Overview*.

4.4.2.2. CRC Response

All external stakeholders were contacted as required by EAP but there were delays in some instances, due to the number of calls to be made while also conducting operational calls (i.e. calls between action officers to manage the situation) and the difficulty in contacting some people in the middle of the night.

4.4.3. Recommendations

There are no recommendations for this section.

4.5. Communication – Population at Risk (PAR)

4.5.1. Description

Notification of PAR is a key requirement of the EAP. Notification requirements range from ‘Dam Safety Advice’ to ‘Emergency Evacuation Advice’, depending on the circumstances.

4.5.2. Observations

4.5.2.1. EAP

The EAP contains detailed guidance and templates for the communication with PAR. Four methods for communications with PAR are detailed:

National Emergency Alert System NEAS

The NEAS can be used to communicate with PAR via SMS based on location. CRC has provided several pre-approved messages as well as a polygon defining the area to be covered by the communication. This system is managed and operated by the Queensland Fire and Emergency Services (QFES).

The NEAS notification process requires internal CRC approval as well as approval from the QFES. This will require between 25 and 45 minutes to process. Once the appropriate approvals are completed the notification will be received by PAR within 8-12 minutes.

WHISPIR

CRC also utilises WHISPIR as an additional communication platform to issue alerts and warnings via SMS, email and voicemail. In addition to local area rate payers, WHISPIR also allows users to opt-in.

Once a notification is approved and the system activated, recipients generally receive messages within 10 minutes.

Media and Social Media

CRC has pre-developed Media Releases as part of the Disaster Management Plan. Media release templates are also included in the EAP. Social Media and local media outlets including TV and Radio can be engaged to release information as deemed appropriate at the time.

Vehicles and Loudspeakers

Depending on the event (safety and time permitting), notification vehicles may be deployed to the area to ensure notification to PAR.

There are several triggers for PAR notification. During the ALERT phase, the *PMF Communication Protocol* requires the Manager Marketing & Communication (MMC) to: “Depending on situation: Notify PAR via WHISPIR using “Alert 1 PMF””. No additional guidance is provided.

During the LEAN FORWARD phase, the *PMF Communication Protocol* provides the following guidance regarding communication to PAR:

Action Officer	Guidance
Manager Operations (MO)	Activate the deployment of CRC vehicles equipped with signage, lighting and sirens as directed by the GMWW, if deemed necessary and safe to do so. Provide information to MMC.
General Manager Water and Waste (GMWW)	Give authority to the MO to activate the deployment of CRC vehicles equipped with signage, lighting and sirens, if deemed necessary and safe to do so. Notify LDC if evacuation necessary.
Local Disaster Coordinator (LDC)	Notify all Emergency/Disaster stakeholders in accordance with local Disaster Management procedure/protocols. Assist MO to facilitate notification of PAR. Alert PAR via NEAS using template “Alert 2 PMF”. Alert PAR immediately via WHISPER using template “Alert 2 PMF”.

Action Officer	Guidance
Manager Marketing and Communication (MMC)	Alert PAR immediately via social media (radio, tv, Facebook) Issue pre-approved media release(s). #5567609, #4120548, #5567607.

4.5.2.2. CRC Response

CRC did not send any notifications to PAR during the event.

During discussions between the LDC and the MO, and the MO and the GMCC at approximately 11.30pm a decision was made not to send out notifications as the risk to the public from water over the spillway was easing and the weather system had moved out to sea.

Consideration was also given to the risk which may result if PAR left their homes during the extreme weather because of notifications. This was deemed to be greater than the risk represented by the dam.

MMC was not contacted by the MO until 12.23am, by which time the level over the spillway had peaked and a decision was made not to send messages.

4.5.2.3. Other

While the use of WHISPIR is explicitly referred to as a means for warning and alerting PAR as part of the CFD EAP, at the time of this review, WHISPIR was not available for this purpose.

CRC successfully uses WHISPIR as a communication platform to issue alerts and warnings via SMS, email and voicemail, for several other emergency action plans, however the CFD implementation has not been completed as contact details for PAR have not been finalised and the system has not been tested.

A review of the CFD Emergency Alert Notifications (#5563411) suggests that some of the messaging for PAR may be overly alarmist and may create undue panic. As an example, the RP2 – Probable Maximum Flood message at STAND-UP reads “EMERGENCY. EMERGENCY.EMERGENCY. COPPERLODE DAM FAILURE IMMINENT”. This is the same message as listed under Sunny Day Failure – STAND UP.

4.5.3. Recommendations

10. The CFD EAP instance of WHISPIR should be completed and tested as soon as possible.
11. The EAP should provide clear guidance on the use of external communications. Where discretionary decisions are required, guidance on the key considerations should be provided
12. Review the use of instructions to “immediately” send specific communications. Consideration should be given to the appropriateness of all external communications before sending, especially in circumstances where the public could be put at risk.
13. Review Alert Notifications to ensure they accurately reflect the situation.

4.6. Local Disaster Management Group (LDMG)

4.6.1. Description

The LDMG plays a critical role in the management of a broad range of disasters in the broader Cairns region. The LDMG is activated regularly during cyclone season and is well practiced in dealing with disasters.

4.6.2. Observations

4.6.2.1. EAP

Although the LDMG plays an important part of any response that may impact PAR, the role of the LDMG in relation to the execution of the CFD EAP is not clearly articulated within the CFD EAP.

EAP Section 6 - Roles and Responsibilities, refers to the LDC as the LDMG rather than the Local Disaster Coordinator (LDC). The LDC as a member of the LDMG has responsibility to co-ordinate activities and communicate with the LDMG.

In most situations, and what was assumed during the development of the EAP, the LDMG will likely already be activated before the EAP is escalated to LEAN FORWARD (most likely because of severe weather or flooding in other areas). In the unlikely event that the EAP is brought to LEAN FORWARD and the LDMG is not already activated, as was the case in this instance, the EAP process does not provide a method for LDMG notification during the ALERT stage.

The EAP does not explicitly refer to the role of the LDMG and detail the interactions between the CFD EAP response team and the LDMG.

4.6.2.2. CRC Response

When LEAN FORWARD was triggered, the GMWW, CEO and LDC all made unsuccessful attempts to contact the Chair of the LDMG via mobile phone. The first attempt was made by GMWW at approximately 11:30. The CEO spoke to the LDC at 5:00am on 27 March to advise he had contacted the Chair of the LDMG and he was aware of the EAP activation and 6:00am LDMG meeting. No attempt was made by the CEO, GMWW or LDC to contact the Deputy Chair of the LDMG.

The LDMG was not stood up during the event and did not take an active role in the activities or management of the response.

4.6.3. Recommendations

14. The LDMG is well trained and experienced at dealing with disasters and disaster preparedness and should therefore be leveraged to its full potential. It is recommended that the LDMG is alerted as soon as the EAP is activated (ALERT) and the role of the LDMG fully integrated into the EAP response. The broader situational awareness and resources afforded the LDMG may provide additional decision-making support to CRC CFD EAP action officers.
15. The LDMG has a number of tools available to assist in the management of an incident. This includes the Guardian Control Centre system. CRC should consider the use of Guardian to assist CFD EAP action officers.
16. The LDMG has several Disaster Action Plans for various types of events. CRC should consider aligning the CFD EAP with other commonly used plans.

5. Review of EAP by Role

5.1. CFC Caretaker (CFDC)

5.1.1. Description

The CFDC role represents the eyes and ears of the EAP response team. The CFDC is physically on site and able to visually monitor any situation at the dam and its surroundings.

5.1.2. Observations

5.1.2.1. EAP

Under the EAP Section 6 Roles and Responsibilities, the CFDC has the following responsibilities:

- Notify appropriate officers as outlined in the notification listing table
- Activate and stand down the EAP only if the TC or MO are unavailable
- Undertake other tasks as directed by TC/MO
- When the spillway is discharging at 1m and above:
    - Monitor water levels and spillway
    - Photograph and report to TC
    - Check embankment alignment for seepage, sink holes, cracks, depressions and bulging
    - Keep a record of observations
    - Provide updates to TC.

The *PMF (RP2 &RP3) Communication Protocol* provides the following additional guidance to the CFDC when the level over the spillway reaches 2m:

- Monitor base of dam for seepage, sink holes, cracks, depressions, bulging
- Monitor spillway block and downstream of spillway for signs of erosion, movement or damage
- Photograph embankment and spillway if access is safe and forward to TC
- Immediately perform a Routine Dam Safety Inspection and note signs of slumps, erosion, springs, cracks, deformation
- Provide regular updates to TC

The EAP does not provide guidance on what is meant by “regular” or specifically what information should be communicated within the updates.

5.1.2.2. Action Officer Response

Conditions on the night of the 26th were extremely challenging due to record rainfall and significant lightning activity. The CFDC performed the majority of the required activities in a timely and professional manner.

The EAP does state that the CFDC should check the embankment, however, under the prevailing conditions it would not have been safe to do so, and therefore this action was not completed until the following morning. The wording of the EAP suggests that photographs should only be taken “if access is safe”, however it makes no such distinction for monitoring.

Communication systems available to the CFDC at the dam are limited and have proven to be unreliable during inclement weather. During the night of 26th the internet connection provided only intermittent communication, making it difficult to send photographs.

5.1.3. Recommendations

17. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the CFDC to focus on the activities that require action.
18. Include clear guidance in relation to the frequency and contents of updates. The use of templates is also recommended.
19. Review the communication facilities available at the dam. It is critical that the CFDC can remain in communication with the TC and MO at all times during an event. It should also be noted that a loss of communication may also have safety implications for staff at the CFD site.
20. Ensure that any guidance provided within the EAP considers the safety of the action officer. Wording should include "if safe to do so" where an activity may place the officer at risk under certain conditions. If an activity must be carried out regardless of the conditions, CRC should investigate ways of doing so without placing an officer at risk.
21. While photographs can be an effective tool for delivering situational awareness to officers not on location, the EAP should take into account that this method of communication can be rendered ineffective under certain conditions. The photographs taken by the CFDC during this event where only of very limited value due to the lack of light and heavy rain.
22. EAP actions for CFDC should also consider fatigue management, as it is highly likely that the EAP will be at ALERT or higher for extended periods during major events.

5.2. Treatment Coordinator (TC)

5.2.1. Description

The TC role is responsible for the activation and escalation of the EAP, monitoring dam levels using the SCADA network of sensors and communicating with the MO and CFDC.

5.2.2. Observations

5.2.2.1. EAP

Under the EAP Section 6 Roles and Responsibilities, the TC has the following responsibilities:

- Notify appropriate officers as outlined in the notification listing table
- Activate and stand down the EAP
- When the spillway is discharging at 1m and above:
    - Ensure Comms, CCTV are functioning to and from the dam
    - Provide instructions to caretaker
    - Keep record of actions and directions
    - Provide regular updates to MO
    - Read/Record piezometer data
    - Review instrumentation data and dam inspection reports for signs of damage to dam
    - Provide SITREP as appropriate

The *PMF (RP2 &RP3) Communication Protocol* provides the following additional guidance to the CFDC when the level over the spillway reaches 2m:

- Monitor Dam Levels for sudden change in reservoir levels.

While "Activate and stand down the EAP" is listed as a responsibility for the TC in Table 3 Section 6 of the EAP, EAP activation is not listed as an action for the TC at ALERT level within the *PMF (PR2 and PR3) Communication Protocol*.

There is no description or guidance related to the activation process within the EAP.

The EAP provides no guidance as to the frequency or distribution list for the SITREP. There is no reference for the TC on where to find the template for the SITREP. The SITREP template provided in Appendix 4 of the EAP does not provide guidance on frequency or distribution.

5.2.2.2. Action Officer Response

The TC performed all required tasks in a professional and timely manner.

5.2.3. Recommendations

23. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the TC to focus on the activities that require action.

5.3. Manager Operations (MO)

5.3.1. Description

The MO's role is primarily responsible for communication during an event and the mobilisation of CRC resources as required. In addition, the MO supports other roles as required.

5.3.2. Observations

5.3.2.1. EAP

Under the EAP Section 6 Roles and Responsibilities, the MO has the following responsibilities:

- Notify LDC and other appropriate officers as outlined in the notifications table
- If TC unavailable, activate and stand down the EAP
- When spillway is discharging at 1.0m and above:
    - Activate the deployment of CRC vehicles equipped with signage, lighting and sirens as directed by the GMWW, if deemed necessary and safe to do so
    - Disseminate information to Manger Marketing and Communications (MMC)
    - Assess rainfall data being issued by the BOM
    - Mobilise additional resources required
    - Suspend non-essential operations
    - Notify other CRC W&W staff
    - Manage operations below the dam
    - Monitor situation at the dam and provide regular updates to those listed above
- Keep records of decisions and directions

The *PMF (RP2 &RP3) Communication Protocol* provides the following additional guidance to the CFDC when the level over the spillway reaches 2m:

- Maintain contact with the TC in order to assess the severity of the event.
- Provide resources and redirect staff as necessary
- Collate dam status updates
- Regularly provide updates to GMWW, LDC and other business units via phone and remotely via Guardian
- Provide information to MMC

The EAP provides no guidance on the frequency or conduct of communications. In most instances there is no guidance for the method of communication.

The sheer volume of communication required from the MO during an incident may prevent the MO from fulfilling other tasks or delay important communication being conducted in a timely manner.

This will be exacerbated late at night or during holidays when it can take considerably longer to contact people and get them up to speed with events. During this event the MO dealt with 46 phone calls and emails in a 3-hour period (Of those 33 where originated by the MO).

As with other roles, the actions required from the MO are not located in one section of the EAP but spread across the body of the document and an appendix. This can be inefficient or lead to action items being missed.

5.3.2.2. Action Officer Response

The MO performed all required tasks in a professional and effective manner.

While there were some delays with communication, these are attributed to the workload imposed on the MO within the EAP, rather than a reflection on the performance of the MO.

The most notable delay was in contacting the MMC, which occurred at 12.23am 27th March, at which stage the water level had started to recede. It would be desirable for the MMC to be alerted sooner. This delay was due to the fact the action to contact the MMC is the last action item listed at LEAN FORWARD in the *PMF (RP2 &RP3) Communication Protocol,* and the MO was fully occupied performing other actions.

5.3.3. Recommendations

24. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the MO to focus on the activities that require action.
25. The volume of communication required by the EAP by the MO during an event is excessive. This can create delays and keep the MO from other important duties. It is recommended that the communication methods and actions are reviewed and streamlined where possible. The use of scheduled conference calls as a means of communication with the entire team should be considered.

5.4. General Manager Waste and Water (GMWW)

5.4.1. Description

The GMWW's role is primarily responsible for communication with the CRC CEO, Mayor and Safety Regulator. The GMWW may also request the LDC to request an evacuation if necessary. Additional duties include evaluations and reports throughout and after the event as necessary.

5.4.2. Observations

5.4.2.1. EAP

Under the EAP Section 6 Roles and Responsibilities, the GMWW has the following responsibilities:

- Notify CEO, Mayor and Dam Safety Regulator as outlined in the notification listing table
- Approve activation of the deployment of CRC vehicles equipped with signage, lighting and sirens as directed by the GMWW, if deemed necessary and safe to do so
- Provide LDMG information and a request for Evacuation to be ordered
- Notify LDC if evacuation necessary and give authority to MO to arrange notification to PAR
- Arrange an inspection by a dam safety engineer in the event of an increased likelihood of failure
- Arrange follow-up evaluation after the emergency event
- Keep a record of major decisions and directions
- Provide regular updates to those listed above
- Provide an emergency event report to DEWS within 30 business days of the event

The *PMF (RP2 &RP3) Communication Protocol* provides the following additional guidance to the CFDC when the level over the spillway reaches 2m:

- Engage a Dam Safety Consultant and prepare for them to conduct a Dam Safety inspection within 48 hours of the event
- Give authority to MO to activate the deployment of CRC vehicles equipped with signage, lighting and sirens, if deemed necessary to do so
- Keep records of actions and directions

The wording of the second item lists the following as responsibility for the GMWW: “Approve activation of the deployment of CRC vehicles equipped with signage, lighting and sirens as directed by the GMWW, if deemed necessary and safe to do so” appears to be an error.

The wording of the third item lists the following as a responsibility for the GMWW: “Provide LDMG information and a request for Evacuation to be ordered” does not include “if necessary”. It should also be noted that this action refers to the LDMG, while the *PMF (RP2 &RP3) Communication Protocol* refers to the LDC for this action. While the LDC is a member of the LDMG, there should be consistency.

Inconsistencies, such as “Keep a record of major decisions and updates” in Section 6 of the EAP and “Keep records of actions and directions” in the Protocol, can cause confusion and should be resolved.

The GMWW has the duty to “Notify the LDC if evacuation necessary”. However, the EAP does not provide any guidance to the GMWW as to the circumstances that would trigger the requirement for an evacuation.

5.4.2.2. Action Officer Response

The GMWW performed all required tasks in a professional and effective manner.

The GMWW made several unsuccessful attempts to contact the LDMG Chair. No attempt was made to contact the Deputy Chair. The EAP does not list alternate contacts or require the GMWW to contact an alternative.

The GMWW, in consultation with the MO and LDC, made the decision not to alert PAR on the basis that the rain had eased significantly and the water level in the dam was falling.

5.4.3. Recommendations

26. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the GMWW to focus on the activities that require action.
27. The process for initiating the deployment of CRC vehicles equipped with signage, lighting and sirens is not clearly articulated within the EAP. The EAP requires the GMWW to approve the activation, while the MO activates the deployment as directed by the GMWW. This should be reviewed and clarified.
28. Given the critical nature of the decision whether to evacuate PAR or not, consideration should be given to how this decision will be made. A decision flowchart would assist with this process and should be included in the EAP. Consideration should also be given to who should be consulted in the decision-making and who gives the final approval to request an evacuation. It should be noted that the final decision to order an evacuation would always lie with Emergency Services and not CRC. The EAP should reflect this.
29. CRC should consider options of additional tools to aid with situational awareness in relation to the CFD. Timely and accurate information regarding rainfall in the CFD catchment, combined with hydrological modelling would allow action officers to make decisions with more confidence. (e.g. Knowing the spillway level has peaked at 2.5m may result in a different decision to only knowing the level is at 2.5m and still rising.)

30. For situations where the EAP requires an action officer to contact a key stakeholder, an alternate contact should be listed in case the primary contact cannot be reached.

5.5. Local Disaster Coordinator (LDC)

5.5.1. Description

The LDC role provides the critical connection to the LDMG. The EAP is most likely to be activated because of extreme weather that is also likely to trigger other Local Disaster Management Plans, which are coordinated by the LDMG. The LDC therefore has visibility of these other events and this wider situational awareness provides an important input to the CFD disaster response team.

The LDC is highly trained and experienced in the management of incidents and disasters and is therefore a critical member of the CFD EAP response team.

5.5.2. Observations

5.5.2.1. EAP

Under the EAP Section 6 Roles and Responsibilities, the LDC has the following responsibilities:

- Yearly review with Waste and Water regarding the GIS polygons, formatted media releases and pre-lodging with State Disaster prior to Wet Season/Cyclone Season
- Assist MO to facilitate notification to PAR
- Liaising with QFES (Emergency Management) as the dam owners (CRC) representative after GMWW notifies LDMG of an Emergency Event and provides an evacuation request
- Utilising information supplied by the GMWW to make decisions regarding specific LDMG response processes
- Coordinate emergency response in accordance with Local Disaster Management Plans if necessary and varied to EAP response

The *PMF (RP2 &RP3) Communication Protocol* provides the following additional guidance to the CFDC when the level over the spillway reaches 2m:

- Determine if adequate response plans have already been activated for prior events
- Order evacuations if necessary in consultation with relevant Emergency Authorities
- Notify all emergency/disaster stakeholders in accordance with Local Disaster Management procedure/protocols
- Assist MO to facilitate notification to PAR
- Alert PAR via NEAS using template “Alert 2 PMF”
- Alert PAR immediately via WHISPIR using template “Alert 2 PMF”

Under the EAP, the LDC is not notified at ALERT.

The wording of the communication protocol in relation to alerting of PAR does not provide for any discretion on the part of the LDC.

While the use of WHISPIR is explicitly referred to as a means for alerting PAR as part of the LDC role, at the time of this review and at the time CFD EAP Version 8 was finalised, WHISPIR was not available for this purpose.

5.5.2.2. Action Officer Response

The requirement for the LDC to alert PAR when the spillway level reaches 2m is clearly articulated in the *PMF (RP2 &RP3) Communication Protocol.* However, this did not occur. The LDC made a conscious decision not to alert PAR based on the following:

- There was no perception of imminent threat to PAR caused by the water spilling over the spillway of the CFD.

- Weather conditions in the area were extreme and it was very late at night. Sending a warning may have placed some people at risk if they had chosen to leave their homes.
- The level of the dam was no longer rising and due to the delay in sending a message using NEAS, the message would not have been received by residents until after the risk had passed.

In all other respects the LDC performed all required tasks in a professional and effective manner.

5.5.3. Recommendations

31. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the LDC to focus on the activities that require action.
32. The EAP wording does not provide discretion regarding the sending of alerts to PAR once the level over the spillway reaches 2m. A review of this is recommended and should consider the level of risk to PAR, the wording of alerts and any risks associated with an alert. If a discretionary element is added to the alerting requirement, a detailed decision process should be documented and included in the EAP.
33. The EAP *PMF (RP2 &RP3) Communication Protocol* does not require any actions from the LDC or LDMG at the ALERT level of activation of the EAP. This could be based on the assumption that the LDMG will already be activated through other processes in the event of severe weather and will be able to quickly respond once LEAN FORWARD is activated. To avoid a situation where the LDMG is not already activated when the EAP moves to LEAN FORWARD, CRC should include LDMG notification and activation at ALERT.

5.6. Manager Marketing and Communications (MMC)

5.6.1. Description

The MMC role prepares and disseminates information to the media and public in the event the EAP is activated.

5.6.2. Observations

5.6.2.1. EAP

Under the EAP Section 6 Roles and Responsibilities, the LDC has the following responsibilities:

- Prepare and disseminate information provided to Marketing and Communication by the GMWW, to the media and public.

The *PMF (RP2 &RP3) Communication Protocol* provides the following additional guidance to the CFDC when the level over the spillway reaches 2m:

- Coordinate and manage public communications
- Alert PAR immediately via social media (radio, tv, Facebook)
- Issue pre-approved media release(s) #5567609, #4120548, #5567607

The requirement to “disseminate information provided to Marketing and Communication by the GMWW” is at odds with the fact that there is no requirement for the GMWW to provide information to the MMC.

5.6.2.2. Action Officer Response

The MO initially alerted the MMC to the fact that the CFD EAP had been escalated to LEAN FORWARD at 12.23am 27th March. At this stage the water level was receding and the MMC was informed “no action was required”.

The MMC took no direct actions during the event.

5.6.3. Recommendations

34. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the MMC to focus on the activities that require action.
35. Review the process by which the MMC is notified of an event to ensure timely community communications can be affected.

6. Freshwater Creek

6.1. Description

During the extreme weather event of 26th March, several properties and residents along Freshwater Creek were affected by flash flooding. While the scope of this report does not include an assessment of the causes of this localised flooding, it is important to understand if actions by CRC officers enacting the CFD EAP may have led to better outcomes for residents, or if there are improvements that could be made to the EAP.

6.2. Timing

The Police Communications Centre received the first '000' call in relation to flooding in Redlynch at 10:59pm on 26 March 2018.

The CFD spillway level reached 2m at 10.51pm, 8 minutes before the first call was made to '000'. The TC escalated the EAP to LEAN FORWARD at 11.03pm. GHD modelling shows that water from the spillway takes approximately 45-60 minutes to travel down Freshwater Creek to the vicinity of the Crystal Cascades Caravan Park.

The CFD water level continued to rise until it peaked at 2.4m above the spillway at approximately 11.45pm. By this time flooding downstream had eased.

It is therefore a reasonable deduction that the water over the spillway was not the primary cause of the flash flooding experienced along Freshwater Creek. This is further supported by the fact that previous events with high water levels over the spillway (dam level reached 2.53m over the spillway during Cyclone Rona in February 1999) did not result in significant flooding on Freshwater Creek.

6.3. Communication

As detailed in the body of this report, although the EAP was enacted and escalated to LEAN FORWARD, CRC action officers did not send warnings or alerts to PAR. This raises the question of whether an alert sent by CRC because of the CFD EAP activation would have been of benefit to the community downstream.

As described in the section above, the flash flooding at Freshwater Creek occurred at almost the same time as the water over the spillway reached 2m. The EAP escalation process recognises that it takes time to complete the required actions, communicate with other action officers, as well as make and approve decisions. Sending an alert takes time depending on the mechanism and technology used. This is factored into the determination of the trigger points within the EAP, allowing for enough time to alert PAR of threats caused by the CFD.

The EAP was escalated to LEAN FORWARD 12 minutes after automatic sensors showed the level over the spillway reaching 2m. The MMC was not advised of the LEAN FORWARD status until 12.23am 27th March at which time the water levels at the dam was dropping. Had the notification to the MMC by the MO been a higher priority on the MO list of actions, the MMC may have received notification earlier and sent out the pre-approved messages via radio, TV and Facebook.

The LDC received advice of the change to LEAN FORWARD from the MO at 11.30pm. Had he immediately enacted the NEAS communication request for PAR as described in the EAP communications protocol, it is unlikely PAR would have received warnings before 12.15am 27th March. Had the WHISPIR system been available to the LDC, warning could have been received by PAR by midnight. However, it should be noted that the LDC is required to perform several other critical activities, such as consulting with the GMWW regarding possible evacuations, before sending communications to PAR.

6.4. Recommendations

36. While the CFD EAP takes concurrent flooding into account, it is not designed to be an effective mechanism for warning residents near Freshwater Creek of localised flash flooding events. Due to the significant differences in the response required for dam related emergencies and flash flooding it is not recommended for CRC to adjust the EAP to accommodate flash flooding. CRC should however consider the development of an EAP for the Redlynch Community and the broader Freshwater Creek catchment area.

7. Training and Exercises

7.1. Description

Effective execution of an EAP requires regular training.

7.2. Observation

Section 6.5 of the EAP states that exercises are to be conducted annually. Appendix 5 lists exercises conducted since 2014.

While CRC has conducted an exercise in 2014, 2015 and 2016 and 2017, the nature and content of the exercises in 2014, 2015 and 2016 did not vary. The scenario involved a dam overflow due to a tropical cyclone and was conducted in the form of a desktop exercise only.

In 2017 the exercise only consisted of a field exercise to test the 3 handheld radios for CFD.

Most action officers identified in the EAP and interviewed during this review agreed that training and exercising of the CFD EAP could be improved.

7.3. Recommendation

37. Develop a schedule for training and exercising of the CFD EAP.
38. Use varied scenarios and types of exercises. This will ensure action officers are familiar with and confident in the execution of their role. This approach will also allow CRC to identify issues and make improvements to the EAP as required.

8. Review of EAP against DNRME EAP for Referable Dam Guideline 2017

8.1. Description

The Department of Natural Resources, Mines and Energy (DNRME) administers the Water Supply (Safety and Reliability) Act 2008. As such DNRME provides a guideline to assist referable dam owners and key stakeholders in developing emergency action plans (EAP). It also outlines the criteria that will be used by the chief executive to assess the plans.

8.2. Observation

The current EAP (*Copperlode Falls Dam Emergency Action Plan, Referable Dam Number 0257, Revision 8*) was endorsed by CRC Officers and issued to the Dam Safety Regulator in October 2017.

Ironside has conducted a review of the CFD EAP against the DNRME guideline (*DNRME EAP for Referable Dam Guideline 2017*). Key findings are highlighted below:

- The Guideline states that the NEAS should be used only for WARNINGS in the STAND-UP phase, and not for alerts. However, the EAP states that the NEAS (as well as WHISPR) is also used for ALERTS.
- Section 3.12 of the Guideline refers to the prioritisation of persons or categories of persons to be prioritised. The EAP does not contain specific priorities for different groups of PAR.
- The Guideline also notes: 'Outflows from dams are only one potential source of floodwater contributing to increased flows and water levels downstream. It may be beneficial for dam owners to include in their EAP and/or associated community educational material, information which puts the significance of dam out flows into context with localised riverine flooding that may result from significant rainfall within the broader catchment area.' This is referenced in the EAP under 9.3 Concurrent Flooding.

8.3. Recommendations

39. Consider if there is scope or benefit for prioritising communication with different groups of PAR at each level of EAP activation.
40. Review the use of NEAS at LEAN FORWARD.
41. Consider updating 9.3 Concurrent Flooding to incorporate any lessons from recent events.

Appendix A – Consolidated Recommendations

The following recommendations have been made throughout this report:

1. Update the EAP to include a clear activation process and activation process diagram.
2. Consider the use of automated alerting of spillway levels to action officers using the SCADA sensors and network to minimise delays and improve situational awareness.[3]
3. Include “Activate EAP” as an activity for the TC at ALERT level.
4. A review of the EAP trigger points is recommended. Considerations should include:
    a. The impact that various levels of water over the spillway have on the downstream community.
    b. The maximum rate the level of water over the spillway can rise.
    c. The time taken for the water to travel from the spillway to areas where there could be people or property at risk.
    d. The time required to issue a warning to residents and visitors in areas that may be affected.
    e. The time required for people to appropriately respond to any warnings.
    f. An appropriate buffer to allow for unforeseen delays.
5. The EAP should clearly define the process for escalation of the EAP.
6. Additional inputs for activation and escalation in addition to water level over the spillway should be considered.
7. The EAP currently relies on one to one communication, resulting an individual action officers having to make or receive large numbers of calls. (e.g. The MO initiated and received 46 communications within a 3-hour period) This process is inefficient and can lead to delays in the dissemination of important information. Ironside recommends the use of a conference system and coordinated conference calls where information can quickly and accurately be provided to all action officers.
8. Guidance within the EAP on the timeframes and information to be included in updates is limited. Ironside recommends creating clear guidelines on the frequency of updates and the information the updates should contain. Where appropriate templates should be utilised. Coupled with the use of conference facilities, information flows can be significantly streamlined.
9. The EAP should also include secondary contacts in the event the primary contact is not available.
10. The CFD EAP instance of WHISPIR should be completed and tested as soon as possible.
11. The EAP should provide clear guidance on the use of external communications. Where discretionary decisions are required, guidance on the key considerations should be provided
12. Review the use of instructions to “immediately” send specific communications. Consideration should be given to the appropriateness of all external communications before sending, especially in circumstances where the public could be put at risk.
13. Review Alert Notifications to ensure they accurately reflect the situation.

[3] At the time of writing this report, the CRC W&W was already implementing a system to automatically alert the TC, MO and CFDC via SMS at specific threshold levels (0.5, 1.0, 1.5, 2.0, 2.5 and 3.0m) #5716727.

14. The LDMG is well trained and experienced at dealing with disasters and disaster preparedness and should therefore be leveraged to its full potential. It is recommended that the LDMG is alerted as soon as the EAP is activated (ALERT) and the role of the LDMG fully integrated into the EAP response. The broader situational awareness and resources afforded the LDMG may provide additional decision-making support to CRC CFD EAP action officers.
15. The LDMG has a number of tools available to assist in the management of an incident. This includes the Guardian Control Centre system. CRC should consider the use of Guardian to assist CFD EAP action officers.
16. The LDMG has several Disaster Action Plans for various types of events. CRC should consider aligning the CFD EAP with other commonly used plans.
17. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the CFDC to focus on the activities that require action.
18. Include clear guidance in relation to the frequency and contents of updates. The use of templates is also recommended.
19. Review the communication facilities available at the dam. It is critical that the CFDC can remain in communication with the TC and MO at all times during an event. It should also be noted that a loss of communication may also have safety implications for staff at the CFD site.
20. Ensure that any guidance provided within the EAP considers the safety of the action officer. Wording should include “if safe to do so” where an activity may place the officer at risk under certain conditions. If an activity must be carried out regardless of the conditions, CRC should investigate ways of doing so without placing an officer at risk.
21. While photographs can be an effective tool for delivering situational awareness to officers not on location, the EAP should take into account that this method of communication can be rendered ineffective under certain conditions. The photographs taken by the CFDC during this event where only of very limited value due to the lack of light and heavy rain.
22. EAP actions for CFDC should also consider fatigue management, as it is highly likely that the EAP will be at ALERT or higher for extended periods during major events.
23. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the TC to focus on the activities that require action.
24. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the MO to focus on the activities that require action.
25. The volume of communication required by the EAP by the MO during an event is excessive. This can create delays and keep the MO from other important duties. It is recommended that the communication methods and actions are reviewed and streamlined where possible. The use of scheduled conference calls as a means of communication with the entire team should be considered.
26. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the GMWW to focus on the activities that require action.
27. The process for initiating the deployment of CRC vehicles equipped with signage, lighting and sirens is not clearly articulated within the EAP. The EAP requires the GMWW to approve the activation, while the MO activates the deployment as directed by the GMWW. This should be reviewed and clarified.

28. Given the critical nature of the decision whether to evacuate PAR or not, consideration should be given to how this decision will be made. A decision flowchart would assist with this process and should be included in the EAP. Consideration should also be given to who should be consulted in the decision-making and who gives the final approval to request an evacuation. It should be noted that the final decision to order an evacuation would always lie with Emergency Services and not CRC. The EAP should reflect this.
29. CRC should consider options of additional tools to aid with situational awareness in relation to the CFD. Timely and accurate information regarding rainfall in the CFD catchment, combined with hydrological modelling would allow action officers to make decisions with more confidence. (e.g. Knowing the spillway level has peaked at 2.5m may result in a different decision to only knowing the level is at 2.5m and still rising.)
30. For situations where the EAP requires an action officer to contact a key stakeholder, an alternate contact should be listed in case the primary contact cannot be reached.
31. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the LDC to focus on the activities that require action.
32. The EAP wording does not provide discretion regarding the sending of alerts to PAR once the level over the spillway reaches 2m. A review of this is recommended and should consider the level of risk to PAR, the wording of alerts and any risks associated with an alert. If a discretionary element is added to the alerting requirement, a detailed decision process should be documented and included in the EAP.
33. The EAP *PMF (RP2 &RP3) Communication Protocol* does not require any actions from the LDC or LDMG at the ALERT level of activation of the EAP. This could be based on the assumption that the LDMG will already be activated through other processes in the event of severe weather and will be able to quickly respond once LEAN FORWARD is activated. To avoid a situation where the LDMG is not already activated when the EAP moves to LEAN FORWARD, CRC should include LDMG notification and activation at ALERT.
34. Create a duty card for the role, providing clear and consistent guidance for each Activation Level. This will reduce the time and effort identifying what needs to be done and will allow the MMC to focus on the activities that require action.
35. Review the process by which the MMC is notified of an event to ensure timely community communications can be affected.
36. While the CFD EAP takes concurrent flooding into account, it is not designed to be an effective mechanism for warning residents near Freshwater Creek of localised flash flooding events. Due to the significant differences in the response required for dam related emergencies and flash flooding it is not recommended for CRC to adjust the EAP to accommodate flash flooding. CRC should however consider the development of an EAP for the Redlynch Community and the broader Freshwater Creek catchment area.
37. Develop a schedule for training and exercising of the CFD EAP.
38. Use varied scenarios and types of exercises. This will ensure action officers are familiar with and confident in the execution of their role. This approach will also allow CRC to identify issues and make improvements to the EAP as required.
39. Consider if there is scope or benefit for prioritising communication with different groups of PAR at each level of EAP activation.
40. Review the use of NEAS at LEAN FORWARD.
41. Consider updating 9.3 Concurrent Flooding to incorporate any lessons from recent events.