DAMWATCH
ENGINEERING BEYOND THE SURFACE

Wrights Road Storage Ponds – Emergency Action Plan (Pre-construction Issue)

8 June 2020

Prepared for Waimakariri Irrigation Ltd

Issue 6

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Executive Summary

General

Waimakariri Irrigation Ltd (WIL) are constructing the Wrights Road Storage Ponds to provide off- stream irrigation water storage in time of excess and to supplement irrigation supply when supply is restricted due to low flow in the Waimakariri River.

This storage consists of two adjoining lined ponds with combined capacity of 8.2 million m^3. The ponds are large dams as defined by The Building Act (2004) and HIGH PIC in accordance with the methodology of the 2015 NZ Dam Safety Guidelines.

Dam safety management system

The dam safety management system (DSMS) for the Wrights Road Storage Ponds forms a structured framework for monitoring, identifying and managing dam safety issues. There are three plans that form the DSMS for the ponds:

- Dam Safety Management Plan (DSMP) – this document describes the management and surveillance of the ponds in terms of dam safety including the identification of a dam safety issue.
- Emergency Action Plan (EAP) – this document describes the actions that are to be taken by Waimakariri Irrigation Limited if a dam safety issue is identified.
- Emergency Evacuation Plan (EEP) – this document describes the actions to be taken in the event of failure or imminent failure of the pond and in particular the actions to be taken in order to safely evacuate affected people downstream of the ponds and prevent others from entering the expected inundation area.

The three plans are sequential documents that come into effect as the situation changes from normal operation (the DSMP) to a potentially serious incident (EAP) and finally to an emergency situation where lives are at risk (EEP).

Figure Exec.1 summarises the overall process linking the dam safety management system, the emergency action plan and the emergency evacuation plan. Figure Exec.2 identifies the geographical areas that are covered by each of the plans.

Emergency Action Plan

This document sets out:

- The processes to identify and evaluate events with the potential to compromise the integrity of the ponds.
- The procedures for declaring an event as a dam safety emergency.
- The actions to be taken in response to the dam safety emergency.
- The procedures for communication with external agencies to minimise the consequences of the dam safety emergency.

This plan is a “live” document and must be reviewed on a regular basis to ensure it reflects the actual procedures carried out on site and contains the correct contact details.

Summary of Procedures

The following bullet points identify the key stages in the dam safety management system and the implementation of the Emergency Action Plan.

- Operate the Dam Safety Management Plan
  - Normal operation of the ponds – DSMP Sections 5.0, 6.0, 7.0, Appendix A
  - Normal surveillance of the ponds – DSMP Section 8.0, Appendix D, Appendix F
  - Dam Safety deficiency identified and WIL Dam Manager notified – DSMP Section 8.11
  - Failure mode identification – DSMP Table 4
  - Incident confirmed by site visit and Alert Level set – DSMP Table 8
  - Police and Civil Defence teams notified if required – DSMP Table 8, Figure 5
- Implement Emergency Action Plan – This Document
  - Notify WIL management and external parties – contact details – EAP Appendix E
  - Identification of people at risk – Inundation maps in EAP Appendix B
  - Identify safe access routes to site – EEP
  - Emergency resources – EAP Section 5.0
  - Dewater guidelines – DSMP Section 6.2
  - Emergency contact details – EAP Appendix E

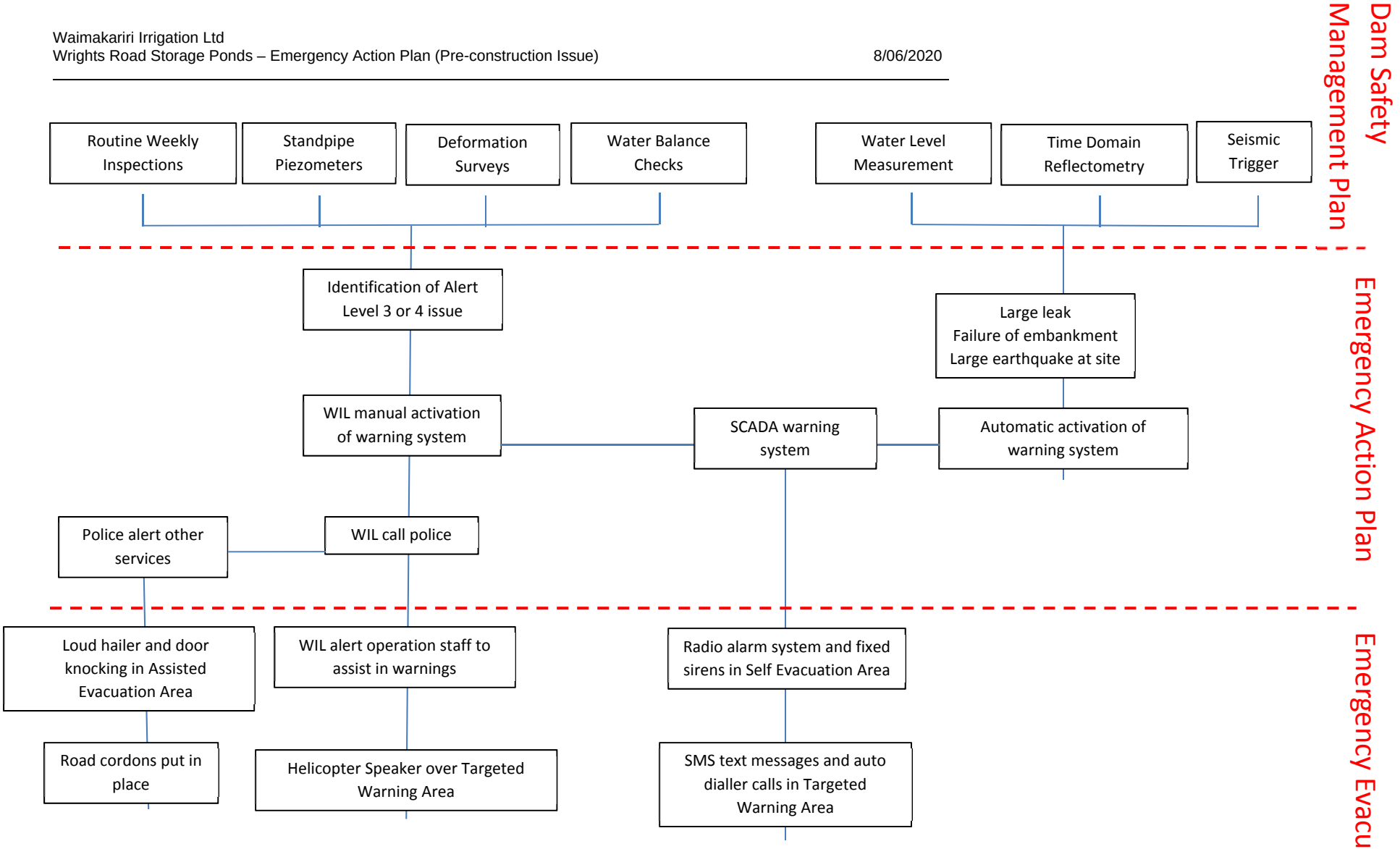

Figure Exec.1 - Links between the Dam Safety Management Plan, the Emergency Action Plan and the Emergency Evacuation Plan

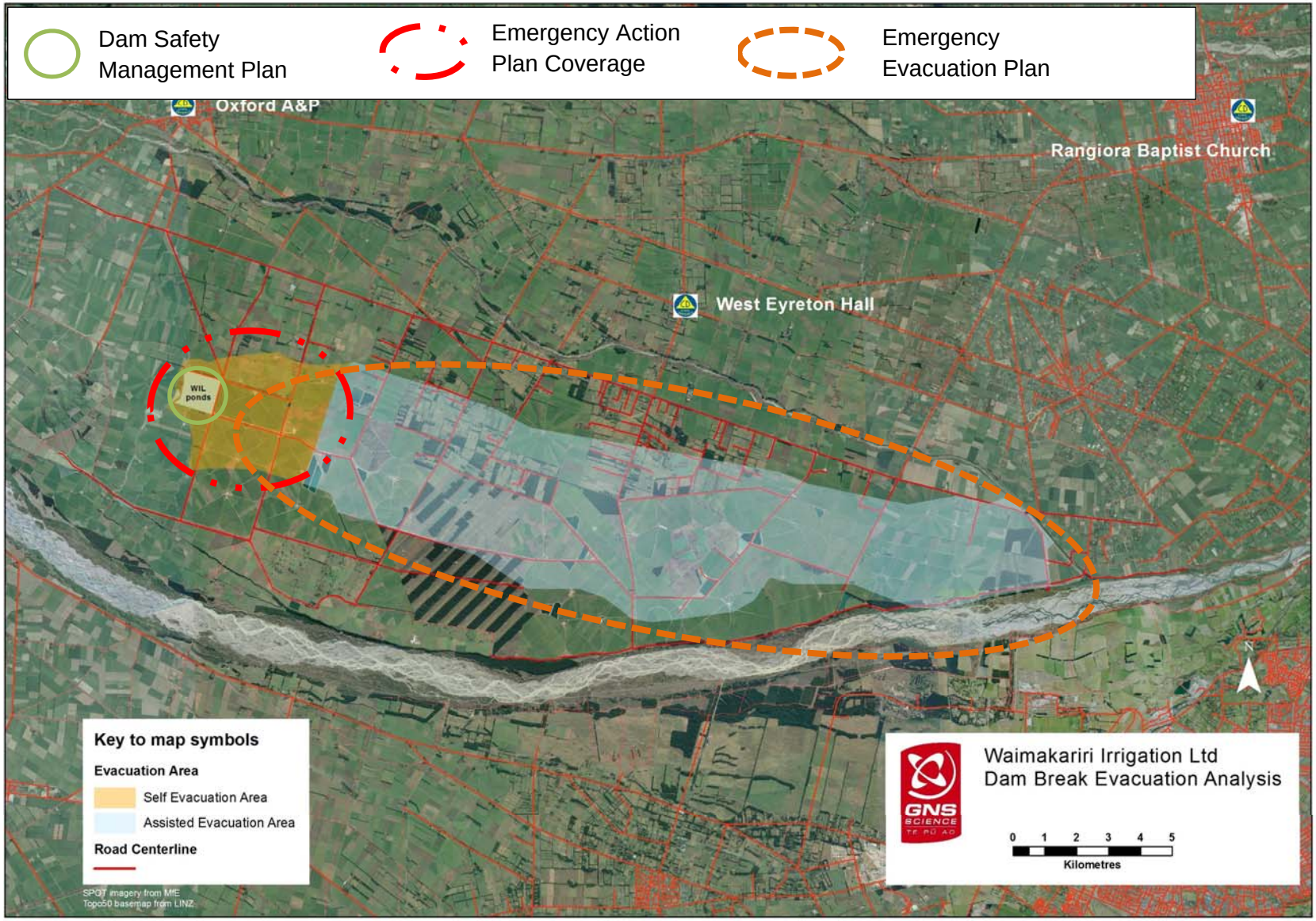

Figure Exec.2 - Plan coverage map

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APPENDICES

1.0 INTRODUCTION

1.1 General

This Emergency Action Plan (EAP) sets out the emergency response procedures specific to Waimakariri Irrigation Limited (WIL) Wrights Road Storage Ponds[1]. A dam safety incident or emergency will be managed and implemented by the WIL team in accordance with this Emergency Action Plan.

This EAP applies only in an emergency situation, which shall be declared by the WIL Dam Manager, where the dam condition or performance may endanger the integrity of the ponds and downstream life, property or environment.

1.2 Purpose

The purpose of this EAP is to guide personnel on what to do, when and how, to:

- Minimise the potential for the pond to fail should an emergency event arise; and
- Reduce the risk of loss of life and injury in the event that failure of the pond cannot be prevented; and
- Reduce the risk of damage to property or the environment in the event that failure of the pond cannot be prevented.

1.3 Scope

This EAP document sets out:

- How to identify and evaluate events with the potential to compromise the integrity of the ponds
- The procedures for declaring an event as a dam safety emergency
- The actions to be taken in response to the dam safety emergency
- The procedures for communications with external agencies to minimise the consequences of the dam safety emergency.

This EAP facilitates efficient mobilisation of manpower and equipment to deal with any undesirable site conditions and allows for communications with the relevant emergency authorities and people downstream of the ponds.

1.4 Emergency Evacuation Plan

The process for an emergency evacuation of the downstream areas is detailed in the Wrights Road Storage Ponds Emergency Evacuation Plan. However, it should be noted that the decision to evacuate is made by the New Zealand Police and local Civil Defence and Emergency Management staff. This decision is likely to be made based on recommendations from WIL.

[1] Note that the Wrights Road Storage Ponds are also referred to as the Waimakariri Storage Ponds. This EAP refers to the ponds as the “Wrights Road Storage Ponds” throughout.

The evacuation areas presented in the Emergency Evacuation Plan are divided into two:

- The self-evacuation area is the area where there would be insufficient time for emergency services or CDEM to provide assistance to the residents of houses local to the ponds.
- The assisted-evacuation area covers the areas where it is expected that there will be sufficient time for the emergency services and CDEM to provide warnings and assistance to the residents.

1.5 Principles

The following principles underlie the emergency actions for all dam safety emergencies:

- **PUBLIC and PERSONNEL SAFETY** must be considered **FIRST** at all times. Evacuation of downstream areas may be necessary
- The primary defence if a pond failure scenario is developing or if the ponds are seriously damaged, is to **LOWER THE POND WATER LEVEL**. This is achieved by opening outflow gates in the ponds with consideration of the urgency for lowering the pond water level and risk of damage downstream by high flow.

2.0 RESPONSIBILITIES

2.1 General

WIL, as the dam owner, is responsible for management of an emergency event at Wrights Road Storage Ponds. WIL is responsible for taking action to prevent the dam from failing and, if required, triggering notifications to emergency services to evacuate downstream areas impacted by failure of the Wrights Road Storage Ponds.

The Police are the lead agency for evacuation of downstream areas that may be impacted by failure of the Wrights Road Storage Pond. The Police may call on other resources (e.g. Civil Defence Emergency Management, Fire Service, etc) to assist with evacuations. The procedures for emergency evacuation are documented in a separate document called the Emergency Evacuation Plan (EEP)[2].

Contact details of the personnel described below are included in Appendix E of this document. These details should be reviewed and updated at least once a year.

2.2 WIL Emergency Response Team

2.2.1 WIL Dam Manager

Shall be initially notified of any event which is perceived to pose a threat to safety of the ponds. The Dam Manager is responsible for:

- Initial verification of the nature and severity of the issue
- Selection and notification of the Emergency Response Team
- Organising response resources
- Liaison with external organisations (if needed)
- Implementing mitigation measures
- Compliance with EAP actions
- Maintain an event emergency log of actions and decisions
- Preparation of the Incident report and Close-out procedures

2.2.2 Operation Manager

Is responsible for managing the daily operation of the ponds and is deputised to act as the Dam Manager if required. The Operation Manager will also take part in daily operation and surveillance tasks with the Racemen if necessary. See Section 2.2.3 for more detail on these tasks.

2.2.3 Racemen / Surveillance Technicians

Shall provide support to the Dam Manager during an emergency and are responsible for:

- Identifying site issues and alerting Dam Manager
- Gate operations

[2] Waimakariri Irrigation Ltd. *Wrights Road Storage Ponds - Emergency Evacuation Plan (EEP)*. Dated: 31-01-2017.

- Data collection
- Data feedback and communication
- Undertaking mitigation measures

2.2.4 Dam Safety Advisor

This position is external to WIL, contact details are located in Appendix E. The Dam Safety Advisor is responsible for:

- Advising on the behaviour of the ponds in an emergency condition
- Formulate, in conjunction with the WIL Dam Manager, the mitigation plan
- Advise the WIL Dam Manager on implementation of mitigation plan
- Provide technical support to WIL as required

2.3 External Emergency Services

In the case of Alert Level 3 and 4 incidents (Section 3.2), external resources, such as the Police, Fire and Civil Defense Emergency Management (CDEM), may be required and become responsible for the management of the emergency.

2.3.1 Police

The Police are the lead agency for evacuation of downstream areas that may be impacted by failure of the Wright's Road Storage Ponds. The Police has the responsibility and authorisations necessary for protecting life and property of residents. The police must be notified:

- In Alert Level 3 or 4 incidents where life or property is threatened or has potential to be threatened
- An injury has been sustained to other than a WIL staff member.

The Police may call on other agencies (e.g. Civil Defence and Emergency Management (CDEM), Fire, etc) to assist with evacuation of downstream areas.

3.0 AUTOMATED WARNING SYSTEM

3.1 General

An automated warning system is integrated into the Wright's Road Storage Pond control system. This is integrated into the WIL SCADA control system. In a dam safety emergency, the automated warning system provides warnings to people in the targeted warning area[5].

The WIL Dam Manager is responsible for activation of the automated control system in Alert Level 3 or 4 events, although in the event of embankment failure, the TDR system (Section 3.4) will send an automatic alarm to the automated warning system. In addition, the seismic triggers will also send an alarm to the system in the event of a major earthquake which results in embankment accelerations of greater than 50% of the design accelerations. The following sections describe the methodology to activate the automated warning system.

3.2 Activation of Alert Level 3 Warning Systems

Activation of the Alert Level 3 warning system will notify residents to be on standby to evacuate. Refer to the Emergency Evacuation Plan for details of the warning message.

Follow the steps below to activate the Alert Level 3 Warning System (activation steps to be confirmed on system development):

1. Activation steps to be confirmed.
2. Activation steps to be confirmed.
3. Activation steps to be confirmed.
4. …

On activation the Alert Level 3 Warning System (to be confirmed following public consultation) will:

- Send an automated alarm to residents in Self Evacuation Area with radio alarm system installed (e.g. Tsunado).
- Send an automated SMS message and phone call to residents in the targeted warning area[3] (self and assisted evacuation areas).
- In the event of a major potentially damaging earthquake at the site an alarm will also be sent to the residents in Self Evacuation Area with radio alarm systems.

3.3 Activation of Alert Level 4 Warning Systems

Activation of the Alert Level 4 warning system will notify residents to evacuate immediately. Refer to the Emergency Evacuation Plan for details of the warning message.

Follow the steps below to activate the Alert Level 4 Warning System (activation steps to be confirmed on system development):

[3] Refer to the Emergency Evacuation Plan for the people listed in the target warning area (to be confirmed following public consultation).

1. Activation steps to be confirmed.
2. Activation steps to be confirmed.
3. Activation steps to be confirmed.
4. …

Activation of the Alert Level 4 Warning System will (to be confirmed following public consultation):

- Send an automated alarm to residents in Self Evacuation Area with radio alarm system installed (e.g. Tsunado).
- Send an automated SMS message and phone call to residents in the targeted warning areas (self and assisted evacuation areas).
- Turn on multi-directional sirens around the Wright's Road Storage Pond.
- In the event of a major potentially damaging earthquake at the site an alarm will also be sent to the residents in Self Evacuation Area with radio alarm systems.

3.4 TDR Activation of Alert Level 4 Warning Systems

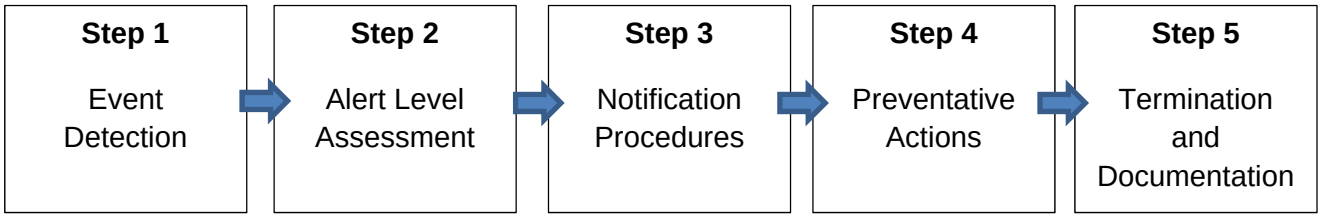
The Wrights Road Storage Ponds has a TDR (Time-Domain Reflectometry) monitoring system installed to provide warning of a failure of the pond embankment. This instrument consists of a cable installed on the embankment crest. Rupture of this cable indicates that a large magnitude slope failure has occurred such as that which will occur if one of the embankments were to fail. In this event the Alert Level 4 Warning Systems outlined in Section 4.3 will be automatically triggered (to be confirmed following public consultation).

3.5 Seismic Trigger Alert Level 3 Warning Systems

Seismic triggers located on the pond embankment crests measure the embankment accelerations induced by earthquakes. When the accelerations felt by the embankment exceed 50% of the design acceleration, an alarm will be sent to the warning system and to the residents with the radio alarm systems to warn them that a potentially damaging earthquake has occurred.

4.0 EAP RESPONSE PROCESS

The EAP response process involves the five steps summarised below.



The following sections describe each of the five steps in more detail.

4.1 STEP 1 – Event Detection

The initial notification of an event or incident that may develop into a dam safety emergency may come from a number of sources:

- Felt or forecast regional event e.g. earthquake, heavy rain
- Seismic trigger alarm of a major earthquake at the ponds
- Observation by a WIL staff member on site
- Values read from monitoring piezometers by Operator/Surveillance Inspector
- Values read from the control system
- Settlement detected from precise survey of the settlement markers
- Observations by a technical specialist carrying out an inspection of the ponds
- Observations by a member of the public or other third party.

The WIL personnel making the observation or receiving the outside notification shall gather as much information as possible including:

- Name of the person making the report and contact details
- Time, location and duration of event that is reported
- Description of the problem/event and if associated with an earthquake
- An estimate of quantity of any unusual flow and whether clear, cloudy, muddy
- Record upstream and downstream pond water levels
- The current weather conditions at the pond
- An indication of whether the situation appears to be worsening, stable or improving
- Photographs and video where appropriate
- Anything else the observer / caller believes important
- Monitoring piezometer readings

Following observation or receipt of a dam safety event or incident the WIL Dam Manager shall be immediately notified.

Appendix E provides contact details for the WIL Dam Manager.

4.2 STEP 2 - Alert Level Assessment

4.2.1 Alert Levels

After an unusual or emergency event is detected or reported, the Dam Manager is responsible for classifying the event into one of the Alert Levels listed in Table 4.1.

See the following pages (Section 4.2.2 and Table 4.2) for guidance in determining the Alert Level for various situations.

Table 4.1 – Alert Level Classification

Alert Level	Description	Safety State	Consequences	Initiating Event	Notifications
1	Unusual Event	Controlled	None expected	Seepage change Earthquake Extreme rainfall	File Notification Report
2	Isolated incident or alarm	Increased dam safety awareness	Potential incident	Increased leakage, seepage or turbidity, embankment deformation, punctured liner	Notify WIL management team, arrange investigation
3	**Potential dam failure situation, rapidly developing**	**Threat to dam safety controllable if action taken swiftly**	**Injury or safety of public or property endangered**	• **Increasing leakage, seepage or turbidity,** • **embankment deformation**	• **Manage corrective measures Notify Police of Alert level 3**
4	**Urgent, dam failure appears imminent or in progress**	**Evacuation needed Serious threat to pond embankment**	**Downstream damages expected**	• **Uncontrollable turbid seepage;** • **Significant or increasing crest settlement leading to overtopping**	• **Alert Police of Alert Level 4 with recommend-ation to evacuate residents in inundation area**

4.2.2 Guidance for Determining the Alert Level

Dam safety emergencies are most likely to be related to one or more of the potential failure modes identified during dam design and as part of ongoing operation. These potential failure modes are listed in the Dam Safety Management Plan (Section 8, Table 4).

Table 4.2 provides guidance on likely initiation events for the potential failure modes listed in the Dam Safety Management Plan and key indicators to aid selection of the appropriate Alert Level.

The following events or hazards should be monitored as a minimum:

- Earthquake shaking
- Extreme rainfall
- Extreme flood
- Construction defect
- Ongoing deterioration with age
- Emergency spillway operation
- Sabotage/vandalism

Identification of any of the key indicators listed in Table 4.2; the occurrence of a felt earthquake at the site, extreme rainfall or inflow malfunction, or an incident that leads to the puncture of the liner, should be reported immediately to the WIL Dam Manager for review.

Table 4.2 - Guidance for Determining Alert Level

Initiation Event	Key indicators	Alert Level
Strong earthquake[4] felt or reported within 100 km of pond (Seismic triggers are located on the embankment crests to identify potentially damaging accelerations at the pond site)	• No observed damage to pond embankments or HDPE liner • Pond water level stable	Alert Level 1 or 2
	• Visible damage to embankment, HDPE liner or appurtenant structures • Unscheduled fall in pond water level • Appearance of seepage on downstream face or toe • Appearance of seepage at downstream end of conduit • Sand boils around embankment toe • Localised settlement on embankment crest • Sinkhole on surface of embankment • Seismic trigger sets off an alarm indicating potentially damaging accelerations in the pond embankments • Visible ruptures of ground adjacent to embankment	Alert Level 2 or 3
	• Any signs of indicators listed above indicating that dam failure is imminent • Visible damage to embankment with uncontrolled release of water from the dam imminent or in progress	Alert Level 4
Puncture or deterioration of HDPE liner	• Minor visual damage, puncture or hole in HDPE liner • No seepage on downstream embankment face or toe • Pond water level stable	Alert Level 1 or 2

[4] A strong earthquake is categorised as shaking of VII on the Modified Mercalli Scale and described as *"felt by all, many frightened. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken."*

Initiation Event	Key indicators	Alert Level
	• Significant visual damage, puncture or hole in HDPE liner • Gradual, unscheduled fall in pond water level • Appearance of seepage on downstream face or toe • Appearance of seepage at downstream end of conduit • Localised settlement on embankment crest • Sinkhole on surface of embankment • Slips, slumps or cracks in the downstream slope of embankment	Alert Level 2 or 3
	• Any signs of indicators listed above indicating that dam failure is imminent • Visible damage to embankment with uncontrolled release of water from the dam imminent or in progress	Alert Level 4
Extreme rainfall[5] and/or inflow malfunction	• Pond water level rises above maximum operation level • Emergency spillway does not operate	Alert Level 1 or 2
	• Pond water level rises above maximum operation level • Emergency spillway operates	Alert Level 2 or 3
	• Any signs of indicators listed above indicating that dam failure is imminent • Visible damage to embankment with uncontrolled release of water from the dam imminent or in progress	Alert Level 4

[5] Rainfall intensity of 30 mm/hour or greater at the pond site is considered “extreme rainfall”.

4.3 STEP 3 – Notification Procedures

After the alert level has been determined the people on the following notification charts (Figure 4.1 to Figure 4.3) for the appropriate alert level shall be notified immediately.

Alert Level 1 – Non-emergency event, unusual event, controlled

If the assessment leads to an Alert Level of 1 then no external notifications are required and the Dam Manager will organize the necessary internal WIL responses, including informing WIL management as necessary.

Refer to Figure 4.1 for a notification chart to manage an Alert Level 1 event.

Alert Level 2 – Non-emergency event, isolated incident or alarm

If the assessment leads to an Alert Level of 2 then no external notifications are required and the Dam Manager will organize the necessary internal WIL responses.

Refer to Figure 4.1 for a notification chart to manage an Alert Level 2 event.

The first response may involve the Dam Manager notifying the Surveillance Inspector/Operator to check operation of the control system and initiating an emergency assessment inspection as described in Section 4.4.2. Additionally WIL management should be informed of any dam safety incidents or alarms.

Technical assistance from the Dam Safety Advisor may also be requested by the Dam Manager.

Alert Level 3 – Emergency event, potential dam failure situation

The Dam Manager must immediately follow the notification flow chart for Alert Level 3 (refer Figure 4.2).

The following pre-scripted message may be used to describe the emergency situation to Police:

- *This is _____ (identify yourself, name and position).*
- *I am notifying you that we have an unusual event at the Wrights Road Storage Ponds, located approximately 9 km south of Oxford, Canterbury.*
- *We are implementing pre-determined actions to respond to this unusual event which could, if not mitigated, result in dam failure*
- *The dam could potentially fail at _____ (state time and date)*
- *Please be advised this situation may require an evacuation of the areas identified on evacuation maps in the Wrights Road Storage Ponds - Emergency Evacuation Plan*
- *Please reference your copy of these evacuation maps*
- *Please be on standby to prepare to evacuate these areas*
- *We will advise you when the situation is resolved or if the situation gets worse*
- *The next status report will be provided in approximately _____ (state number of hours or minutes).*
- *I can be contacted at the following number XXX-XXXX. If you cannot reach me, please call the following alternative number XXX-XXXX.*

Alert Level 4 – Urgent emergency event, dam failure imminent or in progress

The Dam Manager must immediately follow the notification flow chart for Alert Level 4 (refer Figure 4.3

Keep in frequent contact with the emergency services to keep them up-to-date on the condition of the dam. They will tell you how you can help handle the emergency.

If all means of communication are lost: (1) try to find out why, (2) try to get to another radio or telephone that works, or (3) get someone else to try to re-establish communications.

The following pre-scripted message may be used to help describe the emergency situation to Police and CDEM personnel:

- *This is an emergency*
- *This is _____ (identify yourself, name and position).*
- *The Wrights Road Storage Ponds, located approximately 9 km south of Oxford, Canterbury are failing. The downstream area must be evacuated immediately.*
- *Repeat. The Wrights Road Storage Ponds are failing, evacuate the downstream area immediately*
- *Reference your evacuation map in your copy of the Wrights Road Storage Ponds - Emergency Evacuation Plan*
- *We have activated the Emergency Action Plan for this dam and are currently under Alert Level 4 - Imminent Failure.*
- *I can be contacted at the following number XXX-XXXX. If you cannot reach me, please call the following alternative number XXX-XXXX.*
- *The next status report will be provided in approximately thirty minutes.*

Figure 4.1 - Alert Level 1 or Alert Level 2 Notifications

Non-emergency event, unusual event, isolated incident or alarm

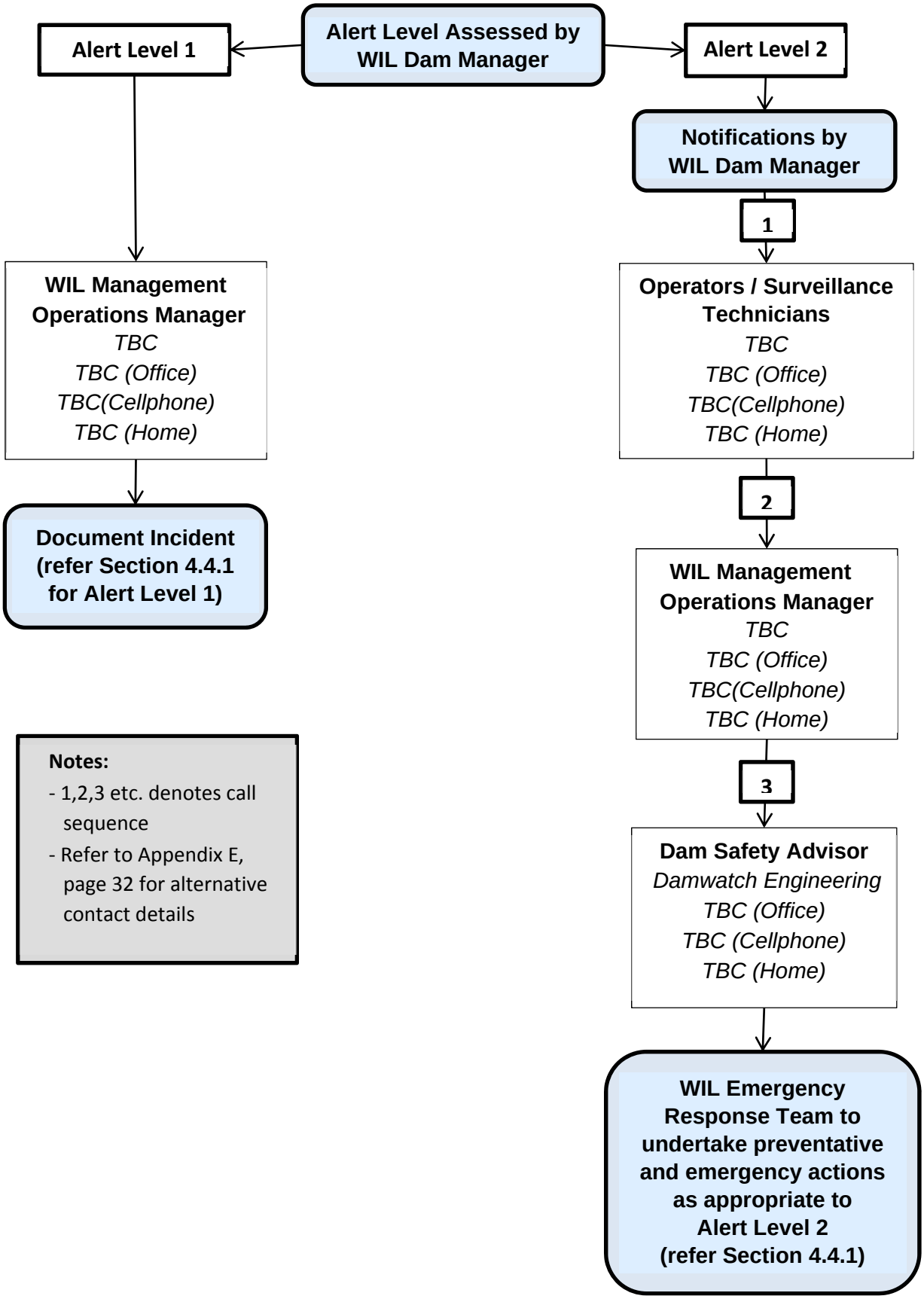


Figure 4.2 - Alert Level 3 Notifications

Emergency event, potential dam failure

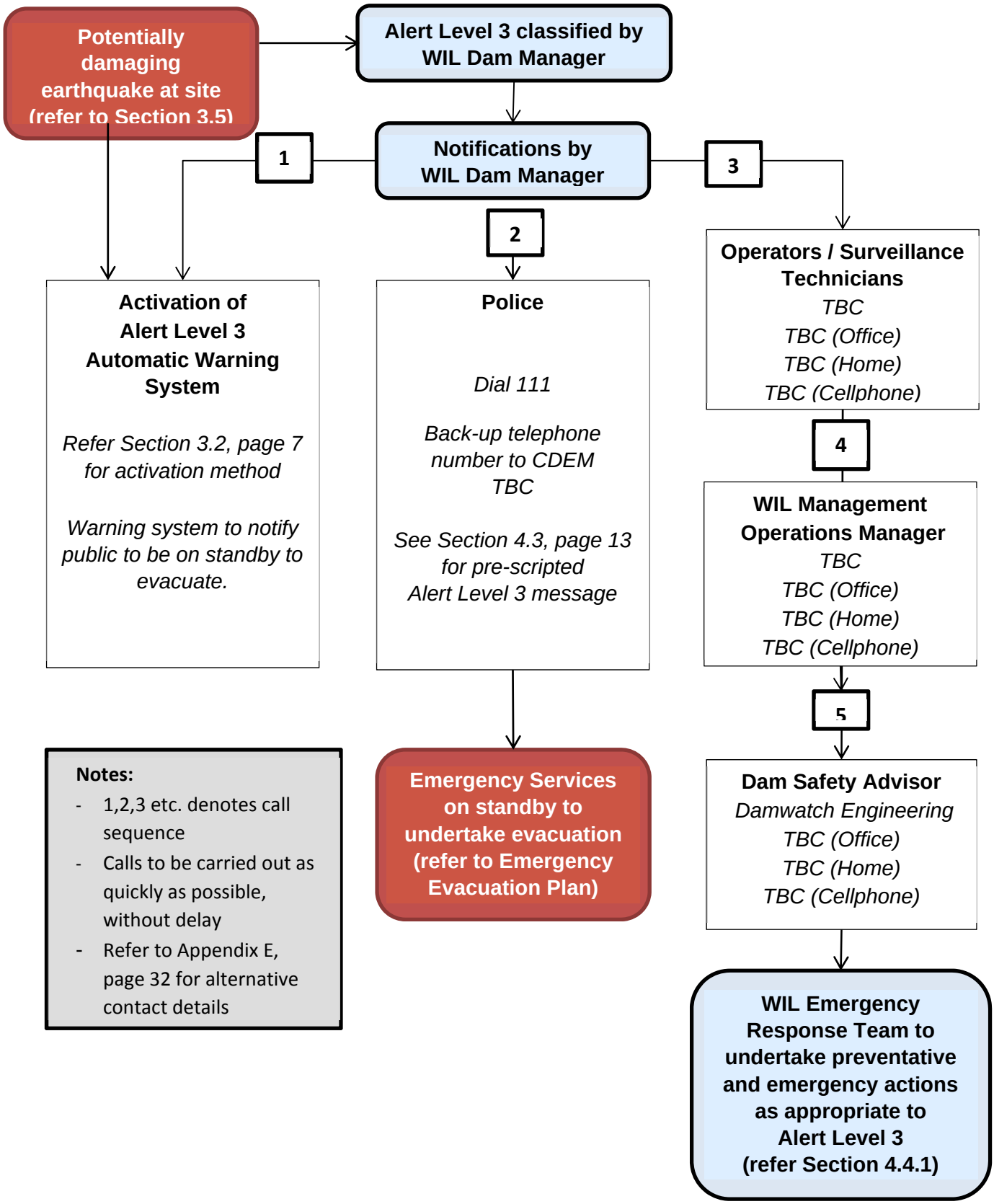
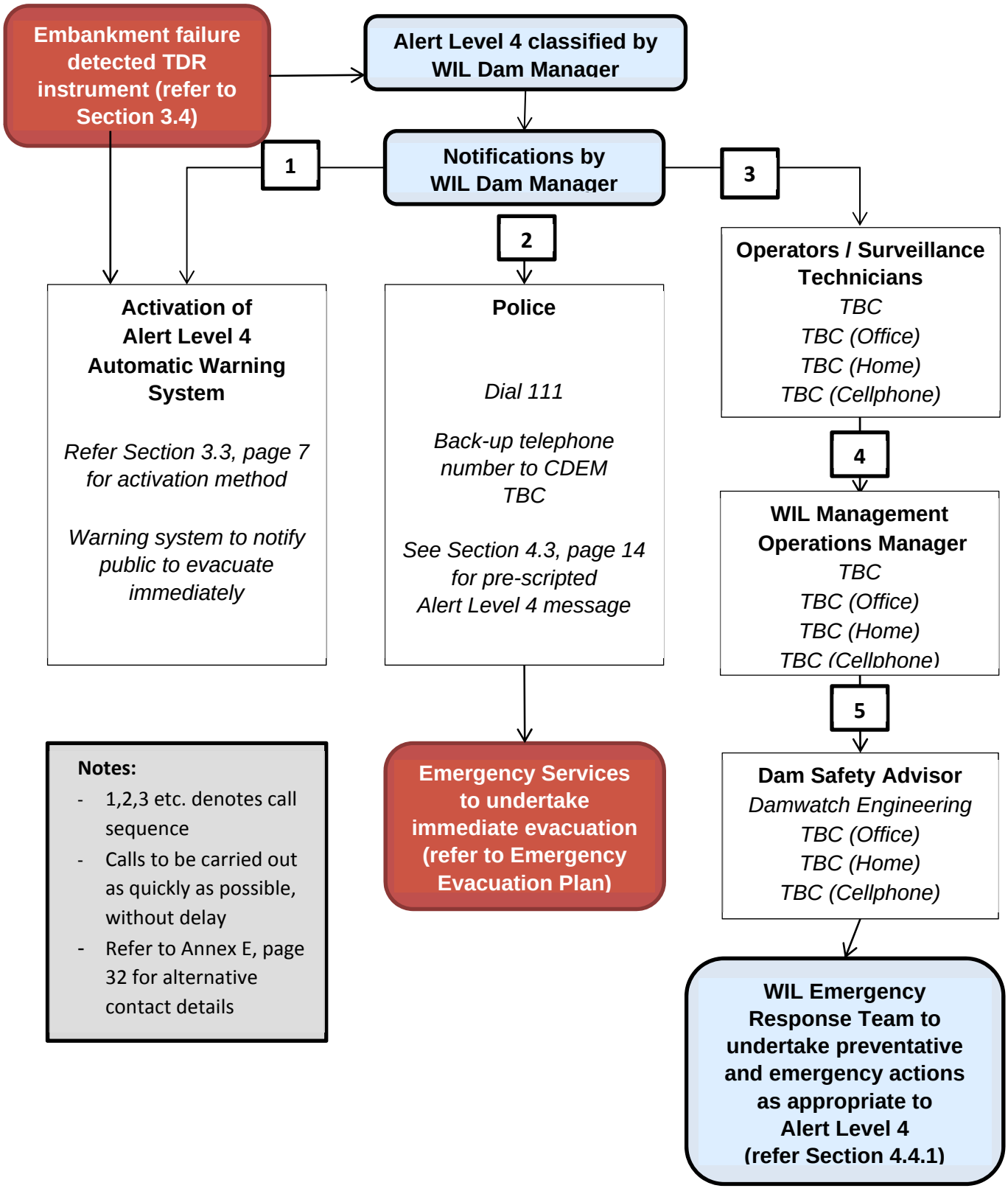


Figure 4.3 - Alert Level 4 Notifications

Emergency event, dam failure imminent or in progress



4.4 STEP 4 – Preventative and Emergency Actions

4.4.1 Expected Actions

The following actions are expected by the WIL Emergency Response Team in a dam safety emergency.

Alert Level 1 – Non-emergency event, unusual event, controlled

a) If the initial assessment leads to an Alert Level of 1 then the Dam Manager will organise the appropriate response and inform WIL management of the incident.

b) The Dam Manager shall document the incident in the Incident Log Form (Appendix C).

Alert Level 2 – Non-emergency event, isolated incident or alarm

a) The WIL Emergency Response Team should initiate an emergency inspection of the dam (refer to Section 4.4.2 for guidance on emergency inspections) and check the operation of the control system. The Dam Manager will also inform WIL management of the incident.

If increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the Dam Manager and/or Dam Safety Advisor.

If any new conditions are observed the Alert Level shall be reassessed according to Section 3.2 "Alert Level Assessment" and actions taken appropriate to the new alert level.

a) Depending on the nature of the event, the Dam Manager may contact the Dam Safety Advisor to advise/investigate the situation and recommend corrective actions.

b) Record all communications that were made. Record all information, observations, and actions taken on the Incident Log Form (Appendix C). Note the time of changing conditions. Document the situation with photographs and video, if possible.

Alert Level 3 – Emergency Event, potential dam failure

a) The Dam Manager is to immediately notify those identified in the notification flow chart for Alert Level 3 (Figure 4.2, page 16) including activation of the automatic warning system as appropriate for Alert Level 3.

b) The Dam Manager is to provide updates to the emergency services personnel to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.

c) If time permits, the WIL Emergency Response Team should implement emergency remedial actions outlined in Appendix D as appropriate.

d) If time permits, and it is safe to do so, the WIL Emergency Response Team should initiate an emergency inspection of the dam (refer to Section 4.4.2) and check the operation of the control system. If increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the Dam Manager and/or Dam Safety Advisor.

If any new conditions are observed the Alert Level shall be reassessed according to Section 4.2 "Alert Level Assessment" and actions taken appropriate to the new alert level.

e) Depending on the nature of the event, the Dam Manager may contact the Dam Safety Advisor to advise/investigate the situation and recommend corrective actions.

f) Record all notifications that were made. Record all information, observations, and actions taken on the Incident Log Form (Appendix C). Note the time of changing conditions. Document the situation with photographs and video, if possible. Complete the Emergency Actions Checklist and Emergency Close Out Forms (contained in Appendix C) as appropriate.

Alert Level 4 – Urgent emergency event, dam failure imminent or in progress

a) The Dam Manager is to immediately notify those identified in the notification flow chart for Alert Level 4 (Figure 4.3, page 17)

b) The Police shall lead the Emergency Management Services to carry out warnings, road closures, and evacuate people at risk downstream of the dam (refer to Wrights Road Storage Ponds - Emergency Evacuation Plan).

c) Emergency Management Services personnel shall alert the public and immediately evacuate at risk people and close roads as necessary.

d) The Dam Manager is to provide updates to the Emergency Management Services personnel to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.

e) The Dam Manager shall advise people monitoring the dam to follow safe procedures. Everyone should stay away from any of the failing structure or slopes and out of the potential breach inundation areas.

f) Record all notifications were made on the Alert Level 4. Record all information, observations, and actions taken on the Event Log Form (Appendix C). Note the time of changing conditions. Document the situation with photographs and video, if possible. Complete the Emergency Actions Checklist and Emergency Close Out Forms (contained in Appendix C) as appropriate.

4.4.2 Emergency Inspection

The purpose of the emergency assessment inspection by a Surveillance Inspector/Operator is to:

- Detect physical indicators of a potential failure mode; and
- Detect physical indicators of any loss or interference with operation of the pond outlet culvert.

The Surveillance Inspector/Operator shall then communicate inspection findings to the Dam Manager.

The Operation Team member making the observation or receiving the outside notification shall gather as much information as possible including:

- Name of the person making the report and contact details
- Time, location and duration of event that is reported
- Description of the problem/event and if associated with an earthquake
- An estimate of quantity of any unusual flow and whether clear, cloudy, muddy
- Record upstream and downstream pond water levels;
- The current weather conditions at the pond;
- An indication of whether the situation appears to be worsening, stable or improving;
- Photographs and video as appropriate;
- Anything else the observer / caller believes important.

Following observation or receipt of a dam safety event or incident the WIL Dam Manager shall be immediately notified.

If any new conditions are observed the Alert Level shall be reassessed according to Section 4.2 "Alert Level Assessment" and actions taken appropriate to the new alert level.

At all times **PUBLIC and PERSONNEL SAFETY** must be considered.

4.5 STEP 5 - Termination of Emergency Action Plan

For Alert Level 1 and 2 the Dam Manager shall notify those shown on the appropriate Alert Level 1 and 2 notification chart (Figure 4.1) that the dam safety event or incident is resolved and routine operations can proceed. The Dam Manager shall document the incident as described in Section 4.4.1 as appropriate to an Alert Level 1 or 2 incident. It is recommended that the Dam Manager also instigates an investigation into the event/incident and the response taken.

For Alert Level 3 and 4, if the dam safety emergency is resolved prior to failure of the embankment or when the dam has completely drained and is no longer a risk to the downstream community, the Emergency Services that have been notified of the emergency must be updated on the situation. The Emergency Services are responsible for declaring an end to any public emergency response.

For Alert Level 3 and 4, following the termination of the dam safety event, the Dam Manager shall instigate an investigation into the incident/emergency and the responses taken. This investigation shall be fully documented and shall include the following:

- Description of the event or condition that initiated the emergency
- Details of the response taken by WIL
- Detail of the responses from the emergency services
- Description and photographs of the extent of any damage to the pond
- Description and photographs of the extent and effect of any downstream inundation
- The justification for terminating the dam safety incident
- Records of instrument readings before, during and after the event
- Identification of any strengths or weaknesses in the dam safety management plan and the emergency action plan

- Details of corrective actions, including programme, to address weaknesses identified in the dam safety management plan and the emergency action plan.

In all cases the Dam manager should inform WIL management when the dam safety event or incident is resolved or terminated.

5.0 EMERGENCY PREPAREDNESS

5.1 Access to Site

The location of the Waimakariri Ponds is 1,534,683 mE, 5,196,928 mN (New Zealand Transverse Mercator Projection) approximately 9 km south of Oxford (Figure 5.1).

In the event of an emergency at the ponds, access to Waimakariri Ponds shall be from Wrights Road or Dixon Road (Figure 5.2). *(Details of access to be included in the plan prior to commissioning).*

Access to the east of the Waimakariri Ponds along Wrights Road and Dixon Road should only be used with caution as these roads may be impacted by a pond breach.

Figure 5.1 - Wright's Road Storage Pond location

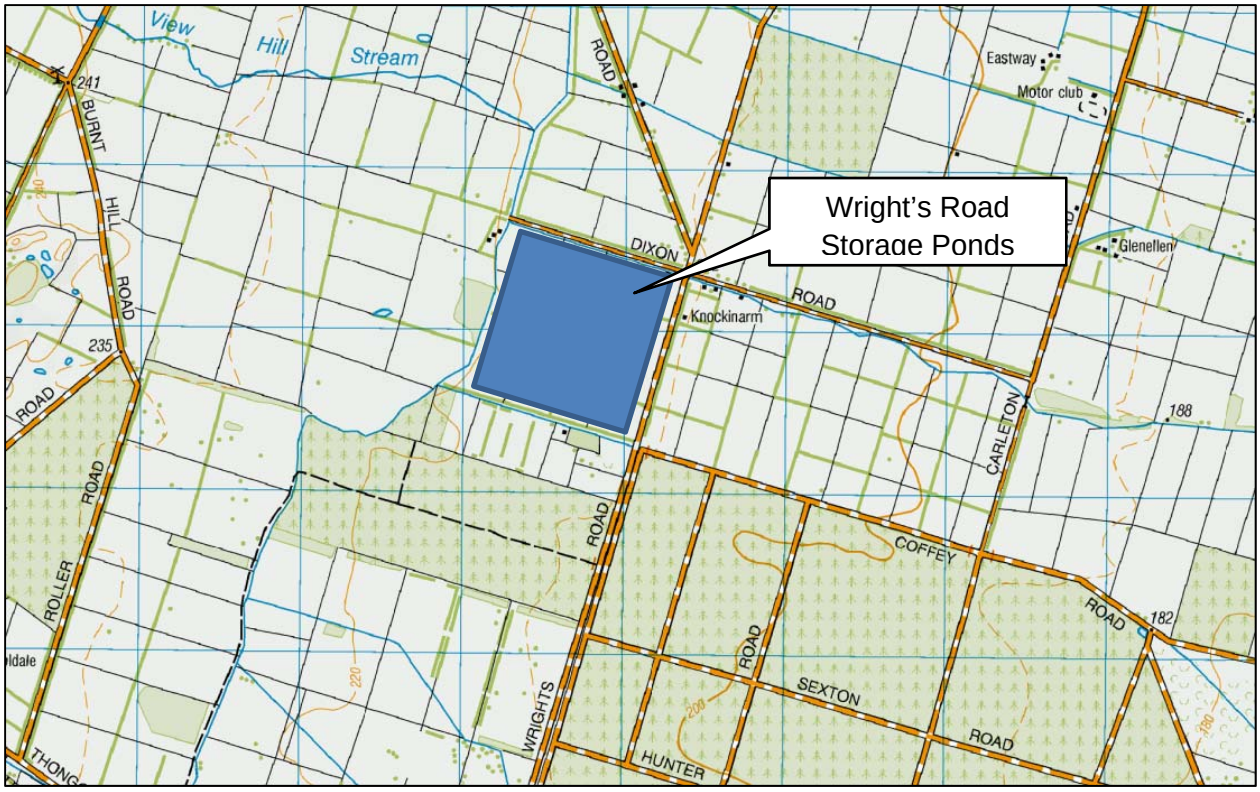


Figure 5.2 – Detailed location of Wright's Road Storage Pond

5.2 Response during Periods of Darkness

The ponds cover a wide area and an emergency could occur at any location. During night time the hazards and risks associated with the location and extent of any damage or breach are markedly increased.

Where required, portable generators and lights shall be set up to improve the safety of personnel and emergency services and their ability to operate. The Racemen and Dam Manager routinely carry torches in their vehicles. WIL have portable generators and lights which are located at Location details to be included in the plan prior to commissioning.

5.3 Response during Periods of Adverse Weather

Adverse weather, rain, snow wind or a combination of any of these increases the hazards associated with both inspections and work to intervene in any emergency activity. Suitable Personal Protective Equipment, capable vehicles and trained operators are necessary to meet the challenges of such adverse conditions.

The WIL Racemen and Dam Manager are equipped with 4WD vehicles and are trained in driving 4WD vehicles. They also own several excavators that can be used in an emergency. Further, WIL Shareholders will be called on in an emergency to provide 4WD and heavy equipment (tractors, excavators) as required by the emergency situation.

5.4 Communication Systems

Cellular smart phones are a component of the communication system which can be used in emergency situations. In area wide emergencies, initiated for instance by major earthquake, shaking cellular phone systems become overloaded. WIL trunk radio, fitted in WIL 4WD vehicles, is available as a backup for communications.

5.5 Emergency Power Supplies

WIL own portable generators for emergency lighting and power tools. These are located at Location details to be included in the plan prior to commissioning.

5.6 Source of Emergency Materials, Supplies and Equipment

The WIL Dam Manager has established an agreement in case of an emergency, for sourcing materials and equipment, to respond at short notice so that corrective measures can be promptly implemented should an emergency situation arise. *(Details of this agreement to be included in the plan prior to commissioning)* The agreement shall include for:

- 1,000m^3 silty gravel for staunching leaks or constructing downstream berms. The grading of this material shall comply as close as possible to the grading specification of the embankment fill
- 200m^2 of geotextile filter fabric (to satisfy TNZ F/7 Specification for Geotextiles as a filter layer)
- 2 No. 20 tonne hydraulic excavators
- 2 No. 10 tonne capacity dump trucks
- Two way hand held radios (one hand set for each member of the contractors team).

5.7 Technical and Operational Support Resources

The Dam Safety Advisor, with additional technical support as necessary, will provide technical advice to develop intervention and mitigation measures during the event/incident.

In the event of a major earthquake, WIL staff, in particular Racemen and the Dam Manager, may be traumatized by personal and domestic consequences of the earthquake. To accommodate WIL staff personal emergency needs, Carew Ponds Racemen are trained in operation and details of the WIL scheme and can be called in to provide essential emergency assistance. *(Details of this agreement to be included in the plan prior to commissioning).*

5.8 Emergency Operations Control

In the event of an emergency Alarm Level 3 or higher, an emergency operations centre will be established at WIL operations base at (*details to be included in the plan prior to commissioning*) managed by the WIL Dam Manager.

The WIL base trunk radio will provide backup communication with the WIL vehicles and staff at the ponds to the cell phone communication used manually.

6.0 EAP MAINTENANCE & TRAINING

The Dam Safety Management Plan, this Emergency Action Plan and the Emergency Evacuation Plan are "live" documents. These documents must be reviewed on a regular basis and updated using lessons learnt. As a minimum the contact details of the EAP should be reviewed and updated on an annual basis. The rest of the document should be reviewed as follows:

- After 1st filling of the ponds
- After the first year of operation
- As part of the Intermediate and Comprehensive Dam Safety Review
- After every dam safety incident
- After changes in legislation affecting reservoir safety

A key part of this maintenance is the training of people likely to be involved in an incident.

All people who may be affected by the failure of the pond should be provided with advice and training on emergency action prior to the commissioning of the pond as this is the most likely time for an incident to occur.

The WIL Emergency Response Team (refer to Section 2.2) and Emergency Services staff need to be made fully aware of the contents of the EAP and the Emergency Evacuation Plan[6].

People living downstream of the pond in the potential inundation area only require to be educated regards the Emergency Evacuation Plan. As a minimum this training should involve the provision of the Emergency Evacuation Plan and an opportunity to discuss the plan with WIL Emergency Response Team and the Emergency Services.

Mock training exercises should be carried out by the WIL Emergency Response Team at least bi-annually. A record should be kept of all training exercises including the lessons learnt, which should be incorporated into the Dam Safety Management Plan and EAP. The first mock training exercise following commissioning of the pond (within 2 years) should if possible include the Police and CDEM officers and the people who live in the dam break flood inundation zone.

[6] Wright's Road Storage Pond – Emergency Evacuation Plan. [Date/Revision TBC]

APPENDICES

Appendix A – Drawings

Appendix B – Dam Break Inundation Maps

Appendix C – Check-lists and Forms

Appendix D – Emergency Remedial Actions

Appendix E – Emergency Contact Details

APPENDIX A – Drawings

- *Details to be included in the plan prior to commissioning*

APPENDIX B – Dam Break Inundation Maps

- *Details to be included in the plan prior to commissioning*

APPENDIX C – Check-Lists and Forms

- Incident Log Form
- Emergency Actions Checklist
- Emergency Close Out Form

INCIDENT LOG FORM [DETAILS TO BE CONFIRMED]

Contact details of person commenting on incident	Name: Location: Phone:	Date:	Time:
Name of Pond:		Time the event was first recorded:	
Part of the embankment affected:		Approximate duration of the event:	
Description of the event:			
People present on site:			

Event Details		Comments
Pond water level (m)		
Level Rising/Stable/Falling		
Operating intakes	Intact/Debris/Blockage	
Piezometer readings		
Weather conditions		
Scour Discharge		
Situation	Improving/Stable/Worsening/Containable	
Initial Alert level:		

Recorded by:	Signature:

EMERGENCY ACTIONS CHECKLIST [DETAILS TO BE CONFIRMED]

EMERGENCY ACTIONS CHECKLIST			Design Engineer
Action	**Initial**	**Time**	**Comment**
Step 1 – Event Detection			
Event reported to Dam Manager			
Step 2– Alert Level Assessment			
Assess alert level			
Step 3– Notifications			
Notify as appropriate to alert level			
Police			
Dam Safety Advisor			
Operators / Surveillance Technicians not already aware of emergency			
Local Contractors			
Step 4 – Preventative Actions (carry out actions below as required)			
Organise Emergency Inspection			
Carry out Emergency Inspection			
Collate available data			
Enhanced monitoring of pond condition and flow control facilities			
Arrange for Dam Safety Advisor to visit site			
Review alert level classification			
Confirm alert level and make notifications as appropriate to new alert level			
Organise Pond dewatering/draw-down			
Undertake any other mitigation measures			
Keep updated a register of people on site			
Ensure safety of staff on site			

EMERGENCY ACTIONS CHECKLIST			Design Engineer
Action	**Initial**	**Time**	**Comment**
Restrict public access			
Downstream warnings given by emergency services			
Liaise with emergency services			
Downstream evacuations initiated by emergency services			
Review evacuation status			
Additional actions taken (list below as required)			
Step 5 – Termination of Emergency			
Complete the Incident Log Form			
Complete Emergency Close Out Form			

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EMERGENCY CLOSE OUT FORM [DETAILS TO BE CONFIRMED]

Action	Initial	Time	Comment
Incident description:			
Intervention implemented:			
Police informed (if required)			
Other organisations involved informed (list below)			
Recorded by:		Signature:	

APPENDIX D – Emergency Remedial Actions

D.1 Mitigation Options and Implementation Time

Mitigation options will be dependent on the specific emergency situation. Lowering the pond water level is the primary mitigation option. This requires closing any inflow and discharging the pond into the irrigation network. Lowering the pond water level is constrained by the outlet works capacity (which discharge from the Tub and from Pond 2 into the irrigation network) and the irrigation network capacity to pass and store water.

D.2 Emergency Works

Staunching

Development of most failure modes involves major damage to a section of the HDPE lining through which leakage occurs. A remedial action is to staunch the area of leakage by placing low permeability material over the damaged lining using a hydraulic excavator operating from the pond embankment crest. However, the location of the leak must be known and located in a position that allows excavator access. A significant amount of material may be required to staunch the leak.

Alternatively, if divers are available and the flow of water through the hole of the liner is not significant, it may be possible to place a temporary seal over the hole to reduce the flow. The personnel safety of the divers must be considered first at all times.

Topping Up of Embankment Crest

If significant settlement of the embankment crest has occurred to the extent that there is a risk of the embankment overtopping then additional fill should be placed on the crest. For localised areas of settlement then sand bags could be used to prevent overtopping. For larger lengths of embankment settlement then additional fill will need to be placed on the crest. However, this form of settlement may have occurred due to liquefaction of the foundation and the running of plant on the crest may place the operatives and the structure at risk.

Placement of Downstream Filters

If there is significant seepage flow through the embankment and a risk of the downstream slope of the embankment unravelling, then reverse filters should be installed. This would involve the placement of a geotextile filter fabric over the area of seepage and then the placement of a gravel berm to keep the filter in place.

D.3 Dewatering Guidelines

Lowering the pond level reduces the water load on the embankment and will result in a less damaging surge downstream if the pond subsequently fails.

Refer to Appendix F for dewatering guidelines.

APPENDIX E – Emergency Contact Details

(*details to be included prior to commissioning*)

Contact Details last updated: *date to be added*

Agency / Organisation	Principal Contact/Position	Address	Emergency Telephone Number	Alternate Telephone Number
WIL Dam Manager				
WIL Management (Operations Manager)				
Operators/Surveillance technician				
Operators/Surveillance technician				
Operators/Surveillance technician				
Dam Safety Adviser				
Alternative Dam Safety Adviser				
CDEM Manager				
Police				
Fire Service				
Contractor 1				
Contractor 2				
Affected Party Contact List	Refer to Emergency Evacuation Plan			

APPENDIX F – Dewatering Guidelines

(A *framework for this appendix is provided below. Specific details to be provided prior to commissioning*).

F.1 Dewatering Facilities and Procedures

Describes which pond facilities fulfil a dewatering function. Details how to release flows from the ponds and into the downstream races, including closing of any inflows to the reservoirs. This will include details of which gates to open and close, how to operate back-up power supplies and how to open the gates manually.

F.2 Drawdown Times

Graphs and tables will be provided to illustrate how quickly the ponds can be dewatered.

An example table is provided in Table F.1, which shows the average pond areas and the time to drawdown the top one metre of storage for a range of pond outflows.

Table F.1 Pond Areas and Drawdown Time

Pond	Average Area (m^2)	Hours for 1 m drawdown at net outflow				
		MR4 = 4 m^3/s	MR4= 5 m^3/s	R2+R3= 11 m^3/s	R2+R3= 14 m^3/s	R2+R3= 15 m^3/s
1	134,400	9.3	7.5	-	-	-
2	658,500	-	-	16.6	13	12.2

F.3 Downstream Conveyance of Dewatering Flow

Irrigation water distribution races downstream of the pond are currently being developed by WIL. They are proposed to include the following races both of which discharge to the Eyre River:

- *Main Race, MR4 – approx. 6.3 km with around 8 culverts and 4 major offtakes*
- *Race R3 – approx. 11.8 km with around 20 culverts and 6 offtakes*

When the races are finalised, a detailed description of the race systems between the reservoirs and the Eyre River will be provided including plans showing the location of the races.

It is recognised that conveyance of maximum Pond dewatering flows may exceed the race capacity and result in local flooding and minor damage to the irrigation network. To minimize this local flooding, the preparation for dewatering procedures in Section F.3 will be provided as well as surveillance requirements during dewatering in Section F.5. The extent of local flooding will also be modelled and mapped as described in Section F.6.

F.4 Preparation for Dewatering

Describes procedures to ensure that the downstream areas along the races are clear of obstructions, particularly at the culvert sections. Plan drawings will be included and referred to, showing the layout of the race systems and the culverts. The culverts are the locations that are most likely to become blocked and could potentially lead to overtopping of the race side embankments.

F.5 Surveillance During Dewatering

Details of monitoring the operation of the races during dewatering to ensure that the culverts remain unobstructed and that there are no issues with side embankment stability.

F.6 Dewatering Potential Downstream Inundation Areas

Maps will be provided that show the area of land subject to inundation between the Ponds and the Eyre River in the event of emergency dewatering. The maps will show the rate of inundation and the dewatering inundation extent and depths. Maps will be provided for the following cases:

- *Maximum dewatering discharge during fine weather conditions (i.e. normal flow in Eyre River)*
- *Maximum dewatering discharge in combination with peak of 1 in 100 AEP flood conditions on Eyre River.*