Purpose

The Corella Dam is managed by DERM. In terms of an MOU with DERM, the RoadTek Works Manager, Asset Services North, Cairns, manages the operation and maintenance of the Corella Dam, including routine dam safety inspections.

Part of the dam safety management program is to inspect the Dam immediately before the spillway starts to overflow. A secondary objective is to advise tourists or campers to that access and egress to the area may be cut off due to local stream rises.

Scope

This Procedure applies to spillway overflow events that are less than the historical maximum event with a storage level of EL301.7m. The personnel are the Emergency Action Plan (EAP) Officers listed in the EAP for Corella Dam.

Personnel Affected and Responsibilities

Officer	Responsibility
RoadTek Engineer	A Registered Professional Engineer, Queensland, responsible for carrying out monthly inspections at the dam.
Emergency Action Plan Officers (EAP Officers)	The Officer based at Cloncurry and at or near Corella Dam responsible for carrying out EAP procedures for the Dam and this Standing Operating Procedure.
Principal Engineer, Non-Commercial Assets	The person responsible for approving the Standing Operating Procedures, the Operation and Maintenance Manual and the persons undertaking the role of EAP Officers and, for managing, receiving, storing and checking data for the Corella Dam, reviewing and authorising documentation produced by the RoadTek Officer and consultants on the dam and initiating investigations into abnormal behaviour of the dam. Manages the Distribution, Approval and Revision Control relating to this Procedure.
Regional Manager, Water Services, Central West Region, DERM	The person responsible for approving the Emergency Action Plan.

Actions

The EAP Officer should be aware of the storage height and rainfall conditions, and be able to estimate when the spillway is likely to overflow. Details for obtaining information on rainfall, storage and river gauge heights from the Bureau of Meteorology website is given in Appendix 7 of the EAP.

- Two hours before the spillway is estimated to overflow, The EAP officer shall visit the dam if safe access is possible, and visually inspect the Dam for any deficiencies.
- Check for new cracking or increased crack widths in the spillway face and the roller compacted main wall. Appendix B gives a guide for inspecting the Dam for deficiencies.
- Advise any tourists or campers at the dam that they should consider leaving the site immediately, while access and egress to the site is open. If they are unable to leave the site because of local stream rises or other reasons they should seek higher ground and await evacuation by police and emergency services.
- Close the gates to the dam site and display the dam site closed sign.
- Read the storage height gauge and rain gauge at one-hour intervals.
- Notify the Police in Cloncurry, and the Executive Officer, Local Disaster Management Group, Cloncurry Shire Council that a spillway discharge is likely, the gates on the access road at the dam entrance have been closed and a sign installed that the dam site is closed. Also provide information of parties that are at the dam site and maybe unable to leave safely.
- At a reasonable time, notify the Principal Engineer, Non-Commercial Assets of storage height and that a spillway discharge is likely. Regularly update Principal Engineer, Non -Commercial Assets during the rainfall event. At least daily or as directed by the Principal Engineer, Non -Commercial Assets.
- Notify property owners and residents at "Corella Park" that the dam site has been closed and a spillway discharge is likely.
- If the storage level is predicted to reach EL301.7m which is equivalent to EL 259.56m at the downstream bridge (deck level), the EAP Officer is to implement the Major Overflow Event in the EAP.
- When the preceding twelve-hour rainfall is less than 50mm and the storage height gauge is less than EL299.4m and falling, and local stream rises have fallen sufficiently to allow access to and egress from the site, the EAP Officer is to make an inspection of the Dam and advise the Principal Engineer, Non-Commercial Assets.
- Once given permission by the Principal Engineer, Non -Commercial Assets the dam site can be opened to the public. The site maybe closed for extended periods following an event due to flood waters on the access road.
- EAP Officer advises the Police in Cloncurry, and the Executive Officer, Local Disaster Management Group, Cloncurry Shire Council that the site has been opened to the public and stands down.

References

- Emergency Action Plan, Corella Dam

Appendix B

INSPECTING FOR DEFICIENCIES: SUMMARY

TYPE OF DEFICIENCY	LOOK FOR
SEEPAGE	A water flow or sand boil on the lower portion of the downstream slope or toe area, especially at the groins. Leakage around conveyance structures such as outlet works. Wet areas or areas where the vegetation appears greener or more lush on the embankment slope or toe area. Blocked toe drains. An increase in the amount of water being released from toe drains. (Remember to take into account changes in the reservoir level.) Turbidity or cloudiness of the seepage.
CRACKING	Desiccation Cracking: A random honeycomb pattern of cracks usually found on the crest and the downstream slope. Transverse Cracking: Cracks that are perpendicular to the length of the dam usually found on the crest. Longitudinal Cracking: Cracks that are parallel to the length of the dam. Longitudinal cracks may be associated with stability problems in the slopes.
INSTABILITY	Slides on the upstream or downstream slopes. Bulging, especially at the toe of the dam.
DEPRESSIONS	Misalignment in the crest and embankment slopes found by sighting along fixed points. Sinkholes found by checking and probing each depression. Remember, sinkholes have steep, bucket like sides while minor depressions have gently sloping, bowl like sides.
MAINTENANCE CONCERNS	Inadequate Slope Protection: Check for bald areas or areas where the protection is sparse or damaged. Surface Runoff Erosion: Check for gullies or other signs of erosion. Make sure to check the low points along the upstream and downstream shoulders and groins since surface runoff can collect in these areas. Inappropriate Vegetative Growth: Check for excessive and deep rooted vegetative growth. Debris: Check for debris on and around the dam, especially near outlet works or spillway inlets. Animal Burrows: Check for damage caused by burrowing animals.

Note: This tabulation taken from Dam Safety Surveillance Field Manual-August 2005

WHEN TO GET FURTHER ASSISTANCE

Several of the deficiencies covered above are very serious. If you observe any of the following deficiencies, you should consult with the Principal Engineer, Non –Commercial Assets:

- Sand boils or turbid seepage.
- Seepage that has increased since the last inspection (taking the reservoir level into consideration).
- Cracking that extends below the reservoir level or potential reservoir level.
- Transverse and longitudinal cracking.
- Deep seated slides or bulging associated with slides.
- Sinkholes or other large depressions.
- Deep rooted vegetation that might need to be removed.

If you are unsure whether or not a condition poses a threat to the safety of the dam, you should discuss your findings with the Principal Engineer, Non –Commercial Assets.

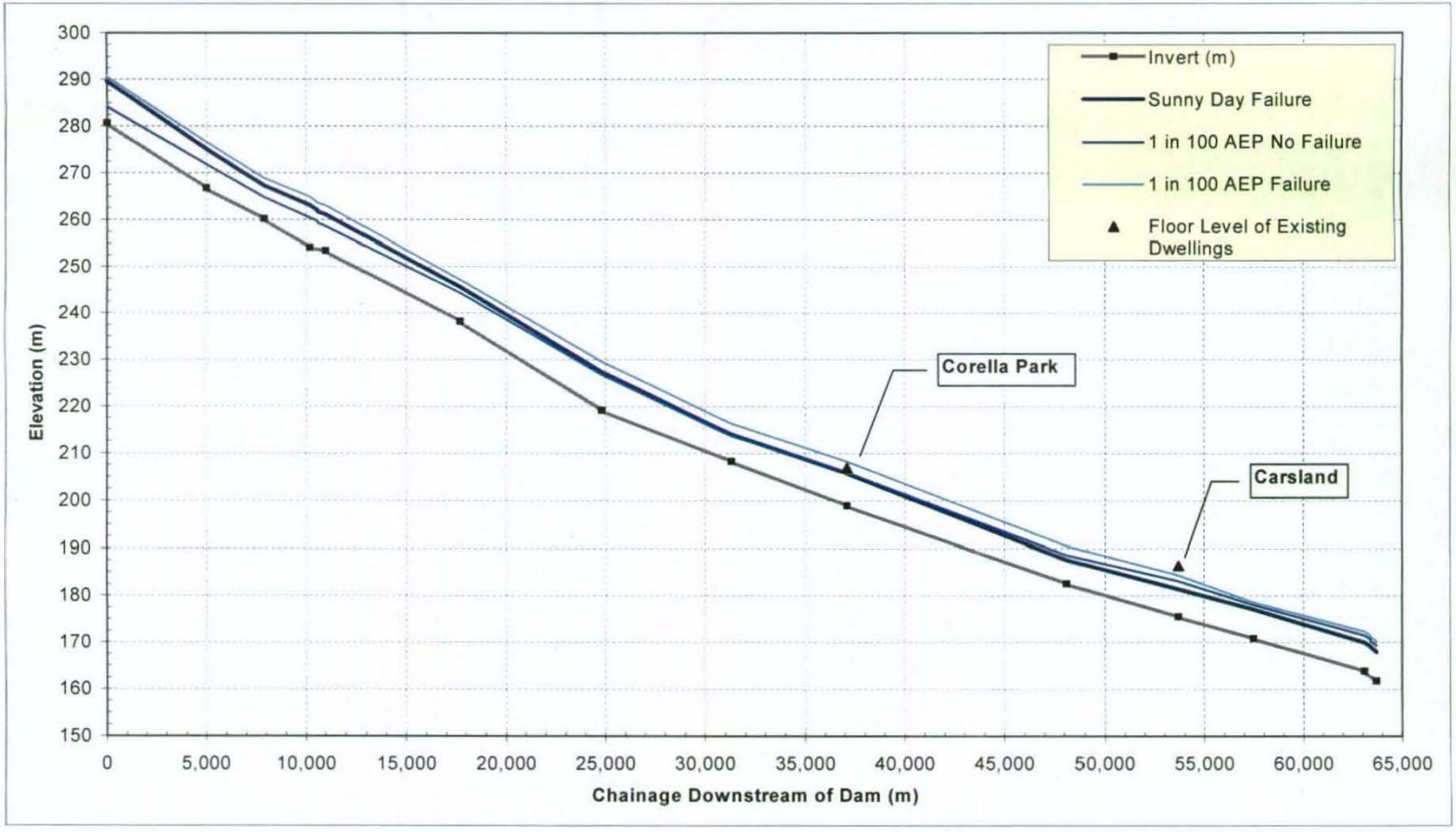
APPENDIX 8
ESTIMATED WATER LEVELS FOR EVENTS

Table1 Estimated Peak Water Levels at Existing Dwellings

Location		Scenario							
Mike 11 Chainage	Description	Sunny Day Failure	1 in 100 AEP No Failure	1 in 100 AEP With Failure	1 in 10,000 AEP No Failure	1 in 10,000 AEP Piping Failure	1 in 20,000 AEP No Failure	1 in 20,000 AEP Piping Failure	1 in 20,000 AEP Overtopping Failure
37,100	Corella Park	205.84	206.02	208.36	206.94	209.33	207.51	209.59	
53,700	Carsland	181.49	183.20	184.46	183.28	184.82	183.90	185.13	

Table 0.2 Floor Levels at Downstream Properties

Carsland Station	Corella Park	
186.37 (New House)	206.78	207.56
186.44 (Old House)	207.26	207.63
	207.48	207.63


Invert (m)
Sunny Day Failure
1 in 100 AEP No Failure
1 in 100 AEP Failure
Floor Level of Existing Dwellings
Corella Park
Carsland
Elevation (m)
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
60,000
65,000
Chainage Downstream of Dam (m)

APPENDIX 9
ENVIRONMENTAL INCIDENT ALERTS

ENVIRONMENTAL INCIDENT ALERT

REGIONAL SERVICE DELIVERY DIVISION

DATE OF INCIDENT:

INCIDENT NOTIFIED BY:

TIME OF NOTIFICATION:

LOCATION OF INCIDENT:

SUMMARY OF INCIDENT AS NOTIFIED:

-
- Provide a brief dot point summary of the situation based on the information available

POTENTIAL IMPACTS:

-
- (this information can be based on advice from the company or source of the incident)
- Likelihood of unlawful environmental harm
- Likelihood of potential risk to public health (if public health risk is identified notify Queensland Health and provide details in this alert)

DERM's PLANNED ACTIONS:

-
- What actions has DERM taken
- What actions are proposed to be taken and timeframe for doing these

NEXT UPDATE ON INCIDENT EXPECTED:

-
- Date/time estimate

COMMUNICATION:

-
- What communications have been made?
- What public notifications have been made?
- What public notifications are expected?

MAP OR PLAN OF SITE:

-
- Where possible attach a map or plan which identifies the site and key features

Region:
Briefing Officer: Telephone: (07) Date:
Approving Officer: Telephone: (07) Date:

From: Brown Damien
Sent: Wednesday, 24 February 2010 2:29 PM
To: Birchley Michael; Buckley Andrew; Hart Randall; Pappalardo Joe
Cc: Miles Rhonda
Subject: Environmental Incident Alert Process for Regional Service Delivery
Importance: High

Good afternoon

As you are aware, Minister Jones' office has requested to be informed immediately of any environmental incidents, the impacts of such and proposed actions by the department. Due to the volume and urgent nature of these alerts I have attached a template that we will use to ensure that consistent and timely responses are provided across Regional Service Delivery, a similar process to what is used for DLO responses.

The attached template is to be used to advise as soon as possible on environmental incidents, such as fish kills, mine discharges, potential environmental harm due to spills, etc. **All information is to be approved by the relevant RSD** and emailed to the following parties:

- John Bradley, Director General;
- Terry Wall , Associate Director General;
- Debbie Best, DDG
- Michael Dart, Senior Policy Advisor to Minister Kate Jones;
- Joshua Cooney, Ministerial Media Officer to Kate Jones;
- Paul Michaels, Director DERM Media unit;
- Damine Brown, ADG RSD
- Kim Harycki , PA RSD

The email is to be sent **by the RSD only**. The email heading is to read "(Minister Jones) Environmental Incident Alert - *subject*" and a brief description is to be provided in the body of the email.

This process is not intended to replace suitable briefing notes on issues when time avails or phone contact with people like me to alert on incidents in a timely way. It is intended only to provide a suitable early alert to a wide group of parties of an incident that we have been notified of. It is not intended to be an onerous process or to delay any action or response. The template should be completed as quickly as possible and if something is unknown, then write in "unknown", don't hold up providing the advice seeking further information, early is better.

I would appreciate you distributing this template to officers within your region for **immediate use**.

If you have any queries in relation to the use of this form, please contact Kim direct.

Regards

Damien Brown

Assistant Director-General

Regional Service Delivery

Telephone: [redacted]

Mobile: [redacted]

Email: [redacted]

www.derm.qld.gov.au

Department of Environment and Resource Management

Level 13

400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

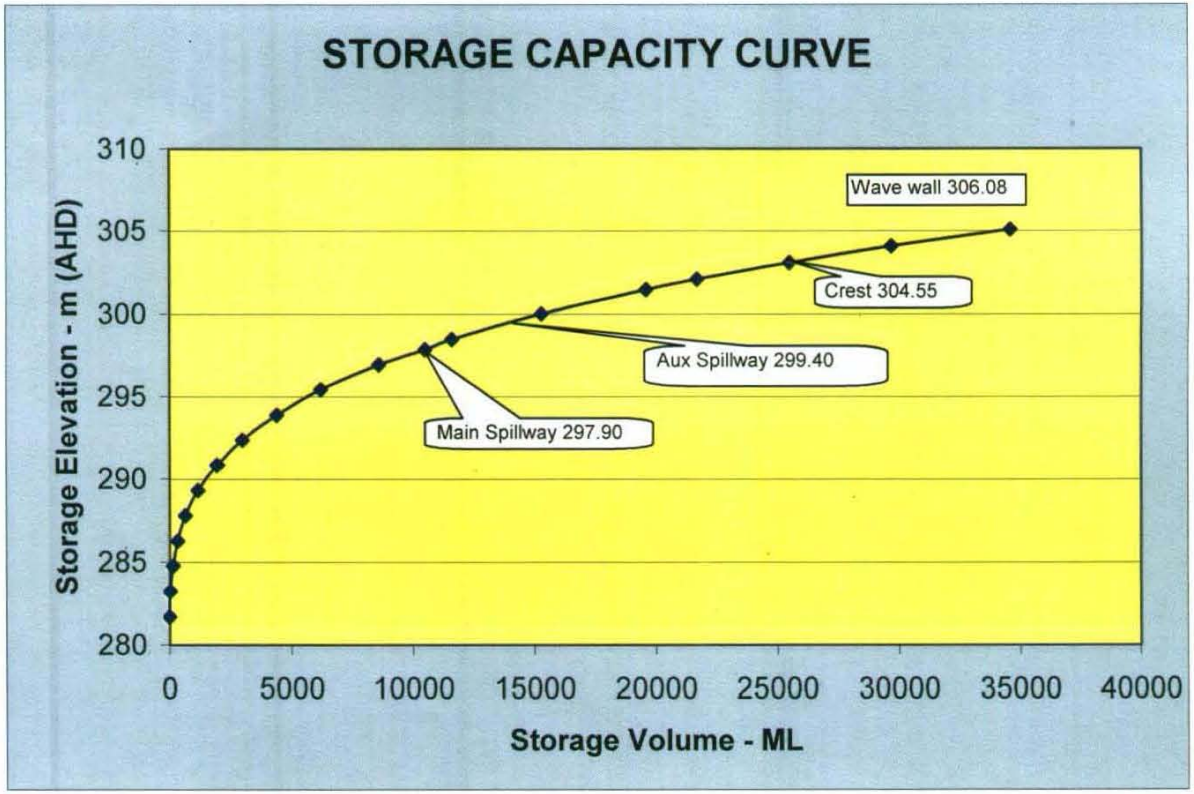
Relevant email addresses:-

[redacted]

[redacted]

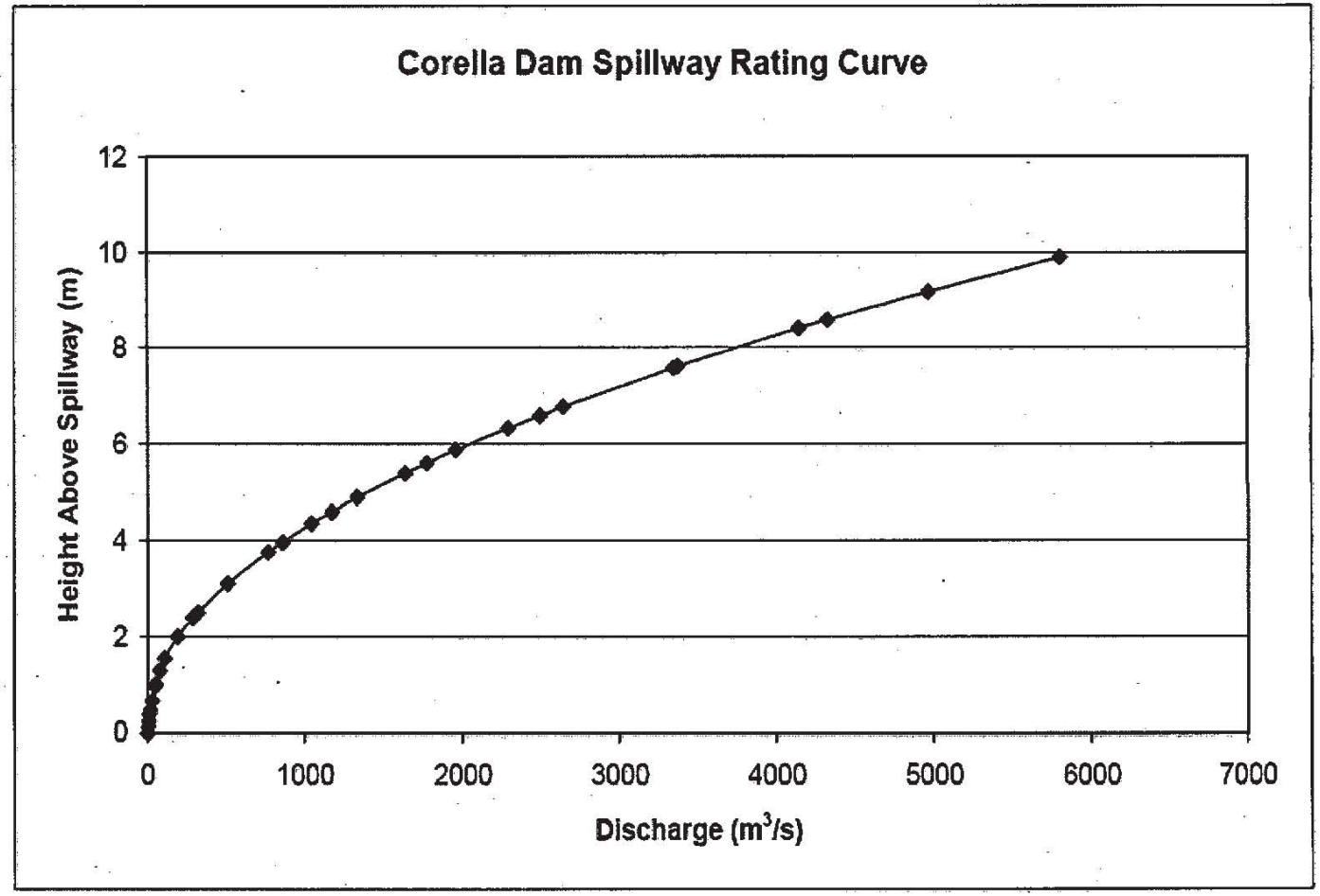
DRAWINGS

Elevation (m)	Volume (ML)
281.74	0
283.27	30
284.79	145
286.31	340
287.84	655
289.36	1174
290.89	1950
292.41	2980
293.93	4390
295.46	6200
296.98	8600
297.9	10500
298.51	11600
300.03	15300

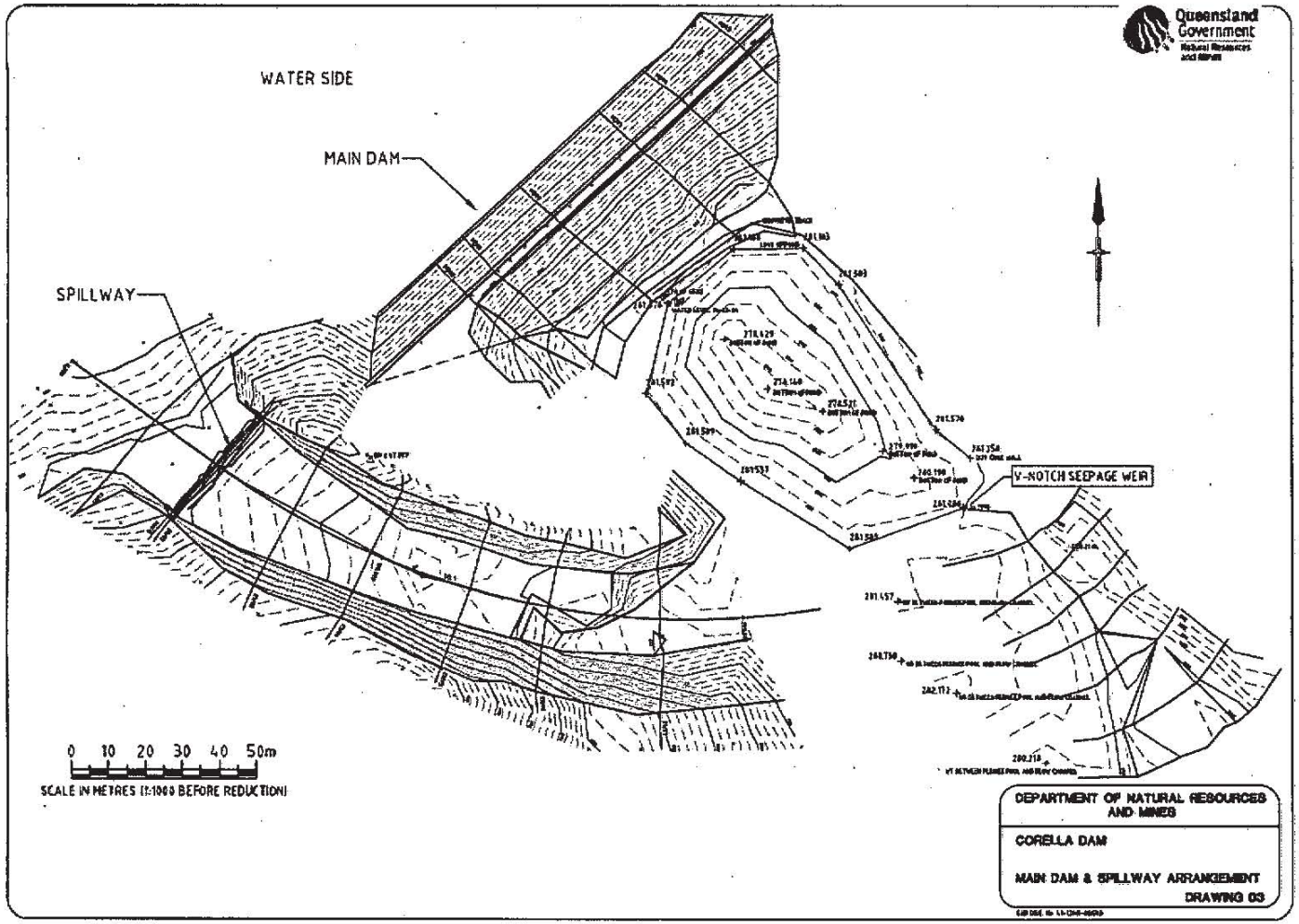


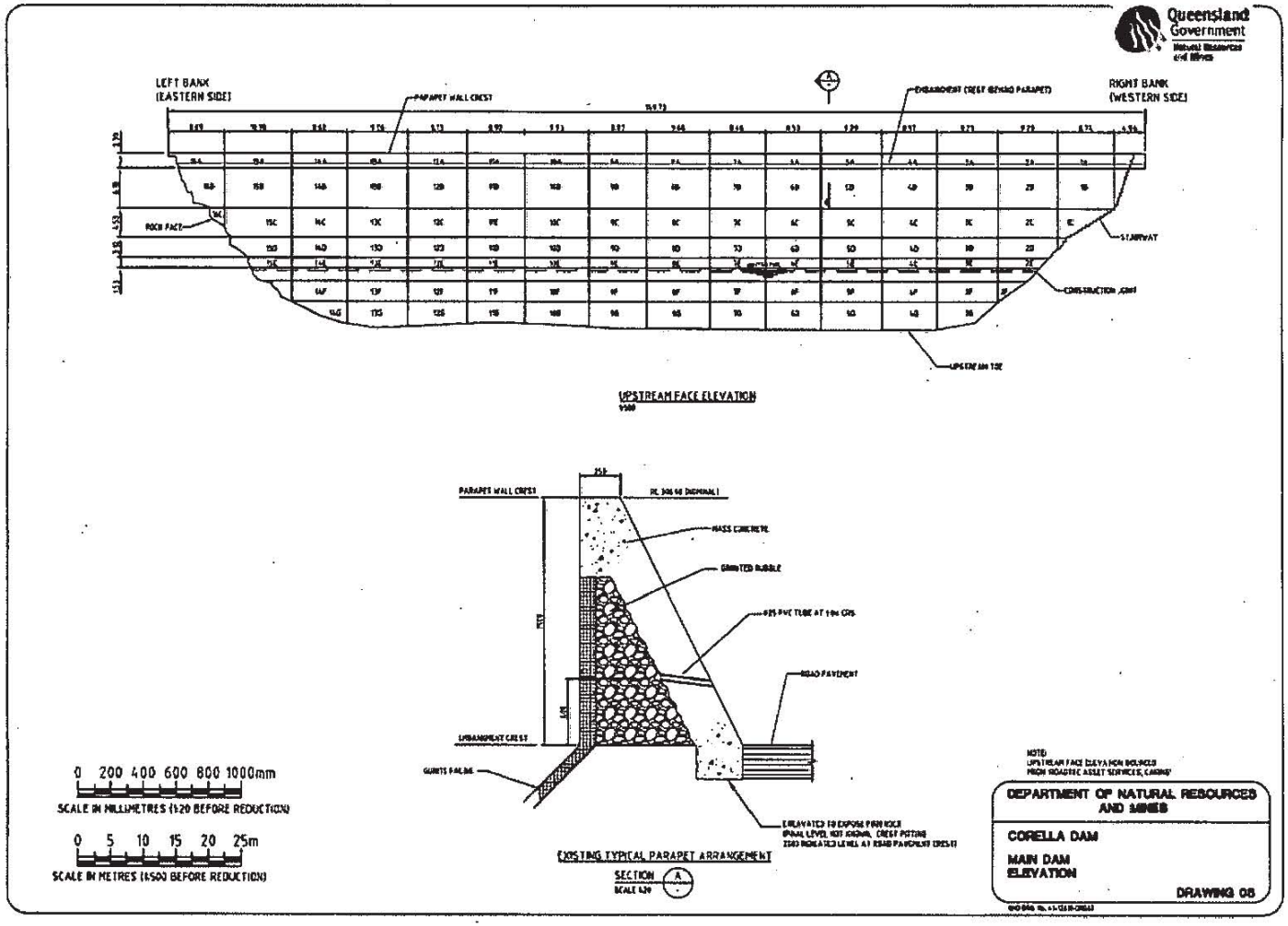
301.48	19600
302.11	21700
303.11	25500
304.11	29700
305.11	34600

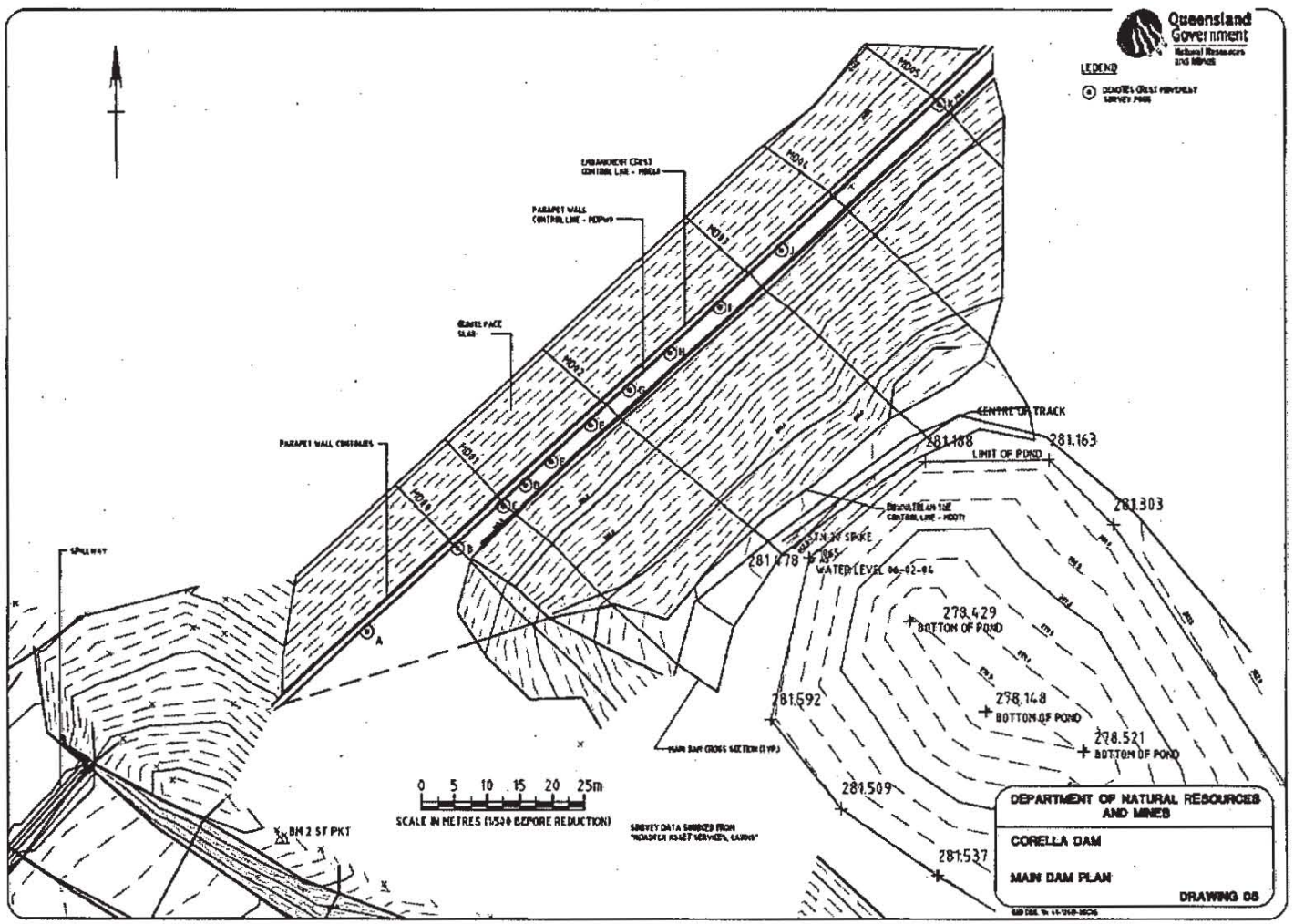
Height (m)	Discharge (m3/s)
0	0
0.14	2
0.26	5
0.39	10
0.49	15
0.67	25
0.99	48
1.02	50
1.31	75
1.56	105
2.01	189
2.41	288
2.51	319
3.12	511
3.77	768

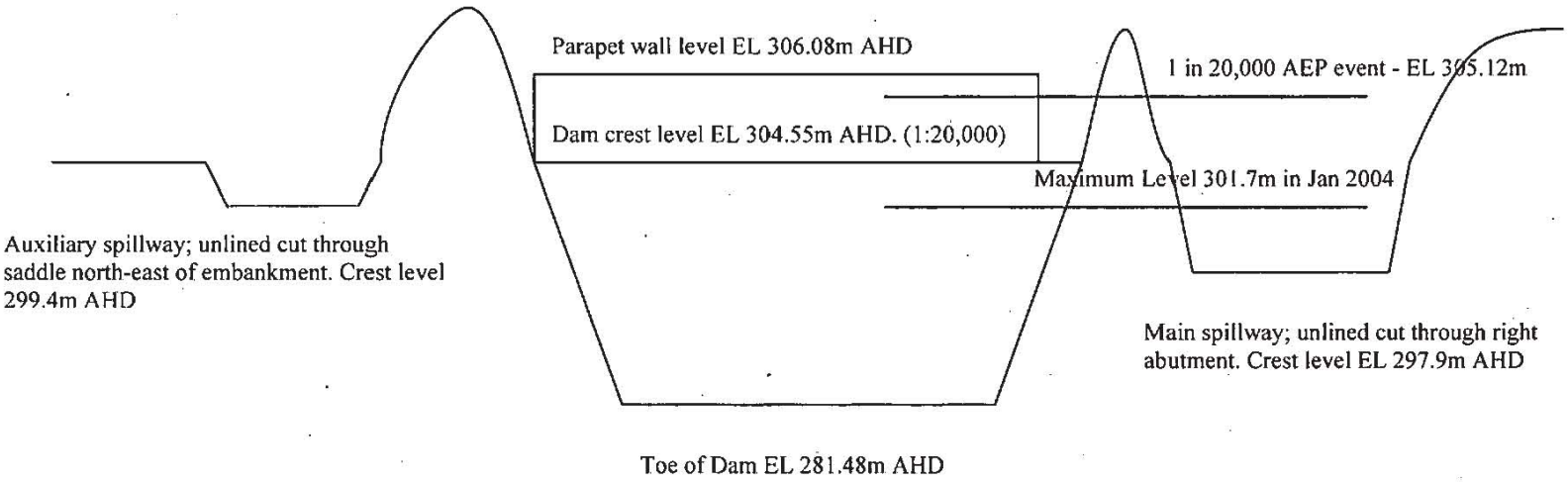


3.96	859
4.35	1044
4.59	1172
4.89	1332
5.39	1640
5.59	1773
5.87	1958
6.33	2290
6.59	2493
6.78	2641
7.59	3343
7.62	3369
8.42	4141
8.59	4324
9.18	4962
9.91	5800







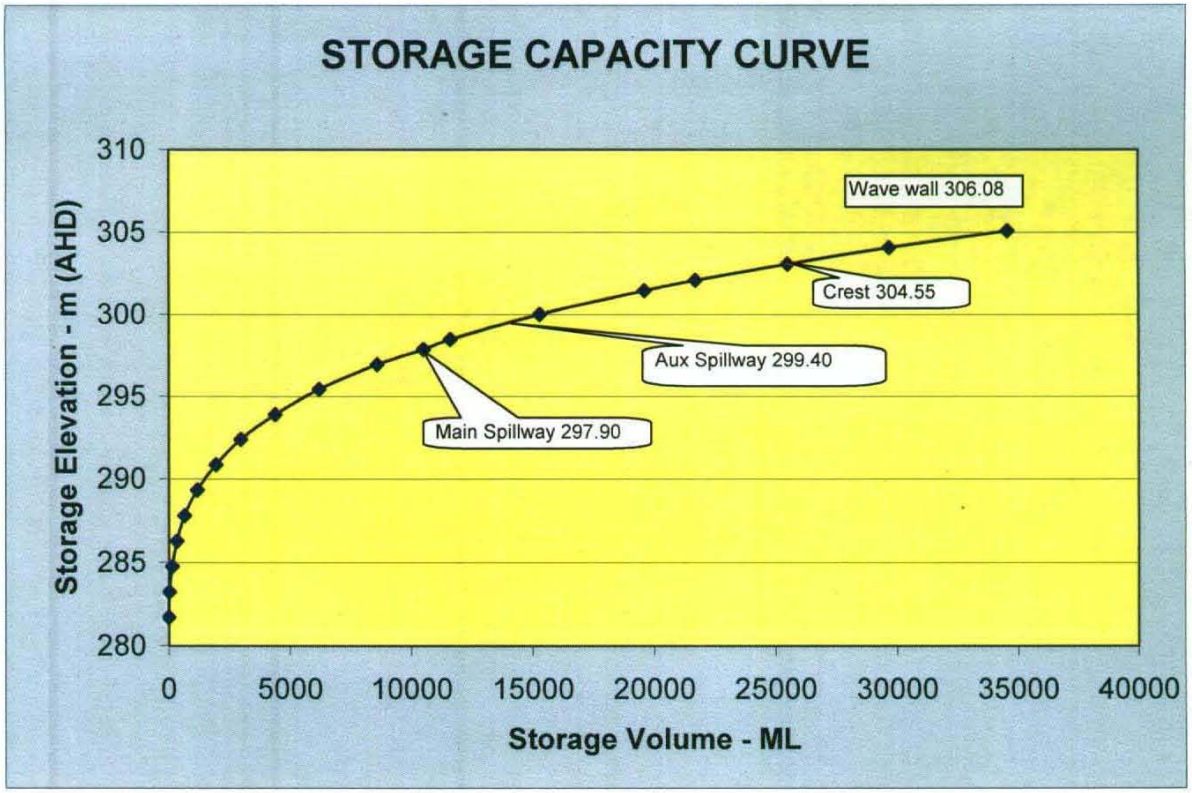


Schematic Sketch of Corella Dam and Spillway Arrangement

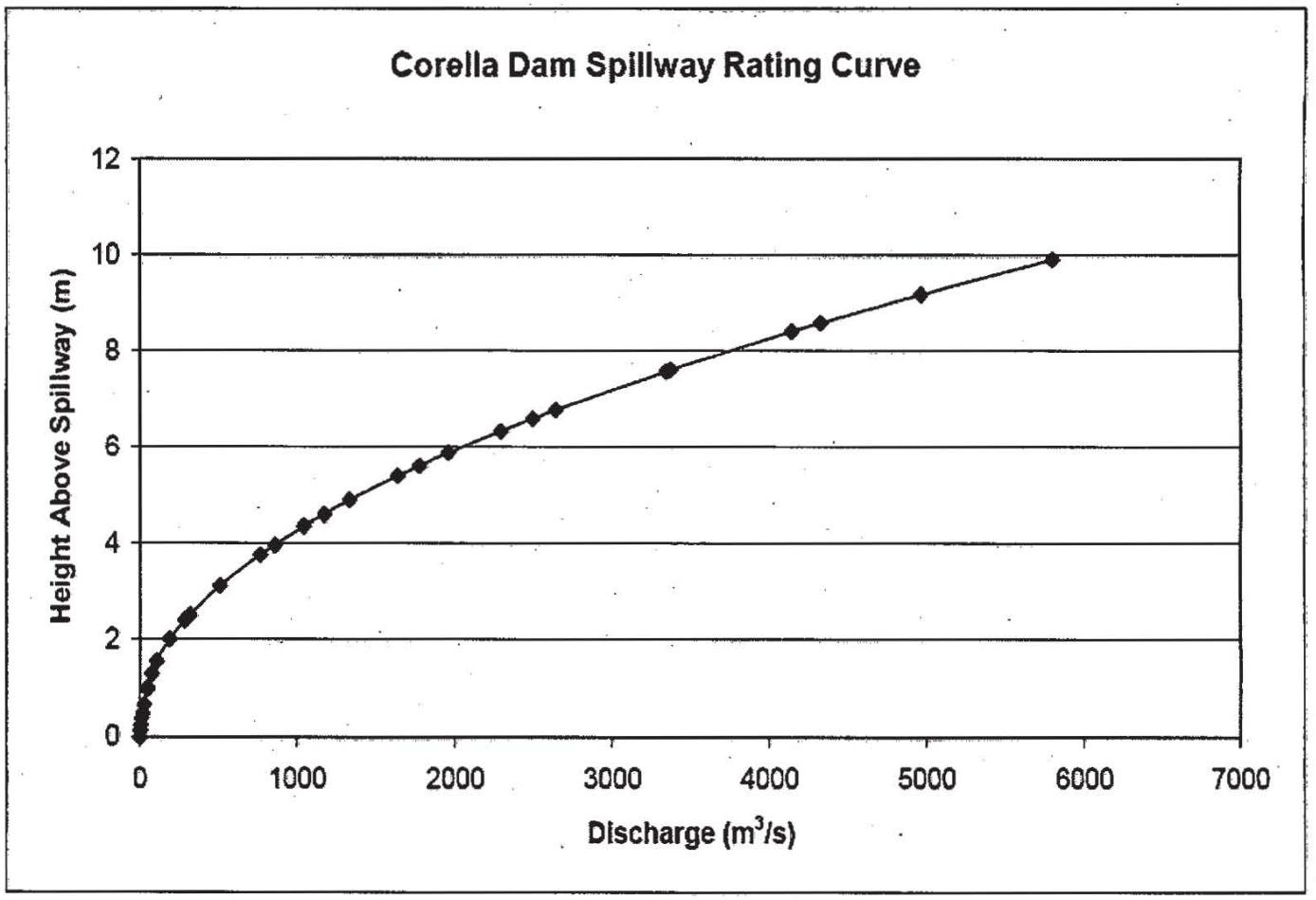
DRAWINGS

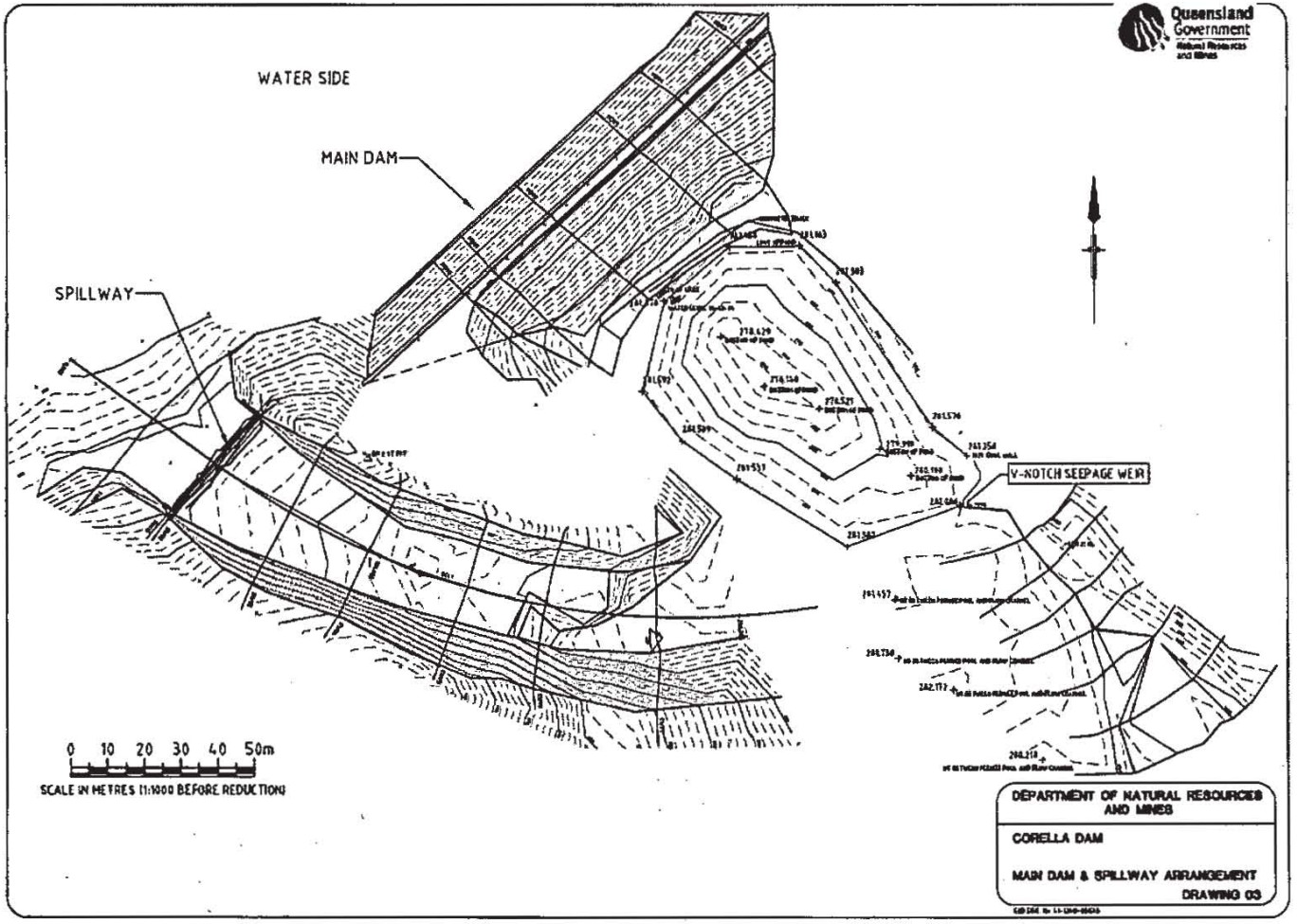
Queensland Government
Natural Resources and Water

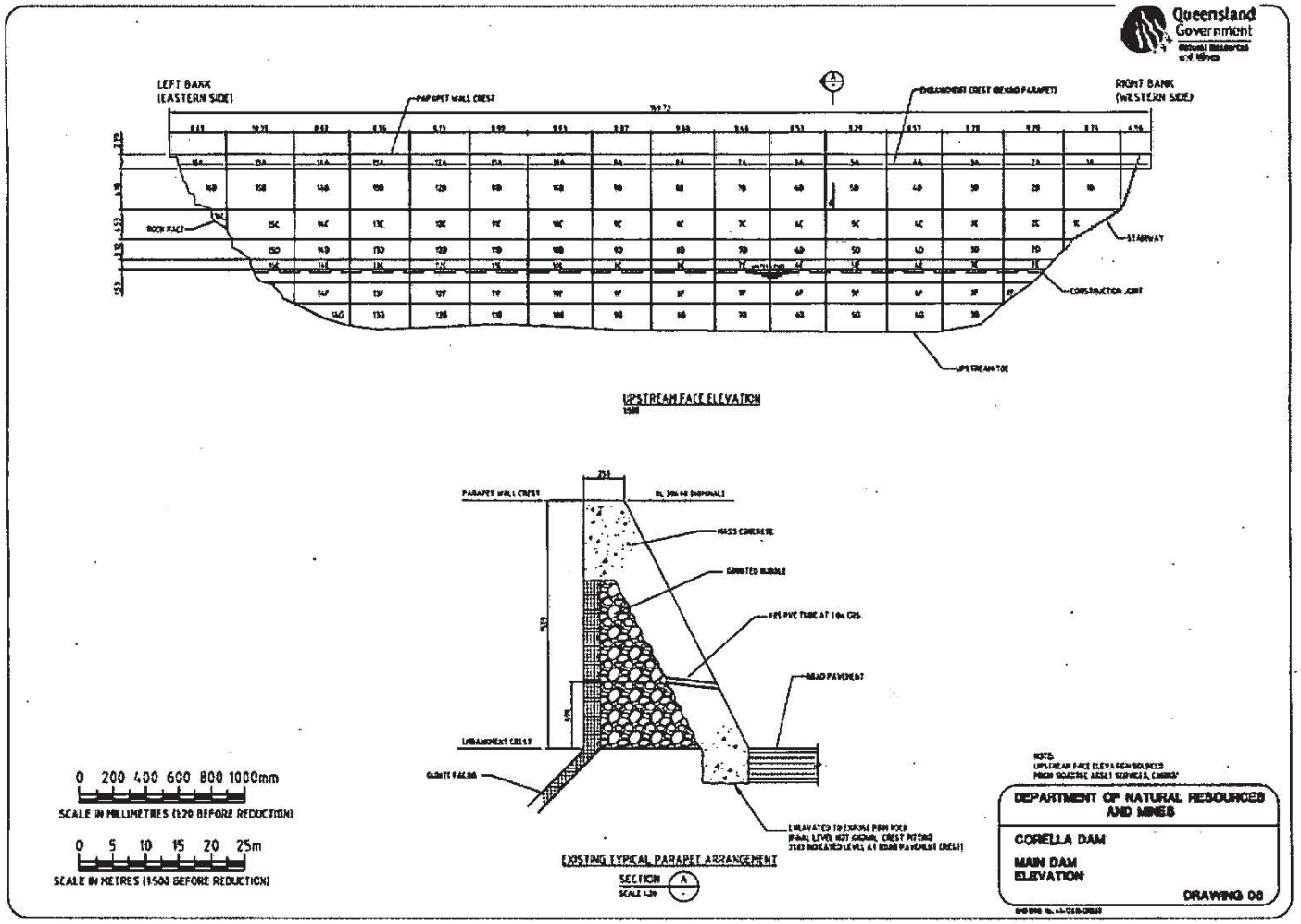
Elevation (m)	Volume (ML)
281.74	0
283.27	30
284.79	145
286.31	340
287.84	655
289.36	1174
290.89	1950
292.41	2980
293.93	4390
295.46	6200
296.98	8600
297.9	10500
298.51	11600
300.03	15300
301.48	19600
302.11	21700
303.11	25500
304.11	29700
305.11	34600

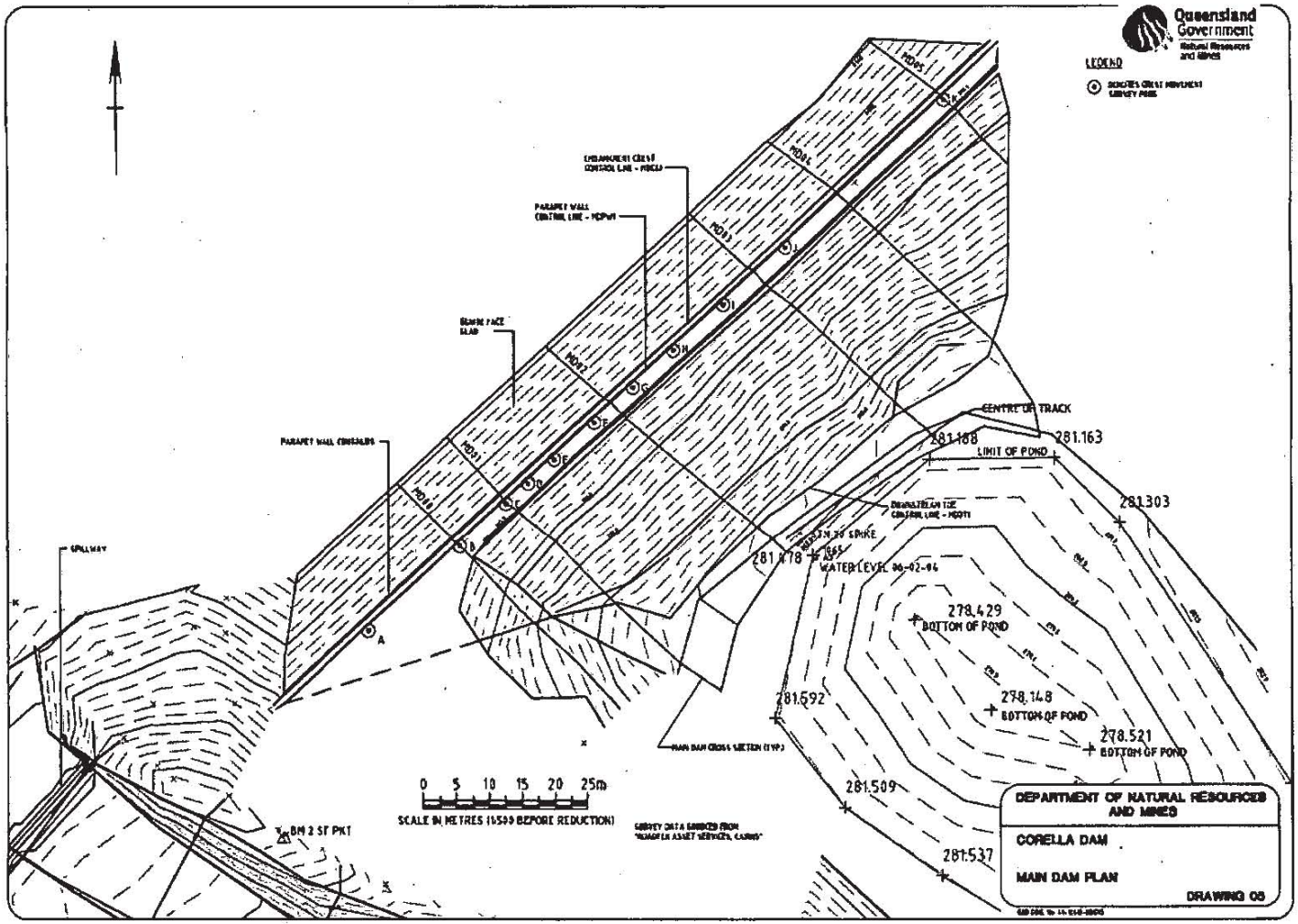


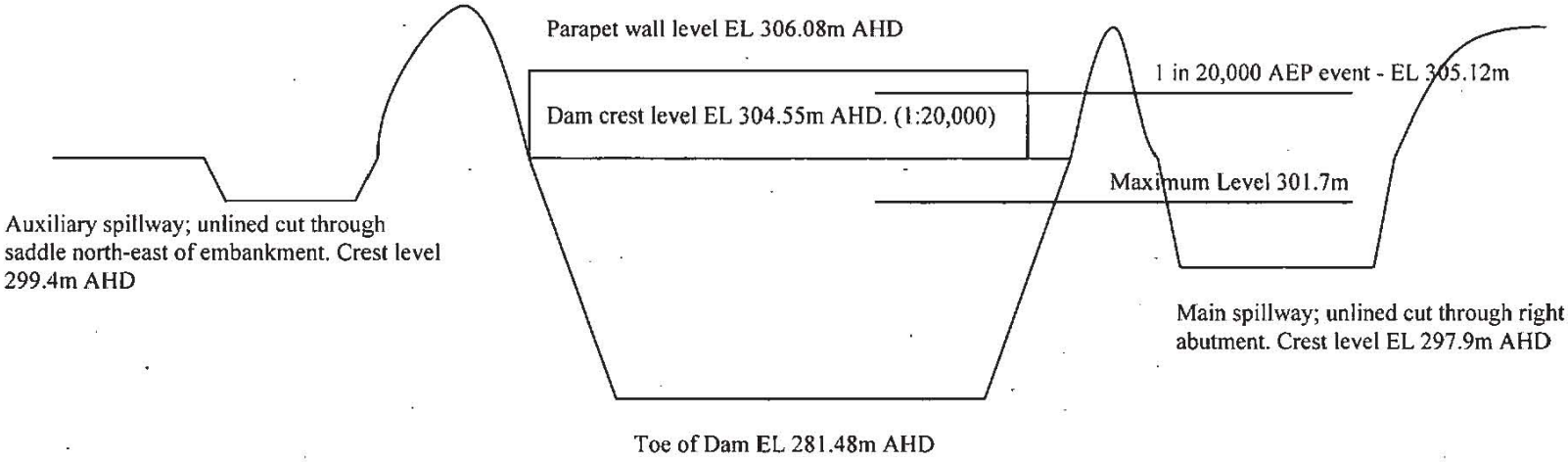
Height (m)	Discharge (m3/s)
0	0
0.14	2
0.26	5
0.39	10
0.49	15
0.67	25
0.99	48
1.02	50
1.31	75
1.56	105
2.01	189
2.41	288
2.51	319
3.12	511
3.77	768
3.96	859
4.35	1044
4.59	1172
4.89	1332
5.39	1640
5.59	1773
5.87	1958
6.33	2290
6.59	2493
6.78	2641
7.59	3343
7.62	3369
8.42	4141
8.59	4324
9.18	4962
9.91	5800



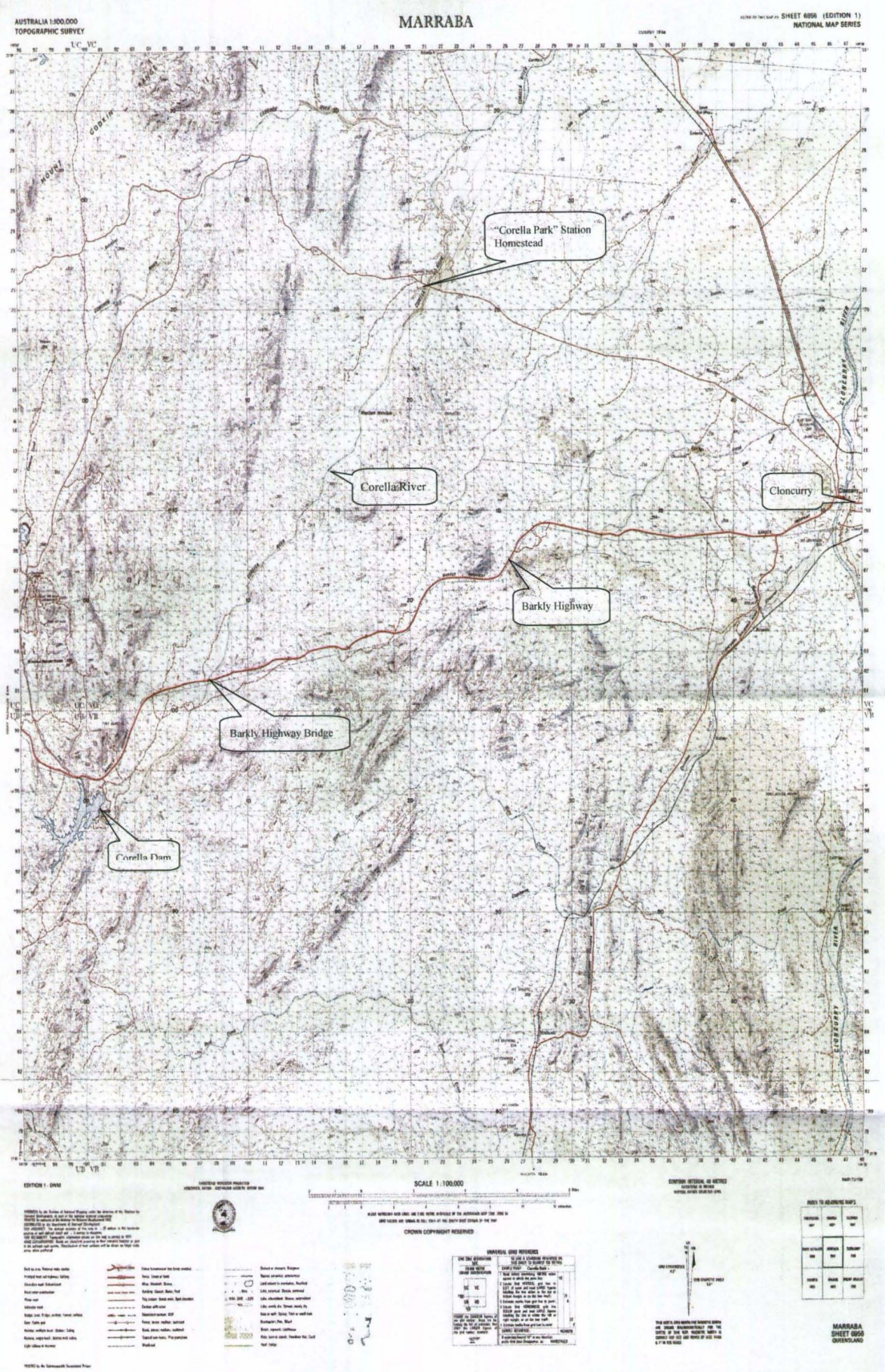

Queensland Government
WATER SIDE
MAIN DAM
SPILLWAY
V-NOTCH SEEPAGE WEIR
0 10 20 30 40 50m
SCALE IN METRES (1:1000 BEFORE REDUCTION)
DEPARTMENT OF NATURAL RESOURCES AND MINES
CORELLA DAM
MAIN DAM & SPILLWAY ARRANGEMENT
DRAWING 03



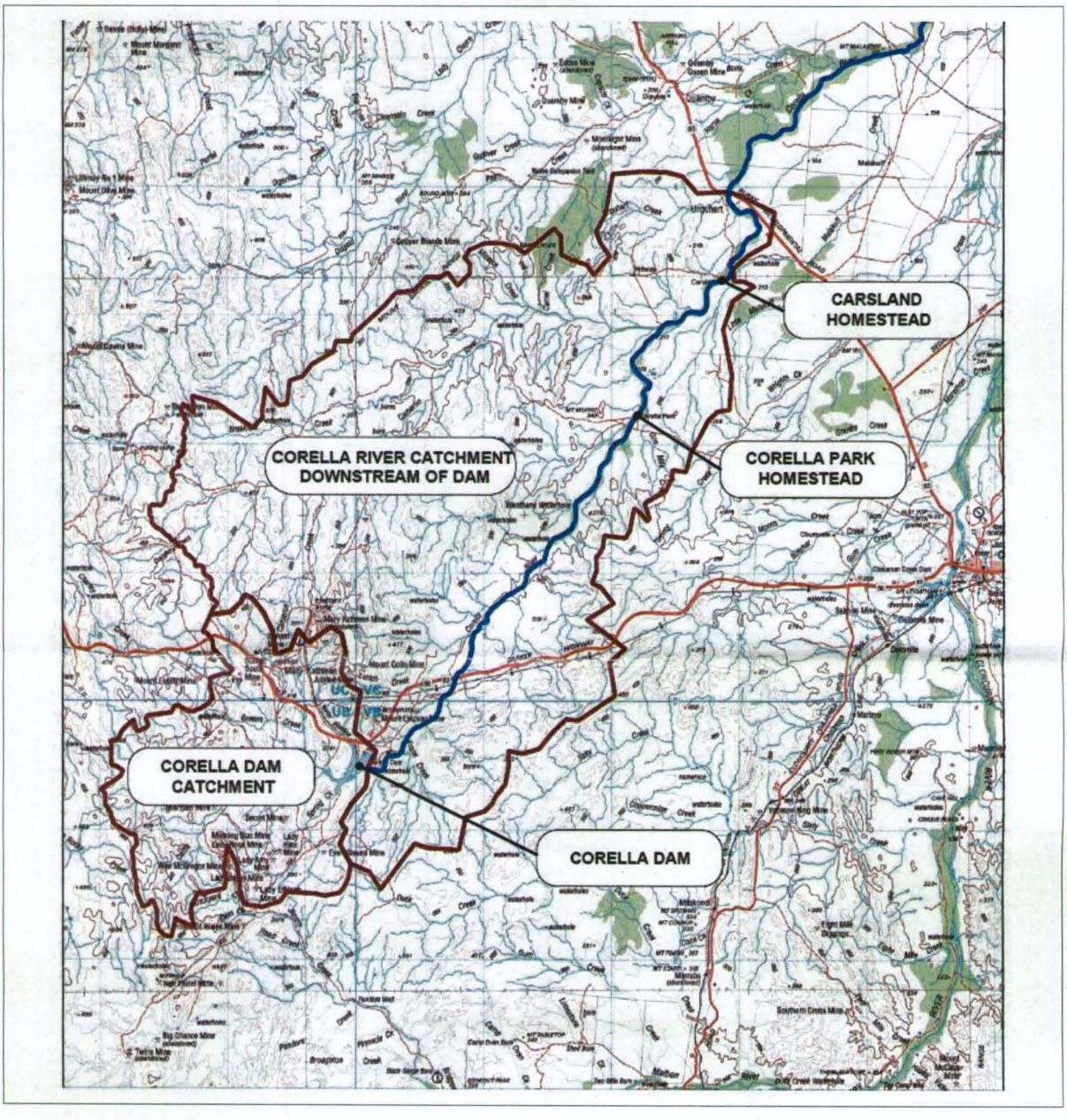



Parapet wall level EL 306.08m AHD
1 in 20,000 AEP event - EL 305.12m
Dam crest level EL 304.55m AHD. (1:20,000)
Maximum Level 301.7m
Auxiliary spillway; unlined cut through saddle north-east of embankment. Crest level 299.4m AHD
Main spillway; unlined cut through right abutment. Crest level EL 297.9m AHD
Toe of Dam EL 281.48m AHD

APPENDIX 1
LOCALITY PLAN


AUSTRALIA 1:100,000
TOPOGRAPHIC SURVEY
MARRABA
SHEET 6956 (EDITION 1)
NATIONAL MAP SERIES
"Corella Park" Station Homestead
Corella River
Cloncurry
Barkly Highway
Barkly Highway Bridge
Corella Dam
EDITION 1 - DNM
SCALE 1:100,000
CROWN COPYRIGHT RESERVED
MARRABA
SHEET 6956
QUEENSLAND

APPENDIX 2
CATCHMENT BOUNDARY


CARSLAND HOMESTEAD
CORELLA RIVER CATCHMENT DOWNSTREAM OF DAM
CORELLA PARK HOMESTEAD
CORELLA DAM CATCHMENT
CORELLA DAM
LEGEND
Catchment Boundary
Corella River

APPENDIX 3
INSPECTION SAFETY PROTOCOL

APPENDIX 3 INSPECTION SAFETY PROTOCOL

All Emergency Action Plan (EAP) officers who visit the dam site are to observe this protocol.

(1) A satellite phone with backup to be available at all inspections.

(2) More than one person to be at site at all times.

(3) Inspections are to be carried out only when conditions are deemed to be safe as per inspection and risk assessment/s.

(4) The holder of the after hours phone is to be advised of any inspection and subsequent completion. This person is to be contacted if any reasonable delay is anticipated.

(5) When necessary a certified boat with operable motor, oars, life jackets, and extra fuel will be utilised.

(6) All personnel likely to be involved are to be informed of the above, and to be made aware that they are mandatory requirements.

(7) All personal are to have had the site specific safety induction.

APPENDIX 4
POTENTIAL PROBLEM IDENTIFICATION

INSPECTION OF CONCRETE AND MASONRY DAMS

INSPECTING FOR DEFICIENCIES: SUMMARY

TYPE OF DEFICIENCY	LOOK FOR
SURFACE DEFECTS	Honeycomb: Voids around aggregate. Stratification: Non-uniform layers of aggregate in concrete. Form Slippage: Uneven joints and surfaces. Stains. Impact damage.
DISPACEMENT	Displacement at joints between blocks. Volume change in concrete. Closing or opening of joints. Loss of joint filler. Cracking. Debonding of lifts. Tilting, shearing, or shifting of hardware.
LEAKAGE and SEEPAGE	Significant new leakage on downstream face Wetness in abutment or foundation adjacent to toe. Major changes in leakage/seepage pattern or flow. Water spurting or running out of joints or cracks. Turbidity of the seepage.
MAINTENANCE CONCERNS	Vegetation in joints between concrete blocks. Large accumulations of debris. Missing or deteriorated joint filler. Quality and condition of previous repairs.

Note: This tabulation taken from Dam Safety Surveillance Field Manual-August 2005

INSPECTION OF EMBANKMENT DAMS

INSPECTING FOR DEFICIENCIES: SUMMARY

TYPE OF DEFICIENCY	LOOK FOR
SEEPAGE	A water flow or sand boil on the lower portion of the downstream slope or toe area, especially at the groins. Wet areas or areas where the vegetation appears greener or more lush on the embankment slope or toe area. Turbidity or cloudiness of the seepage.
CRACKING	Desiccation Cracking: A random honeycomb pattern of cracks usually found on the crest and the downstream slope. Transverse Cracking: Cracks that are perpendicular to the length of the dam usually found on the crest. Longitudinal Cracking: Cracks that are parallel to the length of the dam. Longitudinal cracks may be associated with stability problems in the slopes.
INSTABILITY	Slides on the upstream or downstream slopes. Bulging, especially at the toe of the dam.
DEPRESSIONS	Misalignment in the crest and embankment slopes found by sighting along fixed points. Sinkholes found by checking and probing each depression. Remember, sinkholes have steep, bucket like sides while minor depressions have gently sloping, bowl like sides.
MAINTENANCE CONCERNS	Inadequate Slope Protection: Check for bald areas or areas where the protection is sparse or damaged. Surface Runoff Erosion: Check for gullies or other signs of erosion. Make sure to check the low points along the upstream and downstream shoulders and groins since surface runoff can collect in these areas. Inappropriate Vegetative Growth: Check for excessive and deep rooted vegetative growth. Debris: Check for debris on and around the dam, especially near the spillway. Animal Burrows: Check for damage caused by burrowing animals.

Note: This tabulation taken from Dam Safety Surveillance Field Manual-August 2005

WHEN TO GET FURTHER ASSISTANCE

Several of the deficiencies covered above are very serious. If you observe any of the following deficiencies, you should consult with the PE, NCA:

- Sand boils or turbid seepage.
- Seepage that has increased since the last inspection (taking the reservoir level into consideration).
- Cracking that extends below the reservoir level or potential reservoir level.
- Transverse and longitudinal cracking.
- Deep seated slides or bulging associated with slides.
- Sinkholes or other large depressions.
- Deep rooted vegetation that might need to be removed.

Remember, whenever you are unsure whether or not a condition poses a threat to the safety of the dam, you should discuss your findings with the PE, NCA.

APPENDIX 5
Emergency Event Phone Numbers

Event Phone Numbers for RoadTek Officer

All Emergency Events

Police in Cloncurry
Phone 07 4742 1200, A/H 0428 738 224

Executive Officer, Local Disaster Management Group, Cloncurry Shire
Craig Turnour
Phone [redacted], A/H [redacted]

RoadTek Backup 1
Logitharan Lokanantham
Phone [redacted], A/H [redacted]

RoadTek Backup 2
Alby Anderson
Phone [redacted], A/H [redacted]

Principal Engineering, Non-Commercial Assets, DERM
William Steen
Phone [redacted], A/H [redacted], Mobile [redacted]

if unable to contact then:

Regional Manager, Water Services, Central West Region, DERM
Ed Donohue
Phone [redacted], A/H [redacted], Mobile [redacted]

Event Phone Numbers for A/ Director, Engineering, Non-Commercial Assets

All Emergency Events

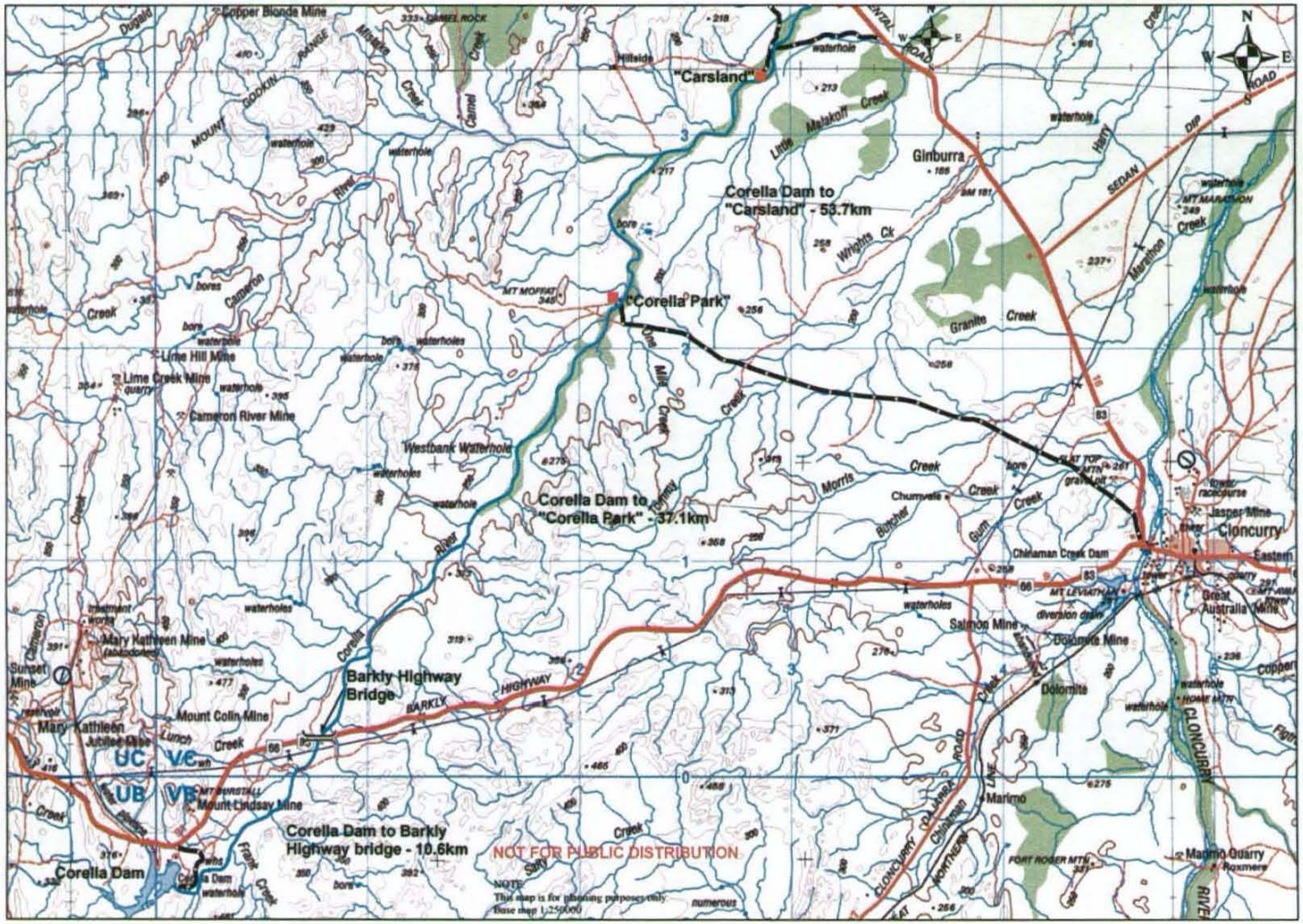
RoadTek Officer,
John Doyle
Phone [redacted], Mobile [redacted]

Director Dam Safety, DERM
Peter Allen
Phone [redacted], A/H [redacted], Mobile [redacted]

Regional Manager, Water Services, Central West Region, DERM
Ed Donohue
Phone [redacted], A/H [redacted], Mobile [redacted]

APPENDIX 6
Property Access Plans


CORELLA DAM ACCESS
BARKLY HIGHWAY
BARKLY HIGHWAY
Mt Isa
69km approx.
Cloncurry
62km Approx.
Approximately 3.7km
from Barkly Highway
to the LB of the dam.
Boat Ramp
Auxilliary Spillway
Lake Corella
Primary Spillway
NOT FOR PUBLIC DISTRIBUTION
Queensland Government



EMERGENCY ACTION PLAN – CORELLA DAM

APPENDIX 7
Small to Medium Spillway Overflows (SOP 14)

Department of Environment and Resource Management

Corella Dam

Standing Operating Procedures

for

Small to Medium Spillway Overflows

SOP - 14

Distribution, Approval and Revision Control

Distribution

Copy Number	Position	Location
1	RoadTek Works Manager, Asset Services North	Cairns
2	Regional Manager, Water Services, North Region, DERM	Cairns
3	Director, Dam Safety, DERM	Brisbane
4	RoadTek Engineer	Cloncurry
5	RoadTek Officer (EAP)	Cloncurry
6	RoadTek Officer (Inspections)	Cloncurry

Authorisation

Approved:

_____ Date: _____.

Principal Engineer, Non-Commercial Assets, DERM

Revision Status

Revision No.	Date	Revision Description
0	July 2010	Original Issue

Table of Contents

Page

Appendices

Purpose

The Corella Dam is managed by DERM. In terms of an MOU with DERM, the RoadTek Works Manager, Asset Services North, Cairns, manages the operation and maintenance of the Corella Dam, including routine dam safety inspections.

Part of the dam safety management program is to inspect the Dam immediately before the spillway starts to overflow. A secondary objective is to advise tourists or campers to that access and egress to the area may be cut off due to local stream rises.

Scope

This Procedure applies to spillway overflow events that are less than the historical maximum event with a storage level of EL301.7m. The personnel are the Emergency Action Plan (EAP) Officers listed in the EAP for Corella Dam.

Personnel Affected and Responsibilities

Officer	Responsibility
RoadTek Engineer	A Registered Professional Engineer, Queensland, responsible for carrying out monthly inspections at the dam.
Emergency Action Plan Officers (EAP Officers)	The Officer based at Cloncurry and at or near Corella Dam responsible for carrying out EAP procedures for the Dam and this Standing Operating Procedure.
Principal Engineer, Non-Commercial Assets	The person responsible for approving the Standing Operating Procedures, the Operation and Maintenance Manual and the persons undertaking the role of EAP Officers and, for managing, receiving, storing and checking data for the Corella Dam, reviewing and authorising documentation produced by the RoadTek Officer and consultants on the dam and initiating investigations into abnormal behaviour of the dam. Manages the Distribution, Approval and Revision Control relating to this Procedure.
Regional Manager, Water Services, Central West Region, DERM	The person responsible for approving the Emergency Action Plan.

Actions

The EAP Officer should be aware of the storage height and rainfall conditions, and be able to estimate when the spillway is likely to overflow. Details for obtaining information on rainfall, storage and river gauge heights from the Bureau of Meteorology website is given in Appendix 7 of the EAP.

- Two hours before the spillway is estimated to overflow, The EAP officer shall visit the dam if safe access is possible, and visually inspect the Dam for any deficiencies.
- Check for new cracking or increased crack widths in the spillway face and the roller compacted main wall. Appendix B gives a guide for inspecting the Dam for deficiencies.
- Advise any tourists or campers at the dam that they should consider leaving the site immediately, while access and egress to the site is open. If they are unable to leave the site because of local stream rises or other reasons they should seek higher ground and await evacuation by police and emergency services.
- Close the gates to the dam site and display the dam site closed sign.
- Read the storage height gauge and rain gauge at one-hour intervals.
- Notify the Police in Cloncurry, and the Executive Officer, Local Disaster Management Group, Cloncurry Shire Council that a spillway discharge is likely, the gates on the access road at the dam entrance have been closed and a sign installed that the dam site is closed. Also provide information of parties that are at the dam site and maybe unable to leave safely.
- At a reasonable time, notify the Principal Engineer, Non-Commercial Assets of storage height and that a spillway discharge is likely. Regularly update Principal Engineer, Non - Commercial Assets during the rainfall event. At least daily or as directed by the Principal Engineer, Non -Commercial Assets.
- Notify property owners and residents at "Corella Park" that the dam site has been closed and a spillway discharge is likely.
- If the storage level is predicted to reach EL301.7m which is equivalent to EL 259.56m at the downstream bridge (deck level), the EAP Officer is to implement the Major Overflow Event in the EAP.
- When the preceding twelve-hour rainfall is less than 50mm and the storage height gauge is less than EL299.4m and falling, and local stream rises have fallen sufficiently to allow access to and egress from the site, the EAP Officer is to make an inspection of the Dam and advise the Principal Engineer, Non-Commercial Assets.
- Once given permission by the Principal Engineer, Non -Commercial Assets the dam site can be opened to the public. The site maybe closed for extended periods following an event due to flood waters on the access road.
- EAP Officer advises the Police in Cloncurry, and the Executive Officer, Local Disaster Management Group, Cloncurry Shire Council that the site has been opened to the public and stands down.

References

- Emergency Action Plan, Corella Dam

Appendix B

INSPECTING FOR DEFICIENCIES: SUMMARY

TYPE OF DEFICIENCY	LOOK FOR
SEEPAGE	A water flow or sand boil on the lower portion of the downstream slope or toe area, especially at the groins. Leakage around conveyance structures such as outlet works. Wet areas or areas where the vegetation appears greener or more lush on the embankment slope or toe area. Blocked toe drains. An increase in the amount of water being released from toe drains. (Remember to take into account changes in the reservoir level.) Turbidity or cloudiness of the seepage.
CRACKING	Desiccation Cracking: A random honeycomb pattern of cracks usually found on the crest and the downstream slope. Transverse Cracking: Cracks that are perpendicular to the length of the dam usually found on the crest. Longitudinal Cracking: Cracks that are parallel to the length of the dam. Longitudinal cracks may be associated with stability problems in the slopes.
INSTABILITY	Slides on the upstream or downstream slopes. Bulging, especially at the toe of the dam.
DEPRESSIONS	Misalignment in the crest and embankment slopes found by sighting along fixed points. Sinkholes found by checking and probing each depression. Remember, sinkholes have steep, bucket like sides while minor depressions have gently sloping, bowl like sides.
MAINTENANCE CONCERNS	Inadequate Slope Protection: Check for bald areas or areas where the protection is sparse or damaged. Surface Runoff Erosion: Check for gullies or other signs of erosion. Make sure to check the low points along the upstream and downstream shoulders and groins since surface runoff can collect in these areas. Inappropriate Vegetative Growth: Check for excessive and deep rooted vegetative growth. Debris: Check for debris on and around the dam, especially near outlet works or spillway inlets. Animal Burrows: Check for damage caused by burrowing animals.

Note: This tabulation taken from Dam Safety Surveillance Field Manual-August 2005

WHEN TO GET FURTHER ASSISTANCE

Several of the deficiencies covered above are very serious. If you observe any of the following deficiencies, you should consult with the Principal Engineer, Non –Commercial Assets:

- Sand boils or turbid seepage.
- Seepage that has increased since the last inspection (taking the reservoir level into consideration).
- Cracking that extends below the reservoir level or potential reservoir level.
- Transverse and longitudinal cracking.
- Deep seated slides or bulging associated with slides.
- Sinkholes or other large depressions.
- Deep rooted vegetation that might need to be removed.

If you are unsure whether or not a condition poses a threat to the safety of the dam, you should discuss your findings with the Principal Engineer, Non –Commercial Assets.

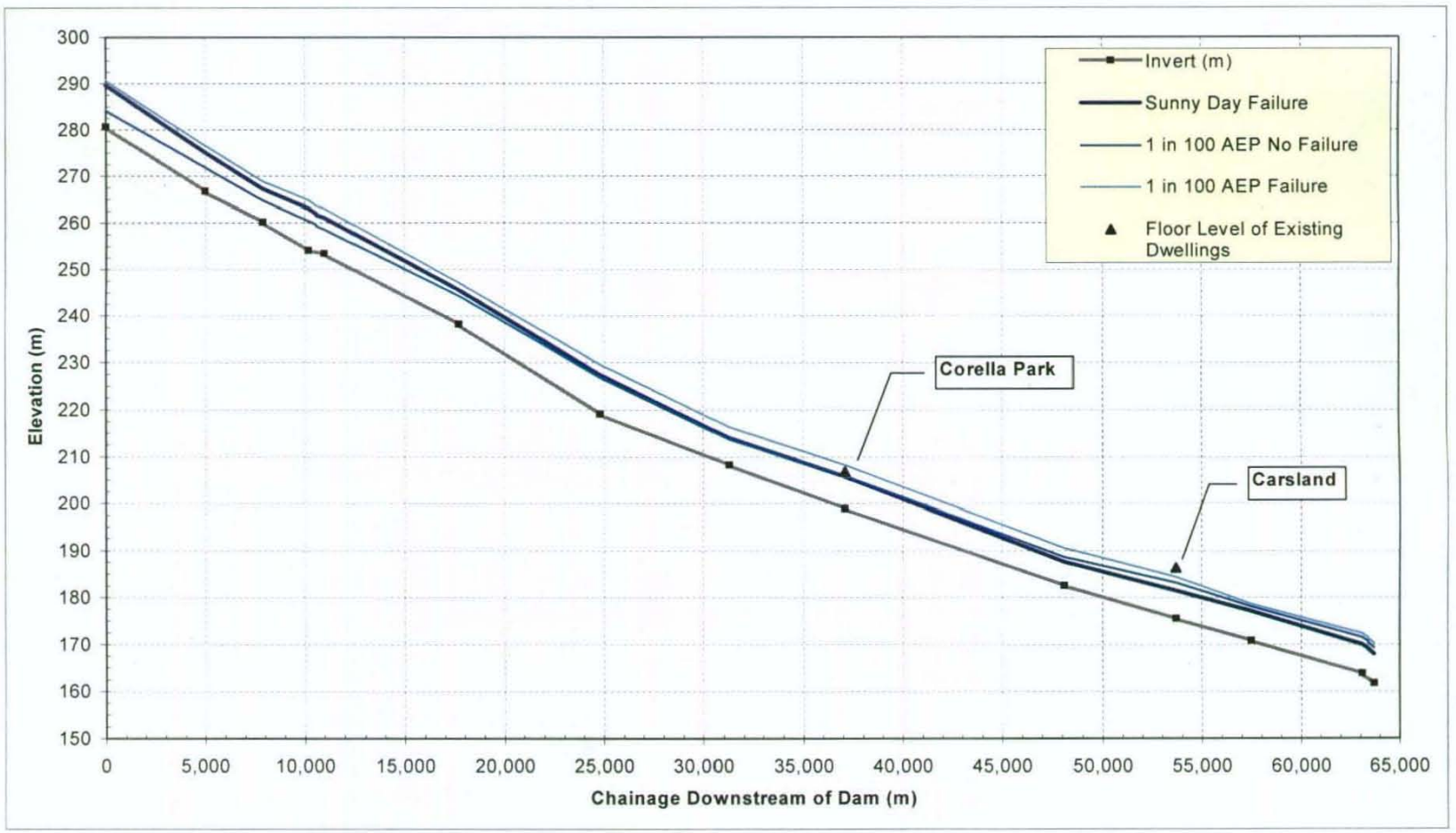
APPENDIX 8
ESTIMATED WATER LEVELS FOR EVENTS

Table1 Estimated Peak Water Levels at Existing Dwellings

Location		Scenario							
Mike 11 Chainage	Description	Sunny Day Failure	1 in 100 AEP No Failure	1 in 100 AEP With Failure	1 in 10,000 AEP No Failure	1 in 10,000 AEP Piping Failure	1 in 20,000 AEP No Failure	1 in 20,000 AEP Piping Failure	1 in 20,000 AEP Overtopping Failure
37,100	Corella Park	205.84	206.02	208.36	206.94	209.33	207.51	209.59	
53,700	Carsland	181.49	183.20	184.46	183.28	184.82	183.90	185.13	

Table 0.2 Floor Levels at Downstream Properties

Carsland Station		Corella Park	
186.37 (New House)		206.78	207.56
186.44 (Old House)		207.26	207.63
		207.48	207.63


Invert (m)
Sunny Day Failure
1 in 100 AEP No Failure
1 in 100 AEP Failure
Floor Level of Existing Dwellings
Corella Park
Carsland
Elevation (m)
Chainage Downstream of Dam (m)
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
60,000
65,000

APPENDIX 9

ENVIRONMENTAL INCIDENT ALERTS

ENVIRONMENTAL INCIDENT ALERT

REGIONAL SERVICE DELIVERY DIVISION

DATE OF INCIDENT:

INCIDENT NOTIFIED BY:

TIME OF NOTIFICATION:

LOCATION OF INCIDENT:

SUMMARY OF INCIDENT AS NOTIFIED:

-
- Provide a brief dot point summary of the situation based on the information available

POTENTIAL IMPACTS:

-
- (this information can be based on advice from the company or source of the incident)
- Likelihood of unlawful environmental harm
- Likelihood of potential risk to public health (if public health risk is identified notify Queensland Health and provide details in this alert)

DERM's PLANNED ACTIONS:

-
- What actions has DERM taken
- What actions are proposed to be taken and timeframe for doing these

NEXT UPDATE ON INCIDENT EXPECTED:

-
- Date/time estimate

COMMUNICATION:

-
- What communications have been made?
- What public notifications have been made?
- What public notifications are expected?

MAP OR PLAN OF SITE:

-
- Where possible attach a map or plan which identifies the site and key features

Region:		
Briefing Officer:	Telephone: (07)	Date:
Approving Officer:	Telephone: (07)	Date:

From: Brown Damien
Sent: Wednesday, 24 February 2010 2:29 PM
To: Birchley Michael; Buckley Andrew; Hart Randall; Pappalardo Joe
Cc: Miles Rhonda
Subject: Environmental Incident Alert Process for Regional Service Delivery
Importance: High

Good afternoon

As you are aware, Minister Jones' office has requested to be informed immediately of any environmental incidents, the impacts of such and proposed actions by the department. Due to the volume and urgent nature of these alerts I have attached a template that we will use to ensure that consistent and timely responses are provided across Regional Service Delivery, a similar process to what is used for DLO responses.

The attached template is to be used to advise as soon as possible on environmental incidents, such as fish kills, mine discharges, potential environmental harm due to spills, etc. **All information is to be approved by the relevant RSD** and emailed to the following parties:

- John Bradley, Director General;
- Terry Wall , Associate Director General;
- Debbie Best, DDG
- Michael Dart, Senior Policy Advisor to Minister Kate Jones;
- Joshua Cooney, Ministerial Media Officer to Kate Jones;
- Paul Michaels, Director DERM Media unit;
- Damine Brown, ADG RSD
- Kim Harycki , PA RSD

The email is to be sent **by the RSD only**. The email heading is to read "(Minister Jones) Environmental Incident Alert - *subject*" and a brief description is to be provided in the body of the email.

This process is not intended to replace suitable briefing notes on issues when time avails or phone contact with people like me to alert on incidents in a timely way. It is intended only to provide a suitable early alert to a wide group of parties of an incident that we have been notified of. It is not intended to be an onerous process or to delay any action or response. The template should be completed as quickly as possible and if something is unknown, then write in "unknown", don't hold up providing the advice seeking further information, early is better.

I would appreciate you distributing this template to officers within your region for **immediate use.**

If you have any queries in relation to the use of this form, please contact Kim direct.

Regards

Damien Brown
Assistant Director-General
Regional Service Delivery
Telephone: [redacted]
Mobile: [redacted]
Email: [redacted]
www.derm.qld.gov.au

Department of Environment and Resource Management
Level 13
400 George Street, Brisbane Q 4000
GPO Box 2454, Brisbane Q 4001

Relevant email addresses:-

[redacted]

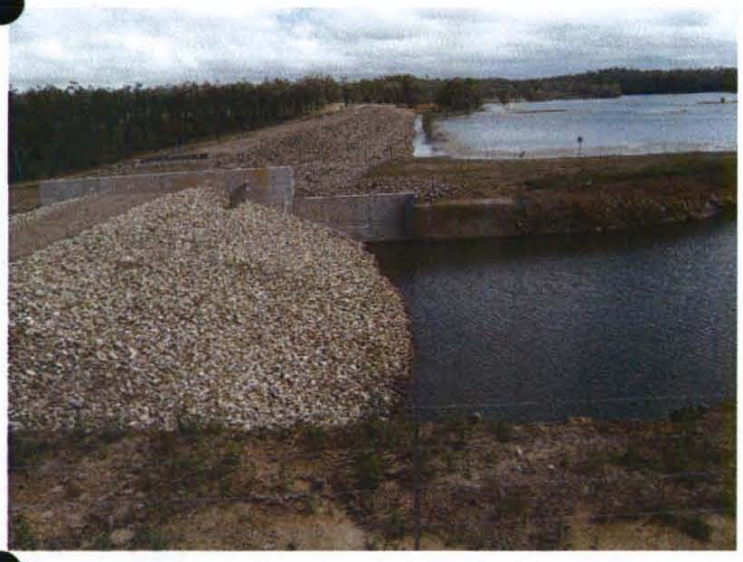
[redacted]

Department of Environment and Resource Management

EMERGENCY ACTION PLAN

Crooks and Wyndham Dam

Revision 6 October 2010



Queensland Government

Prepared by:

Non-Commercial Assets

Department of Environment and Resource Management

October 2010

Preparation and Authorisation

This Emergency Action Plan was prepared by Principal Engineer, Non-Commercial Assets.

Preparation:

Date: _____

William Steen, Principal Engineer,
Non-Commercial Assets, DERM

Approved:

Date: _____

Kerry Marler, A/Regional Manager,
Water Services, Central West Region, DERM

Revision Status

Revision No.	Date	Revision Description
0	November 2005	Interim Issue
1	April 2007	Notification List and documentation updated.
2	September 2007	Notification List and documentation updated
3	March 2008	Notification List and documentation updated
4	October 2009	Updated after 2009 dam safety upgrade works
5	December 2009	Notification List and documentation update
6	October 2010	Plan update based on FIA by GHD, Oct 2010

CONTENTS PAGE

1.0 CONTROLLED COPY DISTRIBUTION LIST

Copy Number	Position	Location
1	RoadTek Engineer	Cairns
2	Emergency Action Plan Officer	Mt Garnet
3	Emergency Action Plan Backup 1	Mt Garnet
4	Emergency Action Plan Backup 2	Mt Garnet
5	Regional Services Director, North Region	Cairns
6	Principal Engineer, Non-Commercial Assets	Rockhampton
7	Regional Manager, Water Services, North Region	Cairns
8	Regional Manager, Water Services, Central West Region	Rockhampton
9	Director, Dam Safety	Brisbane
10	Disaster District Coordinator	Mareeba
11	Officer in Charge, Police	Mareeba
12	Officer in Charge, Police	Mt Garnet
13	Senior Advisor Disaster Management, Planning & Development	Tablelands Regional Council
14	Director, Disaster Operations Emergency Management Queensland	Brisbane
15	Regional Director, Far Northern Region Emergency Management Queensland	Cairns
16	Local Controller, State Emergency Services	Mt Garnet

2.0 NOTIFICATION LIST

TITLE/NAME	Phone Business	Phone A/H	Phone Mobile	Fax
Emergency Action Officers UHF radio channel 40 EAP Officer (Gus Haydon) EAP Backup 1 (Roye Poulson) EAP Backup 2	[redacted]			
Regional Management Regional Services Director, North Region (Andrew Buckley) Regional Manager, Water Services Central West Region (Ed Donohue) Regional Manager, Water Services North Region (Nigel Kelly) Regional Manager, Environmental Services, North Region (Rob Lawrence) Principal Engineer, Non-Commercial Assets (William Steen)	[redacted]			
Dam Safety Group Director Dam Safety (Peter Allen) Principal Engineer Dam Safety (Ron Guppy)	[redacted]			

TITLE/NAME	Phone Business	Phone A/H	Phone Mobile	Fax
RoadTek Engineer (Andrew Schelberg)	[redacted]			
Counter Disaster Groups Regional Director, Far Northern Region, Emergency Management Queensland (Wayne Coutts) Local Controller Tableland Regional Council Emergency Service (Owen Higginson) General Manager Planning & Development, Tablelands Regional Council (Steven Ripper) If Un-contactable:- Senior Advisor Disaster Management, Planning & Development (Sarah Dean) Emergency Management Queensland Watch Desk Officer Chemical Hazards Emergency Management Services Scientific Unit (Michael Logan) Queensland Fire and Rescue Services Chemical Hazards Unit	000			
Police Police Mt Garnet Officer In Charge (In an emergency 000) Police Mareeba Officer In Charge (Snr Sergeant Richard Kroon) (In an emergency 000) Disaster District Coordinator (District Inspector Rolf Stratamier)	[redacted]		[redacted]	
Kagara Zinc Safety and Training Manager (Alan Chester)	[redacted]			

3.0 PREPARATION AND USE OF THIS EMERGENCY ACTION PLAN

3.1 PURPOSE

The purpose of this Emergency Action Plan is to pre-plan the co-ordination of necessary actions by the Department of Environment and Resource Management (DERM), and to provide timely notification to police, local counter disaster groups, the Department's Dam Safety Group and affected persons in the event of an emergency condition or potential emergency condition associated with Crooks Dam and Wyndham Dam.

3.2 SCOPE

This document applies to Crooks Dam and Wyndham Dam and:

- Identifies emergency conditions which could endanger the integrity of the dams and which require immediate action
- Prescribes procedures that are to be followed in the event of an emergency condition developing
- Describes roles and responsibilities for EAP officers and Departmental staff
- Provides inspection officers with a list of potential problems that could arise at the dams

3.3 REFERENCES

Workplace Health and Safety Act 1995

DERM-RoadTek Memorandum of Understanding (2009)

Storage Log Book

3.4 DEFINITIONS

Emergency:

An emergency is an acute situation, which endangers life or property. For this Emergency Action Plan an emergency is an event described in Section 6 - EMERGENCY EVENTS AND ACTIONS.

EAP Officer

EAP Officer is responsible for actions during emergency events outlined in this Emergency Action Plan.

EAP Backup 1 and 2

EAP Backup 1 and 2 are to undertake the duties of EAP Officer in that officer's incapacity to undertake those duties described in this Emergency Action Plan through absence or otherwise, and to assist EAP Officer in times of emergency.

3.5 ABBREVIATIONS

AHD Australian Height Datum

DERM Department of Environment and Resource Management

PAR Population at Risk

SDF Sunny Day Failure

DCF Dam Crest Flood

PMF Probable Maximum Flood

AEP Annual Exceedance Probability

UHF Ultra High Frequency

FIA Failure Impact Assessment

EAP Emergency Action Plan

FSL Full Supply Level

3.6 PERSONNEL AFFECTED AND RESPONSIBILITIES

3.6.1 EAP Officer

EAP Officer shall for emergency events:

- Monitor the dam for any potential emergency conditions.
- Follow the Emergency Action Plan in time of emergency. If unable to notify Principal Engineer, Non-Commercial Assets, then contact shall be made with Regional Manager, Water Services, Central West Region, and if he cannot be contacted, the Regional Manager, Water Services, North Region.
- During an emergency event, report to and receive instructions from the Principal Engineer, Non-Commercial Assets or if cannot be contacted, the Regional Manager, Water Services, Central West Region, or if cannot be contacted, the Regional Manager, Water Services, North Region
- In an emergency event, take steps to ensure personal safety and the safety of other EAP Officers and the public.
- During an emergency maintain records and take photographs.
- Immediately fax or phone all recordings to the Principal Engineer, Non-Commercial Assets for evaluation during the emergency or if cannot be contacted, the Regional Manager, Water Services, Central West Region or if cannot be contacted, the Regional Manager, Water Services, North Region.
- During an emergency event, provide status reports to the Executive Officer of the Local Disaster Management Group, Tablelands Regional Council. These reports

shall contain factual information such as water level and rainfall recordings. Projections or opinions based on past experience of similar events or specialist knowledge may be given. The EAP Officer may give ONLY factual information to the media and the public.

- In the likelihood of adverse weather or stream flow conditions or at any other time that the EAP Officer is unable to fulfil the duties, advise EAP Backup 1 and 2 or 3 of any intended absence from the area and leave a point of contact.
- Immediately notify the EAP Backup officers when the Emergency Action Plan is being initiated.
- Make contact with telephone numbers and facsimile numbers of the Notification List of the Emergency Action Plan by 1st September each year.
- Notify the Principal Engineer, Non-Commercial Assets in writing of any changes to names and numbers on the Notification List of the Emergency Action Plan.
- Notify Principal Engineer, Non-Commercial Assets in writing of names and contact details of personnel undertaking and/or relieving the role of EAP Officer and EAP Backup 1 and 2 or 3.
- Keep the Emergency Action Plan in a clean, secure facility.
- Ensure Emergency events are recorded in the Storage Log Book as described in section 3.7.
- After an emergency event, prepare an Emergency Event Report as described in section 3.8. Immediately after the event this report shall be sent to Principal Engineer, Non-Commercial Assets.

3.6.2 EAP Backup 1 and 2

EAP Backup 1 and 2 shall:

- Assist the EAP Officer in times of emergency.
- Undertake the responsibilities of the EAP Officer should that person be unavailable.
- If, during adverse weather conditions, EAP Backup 1 and 2 have not been contacted by EAP Officer they shall:
  - Attempt to contact EAP Officer ,
  - Enact the Emergency Action Plan if contact with the EAP Officer cannot be made.

3.6.3 Principal Engineer, Non-Commercial Assets

Principal Engineer, Non-Commercial Assets shall for emergency events:

- Ensure this Emergency Action Plan is implemented.
- Approve the person undertaking and/or relieving in the role of EAP Officer and EAP Backup 1 and 2.
- Ensure the EAP Officer and EAP Backup 1 and 2 are conversant with the Emergency Action Plan.
- Review the Emergency Action Plan in consultation with Regional Manager, Water

Services, Central West Region, by 1st September each year.

- Ensure the Emergency Action Plan is distributed according to the Distribution List and that the police and counter disaster organisations are conversant with the plan.
- Notify Director, Dam Safety and Regional Manager, Water Services, Central West Region, of any emergency situation.
- Only on delegation from the Regional Manager, Water Services at the time of each event, act for and on behalf of the Regional Manager during the emergency.
- Monitor emergency condition.
- Evaluate situation on best available information.
- Advise Director, Dam Safety and Regional Manager, Water Services, Central West Region during an emergency event.
- Post analyse and report event to Director Dam Safety and Regional Manager, Water Services, Central West Region.

3.6.4 Regional Manager, Water Services, Central West Region

Regional Manager, Water Services, Central West Region, shall:

- Review this Emergency Action Plan in consultation with the Principal Engineer, Non-Commercial Assets by 1st October each year.
- Direct the actions of Departmental personnel during an emergency to protect life and property to the maximum extent considered possible under the prevailing conditions and with the resources available.
- Delegate role of Regional Manager, Water Services, Central West Region, in his/her absence.
- Authorise this Emergency Action Plan.

3.6.5 Regional Manager, Environmental Services, North Region

Regional Manager, Environmental Services, North Region shall:-

- Review environmental incident alert and provide advice to the Regional services Directors, North and Central Regions.

3.6.6 Regional Services Director, Central West Region

Regional Services Director, Central West Region shall:-

- Review and approve environmental incident alerts and forward to Assistant Director General, Regional Service Delivery.

3.6.7 General Manager, Planning and Development, Tablelands

Regional Council

The General Manager, Planning and Development, Tablelands Regional Council is responsible for:-

- developing an evacuation plan for those who might be affected by a dam failure.
- implementing the evacuation plan when advised by the EAP Officer that the dam is considered to be not safe

The Senior Advisor, Disaster Management, Tablelands Regional Council should be contacted in an emergency event if the General Manager, Planning and Development cannot be contacted.

3.7 STORAGE LOG BOOK

EAP Officer shall ensure that events and appropriate data are recorded in the Storage Log Book.

Entries shall be a record of reservoir levels, rainfall, seepage weir flows, weather observations, inspections, flood discharge, and comments identifying problems and unusual events.

All entries shall be written legibly and be unedited and signed by the person making the entry. Errors made shall be struck out and initialled.

The Storage Log Book shall be kept permanently in the EAP Officer residence. Its location must be known to EAP Backup Officers and Principal Engineer, Non-Commercial Assets.

3.8 EMERGENCY EVENT REPORT

After an Emergency Event defined in Section 6.2, the EAP Officer shall prepare an Emergency Event Report. The report may be free format but shall contain at least:

- A description of the event summarised from the Storage Log Book
- Description of any observed damage or other consequences
- Photographs
- A summary of dam water levels and other data recorded during the event and the times of these recordings such as;
  - Rainfall
  - Water level within the storage
  - Seepage flows and observations
  - Gauge board readings from the Limestone Creek gauge board
- Details of communication which took place during the emergency
- Comment on the adequacy of the Emergency Action Plan
- Any recommendations or suggested changes to the Emergency Action Plan
- Any further comments considered necessary

3.9 COMMUNICATIONS

During an emergency, an open line of communication shall be maintained between EAP Officer, Principal Engineer, Non-Commercial Assets and the Regional Manager, Water Services, Central West Region.

Emergency lines of communication override normal management reporting. However, where possible the Principal Engineer, Non-Commercial Assets shall advise the Regional Service Directors, the Regional Managers, Water Services and Director Dam Safety of an emergency event.

The primary means of communications shall be by telephone.

EAP Officer has been issued a satellite telephone and EAP Officer and EAP Backup 1 and 2 have each been issued a UHF radio. EAP Officer and EAP Backup 2 has also been issued with a standard mobile telephone. EAP Officer carrying out inspections of the dam during an emergency event shall have a satellite phone and a handheld UHF radio at all times. EAP Backup 1 and 2 shall have a UHF radio at all times during an emergency event and EAP Backup 2 shall further have a standard mobile phone at all times during an emergency event. During the emergency event, UHF radio communication, channel 40, shall be the primary communication between one another. The satellite phone shall be used to communicate outside the Dam site should the normal landline fail to operate.

If there is a total communication failure the EAP Officer shall take action that is reasonable under the circumstances and in accordance with the Workplace Health and Safety Act. The details of this action and the reasons for it shall be recorded in the Storage Log Book.

Principal Engineer, Non-Commercial Assets shall, in consultation with Regional Manager, Water Services, Central West Region, assess the situation and establish alternative means of communication should telephone or other communication fail.

4.0 PREDICTED INUNDATION AREA, FLOOD TRAVEL TIMES and TOTAL POPULATION AT RISK (PAR)

4.1 TOTAL POPULATION AT RISK

The PAR shown in the table below has been taken from Section 5.5.1 of the FIA report by GHD, October 2010.

Summary of Total Population at Risk

Flood Event AEP (1 in X)	Event Description	Total PAR
2,500	Fuseplug breached	0
	Dam breached	0
20,000	Fuseplug breached	0
	Dam breached	0
PMP Design Flood	Dam Overtopped – no failure	24
	Dam Overtopped – failure	36

4.2 INUNDATION AREA

Maps of the inundation areas for the PMP flood events are included at Appendix 6.

4.3 FLOOD WAVE TRAVEL TIMES

Calculated flood wave travel times for Return Creek are based on a DCF with breach of Crooks Dam. The travel time is the time from the start of Dam breach to the time the highest downstream flood water level occurs at the Kennedy Highway. The travel time is approximately 1 hour (reference Appendix G of FIA Report) .

5.0 POTENTIAL PROBLEM IDENTIFICATION TO NOTE WHEN INSPECTING THE DAM

5.1 INSPECTION SAFETY PROTOCOL

Refer to APPENDIX 3: INSPECTION SAFETY PROTOCOL. The Inspection Safety Protocol must be observed.

5.2 POTENTIAL PROBLEM IDENTIFICATION

EAP Officer inspects the dam weekly and completes an inspection checklist. RoadTek Engineer also visits the dam monthly and completes a monthly inspection report. Both weekly and monthly inspection checklists are sent to Principal Engineer, Non-Commercial Assets who will check and evaluate these reports.

It is important that, providing it is safe to do so, the dam is inspected during an emergency event or shortly thereafter by EAP Officer. Potential problems that can be identified during these inspections are discussed in APPENDIX 4-POTENTIAL PROBLEM IDENTIFICATION. Any abnormalities shall be immediately brought to the attention of Principal Engineer, Non-Commercial Assets.

5.3 DAM DETAILS

Critical details of the dam are as follows:

5.3 DAM DETAILS

5.3.1 CROOKS DAM

Name and location	
Name of Dam	Crooks Dam
Other Names	None
Location	Latitude S 17036'01" Longitude E 145008'18.5"
Region	North Queensland
Shire	Tablelands Regional
Nearest Town	Mt Garnet
Property Description	Lot 2 on SP189919
Stream and AMTD	Return Creek, AMTD 40.6km
Catchment Area	94km2
Catchment Description	Dry, moderately timbered eucalypt stands with medium length native grass coverage.

Ownership	
Licence No.	45853K
Current Owner	Queensland Government, managed by Department of Environment and Resource Management (DERM)
Designer (Date) Designer of Upgrade (2009)	Owner, Tableland Tin Dredging Company (Mid-Late 1960's) GHD (Malcolm Barker)
Construction Authority – Supervisor	Unknown
Construction Contractor Construction Contractor of Upgrade	Unknown RoadTek
Construction Period Construction of Upgrade	Mid-Late 1960's 2009
Safety Review Dates	January 2007

Dam Characteristics	
Dam Type	Homogenous earth fill embankment with filter blanket and weighting berm added to the DS face.
Purpose	Water supply for stock and recreation at present.
Dam Height (above lowest toe)	15.3m
Dam Length	400m (approx)
Storage at FSL	940 ML
Full Supply Level	690.3m (AHD)
Dam Crest Level (DCL)	696.1m (AHD)
Embankment Crest Width	3.5m
Surface Area	37.6ha at FSL
Length of shoreline	Unknown
Upstream Slope	2 : 1, 35 : 1 (Flat Section) 2 : 1
Downstream Slope	2.8 : 1
Volume RCC Main Dam	N/A
Volume of Concrete Main Dam	N/A
Wall Description (dimensions and zone arrangements)	5.3 m wide crest with 2.9:1 upstream slope and 2.8:1 downstream slope. The wall is homogenous earth-fill with sand filter and weighting berm on the downstream face.

Slope Protection	Rock cobbles and grass coverage
Outlet works	MS pipe through service spillway weir US of causeway. Pipe is un-coated and rusting, capped with MS blank flange (4 holes, 2 bolts) 300mm dia.
Erosion Protection Works	Loose cobbles on the DS face Loose rock rip-rap on the US face
Corrosion Protection System	Not Applicable

Description of Service or Primary Spillway	
Spillway Type	Nib weir (Right Bank), open channel with natural rock-bed foundation,
Spillway Crest Level	RL 690.3m
Spillway Crest Length	Spillway length is indeterminate as it basically conforms to natural surface conditions some 150m DS of the weir.
Spillway Maximum Height	1.5m
Spillway Capacity	1,249 m3/s at dam Crest level
Spillway Chute	Excavated rock
Spillway Channel Width	Varies 72 m approximately at concrete weir section
Erosion Protection Works	Rock mattresses and loose rock on the Left & Right banks and at the toe and DS of the nib weir.
Description of Auxilliary Spillway	
Spillway Type	Excavated rock
Spillway Crest Length	270m approximately
Spillway Maximum Height	6.8m
Spillway Discharge Capacity at dam crest	813 m3/s
Spillway Chute	Excavated rock
Erosion Protection Works	Reinforced concrete on the RB cut for the length of the fuse plug. Selected areas on the LB cut of shot-crete.
Auxilliary Spillway Fuse Plug	
Location	Left abutment
Type	Single-bay fuseplug
Width	25m
Invert level of pilot channel	RL 695.2m

Trigger level for initiation of erosion	RL 695.5m
Width of pilot channel	5m
Adopted flow depth for initiation of erosion	0.3m
AEP of fuse plug trigger	1 in 2,500
Invert of spillway channel	RL 688.8m

Design Rainfall Review	
Conducted by (date)	
Methods	Design rainfall derived using the Department of Environment and Resource Management CRC Forge data for Queensland for floods up to the 1 in 1000 AEP event and GSDM for less frequent events up to PMP

Description of outlet works	
Reservoir Outlet Description	MS pipe through spillway weir US of causeway. Pipe is un-coated and rusting, capped with MS blank flange (4 holes, 2 bolts). The pipe and flange have been dens0-wrapped.
Conduit Description	MS Pipe, unknown if lined.
Regulator Description	No control present. Pipe is capped
Outlet – Off take Description	End of outlet pipe

Hydrologic Performance	
Date	None recorded
Peak Reservoir Level	
Peak Discharge	

Description of Access	
Access Description	Access roads to the dam are sealed and unsealed
Access Route	At the corner of Garnet and Mica streets opposite the Mt. Garnet Hotel Mt. Garnet, set 0.0km and proceed north on Mica St. At 0.45km, Mica St., becomes Coolgarra Road, a 2 lane sealed road. Follow Coolgarra Road north and cross a grid at 1.5km where the road becomes a 2 lane

	unsealed road. Travel north on Coolgarra Road and pass a road signposted "Limeworks" on the right at 4.0km. Continue on Coolgarra Road sign posted, :Coolgarra'' "Irvinebank" and "Xtreme". At 8.8 km, pass a road leading east sign posted "Xtreme" and at 9.9kms turn right into a road sign posted "No Through Road". Follow the road reaching the locked access to Crooks LB at 10.1km

5.3.2 WYNDHAM DAM

Name and location	
Name of Dam	Wyndham Dam
Other Names	None
Location	Latitude S 17035'15" Longitude E 145008'23"
Region	Far North Queensland
Shire	Tablelands Regional
Nearest Town	Mt Garnet
Property Description	Lot 2 on SP189919
Stream and AMTD	Wyndham Creek, AMTD 1.0km
Catchment Area	43km2
Catchment Description	Undulating rocky hills with emerging eucalypt forest

Ownership	
Licence No.	N/A
Current Owner	Queensland Government, managed by Department of Natural Resources & Water (NRW)
Designer (Date)	Owner, Tableland Tin Dredging Company (Mid-Late 1960's)
Construction Authority – Supervisor	Unknown
Construction Contractor	Unknown

Construction Period	Mid-Late 1960's
Structural Upgrade Contractor	RoadTek, Queensland Main Roads
Structural Upgrade Designer	GHD Pty ltd
Structural Upgrade Date	April – November 2008
Safety Review Dates	January 2007

Dam Characteristics	
Dam Type	Homogenous earth fill embankment with concrete cut-off wall in lower section of embankment. A seepage control berm constructed of filter sand and compacted fill was added to the DS face of the embankment as part of the 2008 upgrade.
Purpose	Current use – water supply for stock and recreation.
Dam Height (above lowest toe)	13.8m
Dam Length	286m (approx)
Storage at FSL	1,142ML
Full Supply Level	701.7(AHD) After spillway upgrade.
Dam Crest Level (DCL)	703.8m (AHD)
Embankment Crest Width	4m
Surface Area	32.5ha at FSL
Length of shoreline	Unknown
Upstream Slope	3H:1V (GHD Safety Review)
Downstream Slope	2H:1V (GHD Safety Review)
Volume RCC Main Dam	N/A
Volume of Concrete Main Dam	N/A
Slope Protection	Sown native grasses
Outlet works	A controlled 200mm diameter DICL pipe at RL 692.3m AHD
Erosion Protection Works	Sown native grasses and rock lined groin and toe drains
Corrosion Protection System	None
Erodible embankment section	
Location	Western end of embankment

Trigger level for initiation of erosion	RL 704.1m
AEP of initiating event	1 in 3500
Section width	15m
Peak breach section outflow	1,117 m3/s
Peak water level in Crooks Reservoir immediately prior to breach	RL 694.58m
Peak water level in Crooks reservoir after breach	RL 695.49m

Description of Primary Spillway	
Spillway Type	Broad crested weir (Right Bank)
Spillway Crest Length	56m
Spillway Maximum Height	RL 701.7m AHD
Spillway Capacity	243 m3/s at Dam Crest Level AEP of dam crest flood 1 in1,000
Spillway Chute	Excavated rock

Description of Auxilliary Spillway	
Spillway Type	Broad crested weir (Left Bank)
Spillway Crest Length	23.9m total length
Spillway Maximum Height	699.8m AHD
Spillway Discharge Capacity	187 m3/s at Dam Crest Level AEP of dam crest flood 1 in1,000
Spillway Chute	Excavated rock
Auxilliary Spillway Fuse Plug	
Trigger level for initiation of erosion	RL 703.7m
Invert level of pilot channel	RL 703.4m
Width of pilot channel	3m
Adopted flow depth for initiation of erosion	0.3m
AEP of fuse plug trigger	1 in 1000
Invert of spillway channel	699.7m

Description of outlet works	
Reservoir Outlet Description	Refurbished outlet works are now operational and can release water to Crooks Dam through a controlled 200mm diameter DICL pipe at RL 692.3m AHD. The flow is controlled by two (2) AVK resilient seat gate valves.
Conduit Description	300mm Mild Steel Pipe, reduced to 200mm DICL pipe.
Regulator Description	Downstream gate valve
Outlet – Off take Description	200mm diameter DICL pipe controlled by two (2) AVK resilient seat gate valves

Description of Access	
Access Description	Access roads to the dam are unsealed
Access Route	At the corner of Garnet and Mica streets opposite the MT Garnet Hotel Mt. Garnet, set 0.0km and proceed north on Mica St. At 0.45km, Mica St., becomes Coolgarra Road, a 2 lane sealed road. Follow Coolgarra Road north and cross a grid at 1.5km where the road becomes a 2 lane unsealed road. Travel north on Coolgarra Road and pass a road signposted "Limeworks" on the right at 4.0km. Continue on Coolgarra Road sign posted, :Coolgarra'' "Irvinebank" and "Xtreme". At 8.8 km, pass a road leading east sing posted "Xtreme" and at 9.9kms pass another road leading east sign posted "No Through Road". Cross a culvert DS of Crooks embankment at 10.3km and pass the locked access to the RB of Crooks embankment on the right at 10.6km. At 10.85 cross a concrete causeway and continue north, reaching a locked access to Wyndham dam at 11.9km. Pass through the gate and proceed east until reaching the Wyndham RB spillway at 12.4km. 4WD access is recommended past the gate even though the road is well defined. The embankment is not visible from the entry gate.

6.0 EMERGENCY EVENTS AND ACTIONS

6.1 GENERAL

SOP 14 (APPENDIX 9) is to be followed up to and including storage level EL692.0m. This would normally occur before the following events which are defined as emergency events:

- Reservoir level EL692.0m and rainfall of about 25mm in the first thirty minutes commencing in the catchment. The storage level would be 0.7m over Crooks Dam Concrete Weir Spillway Crest (EL 691.3)
- Reservoir level at gauge height 695.2 or higher at Crooks Dam and there is heavy rainfall in the catchment.
- Rainfall greater than 120mm in half an hour.
- Earthquake/Tremor.
- Toxic spill within storage/catchment.

6.2 EVENTS

EVENT 1

Reservoir level in Crooks Dam above EL 692.0m and heavy rainfall at about 25mm in the half hour commencing in the catchment.

The EAP Officer shall:

- Mobilise EAP Backup 1 and 2 and request Backup 2 to travel to Limestone Creek[1] and commence reading the gauge board and report.
- Commence reading Crooks Dam storage height gauge and rainfall gauge at half hourly intervals. While safe read Wyndham Dam storage height at least twice daily or as directed by Principal Engineer, Non- Commercial Assets. If access to the site is not safe remotely monitor the rainfall and gauge levels at Limestone Creek.
- Inspect the embankment of Wyndham and Crooks dam for new deficiencies, including springs, sliding of the downstream face, deformation, transverse and longitudinal cracking, sinkholes, slumps and erosion. Appendix 5 gives a guide for inspection.
- Notify the Principal Engineer, Non-Commercial Assets of storage height and spillway flow predictions. Update the Principal Engineer, Non-Commercial Assets at least twice daily during the rainfall event, or as directed.
- This Event ends when rainfall in the preceding two hours is less than 25mm and Crooks Dam gauge height is less than 691.8 and falling. EAP Officer makes a final visual inspection of the Dam embankments and notifies EAP Backup 1 and 2, Principal Engineer, Non-Commercial Assets that the Emergency Event is at an end and stands down.
- After the event, compile an Emergency Event Report and forward unedited copies

to Principal Engineer, Non-Commercial Assets.

EVENT 2

Reservoir level in Crooks Dam at or above gauge height 695.2 and heavy rainfall at 25mm in the half hour commencing or continuing in the catchment.

The EAP Officer shall:

- Mobilise EAP Backup 1 and 2 and if not already Mobilised.
- Commence or continue reading storage height gauges and rainfall gauges at half hourly intervals.
- If the fuse plug starts to erode, notify the Executive Officer, Local Disaster Management Group Tablelands Regional Council that collapse of the fuse plug has started and that the bridge at the Kennedy Highway should be overtopped by about 1 metre of water in 2 hours time.
- Relocate EAP officers to Mt Garnet and continue to read rain gauge at half hour intervals.
- Ensure EAP Officers and Back-ups cease to read the gauge at Limestone Creek and go to higher ground
- Notify the Principal Engineer, Non-Commercial Assets of that the fuse plug has started to collapse and report on the rainfall.
- This Event ends when rainfall in the preceding two hours is less than 25mm and Crooks Dam gauge height is less than 695.2 and falling. EAP Officer makes a final visual inspection of Dam embankments and notifies EAP Backup 1 and 2, Principal Engineer, Non-Commercial Assets, the Police in Mareeba and the Executive Officer, Disaster Management, Tablelands Regional Council, that the emergency event is at an end and stands down.
- After the event, compile an Emergency Event Report and forward unedited copies to Principal Engineer, Non-Commercial Assets.

EVENT 3

Rainfall greater than 120mm in half an hour.

The EAP Officer shall:

- Mobilise EAP Backup 1 and 2 and if not already mobilised.
- Commence or continue reading rainfall gauges at half hourly intervals.
- Notify the Principal Engineer, Non-Commercial Assets of the rainfall. Regularly update Principal Engineer, Non-Commercial Assets during the event
- If total rainfall for the hour exceeds 165mm, notify the Executive Officer, Local Disaster Management Group Tablelands Regional Council that flooding of up to 12 houses in Mt Garnet could occur within approximately 2 hours. Locations of these houses are shown in Appendix 6 (Figure C14 of GHD Report).
- This Event ends when rainfall in the preceding three hours is less than 60mm. EAP Officer makes a final visual inspection of Dam embankments and notifies EAP Backup 1 and 2, Principal Engineer, Non-Commercial Assets, the Police in

Mareeba and the Executive Officer, Disaster Management, Tablelands Regional Council that the emergency event is at an end and stands down.

- After the event, compile an Emergency Event Report and forward unedited copies to Principal Engineer, Non-Commercial Assets.

The Executive Officer, Disaster Management, Tablelands Regional Council shall:

- Implement, or arrange to be implemented, Evacuation Plan when advised of the likelihood of this event.

EVENT 4

Earthquake/Tremor felt in Area / Landslide.

The EAP Officer shall:

- Mobilise EAP Backup 1 and 2.
- Immediately inspect the dams and spillways if safe to do so for new deficiencies, including springs, deformations, slumps, slope failure, cracking and erosion. Appendix 5 gives a guide for inspecting the structures. If anything unusual is observed:
- Notify the Executive Officer, Local Disaster Management Group
- Tablelands Regional Council, that the dams should be considered unsafe and of the possibility of dam failures.
- Report results of inspection immediately to the Principal Engineer, Non-Commercial Assets.
- After the event (usually within 24 hours), compile an Emergency Event Report and forward unedited copies to Principal Engineer, Non-Commercial Assets.

Principal Engineer, Non-Commercial Assets shall:

- If thought necessary, after considering EAP Officer's verbal and written reports, arrange for inspection of the dam by an experienced Consulting Dam Safety Engineer.
- Report Dam Safety Engineers findings to Director Dam Safety and obtain clearance to end the event.
- Instruct EAP Officer to notify EAP Backup 1 and 2, the Police in Mareeba and the Executive Officer, Disaster Management, Tablelands Regional Council, that the emergency event is at an end and then stand down.

EVENT 5

Toxic spill within the Catchment/Storage.

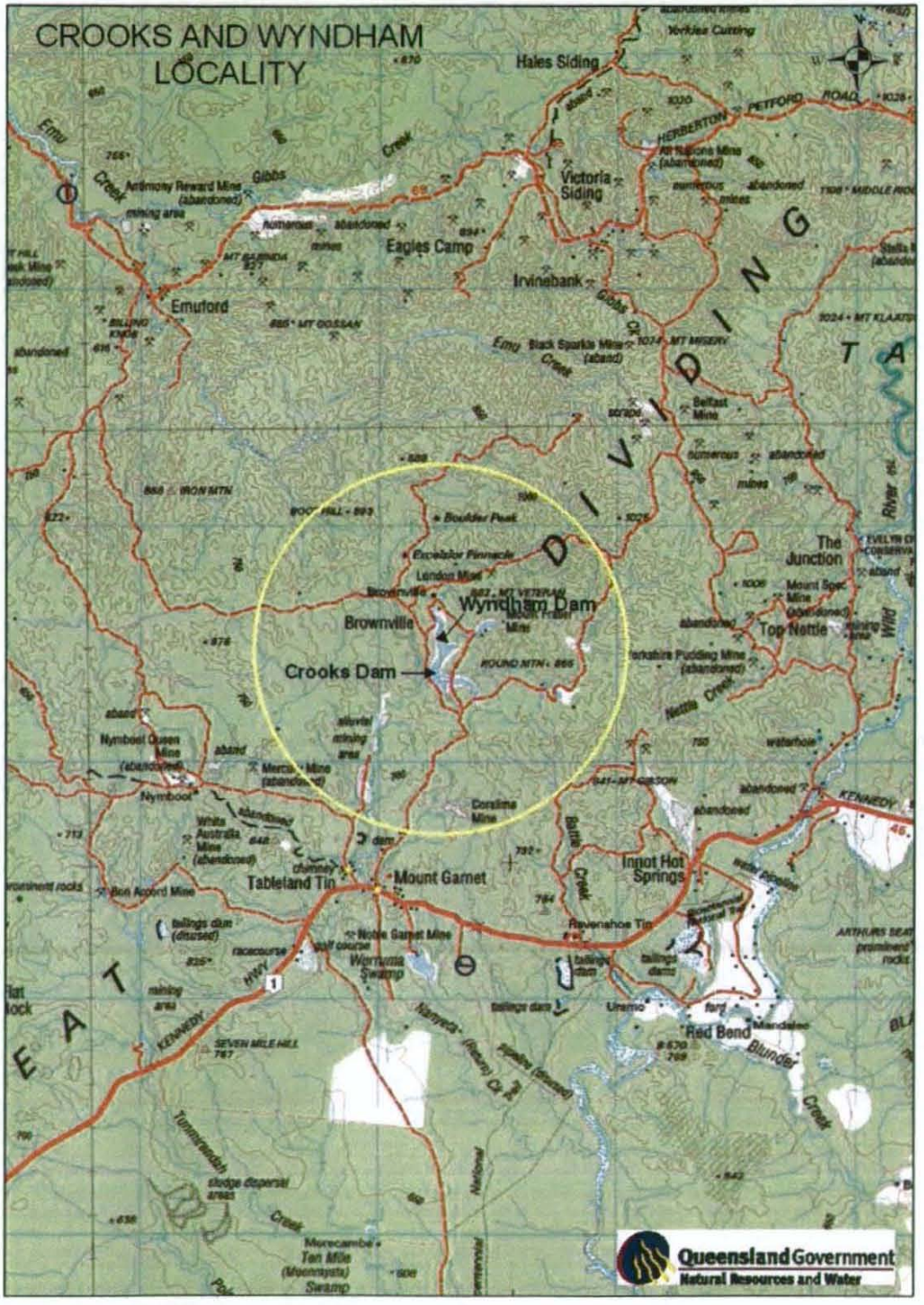
Note: Under no circumstances shall EAP officers approach spills where the nature or toxicity of the substance is not known.

On detection or notification of a toxic or hazardous substance contaminating the catchment or storage the EAP Officer shall:

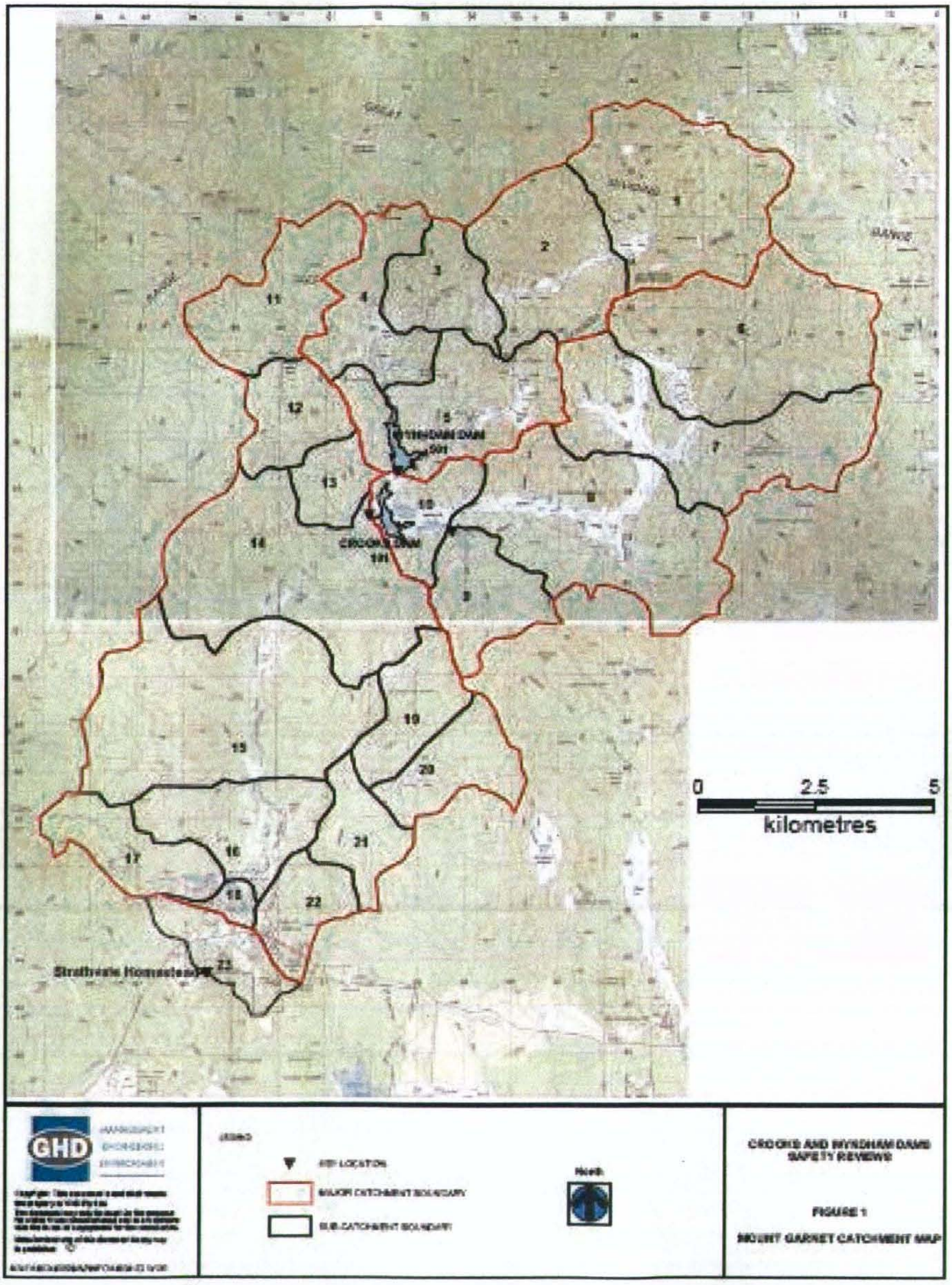
- Mobilise EAP Backup 1 and 2.
- Identify the hazardous substance or chemical, if possible.
- Seek advice from the Queensland Fire and Rescue Service by dialling the general emergency telephone number 000 and/or the Chemical Hazards and Emergency Management Unit, on the nature of the hazard.
- Take reasonable steps to isolate the spill, or containment of the spill from the dam by construction of a containment embankment, or prevent further contamination.
- Notify the Executive Officer, Local Disaster Management Group, Tablelands Regional Council.
- Notify the Principal Engineer, Non-Commercial Assets who will assess the situation and advise on further action.
- This Event ends when advice is received from the Chemical Hazards and Emergency Management Unit that the spill is no longer a toxic hazard. EAP Officer makes a final inspection of the dam and notifies EAP Backup 1 and 2, Principal Engineer, Non-Commercial Assets and the Executive Officer, Disaster Management, Tablelands Regional Council that the emergency event is at an end and stands down.
- After the event, compile an Emergency Event Report and forward unedited copies to Principal Engineer, Non-Commercial Assets.

APPENDIX 1

LOCALITY PLAN


CROOKS AND WYNDHAM
LOCALITY
Hales Siding
Victoria Siding
Eagles Camp
Irvinebank
Emuford
Gibbs
Emu Creek
PETFORD ROAD
HERBERTON
Belfast Mine
The Junction
Top Nettle
Wyndham Dam
Brownville
Crooks Dam
Nymboola
Tableland Tin
Mount Garnet
Innot Hot Springs
Red Bend
Blunder Creek
Nettle Creek
Barron Creek
KENNEDY
GREAT DIVIDING
Queensland Government
Natural Resources and Water

APPENDIX 2
CATCHMENT BOUNDARY


0
2.5
5
kilometres
GHD
CROOKS AND WYNDHAM DAMS SAFETY REVIEWS
FIGURE 1
MOUNT GARNET CATCHMENT MAP

APPENDIX 3

INSPECTION SAFETY PROTOCOL

APPENDIX 3 INSPECTION SAFETY PROTOCOL

All Emergency Action Plan (EAP) officers who visit the dam site are to observe this protocol.

(1) A hand held satellite phone with backup battery to be available at all inspections.

(2) Officers on site to have UHF Radio available at all times.

(3) More than one person to be on site at all times.

(4) Inspections are to be carried out only when conditions are deemed to be safe as per inspection and risk assessment/s.

(5) During an emergency event access to dam embankments and spillways is not to be made by boat.

(7) All personnel likely to be involved are to be informed of the above, and to be made aware that they are mandatory requirements.

APPENDIX 4

POTENTIAL PROBLEM IDENTIFICATION

INSPECTION OF EMBANKMENT DAMS

INSPECTING FOR DEFICIENCIES: SUMMARY

TYPE OF DEFICIENCY	LOOK FOR
SEEPAGE	A water flow or sand boil on the lower portion of the downstream slope or toe area, especially at the groins. Wet areas or areas where the vegetation appears greener or lusher on the embankment slope or toe area. An increase in the amount of water being released from toe drains and relief wells. (Remember to take into account changes in the reservoir level.) Turbidity or cloudiness of the seepage.
CRACKING	Desiccation Cracking: A random honeycomb pattern of cracks usually found on the crest and the downstream slope. Transverse Cracking: Cracks that are perpendicular to the length of the dam usually found on the crest. Longitudinal Cracking: Cracks that are parallel to the length of the dam. Longitudinal cracks may be associated with stability problems in the slopes.
INSTABILITY	Slides on the upstream or downstream slopes. Bulging, especially at the toe of the dam.
DEPRESSIONS	Misalignment in the crest and embankment slopes found by sighting along fixed points. Sinkholes found by checking and probing each depression. Remember, sinkholes have steep, bucket like sides while minor depressions have gently sloping, bowl like sides.
MAINTENANCE CONCERNS	Inadequate Slope Protection: Check for bald areas or areas where the protection is sparse or damaged. Surface Runoff Erosion: Check for gullies or other signs of erosion. Make sure to check the low points along the upstream and downstream shoulders and groins since surface runoff can collect in these areas. Inappropriate Vegetative Growth: Check for excessive and deep rooted vegetative growth. Debris: Check for debris on and around the dam, especially near the spillways. Animal Burrows: Check for damage caused by

	burrowing animals.

WHEN TO GET FURTHER ASSISTANCE

Several of the deficiencies covered in this unit are very serious. If you observe any of the following deficiencies, you may need to consult with an experienced and qualified engineer:

- Sand boils or turbid seepage.
- Seepage that has increased since the last inspection (taking the reservoir level into consideration).
- Cracking that extends below the reservoir level or potential reservoir level.
- Transverse and longitudinal cracking.
- Deep seated slides or bulging associated with slides.
- Sinkholes or other large depressions.
- Deep rooted vegetation that might need to be removed.

Remember, whenever you are unsure whether or not a condition poses a threat to the safety of the dam, you should discuss your findings with an experienced and qualified engineer, Principal Engineer, Non- Commercial Assets.

APPENDIX 5

Emergency Event Phone Numbers

Event Phone Numbers for EAP Officer

All Emergency Events
Police in Mareeba
Phone 07 4030 3370, A/H [redacted]

EAP Backup 1
Roye Poulson, Phone [redacted]

Senior Advisor, Disaster Management, Tablelands Regional Council
Sarah Dean, Phone [redacted], A/H [redacted]

Principal Engineering, Non-Commercial Assets
William Steen, Phone [redacted], A/H [redacted], Mobile [redacted]

if unable to contact then:

Regional Manager, Water Services, Central West Region
Ed Donohue, Phone [redacted], A/H [redacted], Mobile [redacted]

Event Phone Numbers for Principal Engineering, Non-Commercial Assets

All Emergency Events

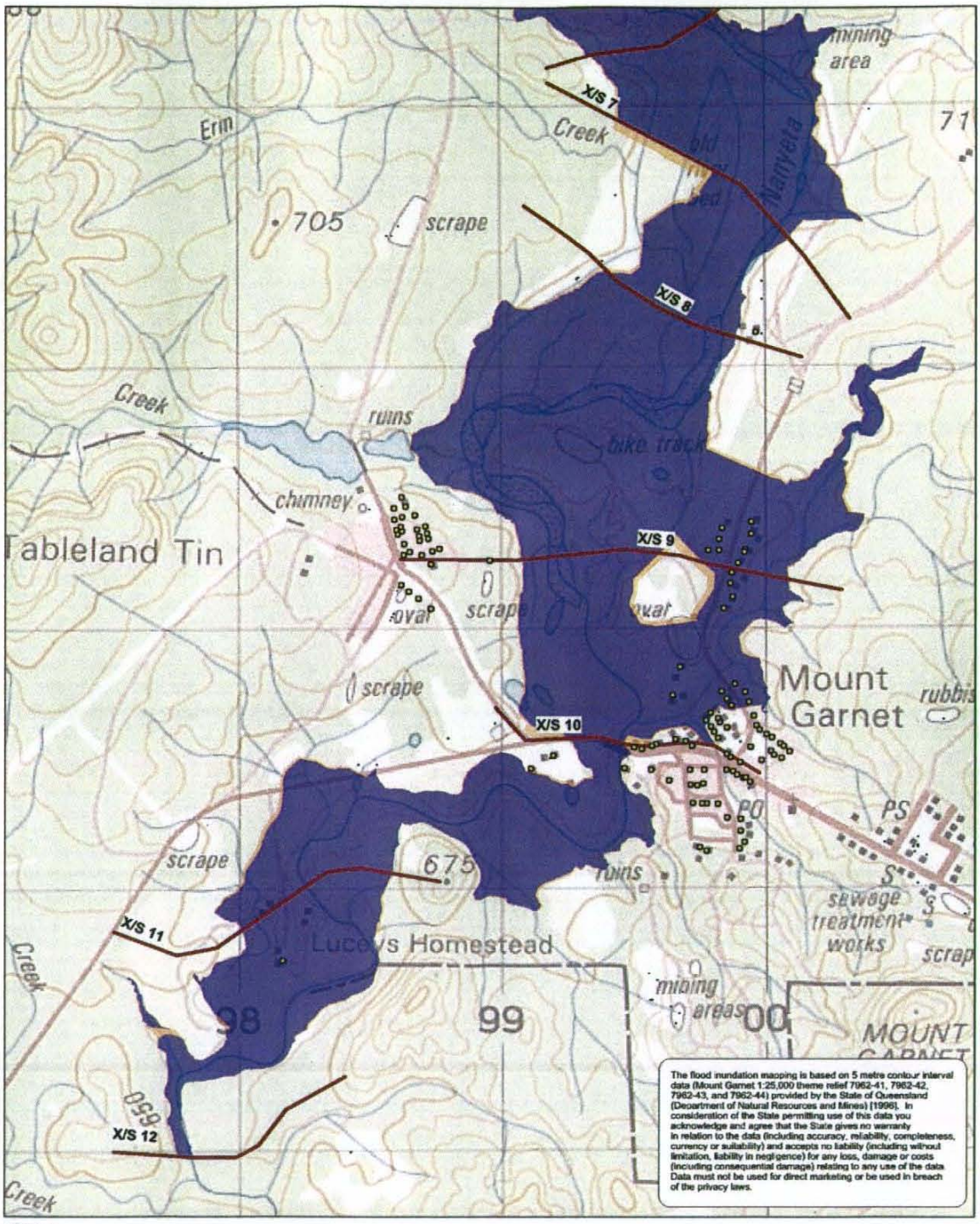
EAP Officer
Gary Haydon, Phone [redacted], Sat Phone [redacted]

Director Dam Safety
Peter Allen, Phone [redacted], A/H [redacted], Mobile [redacted]

Regional Manager, Water Services Central West Region
Ed Donohue, Phone [redacted], A/H [redacted], Mobile [redacted]

APPENDIX 6

PROPERTIES WITHIN INUNDATION AREA



LEGEND

- Surveyed Dwelling Location
- Cross Section
- "No-Failure" Flood Extent
- Flood Failure Extent

1:20,000
0 250 500
metres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

Department of Environment and Resource Management
Crooks Dam Failure Impact Assessment

Job Number 41-22582
Revision 0
Date 1 Sep 2010

Flood Inundation at Mount Garnet
PMP Design Flood Event Sensitivity

Figure C14

G:\41\22582\GIS\22582-18.wor

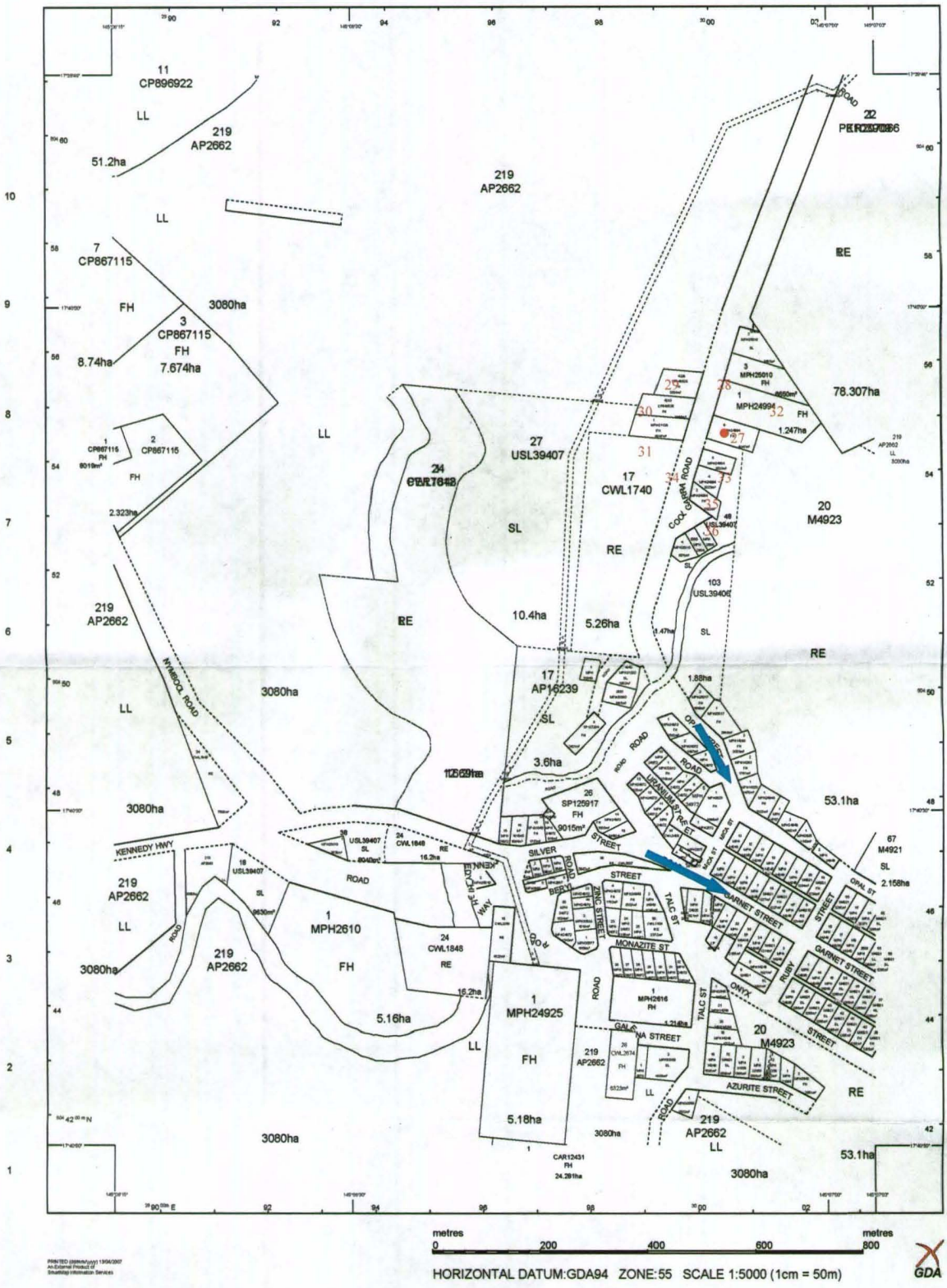
Suite 4, 1-3 Annand Street Toowoomba QLD 4350 Australia T 61 7 4633 8000 F 61 7 4613 1687 E tbarnell@ghd.com.au W www.ghd.com.au

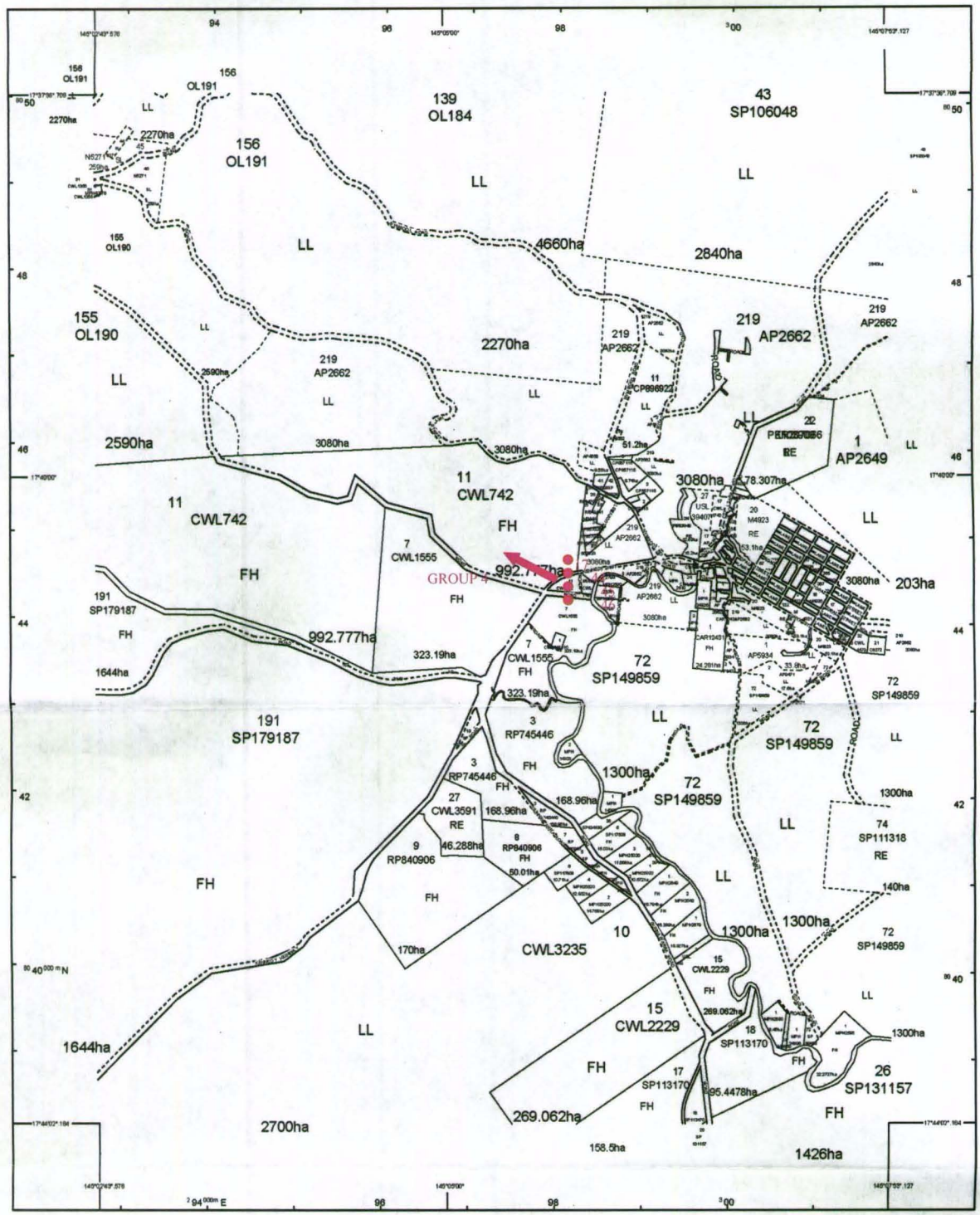
 Data source: Geoscience Australia, Mount Garnet 7962-4 1:50,000 Topographic Line Map Edition 1; RPS, Cross Section and Dwelling Survey commissioned by DERM, 2010. Created by: TL

PROPERTIES WITHIN INUNDATION AREA
AS IDENTIFIED IN 1 in 2500 AEP, 1 in 20,000 AEP and PMP FLOOD EVENTS and GROUND INVESTIGATION

Property Number	Lot & Plan	Postal Address	Group No
1	[redacted]		
2			2
3			1
4			1
5			2
6			2
7			2
8			2
9			2
10			2
11			2
12			2
13			2
14			2
15			3
16			3
18			2
19			2
20			2
21			2
22			2
23			2
24			2
25			2
26			2
27			1
28			1
29			1
30			1
31			1
32	[redacted]		1
33			1
34			1
35			1
36			1
37 [redacted]			1
38			1
39			2
40			2

41	[redacted]	2
42		2
43		2
17		4
44		4
45		4
46		4
47		5
48		5


11
CP896922
LL
219
AP2662
51.2ha
219
AP2662
LL
7
CP867115
FH
3080ha
3
CP867115
FH
8.74ha
7.674ha
LL
27
USL39407
24
CWL1848
RE
SL
17
CWL1740
RE
10.4ha
5.26ha
78.307ha
1.247ha
20
M4923
219
AP2662
RE
3080ha
LL
17
AP16239
SL
3.6ha
1.88ha
53.1ha
KENNEDY HWY
219
AP2662
LL
3080ha
1
MPH2610
FH
24
CWL1848
RE
16.2ha
5.16ha
219
AP2662
LL
1
MPH24925
FH
5.18ha
3080ha
219
AP2662
LL
3080ha
53.1ha
CAR12431
FH
24.281ha
NYMBOOL ROAD
Cox Creek ROAD
SILVER STREET
ZINC STREET
TALC ST
MONAZITE ST
GARNET STREET
RUBY STREET
ONYX STREET
OPAL ST
AZURITE STREET
metres
0
200
400
600
800
HORIZONTAL DATUM:GDA94 ZONE:55 SCALE 1:5000 (1cm = 50m)
GDA



STANDARD MAP NUMBER
7962-43132

MAP WINDOW POSITION & NEAREST LOCATION

SUBJECT PARCEL DESCRIPTION

DCDB

Lot/Plan	7/CWL1555
Area/Volume	323.19ha
Tenure	FREEHOLD
Local Government	HERBERTON SHIRE
Locality	MOUNT GARNET
Parish	MULLABURRA
County	CARDWELL
Parcel/Segment	14/39414

CLIENT SERVICE STANDARDS

PRINTED (dd/mm/yyyy) 16/04/2007

DCDB 13/04/2007 (Lots with an area less than 1.000ha are not shown)

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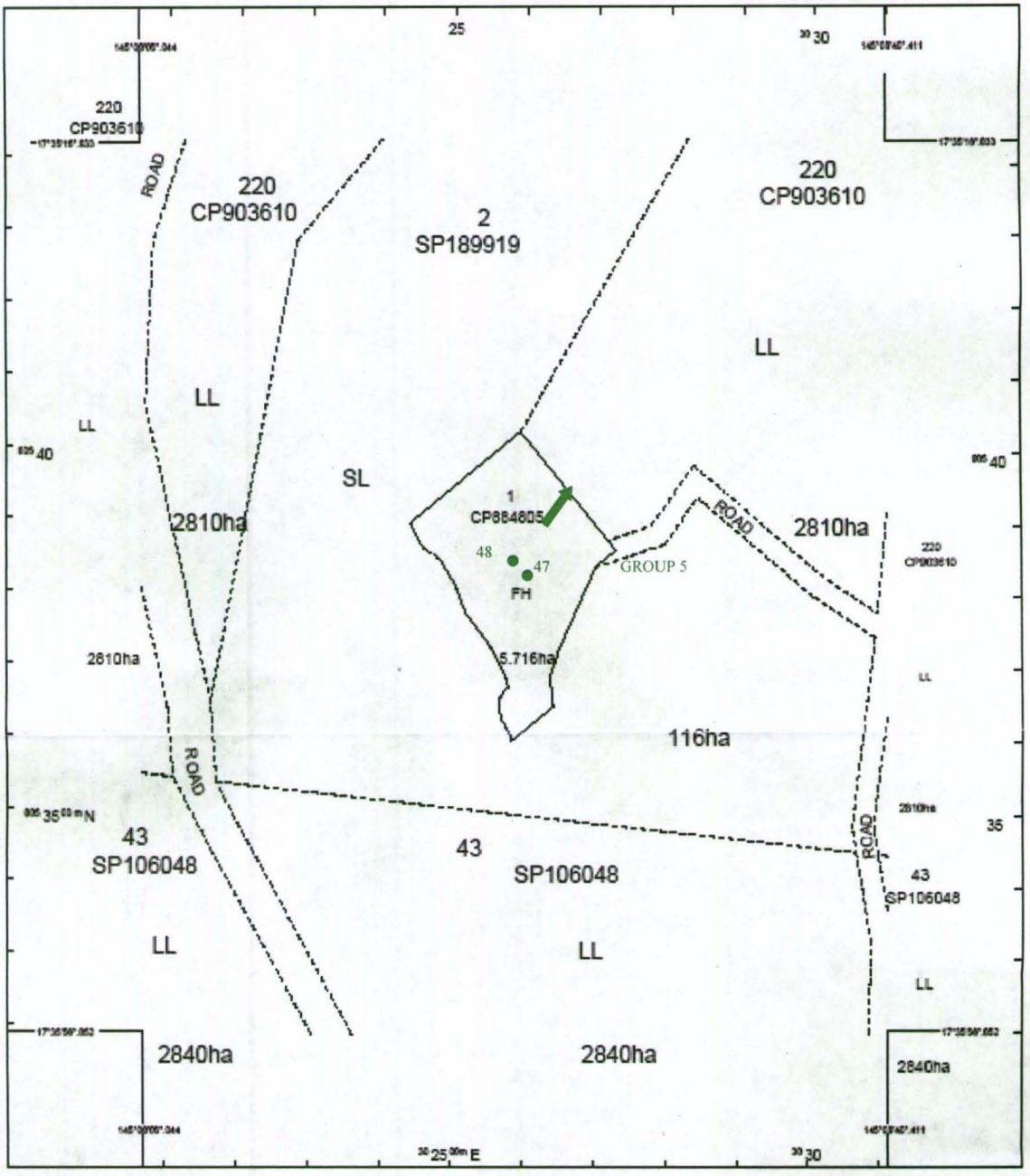
For further information on SmartMap products visit http://www.dnrw.qld.gov.au/property/mapping/smmap

HORIZONTAL DATUM GDA94 ZONE 55 SCALE 1: 40000

SmartMap
An External Product of SmartMap Information Services
Based upon an extraction from the Digital Cadastral Data Base

Queensland Government
Natural Resources and Water

GDA



STANDARD MAP NUMBER
7962-41343

0 150 300 450 600 750 m

HORIZONTAL DATUM:GDA94 ZONE:55 SCALE 1 : 7500

MAP WINDOW POSITION & NEAREST LOCATION

SUBJECT PARCEL DESCRIPTION

DCDB

Lot/Plan	1/CP884805
Area/Volume	5.716ha
Tenure	FREEHOLD
Local Government	HERBERTON SHIRE
Locality	MOUNT GARNET
Parish	COOLGARRA
County	CARDWELL
Parcel/Segment	24/39436

CLIENT SERVICE STANDARDS

PRINTED (dd/mm/yyyy) 24/04/2007

DCDB 23/04/2007

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GDA

SmartMap
An External Product of SmartMap Information Services.
Based upon an extraction from the Digital Cadastral Data Base

Queensland Government
Natural Resources and Water

INUNDATION MAPPING - 1:2,500 AEP EVENT

DEPARTMENT OF NATURAL RESOURCES AND WATER

CROOKS DAM REMEDIAL WORKS
FLOOD INNUNDATION MAPPING
FOR THE 1 IN 2,500 AEP EVENT

FIGURE 4.10

Houses included in PAR assessment (minimum 0.3m depth)

Houses located outside the inundation area (0.3m depth)

MIKE11 Model Cross Sections

Flood Inundation Extent

Fuseplug Breach Inundation Extent

Dam and Fuseplug Breach Inundation Extent

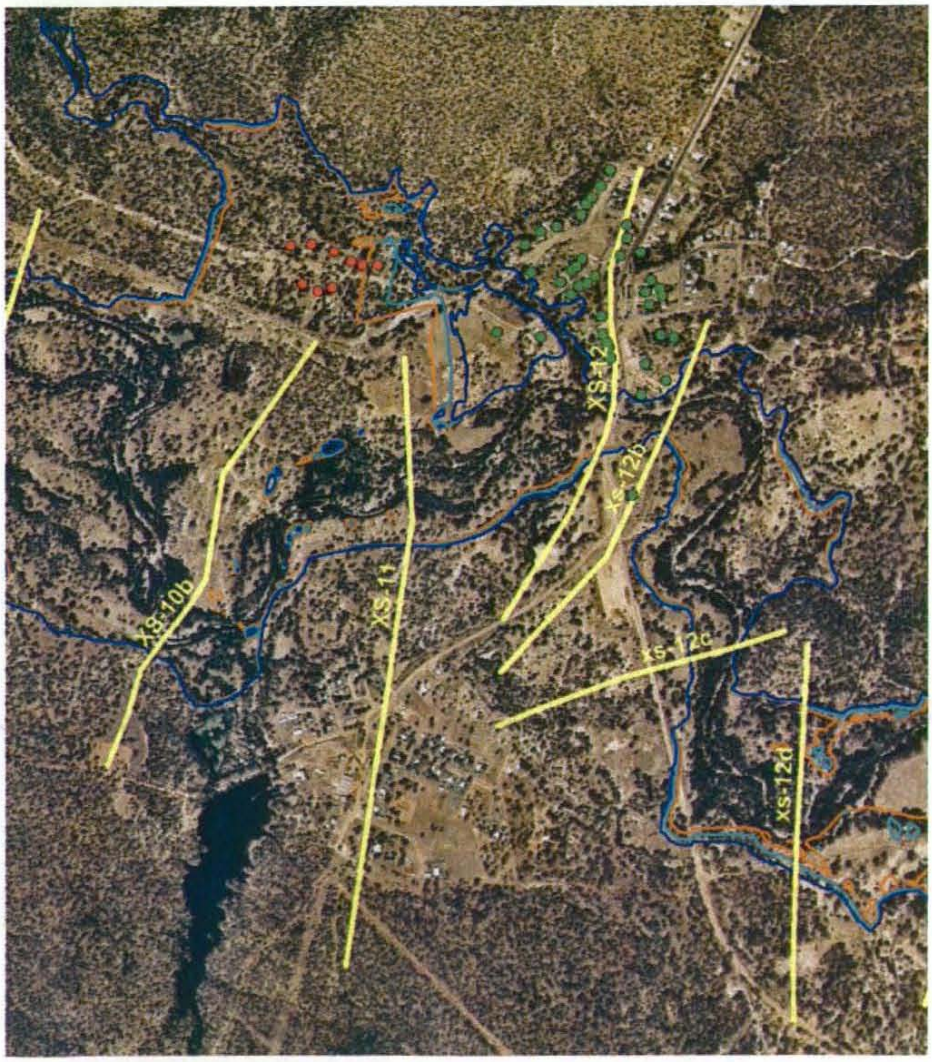
North

0 250 500 metres

Source Information: 1:50,000 Mount Garnet Mapsheet, Ravenshoe Aerial Photography (NRM, 1997), and Property Boundary Dataset (NRM 2004).

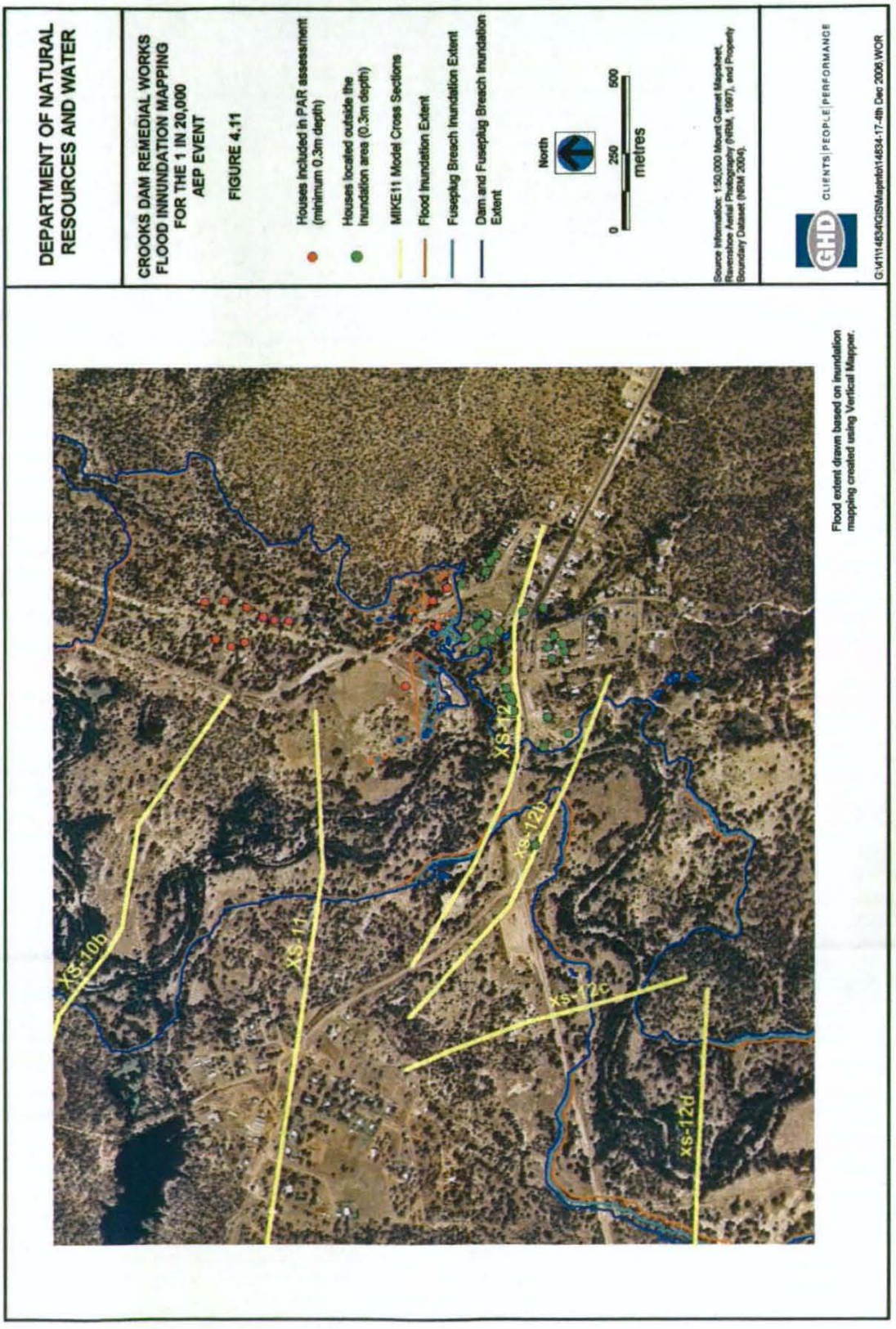
CLIENTS|PEOPLE|PERFORMANCE

G:\41\14834\GIS\Mapinfo\14834-17-4th Dec 2006.WOR

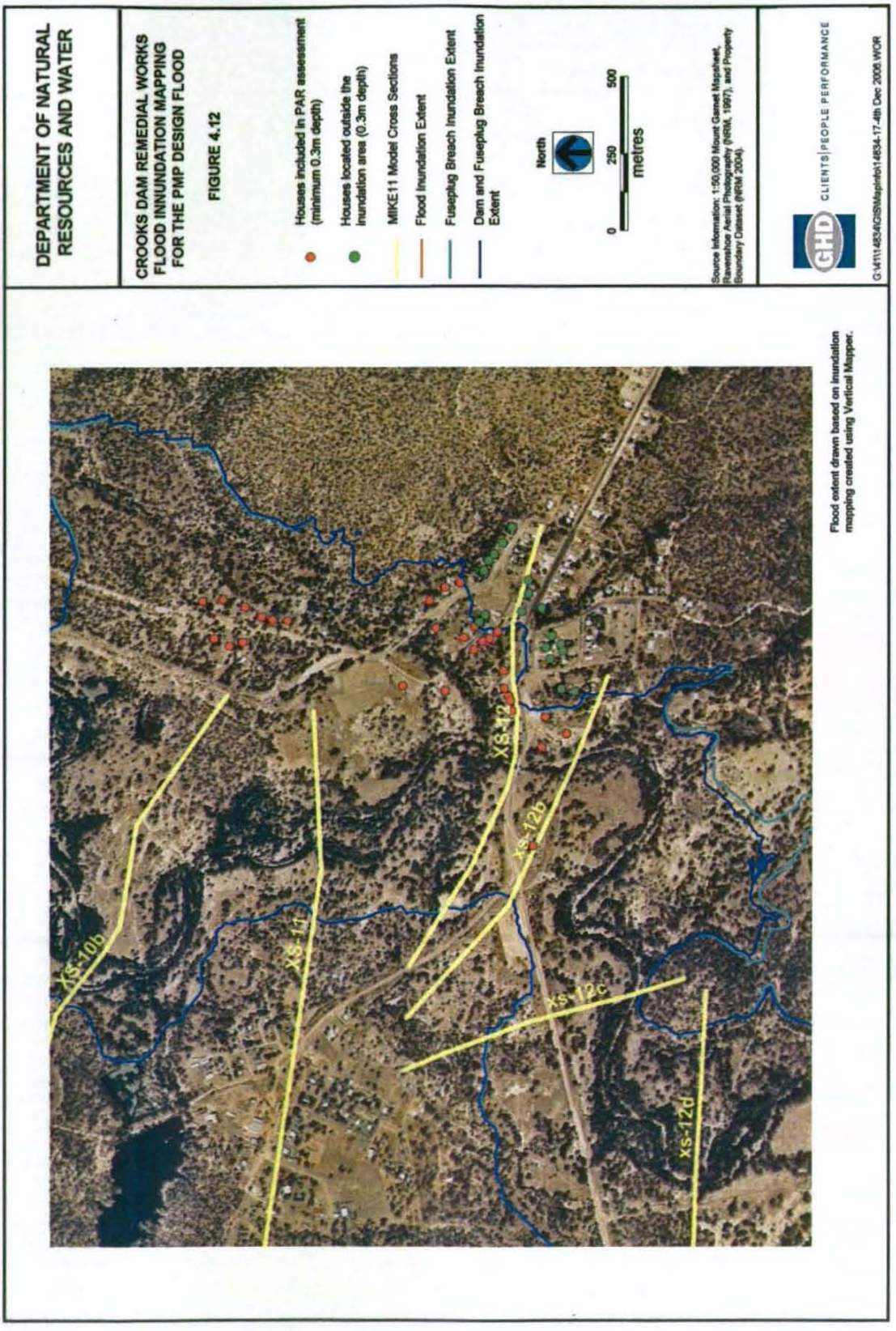


Flood extent drawn based on inundation mapping created using Vertical Mapper.

INUNDATION MAPPING - 1:20,000AEP EVENT



INUNDATION MAPPING - PMP DESIGN FLOOD



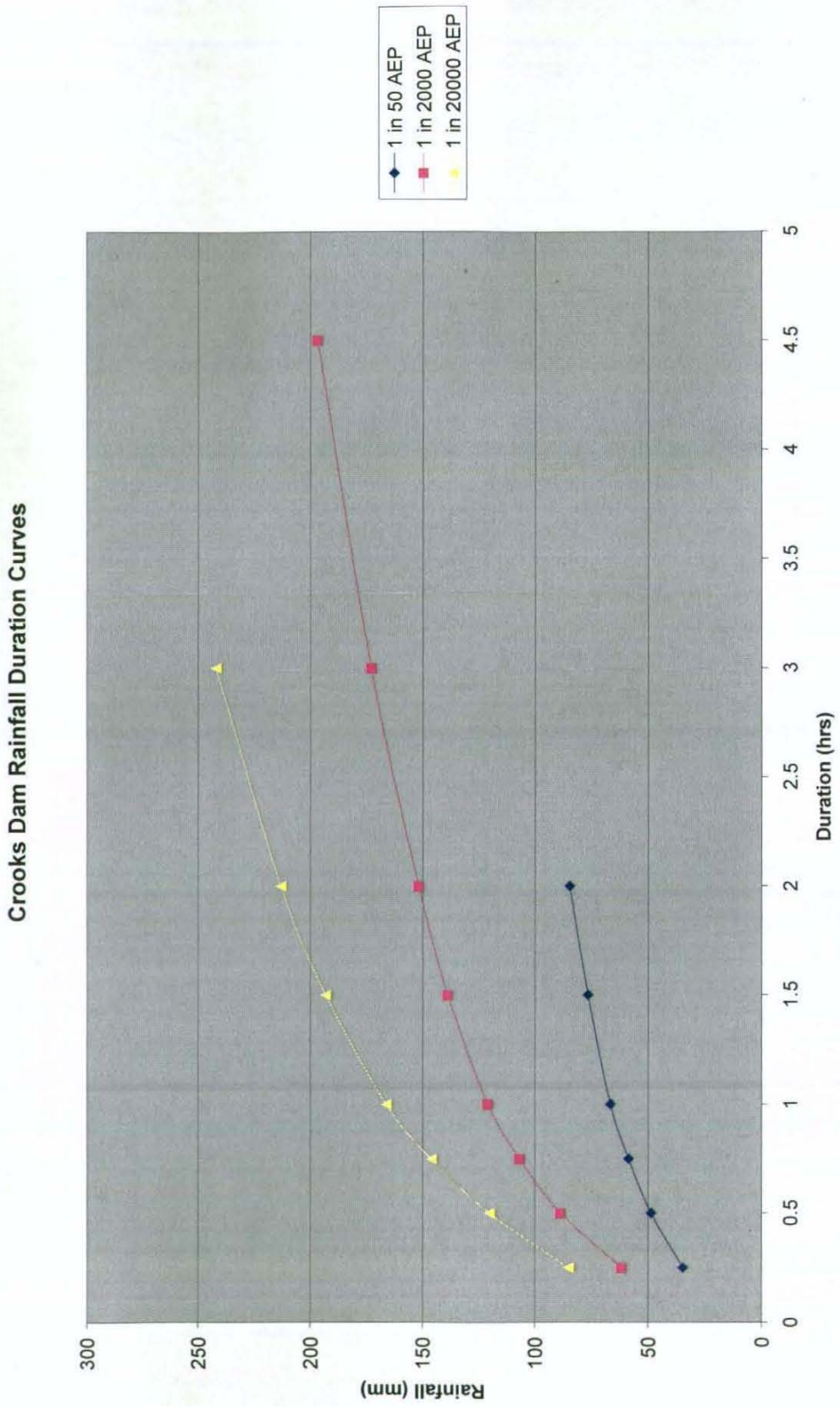
APPENDIX 7

RAINFALL/DURATION CURVES

The Bureau of Meteorology update their website hourly from 9am. Thus, during an event the website shall be accessed hourly. The site is www.bom.gov.au. The closest Bureau rain gauges are at Herberton and Mt Garnet. The Cairns radar image covers Mt Garnet area.

- Left Click - Queensland area of the map of Australia.
- Scroll down to Flood Warning, Rainfall and River Information. Left click - Queensland Flood Warning Centre.
- Scroll down to "Zoom in to:"
- Left Click – Daintree to Townsville.
- Scroll Down to table under map and go to column displaying "Latest Rainfall Data"
- Left Click – 1hr for Herbert River – Read rainfall data for Herbert at Herberton and Mt Garnett AL.
- Move to top tool bar and Left Click – Back arrow
- Left Click – 3hr for stations as above – read rainfall data.
- Move to top tool bar and Left Click – Back arrow.
- Left Click – 24 hr for stations as above – read rainfall data.
- Move to top tool bar and Left Click – Back arrow
- Scroll down to table under map and go to column displaying "Radar"
- Left Click Cairns and read radar data for Herberton and Mt Garnet at "128 km Cairns Radar" site.

All data received by EAP Officer is to be recorded in the storage log book.


Crooks Dam Rainfall Duration Curves
1 in 50 AEP
1 in 2000 AEP
1 in 20000 AEP
Rainfall (mm)
0
50
100
150
200
250
300
Duration (hrs)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

APPENDIX 8

RATING TABLES (NOT USED IN THIS DOCUMENT)

APPENDIX 9

SOP 14 Small to Medium Spillway Overflows

Department of Environment and Resource Management

Crooks Dam

Standing Operating Procedures

for

Small to Medium Spillway Overflows

SOP - 14

Distribution, Approval and Revision Control

Distribution

Copy Number	Position	Location
1	RoadTek Works Manager, Asset Services North	Cairns
2	Regional Manager, Water Services, North Region, DERM	Cairns
3	Director, Dam Safety, DERM	Brisbane
4	RoadTek Engineer	Cairns
5	RoadTek Officer (EAP)	Mt. Garnet
6	RoadTek Officer (Inspections)	Mt. Garnet

Authorisation

Approved:

_____ Date: _____.

Principal Engineer, Non-Commercial Assets, DERM

Revision Status

Revision No.	Date	Revision Description
0	July 2010	Original Issue

Table of Contents

Page

Appendices

Purpose

The Crooks Dam is managed by DERM. In terms of an MOU with DERM, the RoadTek Works Manager, Asset Services North, Cairns, manages the operation and maintenance of the Crooks Dam, including routine dam safety inspections.

Part of the dam safety management program is to inspect the Dam immediately before the spillway starts to overflow. A secondary objective is to advise tourists or campers to that access and egress to the area may be cut off due to local stream rises.

Scope

This Procedure applies to spillway overflow events that are less than the historical maximum event with a storage level of EL 692.0m. The personnel are the Emergency Action Plan (EAP) Officers listed in the EAP for Crooks Dam.

Personnel Affected and Responsibilities

Officer	Responsibility
RoadTek Engineer	A Registered Professional Engineer, Queensland, responsible for carrying out monthly inspections at the dam.
Emergency Action Plan Officers (EAP Officers)	The Officer based at Mt. Garnet and at or near Crooks Dam responsible for carrying out EAP procedures for the Dam and this Standing Operating Procedure.
Principal Engineer, Non-Commercial Assets	The person responsible for approving the Standing Operating Procedures, the Operation and Maintenance Manual and the persons undertaking the role of EAP Officers and, for managing, receiving, storing and checking data for the Crooks Dam, reviewing and authorising documentation produced by the RoadTek Officer and consultants on the dam and initiating investigations into abnormal behaviour of the dam. Manages the Distribution, Approval and Revision Control relating to this Procedure.
Regional Manager, Water Services, Central West Region, DERM	The person responsible for approving the Emergency Action Plan.

Actions

The EAP Officer should be aware of the storage height and rainfall conditions, and be able to estimate when the spillway is likely to overflow. Details for obtaining information on rainfall, storage and river gauge heights from the Bureau of Meteorology website is given in Appendix 7 of the EAP.

- Two hours before the spillway is estimated to overflow, The EAP officer shall visit the dam if safe access is possible, and visually inspect the Dam for any deficiencies.
- Check for new cracking or increased crack widths in the spillway face and main wall. Appendix B gives a guide for inspecting the Dam for deficiencies.
- Read the storage height gauge and rain gauge at the WAP Officer's residence at one-hour intervals.
- At a reasonable time, notify the Senior Advisor, Local Disaster Management Group, Tablelands Regional Council that a spillway discharge is likely.
- At a reasonable time, notify the Principal Engineer, Non-Commercial Assets of storage height and that a spillway discharge is likely. Regularly update Principal Engineer, Non -Commercial Assets during the rainfall event. At least daily or as directed by the Principal Engineer, Non -Commercial Assets.
- If the storage level is predicted to reach EL 692.0m, the EAP Officer is to implement the Major Overflow Event in the EAP.
- When the preceding twelve-hour rainfall is less than 50mm and the storage height gauge is less than EL691.5m and falling, and local stream rises have fallen sufficiently to allow access to and egress from the site, the EAP Officer is to make an inspection of the Dam and advise the Principal Engineer, Non-Commercial Assets.
- Once given permission by the Principal Engineer, Non -Commercial Assets the dam site can be opened to the public. The site maybe closed for extended periods following an event due to flood waters on the access road.
- EAP Officer advises the Police in Cairns, and the Executive Officer, Local Disaster Management Group, Tablelands Regional Council that the site has been opened to the public and stands down.

References

- Emergency Action Plan, Crooks Dam

Appendix B

INSPECTING FOR DEFICIENCIES: SUMMARY

TYPE OF DEFICIENCY	LOOK FOR
SEEPAGE	A water flow or sand boil on the lower portion of the downstream slope or toe area, especially at the groins. Leakage around conveyance structures such as outlet works. Wet areas or areas where the vegetation appears greener or more lush on the embankment slope or toe area. Blocked toe drains. An increase in the amount of water being released from toe drains. (Remember to take into account changes in the reservoir level.) Turbidity or cloudiness of the seepage.
CRACKING	Desiccation Cracking: A random honeycomb pattern of cracks usually found on the crest and the downstream slope. Transverse Cracking: Cracks that are perpendicular to the length of the dam usually found on the crest. Longitudinal Cracking: Cracks that are parallel to the length of the dam. Longitudinal cracks may be associated with stability problems in the slopes.
INSTABILITY	Slides on the upstream or downstream slopes. Bulging, especially at the toe of the dam.
DEPRESSIONS	Misalignment in the crest and embankment slopes found by sighting along fixed points. Sinkholes found by checking and probing each depression. Remember, sinkholes have steep, bucket like sides while minor depressions have gently sloping, bowl like sides.
MAINTENANCE CONCERNS	Inadequate Slope Protection: Check for bald areas or areas where the protection is sparse or damaged. Surface Runoff Erosion: Check for gullies or other signs of erosion. Make sure to check the low points along the upstream and downstream shoulders and groins since surface runoff can collect in these areas. Inappropriate Vegetative Growth: Check for excessive and deep rooted vegetative growth. Debris: Check for debris on and around the dam, especially near outlet works or spillway inlets. Animal Burrows: Check for damage caused by burrowing animals.

Note: This tabulation taken from Dam Safety Surveillance Field Manual-August 2005

WHEN TO GET FURTHER ASSISTANCE

Several of the deficiencies covered above are very serious. If you observe any of the following deficiencies, you should consult with the Principal Engineer, Non –Commercial Assets:

- Sand boils or turbid seepage.
- Seepage that has increased since the last inspection (taking the reservoir level into consideration).
- Cracking that extends below the reservoir level or potential reservoir level.
- Transverse and longitudinal cracking.
- Deep seated slides or bulging associated with slides.
- Sinkholes or other large depressions.
- Deep rooted vegetation that might need to be removed.

If you are unsure whether or not a condition poses a threat to the safety of the dam, you should discuss your findings with the Principal Engineer, Non –Commercial Assets.

APPENDIX 10

ENVIRONMENTAL INCIDENT ALERTS

ENVIRONMENTAL INCIDENT ALERT

REGIONAL SERVICE DELIVERY DIVISION

DATE OF INCIDENT:

INCIDENT NOTIFIED BY:

TIME OF NOTIFICATION:

LOCATION OF INCIDENT:

SUMMARY OF INCIDENT AS NOTIFIED:

- Provide a brief dot point summary of the situation based on the information available

POTENTIAL IMPACTS:

- (this information can be based on advice from the company or source of the incident)
- Likelihood of unlawful environmental harm
- Likelihood of potential risk to public health (if public health risk is identified notify Queensland Health and provide details in this alert)

DERM's PLANNED ACTIONS:

- What actions has DERM taken
- What actions are proposed to be taken and timeframe for doing these

NEXT UPDATE ON INCIDENT EXPECTED:

- Date/time estimate

COMMUNICATION:

- What communications have been made?
- What public notifications have been made?
- What public notifications are expected?

Region:
Briefing Officer: Telephone: (07) Date:
Approving Officer: Telephone: (07) Date:

MAP OR PLAN OF SITE:

- Where possible attach a map or plan which identifies the site and key features

From: Brown Damien
Sent: Wednesday, 24 February 2010 2:29 PM
To: Birchley Michael; Buckley Andrew; Hart Randall; Pappalardo Joe
Cc: Miles Rhonda
Subject: Environmental Incident Alert Process for Regional Service Delivery
Importance: High

Good afternoon

As you are aware, Minister Jones' office has requested to be informed immediately of any environmental incidents, the impacts of such and proposed actions by the department. Due to the volume and urgent nature of these alerts I have attached a template that we will use to ensure that consistent and timely responses are provided across Regional Service Delivery, a similar process to what is used for DLO responses.

The attached template is to be used to advise as soon as possible on environmental incidents, such as fish kills, mine discharges, potential environmental harm due to spills, etc. **All information is to be approved by the relevant RSD** and emailed to the following parties:

- John Bradley, Director General;
- Terry Wall , Associate Director General;
- Debbie Best, DDG
- Michael Dart, Senior Policy Advisor to Minister Kate Jones;
- Joshua Cooney, Ministerial Media Officer to Kate Jones;
- Paul Michaels, Director DERM Media unit;
- Damine Brown, ADG RSD
- Kim Harycki , PA RSD

The email is to be sent **by the RSD only**. The email heading is to read "(Minister Jones) Environmental Incident Alert - *subject*" and a brief description is to be provided in the body of the email.

This process is not intended to replace suitable briefing notes on issues when time avails or phone contact with people like me to alert on incidents in a timely way. It is intended only to provide a suitable early alert to a wide group of parties of an incident that we have been notified of. It is not intended to be an onerous process or to delay any action or response. The template should be completed as quickly as possible and if something is unknown, then write in "unknown", don't hold up providing the advice seeking further information, early is better.

I would appreciate you distributing this template to officers within your region for **immediate** use.

If you have any queries in relation to the use of this form, please contact Kim direct.

Regards

Damien Brown

Assistant Director-General

Regional Service Delivery

Telephone: [redacted]

Mobile: [redacted]

Email: [redacted]

www.derm.qld.gov.au

Department of Environment and Resource Management

Level 13

400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

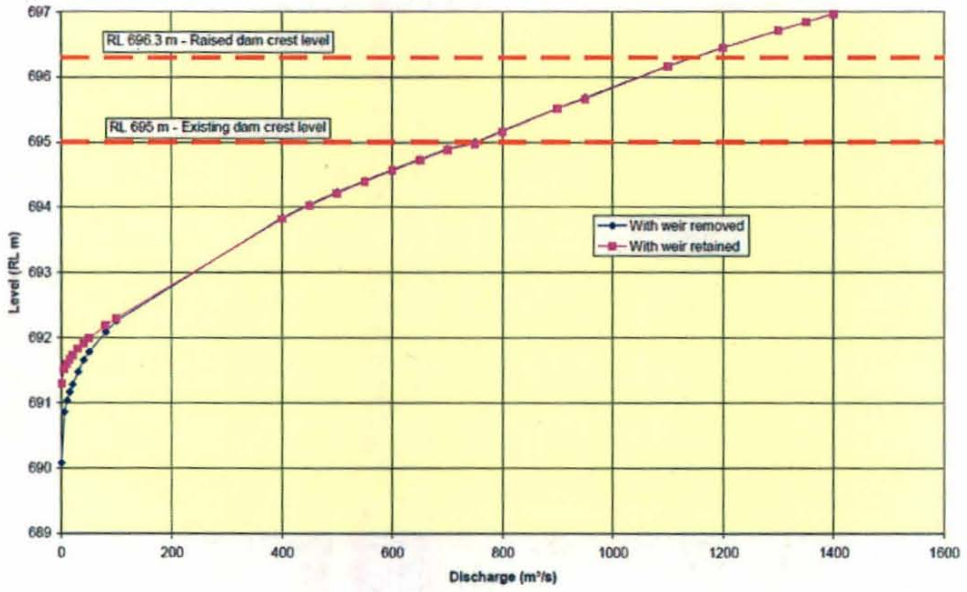
Relevant email addresses:-

[redacted]

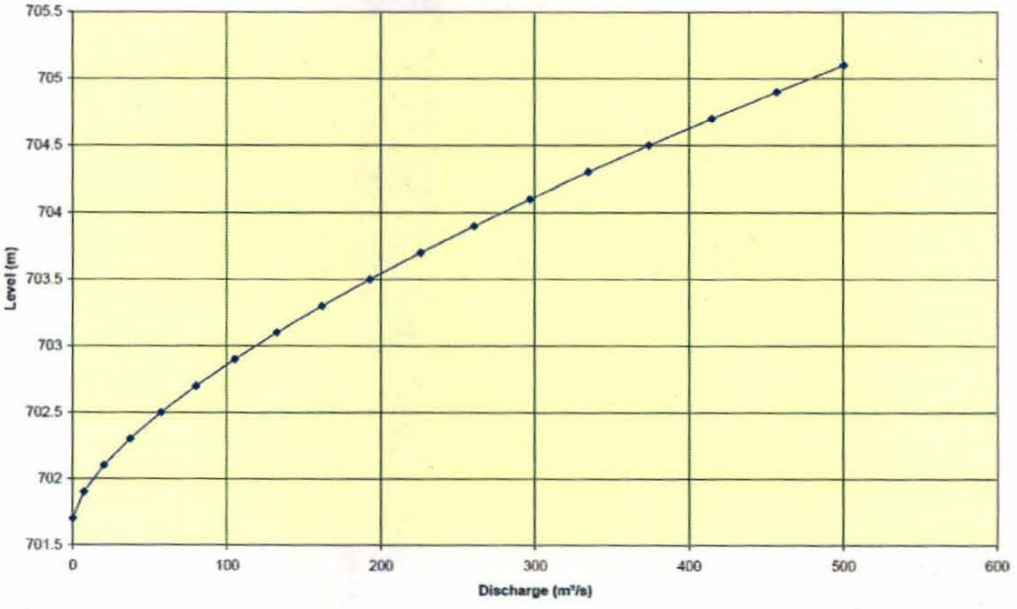
[redacted]

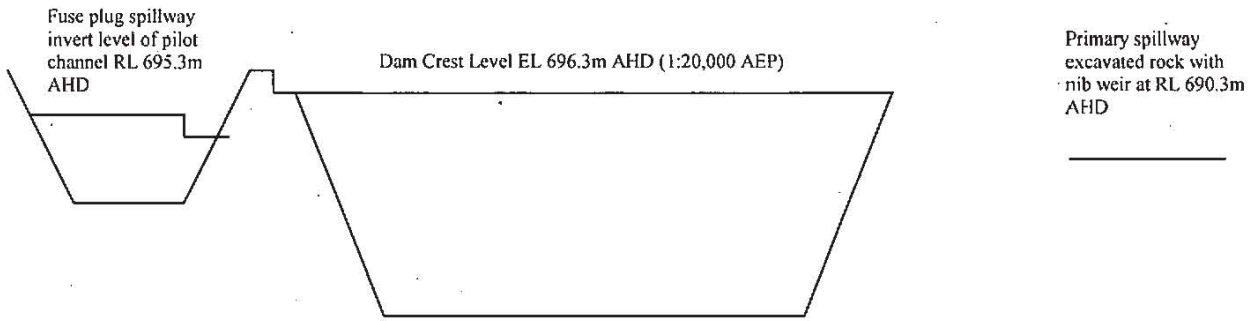
DRAWINGS

Service Spillway Rating Curve – Crooks Dam



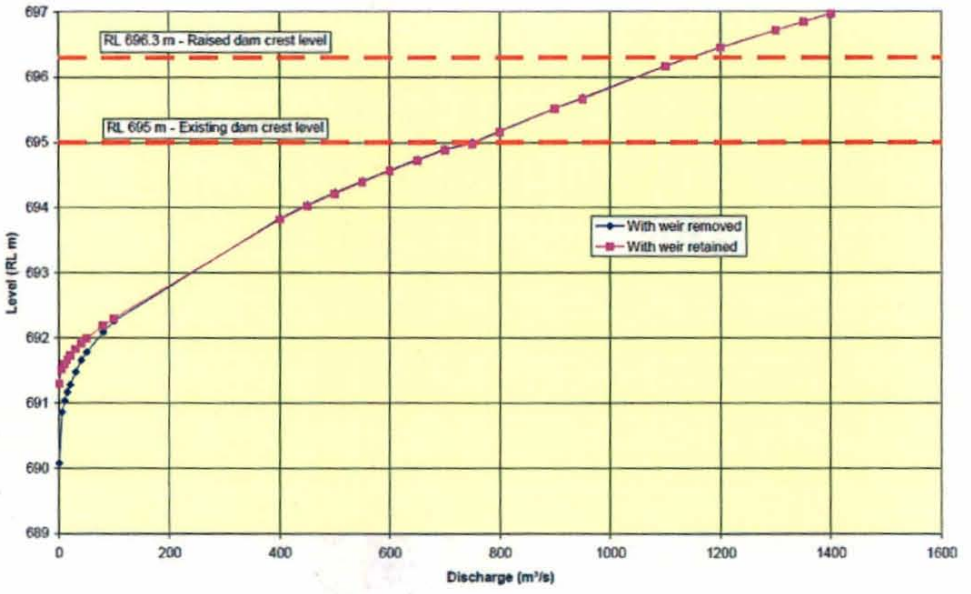
Service Spillway Rating Curve – Wyndham Dam



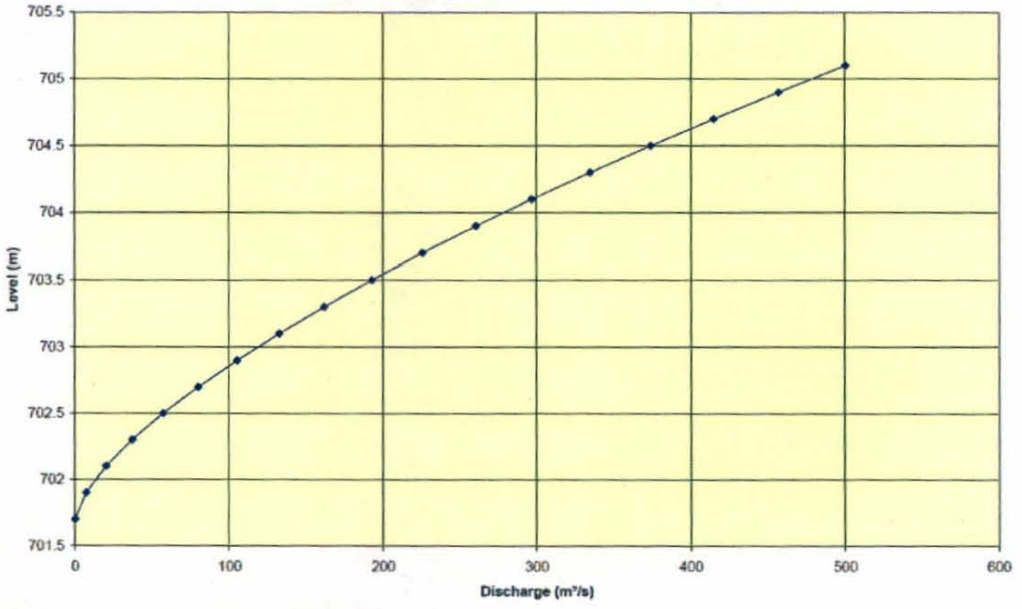

Fuse plug spillway invert level of pilot channel RL 695.3m AHD
Dam Crest Level EL 696.3m AHD (1:20,000 AEP)
Primary spillway excavated rock with nib weir at RL 690.3m AHD

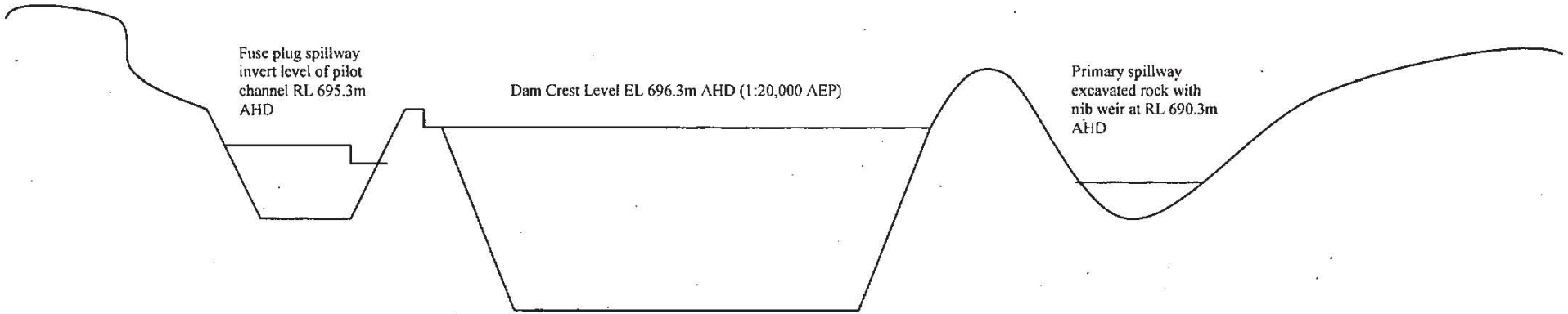
DRAWINGS

Service Spillway Rating Curve – Crooks Dam

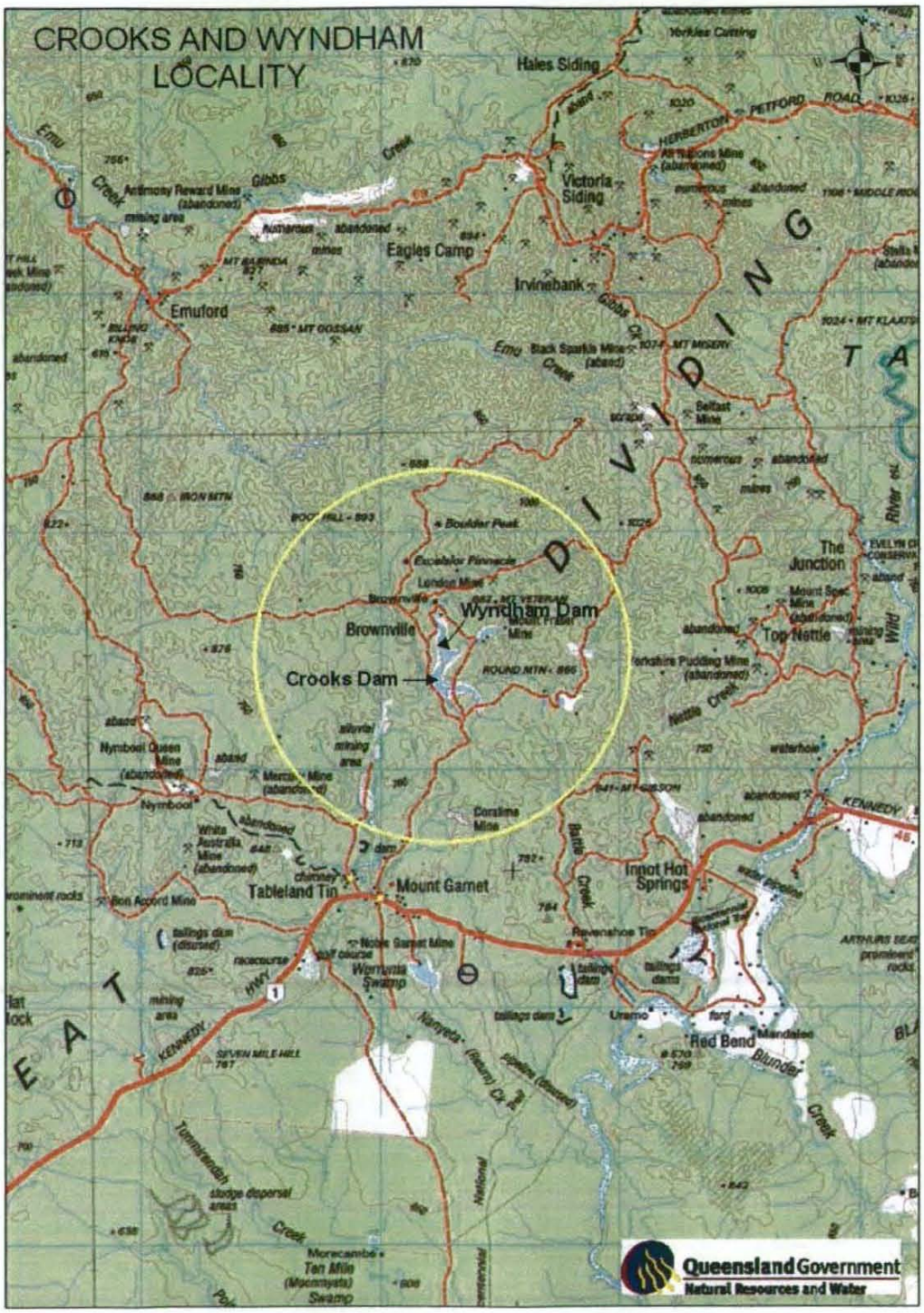


Service Spillway Rating Curve – Wyndham Dam

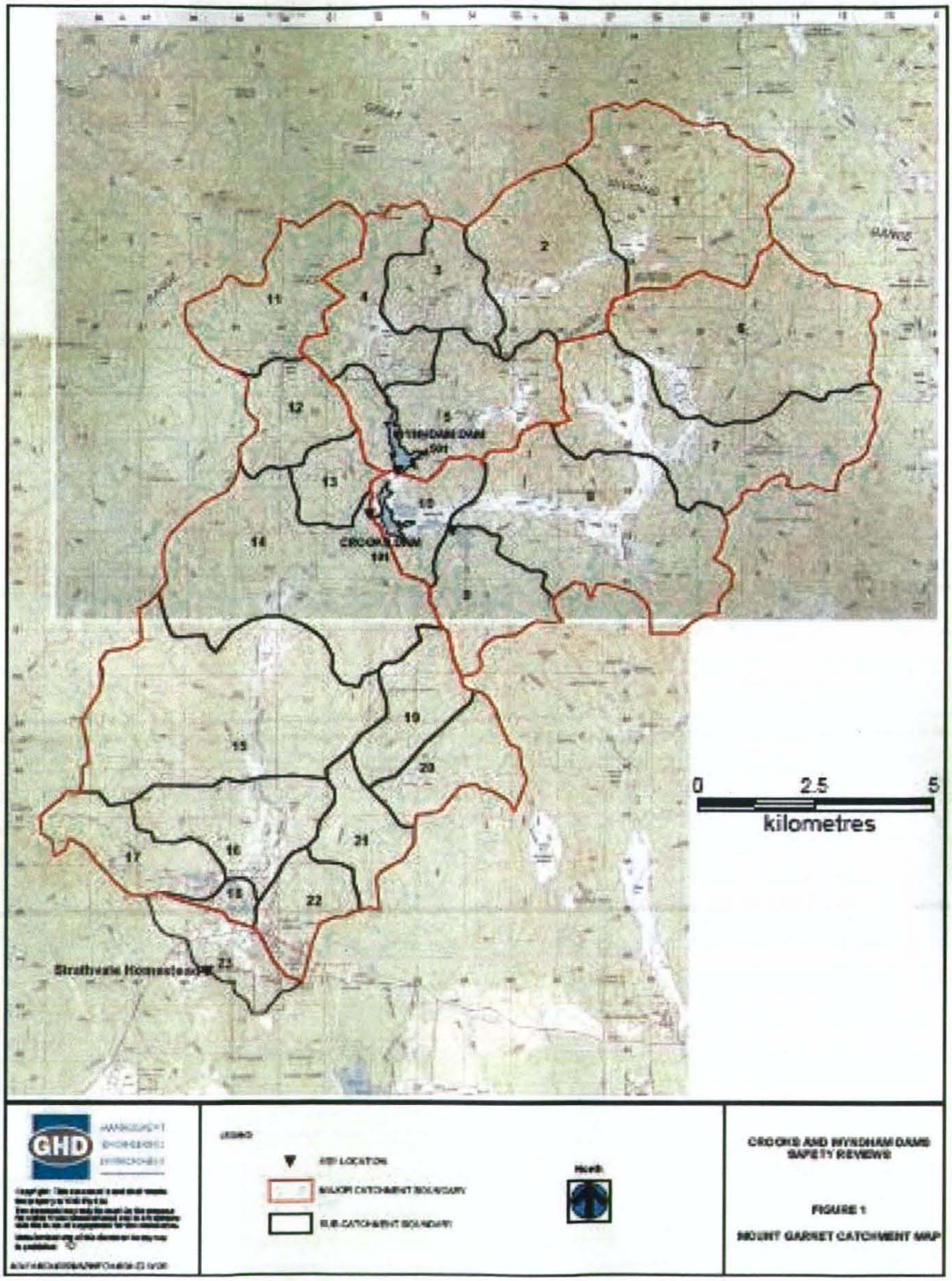



Fuse plug spillway
invert level of pilot
channel RL 695.3m
AHD
Dam Crest Level EL 696.3m AHD (1:20,000 AEP)
Primary spillway
excavated rock with
nib weir at RL 690.3m
AHD

APPENDIX 1
LOCALITY PLAN


CROOKS AND WYNDHAM
LOCALITY
Hales Siding
Victoria Siding
Eagles Camp
Irvinebank
Emuford
Wyndham Dam
Brownville
Crooks Dam
The Junction
Top Nettle
Nymboola
Tableland Tin
Mount Garnet
Innot Hot Springs
Red Bend
Queensland Government
Natural Resources and Water

APPENDIX 2
CATCHMENT BOUNDARY


WYNDHAM DAM
CROOKS DAM
Strathvale Homestead
0
2.5
5
kilometres
GHD
CROOKS AND WYNDHAM DAMS SAFETY REVIEWS
FIGURE 1
MOUNT GARRET CATCHMENT MAP

APPENDIX 3
INSPECTION SAFETY PROTOCOL

APPENDIX 3 INSPECTION SAFETY PROTOCOL

All Emergency Action Plan (EAP) officers who visit the dam site are to observe this protocol.

(1) A hand held satellite phone with backup battery to be available at all inspections.

(2) Officers on site to have UHF Radio available at all times.

(3) More than one person to be on site at all times.

(4) Inspections are to be carried out only when conditions are deemed to be safe as per inspection and risk assessment/s.

(5) During an emergency event access to dam embankments and spillways is not to be made by boat.

(7) All personnel likely to be involved are to be informed of the above, and to be made aware that they are mandatory requirements.

APPENDIX 4
POTENTIAL PROBLEM IDENTIFICATION

INSPECTION OF EMBANKMENT DAMS

INSPECTING FOR DEFICIENCIES: SUMMARY

TYPE OF DEFICIENCY	LOOK FOR
SEEPAGE	A water flow or sand boil on the lower portion of the downstream slope or toe area, especially at the groins. Wet areas or areas where the vegetation appears greener or lusher on the embankment slope or toe area. An increase in the amount of water being released from toe drains and relief wells. (Remember to take into account changes in the reservoir level.) Turbidity or cloudiness of the seepage.
CRACKING	Desiccation Cracking: A random honeycomb pattern of cracks usually found on the crest and the downstream slope. Transverse Cracking: Cracks that are perpendicular to the length of the dam usually found on the crest. Longitudinal Cracking: Cracks that are parallel to the length of the dam. Longitudinal cracks may be associated with stability problems in the slopes.
INSTABILITY	Slides on the upstream or downstream slopes. Bulging, especially at the toe of the dam.
DEPRESSIONS	Misalignment in the crest and embankment slopes found by sighting along fixed points. Sinkholes found by checking and probing each depression. Remember, sinkholes have steep, bucket like sides while minor depressions have gently sloping, bowl like sides.
MAINTENANCE CONCERNS	Inadequate Slope Protection: Check for bald areas or areas where the protection is sparse or damaged. Surface Runoff Erosion: Check for gullies or other signs of erosion. Make sure to check the low points along the upstream and downstream shoulders and groins since surface runoff can collect in these areas. Inappropriate Vegetative Growth: Check for excessive and deep rooted vegetative growth. Debris: Check for debris on and around the dam, especially near the spillways. Animal Burrows: Check for damage caused by burrowing animals.

WHEN TO GET FURTHER ASSISTANCE

Several of the deficiencies covered in this unit are very serious. If you observe any of the following deficiencies, you may need to consult with an experienced and qualified engineer:

- Sand boils or turbid seepage.
- Seepage that has increased since the last inspection (taking the reservoir level into consideration).
- Cracking that extends below the reservoir level or potential reservoir level.
- Transverse and longitudinal cracking.
- Deep seated slides or bulging associated with slides.
- Sinkholes or other large depressions.
- Deep rooted vegetation that might need to be removed.

Remember, whenever you are unsure whether or not a condition poses a threat to the safety of the dam, you should discuss your findings with an experienced and qualified engineer, Principal Engineer, Non- Commercial Assets.

APPENDIX 5
Emergency Event Phone Numbers

APPENDIX 7 EMERGENCY EVENT PHONE NUMBERS

Event Phone Numbers for EAP Officer

All Emergency Events

Police in Mareeba
Phone 07 4030 3370, A/H [redacted]

EAP Backup 1
Roye Poulson, Phone [redacted]

EAP Backup 2
Doug McAuley, Phone [redacted]

Executive Officer, Disaster Management, Tablelands Regional Council
Bob McLagan, Phone [redacted], A/H [redacted]

Principal Engineering, Non-Commercial Assets
William Steen, Phone [redacted], A/H [redacted], Mobile [redacted]

if unable to contact then:

Regional Manager, Water Services, Central West Region
Ed Donohue, Phone [redacted], A/H [redacted], Mobile [redacted]

Event Phone Numbers for Principal Engineering, Non-Commercial Assets

All Emergency Events

EAP Officer
Gary Haydon, Phone [redacted], Sat Phone [redacted]

Director Dam Safety
Peter Allen, Phone [redacted], A/H [redacted], Mobile [redacted]

Regional Manager, Water Services Central West Region
Ed Donohue, Phone [redacted], A/H [redacted] Mobile [redacted]

APPENDIX 6
PROPERTIES WITHIN INUNDATION AREA 1 in 2,500 AEP, 1 in 20,000 AEP and PMP FLOODS