TOOWOOMBA REGIONAL COUNCIL

QFCI

Date: 19/4/11

Exhibit Number: 83

JM

EMERGENCY ACTION PLAN

COOBY DAM

TABLE OF CONTENTS

SECTION 1

DOCUMENT CONTROL SHEET

DOCUMENT CONTROL SHEET

CONTROLLED COPY NUMBER:
AUTHORISATION:

Approved by: (Toowoomba Regional Council CEO) **Date:** November 2010

This Emergency Action Plan was originally prepared by Sun Water, Engineering Services for the, Toowoomba City Council. (Now Water Service Branch, Toowoomba Regional Council) The plan has been reviewed due to amalgamation of Councils on March 15 2008 and is to be issued as an interim document pending full review in 2009.

REVISION STATUS:

Revision Number	Revision Description	Section Number	Revision Date
0	Draft		14/8/97
0	Issue 2	1-10	September 2005
1	Issue 3	1-10	August 2007
2	Issue 4	Complete	December 2008
3	Issue 5	Complete	October 2009
4	Issue 6	Complete	October 2010

Note: Future updates to the Telephone and Radio Notification List shall be compiled and distributed by the Water Infrastructure Asset Management group and approved separately by the Manager Water Infrastructure Assets Management. See Section 3.

SECTION 2
CONTROLLED COPY
DISTRIBUTION SHEET

	Position	Location
1	Director Water Services	Toowoomba Regional Council
2	Manager Water Infrastructure Assets Management	Toowoomba Regional Council
3	Senior Civil Engineer Water Infrastructure Assets Management	Toowoomba Regional Council
4	Manager Water Operations	Toowoomba Regional Council
5	Dam Operator, Cooby Dam	Toowoomba Regional Council
6	Manager Goombungee Service Centre	Goombungee Service Centre
7	Manager Crows Nest Service Centre	Crows Nest Service Centre
8	Manager Jondaryan Service Centre	Jondaryan Service Centre
9	Librarian, GHD Pty Ltd	Brisbane
10	Director, Dam Safety, Department of Environment and Resource Management	DERM, Brisbane
11	Regional Office, Department of Environment and Resource Management	DERM, Toowoomba
12	Area Director Counter Disaster and Rescue Services (South East Region)	P O Box 301 Beenleigh, QLD 4207
13	Regional Director Counter Disaster and Rescue Services (South-West Region)	Toowoomba
14	Officer in charge, Police Toowoomba	Toowoomba Police
15	Officer in charge, Police Oakey	Oakey Police
16	Area Director Counter Disaster and Rescue Services (Toowoomba Area)	Toowoomba
17	SEQ Water, Operations Manager	P O Box 15236 City East Qld 4002
18	Qld Ambulance	Toowoomba
19	Queensland Fire and Rescue Authority	Toowoomba
20	Sun Water, Manager Risk Management	Sun Water
21	Water Services Library	Toowoomba Regional Council

SECTION 3
TELEPHONE AND RADIO NOTIFICATION LIST

COOBY DAM
TELEPHONE AND RADIO NOTIFICATION LIST

AUTHORISATION:

Approved by: **Date:** October 2010

(Manager, Water Infrastructure Assets Management)

REVISION STATUS:

Revision Number	Revision Description	Revision Date
1	Telephone and Radio Notification List updated	September 2005
2	Telephone and Radio Notification List updated	September 2007
3	Telephone list updated	October 2008
4	Telephone list updated	July 2009
5	Telephone list updated	October 2010

POSITION	NAME	PHONE	AFTER HOURS	FACSIMILE
Mayor,Toowoomba Regional Council	Peter Taylor	[redacted]		
Chief Executive Officer, CEO	Ken Gouldthorpe			
Director Water Services (DWS)	Kevin Flanagan			
Manager Water Operations (MWO)	Alan Kleinschmidt			
Manager Water Infrastructure Assets Management (MWIAM)	Lawrence Ashe			
Unit Leader Water Operations - North	David Frizzell			

OTHER EMERGENCY NUMBERS

DESCRIPTION	NAME	PHONE	AFTER HOURS	FACSIMILE
Emergency Management QLD Regional Director Area Director South East Region emqserops06@dcs.qld.gov.au	Eddie Bennett Deryck Taylor	[redacted]		
Emergency Management QLD Regional Director South West Region	Robert Bundy			
Emergency Management QLD Area Director Toowoomba Area	Chris Artiemiew			
SES Liaison Officer	Kevin Wruck			
TRC Disaster Coordination Committee Coordinator (TRC DCC Coordinator) Local Controller Tmba SES Frank.dev@bigpond.com.au	Norman Fry Frank Devlin			
Toowoomba Police	Sergeant In-charge Police Communications			
Qld Fire & Rescue Service	Steve McInerney			
Qld Ambulance	Ross Chalmers			

DESCRIPTION	NAME	PHONE	AFTER HOURS	FACSIMILE
Executive Director of Medical Service - Toowoomba Health	Dr Peter Bristow			
Telstra Services	Jamie Stevenson Nigel Beaman			
Ergon Energy	Michael Hellyer			
Department of Main Roads	Neil Carter			
Disaster District Coordinator	Andy Morrow			
District Coordinator Office In Charge	Mark Wheeler			
Dam Engineer (GHD)	Malcolm Barker			
Director Dam Safety (1st contact priority) Department of Environment & Resource Management	Peter Allen			
Director Dam Safety (2nd contact priority) Department of Environment and Resource Management	Ron Guppy			
Department of Environment and Resource Management, Regional Office	Timothy Eckert			
SEQ Water, Operations Manager	Robert Drury			

DESCRIPTION	NAME	PHONE	AFTER HOURS	FACSIMILE
Bureau of Meteorology Website	www.bom.gov.au	[redacted]		
Bureau of Meteorology Brisbane Office – Current Weather / Forecasts / Duty Senior Forecaster	Geoff Doueal Gavin Holcolmbe			
Tropical Cyclone Warning Centre				

OAKEY SERVICE CENTRE DISASTER COMMITTEE

POSITION	NAME	PHONE	AFTER HOURS	FACSIMILE
District Manager Oakey Service Centre	Ian Stevenson	[redacted]		
SES Liaison Officer	Peter Abbott			
SES Controller	John Harrison			

GOOMBUNGEE SERVICE CENTRE DISASTER COMMITTEE

POSITION	NAME	PHONE	AFTER HOURS	FACSIMILE
District Manager Goombungee Service Centre	David O'shea	[redacted]		
SES Liaison Officer	Ken Black			
SES Controller	Stan Sullivan			

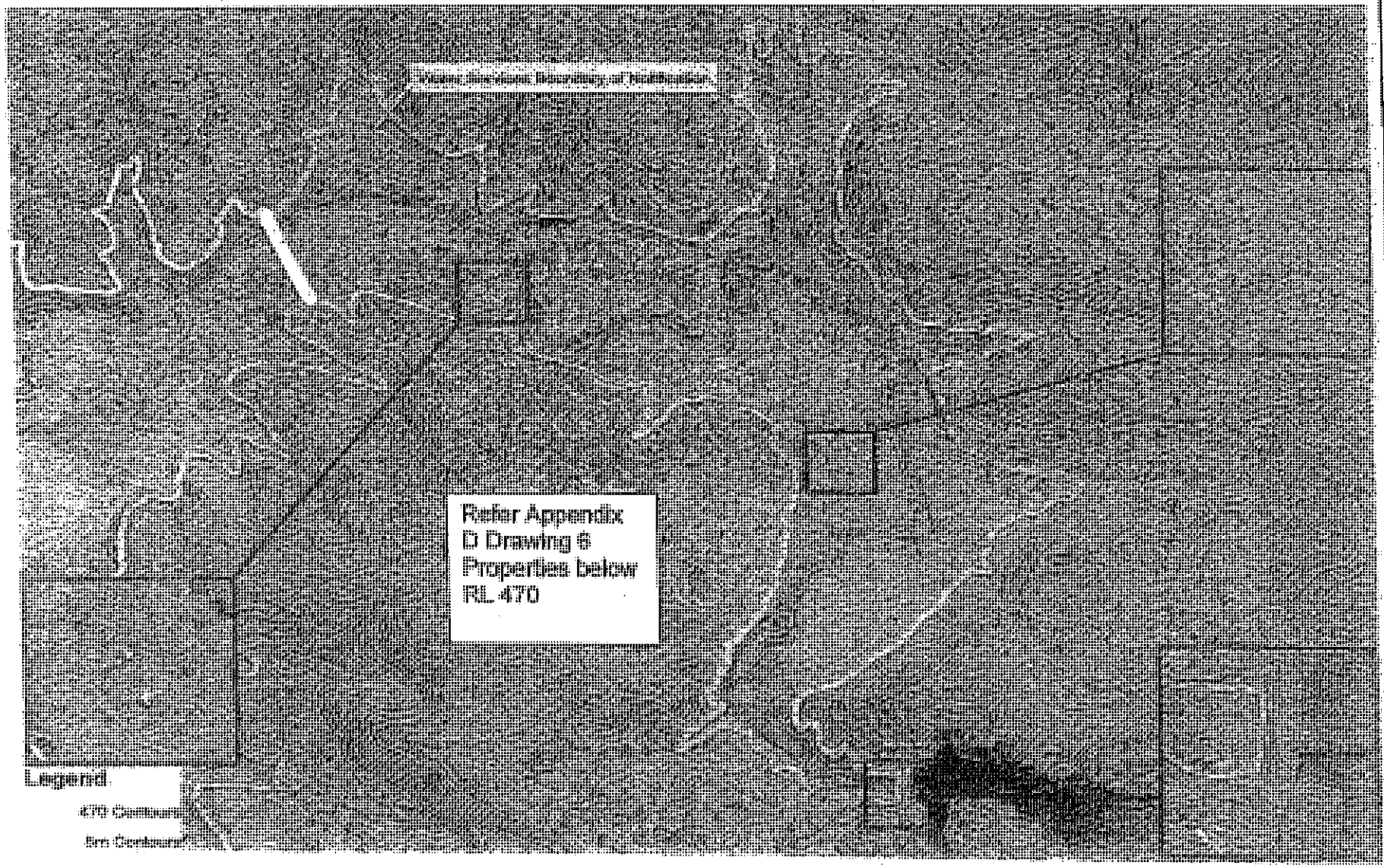
FREQUENCIES USED BY TOOWOOMBA REGIONAL COUNCIL

COMS					
CH1	Kynoch TTR	Com TX	[redacted]	Com Link	TX
CH11	(Simplex)	Com RX			RX
CH2	Pechey TTR	Com TX		Com Link	TX
CH12	(Simplex)	Com RX			RX
CH4	Cooby TTR Mt Moor	Com TX		Com Link	TX
CH14	(Simplex)	Com RX			RX
CH4	Cresbrook TTR Mt Misery	Com TX		Com Link	TX
CH14	(Simplex)	Com RX			RX
CH15	Simplex Dams	TX/RX			
CH16	Simplex Airport	TX/RX			
	Empire Theatre	TX/RX			
	Milne Bay AC	TX/RX			

TELEMETRY					
	Freneau Pine TTR	TX	[redacted]	System	TX
		RX		System	RX
	Freneau Pine SPS TTR	TX		System	TX
		RX		System	RX
	Picnic SPS S&F	TX		System	TX
		RX		System	RX
	Lofty Res S&F	TX		System	TX
		RX		System	RX
	Lofty Res SPS S&F	TX		System	TX
		RX		System	RX
	Wetalla SPS	TX		System	TX
		RX		System	TX
	Pechey TTR	TX		System	TX
		RX		System	RX
	Cooby TTR	TX		System	TX
		RX		System	RX
	PARKS & Rec	TX/Rx			

SMF Mt Kynoch						
	Mt Kynoch SMF	Tele TX	[redacted]	System	TX	[redacted]
		Tele RX		System	RX	
EMS				PAGING		
	EMS	TX/RX		Paging	TX	
	Freneau Pine EMS S&F	TX/RX				
	Pechey EMS S&F	TX/RX				
	Mt Misery EMS S&F	TX/RX				
	Picnic Pt EMS S&F	TX/RX				
AIRPORT				EP		
	Airport Lights PAALC	RX		EP	TX/RX	[redacted]
	Airport NDB	TX				
	Airport AWIB	TX				
	Airport Coms	TX				
GPS				105U		
	GPS	TX		105U	TX/RX	[redacted]
LINK						
	PABX link	10.63 GHz				
	Band width	7000 KHz				
ERRTS						
	SEQWB	RX Pechey	[redacted]	TX Pechey		[redacted]

CB
HF CB Freq 26.965 to 27.405 CH No 1 to 40
UHF CB Freq 476.425 to 477.400 CH No. 1 to 40
Toowoomba UHF TTR CH2 Dup
Crows Next UHF TTR CH5 Dup EMERGENCY ONLY


Refer Appendix
D Drawing 6
Properties below
RL 470
Legend

LIST OF DOWNSTREAM RESIDENCES (Excl. Oakey Township & Army Aviation Base)

PROPERTY DESCRIPTION	PROPERTY DESCRIPTION	PROPERTY DESCRIPTION
Lot 2602 on AG341176	Lot 1 on RP138895	Lot 25 on O15210
Lot 2603 on AG341176	Lot 1 on RP123544	Lot 1 on RP69986
Lot 2 on RP45351	Lot 2 on RP80417	Lot 2 on RP69986
Lot 1 on RP205985	Lot 7 on RP60308	Lot 38 on O15210
Lot 71 on AG99	Lot 7 on RP60308	Lot 1 on O1522
Lot 67 on AG99	Lot 114 on AG380	Lot 2 on O1522
Lot 67 on AG99	Lot 1 on RP143419	Lot 3 on O1522
Lot 3 on RP45411	Lot 1 on RP125148	Lot 4 on O1522
Lot 1 on RP898491	Lot 2 on RP113524	Lot 5 on O1522
Lot 4 on RP898491	Lot 1 on CP851106	Lot 6 on O1522
Lot 2 on AG2631	Lot 4 on RP88219	Lot 7 on O1522
Lot 2 on RP204240	Lot 1 on RP213836	Lot 8 on O1522
Lot 1 on RP162535	Lot 2 on O15210	Lot 2 on RP83126
Lot 24 on AG99	Lot 17 on RP27296	Lot 1 on RP83126
Lot 24 on AG99	Lot 111 on AG380	Lot 2 on RP4299
Lot 64 on AG80	Lot 2 on RP60974	Lot 1 on O1526
Lot 63 on AG80	Lot 12 on RP27296	Lot 2 on RP175645
Lot 62 on AG80	Lot 1 on RP60974	
Lot 22 on AG105	Lot 113 on AG380	
Lot 2 on RP838185	Lot 1 on RP27296	
Lot 219 on AG80	Lot 3 on RP27296	
Lot 219 on AG80	Lot 4 on RP27296	
Lot 96 on AG73	Lot 5 on RP27296	
Lot 59 on AG80	Lot 1 on O15223	
Lot 209 on AG80	Lot 1 on O15223	
Lot 86 on AG3051	Lot 1 on RP182000	
Lot 2 on RP154762	Lot 2 on RP182000	
Lot 1 on RP154762	Lot 28 on O15210	
Lot 87 on AG73	Lot 27 on O15210	
Lot 76 on AG73	Lot 26 on O15210	

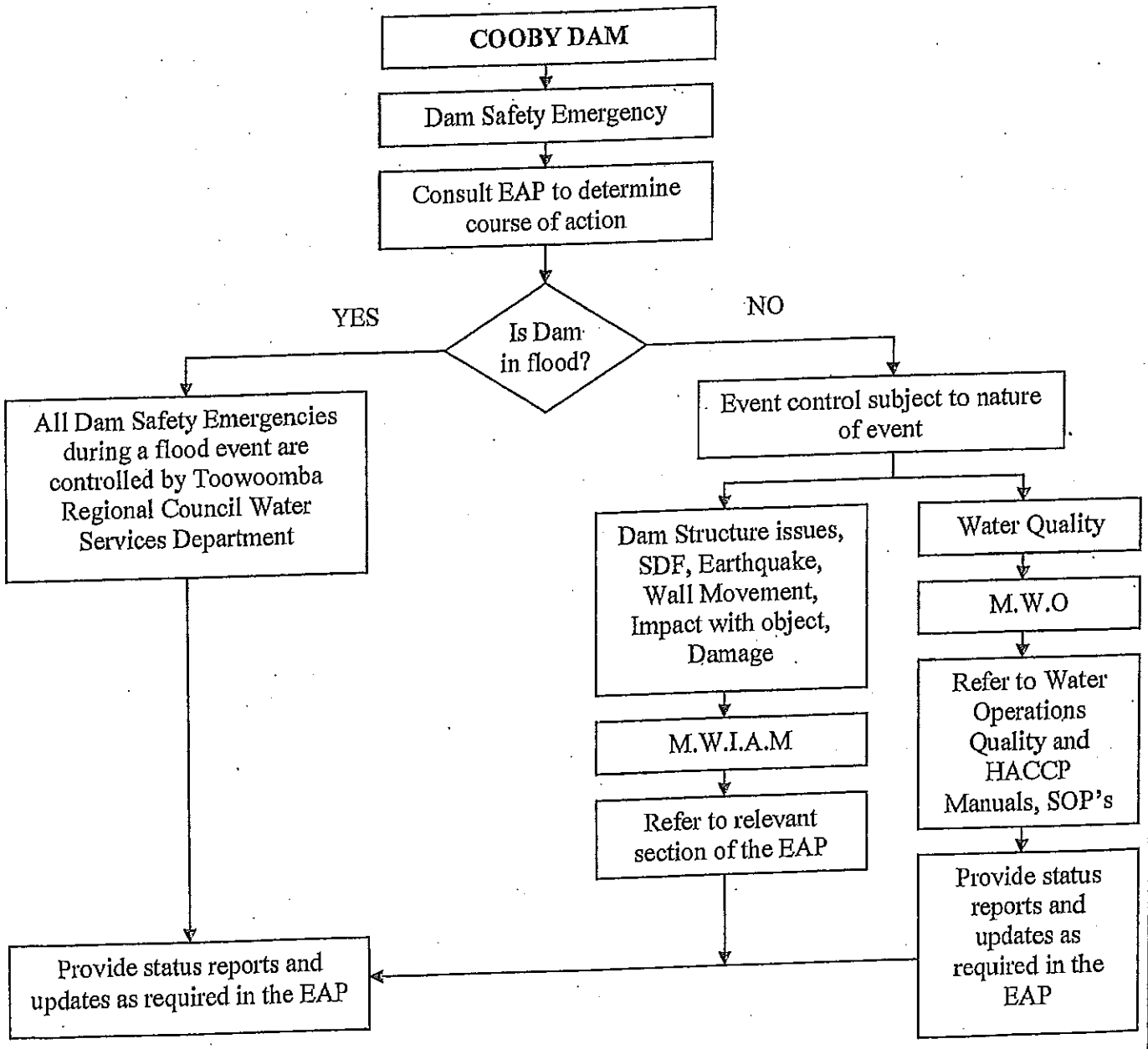
Note : * Under Sunny Day Failure Event notify residences 10-14 inclusive.

SECTION 4
EMERGENCY EVENTS AND PROCEDURES

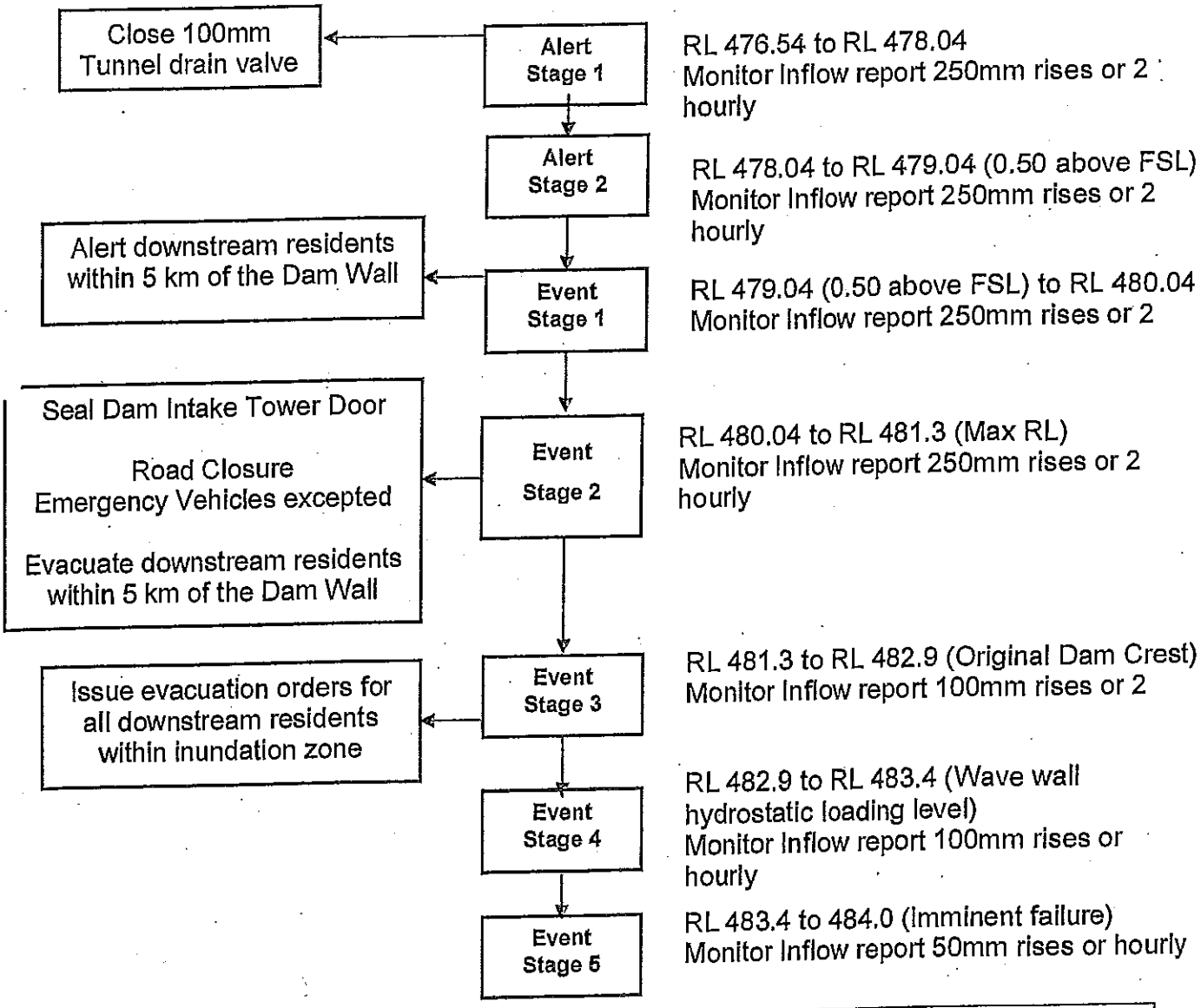
INTRODUCTION

This Emergency Action Plan (EAP) identifies emergency conditions that could endanger the integrity of Cooby Dam and describes procedures which should be followed by Toowoomba Regional Council (TRC) staff in the event of such an emergency. A primary focus of these actions is to provide timely warning to appropriate emergency response and management agencies, to allow these agencies to implement protection measures for downstream communities.

The flowchart below summarises the actions that occur in an emergency situation.



EMERGENCY EVENTS AND PROCEDURES
COOBY DAM SUMMARY



Item	RL
Full Supply Level (FSL)	RL 478.54
Maximum RL	RL 481.30 – Original Spillway Flood Design
Dam Crest	RL 482.9
Wave Wall Crest	RL 484.00
Freeboard	RL 481.30 1.6M below Original Crest 2.7M below Wave Wall Crest
Spillway Design	RL 486.81 – Overtopped by 2.8M
Wave Wall hydrostatic Loading Level	RL 483.4

4.1 FLOOD ALERT STAGE 1

Flood alert 1 is activated when storage is RL 476.54, 2m below Full Supply Level and rising to 478.04, 0.5 m below Full Supply Level

ACTIONS

NOTE: If weather conditions indicate a large Spillway flow is imminent, station officers at the Dam

The Dam Operator or Standby officer shall:

- Monitor water levels in the dam reporting every 250mm rise or 2 hours. Ring or radio through to the Unit Leader Water Operations - North (ULWO-N) the reservoir levels and rainfall totals.
- Close 100mm drain valve at the bottom of the tunnel. (NOTE: reopen valve after inflow and/or spillway overflow ceases)
- Monitor reservoir water levels and rainfall totals. Ring or radio through to the Unit Leader Water Operations - North (ULWO-N) the reservoir levels and rainfall totals.
- Record the Reservoir level using pages in Section 5, to plot a graph of heights versus time, so that the trend of the inflow may be monitored. Record the rainfall on pages in, Section 5, at regular intervals. Maintain Log of events/actions pages in Section 5. Submit pages to MWO.
- On the Record of Communications sheet, in Section 5, keep a daily running record of all telephone calls to and from the Dam Operator, or Standby Officer, for the duration of the Alert. Record to and from whom, actions requested and carried out, and time and date. On the Log of Events/Action sheet, in Section 5, record daily Events/Actions for later transfer to the Dam Log Book.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Inform the Manager Water Operations (MWO), Manager Water Infrastructure Assets Management (MWIAM) and alert standby officers.
- Review staffing levels to ensure that there is staff to cover the Event. Report to Manager Water Operations (MWO), Manager Water Infrastructure Assets Management (MWIAM) any deficiencies in staffing levels.
- Submit records and reports every 250mm rise or 2 hours to MWO and MWIAM for review.
- Monitor SCADA for Dam levels, TRC rainfall gauges, and flow through inflow weirs.

The Manager Water Operations (MWO) shall:

- Inform Director Water Services (DWS) and Manager Water Infrastructure Assets Management (MWIAM) of alert status after receiving confirmation from Unit Leader Water Operations - North (ULWO-N).
- Provide status report to DWS & MWIAM.
- Review all event logs, records and reports from the Unit Leader Water Operations - North (ULWO-N).

- Ensure Water Operations staffing levels are sufficient to cover the Event. .
- Ensure Water Operations staff are equipped to cover the Event.
- Refer Flood Inundation Maps (Appendix B)

4.2 FLOOD ALERT STAGE 2

Flood alert 2 is activated when storage Level is RL 478.04, 0.5m below Full Supply Level and rising to RL 479.04, 0.50m above Full Supply Level

ACTIONS

NOTE: If weather conditions indicate a large Spillway flow is imminent, station officers at the Dam.

The Dam Operator shall:

- Monitor water levels in the dam reporting every 250mm rise or 2 hours. Ring or radio through to the Unit Leader Water Operations - North (ULWO-N) the reservoir levels and rainfall totals.
- Check that the 100mm drain valve at the bottom of the tunnel is closed. (NOTE: reopen valve after inflow and/or spillway overflow ceases)
- Notify Parks and Recreation to evacuate picnic area below spillway and dam wall, close Cooby dam to the public and lock the main entrance gates.
- Monitor reservoir water levels and rainfall totals. Ring or radio through to the Unit Leader Water Operations - North (ULWO-N) the reservoir levels and rainfall totals.
- Record the Reservoir level using pages in Section 5, to plot a graph of heights versus time, so that the trend of the inflow may be monitored. Record the rainfall on pages in Section 5, at regular intervals. Maintain Log of events/actions page in Section 5. Submit pages to MWO.
- On the Record of Communications sheet in Section 5, keep a daily running record of all telephone calls to and from the Dam Operator, or Standby Officer, for the duration of the Alert. Record to and from whom, actions requested and carried out, and time and date. On the Log of Events/Action sheet in Section 5, record daily Events/Actions for later transfer to the Dam Log Book.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Inform the Manager Water and Waste Operations (MWO), Manager Water Infrastructure Assets Management (MWIAM) and alert standby officers.
- Submit records and reports every 250mm rise or 2 hours to MWO and MWIAM for review.
- Monitor SCADA for Dam levels, TRC rainfall gauges, and flow through inflow weirs.
- Review staffing levels to ensure that there is staff to cover the Event. Report to Manager Water Operations (MWO), Manager Water Infrastructure Assets Management (MWIAM) any deficiencies in staffing levels.

The Manager Water Operations (MWO) shall:

- Inform Director Water Services (DWS) and Manager Water Infrastructure Assets Management (MWIAM) of alert status after receiving confirmation from Unit Leader Water Operations - North (ULWO-N).

- Provide status report to DWS & MWIAM.
- Review all event logs, records and reports from the Unit Leader Water Operations - North (ULWO-N).
- Ensure Water Operations staffing levels are sufficient to cover the Event.
- Ensure Water Operations staff are equipped to cover the Event.
- Refer Flood Inundation Maps (Appendix B)

4.3 FLOOD EVENT STAGE 1

Flood event 1 is activated when storage Level is RL 479.04, 0.5m above Full Supply Level and rising to RL 480.04, 1.5m over the spillway crest.

ACTIONS

NOTE: In any Flood Event, once the Spillway discharge peaks and commences to fall, inflow and tailwater levels should still be recorded as requested at the time of the Event.

The Dam Operator/Standby Officer shall:

- Monitor water levels in the dam reporting every 250mm rise or 2 hours. Ring or radio through to the Unit Leader Water Operations - North (ULWO-N) the reservoir levels and rainfall totals.
- On the Record of Communications sheet in Section 5, keep a daily running record of all telephone calls to and from the Dam Operator, or Standby Officer, for the duration of a Flood or Emergency Event. Record to and from whom, actions requested and carried out, and time and date. On the Log of Events/Action sheet in Section 5, record daily Events/Actions for later transfer to the Dam Log Book.
- After the Event, compile an Emergency Event Report, using the Format in Section 5, and forward unedited copies to the ULWO-N.
- Record the Reservoir level using pages in Section 5, to plot a graph of heights versus time, so that the trend of the inflow may be monitored. Record the rainfall on Sheet 1, Section 5, at regular intervals. Maintain Log of events/actions in Section 5.
- Photograph the embankment, spillway and area downstream of the spillway where damage is observed. Submit Sheets to Unit Leader Water Operations - North (ULWO-N).
- After the event undertake a dam safety inspection and submit the report to Unit Leader Water Operations - North (ULWO-N) for review.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Inform the Manager Water Operations (MWO) and Manager Water Infrastructure Assets Management (MWIAM) and mobilise standby officers. (The Standby Officer/s shall be available for the duration of a Flood or Emergency Event).
- Submit records and reports every 250mm or 2 hours to MWIAM for review.
- Forward copy of Status Report to the MWIAM.
- Monitor SCADA for Dam levels, TRC rainfall gauges, and flow through inflow weirs.
- Organise for a command post to be set up and manned at Mt Kynoch Treatment Plant.
- Review staffing levels to ensure that there is staff to cover the Event. Report to Manager Water Operations (MWO), Manager Water Infrastructure Assets Management (MWIAM) any deficiencies in staffing levels.
- If lake level is 479.04 and no more rain is forecast advise MWIAM to close the incident and re

classify to Flood Alert Stage 2.

The Manager Water Infrastructure Assets Management (MWIAM) shall:

- Inform Director Water Services (DWS) of flood status after receiving confirmation from ULWO-N.
- Advise TRC DCC Coordinator to alert downstream residences within 5km of the dam wall. (Section 3 Page7)
- Provide status report to DWS.
- Review all event logs, records and reports from the ULWO-N.
- Review the dam safety inspection report.
- Organise dam safety inspections by a Dam Safety Engineer where damage has occurred.
- Ensure Water Operations staffing levels are sufficient to cover the Event.
- Ensure Water Operations staff are equipped to cover the Event.
- Edit the Emergency Event Report for presentation to DWS within 48 hours of close of the incident.
- Refer Flood Inundation Maps (Appendix B)

The Director Water Services (DWS) shall:

Notify the TRC DCC to inform the following agencies of flood status;

- CEO of Toowoomba Regional Council.
- Jondaryan, Goombungee and Crows Nest Service Centre Managers;
- SES (South East Region);
- SES District Manager (Darling-Downs District);
- Director, Dam Safety (Water Supply) of Department of Environment and Resource Management, Brisbane of flood status.
- Review Status Reports, Emergency Event Report and any reports from the Dam Safety Engineer.
- Submit Emergency Event Report and any reports from the Dam Safety Engineer to the Director, Dam Safety (Water Supply) of DERM.
- Submit report to Toowoomba Regional Council where damage to the dam or potential dam safety issues have occurred.

Dam levels falling below current event stage:

- Inform TRC DCC Coordinator:

(1) To notify the following agencies that Cooby Dam is at Flood Alert Stage 2.

- CEO of Toowoomba Regional Council.
- Jondaryan, Goombungee and Crows Nest Service Centre Managers
- SES (South East Region).
- SES District Manager (Darling-Downs District).

(2) Provide advice on the status report to the DCC Coordinator as required.

(3) Advise Director, Dam Safety (Water Supply) of DERM of flood status

The Chief Executive Officer (CEO) shall:

- Reply to public/media requests for event information.

4.4 FLOOD EVENT STAGE 2

Flood event 2 is activated when storage Level is RL 480.04, 1.5m above Full Supply Level and rising to RL 481.3, 2.76m over the spillway crest

ACTIONS

The Dam Operator/Standby Officer shall:

- Monitor water levels in the dam reporting every 250mm rise or 2 hours. Ring or radio through to the Unit Leader Water Operations - North (ULWO-N) the reservoir levels and rainfall totals.
- Seal door to intake tower. (NOTE: Unseal door after inflow and/or spillway overflow ceases)
- Monitor water levels in Cooby Creek downstream of the dam and at toe of Dam wall for backfilling of water and erosion of toe of wall.
- On the Record of Communications sheet in Section 5, keep a daily running record of all telephone calls to and from the Dam Operator, or Standby Officer, for the duration of a Flood or Emergency Event. Record to and from whom, actions requested and carried out, and time and date. On the Log of Events/Action sheet in Section 5, record daily Events/Actions for later transfer to the Dam Log Book.
- Record the Reservoir level using pages in Section 5, to plot a graph of heights versus time, so that the trend of the inflow may be monitored. Record the rainfall in Section 5, at regular intervals. Maintain Log of events/actions in Section 5.
- Monitor and record events details in the log of events as they occur, including details of weather conditions and rainfall, development of seepage areas or signs of movement and photograph any damage to the dam embankment, spillway, area downstream of the spillway and areas upstream and downstream of the dam.
- Make hourly inspections of the dam and spillway, looking for signs of damage such as deformation, structural movement, erosion, springs, cracking, slumping.
- Photograph the embankment, spillway and area downstream of the spillway where damage is observed. Submit to Unit Leader Water Operations - North (ULWO-N).
- After the Event, compile an Emergency Event Report, using the Format in Section 5, and forward unedited copies to the ULWO-N.
- After the event undertake a dam safety inspection and submit the report to Unit Leader Water Operations - North (ULWO-N) for review.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Inform the Manager Water Operations (MWO) and Manager Water Infrastructure Assets Management (MWIAM) of flood status.
- Submit records and reports to MWIAM for review for each 250 mm rise in water level or every 2 hours.

- Forward unedited copies of Status Report to the MWIAM.
- Monitor SCADA for Dam levels, TRC rainfall gauges, and flow through inflow weirs.
- Organise for a command post to be set up and manned at Mt Kynoch Treatment Plant.
- Review staffing levels to ensure that there is staff to cover the Event. Report to Manager Water Operations (MWO), Manager Water Infrastructure Assets Management (MWIAM) any deficiencies in staffing levels.
- If lake level is 480.04 and no more rain is forecast, advise MWIAM to close the incident and re classify to Event Stage 1.

The Manager Water Infrastructure Assets Management (MWIAM) shall:

- Inform Director Water Services (DWS) of flood status after receiving confirmation from ULWO-N.
- Recommend to DWS to evacuate properties identified within 5km downstream of Cooby Dam Wall.
- Issue request to close the following road access areas to Cooby Dam;
  (1) Pipeline Road / Cooby Dam Road (Emergency/authorised vehicles only)
  (2) Cooby Dam Road / Leahy Road (Emergency/authorised vehicles only)
  (3) Cooby Dam Road / Klein Road (Emergency/authorised vehicles only)
- Provide status report to DWS.
- Review all event logs, records and reports from the ULWO-N.
- Review the dam safety inspection report.
- Organise dam safety inspections by a Dam Safety Engineer where damage has occurred.
- Ensure Water Operations staffing levels are sufficient to cover the Event.
- Ensure Water Operations staff are equipped to cover the Event.
- Edit the Emergency Event Report for presentation to DWS within 48 hours of close of incident.
- Refer Flood Inundation Maps (Appendix B)
- Advise TRC DCC Coordinator to notify the Residents downstream of Cooby Dam of expected flood levels and prepare to issue evacuation orders. Notification should include all properties that are within the boundaries of the inundation maps, the Army Aviation Base and residences in Oakey.

The Director Water Services (DWS) shall:

(1) Notify the TRC DCC Coordinator to inform the following agencies of flood status;

- CEO of Toowoomba Regional Council.

- Jondaryan, Goombungee and Crows Nest Service Centre Managers;
- SES (South East Region);
- SES District Manager (Darling-Downs District);
- Director, Dam Safety (Water Supply) of Department of Environment and Resource Management, Brisbane of flood status.
- Authorise MWIAM to issue evacuation order to the TRC DCC Coordinator for Cooby Creek area downstream of Cooby Dam.

(2) Review Status Reports, Emergency Event Report and any reports from the Dam Safety Engineer.

(3) Submit Emergency Event Report and any reports from the Dam Safety Engineer to the Director, Dam Safety (Water Supply) of DERM.

(4) Submit report to Toowoomba Regional Council where damage to the dam or potential dam safety issues have occurred.

(5) Review status of the Dam and if required, advise Oakey and Toowoomba Police and SES (South East Region) and SES District Manager (Darling-Downs District) to evacuate the downstream flood plain.

(6) Road and Rail shall be signed for possible closure or be closed with appropriate signage at Oakey Creek (ie. Highfields Road, Kingsthorpe- Haden, Acland Road and Warrego Highway).

Dam levels falling below current event stage:

- Inform TRC DCC Coordinator:

(1) To notify the following agencies that Cooby Dam is at Flood Event Stage 1

- CEO of Toowoomba Regional Council
- Jondaryan, Goombungee and Crows Nest Service Centre Managers
- SES (South East Region)
- SES District Manager (Darling-Downs District)

(2) Provide advice on the status report to the TRC DCC Coordinator as required.

(3) Advise Director, Dam Safety (Water Supply) of DERM of flood status.

The Chief Executive Officer (CEO) shall:

- Reply to public/media requests for event information.

4.5 FLOOD EVENT STAGE 3

Flood event 3 is activated when storage Level is RL 481.3, 2.76m above Full Supply Level and rising to RL 482.9, 4.36m over the spillway crest

ACTIONS

The Dam Operator/Standby Officer shall:

- Monitor water levels in the dam every 250mm rises or 2 hour. Ring or radio through to the Unit Leader Water Operations - North (ULWO-N) the reservoir levels and rainfall totals.
- Monitor water levels in Cooby Creek downstream of the dam and at toe of Dam wall for backfilling of water and erosion of toe of wall.
- On the Record of Communications sheet, Page 4, Section 5, keep a daily running record of all telephone calls to and from the Dam Operator, or Standby Officer, for the duration of a Flood or Emergency Event. Record to and from whom, actions requested and carried out, and time and date. On the Log of Events/Action sheet, Sheet 3, Section 5, record daily Events/Actions for later transfer to the Dam Log Book.
- Record the Reservoir level using page in Section 5, to plot a graph of heights versus time, so that the trend of the inflow may be monitored. Record the rainfall on page in Section 5, at regular intervals. Maintain Log of events/actions in Section 5.
- Monitor and record events details in the log of events as they occur, including details of weather conditions and rainfall, development of seepage areas or signs of movement and photograph any damage to the dam embankment, spillway, area downstream of the spillway and areas upstream and downstream of the dam.
- Make hourly inspections of the dam and spillway, looking for signs of damage such as deformation, structural movement, erosion, springs, cracking, slumping.
- Photograph the embankment, spillway and area downstream of the spillway where damage is observed. Submit to Unit Leader Water Operations - North (ULWO-N).
- After the Event, compile an Emergency Event Report, using the Format in Section 5, and forward unedited copies to the ULWO-N.
- After the event undertake a dam safety inspection and submit the report to Unit Leader Water Operations - North (ULWO-N) for review.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Inform the Manager Water Operations (MWO) and Manager Water Infrastructure Assets Management (MWIAM) of flood status.
- Submit records and reports to MWAIM for review for each 250 mm rise in water level or every 2 hours.
- Forward unedited copies of Emergency Event Report to the MWIAM.

- Monitor SCADA for Dam levels, TRC rainfall gauges, and flow through inflow weirs.
- Organise for a command post to be set up and manned at Mt Kynoch Treatment Plant.
- Review staffing levels to ensure that there is staff to cover the Event. Report to Manager Water Operations (MWO), Manager Water Infrastructure Assets Management (MWIAM) any deficiencies in staffing levels.
- If lake level is 481.30 and no more rain is forecast, advise MWIAM to reclassify the incident to Flood Event Stage 2.

The Manager Water Iufrastructure Assets Management (MWIAM) shall:

- Inform Director Water Services (DWS) of flood status after receiving confirmation from Dam operators/Standby officer/s.
- Provide status report to DWS.
- Review all event logs, records and reports from the ULWO-N.
- Review the dam safety inspection report.
- Organise dam safety inspections by a Dam Safety Engineer where damage has occurred.
- Ensure Water Operations staffing levels are sufficient to cover the Event.
- Ensure Water Operations staff are equipped to cover the Event.
- Edit the Emergency Event Report for presentation to DWS.
- Refer Flood Inundation Maps (Appendix B)
- Advise TRC DCC Coordinator to notify the Residents downstream of Cooby Dam of expected flood levels issue evacuation orders. Notification should include all properties that are within the boundaries of the inundation maps, the Army Aviation Base and residences in Oakey.
-

The Director Water Services (DWS) shall:

(1) Notify the TRC DCC Coordinator to inform the following agencies of flood status;

- CEO of Toowoomba Regional Council.
- Jondaryan, Goombungee and Crows Nest Service Centre Managers;
- SES (South East Region);
- SES District Manager (Darling-Downs District);
- Director, Dam Safety (Water Supply) of Department of Environment and Resource Management, Brisbane of flood status.
- Authorise MWIAM to issue evacuation order to the TRC DCC Coordinator for Cooby Creek area downstream of Cooby Dam.

(2) Review Status Reports, Emergency Event Report and any reports from the Dam Safety Engineer.

(3) Submit Emergency Event Report and any reports from the Dam Safety Engineer to the Director, Dam Safety (Water Supply) of DERM.

(4) Submit report to Toowoomba Regional Council where damage to the dam or potential dam safety issues have occurred.

(5) Review status of the Dam and if required, advise Oakey and Toowoomba Police and SES (South East Region) and SES District Manager (Darling-Downs District) to evacuate the downstream flood plain.

(6) Road and Rail shall be signed for possible closure or be closed with appropriate signage at Oakey Creek (ie. Highfields Road, Kingsthorpe- Haden, Acland Road and Warrego Highway).

Dam levels falling below current event stage:

- Inform TRC DCC Coordinator:

(1) To notify the following agencies that Cooby Dam is at Flood Event Stage 2

- CEO of Toowoomba Regional Council
- Jondaryan, Goombungee and Crows Nest Service Centre Managers
- SES (South East Region)
- SES District Manager (Darling-Downs District)

(2) Provide advice on the status report to the DCC Coordinator as required.

(3) Advise Director, Dam Safety (Water Supply) of DERM of flood status.

The Chief Executive Officer (CEO) shall:

- Reply to public/media requests for event information.

4.6 FLOOD EVENT STAGE 4

Flood event 4 is activated when storage Level is RL 482.90, 3.86 m above Full Supply Level and rising to RL 483.40, 4.86 m over the spillway crest

Note: The Dam structure is under significant loading at water depth of 4.86m. The Residences within 5 km downstream of the dam should be evacuated.

ACTIONS

The Dam Operator/Standby Officer shall:

- Monitor water levels in the dam every 100mm rises or hourly. Ring or radio through to the Unit Leader Water Operations - North (ULWO-N) the reservoir levels and rainfall totals.
- Monitor water levels in Cooby Creek downstream of the dam and at toe of Dam wall for backfilling of water and erosion of toe of wall.
- On the Record of Communications sheet in Section 5, keep a daily running record of all telephone calls to and from the Dam Operator, or Standby Officer, for the duration of a Flood or Emergency Event. Record to and from whom, actions requested and carried out, and time and date. On the Log of Events/Action sheet in Section 5, record daily Events/Actions for later transfer to the Dam Log Book.
- Record the Reservoir level using page in Section 5, to plot a graph of heights versus time, so that the trend of the inflow may be monitored. Record the rainfall in Section 5, at regular intervals. Maintain Log of events/actions in Section 5.
- Monitor and record events details in the log of events as they occur, including details of weather conditions and rainfall, development of seepage areas or signs of movement and photograph any damage to the dam embankment, spillway, area downstream of the spillway and areas upstream and downstream of the dam.
- Make hourly inspections of the dam and spillway, looking for signs of damage such as deformation, structural movement, erosion, springs, cracking, slumping.
- Photograph the embankment, spillway and area downstream of the spillway where damage is observed. Submit to Unit Leader Water Operations - North (ULWO-N).
- After the Event, compile an Emergency Event Report, using the Format in Section 5, and forward unedited copies to the ULWO-N.
- If embankment failure occurs, **immediately** report to MWIAM and photograph event using video camera (if safe to do so)
- After the event undertake a dam safety inspection and submit the report to Unit Leader Water Operations - North (ULWO-N) for review.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Inform the Manager Water Operations (MWO) and Manager Water Infrastructure Assets Management (MWIAM) of flood status.

- Submit records and reports to MWIAM for review for each 100 mm rise in water level or hourly.
- Forward unedited copies of Emergency Event Report to the MWIAM.
- Monitor SCADA for Dam levels, TRC rainfall gauges, and flow through inflow weirs.
- Organise for a command post to be set up and manned at Mt Kynoch Treatment Plant.
- Review staffing levels to ensure that there is staff to cover the Event. Report to Manager Water Operations (MWO), Manager Water Infrastructure Assets Management (MWIAM) any deficiencies in staffing levels.
- If lake level is 482.40 and no more rain is forecast, advise MWIAM to reclassify the incident to Flood Event Stage 3.

The Manager Water Iufrastructure Assets Management (MWIAM) shall:

- Inform Director Water Services (DWS) of flood status after receiving confirmation from Dam operators/Standby officer/s.
- Provide status report to DWS.
- Review all event logs, records and reports from the ULWO-N.
- Monitor the BoM rainfall information and track progress of flood using the TRC flood warning system. (Pending the expansion of the BCC Flood Wise System)
- Review the dam safety inspection report.
- Edit the Emergency Event Report for presentation to DWS.
- Organise dam safety inspections by a Dam Safety Engineer where damage has occurred.
- Ensure Water Operations staffing levels are sufficient to cover the Event.
- Ensure Water Operations staff are equipped to cover the Event.
- Refer Flood Inundation Maps (Appendix B)

The Director Water Services (DWS) shall:

(1) Notify the TRC DCC Coordinator to inform the following agencies of flood status;

- CEO of Toowoomba Regional Council.
- Jondaryan, Goombungee and Crows Nest Service Centre Managers;
- SES (South East Region);
- SES District Manager (Darling-Downs District);
- Director, Dam Safety (Water Supply) of Department of Environment and Resource Management, Brisbane of flood status.

(2) Review Status Reports, Emergency Event Report and any reports from the Dam Safety Engineer.

(3) Submit Emergency Event Report and any reports from the Dam Safety Engineer to the Director,

Dam Safety (Water Supply) of DERM.

(4) Submit report to Toowoomba Regional Council where damage to the dam or potential dam safety issues have occurred.

(5) Review status of the Dam and if required, advise Oakey and Toowoomba Police and SES (South East Region) and SES District Manager (Darling-Downs District) to evacuate the downstream flood plain.

(6) Road and Rail shall be signed for possible closure or be closed with appropriate signage at Oakey Creek (ie. Highfields Road, Kingsthorpe- Haden, Acland Road and Warrego Highway).

(7) Confirm with TRC DCC Coordinator that all properties that are within the boundaries of the inundation maps, the Army Aviation Base and residences in Oakey have been evacuated.

Dam levels falling below current event stage:

- Inform TRC DCC Coordinator:

(1) To notify the following agencies that Cooby Dam is at Flood Event Stage 3

- CEO of Toowoomba Regional Council
- Jondaryan, Goombungee and Crows Nest Service Centre Managers
- SES (South East Region)
- SES District Manager (Darling-Downs District)

(2) Provide advice on the status report to the DCC Coordinator as required.

(3) Advise Director, Dam Safety (Water Supply) of DERM of flood status.

The Chief Executive Officer (CEO) shall:

- Reply to public/media requests for event information.

4.7 FLOOD EVENT STAGE 5

Flood event 5 is activated when storage Level is RL 483.40, 4.86 m over the spillway crest and Reaching and Overtopping the Dam Crest Wave Wall i.e. 5.46 m (RL 484).

Note 1. : The Dam structure is under significant loading at water depth of 4.86m. At 5.4m the wave wall will be overtopped and the dam is at imminent failure condition. The Residences downstream of the dam should be evacuated.

Note 2. : The probable maximum precipitation flood is estimated to flow 8.3m over the spillway or assuming the dam does not fail first, approximately 2.8 m flowing over the dam crest wave wall.

ACTIONS

The Dam Operator/Standby Officer shall:

- Monitor water levels in the dam every 50mm rises or 1 hour. Ring or radio through to the Unit Leader Water Operations - North (ULWO-N) the reservoir levels and rainfall totals.
- Monitor water levels in Cooby Creek downstream of the dam and at toe of Dam wall for backfilling of water and erosion of toe of wall.
- On the Record of Communications sheet in Section 5, keep a daily running record of all telephone calls to and from the Dam Operator, or Standby Officer, for the duration of a Flood or Emergency Event. Record to and from whom, actions requested and carried out, and time and date. On the Log of Events/Action sheet in Section 5, record daily Events/Actions for later transfer to the Dam Log Book.
- Record the Reservoir level using pages in Section 5, to plot a graph of heights versus time, so that the trend of the inflow may be monitored. Record the rainfall in Section 5, at regular intervals. Maintain Log of events/actions in Section 5.
- Monitor and record events details in the log of events as they occur, including details of weather conditions and rainfall, development of seepage areas or signs of movement and photograph any damage to the dam embankment, spillway, area downstream of the spillway and areas upstream and downstream of the dam.
- Make hourly inspections of the dam and spillway, looking for signs of damage such as deformation, structural movement, erosion, springs, cracking, slumping.
- Photograph the embankment, spillway and area downstream of the spillway where damage is observed. Submit to Unit Leader Water Operations - North (ULWO-N).
- After the Event, compile an Emergency Event Report, using the Format in Section 5, and forward unedited copies to the ULWO-N.
- If embankment failure occurs, **immediately** report to MWIAM and photograph event using video camera (if safe to do so)
- After the event undertake a dam safety inspection and submit the report to Unit Leader Water Operations - North (ULWO-N) for review.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Inform the Manager Water Operations (MWO) and Manager Water Infrastructure Assets Management (MWIAM) of flood status.
- Submit records and reports to MWIAM for review for each 50 mm rise in water level or hourly.
- Forward unedited copies of Emergency Event Report to the MWIAM.
- Monitor SCADA for Dam levels, TRC rainfall gauges, and flow through inflow weirs.
- Organise for a command post to be set up and manned at Mt Kynoch Treatment Plant.
- Review staffing levels to ensure that there is staff to cover the Event. Report to Manager Water Operations (MWO), Manager Water Infrastructure Assets Management (MWIAM) any deficiencies in staffing levels.
- If lake level is 483.40 and no more rain is forecast, advise MWIAM to reclassify the incident to Flood Event Stage 4.

The Manager Water Infrastructure Assets Management (MWIAM) shall:

- Inform Director Water Services (DWS) of flood status after receiving confirmation from Dam operators/Standby officer/s.
- Provide status report to DWS.
- Review all event logs, records and reports from the ULWO-N.
- Monitor the BoM rainfall information and track progress of flood using the TRC flood warning system. (Pending the expansion of the BCC Flood Wise System)
- Review the dam safety inspection report.
- Edit the Emergency Event Report for presentation to DWS.
- Organise dam safety inspections by a Dam Safety Engineer where damage has occurred.
- Ensure Water Operations staffing levels are sufficient to cover the Event.
- Ensure Water Operations staff are equipped to cover the Event.
- Refer Flood Inundation Maps (Appendix B)

The Director Water Services (DWS) shall:

(1) Notify the TRC DCC Coordinator to inform the following agencies of flood status;

- CEO of Toowoomba Regional Council.
- Jondaryan, Goombungee and Crows Nest Service Centre Managers;

- SES (South East Region);
- SES District Manager (Darling-Downs District);
- Director, Dam Safety (Water Supply) of Department of Environment and Resource Management, Brisbane of flood status.

(2) Review Status Reports, Emergency Event Report and any reports from the Dam Safety Engineer.

(3) Submit Emergency Event Report and any reports from the Dam Safety Engineer to the Director, Dam Safety (Water Supply) of DERM.

(4) Submit report to Toowoomba Regional Council where damage to the dam or potential dam safety issues have occurred.

(5) Review status of the Dam and if required, advise Oakey and Toowoomba Police and SES (South East Region) and SES District Manager (Darling-Downs District) to evacuate the downstream flood plain.

(6) Road and Rail shall be signed for possible closure or be closed with appropriate signage at Oakey Creek (ie. Highfields Road, Kingsthorpe- Haden, Acland Road and Warrego Highway).

Dam levels falling below current event stage:

- Inform TRC DCC Coordinator:

(1) To notify the following agencies that Cooby Dam is at Flood Event Stage 4

- CEO of Toowoomba Regional Council
- Jondaryan, Goombungee and Crows Nest Service Centre Managers
- SES (South East Region)
- SES District Manager (Darling-Downs District)

(2) Provide advice on the status report to the DCC Coordinator as required.

(3) Advise Director, Dam Safety (Water Supply) of DERM of flood status.

The Chief Executive Officer (CEO) shall:

- Reply to public/media requests for event information.

4.8 SUNNY DAY FAILURE EVENT

Emergency Situation has developed or is developing. Increasing Seepage or New Area of Seepage through the Embankment

ACTIONS

The Dam Operator/Standby Officer shall:

- Immediately report to Unit Leader Water Operations - North (ULWO-N) any sudden increases or changes in seepage from the downstream face, toe and groins of the dam (i.e., seepage rates or colour) or slumps, slips or bulging in the embankment.
- Provide information and assist the ULWO-N in monitoring the seepage and other areas of dam safety concern at the dam as directed by the ULWO-N and to confirm that telemetry data for seepage is correct.
- Record the Reservoir level using sheet in Section 5, to plot a graph of heights versus time, so that the trend of the inflow may be monitored. Record the rainfall on Sheet 1, Section 5, at regular intervals. Maintain Log of events/actions in Section 5. Monitor and photograph any damage to the embankment, spillway and area downstream of the spillway at regular intervals. Submit to ULWO-N.
- On the Record of Communications sheet, in Section 5, keep a daily running record of all telephone calls to and from the Dam Operator/Standby Officer, for the duration of Sunny Day Event. Record to and from whom, actions requested and carried out, and time and date. On the Log of Events/Action sheet, Sheet 3, Section 5, record daily Events/Actions for later transfer to the Dam Log Book.
- After the Event, compile an Emergency Event Report, using the Format on Page 5, Section 5, and forward unedited copies to the ULWO-N.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Where confirmed by Dam Operator, inform Manager Water Infrastructure Assets Management (MWIAM) and Manager Water Operations (MWO) of noticeable changes in the embankment. Observations and comments made by the Dam Operator or members of the public are to be acted upon when received in order to ensure timely recognition of a potential damage situation.
- Measure the rate of seepage flow and observe the clarity of the seepage flow, keeping notes and photographs for the log and the routine dam safety inspections.
- Advise MWIAM of status.
- If it is deemed that there are no immediate concerns to the safety of the dam and immediate repairs are not needed then continue to monitor the damage and record the event details in the Log.
- If the seepage is increasing, report the increase to MWIAM.
- If embankment failure occurs, **immediately** report to MWIAM and photograph event using video camera (if safe to do so)

- After the event submit records and reports to MWIAM for review.

Manager Water Infrastructure Assets Management (MWIAM)

- Inform the DWS of the status.
- Review seepage records and where data indicates sudden unexplained increase, request ULWO-N /Dam Operator to inspect the dam and structures for signs of damage.
- On receipt of damage report, carry out field inspection. If necessary, obtain specialist technical advice from a Dam Consultant.
- If the damage is unlikely to lead to dam failure, advise the ULWO-N to continue monitoring the damage for signs of increased seepage.
- If possible, carry out emergency repairs to prevent the rate of seepage leading to failure of the dam. Obtain the likelihood of adverse weather conditions from the Bureau of Meteorological Services preventing or hampering repairs.
- If failure of the dam does not occur, arrange for a dam safety inspection after the event.
- Where emergency repairs have been carried out, arrange for construction details to be recorded.
- After the event, review records and reports from the MWO and other reports produced following the event and compile an Emergency Event Report to DWS for review.
- If dam failure has occurred, make all records of the event available for future investigation.
- Refer Flood Inundation Maps (Appendix B)

Director Water Services (DWS)

- If reports from MWIAM confirm that significant damage has occurred or emergency situation is developing immediately inform the Toowoomba Regional Council CEO and the Jondaryan, Goombungee and Crows Nest Service Centre Managers and Director Dam Safety (Water Supply, DERM) of damage and steps taken or being taken to address the problem including the use of specialised technical advisors. Maintain contact hourly until the end of the event or until rectified and record all phone calls and conversations on Sheet 4, Section 5 of this EAP.
- Review status of the Dam and if required, advise Oakey and Toowoomba Police and SES (South East Region) and SES District Manager (Darling-Downs District) to evacuate the downstream flood plain.
- Road and Rail shall be signed for possible closure or be closed with appropriate signage at Oakey Creek (ie. Highfields Road, Kingsthorpe- Haden, Acland Road and Warrego Highway).
- Advise TRC DCC Coordinator to notify the Residents downstream of Cooby Dam of expected flood levels. Notification should include all properties that are within the boundaries of the inundation maps, the Army Aviation Base and residences in Oakey.
- Arrange for additional steps to be taken as required to mitigate the effects of any damage. The Director Dam Safety (Water Supply, DERM) may direct activities based on the extent and type

of damage.

- Review Emergency Event Report and submit to CEO. Submit Emergency Event Report to the Director of Dam Safety (Water Supply, DERM).
- If required after the event, arrange for an investigation.
- Submit report to Toowoomba Regional Council where damage to the dam or potential dam safety issues has occurred.

The Chief Executive Officer (CEO) shall:

- Reply to public/media requests for event information.

4.9 COOBY LOW LEVEL INFLOW EVENTS

The Low level inflow event is activated when storage rises 5m or greater but does not reach the Alert and Event trigger levels.

NOTE: Once the dam level reaches the trigger levels for the Alert and Event level follow the actions as listed under the appropriate section.

ACTIONS

The Dam Operator/Standby Officer shall:

- Monitor water levels in the dam reporting every 500mm rise or 12 hours. Ring or radio through to the Unit Leader Water Operations - North (ULWO-N) the reservoir levels and rainfall totals.
- Record the Reservoir level using Sheet 2, Section 5, to plot a graph of heights versus time, so that the trend of the inflow may be monitored. Record the rainfall on Sheet 1, Section 5, at regular intervals. Maintain Log of events/actions Sheet 3, Section 5. Photograph the embankment, spillway and area downstream of the spillway where damage is observed. Submit Sheets 1, 2 and 3 to ULWO-N.
- On the Record of Communications sheet, Page 4, Section 5, keep a daily running record of all telephone calls to and from the Dam Operator, or Standby Officer, for the duration of a Flood or Emergency Event. Record to and from whom, actions requested and carried out, and time and date. On the Log of Events/Action sheet, Sheet 3, Section 5, record daily Events/Actions for later transfer to the Dam Log Book.
- After the Event, compile an Emergency Event Report, using the Format on Page 5, Section 5, and forward unedited copies to the ULWO-N.
- In accordance with SOP16 undertake daily routine inspections for a period of three weeks.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Inform the Manager Water Operations (MWO) and Manager Water Infrastructure Assets Management (MWIAM) and mobilise standby officers. (The Standby Officer/s shall be available for the duration of a Flood or Emergency Event).
- Submit records and reports every 500mm or 12 hours to MWIAM for review.
- Forward copy of Emergency Event Report to the MWIAM.
- Review Low level inflow event at Perseverance Dam, which is likely to be experiencing a similar or greater dam level rise. Carry out EAP as appropriate for that structure.
- Monitor SCADA for Dam levels, TRC rainfall gauges, and flow through inflow weirs.
- Organise for a command post to be set up and manned at Mt Kynoch Treatment Plant.
- Review staffing levels to ensure that there is staff to cover the Event. Manager Water

Operations (MWO), Manager Water Infrastructure Assets Management (MWIAM) any deficiencies in staffing levels.

The Manager Water Infrastructure Assets Management (MWIAM) shall:

- Inform Director Water Services (DWS) of flood status after receiving confirmation from Dam operators/Standby officer/s.
- Provide status report to DWS.
- Review all event logs, records and reports from the ULWO-N.
- Monitor the BoM rainfall information and track progress of flood using the TRC flood warning system. (Pending the expansion of the BCC Flood Wise System)
- Review the dam safety inspection report.
- Edit the Emergency Event Report for presentation to DWS.
- Organise dam safety inspections by a Dam Safety Engineer where damage has occurred.
- Ensure Water Operations staffing levels are sufficient to cover the Event.
- Ensure Water Operations staff are equipped to cover the Event.

The Director Water Services (DWS) shall:

- Review Emergency Event Report and any reports from the Dam Safety Engineer.
- Submit report to Toowoomba Regional Council where damage to the dam or potential dam safety issues have occurred.

The Chief Executive Officer (CEO) shall:

- Reply to public/media requests for event information.

4.10 EARTHQUAKE EVENT

4.10.1 Earthquake Felt in Area

ACTIONS

The Dam Operator shall:

- Inform the Unit Leader Water Operations - North (ULWO-N) of any seismic activity felt/known from any source at the dam and assist the ULWO-N in monitoring the performance of the dam.
- Immediately inspect the embankment, concrete face slab and plinth, outlet pipe, conduit, intake tower, spillway structure and abutments for springs, deformation, cracking and erosion, concrete damage, etc. Check for signs of slumps, sink holes and erosion on the downstream face of the embankment, especially near the spillway and the pipe outlets. Complete a Log of events/actions Sheet 3, Section 5 and submit to ULWO-N for review.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Respond to any information of an earthquake in the area from the Dam Operator or local residents and inform Manager Water Infrastructure Assets Management (MWIAM) and Manager Water Operations (MWO) that an earthquake was felt in the area. The ULWO-N is to ensure timely observation of potential damage to the dam due to the event.
- Immediately perform a dam safety inspection to confirm damage identified by Dam operator. During the inspection note signs of slumps, erosion, springs, cracks, high seepage flows, or any deformation,
- On detection of leakage and/or springs, proceed with the Emergency Actions for 4.8 Sunny Day Failure.
- After the event immediately submit records and reports to the MWIAM for review.
- Compile Emergency Event Log and submit to MWIAM for review.

Manager Water Infrastructure Assets Management (MWIAM) shall:

- Inform the DWS of the status.
- Review seepage records or alarms and where data indicates sudden increase, request ULWO-N /Dam Operator to inspect the dam and structures for signs of damage.
- On receipt of damage report, carry out field inspection if damage identified. If necessary, obtain specialist technical advice from a Dam Consultant.
- Submit damage report to the DWS for action.
- If the damage is unlikely to lead to dam failure, advise the MWO to compile an Emergency Event Report and submit to DWS.
- If a new area of seepage has initiated, carry out emergency repairs to prevent the rate of seepage leading to failure of the dam.

- If failure of the dam does not occur, arrange for a dam safety inspection after the event.
- Where emergency repairs have been carried out, arrange for construction details to be recorded.
- After the event, review records and reports from the MWO and other reports produced following the event and submit Emergency Event Report to DWS.
- If dam failure has occurred, make all records of the event available for future investigation.
- Refer Flood Inundation Maps (Appendix B)

Director Water Services (DWS) shall:

- If reports from MWIAM confirm that significant damage has occurred or emergency situation is developing immediately inform the Toowoomba Regional Council CEO and the Jondaryan, Goombungee and Crows Nest Service Centre Managers and Director Dam Safety (Water Supply, DERM) of damage and steps taken or being taken to address the problem including the use of specialised technical advisors. Maintain contact hourly until the end of the event or until rectified and record all phone calls and conversations on pages in Section 5 of this EAP.
- Review status of the Dam and if required, advise Oakey and Toowoomba Police and SES (South East Region) and SES District Manager (Darling-Downs District) to evacuate the downstream flood plain.
- Road and Rail shall be signed for possible closure or be closed with appropriate signage at Oakey Creek (ie. Highfields Road, Kingsthorpe- Haden, Acland Road and Warrego Highway).
- Advise TRC DCC Coordinator to notify the Residents downstream of Cooby Dam requesting them to observe flood levels in the Oakey Creek catchment area. Notification should include all properties that are within the boundaries of the inundation maps, the Army Aviation Base and residences in Oakey.
- The Director Dam Safety (Water Supply, DERM) may direct activities based on the extent and type of damage.
- Review Emergency Event Report and submit to CEO. Submit Emergency Event Report to the Director of Dam Safety (Water Supply, DERM).
- Arrange for additional steps to be taken as required to mitigate the effects of any damage.
- Submit report to Toowoomba Regional Council where damage to the dam or potential dam safety issues has occurred.

The Chief Executive Officer (CEO) shall:

- Reply to public/media requests for event information.

4.10.2 Results of Earthquake:

4.10.2.1 Outlet Pipe Blockage

ACTIONS

The Dam Operator shall:

- Notify Unit Leader Water Operations - North (ULWO-N) of outlet pipe blockage.
- Immediately inspect the embankment, concrete face slab and plinth, outlet pipe, conduit, intake tower, spillway structure and abutments for springs, deformation, cracking and erosion, concrete damage, etc. Check for signs of slumps, sink holes and erosion on the downstream face of the embankment, especially near the spillway and the pipe outlets. Complete a Log of Events/Actions in Section 5 and submit to ULWO-N for review.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Unit Leader Water Operations - North (ULWO-N) to confirm blockage of outlet pipe and direct Dam Operator to isolate the outlet pipe at the valve house.
- Inform Manager Water Infrastructure Assets Management (MWIAM) and Manager Water Operations (MWO) of the closure.
- Compile Emergency Event Log and submit to MWIAM for review.

Manager Water Infrastructure Assets Management (MWIAM) shall:

- Inform the DWS of the status.
- Identify the problem, check the Design drawings and plan rectification action.
- On receipt of damage report, carry out field inspection if damage identified. If necessary, obtain specialist technical advice from a Dam Consultant. Carry out emergency repairs to rectify the situation.
- Submit Emergency Event Log to the DWS.

4.10.2.2 Sink Holes Occurring

ACTIONS

The Dam Operator shall:

- Immediately inspect the dam embankment for further holes.
- Inform the Unit Leader Water Operations - North (ULWO-N) of the number, size and location, photograph and monitor development.
- On the Log of Events/Action sheet, Sheet 3, Section 5, record daily Events/Actions for later transfer to the Dam Log Book.
- If leakage occurs initiate Emergency Action Plan for Increasing Seepage or New Area of Seepage through the Embankment (Section 4.8).

The Unit Leader Water Operations - North (ULWO-N) shall:

- Immediately perform a dam safety inspection to confirm damage identified by Dam Operator.
- Inform Manager Water Infrastructure Assets Management (MWIAM) and Manager Water Operations (MWO) of damages.

Manager Water Infrastructure Assets Management (MWIAM) shall:

- Arrange dam safety inspection and obtain specialist technical advice from a Dam Consultant to investigate and recommend rectification works.

4.10.2.3 Flow Slide of the Embankment

ACTIONS

- Initiate Emergency Action Plan for Increasing Seepage or New Area of Seepage through the Embankment (Section 4.8).

4.10.2.4 Shallow Slides or Cracking of the Embankment

ACTIONS

The Dam Operator/Standby Officer shall:

- Immediately inspect the dam for further slides or cracking of the embankment. Inform the Unit Leader Water Operations - North (ULWO-N) of the number, size and location, photograph and monitor development.
- If leakage occurs initiate Emergency Action Plan for Increasing Seepage or New Area of Seepage through the Embankment (Section 4.8).
- Complete a Log of Events/Actions in Section 5 and submit to ULWO-N for review.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Immediately perform a dam safety inspection to confirm damage identified by Dam Operator.
- Inform Manager Water Infrastructure Assets Management (MWIAM) and Manager Water Operations (MWO) of damages

4.10.2.5 Deep-Seated Slides or Foundation Failure of Embankment

ACTIONS

The Dam Operator/Standby Officer shall:

- Storage Level >Top of Embankment Level – Depth of Water over Spillway > 4.86 m (EL 483.4) and Reaching and Overtopping the Dam Crest Wave Wall i.e. 5.46 m (EL 484) (Section 4.7).

4.11 TOXIC SPILL WITHIN CATCHMENT AREA

On detection or notification of a toxic or hazardous substance contaminating the Catchment or Storage

ACTIONS

The Dam Operator/Standby Officer shall:

- Identify the hazardous chemical or substance if possible and attempt to define the source and extent of contamination.
- Inform the Unit Leader Water Operations - North (ULWO-N) and assist in monitoring the spill.
- On the Log of Events/Actions sheet, and the Record of Communications sheet, (Section 5 of this EAP) keep a daily running record of all Actions/Events and telephone calls to and from the Storage Operator or Standby Officer, for the duration of an Emergency Event. Record to and from whom, actions requested and carried out, and time and date. Record the rainfall (if any) at the Dam during the Event (Section 5 of this EAP).
- After the Event, compile an Emergency Event Report, and forward unedited copies to the ULWO-N. Transfer the Record of Events/Actions, Communications, and Rainfall to the Dam Log Book after the Event (Section 5 of this EAP).

The Unit Leader Water Operations - North (ULWO-N) shall:

- Immediately inform the Police and SES Toowoomba of the presence of a contaminated site and, if required, seek advice as to the nature of the substance.
- Advise the Manager Water Infrastructure Assets Management (MWIAM) and Manager Water Operations (MWO) of the contamination and water supply status.
- Take reasonable steps to isolate the spill or contaminant from the Dam (containment embankment) or prevent further contamination.
- If there is a potential danger of the contaminated entering or being present in the storage, shut off all releases.
- Isolate the Intake Tower and stop all pumping.
- Monitor status of contamination and keep MWIAM informed.
- If safe, together with operational staff, take any reasonable measures to isolate the spill or contamination from the dam and reservoir.
- Provide alternative water sources for the location affected by closure of the water supply.
- If there is no potential danger of the contamination entering the reservoir, assist police by providing information and notifying the affected people (Tourists, residents).
- After the event immediately submit records and reports to the MWIAM for review.

Manager Water Infrastructure Assets Management (MWIAM) shall:

- Notify the Toowoomba Regional Council DWS by phone in the first instance, and follow up by facsimile.
- Inform the DWS of the contamination and the likelihood of contamination spreading to the downstream area.
- If the spill or contamination cannot be removed or isolated, arrange for specialist advice to address the problem in order to neutralise the effect of the contaminant.
- After the event review records and reports from the MWO and compile Emergency Event Report.

Director Water Services (DWS) shall:

- Inform CEO Toowoomba and Director Dam Safety (Water Supply, DERM).
- Inform of dam status to Jondaryan, Goombungee and Crows Nest Service Centre Managers, and those private properties that draw raw water from the pipeline.
- If the contamination is likely to spread to the downstream area, inform Police and State Emergency Service of contamination and prevent access to the area. Advise the general public to avoid entry into the area or use of water directly from contaminated reservoirs and creeks, until the contamination is identified and isolated.
- Submit report to Toowoomba Regional Council where a toxic spill has occurred within the catchment or storage area.

The Chief Executive Officer (CEO) shall:

- Reply to public/media requests for event information.

4.12 MOVEMENT OF DAM WALL

ACTIONS

Dam Operators

- Inform the Unit Leader Water Operations - North (ULWO-N) of any noticeable movement, slumping or crest settlements of the dam or the spillway and cracking that may be observed when attending the dam.
- Immediately inspect the embankment, concrete face slab and plinth, outlet pipe, conduit, intake tower, spillway structure and abutments for springs, deformation, cracking and erosion, concrete damage, etc. Check for signs of slumps, sink holes and erosion on the downstream face of the embankment, especially near the spillway and the pipe outlets. Complete a Log of events/actions in Section 5 and submit to ULWO-N for review.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Where confirmed by Dam Operator, inform Manager Water Infrastructure Assets Management (MWIAM) and Manager Water Operations (MWO) of noticeable changes in the embankment. Observations and comments made by the Dam Operator or members of the public are to be acted upon when received in order to ensure timely recognition of a potential damage situation.
- Perform a weekly inspection looking for new cracks or areas that have slumped or cracked. Information required to assess damage include the location, direction, size and shape of new cracks or sinkholes.
- Look for any new seepage or increase in the rate of seepage flow and observe the change in colour of the seepage flow, keeping notes and photographs for the log and the routine dam safety inspections.
- Where unexplained movement or cracks have occurred either with or without increased seepage, this shall be classified as damage to the dam. Advise MWIAM of damage and Section 4.13 of the EAP shall be followed
- If it is deemed that there are no immediate concerns to the safety of the dam and immediate repairs are not needed then continue to monitor the damage and record the event details in the Log.
- If embankment failure occurs, **immediately** report to MWIAM and photograph event using video camera (if safe to do so)
- After the event submit records and reports to MWIAM for review.

Manager Water Infrastructure Assets Management (MWIAM)

- Inform the DWS of the status.
- Review seepage records or alarms and where data indicates sudden increase, request ULWO-N /Dam Operator to inspect the dam and structures for signs of damage.

- On receipt of damage report, carry out field inspection if damage identified. If necessary, obtain specialist technical advice from a Dam Consultant. Arrange for a survey of the dam similar to the overtopping surveys.
- Submit damage report to the DWS for action.
- If the damage is unlikely to lead to dam failure, advise the MWO to compile an Emergency Event Report and submit to DWS.
- If a new area of seepage has initiated, carry out emergency repairs to prevent the rate of seepage leading to failure of the dam.
- If failure of the dam does not occur, arrange for a dam safety inspection after the event.
- Where emergency repairs have been carried out, arrange for construction details to be recorded.
- After the event, review records and reports from the MWO and other reports produced following the event and submit Emergency Event Report to DWS.
- If dam failure has occurred, make all records of the event available for future investigation.
- Refer Flood Inundation Maps (Appendix B)

Director Water Services (DWS)

- If reports from MWIAM confirm that significant damage has occurred or emergency situation is developing immediately inform the Toowoomba Regional Council CEO and the Jondaryan, Goombungee and Crows Nest Service Centre Managers and Director Dam Safety (Water Supply, DERM) of damage and steps taken or being taken to address the problem including the use of specialised technical advisors. Maintain contact hourly until the end of the event or until rectified and record all phone calls and conversations on pages in Section 5 of this EAP.
- Review status of the Dam and if required, advise Oakey and Toowoomba Police and SES (South East Region) and SES District Manager (Darling-Downs District) to evacuate the downstream flood plain. Road and Rail lines shall be signed for possible closure or closed as appropriate.
- Arrange for Jondaryan, Goombungee and Crows Nest Service Centre Managers to make contact with householders on the Telephone Notification Listing in Section 3, the Army Aviation base and householders within the town of Oakey requesting them to observe flood levels in the Oakey Creek catchment area.
- The Director Dam Safety (Water Supply, DERM) may direct activities based on the extent and type of damage.
- Review Emergency Event Report and submit to CEO. Submit Emergency Event Report to the Director of Dam Safety (Water Supply, DERM).
- Arrange for additional steps to be taken as required to mitigate the effects of any damage.
- Submit report to Toowoomba Regional Council where damage to the dam or potential dam safety issues has occurred.

The Chief Executive Officer (CEO) shall:

- Reply to public/media requests for event information.

4.13 AN OBJECT CRASHES INTO THE DAM OR RESERVOIR

ACTIONS

Dam Operators

- Immediately advise Police and SES (South East Region) and SES District Manager (Darling-Downs District).
- Advise Unit Leader Water Operations - North (ULWO-N) of the event and current status.
- Assist the ULWO-N in follow up action as required to confirm the reports and attend to the emergency event.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Inform Manager Water Infrastructure Assets Management (MWIAM) and Manager Water Operations (MWO) that an object has crashed into the dam or reservoir
- Timely follow up on the reports and assist rescue and recovery.
- Ensure that potential damage or contamination of the reservoir is identified and ascertain the extent of any structural damage to the dam by a brief visual inspection of the dam.
- Immediately perform a dam safety inspection to confirm damage identified by Dam operator.
- Check for any contamination of the reservoir or catchment area. Contamination shall be treated in accordance with section 4.10.
- After the event submit records and reports to MWIAM for review.

Manager Water Infrastructure Assets Management (MWIAM)

- Advise Director Water Services (DWS) of the event and current status.
- On receipt of damage report, carry out field inspection if damage identified. If necessary, obtain specialist technical advice from a Dam Consultant.
- Proceed with section 4.10 if contamination is noted by the MWO.
- Where emergency repairs have been carried out, arrange for construction details to be recorded.
- After the event, review records and reports from the MWO and other reports produced following the event and submit Emergency Event Report to DWS.

Director Water Services (DWS)

- If reports from MWIAM confirm that significant damage has occurred or emergency situation is developing immediately inform the Toowoomba Regional Council CEO and the Jondaryan, Goombungee and Crows Nest Service Centre Managers and Director Dam Safety (Water Supply, DERM) of damage and steps taken or being taken to address the problem including the use of specialised technical advisors. Maintain contact hourly until the end of the event or until rectified and record all phone calls and conversations on pages in Section 5 of this EAP.

- Review status of the Dam and if required, advise Oakey and Toowoomba Police and SES (South East Region) and SES District Manager (Darling-Downs District) to evacuate the downstream flood plain. Road and Rail lines shall be signed for possible closure or closed as appropriate.
- Arrange for Jondaryan, Goombungee and Crows Nest Service Centre Managers to make contact with householders on the Telephone Notification Listing in Section 3, the Army Aviation base and householders within the town of Oakey requesting them to observe flood levels in the Oakey Creek catchment area.
- The Director Dam Safety (Water Supply, DERM) may direct activities based on the extent and type of damage.
- Review Emergency Event Report and submit to CEO. Submit Emergency Event Report to the Director of Dam Safety (Water Supply, DERM).
- Arrange for additional steps to be taken as required to mitigate the effects of any damage.
- Submit report to Toowoomba Regional Council where damage to the dam or potential dam safety issues has occurred.

The Chief Executive Officer (CEO) shall:

- Reply to public/media requests for event information.

4.14 DAMAGE

ACTIONS

Dam Operators

- Inform the Unit Leader Water Operations - North (ULWO-N) of any noticeable changes suddenly, i.e. increased seepage, discolouration of seepage flow, cracking, crest or downstream movement, erosion or other adverse changes in dam safety status,.
- Immediately inspect the embankment, concrete face slab and plinth, outlet pipe, conduit, intake tower, spillway structure and abutments for springs, deformation, cracking and erosion, concrete damage, etc. Check for signs of slumps, sink holes and erosion on the downstream face of the embankment, especially near the spillway and the pipe outlets. Complete a Log of events/actions Sheet 3, Section 5 and submit to ULWO-N for review.

The Unit Leader Water Operations - North (ULWO-N) shall:

- Where the status of the dam changes suddenly, i.e. increased seepage, discolouration of seepage flow, cracking, crest or downstream movement, erosion or other adverse changes in dam safety status, report this as damage to the Manager Water Infrastructure Assets Management (MWIAM) and Manager Water Operations (MWO)
- If it is deemed that there are no immediate concerns to the safety of the dam and immediate repairs are not needed then continue to monitor the damage and record the event details in the Log.
- If the damage increases, report the increase to the MWIAM.
- After the event submit records and reports to MWIAM for review.

Manager Water Infrastructure Assets Management (MWIAM)

- Inform the Director Water Services (DWS) of the status.
- Inspect the initial damage. If necessary, obtain specialist technical advice from a Dam Consultant.
- If the damage is unlikely to lead to dam failure, advise the ULWO-N to continue monitoring the damage for signs of increased damage by competent Dam Operators.
- If possible, carry out emergency repairs to prevent the damage leading to failure of the dam.
- Monitor weather condition reports from the Bureau of Meteorological Services to prevent bad weather preventing or hampering repairs.
- If failure of the dam does not occur, arrange for a dam safety inspection after the event.
- Where emergency repairs have been carried out, arrange for construction details to be recorded.
- After the event, review records and reports from the MWO and other reports produced following the event and submit Emergency Event Report to DWS.

- If dam failure has occurred, make all records of the event available for future investigation.

Director Water Services (DWS)

- If reports from MWIAM confirm that significant damage has occurred or emergency situation is developing immediately inform the Toowoomba Regional Council CEO and the Jondaryan, Goombungee and Crows Nest Service Centre Managers and Director Dam Safety (Water Supply, DERM) of damage and steps taken or being taken to address the problem including the use of specialised technical advisors. Maintain contact hourly until the end of the event or until rectified and record all phone calls and conversations on pages in Section 5 of this EAP.
- Review status of the Dam and if required, advise Oakey and Toowoomba Police and SES (South East Region) and SES District Manager (Darling-Downs District) to evacuate the downstream flood plain. Road and Rail lines shall be signed for possible closure or closed as appropriate.
- Arrange for Jondaryan, Goombungee and Crows Nest Service Centre Managers to make contact with householders on the Telephone Notification Listing in Section 3, the Army Aviation base and householders within the town of Oakey requesting them to observe flood levels in the Oakey Creek catchment area.
- The Director Dam Safety (Water Supply, DERM) may direct activities based on the extent and type of damage.
- Review Emergency Event Report and submit to CEO. Submit Emergency Event Report to the Director of Dam Safety (Water Supply, DERM).
- Arrange for additional steps to be taken as required to mitigate the effects of any damage.
- Submit report to Toowoomba Regional Council where damage to the dam or potential dam safety issues has occurred.

The Chief Executive Officer (CEO) shall:

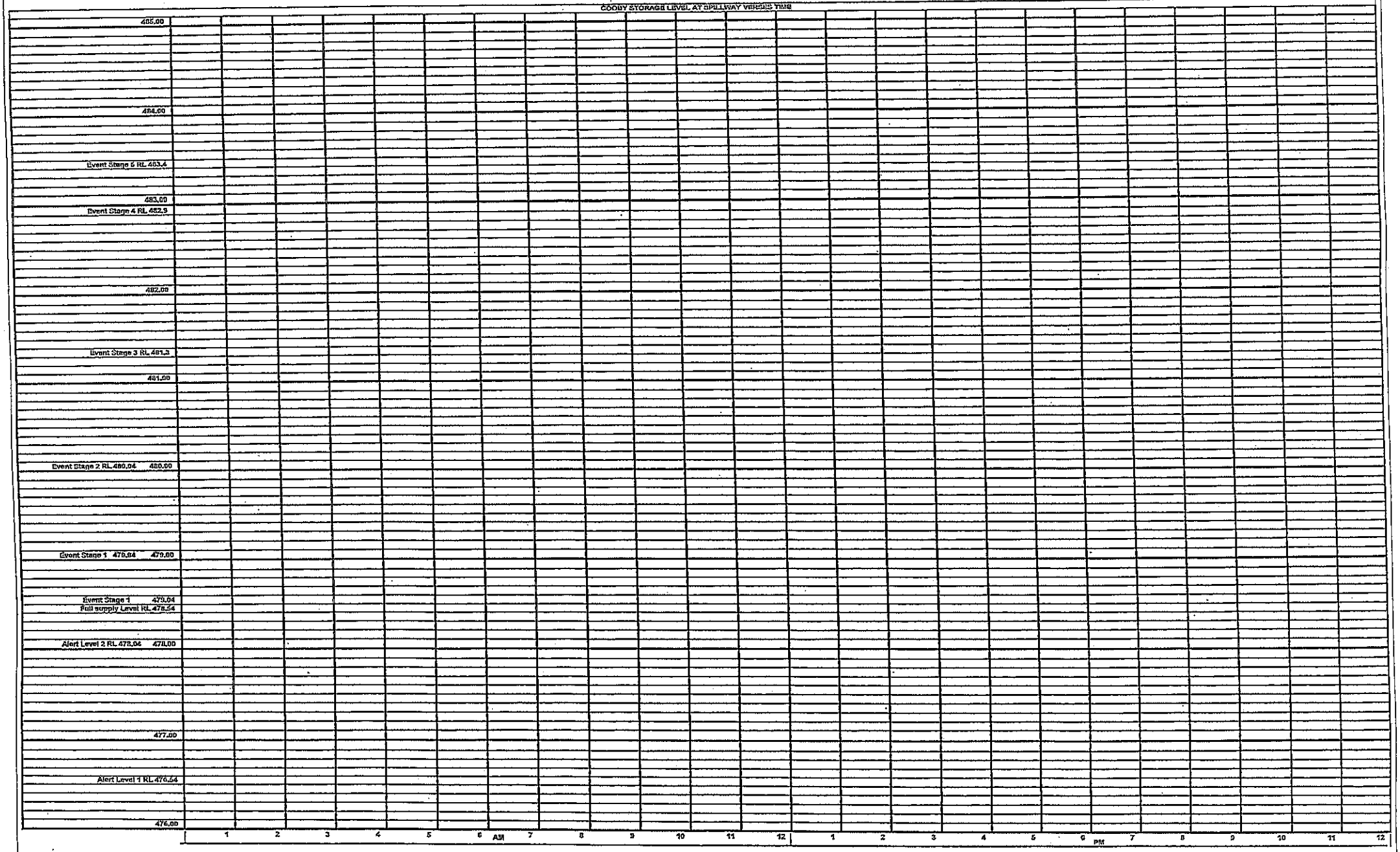
- Reply to public/media requests for event information.

SECTION 5
EMERGENCY EVENTS
REPORTS GRAPHS AND FORMS

RECORD OF RAINFALL DURING A FLOOD EVENT

DATE	TIME	RAINFALL	DAILY TOTAL	COMMENTS

RULE ACROSS UNDER EACH DAYS TOTAL RAINFALL


COOBY STORAGE LEVEL AT SPILLWAY VERSUS TIME
485.00
484.00
Event Stage 5 RL 483.4
483.00
Event Stage 4 RL 482.9
482.00
Event Stage 3 RL 481.3
481.00
Event Stage 2 RL 480.04
480.00
Event Stage 1 479.04
479.00
Event Stage 1
479.04
Full supply Level RL 478.54
Alert Level 2 RL 478.04
478.00
477.00
Alert Level 1 RL 476.54
476.00
1 2 3 4 5 6 AM 7 8 9 10 11 12
1 2 3 4 5 6 PM 7 8 9 10 11 12

LOG OF EVENTS / ACTIONS

Date	Time	Event description / Action carried out	Record entered by

REGIONAL COUNCIL

RECORD OF COMMUNICATION

Date	Time	Phone Number	Contact	Message sent / received	Call sent / received by

Sequential Report Number:

Status Report Emergency Event at Dams

Alert / Event Stage	
Crossbrook	
Perseverance	
Cooby	

Report Period Commencing: Date: Time:

Statistics for Reporting Period:

	Last Report Storage Level RL	Current Storage Level RL	Inflow MI/s	Discharge MI/s	Metres over Spillway
Crossbrook					
Perseverance					
Cooby					

Rate of Rise	Metre / Time	eg: 1.5 mt / hr	Spillway Discharge	Time and date event started
Crossbrook			Crossbrook	
Perseverance			Perseverance	
Cooby			Cooby	

Damage Report for Dam structure and immediate vicinity downstream

Crossbrook:

Perseverance:

Cooby:

Weather Conditions at Dams

Crossbrook:

Perseverance:

Cooby:

General Comments:

Signature: Designation:

DOCS-#3453022-v8-Status_Report_Dam_Emergency_Event

Emergency Event Report

NATURE OF THE EVENT

< Describe the Event, eg, Spillway discharge, Earthquake, Chemical spill, etc >

Commencing Time.....Date...../...../.....

Finishing Time.....Date...../...../.....

DESCRIPTION OF THE EVENT

< Describe in your own words the lead up to and progress of the Event, eg, a Spillway discharge. Include such information as listed below >

- Weather conditions and rainfall in the Catchment
- The rate of rise of the Storage
- When the Spillway was overtopped
- When the first Gate opened (if applicable)
- Date and time of highest level
- Briefly Describe any immediate downstream damage caused by the discharge
- Include any other information considered relevant

STATISTICS

- Total inflow. .....Megalitres
- Total discharge.....Megalitres
- Capacity of Storage prior to inflow.....%
- Volume prior to inflow.....Megalitres
- Maximum inflow.....Megalitres per day
- Maximum discharge.....Megalitres per day

EVENT PROGRESS

< Briefly Describe the daily rate of Storage rise, time to peak level, and weather conditions. Attach copies of the Spillway Level Versus Time Graph, the Communications Record Sheet, and the Log of Events / Actions Sheet (Section 5 of the EAP) >

GENERAL COMMENTS

< Include in this section any observations or comments' regarding the Event, such as Equipment malfunctions, improved Reporting, Safety issues, or any suggestions which may improve monitoring of the Event >

DAMAGE REPORT

< Detail any tail water damage to the Embankment or Stream bank damage in the immediate area of the Dam. Attach photos >

ATTACHMENTS

- Photos, video of the Event
- Spillway Level versus Time Graph
- Communications record sheet
- Leg of Events / Action sheet
- Record of Gate opening (Gated Dams)

Signed.....Designation.....Date...../...../.....

FOWARDING INFORMATION

Once report is complete forward to the Manager Water Infrastructure Assets Management

SECTION 6

COOBY DAM SPILLWAY RATING CURVE

COOBY DAM STORAGE CURVE

TABLE OF FLOOD EMERGENCY TRIGGER LEVELS

&

FLOOD FREQUENCY ESTIMATES

SPILLWAY RATING CURVE (Note that 1,000 m3/s = 1,000 kl/s = 1 Ml/s)

TABLE OF FLOOD EMERGENCY TRIGGER LEVELS & FLOOD FREQUENCY ESTIMATES

DESCRIPTION	RL's DD (m)	SPILLWAY Depth of Flow (m)
	476.54	
	478.04	
SPILLWAY CREST LEVEL	478.54	-
	479.04	0.50
1 : 50 AEP FLOOD	480.3	1.76
1: 100 AEP FLOOD	480.54	2.0
1: 200 AEP FLOOD	481.68	3.14
1: 500 AEP FLOOD	481	2.46
1: 1,000 AEP FLOOD	481.27	2.73
1: 2,000 AEP FLOOD	481.56	3.02
1: 5,000 AEP FLOOD	481.96	3.42
1: 10,000 AEP FLOOD	482.31	3.77
EMBANKMENT CREST LEVEL	482.90	4.27
1: 50,000 AEP FLOOD	483.22	4.68
1: 100,000 AEP FLOOD	483.72	5.18
TOP OF WAVEWALL LEVEL (DCF)	484	5.46
1: 200,000 AEP FLOOD	484.24	5.7
1: 500,000 AEP FLOOD	484.89	6.35
1: 1,000,000 AEP FLOOD	485.36	6.82
1: 6,180,000 AEP FLOOD (PMPDF)	486.81	8.27

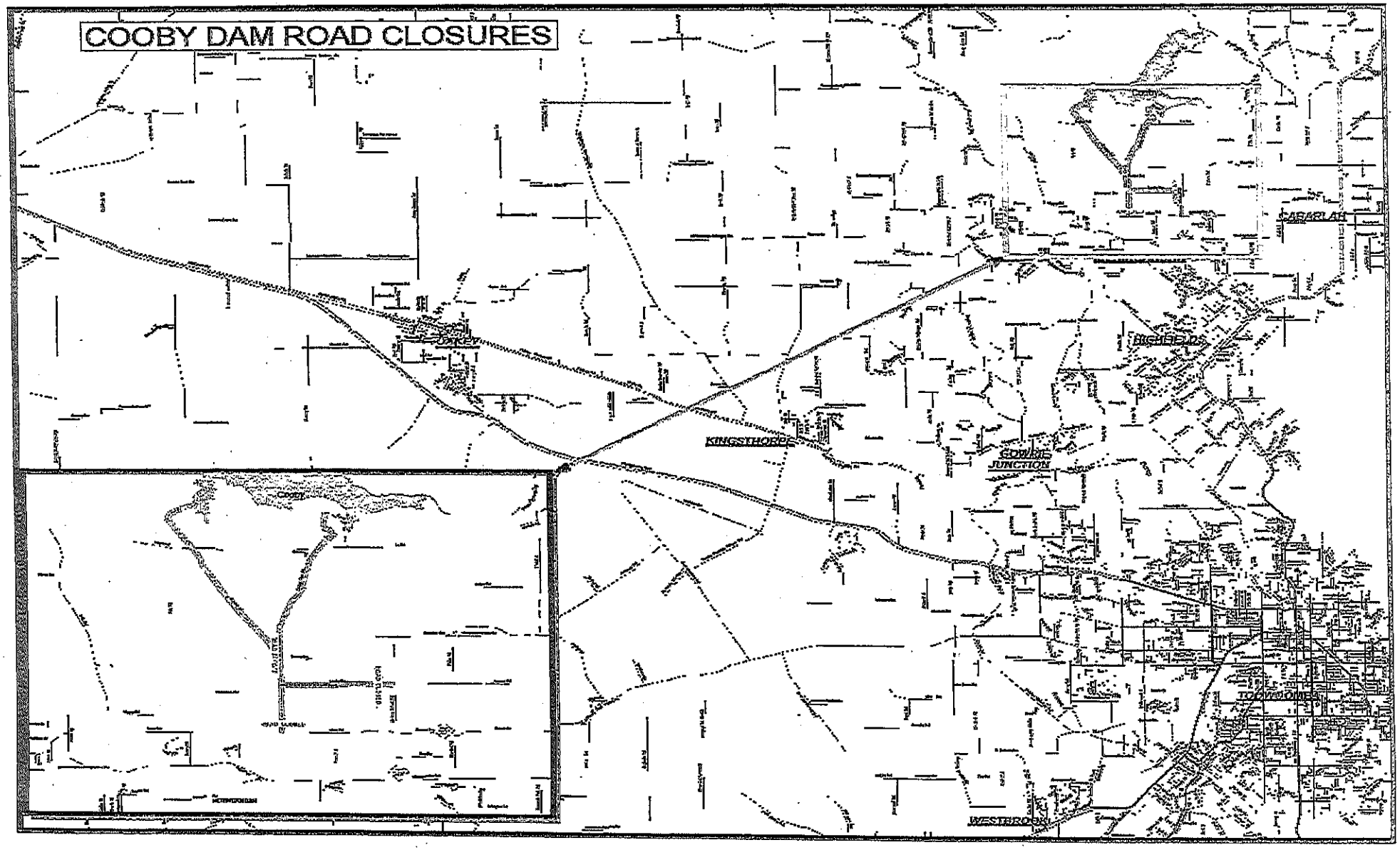
FLOOD FREQUENCY ESTIMATES

FLOOD EVENTS	PEAK INFLOWS (m^3/s)	PEAK OUTFLOWS (m^3/s)
1 : 50 AEP FLOOD	600	330
1: 100 AEP FLOOD	680	380
1: 1,000 AEP FLOOD	1030	600
1: 2,000 AEP FLOOD	1170	690
1: 10,000 AEP FLOOD	1590	1020
1: 50,000 AEP FLOOD	2170	1504
TOP OF WAVEWALL LEVEL (DCF)	2690	1920

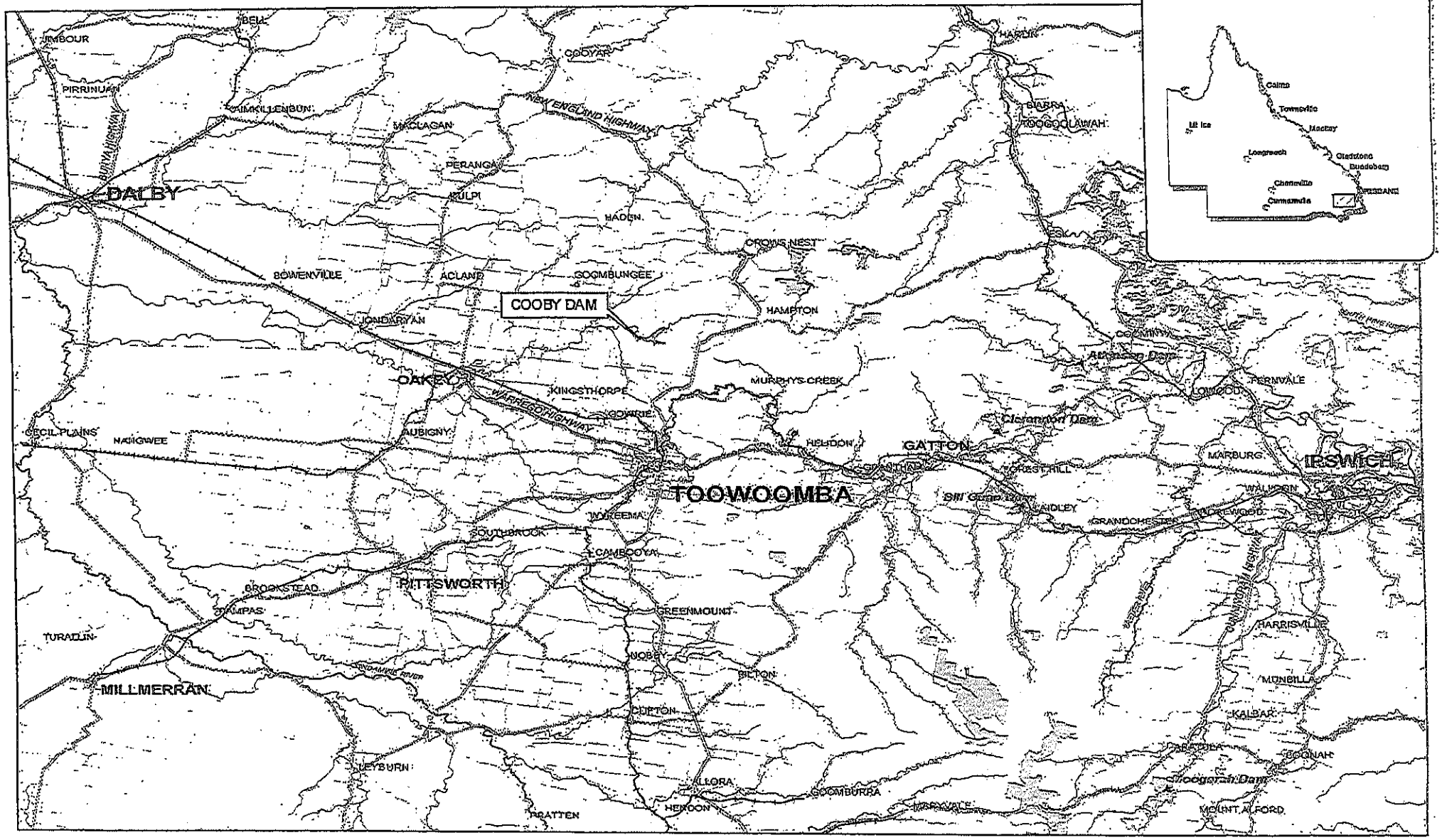
SECTION 7

COOBY DAM

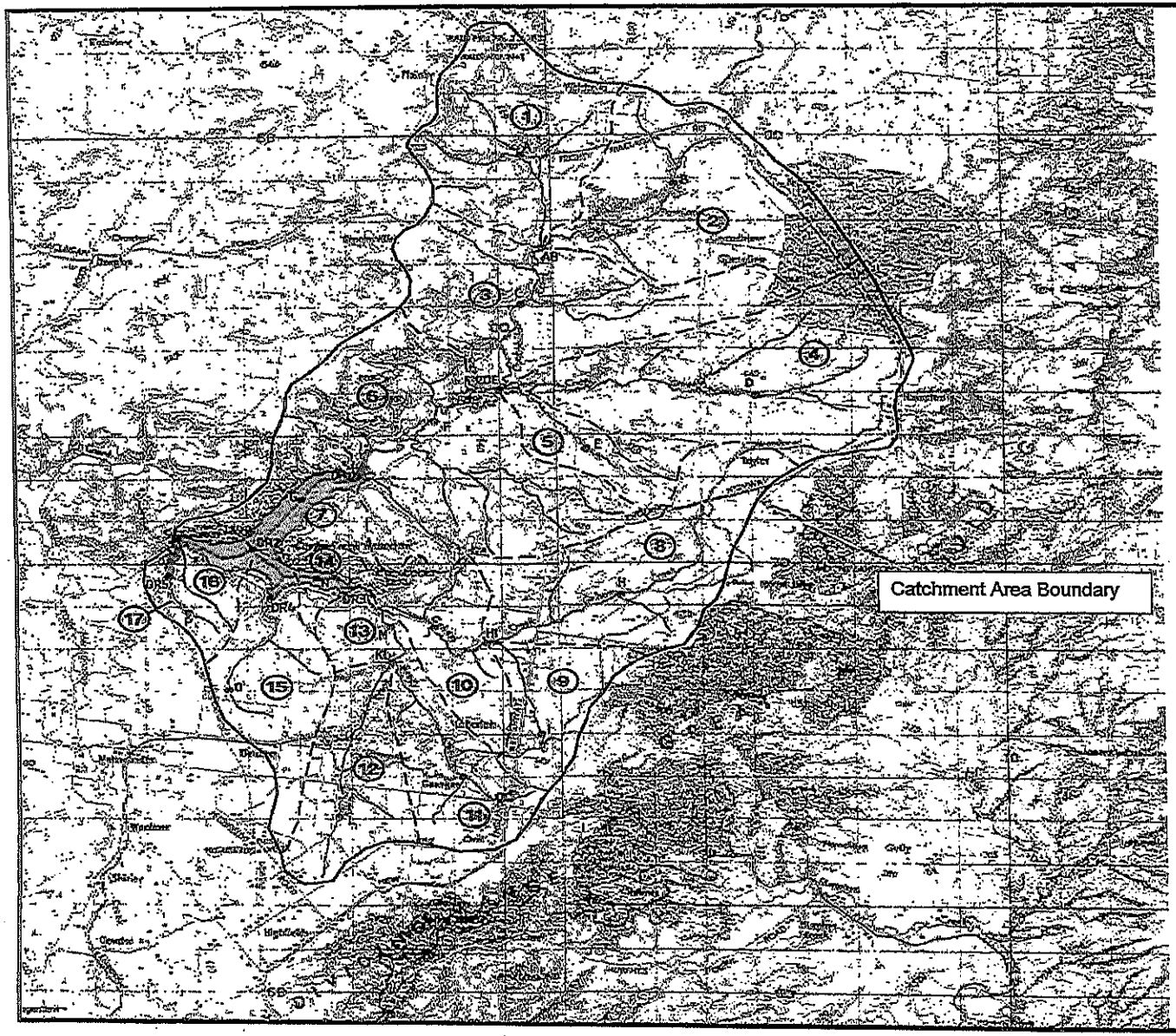
ROAD CLOSURE MAPS

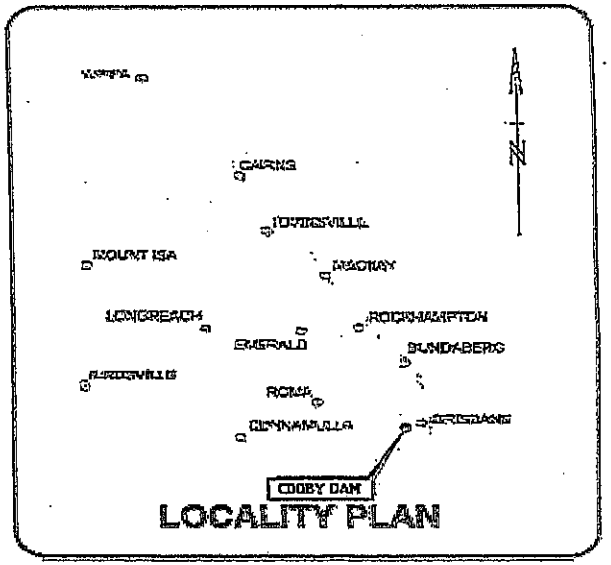

COOBY DAM ROAD CLOSURES
CARABLAH
HIGHFIELDS
KINGSTHORPE
GOWRIE JUNCTION
TOOWOOMBA
WESTBROOK
COOBY

SECTION 8
LOCALITY PLAN
AND
CATCHMENT AREA BOUNDARY



Cooby Dam Locality Plan





LEGEND:

- CATCHMENT BOUNDARY
- SUBCATCHMENT BOUNDARY AND NUMBER
- STREAM
- NODE
- RESERVOIR AREA El. 478.7m

CATCHMENT AREA = 161.608 km²

0 1.0 2.0 3.0 4.0 5.0 KILOMETRES
1:100000

Cooby Dam Catchment Area Plan

SECTION 9
FLOODING EVENT DEFINITIONS
TRC ORGANISATIONAL STRUCTURE
&
RESPONSIBILITIES

FLOODING EVENT DEFINITIONS

- "DCF" or

  "Dam Crest Flood" (Formerly IFF or Impending Failure Flood)
  The flood Event which when routed through the Reservoir just threatens failure of the Dam. The Reservoir is assumed to be initially at Full Storage Level

- "PMF" or

"Probable Maximum Flood"

The flood resulting from the Probable Maximum Precipitation, coupled with the worst flood producing catchment conditions that can be realistically expected in the prevailing meteorological conditions

- "PMP" or

"Probable Maximum Precipitation"

The theoretical greatest depth of precipitation for a given duration that is physically possible over a particular drainage system.

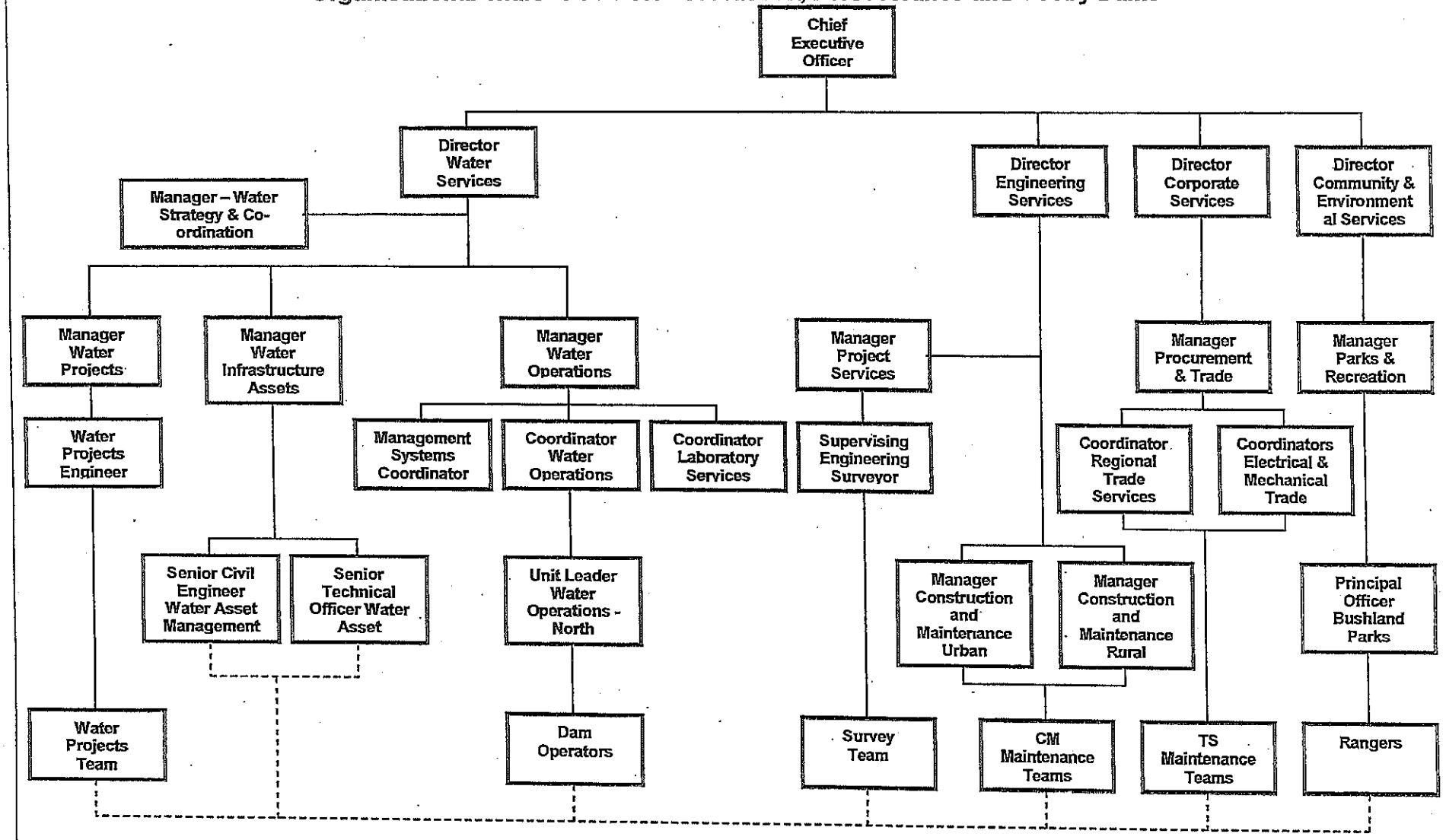
- "SUNNY DAY BREAK"

Unexpected failure of a dam not associated with flooding or natural disaster

NOTE

PMP events may occur over tributaries of Oakey and Cooby Creeks below Cooby Dam (specifically Meringandan and Gomaren Creeks) causing major flooding without contribution from Cooby Dam.

Organisational chart of TCC for Cressbrook, Perseverance and Cooby Dams



Functional responsibilities

Chief Executive Officer (CEO)	The person responsible to the Toowoomba Regional Council for the overall management of the Council organization
Director Water Services (DWS)	The person responsible to the CEO for the overall management of the TRC's Water Services including water supply assets and water delivery services
Director Community and Environmental Services (DCES)	The person responsible to the CEO for the overall management of TRC's Community and environmental services, including parks and other recreational facilities
Director Corporate Services (DCS)	The person responsible to the CEO for managing TRC's corporate and specialist-support services
Senior Civil Engineer Water Infrastructure Asset Management (SCEWI)	The person responsible to the MWIAM for providing TRC's Civil Asset Management Services; developing and maintaining TRC's Asset Management Systems; setting and auditing TRC's Maintenance, Operation, and Service Standards; and the developing and implementing of TRC's Dam Safety Programme.
Manager Water Infrastructure Asset Management (MWIAM)	The person responsible to the DWS for providing TRC's Water Infrastructure Asset Services; developing and maintaining TRC's Water Asset Management Systems; setting and auditing TRC's Water Maintenance, Operation, and Service Standards; coordinating TRC's SCADA Services; the letting of maintenance contracts;
Senior Technical Officer Water Infrastructure (STOWI)	The person responsible to the MWIAM for coordinating activities for TRC's Infrastructure Asset Services; developing and maintaining TRC's Asset Management Systems; setting and auditing TRC's Maintenance, Operation, and Service Standards; coordinating TRC's SCADA Services; the letting of maintenance contracts;
Manager – Water Strategy & Co-ordination (MWSC)	The person responsible to the DWS for the coordination and overview of the Water Services Department's administrative requirements, including budgets, performance indices, processing complaints, and statutory reporting
Director Engineering Services (DES)	The person responsible to the CEO for the overall management of TRC's Construction and Maintenance Services.
Manager Construction and Maintenance Urban (MCM-U)	The person responsible to the DES for the overall management of TRC's Construction and Maintenance Services and engaged by the MIAM to provide civil engineering maintenance services for the Dams in conjunction with MCM-R
Manager Construction and Maintenance Rural (MCM-R)	The person responsible to the DES for the overall management of TRC's Construction and Maintenance Services and engaged by the MIAM to provide civil engineering maintenance services for the Dams in conjunction with MCM-U
Construction & Maintenance Team	The group of civil-engineering trade-persons and trade-assistants responsible to the MCM-U or MCM-R for carrying out repairs and maintenance to TRC owned facilities and infrastructures, including pump station buildings, pipelines, and dam structures

Manager Water Operations (MWO)	The person responsible to the DES for the overall management of TRC's Water Operations including employee training, and the WO's QA-System
Coordinator Laboratory Services (CLS)	The person responsible to the MWO for the monitoring and testing of environment and water quality including the water stored and drawn from the Dams.
Coordinator Water Operations (CWWO)	The person responsible to the MWO for the proving the Water Operations Branch with technical support.
Management System Coordinator (MSC)	The person responsible to the MWO to provide the WO Branch with administrative support including the managing of the WO Branch's controlled QA-documents such as all work procedures, work instructions, manuals, and plans. This also includes SOP'S EAP'S and HACCP manuals
Unit Leader Water Operations - North (ULWO-N)	The person responsible to the MWO for the overall management of the TRC Water Supply Operations
Water Supply Systems Controller (WSSC)	The person(s) responsible to the ULWO-N for the process control and telemetric monitoring of TRC's water reticulation system including pumping stations and reservoir s
Dam Operator(s)	The person(s) responsible to ULWO-N for operating and routine monitoring and servicing of TRC's water supply facilities, including pump stations, treatment plants, and dams as well as – where necessary – implementing the directives from the ULWO-N and monitoring seepage, rainfall, and dam water levels at the Dams.
Manager Parks and Recreation (MPR)	The person responsible to the DCES for the management of TRC's Parks and Recreational Areas and Facilities, including the public area at the Dams and the control of declared plants around the perimeter of the Dam Storage Areas
Principal Officer Bushland Parks	The person responsible to the MPR for coordinating activities for the control of declared plants and the maintenance of the recreational areas including those at the Dam
Ranger	The person responsible to the MPR for the control of vegetation and pests and the maintenance of the recreational areas including those at the Dam
Manager Procurement & Trade Services (MPTS)	The person responsible to the DCS for managing TRC's technical-specialist support services who are engaged by the MWIAM to provide specialist mechanical, electrical, and electronic maintenance services for the Dams
Trade Services Maintenance Team	The group of trade persons – such as electricians, fitters, and painters – responsible to the MPS for carrying out repairs and maintenance to the mechanical, electrical, and electronic equipment associated with TRC's facilities and infrastructures including those associated with the Dams
Manager of Water Projects (MWP)	The person responsible to the DWS for coordinating activities and providing engineering support to MWIAM
Water Projects Team	Person responsible for providing Engineering Support to MWP
Supervisor Engineering Surveying (SES)	Person responsible for coordinating surveying activities of dam walls

Surveying Team	The Persons responsible for conducting surveying activities at the dam sites.

SECTION 10
DAM BREAK ANALYSIS

1.0 HYDRAULIC MODEL (MIKE 11)

The software package MIKE 11 (DHI, 2003) was used to model the effects of dam failure on a Sunny Day Failure and during Design flood events. MIKE 11 is a dynamic one-dimensional branched network model capable of simulating flows in natural stream and channel systems, including the effects of structures such as culverts, bridges and weirs. As a hydrodynamic model, MIKE 11 solves the vertically integrated equations for the conservation of continuity and momentum, i.e. the Saint Venant equations.

1.1 TOPOGRAPHIC DATA

Toowoomba Regional Council supplied 23 detailed cross sections of Cooby and Oakey Creeks extending from the Cooby Dam area to downstream of the township of Oakey. A further 3 sections were interpolated from available topographic data in the immediate dam area (Dam) and downstream of Oakey (not shown).

Cross section location has been presented in the model layout in Appendix C. A summary of cross section location has been listed in Table 1.1, where chainage is given as distance in metres downstream of Cooby Dam. The cross sections will also be used as locations to report flow characteristics determined through simulation.

As the model has been based on surveyed sections the vertical accuracy is considered to be high. However, as the sections are located at 1 to 2 km spacing, the degree of vertical accuracy reflected in calculated results will be diminished to some degree.

Aerial photography, 9243 runs 2, 3 and 4, flown on 7 June 2000 was used to create a photo mosaic of Oakey to supplement the available topographic data and to provide a photographic background for flood inundation mapping.

Table 1.1. Cross Section Location

Section Location	Chainage (m)
Dam (2 sections)	0
1	400
2	1,500
3	2,900
6	7,000
7	8,000
8	9,800
9	11,100
10	13,300
11	15,600
12	19,400
13	20,700
14	22,500
15	25,400
16	29,200
17	31,500
18	33,800
19-Kent St	35,560
20-Cherry St	36,040
21-Voll St	36,650
22a-Lorimer St	37,510
22	37,732
23	Downstream Boundary

1.2 MODEL LAYOUT

The hydraulic model layout included in Appendix E consists of a main branch, which extends 41.3 kms from Cooby Dam to the railway crossing of Oakey Creek approximately 3 km south west of Oakey. The main branch of the hydraulic model follows Cooby Creek and then Oakey Creek after it forms.

Several tributaries including Gomaren and Little Gomaren Creeks as well as several overland flow areas discharge into the main branch as it progresses towards Oakey. The tributary inflows as discussed in Section 4.4.2 are applied to the main branch of the hydraulic model at their appropriate locations as presented in Table 1.2.

1.3 MODEL BOUNDARIES

Boundaries were adopted in appropriate locations along the main branch of the hydraulic model to represent inflows at several points including the Cooby Dam catchment. Table 1.2 lists the locations of inflow boundaries for the system. The base flow adopted for each inflow was 2 m^3/s.

Table 1.2. Inflow Boundary Locations

Boundary	Distance from Dam (m)
Cooby Dam Catchment	0
Catchment 11,12,13	7,450
Catchment 1 to 10	9,950
Catchment 14	9,950
Catchment 16	19,700
Catchment 15	19,700
Catchment 18, 19	24,500
Catchment 20	24,500
Catchment 17	24,500
Catchment 21	35,300
Catchment 22	40,600

The downstream boundary of the model was located in the area of the rail crossing of Oakey Creek, approximately 3 km south west of Oakey and 41,300 m downstream of Cooby Dam. A review using the HEC –RAS normal depth flow program proved there were potential PAR in Oakey and as a consequence the model was extended to several kilometres downstream of Oakey to a point where no further potential PAR could be identified.

Sectional geometry for the downstream boundary was based on a cross section of Oakey Creek considered typical for the area. The creek section was extended with sectional data interpolated from available topographic information.

Manning's equation was used to estimate flow depth for a range of discharges based on the adopted channel geometry and grade. This information was used to derive a rating curve subsequently adopted for the downstream boundary.

1.4 BREACH FORMATION

In this analysis breach magnitude and timing were determined in accordance with the *Guidelines for Failure Impact Assessment of Water Dams* (NRM, 2002) as applied to embankment dams. This method calculates the volume of material to be removed during the breach formation based on flow through the breach (*Guidelines* Figure 4, based on MacDonald & Langridge-Monopolis, 1984). If the calculated volume of material to be removed exceeds that existing in the embankment, the existing embankment volume is adopted. Assumptions are made about the breach shape with respect to side slope and breach proportions, guided by historical data on breach shapes (*Guidelines* Figure 5, based

on Singh & Scarlatos, 1988). The volume of material to be removed is subsequently used to determine breach development time (*Guidelines* Figure 6, based on MacDonald & Langridge-Monopolis, 1984).

The estimated volume of material to be removed in every scenario exceeded that available in Cooby Dam, effectively removing the entire embankment. Using an estimated embankment volume of 120,000 m^3 (excluding the berm) a breach formation time of 2.2 hours was determined.

A trapezoidal breach shape was assumed in this analysis. The bed limit of the breach was adopted as 464 m AHD, close to the level of the downstream berm at 463.3 m AHD. The natural topography at the dam wall indicated that a breach bed width of 70m would be accommodated at the site. Reducing the level below 464 m AHD decreased the available space within the natural gully in which the breach could form thereby limiting the size of the final breach. Limiting the breach elevation to 464 m AHD has no detrimental influence on the outcomes of this investigation as Cooby Dam only stores around 900 ML at that level. When the storage level reaches the breach bed the breach hydrograph would be well advanced along the receding limb.

The adopted breach has a depth 18.8m from the dam crest and side slopes of 45° resulting in a breach top width of 108 m. These dimensions conform to the Singh – Scarlatos Criteria.

Cooby Dam includes a berm that extends 48m from its downstream face and has not been considered in the derivation of breach characteristics. As the adopted breach bed is located at the top of the berm, the berm's volume has not been included as embankment material removed in the formation of the breach. Inclusion of this material would increase the breach formation time and reduce the peak discharge through the breach.

All head differences between the upstream and downstream sides of the dam have excluded the berm. It has been assumed that the berm would offer little resistance to a breach discharge and be eroded rapidly. Excluding the berm in this instance increases the available head used in determining the Breach Formation Factor and subsequently the volume of material to be removed. Further investigation into this aspect of the breach formation has indicated that the volume of material removed when the berm is included or excluded exceeds the available volume. As a result, it was

concluded in this analysis that Breach Formation Time is unaffected by the berm.

The adopted trapezoidal breach shape has been summarised in Table 1.3.

Table 1.3: Breach Formation Parameters

[redacted]

1.5 MANNING'S ROUGHNESS CO-EFFICIENT

Manning's roughness coefficients were selected through photographs of the site and previous investigations. A value of 0.08 was adopted for use within the low flow areas of the creeks. This value is typical for streams sluggish in nature with reedy reaches and deep pools. A value of 0.12 was selected for overbank flow and is consistent with medium to dense bush and cultivation.

In the absence of gauged stream flow data the hydraulic model could not be calibrated. As a result the adopted Manning's roughness coefficients could not be confirmed as the most appropriate, but a sensitivity analysis was undertaken to determine how the hydraulic model responded to variations in Manning's roughness coefficient. The results are discussed in Section 2.5 and demonstrate that the adopted values are satisfactory.

1.6 COMPUTATIONAL PARAMETERS

Computational time steps of 9 seconds were adopted to ensure that the Courant stability criterion was satisfied.

2.0 HYDRAULIC MODEL RESULTS

The results of the hydraulic model simulations are presented in this section of the report.
The following events were analysed:

1. Sunny Day Failure
2. Dam Crest Flood (DCF) - with and without dam failure
3. Probable Maximum Precipitation (PMP) Design Flood - with and without dam failure

Information extracted from the results includes peak flood levels along the creek reach, time to peak flood levels, peak flow rates and peak mean velocities. These results have been reported in the following sections for each cross section used in the analysis.

References in the following sections to Oakey are based on the results calculated at cross sections 18 to 22.

2.1 BREACH DISCHARGE HYDROGRAPHS

In cases where dam failure occurs during a flooding event the breach hydrograph has been adopted as the greater discharge resulting from the combination of spillway discharge and breach discharge. The combined or peak outflow hydrograph data has been presented in Table 2.1. Figures 2.1 to 2.3 present breach hydrographs for all scenarios modelled.

Table 2.1. Breach Discharge Data

Event	Peak Discharge (m^3/s)	Time to Peak Discharge From Start of Event (hrs:min)	Time to Peak Discharge From Breach Start (hrs:min)
SDF	3,840	1:25	1:25
DCF	5,840	6:40	2:01
PMF	9,250	4:27	2:01

Figure 2.1. SDF Breach Hydrograph.

Figure 2.2. DCF Failure Breach Hydrographs

Figure 2.3. PMF Failure Breach Discharges

2.2 PEAK FLOOD LEVELS

Calculated peak flood levels for each mode of failure have been listed in the following tables at the section locations shown. Time elapsed from commencement of breach in the Sunny Day Failure and from commencement of event for DCF and PMF events have been included along with the increase in flood water levels.

Stage hydrographs for Oakey sections and selected upstream sections are presented in Appendix G where they have been separated into two groups representing those in and around Oakey and those further upstream.

2.2.1 SUNNY DAY FAILURE

Peak flood levels resulting from simulation of the SDF scenario have been listed in Table 2.2. Note that the greatest depth increases due to the SDF occur closer to the dam. Flood levels in the Oakey region vary by up to 1.67m but are contained within the main flow channel of Oakey Creek. The

extent of inundation for the SDF has been presented in Figure 1 of Appendix B.

Generally, flood levels begin to rise in Oakey around 24 hours after the breach commences and peak another 12 hours later, 36 hours after the breach started to form. 48 hours after the peak level has been reached the flood level has receded to about 50% of the peak.

Table 2.2. Peak Flood Levels for SDF

Section Location	Chainage (m)	Time to Peak (Failure) (hrs:min)	Peak Flood Level		Difference (m)
			Normal (mAHD)	Failure (mAHD)	
Dam	0	2:14	457.68	473.76	16.08
1	400	2:14	457.53	469.66	12.13
2	1,500	2:14	450.42	461.55	11.13
3	2,900	2:26	438.59	455.32	16.73
6	7,000	3:15	433.69	442.86	9.17
7	8,000	3:39	432.89	439	6.11
8	9,800	4:52	427.16	435.24	8.08
9	11,100	5:28	426.45	431.04	4.59
10	13,300	7:18	423.98	428.6	4.62
11	15,600	8:43	423.32	425.3	1.98
12	19,400	18:02	414.47	419.83	5.36
13	20,700	20:03	413.26	417.08	3.82
14	22,500	22:29	411.54	412.46	0.92
15	25,400	23:30	406.74	408.95	2.21
16	29,200	26:20	401.89	403.38	1.49
17	31,500	30:59	398.69	400.27	1.58
18	33,800	34:50	397.94	399.02	1.08
19-Kent St	35,560	38:41	396.74	398.41	1.67
20-Cherry St	36,040	40:06	396.19	397.63	1.44
21-Voll St	36,650	40:55	396.05	397.38	1.33
22a-Lorimer St	37,510	43:08	395.7	396.96	1.26
22	37,732	43:32	395.59	396.93	1.34

6.2.2 DAM CREST FLOOD

Peak water levels due to the DCF have been listed in Table 2.3. It can be noted that the no failure flood levels are greater than those for the SDF event. The greatest flood depth increases occur closest to the dam and gradually decrease as the flood approaches Oakey.

Oakey experiences a minor flood level of 401.0 m AHD due to local flooding 6 hours after the start of the event. The flood level recedes to 400.2 m AHD when the first rises due to DCF with failure occur about 12 hours after the start of the event.

While the dam crest flood without failure is largely contained within the greater Oakey Creek channel there are areas within the town where the banks are overtopped. The flood wave associated with failure of the dam during the DCF increases peak flood levels beyond the capacity of Oakey Creek. Depth increases in Oakey due to the failure of Cooby Dam reach 1.6m. The extent of inundation for the dam crest flood with and without failure has been presented in Figure 2 of Appendix B.

Flood levels peak in Oakey around 26 hours after the start of the dam crest flood event when no failure occurs. The time to peak flood level is decreased by 4 hours for the dam failure scenario, arriving in the Town of Oakey some 22 hours after the start of the event or 16.5 hours after the breach begins to form.

Table 2.3. Peak Flood Levels for DCF

Section Location	Chainage (m)	Time to Peak (Failure) (hrs:min)	Peak Flood Level		Difference (m)
			No Failure (mAHD)	Failure (mAHD)	
Dam	0	6:40	470.48	476.91	6.43
1	400	6:40	466.82	472.42	5.6
2	1,500	6:53	459.69	463.48	3.79
3	2,900	7:05	453.74	457.52	3.78
6	7,000	7:17	442.18	444.8	2.62
7	8,000	7:53	435.96	440.95	4.99
8	9,800	8:06	438.76	439.8	1.04
9	11,100	8:18	431.95	433.92	1.97
10	13,300	9:18	429.24	430.71	1.47
11	15,600	9:43	426.84	429.15	2.31
12	19,400	12:21	421.38	422.42	1.04
13	20,700	12:45	418.57	419.71	1.14
14	22,500	13:46	414.53	415.86	1.33
15	25,400	14:59	411.51	412.45	0.94
16	29,200	17:00	406.72	407.99	1.27
17	31,500	18:13	405.24	406.29	1.05
18	33,800	21:40	402.64	404.09	1.45
19-Kent St	35,560	22:04	402.1	403.43	1.33
20-Cherry St	36,040	22:16	401.67	403.05	1.38
21-Voll St	36,650	22:28	400.74	402.31	1.57
22a-Lorimer St	37,510	24:05	398.8	399.73	0.93
22	37,732	24:17	398.74	399.64	0.9

* Time to peak measured form start of rainfall event

2.2.3 PMP DESIGN FLOOD

Peak water levels for the PMP Design Flood event with and without failure have been listed in Table 2.4. Peak flood levels are considerably greater for the PMPDF than for other events investigated as would be expected. As noted previously the variation in peak flood levels is greater closer to the dam. In Oakey, increases in peak flood levels due to dam failure are up to 0.9m.

Peak flood levels in Oakey are reached around 19 hours after the start of the rainfall event for the no failure scenario. The peak arrives two hours earlier at 17 hours after the start of the event for the dam failure scenario or 15 hours after the breach begins to form.

The extent of inundation for the PMP Design Flood no failure and with failure events have been presented in Figure 3 of Appendix B.

Table 2.4. Peak Flood Levels for PMP DWSign Flood

Section Location	Chainage (m)	Time to Peak (Failure) (hrs:min)	Peak Flood Level (mAHD) No Failure	Peak Flood Level (mAHD) Failure	Difference (m)
Dam	0	4:27	476.44	479.89	3.45
1	400	4:27	471.96	475.35	3.39
2	1,500	4:27	463.21	465.72	2.51
3	2,900	4:39	457.44	460	2.56
6	7,000	5:03	444.85	446.68	1.83
7	8,000	5:28	441.37	444.26	2.89
8	9,800	5:28	440.26	443.16	2.90
9	11,100	5:40	434.31	435.64	1.33
10	13,300	6:40	431.07	432.5	1.43
11	15,600	6:53	429.49	430.77	1.28
12	19,400	9:31	422.63	423.55	0.92
13	20,700	9:43	419.96	420.99	1.03
14	22,500	10:31	416.08	416.93	0.85
15	25,400	11:20	412.7	413.52	0.82
16	29,200	13:21	408.3	409.1	0.80
17	31,500	14:10	406.55	407.21	0.66
18	33,800	17:24	404.53	405.4	0.87
19-Kent St	35,560	17:49	403.77	404.43	0.66
20-Cherry St	36,040	18:01	403.34	403.95	0.61
21-Voll St	36,650	18:13	402.62	403.25	0.63
22a-Lorimer St	37,510	19:38	400.08	400.69	0.61
22	37,732	19:50	399.98	400.57	0.59

* Time to peak measured form start of rainfall event

2.3 PEAK DISCHARGES

Calculated peak flood discharges for each mode of failure have been listed in the following tables at the section locations shown. Time elapsed from commencement of breach in the Sunny Day Failure and from commencement of rainfall event for DCF and PMF events have been included along with the increase in peak flood discharges.

No discussion on timing for the start of increased discharge has been included in this section. These times will be effectively the same as those shown in Tables 2.1 to 2.3.for each scenario considered.

Discharge hydrographs for all sections are presented in Appendix H where they have been separated into two groups representing those in and around Oakey and those further upstream.

2.3.1 SUNNY DAY FAILURE

While a Sunny Day Failure would realistically discharge flow into a creek with no flow, a small base flow has been included to satisfy hydraulic model requirements. The base flow can be considered insignificant in the context of dam break discharges.

The peak discharge due to a Sunny Day Failure decreases as it progresses downstream of the dam. The peak discharges in the vicinity of Oakey are around $100m^3/s$.

Peak discharges for each cross section have been listed in Table 2.5.

Table 2.5. SDF Peak Mean Velocities

Section Location	Chainage (m)	Time to Peak (hrs:min)	Peak Discharge (m^3/s)
Dam	0	3:14	3554
1	400	3:14	3443
2	1,500	3:14	3488
3	2,900	3:26	3302
6	7,000	4:15	2531
7	8,000	4:39	2267
8	9,800	5:40	1321
9	11,100	6:16	1189
10	13,300	8:18	757
11	15,600	9:43	626
12	19,400	18:13	198
13	20,700	21:15	163
14	22,500	23:29	134
15	25,400	24:30	138
16	29,200	26:55	127
17	31,500	30:22	116
18	33,800	33:36	112
19-Kent St	35,560	38:52	103
20-Cherry St	36,040	39:17	102
21-Voll St	36,650	40:17	101
22a-Lorimer St	37,510	40:42	101
22	37,732	41:06	100

2.3.2 DAM CREST FLOOD

Peak discharge increases due to failure of the dam during the DCF event have been listed in Table 2.6. Peak flows in Oakey are around 700m^3/s greater than for the non-failure DCF.

Table 2.6. DCF Peak Discharges

Section Location	Chainage (m)	Time to Peak* (Failure) (hrs:min)	Peak Discharge No Failure (m3/s)	Peak Discharge Failure (m3/s)	Difference (m)
Dam	0	6:40	1762	5838	4076
1	400	6:40	1763	5782	4019
2	1,500	6:53	1762	5669	3907
3	2,900	6:53	1758	5605	3847
6	7,000	7:17	1725	5198	3472
7	8,000	7:29	1815	4996	3181
8	9,800	7:53	1657	4300	2642
9	11,100	8:05	1769	4298	2529
10	13,300	8:42	1708	3928	2220
11	15,600	9:30	1565	3409	1844
12	19,400	11:20	1161	2548	1387
13	20,700	12:33	1118	2333	1215
14	22,500	13:09	1102	2293	1191
15	25,400	14:46	1081	2157	1076
16	29,200	16:11	1049	2006	956
17	31,500	17:36	987	1890	903
18	33,800	19:02	798	1689	891
19-Kent St	35,560	21:39	716	1428	711
20-Cherry St	36,040	21:52	709	1423	715
21-Voll St	36,650	22:16	697	1418	721
22a-Lorimer St	37,510	22:28	692	1406	714
22	37,732	22:40	687	1392	705

* Time to peak measured form start of rainfall event

2.3.3 PMP DWSIGN FLOOD

Differences in peak discharges between the fail and non-failure cases are around 760 m^3/s in Oakey.

Table 2.7. PMP Design Flood Peak Discharges

Section Location	Chainage (m)	Time to Peak (Failure) (hrs:min)	Peak Discharge		Difference (m)
			No Failure (m3/s)	Failure (m3/s)	
Dam	0	4:27	5326	9250	3924
1	400	4:27	5327	9243	3916
2	1,500	4:27	5324	9118	3794
3	2,900	4:39	5280	8900	3620
6	7,000	4:51	5197	8564	3367
7	8,000	5:03	5190	8053	2863
8	9,800	5:27	4653	7398	2745
9	11,100	5:27	4919	7587	2668
10	13,300	5:52	4577	7049	2473
11	15,600	6:53	3929	6259	2330
12	19,400	8:18	2845	4539	1694
13	20,700	9:43	2633	4164	1531
14	22,500	10:07	2594	4097	1502
15	25,400	11:08	2461	3913	1451
16	29,200	12:45	2289	3494	1205
17	31,500	13:46	2170	3345	1174
18	33,800	14:34	1952	2871	919
19-Kent St	35,560	17:36	1736	2504	768
20-Cherry St	36,040	17:49	1733	2499	766
21-Voll St	36,650	18:01	1730	2494	763
22a-Lorimer St	37,510	18:13	1722	2479	757
22	37,732	18:13	1709	2461	751

2.4 PEAK MEAN FLOOD VELOCITIES

The calculated peak mean velocities have been listed in following Tables 2.8 to 2.10 for each scenario investigated. The presented velocities are peak mean velocities for the entire cross section. Actual velocity of flow would vary across the section with greater velocities experienced in the creek channel and slower velocities on the flood plain.

Peak mean velocities are greatest closest to the dam. Velocities in and around Oakey for the DCF and PMF failure events average around 1.0 m/s although some instances of higher velocities are apparent. This is considered a hazardous velocity for adults and children particularly when water depth exceeds

0.5m.

No discussion on timing for the start of increased velocities has been included in this section. Such times will be effectively the same as those discussed in Section 2.2 for each scenario considered.

Table 2.8. SDF Peak Mean Velocities

Location	Chainage (m)	Time to Peak (hrs:min)	Failure (m/s)
Dam	0	3:14	2.61
1	400	3:14	3.56
2	1,500	3:14	1.76
3	2,900	3:38	2.4
6	7,000	3:50	1.97
7	8,000	4:02	1.51
8	9,800	5:40	0.47
9	11,100	6:04	1.05
10	13,300	6:28	0.62
11	15,600	9:43	0.59
12	19,400	11:56	0.74
13	20,700	18:25	0.51
14	22,500	21:27	1.14
15	25,400	23:17	0.53
16	29,200	25:55	0.42
17	31,500	27:20	0.53
18	33,800	46:46	0.65
19-Kent St	35,560	37:15	0.74
20-Cherry St	36,040	26:31	0.44
21-Voll St	36,650	28:45	0.62
22a-Lorimer St	37,510	36:51	0.33
22	37,732	3:02	0.41

Table 2.9. DCF Peak Mean Velocities

Location	Chainage (m)	Time to Peak (hrs:min)	Peak Mean Velocity (m/s)		
			No Failure (m/s)	Failure (m/s)	Difference (m/s)
Dam	0	06:40	2.12	3.14	1.02
1	400	06:40	2.86	4.17	1.31
2	1,500	06:40	1.37	2.05	0.68
3	2,900	06:53	1.46	1.68	0.22
6	7,000	07:17	1.71	2.16	0.45
7	8,000	06:53	1.54	1.74	0.20
8	9,800	07:53	0.54	1.04	0.50
9	11,100	02:13	1.05	1.05	0.00
10	13,300	08:18	0.72	0.89	0.17
11	15,600	08:05	0.85	0.94	0.09
12	19,400	09:06	0.76	0.88	0.12
13	20,700	12:08	0.69	0.86	0.17
14	22,500	10:31	0.59	0.64	0.05
15	25,400	11:44	0.55	0.73	0.18
16	29,200	12:33	0.63	0.76	0.13
17	31,500	13:46	0.94	1.03	0.09
18	33,800	18:01	0.62	0.73	0.11
19-Kent St	35,560	17:24	1	1.08	0.08
20-Cherry St	36,040	18:25	0.68	0.84	0.16
21-Voll St	36,650	20:39	0.67	0.87	0.20
22a-Lorimer St	37,510	21:03	0.78	1.15	0.37
22	37,732	21:15	0.21	0.3	0.09

Table 2.10. PMP Design Flood Peak Mean Velocities.

Location	Chainage (m)	Time to Peak (hrs:min)	Peak Mean Velocity (m/s)		
			No Failure (m/s)	Failure (m/s)	Difference (m/s)
Dam	0	4:27	2.97	3.63	0.66
1	400	4:27	4.06	4.75	0.69
2	1,500	4:27	2	2.36	0.36
3	2,900	4:27	1.68	1.96	0.28
6	7,000	4:51	2.14	2.6	0.46
7	8,000	4:02	1.8	1.88	0.08
8	9,800	5:27	1.09	1.48	0.39
9	11,100	5:15	1.07	1.24	0.17
10	13,300	5:15	0.95	1.07	0.12
11	15,600	5:40	1.18	1.31	0.13
12	19,400	6:40	1.11	1.34	0.23
13	20,700	9:30	0.89	1.04	0.15
14	22,500	7:41	1.15	1.23	0.08
15	25,400	1:00	0.73	0.73	0.00
16	29,200	9:43	0.65	0.71	0.06
17	31,500	10:31	0.93	0.97	0.04
18	33,800	13:21	0.77	0.88	0.11
19-Kent St	35,560	13:33	1.09	1.16	0.07
20-Cherry St	36,040	14:10	0.86	1	0.14
21-Voll St	36,650	15:11	0.87	0.94	0.07
22a-Lorimer St	37,510	15:59	1.26	1.54	0.28
22	37,732	15:47	0.39	0.41	0.02

2.5 MANNING'S ROUGHNESS SENSITIVITY ANALYSIS

Manning's roughness coefficients selected in analysis were 0.08 for creek channels and 0.12 for over bank flow. Variation to Manning's values will effect flow depth and velocity. As no data was available for calibration of the hydraulic model a sensitivity analysis was undertaken to determine the degree of variation to flow depth and velocity that might result from a reasonable variation in Manning's coefficient. A sensitivity analysis was carried out on the PMF with dam failure scenario where Manning's values were varied by ±20%.

Increasing Manning's values by 20% resulted in a maximum depth increase of 0.5m at chainage 5,500m where the corresponding maximum flow depth was 17.65m. A 20% increase in roughness resulted in a 3% increase in flow depth.

The largest decrease in flow depth resulting from a 20% reduction in Manning's coefficient was 2.0m and occurred at chainage 400m. This represents a flow depth decrease of 10%. As flow continued the degree of variation in flow depth was reduced. In the vicinity of Oakey the variation in flow depth has been reduced to less around 1%.

Variations to peak mean velocities were negligible for the decrease and increase in Manning's values.

The sensitivity analysis confirmed that any reasonable variation from the assumed Manning's roughness coefficient would result in acceptable variations of the flood levels.

3.0 HAZARD ASSESSMENT

The Sunny Day Hazard Category and Incremental Flood Hazard Category (IFHC) are determined using the *Guidelines on Assessment of the Consequences of Dam Failure* (ANCOLD, 2000b) through estimating the population at risk (PAR) and the extent and severity of damages and loss resulting from dam failure. In addition, this report establishes an Acceptable Flood Capacity Fallback alternative for Cooby Dam based on the hazard category in accordance with the *Guidelines on Selection of Acceptable Flood Capacity for Dams* (ANCOLD, 2000a).

3.1 POPULATION AT RISK

The population at risk (PAR) was assessed for:

1 Sunny Day Failure

2 Dam Crest Flood incremental flood impacts with and without dam failure

3 PMP Design Flood incremental impacts with and without dam failure.

Results have been summarised in Table 3.1.

In order to determine the PAR, default populations were adopted from *Guidelines for Failure Impact Assessment of Water Dams* (NRM, 2002). The PAR count was based on aerial photography.

Table 3.1. Estimated Population at Risk

Location	SDF	DCF Incremental PAR	PMP Incremental PAR
Upstream of Oakey	61	27	9
PAR in Oakey (Dwellings)	6	322	154
PAR in Oakey (Industrial Buildings, Hotels, Motels)	-	187	24
Army Aviation Base	-	36	360
Total PAR	67	572	547

3.2 SUNNY DAY HAZARD CATEGORY

The Sunny Day Hazard Category is determined from the PAR in conjunction with the extent and severity of damages and loss resulting from dam failure under a Sunny Day Failure event. The PAR for the Sunny Day Failure was determined to be 67. Farm houses upstream of Oakey contributed 61

PAR to the total while the remaining 6 PAR were detached houses located in the vicinity of Oakey township. The PAR count was based on a visual assessment of available aerial photography and a site visit.

Although Cooby Dam is no longer the principal water supply for Toowoomba, consideration of the cost of re-establishing a backup water supply, the cost of damage to agricultural land and the environment due to failure was assessed as "Major" using the ANCOLD "*Guidelines on Assessment of the Consequences of Dam Failure*" (ANCOLD, 2000b).

Accordingly, Cooby Dam is classified as having a "*High B*" Hazard Category for a "*Sunny Day*" failure.

3.3 INCREMENTAL FLOOD HAZARD CATEGORY (IFHC)

The IFHC is determined using the highest incremental PAR and the associated extent and severity of damages and loss due to increases in an existing flood caused by dam failure.

Both DCF and PMF failure events demonstrate incremental rises greater than 0.3m throughout the study area.

The highest incremental effect was adopted as the difference between the failure and no failure cases for both the DCF and PMP Design Flood events. The greatest of the two was the PMP Design Flood and amounted to a PAR of 707 including significant portions of Oakey and the Army Aviation Base. The severity of damage and loss was assessed as "Major" using the ANCOLD "Guidelines on Assessment of the Consequences of Dam Failure" (ANCOLD, 2000b).

3.4 FAILURE IMPACT RATING

Accordingly, Cooby Dam is categorized as a "High A" IFHC Dam. The Acceptable Flood Capacity fallback alternative for this rating is the PMP Design Flood.

4.0 CONCLUSION

INCREMENTAL FLOOD CONCLUSIONS

- The flood arising from the DCF with dam failure creates the greatest population at risk of all the scenarios analysed. The PAR was estimated to be 572.
- Oakey and the Army Aviation Base are inundated during the PMP Design flood and are both subject to flood level increases greater than 300mm with dam failure during this event.
- The incremental flood depth increase due to dam failure would be as much as 1.6 m and 0.9m in Oakey for DCF and PMP Design Flood respectively.
- The peak flood levels for the DCF event without dam failure and with dam failure would arrive at Oakey around 26 hours and 22 hours respectively after the start of the rainfall event.
- The peak flood levels for the PMP Design Flood event without dam failure and with dam failure would reach Oakey 19 hours and 17 hours after the start of rain and 16.5 and 15 hours after the breach started to form respectively.
- Cooby Dam is assessed as having a "High A" Incremental Flood Hazard Category (IFHC) based on an incremental PAR of 572 and major damages and loss in accordance with the Guidelines of Assessment of Consequences of Dam Failure (ANCOLD, 2000b).

SUNNY DAY FAILURE CONCLUSIONS

- A Sunny Day Failure results in a population at risk of 67, the majority of which are located between Cooby Dam and Oakey.
- In the case of a Sunny Day Failure flood waters would arrive in Oakey around 24 hours after the breach began to form will peak at further 12 hours or 36 hours after the breach initiation.
- The flood flow resulting from the Sunny Day Failure is generally confined to the creek channel through Oakey.
- Cooby Dam is assessed as having a High B Hazard Category Rating for the Sunny Day Failure scenario.

APPENDIX A

COOBY DAM GENERAL LAYOUT

APPENDIX B
INUNDATION PLANS

1 Drawing No. 222099

2 Drawing No. 222100

3 Drawing No. 222101

4 Drawing No. 222233

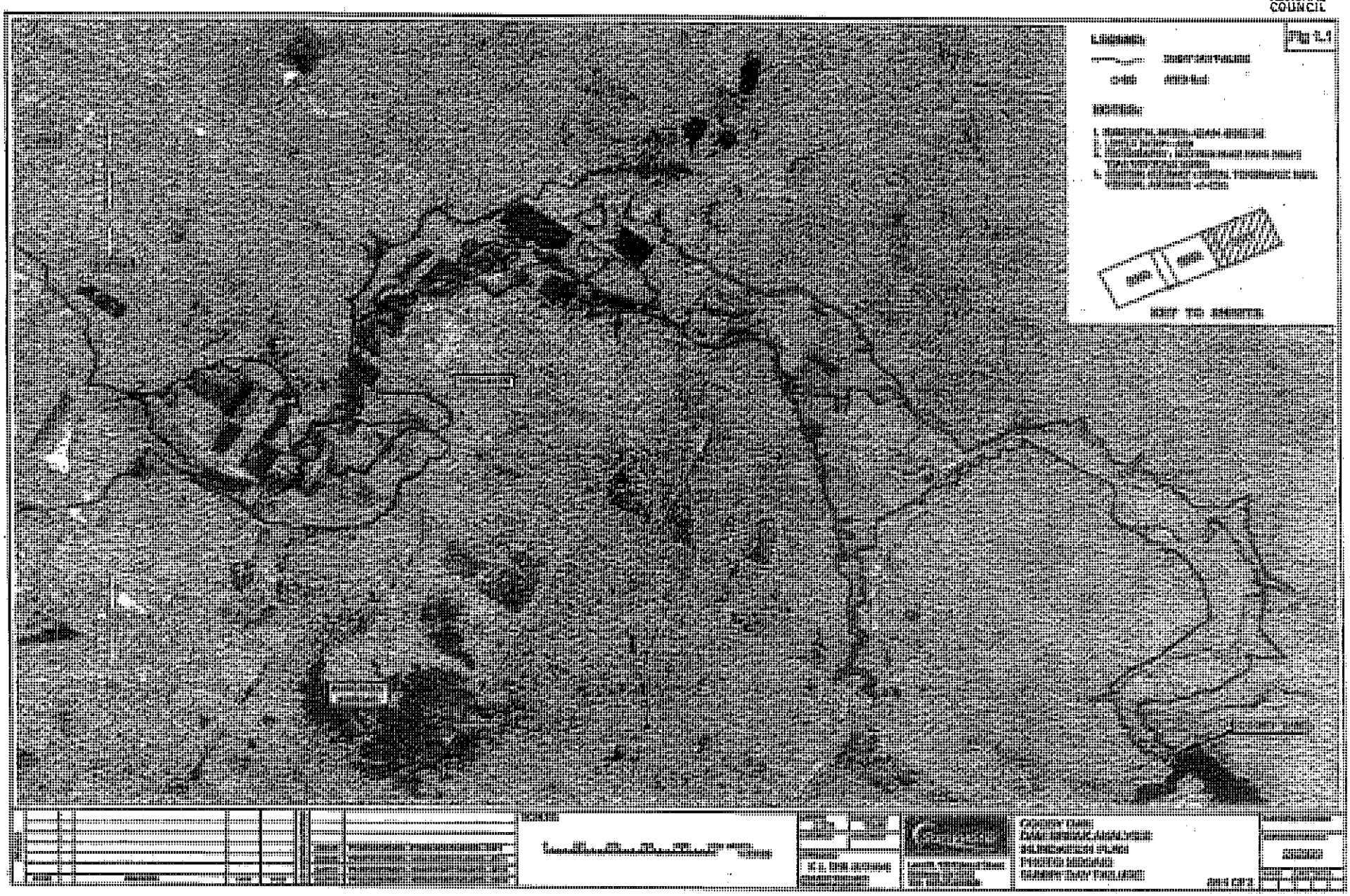
5 Drawing No. 222234

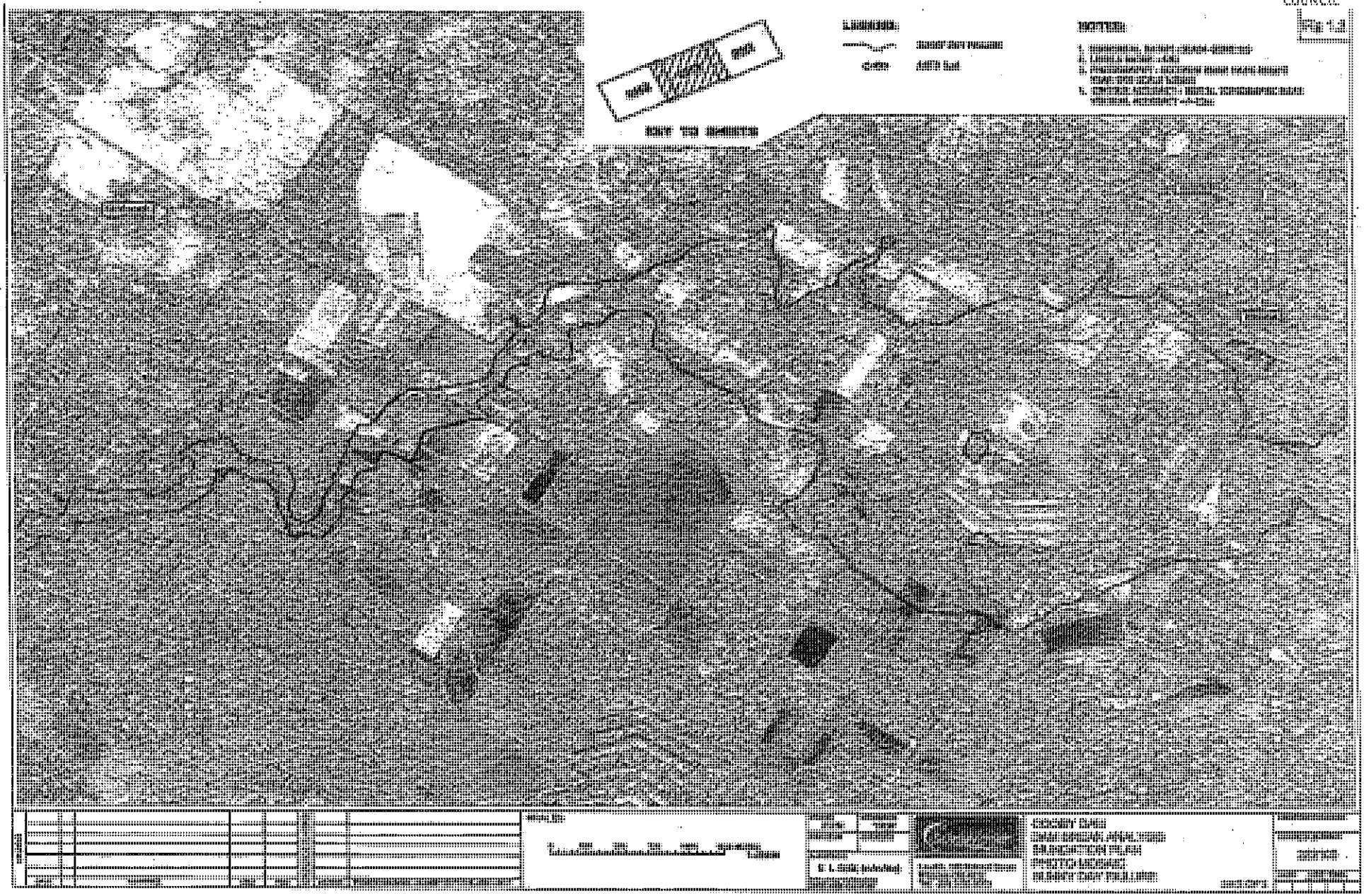
6 Drawing No. 222235

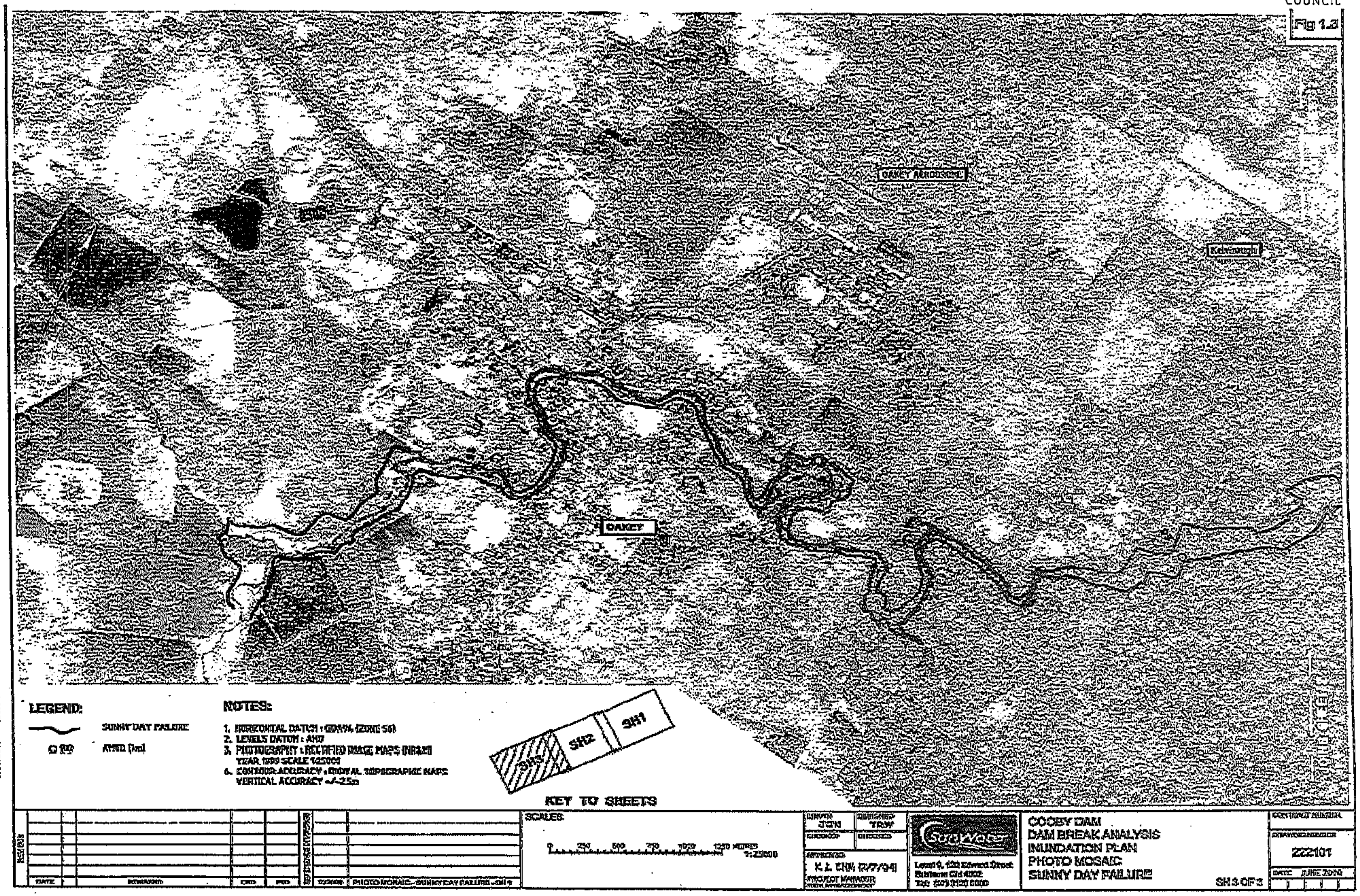
7 Drawing No. 222236

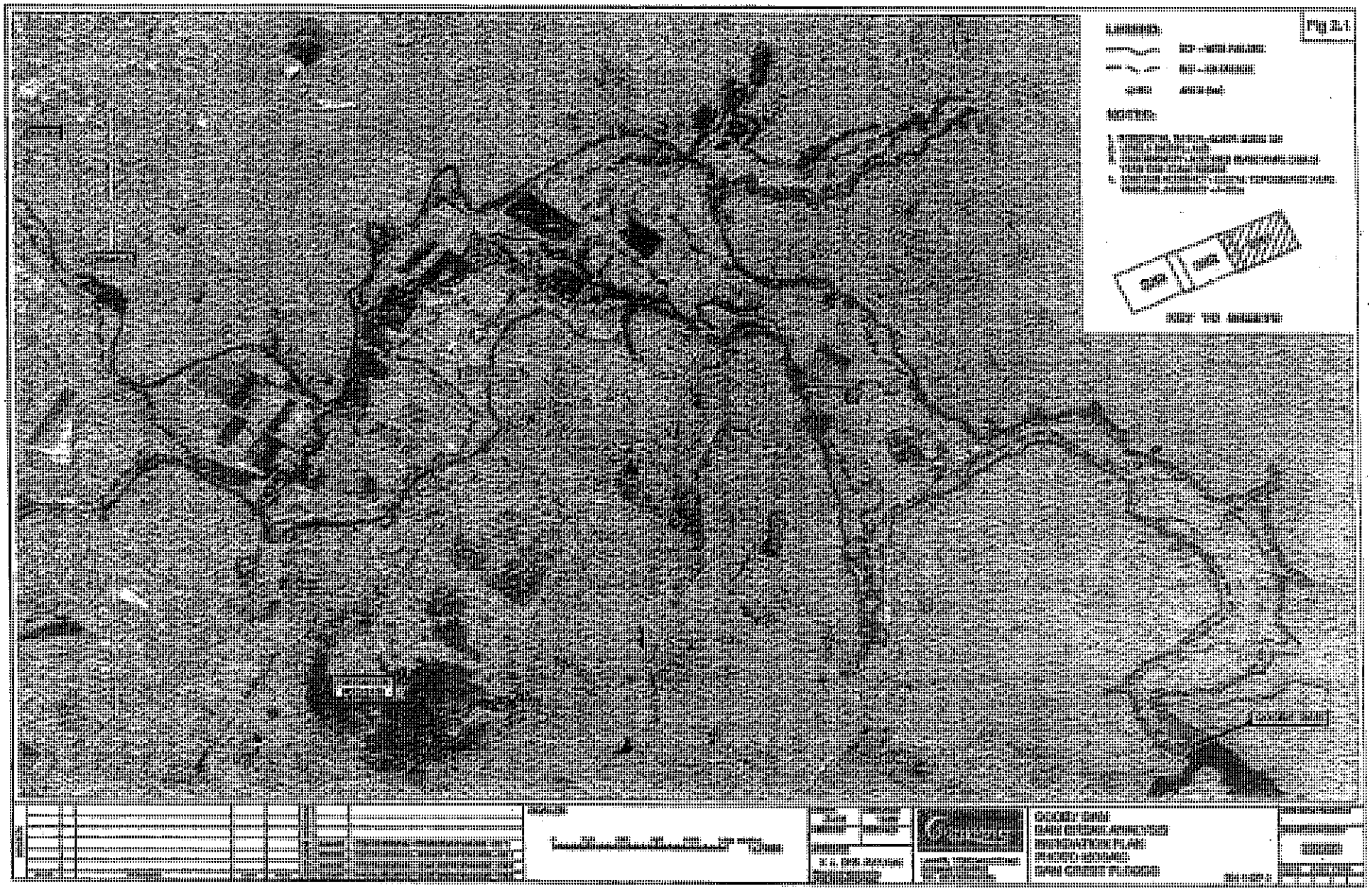
8 Drawing No. 222237

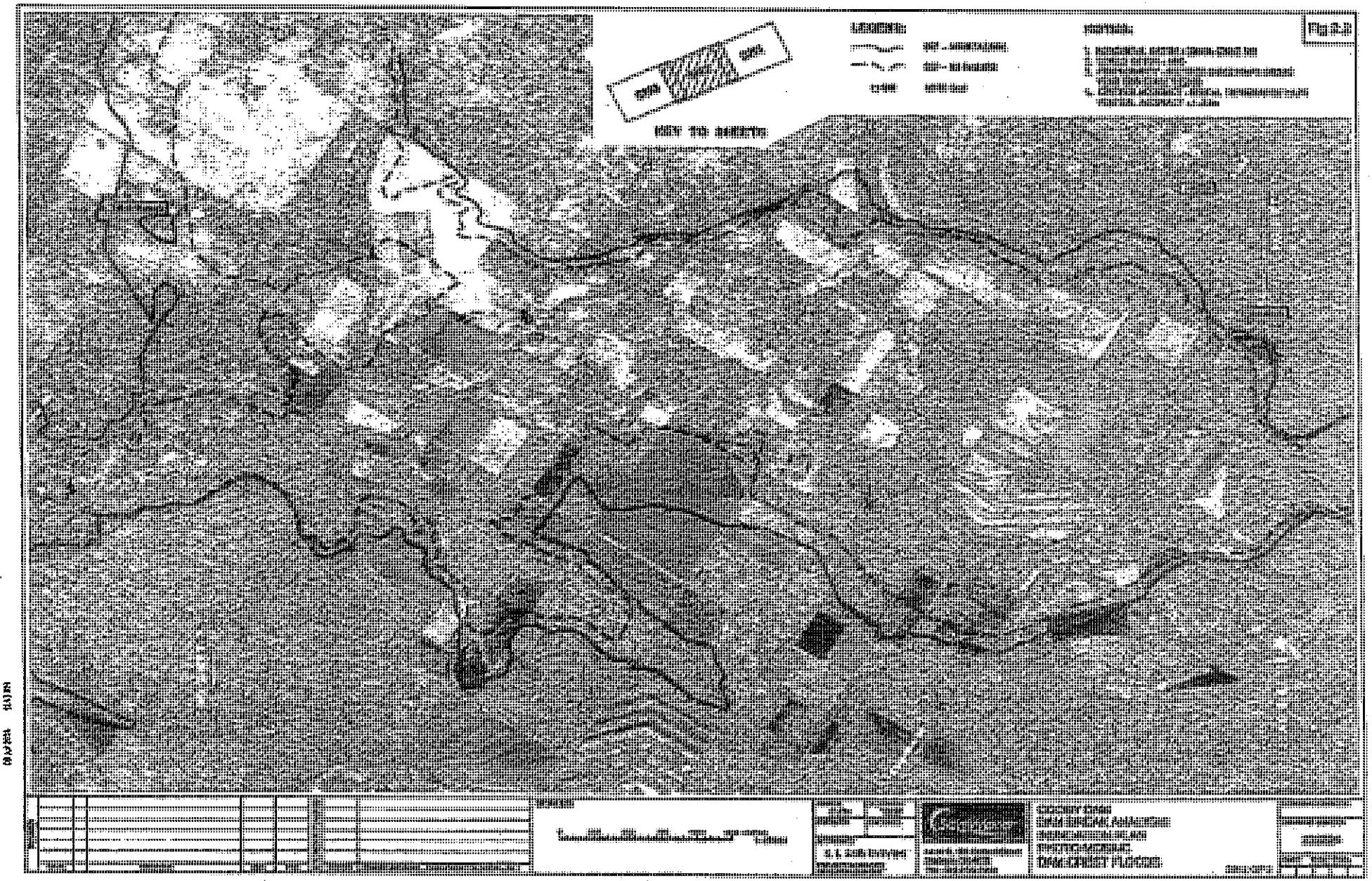
9 Drawing No. 222238

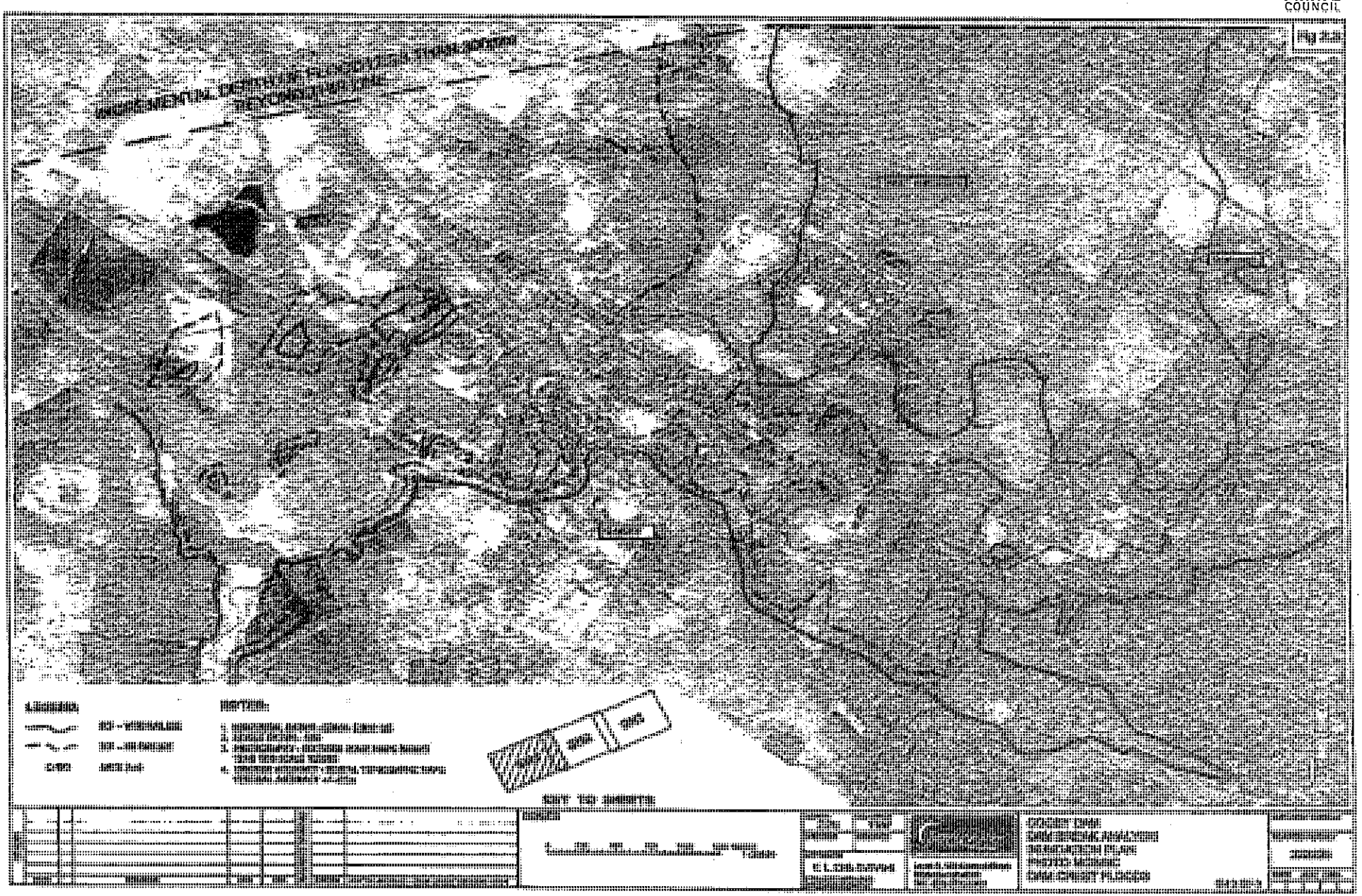


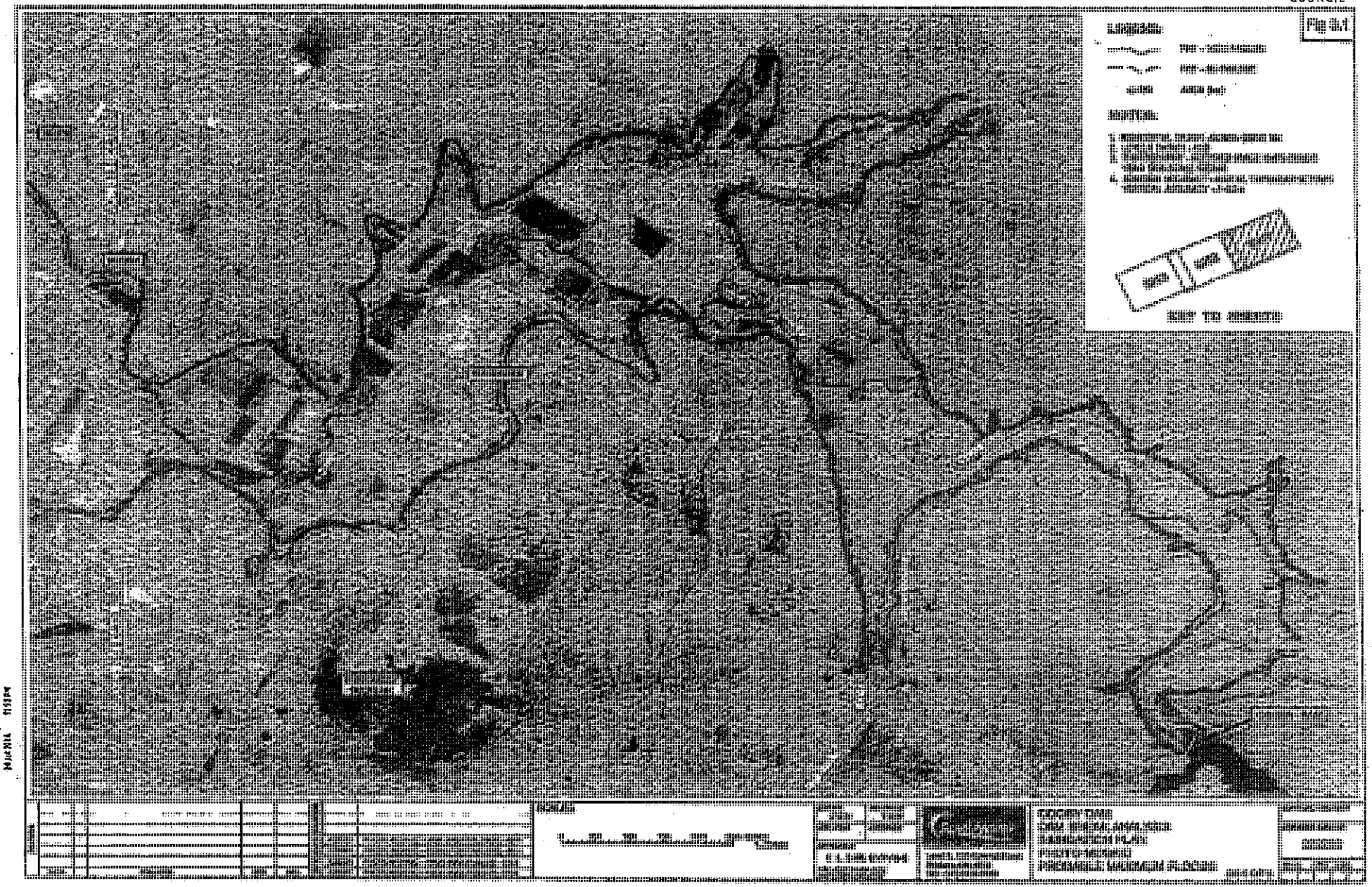


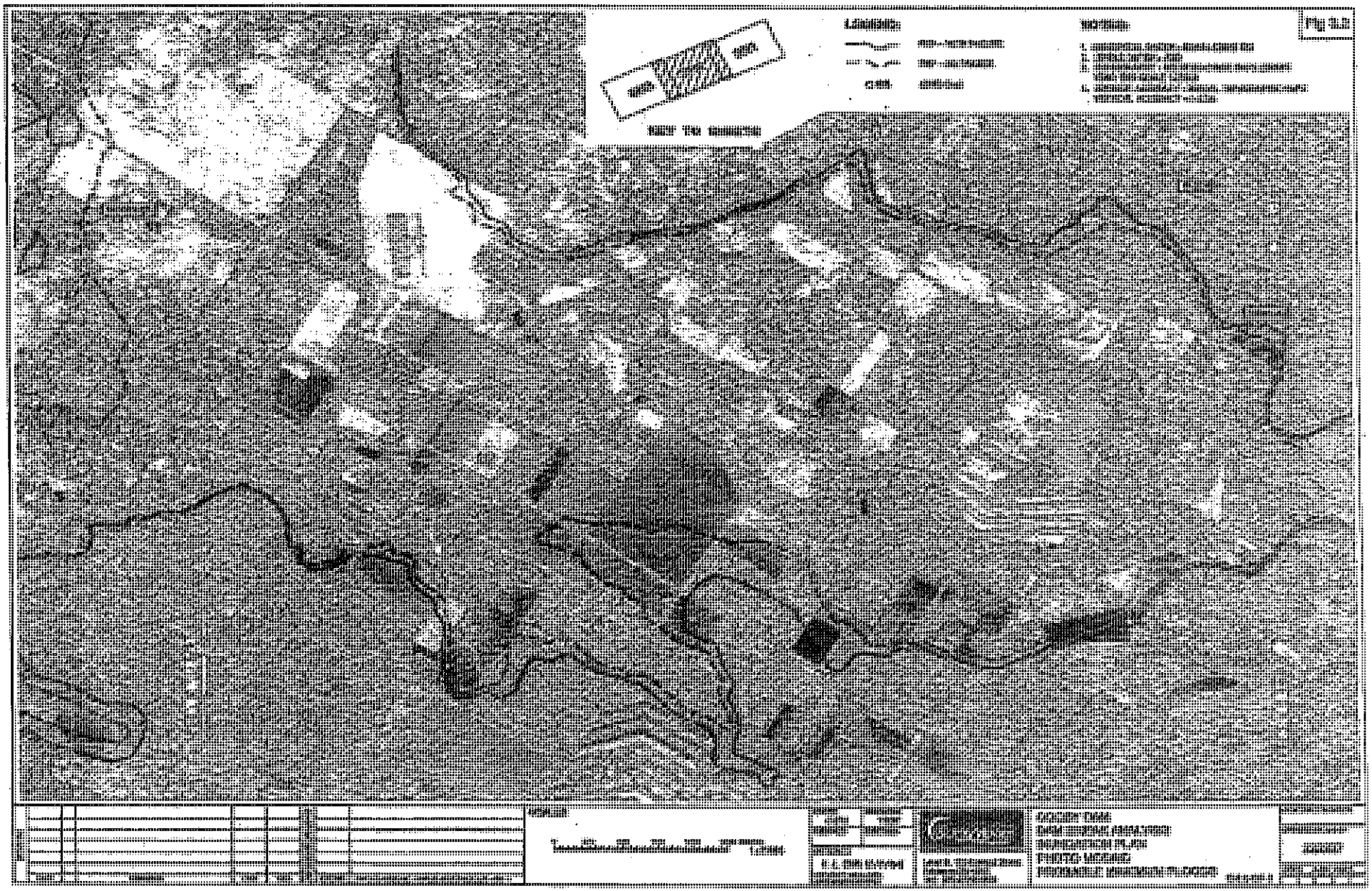

REGIONAL COUNCIL
Fig 1.3
OAKEY AERODROME
Kelvinhaugh
OAKEY
LEGEND:
SUNNY DAY FAILURE
AMTD (km)
NOTES:
1. HORIZONTAL DATUM : GDA94 (ZONE 56)
2. LEVELS DATUM : AHD
3. PHOTOGRAPHY : RECTIFIED IMAGE MAPS
4. CONTOUR ACCURACY : DIGITAL TOPOGRAPHIC MAPS VERTICAL ACCURACY +/-2.5m
KEY TO SHEETS
SH3
SH2
SH1
SCALES
1:25000
COOBY DAM
DAM BREAK ANALYSIS
INUNDATION PLAN
PHOTO MOSAIC
SUNNY DAY FAILURE
SH3 OF 3
222101
JUNE 2004

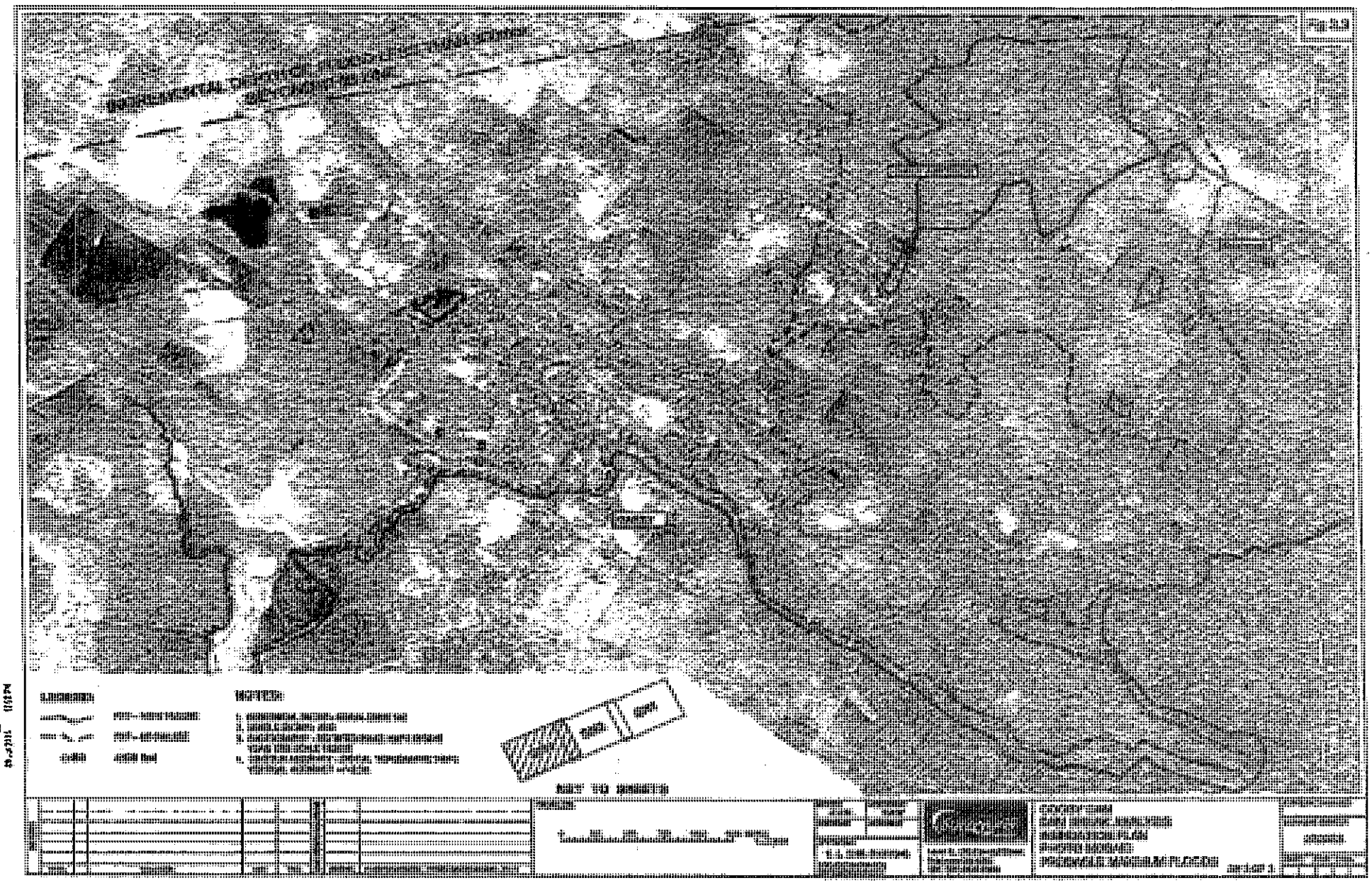








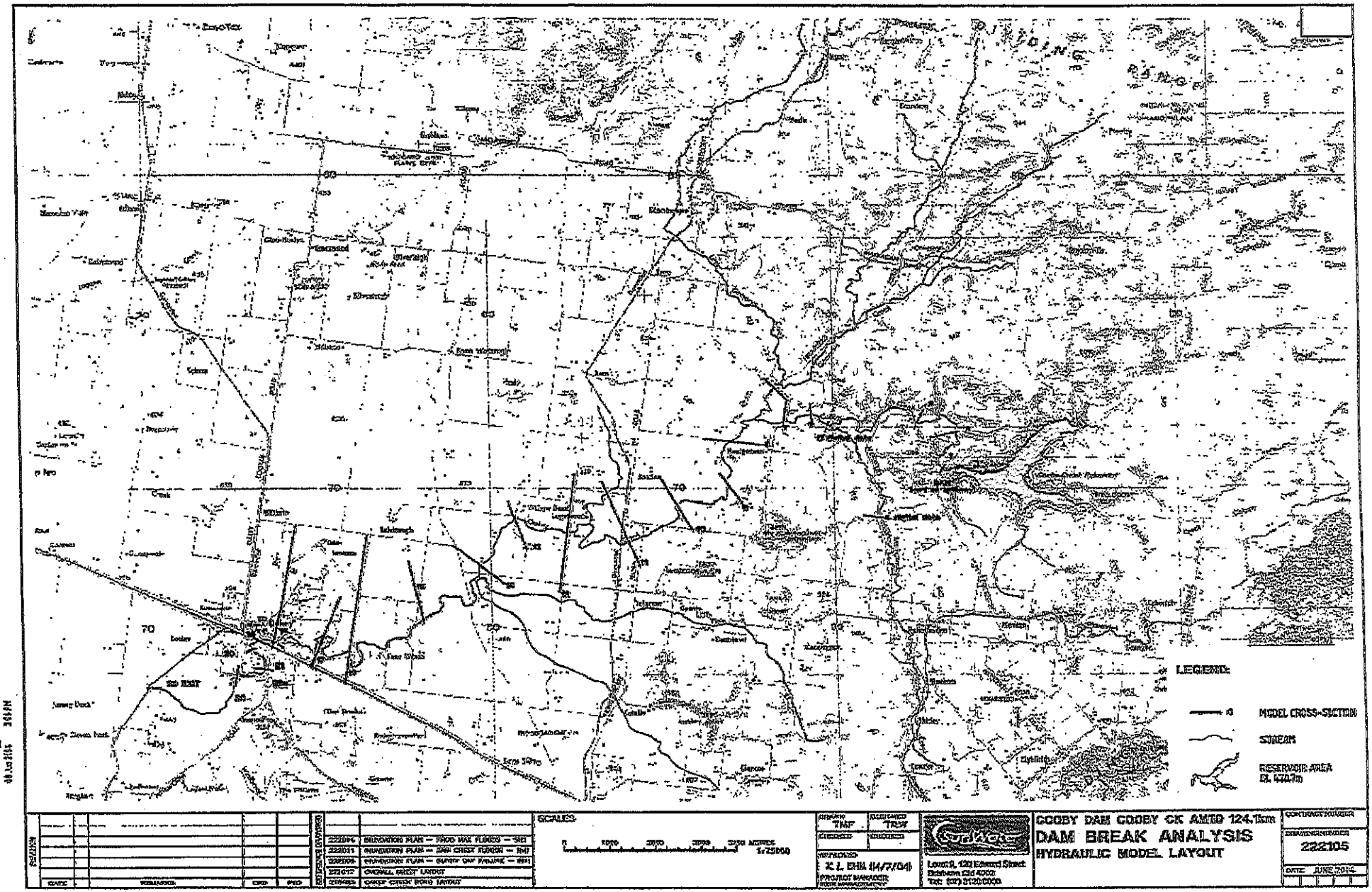




APPENDIX C

MIKE 11 HYDRAULIC MODEL LAYOUT

1 Drawing No. 222105


LEGEND:
MODEL CROSS-SECTION
STREAM
RESERVOIR AREA
EL 470.7m
SCALES:
1:25000
COOBY DAM COOBY CK AMTD 124.1km
DAM BREAK ANALYSIS
HYDRAULIC MODEL LAYOUT
222105
JUNE 2014

APPENDIX D

STAGE HYDROGRAPHS

1 Peak Flood Levels – Profiles

2 PMF – with Dam Failure – Upstream of Oakey

3 PMF – with Dam Failure at Oakey

4 DCF with Dam Failure – Upstream of Oakey

5 DCF with Dam Failure – Oakey

6 Sunny Day Failure – Upstream of Oakey

7 Sunny Day Failure – At Oakey

Dam Failure Flood Profiles

APPENDIX E

DISCHARGE HYDROGRAPHS

1 PMF – with Dam Failure – Upstream Of Oakey

2 PMF – with Dam Failure – at Oakey

3 DCF With Dam Failure – Upstream Of Oakey

4 DCF With Dam Failure – At Oakey

5 Sunny Day Failure – Upstream Of Oakey

6 Sunny Day Failure – At Oakey