EMERGENCY ACTION PLAN — KROOMBIT DAM (ID 527)

ISSUE: 10.1 — September 2023

Expiry:

Prepared by Sunwater Limited

Controlled Copy No.

Gated: No	Staffed: No

Type: RCC gravity dam with zoned earth and rock-fill embankments

Project: Kroombit EAP

File no.: 08-000371/001

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24°24'57.49" S 150°46'17.86" E

Approved by the delegate of the Chief Executive, Department of Regional Development, Manufacturing and Water until 1 September 2025.

Emergency activation quick reference – Dam Hazards

The Emergency Action Plan (EAP) for Kroombit Dam covers dam hazards evaluated within Sunwater's Dam Safety Management Program. Use the following table to select the relevant section of the EAP that deals with the dam hazard.

NOTE: The Incident Coordinator (IC) is responsible for activating the EAP unless otherwise directed by the Flood Operations Decision Maker (FODM) or Dam Safety Technical Decision Maker (DSTDM). Should the IC be unavailable, the Local Event Coordinator (LEC), Owner's Regional Representative (ORR) or Dam Duty Officer (DDO) is responsible.

Table 1: Emergency activation quick reference - Dam Hazards

Dam Hazards and section numbers	Activation levels for dam hazards			
	Alert	Lean Forward	Stand Up	Stand Down
Flood operations **See section 5**	• Storage EL 265.70 m and rising	• Storage above FSL 265.80 m NOTE: Consider interdependency and coincident flooding with Callide Dam and relevant messaging to D/S Residents	• Storage above EL 267.08 m	• Storage EL 266.00 m and falling, with no significant rainfall expected in the catchment
Piping: embankment, foundation, or abutments **See section 6**	• Increasing leakage through an embankment, the foundations, or abutments	• Increasing leakage through an embankment, the foundations, or abutments with cloudy water	• Piping condition has been established	• Risk assessment has determined that failure risk has reduced
Earthquake **See section 7**	• Earthquake confirmed or felt in the area, AND • Intensity less than 5 Modified Mercalli (MM)	• Earthquake confirmed or felt in the area, AND • Intensity greater than or equal to 5MM, OR • Intensity less than 5MM and change detected during surveillance inspection	• Earthquake confirmed or felt in the area, AND • A possible failure path has been identified	• Risk assessment has determined that failure risk has reduced
Terrorist threat/ activity or high energy impact **See section 8**	• Not applicable	• Not applicable	• Possible terrorist activity noticed at dam or threat received • Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit) • Failure in progress or likely due to impact or explosion, and sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Overturning/sliding of monoliths **See section 9**	• Indications of movement of monoliths noted such as cracking, increased seepage, or opening of joints Continued next page	• Observed increasing seepage from spillway structure, OR • Storage at or above Kroombit Dam EL 267.5 m	• Spillway failure possible due to sliding or overturning (e.g., due to obvious displacement or concrete scour at the toe of one or more monoliths), AND • Sufficient water in storage to create a dam hazard, OR • Storage at or above Kroombit Dam HW EL 268.0 m	• Stability assessment determines that sliding or overturning is unlikely.

Emergency activation quick reference – Other Emergency Situations

The EAP for Kroombit Dam covers one other emergency situation evaluated within Sunwater's Dam Safety Management Program; this is the communications failure emergency situation.

NOTE: The IC is responsible for the decision to activate the EAP. Should the IC be unavailable, the LEC or DDO is responsible for the decision.

Table 2: Emergency activation quick reference - Other Emergency Situations

Other Emergency Situations and section numbers	Activation levels		
	Communications Failure – Dam Site (DDO)	Communications Failure – Local Area (LEC/ORR)	Communications Failure – Brisbane (IC/DSTDM)
	• Site managed (DDO - becomes LEC)	• Brisbane managed by IC	• Locally managed by LEC
	Activation triggers for other emergency situations		
Communication Failure **See section 10**	• Unable to communicate to or from Dam site	• Unable to communicate to or from Local Area	• Unable to communicate to or from Sunwater Brisbane

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Document control

Authorisation of document

Name	Position/role	Signature/date
[redacted]	EAP Program Lead —Prepared for submission	[redacted] 29/09/2023

Document revision history

Issue	Date	Prepared by	Reason for change	eDOCS#
2	May 2008		Significant changes of Kroombit Dam Emergency Action Plan to reflect Sunwater Management structure and other minor changes. **Note:** Refer HB # 710727 for amendments issued.	
3	October 2011		Significant changes of Kroombit Dam Emergency Action Plan to reflect current Sunwater Management structure and other changes.	
4	October 2015		New Emergency Action Plan developed at expiry of 3E approval. Issued for consultation with Relevant Disaster Management Groups.	HB # 1825728
5	September 2016		Updates to notification & communication lists and Emergency Alert sections.	HB # 2026857
6	October 2017		Updates to notification & communication lists and minor corrections.	HB # 2224224
7	February 2018		Revised and reviewed Emergency Action Plan which includes updates that reflect the Water Legislation (Dam Safety) Amendment Act 2017, implementation of changes to Sunwater management structure, new event management roles and addition of new Emergency Activation section (*Other Emergency Situations*).	HB # 2096046
8	September 2018		Amended contacts and associated sections, e.g., Organisation chart & Controlled Copy Holders list. Minor error corrections and other non-substantive changes.	HB # 2367200
8.1	September 2019		Amended contacts and associated sections, e.g., Organisation chart & Controlled Copy Holders list. Minor error corrections and other non-substantive changes.	HB # 2471453
8.2	September 2020		Amended contacts and associated sections, e.g., Organisation chart & Controlled Copy Holders list. Minor error corrections and other non-substantive changes.	HB # 2572566
8.3	September 2021		Amended contacts and associated sections, e.g., Organisation chart & Controlled Copy Holders list. Minor error corrections and other non-substantive changes such as removing Comprehensive Risk Assessments description (2.9) and simplifying FODM role in Activation triggers (5.2.1) including removing para 5.2.2.	HB # 2653136
9.0 (Refused, not Approved)	March 2022		Revised and reviewed at expiry of approval. Includes changes to the triggers and associated actions in Sections four (Flood) and nine (Overturning) that reflect the updated data available. Error corrections and other non-substantive changes to improve readability and useability. Incorporated global non-substantive EAP changes resulting from feedback from previous internal and external reviews. Amended to comply with the new Sunwater branding. Amended contacts and associated sections.	HB # 2674836
10.0	October 2022		Addressed items listed in the Schedule of Matters from Issue 9.0 submission. Updated contacts and error corrections.	HB # 2739608
10.1	September 2023		Added Fatigue Management as section 2.5. Removed Hazard Management Toolkit from Appendix D. Removed references to chemical spill. Added Annexe and amended messaging in communication tables to comply with AWS requirements. Updated equipment in Appendix C. Non-substantive updates as part of Annual Safety Statement. Minor error corrections and readability improvements.	2813137

Controlled document distribution list

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1	Senior Operator	Sunwater, Biloela Depot
2	Operations Manager	Sunwater, Biloela
3	Emergency Action Plan Coordinator	Sunwater, Brisbane
4	Deputy Local Disaster Coordinator—Local Disaster Management Group (LDMG)	Banana Shire Council, Biloela
NOTE: Communication information for each 'Controlled Copy Holder' is attached in Appendix A.		

Electronic document distribution list

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Position	Location
Officer in Charge—Biloela Police (QPS)	Police, Biloela
District Disaster Coordinator—Gladstone District Disaster Management Group (DDMG)	Police, Gladstone
Senior Flood Forecaster	Bureau of Meteorology, Brisbane
NOTE: Communication information for each 'Electronic Copy Holder' is in Appendix A.	

1. References, abbreviations and definitions

1.1 References/associated documents

Ref	Document title	Reference/location
A	Water Supply (Safety and Reliability) Act 2008 (May 2020)	https://www.legislation.qld.gov.au/view/whole/pdf/inforce/current/act-2008-034
B	Emergency action plan for referable dam guideline (RDMW 2021)	https://www.resources.qld.gov.au/__data/assets/pdf_file/0018/84015/eap-guideline.pdf
C	Queensland State Disaster Management Plan 2018 (Queensland's Disaster Management Committee) Updated 2023	https://www.disaster.qld.gov.au/__data/assets/pdf_file/0027/339336/Interim-2023-QSDMP-V1.2.pdf
D	Queensland Government Communications and systems for public information and warnings	https://www.disaster.qld.gov.au/dmg/Response/Pages/5-6.aspx
E	Guidelines for the Development of Communication Education, Awareness and Engagement Programs (2010)	https://knowledge.aidr.org.au/media/1970/manual-45-guidelines-for-the-development-of-communication-education-awareness-and-engagement-programs.pdf
F	Queensland Emergency Alert Manual – M.1.174 (February 2022)	https://www.disaster.qld.gov.au/__data/assets/pdf_file/0027/339417/M1174-Queensland-Emergency-Alert-Manual.pdf
G	Sunwater website — Emergency Action Plans, Flood Maps and Dam Emergency Sirens	https://www.sunwater.com.au/community/preparing-for-weather-events/emergency-management/
H	Sunwater website — Emergency Notification Service	https://www.sunwater.com.au/community/preparing-for-weather-events/stay-informed/emergency-notification-service/
I	Professional Engineers Act 2002 (RPEQ) (September 2013)	https://www.legislation.qld.gov.au/view/pdf/inforce/2013-09-23/act-2002-054
J	Sunwater (internal) Kroombit Dam Comprehensive Risk Assessment	eDOCS# 2549213
K	Sunwater (Internal) Kroombit Dam Failure Impact Assessment	eDOCS# 2492706
L	Sunwater (internal) Strategic Event Procedure	Strategic Event Procedure
M	Sunwater (internal) Kroombit Dam Safety Condition Schedule	eDOCS# 1740579
N	Queensland Disaster Management Act 2003 (April 2022)	https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-2003-091
O	Queensland Disaster Management Guidelines	https://www.disaster.qld.gov.au/dmg/Pages/DM-Guideline.aspx
P	Guidelines on Selection of Acceptable Flood Capacity for Dams (ANCOLD, 2000)	ANCOLD
Q	Queensland Dam Safety Management Guidelines (DNRME October 2020)	https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0007/78838/dam-safety-management.pdf
R	Australian Rainfall and Runoff (ARR) 2016	http://book.arr.org.au.s3-website-ap-southeast-2.amazonaws.com/
S	Sunwater (internal) Kroombit Dam Operation and Maintenance Manual	Kroombit_Dam_Operation_and_Maintenance_Manual
T	Guidelines on Dam Safety Management (ANCOLD, 2003)	ANCOLD ISBN: 0-731027620
U	Guidelines on Consequence Categories for Dams (ANCOLD, 2012)	ANCOLD ISBN: 978-0-9808192-5-0
V	Guideline for Failure Impact Assessment of Water Dams (DNRME 2018)	Guideline for failure impact assessment of water dams (resources.qld.gov.au)
W	Sunwater (internal) Emergency Alert Protocol	eDOCS# 2156253
X	Water Act 2000	https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-2000-034
Y	Sunwater (Internal) Kroombit Dam Design Flood Hydrology Report	eDOCS# 2578479
Z	Fatigue Management Procedure WHS42 (Sunwater internal)	Fatigue Management Procedure

Ref	Document title	Reference/location
AA	Sunwater (internal) Standing Operating Procedure (SOP) 12 – Dam Log Books	Policies, Procedures and Guidelines - SOP12 Dam Log Books - All Documents - Default (Function and Activity) (sharepoint.com)

1.2 Abbreviations and acronyms

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AMTD	Adopted Mean Thread Distance
ANCOLD	Australian National Committee on Large Dams
BOM	Bureau of Meteorology
CED	Chief Engineer Dams
CEO	Chief Executive Officer
CRA	Comprehensive Risk Assessment
CTG	Counter Terrorism Group
D/S	Downstream
DCF	Dam Crest Flood
DCL	Dam Crest Level
DDC	District Disaster Coordinator
DDMG	District Disaster Management Group
DDMP	District Disaster Management Plan
DDO	Dam Duty Officer
DDS	Director Dam Safety
DHT	Dam Hazard Toolkit
DSR	Dam Safety Regulator
DSSC	Dam Safety Surveillance Coordinator
DSTDM	Dam Safety Technical Decision Maker
EAP	Emergency Action Plan
EA	Emergency Alert
EER	Emergency Event Report
EGMO	Executive General Manager Operations
EGME&WR	Executive General Manager Engineering & Water Resources
EL	Elevation Level
ELT	Executive Leadership Team
FCL	Fixed Crest Level
FODM	Flood Operations Decision Maker
FSL	Full Supply Level
GM	General Manager
IC	Incident Coordinator
IFHC	Incremental Flood Hazard Category
IGEM	Inspector-General Emergency Management
LB	Left Bank
LDC	Local Disaster Coordinator
LDMG	Local Disaster Management Group
LDMP	Local Disaster Management Plan
LEC	Local Event Coordinator
MAP	Manager Asset Planning
Max. OL	Maximum Operating Level
ME	Manager Environment
MM	Modified Mercalli
O&M	Operation & Maintenance
OB	Observation Bore
OC	Operations Centre
OCDO	Operations Centre Duty Officer
OCO	Operations Coordinator
OM	Operator Maintainer
OMGR	Operations Manager
OS	Operations Supervisor
ORR	Owner's Regional Representative
PAR	Population at Risk
PDSE	Principal Dam Safety Engineer
PFRM	Predictive Flood Routing Model
PLL	Probable Loss of Life
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PMPDF	Probable Maximum Precipitation Design Flood
PWRE	Principal Water Resources Engineer
QDMC	Queensland Disaster Management Committee
QFES	Queensland Fire & Emergency Services
QPS	Queensland Police Service
RB	Right Bank
RC	Regional Council
RCC	Roller Compacted Concrete
RDMW	Department of Regional Development, Manufacturing & Water
ROC	Regional Operations Centre
RPEQ	Registered Professional Engineer of Queensland
RSL	Reduced Supply Level
SCED	Senior Civil Engineer Dams
SCTN	Security and Counter Terrorism Network
SDCC	State Disaster Coordination Centre
SDF	Sunny Day Failure
SDTE	Senior Dam Technical Engineer
SES	State Emergency Service
SMS	Short Message Service
SMT	Sunwater Media Team
SO	Standby Operator
SOP	Standard Operating Procedure
SRT	Strategic Response Team
SS	Storage Supervisor
SWL	Storage Water Level
SWRE	Senior Water Resources Engineer
U/S	Upstream
WHS	Workplace Health & Safety
WQ	Water Quality

1.3 Business terms and definitions

The meaning of terms used in this section are set out in accordance with relevant legislation or as defined by operator requirements

Term	Definition
Terms defined in accordance with **Water Supply (Safety and Reliability) Act 2008** (the Act) (ref A)	
Dam hazard	Means a reasonably foreseeable situation or condition that may: • cause or contribute to the failure of the dam, if the failure may cause harm to persons or property, OR • require an automatic or controlled release of water from the dam if the release of the water may cause harm to persons or property. • NOTE: Various dam failure modes have been referred to as *hazards* in this document e.g., piping, instability, and overtopping.
Dam hazard event	Means an event arising from a *dam hazard* if: • persons or property may be harmed because of the event, AND • a coordinated response, involving two or more of the following *relevant entities*, is unlikely to be required; each *local group* and *district group* for the EAP, each local government whose area may be affected, the Chief Executive, another entity the owner of the dam considers appropriate, AND • the event is not an *emergency event*.
Disaster management plan	Of a *district group* or local government, means the group's District Disaster Management Plan (DDMP) or local government's Local Disaster Management Plan (LDMP) under ref O.
District group	For an EAP, means a district group established under ref O, section 22 whose disaster district under that Act could, under the plan, be affected by a *dam hazard*.
Emergency event	Means an event arising from a *dam hazard* if: • persons or property may be harmed because of the event, AND • any of the following apply: o a coordinated response, involving two or more of the following *relevant entities*, is likely to be required; each *local group* and *district group* for the EAP, each local government whose area may be affected, the Chief Executive, another entity the owner of the dam considers appropriate, OR o the event may arise because of a disaster situation declared under ref O, OR o an entity performing functions under the State *Disaster Management Plan* may, under that plan, require the owner of the dam to give the entity information about the event.
Local group	For an EAP, means a local group established under ref O, section 29 whose local government area could, under the plan, be affected by a *dam hazard*.
Notice response	A dam owner's written response to a notice following an assessment of an EAP by a local government or *district group*.
Referable dam	A dam, or a proposed dam after its construction, will be a referable dam if: • a failure impact assessment of the dam, or the proposed dam, is carried out under the Act, AND • the assessment states the dam has, or the proposed dam after its construction will have, a category one or category two failure impact rating, AND • the Chief Executive has, under section 349 of the Act, accepted the assessment. Also, a dam is a referable dam if: • under section 342B of the Act, the owner of a dam is given a referable dam notice and, before the effective day for the notice, does not give the Chief Executive a failure impact assessment for the dam, AND • the Chief Executive has not, under section 349 of the Act, accepted a failure impact assessment of the dam.
Relevant entity	Means each of the following under the EAP for the dam: • the persons who may be affected, or whose property may be affected, if a *dam hazard event* or *emergency event* were to happen for the dam, e.g., the owners of parcels of farmland adjacent to the dam or residents of a township • each local group and district group for the EAP • each local government whose local government area may be affected if *a dam hazard event or emergency event* were to happen • the Chief Executive • another entity the owner of the dam considers appropriate e.g., the Queensland Police Service (QPS).

Term	Definition
Terms consistent with Queensland Disaster Management Guidelines (ref P)	
Activation levels	The four levels of EAP activation are: • **Alert:** A heightened level of vigilance due to the possibility of an event occurring. No further action may be required; however, the situation should be monitored by someone capable of assessing the potential of the threat. Moving to an Alert level indicates the dam owner is getting ready to activate the Lean Forward level of the EAP if the situation deteriorates. • **Lean Forward:** An operational state characterised by a heightened level of situational awareness of an impending disaster event and a state of operational readiness. Disaster coordination centres are on standby and prepared but not activated. • **Stand Up:** The operational state where resources are mobilised, personnel are activated, and operational activities commenced. Disaster coordination centres are activated. The dam owner needs to provide an Emergency Event Report (EER) in accordance with the provision of the Act. • **Stand Down:** Transition from responding to an event back to normal core business and/or continuance of recovery operations. There is no longer a requirement to respond to the event and the threat is no longer present. The movement through these levels of activation is not necessarily sequential. It should be applied with flexibility and adaptability and be tailored to the location and event. Triggering one of these levels of activation may not necessarily mean a similar activation of LDMGs or DDMGs.
Bureau of Meteorology flood level classifications	The three levels of flooding are: • **Minor flooding:** This causes inconvenience such as closing of minor roads and the submergence of low-level bridges and makes the removal of pumps located adjacent to the river necessary. • **Moderate flooding:** This causes the inundation of low-lying areas requiring the removal of stock and/or the evacuation of some houses. Main traffic bridges may be closed by flood waters. • **Major flooding:** This causes inundation of large areas, isolating towns and cities. Major disruptions occur to road and rail links. Evacuation of many houses and business premises may be required. In rural areas widespread flooding of farmland is likely.
Concurrent Flooding	Flood flows downstream of a dam that are not a result of dam outflows; for instance, those from adjacent catchments or from the sea, and which occur in the same period as downstream releases or flooding from the dam.
Dam crest (ref Q)	The lowest elevation of the non-overflow crest section of the dam excluding handrails, parapets or wave walls that have not been designed to store water.
Dam crest flood	The flood event which, when routed through the reservoir, results in a still water reservoir level equivalent to the lowest dam crest level.
Dam failure	Dam failure is the physical collapse of all or part of a dam or the uncontrolled release of any of its contents.
Downstream releases	Downstream releases are outflows from the dam made through appurtenant structures such as spillways or outlet works that are in accordance with the design of the dam.
Earthquake	A sudden release of energy in the earth's crust or upper mantle, usually caused by movement along a fault plane or by volcanic activity, resulting in the generation of seismic waves that can be destructive. The potential consequences of an earthquake include: • settlement, sliding, or overturning of monoliths in the dam wall • initiation of seepage lines in the foundations or abutments that could lead to piping damage and potential inoperability of appurtenant works.
Flood release	A flood release from a dam occurs when catchment inflows raise the storage level above the Full Supply Level (FSL) resulting in a discharge from the spillway of the dam.
Piping	Internal scour caused by the water flow and seepage that occurs through earth dams, dam foundations, or dam abutments. The internal scour can lead to the formation of a pipe, which can lead to a failure of the dam.
Plane strike or other impact	The impact of a plane, meteorite, or other high energy item on or in close vicinity of a dam that could damage the dam structure or create a wave that could overtop the dam.
Plane strike or other impact	The impact of a plane, meteorite, or other high energy item on or in close vicinity of a dam that could damage the dam structure or create a wave that could overtop the dam.
Probable maximum flood (ref R)	The flood resulting from the *probable maximum precipitation* coupled with the worst flood-producing catchment conditions that can be realistically expected in the prevailing meteorological conditions.
Probable maximum precipitation (ref R)	The theoretical greatest depth of precipitation for a given duration that is physically possible over a particular drainage basin.
Probable maximum precipitation design flood (ref S)	The flood resulting from the *probable maximum precipitation* coupled with typical catchment conditions.

Term	Definition
Stability, main embankment	High foundation pore pressure peaks may reduce the Factor of Safety against slip circle failure to an unacceptable level.
'Sunny Day' failure	A failure that occurs at the FSL and there is no concurrent rain associated flooding.
Terrorist activity	A deliberate attempt to damage, fail or contaminate a dam.

2. Introduction

2.1 Context

Under the *Water Supply (Safety and Reliability) Act (2008)* (the Act), (ref A) the owner of a referable dam must have an approved EAP for the dam. Referable dams, by definition, would put lives at risk if they were to fail.

This EAP has been prepared in accordance with Chapter 4 of the Act. The content requirements for EAPs are contained in section 352H of the Act.

Summary of legal requirements – Section 352H

Section 352H(1) of the Act requires that the EAP must identify each dam hazard for the dam,

and for each of these dam hazard types (e.g., flood operations or piping risk):

- identify the area likely to be affected by a dam hazard event or emergency event arising from the dam hazard
- identify each circumstance that indicates a material increase in the likelihood of the dam hazard event or emergency event happening
- state when and how the owner of the dam plans to warn persons who may be harmed, or whose property may be harmed by an event caused by the dam hazard, if one happens, and/or there is a material increase in the likelihood of an occurrence, including the order of priority in which the persons or categories of persons are to be warned
- state when and how the owner plans to notify the relevant entities for the dam, if a dam hazard event or emergency event happens or, there is a material increase in the likelihood of such an occurrence, including the order of priority in which the relevant entities are to be notified
- state the actions the owner of the dam plans to take in response to a dam hazard event or emergency event.

In accordance with section 352H(2) of the Act, the EAP may provide for the dam owner to make arrangements with a relevant entity for warnings to be given by the relevant entity on behalf of the dam owner in appropriate circumstances.

Section 352HA of the Act states that before giving the Chief Executive an EAP, the owner of the dam must give a copy of the plan to each local government whose area may be affected by a dam hazard identified in the plan, and each district group for the plan.

Section 352HB of the Act states that the local government must assess the EAP for consistency with its disaster management plan. In its assessment, the local government must consult with the local district group for the plan.

Within 30 business days of receiving the EAP, the local government must give the owner of the dam a notice, which states whether it considers the plan is consistent with its disaster management plan; and if not, give reason why it considers the EAP is not consistent. The EAP must include any such notices, provided to the owner of the dam by a local government (or district group); and any responses which the owner gives to these notices. Section 352H(1) further stipulates that an EAP must include any other relevant matter prescribed by regulation.

The local government whose area may be affected by a dam hazard for Kroombit Dam has been assessed as **Banana Shire Council (BSC)**. Sunwater has provided the BSC with a copy of the draft EAP for assessment.

Section 352HC of the Act states that a district group may review the EAP for consistency with its disaster management plan. The district group for Kroombit Dam **Gladstone Police District Disaster Management Group (DDMG).** Sunwater has provided the DDMG with a copy of the draft EAP for review.

NOTE: Sunwater has attempted to write the EAP to cope with all reasonably foreseeable emergency situations. However, there is considerable uncertainty about how any emergency situation might develop and progress. Factors such as the weather, the location, the mechanics, and the rate and size of any actual failure can considerably affect any resulting flood discharges. Therefore, a significant number of assumptions have had to be made in compiling sections of the EAP. Some variation in outcome should be expected where the event differs from the assumed behaviour.

2.2 Purpose

The purpose of this EAP is:

- to minimise the risk of harm to persons or property if a dam hazard event or emergency event for the dam happens
- to identify dam hazards that could occur at Kroombit Dam and the area likely to be affected for each hazard
- to prescribe emergency actions taken by the dam owners and operating personnel in identifying and responding to dam hazards and notifying relevant entities.

It is possible for more than one dam hazard to exist at Kroombit Dam at the one time. In such a circumstance, it may be necessary to act on the procedures within separate sections simultaneously.

The focus of this EAP is the management of dam hazards at Kroombit Dam by the owner of the dam (Sunwater) and the communication and notification of dam hazards to the LDMGs, DDMGs and broader community. However, the EAP sits within the broader emergency response framework. This EAP has been developed to be consistent with and support the objectives of the Banana Shire Council Local Disaster Management Plan (LDMP) and associated sub plans.

2.3 Scope

The Kroombit Dam EAP covers:

- dam hazards evaluated within Sunwater's Dam Safety Management Program
- details about the dam that are relevant to a dam hazard
- identification of circumstances that indicates a material increase in the likelihood of a dam hazard event and/or emergency event happening
- triggers for activation of a tiered response to dam hazard event or emergency event
- roles and responsibilities in responding to a dam hazard event or emergency event
- notification, warning, and communication protocols
- inspection, monitoring, and reporting protocols during emergencies (ref D)
- other relevant information that may assist with identifying the area affected by a dam hazard event or emergency event, and the management of such.

2.4 Sunwater training

Training of the use and implementation of this EAP document is carried out at various times throughout the year. Specific pre-wet season training is undertaken leading up to the wet season. During this period, Sunwater staff complete work instructions for site preparations and from July to September carry out checks on; stores, supplies of fuel and the current EAP such as contact details for individuals and dam information.

The EAP training that is carried out on-site includes walkthroughs of new changes, scenario (role play) and Q&A to check the knowledge and competency of all those who attended. This on-site training is presented to relevant Sunwater staff (DDO's, LECs and ICs) and disaster management stakeholders. DSTDM and FODM information sessions are carried out once a year with the same walkthrough of new changes and Q&A, but this is not specific to any one dam. New Sunwater employees in these various roles also have a walkthrough of the EAP.

NOTE: All enquiries regarding EAP training should be directed to

Sunwater is also working towards carrying out exercises involving each local authority and disaster management stakeholders. Where there is more than one referable dam in a local area, the exercise could involve more than one dam, or the location will be rotated. This full test would involve the State Disaster Coordination Centre (SDCC) and include the (non- live) testing of Emergency Alerts (EAs). The test results relating to numbers of alerts generated will be shared with local authority and disaster management stakeholders.

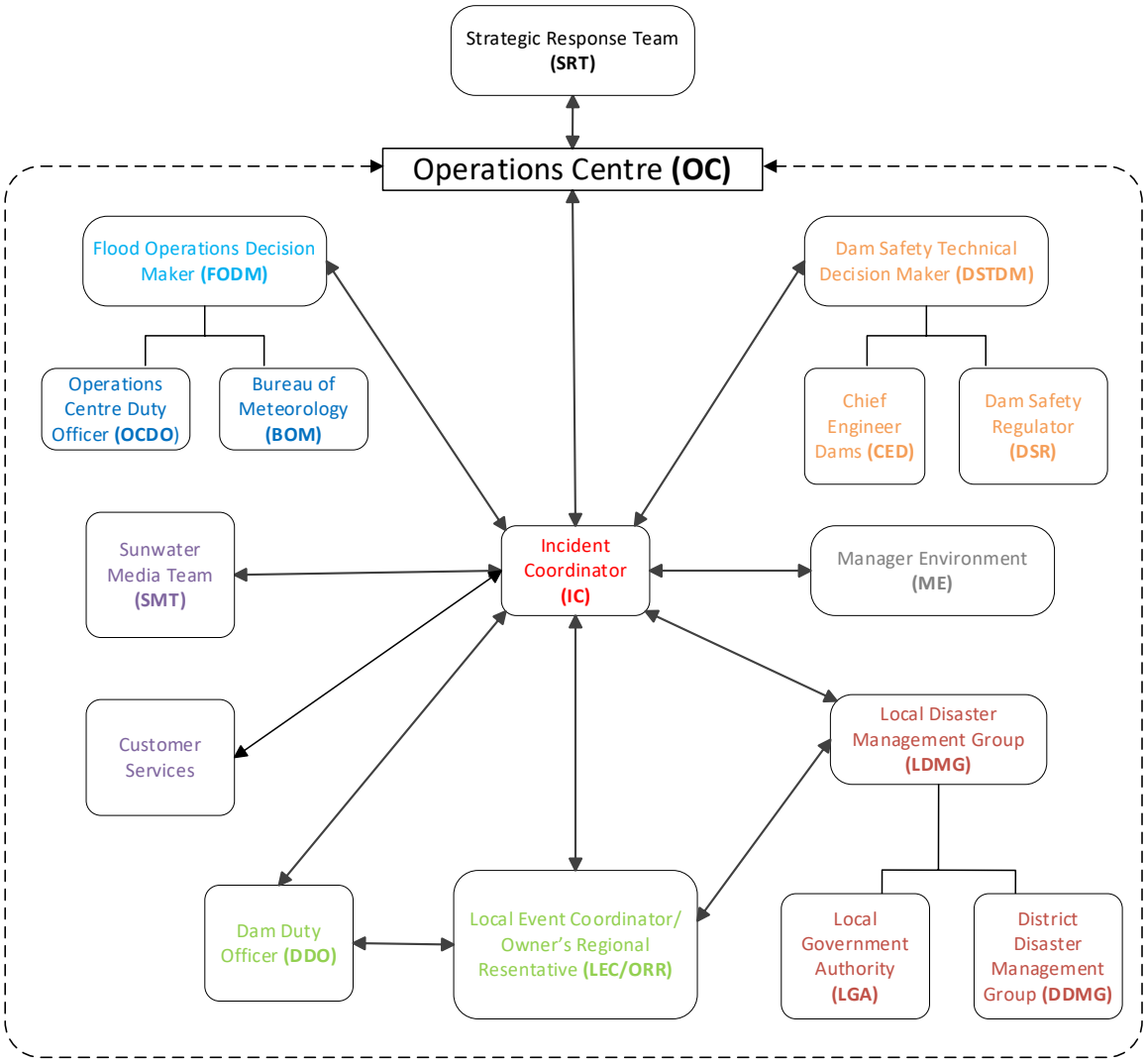
2.5 Fatigue Management Plan

Sunwater has a Fatigue Management Procedure (ref Z). This document recognises fatigue as an important workplace hazard and has identified and outlined control processes to mitigate the risk of fatigue impaired HSE incidents. A copy of Sunwater's Fatigue Management Procedure can be provided upon request.

2.6 Dam emergency organisation within Sunwater

The Sunwater emergency management framework generally utilises the organisation's hierarchy and in-house experts as illustrated in Figure 1 below.

Figure 1: Sunwater emergency response organisation



Key aspects of the dam hazard management framework are:

- Central to the framework is the role of IC for any dam hazard at a dam. The IC will maintain overall responsibility for a coordinated response to the dam hazard incident.
- The IC is responsible for activating the EAP when the dam reaches an EAP activation level, unless instructed to activate by the FODM or the DSTDM who have determined that it is reasonably likely that the dam could reach an EAP activation level. Should the IC be unavailable, the LEC followed by the DDO is responsible for the activation. If the IC loses all communications during a dam hazard, then as a fail-safe position, the LEC followed by the DDO will assume the duties and responsibilities of the IC. However, communications failure could result in some communication processes defined in this EAP not being carried out contemporaneously. As this is an identified risk, guidance has been provided to assist with mitigating this risk in Section 10 (Other emergency situation — communications failure).

- Sunwater's in-house engineering (includes FODM and DSTDM) and technical staff will provide technical advice to the IC, LEC and DDO on an as needs basis. The FODM and DSTDM will also make flood and dam engineering decisions respectively during a dam hazard. These roles are filled by Registered Professional Engineers of Queensland (RPEQs), or by experienced engineers under the direct supervision of an RPEQ and are suitably qualified professionals. Such advice will be provided within an established framework of SOPs, models, standards, and manuals wherever possible.

2.7 Community information

Sunwater with the assistance of the local councils will ensure community education around messaging and impacts of the EAP and its related events is undertaken and continually improved by incorporating actions from Lessons Learnt (section 2.8).

Sunwater proactively engages with Banana Shire Council in the development and implementation of community education and information programs for identified communities at risk of dam release scenarios where the downstream flooding can be directly related to dam outflow. This includes communication of any change to the risk profile of Kroombit Dam and educational material contextualising dam outflows with localised riverine flooding.

Sunwater currently provides information externally to customers, downstream (D/S) residents and the community in a range of methods or channels in relation to dam hazards and emergencies. Individuals can access information through Facebook, Twitter, the Sunwater web page, Sunwater App and at several show/field days across regional Queensland where Sunwater may have stalls and information available.

Notifiable D/S residents are also provided information in text messages, phone calls and emails in the event of an activation of this EAP.

In the event of an emergency event or when otherwise required, Sunwater and the affected local government also have the use of the National Emergency Alert System to send a voice message and SMS. This service is provided by Telstra and managed by Queensland Fire and Emergency Services (QFES) at the SDCC. The process Sunwater follows is documented in Appendix A8.

A copy of all Sunwater approved EAPs are available to the public on the Sunwater website (ref H). These copies are redacted to protect people's personal details.

2.8 Lessons learnt

Sunwater carries out Lessons Learnt workshops as part of its post event management. These Lessons Learnt can result in changes to the EAP. These are captured and if applicable to this document are implemented at the earliest opportunity and are made available in the next EAP update to the Dam Safety Regulator (DSR) as part of Sunwater's continual improvement of its EAPs. The Lessons Learnt actions if relevant are provided to stakeholders, such as the LDMGs, DDMGs, other dam owners and Department of Regional Development, Manufacturing and Water (RDMW) as appropriate.

In addition, Sunwater requests any post event learnings be communicated regarding operational effectiveness and areas for improvement.

2.9 Downstream notification lists

Sunwater has compiled the notification lists through an iterative process. At least every five years, Sunwater writes to all lot on plan landholders that are impacted in the downstream zones. In addition to individual letters, advertisements are placed yearly in local papers to capture any new residents in the areas. All year, applicable individuals can register to receive notifications for this EAP and are able to register either through the Sunwater website (ref H) or by calling Sunwater Customer Enquiries on 13 15 89.

3. Dam details

3.1 General dam information

Location: Kroombit Dam is located on Kroombit Creek at AMTD 68.8km, approximately 30km, by road, east of Biloela. A dam locality plan can be found in Appendix B5.

Purpose: The dam is owned and operated by Sunwater and serves as a part of the Callide Valley Water Supply Scheme, providing regular water supply for recharge of the downstream alluvial aquifers.

Kroombit Dam (Lake Kroombit) together with Callide Dam (Lake Callide), Callide Weir, Kariboe Creek Weir, Grevillea Weir, and Thangool Weir make up the water source for the Callide Valley Water Supply Scheme. It should be noted that all of the above, with the exception of Callide Dam, are for the sole purpose of groundwater recharge and only Callide Weir, Callide Dam, and Kroombit Dam are owned and operated by Sunwater.

Kroombit Dam water is released downstream into Kroombit Creek where it replenishes the underground system through the pervious bed. This is monitored by a series of strategically placed bores with the depth to the water read on a one-monthly basis at 15 sites, and a three-monthly basis on all other bores. Releases are made in such a way that all the water is used only within the benefited area. When Kroombit Dam is overtopping, the release to Kroombit Creek is by gravity over the centrally located spillway. Once the water ceases to flow over the spillway, the water is then released by way of the downstream cone valve.

Construction: Kroombit Dam's construction was completed in 1992. The dam has a main embankment with a central roller compacted concrete (RCC) spillway which is covered with facing concrete. The gravity type spillway is flanked on each abutment by central core rock-fill embankments. The outlet works are located within the RCC of the right abutment retaining wall.

Specification: The table below lists general specifications of Kroombit Dam.

Table 3: Kroombit Dam specifications

Description	Specification
Main Dam	RCC gravity dam with zoned earth and rock-fill embankments
Full Supply Level (FSL)	EL 265.80 m
Dam Crest Level (DCL)	EL 270.70 m
Dam length (m)	910 m (including 250 m spillway located at the centre of the dam)
Left embankment crest length	235 m
Right embankment crest length	425 m
Dam height above foundation	25 m
Storage capacity at FSL	14,600 ML
Storage area (at FSL)	289ha
Catchment area	336km^2
Spillway	Uncontrolled concrete ogee crest made of Roller compacted concrete and covered in facing concrete
Spillway crest level	EL 265.80 m
Spillway Design Capacity	6,360 m^3/s (549,504ML/d)
Spillway Crest Length	Left:235 m; Right: 425 m
Outlet description	1200 mm dia. RC pipe in right abutment concrete with 450 mm dia. fixed cone dispersion regulator valve in outlet valve downstream outlet structure
Outlet capacity at FSL	2.3 m^3/s at FSL (200 ML/d)

All levels are to Australian Height Datum, AHD.

Conversion for Dam is AHD = ((State Datum in feet x 0.348) + 0.303) m.

The rating and storage curves for Kroombit Dam can be found in Appendix C2 and Appendix C3.

3.2 Population at risk

The Population at Risk (PAR) from flood events through or failure of Kroombit Dam was assessed in the 2021 Comprehensive Risk Assessment (CRA). The result of this assessment is that the dam is a Category 2 referable dam, under RDMW guidelines. Category 2 dams have a PAR of greater than 100. Under ANCOLD (2012) guidelines, the dam is classed as 'High A' as the failure results in major damage and loss.

Population at risk is divided into two types: total population at risk and incremental. Total PAR includes people who are at risk due to natural catchment flooding, and incremental population at risk only includes those who are at added risk of flooding from a dam failure.

The Sunny Day Failure (SDF) of the dam would result in a PAR of 156 . The largest incremental consequence from the flood failure scenarios modelled is for the Dam Crest Flood (DCF), with an incremental PAR of 1223. The PAR are typically located on the outskirts of the Biloela township and adjacent to Washpool Gully.

The total PAR (including natural flooding and dam break) is 2706 for the same DCF event.

The CRA (ref J) for Kroombit dam was completed in 2021 and includes further information on PAR, dam break analysis and spillway adequacy. The CRA is available upon request.

3.3 Spillway adequacy

The existing spillway has the capacity to pass the 1:564,000 Annual Exceedance Probability (AEP) flood event. The Dam Crest Flood (DCF) capacity equates to 55% of PMPDF of AEP 1:2,976,000. As the Consequence Category for Kroombit Dam is ‘High A’, the ANCOLD fallback Acceptable Flood Capacity (AFC) is the Probable Maximum Precipitation (PMP) design flood.

Further details on spillway adequacy are available in the 2021 CRA (ref J).

3.4 General arrangement

The general arrangement drawings are in Appendix B1.

3.5 Inspections and monitoring

To maintain the dam and comply with regulatory requirements, the following is applicable to Kroombit Dam.

3.5.1 Inspections

- Routine Visual Inspection: Conducted as per routine surveillance Work Order or as directed by the DSTDM
- Detailed Inspection: Conducted annually
- Comprehensive Inspection: Conducted 5-yearly

3.5.2 Instrumentation and monitoring

Instrumentation at Kroombit Dam consists of:

8 x deformation survey points along the embankment crest

5 deformation survey points along the spillway crest

6 x survey control stations

Headwater gauging station and tailwater gauging stations and gauge boards

Automatic rain gauge

20 x observation bores (off-site down Kroombit Creek)

CCTV remote monitoring camera

The dam is regularly monitored by physically inspecting the structure and reading instruments that record water storage levels. The dam is surveyed every year using defined points to determine whether any movement has occurred. Regular surveillance is by way of a remote camera installation that provides images of the dam spillway and Kroombit Creek. The CCTV installation is located on the right abutment, overlooking the intake structure.

3.6 Emergency inspections and monitoring

If required, triggers for emergency inspections and monitoring of Kroombit Dam are detailed in the action tables across all the dam hazard scenarios.

4. Roles and responsibilities

Roles and responsibilities	Position holder
Owner (Sunwater) • Liaise with the Board and Minister. • Execute Sunwater Strategic Event Procedure (ref M) and Business Continuity Plans, if required. • Ensure necessary resources are available to manage any event. • Maintain an up-to-date list of notifiable D/S residents (Appendix A4 and Appendix A5) of Kroombit Dam. The downstream limit is indicated in the drawing in Appendix B2 by the zone labelled *Limit of downstream notification area*. • At all times, aim to provide timely advice and support to the LDMGs in the affected local government areas and the DDMGs in the affected disaster districts. • During a dam hazard emergency event that occurs with little or no warning, undertake the following actions to ensure the community is informed as soon as possible: o notify the residents listed in Appendix A4 and A5 via SMS o contact SDCC Watch Desk to request an Emergency Alert campaign throughout the Kroombit Dam Emergency polygons • During a dam hazard event that occurs with adequate warning; notify the residents listed in Appendix A4 via SMS, **unless otherwise agreed with the LDMGs**. • Record communications, notifications and observations as required.	CEO EGMO EGME&WR
Strategic Response Team (SRT) • Facilitate the assessment, escalation and notification and management of strategic response and recovery for a high or extreme risk, or impact, event. Responsible for the following key activities: o initial and ongoing assessment of event status and requirements o development, and revision of, strategic objectives based on requirements o identifying, managing, and monitoring strategic risks o monitor media and stakeholder/customer impacts o managing/overseeing event communications including media, stakeholder, customer and internal communications. • Record communications, notifications and observations as required.	Various ELT members as per SRT roster
Owner's Head Office Representative • Authorise the issuing of EAPs, SOPs and O&M Manuals and amendments. • Facilitate Dam Safety Training Courses for Service Managers, Operations Supervisor, Dam Operators, and other staff as appropriate and ensure that all staff required to undertake Dam Safety work are trained and accredited. • Ensure that risks identified in CRAs or other technical reports undertaken in relation to Dam Safety are included in the EAP. • Ensure visual inspections and instrumentation monitoring frequencies conform to ANCOLD Guidelines. • Ensure all Dam Safety work orders, work instructions and lesson learned outcomes are fully implemented. • Ensure requirements of the Dam Condition Schedule (ref N) are met • Ensure the work instructions are correct and the Logbooks, SOPs, Data Books and EAPs are reviewed annually as per ref N. • Undertake and prepare the 5 yearly Comprehensive Inspection Reports with suitably qualified personnel within the time specified in ref N and that work orders are created for recommendations and work is undertaken as required. • Undertake Annual Inspections and prepare reports within the time frames specified in ref N and that work orders are created for recommendations and work is undertaken as required. • Review the Dam Safety Instrumentation Database and evaluate data to verify the structural integrity of the dams on a regular basis and maintain a spread sheet for verification for audit and quality control. • Record communications, notifications and observations as required.	SCED PDSE CED MAP

Roles and responsibilities	Position holder
Owner's Regional Representative (ORR) • Liaise with the Storage Supervisor/Operator Maintainer. • Arrange dam specific training and accreditation for relevant staff. • Ensure competent, trained and accredited personnel operate the storages. • Undertake the role of LEC as required: o liaise with the Local Disaster Coordinator (LDC) or proxy o activate the EAP, when necessary o ensure the EAP is implemented appropriately and carry out the LEC role as required • Ensure all work orders, work instructions and lesson learned outcomes are fully implemented. • Record communications, notifications and observations as required.	GM Central OCO OS
Technical Advisor • Analyse the situation and provide expert technical advice. • Discuss issues with peers and other technical experts and make sound decisions to mitigate the risk • Determine response to incidents and emerging issues. • Record communications, notifications and observations as required.	ME
Dam Safety Technical Decision Maker (DSTDM) • Maintain current RPEQ accreditation. • Analyse the situation and provide expert technical advice in relation to Dam Safety. • Discuss dam hazards with peers and other technical experts and make sound decisions to reduce the risk. • Determine response to dam safety incidents and emerging issues. • Issue warning on dam failure and advise on potential remedial measures. • Liaise with DSR as required. • Ensure the EAP is implemented appropriately from a dam safety perspective and carry out the DSTDM role as required. • Record communications, notifications and observations as required.	Various personnel as per DSTDM roster
Flood Operations Decision Maker (FODM) • Maintain current RPEQ accreditation. • Provide hydrological advice in relation to predicted and actual dam outflows including assessment of weather and flood warnings and other related matters as identified in the OC SOP. • Interpret and apply rainfall data in accordance with the OC SOP, including, as required under the OC SOP, liaising with BOM. • Ensure the EAP is implemented appropriately and carry out the FODM role as required. • Record communications, notifications and observations as required.	Various personnel as per FODM roster
Operations Centre Duty Officer (OCDO) • Decide if a flood is imminent and record modes of operation • Extract data relative to the event from available sources • Utilise this data in predictive flood models and determine results from these models for approval by FODM • Liaise with the FODM or IC to update current flood situation and routing data • Record communications, notifications and observations as required	Various personnel as per FODM roster
Sunwater Media Team (SMT) • Analyse sensitive issues, discuss with the Owner, and issue media releases. • Handle public and customer comments (including social media) and advise the Owner if necessary. • Liaise with the IC and update QDMC of flood events. • Record communications, notifications and observations as required.	Various personnel as per Media Team roster
Incident Coordinator (IC) • Notify LDMGs, or councils if LDMGs not Stood Up, of intent to use the Emergency Alert. • Activate the EAP, when necessary. • Ensure the EAP is implemented appropriately and carry out the IC role as required. • Arrange Situation Reports and determine frequency, as required. • Record communications, notifications and observations as required.	Various personnel as per IC roster
Local Event Coordinator (LEC) • Refer to ORR role.	Various personnel as per LEC roster

Roles and responsibilities	Position holder
Dam Duty Officer (DDO) • Complete accreditation to operate and maintain relevant storage. • Ensure the EAP is implemented appropriately and carry out the DDO role as required. • Take direction from the DSTDM and IC as requested. • Arrange immediate site inspection and make informed assessment of the situation. • Escalate any issue not covered in the EAP or where actions are not clear. • Record communications, notifications and observations as required.	SOM SS OM
Councils Councils have legislated local government functions, as per Section 80 of ref O. These include: • Ensure it has a disaster response capability. • Approve its local disaster management plan. • Ensure information about an event or a disaster in its area is promptly given to the DDMG for the disaster district in which area it is situated. • Perform other functions given to the local government under ref O. And as per Section 352HB of the Act: • *Must* assess (in consultation with its LDMG) the EAP for consistency with the LDMP.	
Queensland Police Service (QPS) Manage the initial situation based on local operational procedures; including but not limited to: • conduct emergency operations • provide support for Local Disaster Management Groups and Sunwater during a declared emergency at the dam • liaise with relevant organisations • evacuation of persons (if required) in accordance with Roles & Responsibilities contained in the State Disaster Management Plan • control of essential traffic • security of specific area.	Local Police
Disaster Management Groups/Personnel - (In addition to requirements outlined ref O) • LDMG o As per IGEM review recommendation, work together with Sunwater and the councils to ensure community education around messaging and impacts of EAP related events is undertaken and continually improves. o Work with councils and Sunwater to ensure the EAP is regularly exercised. o Identify and coordinate the use of resources and support services that may be required for an EAP event, noting that for safety events unique to the dam Sunwater will approach councils to initiate. o During a dam hazard/emergency event, providing they are Stood Up, the LDMGs in the affected local government areas will take the lead role in notifying the broader community. o Identify and provide advice to the relevant DDMGs about support services required by the LDMG to manage an EAP event. o Provide reports and make recommendations to the relevant DDMGs about matters relating to EAP events. • QFES o Work with dam owner and LDMGs to ensure Emergency Alert polygons are prepared, stored, and tested at the State Watch Desk. • DDMG o May review the EAP for consistency with the DDMP. • SCTN (Security and Counter Terrorism Network) Coordinator o Identifies Areas of Concern during the preparation of disaster plans and provides advice during counter terrorism emergency events	LDMG QFES DDMG SCTN Coordinator
Dam Safety Regulator (DSR) • Liaise with relevant Minister on necessary actions. • Approve this document as required under legislation. • Liaise with Chief Executive as required in administering (regulating) the Act.	DDS

5. Dam hazard — flood operations

5.1 Overview

The emergency action described in this section (Dam hazard — flood operations) relates to:

- A dam hazard where natural catchment inflows fill Kroombit Dam to FSL 265.80 m and the rate of inflow exceeds the capacity of the outlet works. The spillway will then discharge water downstream into the Kroombit Creek. These flood flows can create a dam hazard. Inflows will also cause the storage to temporarily rise to above the FSL of the storage. Note:

  The greater the rate of inflow, the higher the storage will rise.

  The higher the storage level rises, the greater the loads on the dam structure.

  Although unlikely, the greater the loading, the higher the likelihood of a dam failure.

  Typically, the level of surveillance is increased during flood operations (refer Action tables in this section).
- Spillway discharge from the dam where there have been no indications that a dam failure may be initiating or in progress.

The area likely to be affected by this dam hazard is described as:

- For small flows, the water will be contained within the Kroombit Creek and will not create an emergency event.
- As the rate of discharge increases, there will be an impact on low-level road crossings of Kroombit Creek and other infrastructure in the creek such as pump sites. Detailed information on downstream flood impacts, including tables and maps
- Note areas adjacent to Washpool Gully and south of Callide Creek may also be impacted by Kroombit Dam outflows. Refer to separate Fact Sheet and Flood Map for Kroombit Dam, https://www.banana.qld.gov.au/downloads/file/277/kroombit-dam-fact-sheet-pdf
- Flooding at Biloela is primarily caused by the Washpool Gully breakout from Kroombit Creek approximately 9 km upstream of Biloela. Callide Creek also floods a large area when the full supply level of Callide Dam is exceeded. During the 2% AEP flood event, breakout flows from Washpool Gully quickly impact properties along Bailey's Lane and those fronting Tognolini-Baldwin Road and some properties in Alexandra Avenue.

The following table depicts historical floods experienced at Kroombit Dam.

Table 4: Historical floods experienced at Kroombit Dam

Flood rank	Date	Peak height EL (AHD)	Peak height (m over crest)
1	February 2015	268.36	2.56
2	January 2013	267.47	1.67
3	March 2017	267.18	1.38
4	February 2013	266.67	0.87
5	December 2010	266.66	0.86

Detailed information on downstream flood impacts is presented in Appendix B.

5.1.1 Activation triggers

Table 5: Flood emergency activation trigger summary

Alert	• Storage EL 265.70 m and rising (0.1m below FSL)
Lean Forward	• Storage above FSL 265.80 m
Stand Up—1	• Storage above EL 267.08 m (750 m^3/s)
Stand Up—2	• Storage above EL 267.78 m (1500 m^3/s)
Stand Up—3 (greater than flood of record)	• Storage above EL 268.36 m (greater than 2250 m^3/s) (Flood of record—Feb 2015)
Refer to Overturning or sliding of Monoliths Section 9 in this EAP following Stand Up-3	
Stand Down	• Storage level EL 266.00 m and falling, with no significant rainfall expected in the catchment

Note: Stand Up-4 Storage above EL 270.20 m (0.5 m below Dam Crest Level) has been superseded by the Overturning and Sliding section in this EAP (Section 9).

While this EAP is not triggered until Kroombit Dam reaches EL 265.70 m, Sunwater and Banana Shire Council LDMG will work cooperatively and will endeavour to share intelligence of any rainfall event as and when either organisation becomes aware of a situation that could result in the activation of the EAP.

In respect of forecast rainfall, as is identified in the roles and responsibilities of the FODM, regard must be had to the OC SOP.

5.1.2 Emergency action roles

Table 6 to Table 11 specify emergency actions for the following roles:

- Dam Duty Officer (DDO)
- Local Event Coordinator (LEC)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM)
- Flood Operations Decision Maker (FODM).

Table 6: Flood operations — DDO emergency action

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Up — 3 (greater than flood of record)	Stand Down
Activation trigger	• EL 265.70 m and rising • (0.1m below FSL)	• Storage above FSL 265.80 m	• Storage above EL 267.08 m (750 m^3/s)	• Storage above EL 267.78 m (1500 m^3/s)	• Storage above EL 268.36 m (greater than 2250 m^3/s)	• Storage level EL 266.00 m and falling, with no significant rainfall expected in the catchment
Actions	• Record all communication • Inspect the dam daily (or as instructed by the DSTDM) and photograph/video and record using approved forms and send to DSTDM, IC & Hydrographers • Undertake site preparations including but not limited to checking (if not already): o fuel and operation of backup generator o operations of sump pump o seal of outlet building o communication systems (including backup radio, satellite, phones, and internet) • Update Logbook as per SOP 12 (ref AA) • Notify the SO • Record the Storage Level daily (or as instructed by the DSTDM) using gauge boards and confirm accuracy of gauging station • Record river height at the tailwater gauge — daily or as instructed	• As per previous activation level, AND • Continue to inspect the dam daily (or as instructed by the DSTDM) with particular attention to: o visual inspection of flow patterns over spillway and dissipator for evidence of scouring o inspect embankment for leaks, deformation, and slumping o obvious signs of seepage, • Read dam instrumentation daily (or as instructed by the DSTDM), as shown in section 3.5.2	NOTE: At storage level 267.5 m — EAP activated for overturning or sliding of monoliths at Lean Forward (Section 8) • As per previous activation level	NOTE: At storage level 268.0 m — EAP activated for overturning or sliding of monoliths at Stand Up 1 (Section 8) • As per previous activation level	• As per previous activation level, AND • Remotely inspect the dam four times daily (or as instructed by the DSTDM) • Frequently photograph the spillway and tailwater areas, and after overtopping of the downstream abutment • Inspect for scouring or slope failures downstream of the spillway • NOTE: At storage level 268.36 m — EAP activated for overturning or sliding of monoliths at Stand Up 2 (Section 8)	• Return to routine surveillance activities and frequencies— inspect the dam for any damage and photograph any damage identified • If required, forward all relevant communication including emails, and inspection sheets for EER to: [redacted] • DDO to inspect areas with minor spalling where the contraction and construction joint intersect on the spillway at stand down. Photos of these areas must be provided to DSTDM after inspection has been carried out • DDO to inspect the area of scour damage on the left bank plunge pool at stand down. Photos of this area must be provided to DSTDM after inspection has been carried out • Update Dam Logbook as per SOP 12 (ref AA)

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ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

Table 6: Flood operations — DDO emergency action						
Activation level	**Alert**	**Lean Forward**	**Stand Up—1**	**Stand Up—2**	**Stand Up — 3 (greater than flood of record)**	**Stand Down**
	• Record rainfall — daily • Update Dam Logbook as per SOP 12 (ref AA)					
Notifications	IC SO LEC	IC SO DSTDM (as required)	IC SO DSTDM (as required)	IC SO DSTDM (as required)	IC SO DSTDM (as required)	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

Table 7: Flood operations — LEC emergency action						
Activation level	**Alert**	**Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Up — 3 (greater than flood of record)**	**Stand Down**
Activation trigger	• EL 265.70 m and rising • (0.1m below FSL)	• Storage above FSL 265.80 m	• Storage above EL 267.08 m	• Storage above EL 267.78.0 m	• Storage at or above EL 268.36 m (greater than 2250 m3/s)	• Storage level EL 266.00 m and falling, with no significant rainfall expected in the catchment
Actions	• Record all communication • Develop/implement staff roster *NOTE: IC to contact LDMGs unless LDMG1 is *Stood Up*	• As per previous activation level, AND • Ensure all abnormal observations or damage has been reported to DSTDM and IC	NOTE: At storage level 267.5 m — EAP activated for overturning or sliding of monoliths at Lean Forward (Section 8) • As per previous activation level	NOTE: At storage level 268.0 m — EAP activated for overturning or sliding of monoliths at Stand Up 1 (Section 8) • As per previous activation level	• As per previous activation level NOTE: At storage level 268.36 m — EAP activated for overturning or sliding of monoliths at Stand Up 2 (Section 8)	• If required, forward all relevant communication, including emails for EER to: [redacted] • Return to routine activities
Notifications	DDO IC LDMG*	DDO IC LDMG*	DDO IC LDMG*	DDO IC LDMG*	DDO IC LDMG*	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

Table 8: Flood operations — IC emergency action

Activation level	Alert	Lean Forward	Stand Up — 1	Stand Up — 2	Stand Up — 3 (greater than flood of record)	Stand Down
Activation trigger	• EL 265.70 m and rising • (0.1m below FSL)	• Storage above FSL 265.80 m	• Storage above EL 267.08 m (750 m^3/s)	• Storage above EL 267.78 m (1500 m^3/s)	• Storage at or above EL 268.36 m (greater than 2250 m3/s)	• Storage level EL 266.00 m and falling, with no significant rainfall expected in the catchment
Actions *NOTE: IC to contact LDMGs unless LDMG1 is *Stood Up*	• Record all communication • Liaise with Sunwater Customer Support to send SMS and email to D/S residents and phone those without mobiles • Create Incident Report record • Update intranet with EAP status	• As per previous activation level, AND • Ensure all abnormal observations or damage has been reported to DSTDM NOTE: Consider interdependency and coincident flooding with Callide Dam and relevant messaging to D/S Residents	• As per previous activation level NOTE: At storage level 267.5 m — EAP activated for overturning or sliding of monoliths at Lean Forward (Section 8)	• As per previous activation level NOTE: At storage level 268.0 m — EAP activated for overturning or sliding of monoliths at Stand Up 1 (Section 8)	• As per previous activation level NOTE: At storage level 268.36 m — EAP activated for overturning or sliding of monoliths at Stand Up 2 (Section 8)	• Deactivate EAP • Complete all internal and external notifications • Forward all relevant communication, including emails for EER to: [redacted] • Close out Incident Report record • Update intranet with EAP status • Return to routine activities
Notifications	FODM DDO LEC/ORR DSTDM SMT D/S Residents LDMG * DDMG SRT	FODM DDO LEC/ORR DSTDM SMT D/S Residents LDMG * DDMG SRT	FODM DDO LEC/ORR DSTDM SMT D/S Residents SDCC LDMG * DDMG SRT	FODM DDO LEC/ORR DSTDM SMT D/S Residents SDCC LDMG * DDMG SRT	FODM DDO LEC/ORR DSTDM SMT D/S Residents SDCC LDMG * DDMG SRT	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

Table 9: Flood operations — LEC and IC external communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
Alert	• Storage EL 265.70 m and rising •	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? What is the status? Advise of current storage level
		• D/S Residents	• SMS • Email • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS
		• LDMG	• Phone • Email	IC to contact LDMG and provide update on result of attempts to contact D/S residents with landline only.
Lean Forward	• Storage above FSL 265.80 m	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? What is the status? Advise of current storage level and whether any flood releases are due to commence Discuss any potential road/bridge closures
		• D/S Residents • (Washpool)	• SMS • Email • Phone (for those without mobiles)	Consider interdependency and coincident flooding with Callide Dam and relevant messaging. IC liaise with FODM re content of message to Washpool D/S residents (Appendix A5). *Develop messages in consultation with FODM — and LDMG if time permits otherwise use generic message below.*
		• D/S Residents	• SMS • Email • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS
		• LDMG	• Phone • Email	IC to contact LDMG and provide update on result of attempts to contact D/S residents with landline only.

Table 9: Flood operations — LEC and IC external communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
Stand Up — 1	• Storage above EL 267.08 m	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? What is the status? (*Storage is discharging into blue zone)* Advise of current storage level Advise of any forecasts you are aware of
		• D/S Residents	• SMS • Email • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.
		• LDMG	• Phone • Email	IC to contact LDMG and provide update on result of attempts to contact D/S residents with landline only.
		• SDCC Watch Desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form if required (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.

Table 9: Flood operations — LEC and IC external communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
Stand Up — 2	• Storage above EL 267.78 m (1500 m^3/s)	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? What is the status (*flooding up to blue and yellow zones expected*)? Advise of current storage level Advise of any forecasts you are aware of
		• D/S Residents	• SMS • (Phone for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS
		• LDMG	• Phone • Email	IC to contact LDMG and provide update on result of attempts to contact D/S residents with landline only.
		• SDCC Watch Desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form if required (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.

Table 9: Flood operations — LEC and IC external communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
Stand Up — 3 (Greater than flood of record)	• Storage above EL 268.36 m (greater than 2250 m^3/s)	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? What is the status? (*Storage is greater than Flood of Record/instability status*) Advise of current storage level Advise of any forecasts you are aware of
		• D/S Residents	• SMS • Email • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS .
		• LDMG	• Phone • Email	IC to contact LDMG and provide update on result of attempts to contact D/S residents with landline only.
		• SDCC Watch Desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form if required (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.
Stand Down	• Storage level EL 266.00 m and falling, with no significant rainfall expected in the catchment	• LDMG • DDMG	• Phone	Describe current situation with dam — What is the event? What is the status? Advise of current storage level Advise EAP has been deactivated
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.

Table 10: Flood operations — DSTDM emergency action						
Activation level	**Alert**	**Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Up — 3 greater than flood of record**	**Stand Down**
Activation trigger	• EL 265.70 m and rising • (0.1m below FSL)	• Storage above FSL 265.80 m	• Storage above EL 267.08 m (750 m^3/s)	• Storage above EL 267.78 m (1500 m^3/s)	• Storage above EL 268.36 m (greater than 2250 m^3/s)	• Storage EL 266.00 m and falling with no forecast increase in EL for 48 hours
Action	• Record all communication • Provide technical advice to DDO and IC on a need's basis • Review surveillance reports and determine if any additional responses are required • Review instrumentation data and determine if any additional responses are required • Advise DSR of EAP activation	• As per previous activation level	• As per previous activation level NOTE: At storage level 267.5 m —EAP activated for overturning or sliding of monoliths at Lean Forward (Section 8)	• As per previous activation level NOTE: At storage level 268.0 m —EAP activated for overturning or sliding of monoliths at Stand Up 1 (Section 8)	• As per previous activation level NOTE: At storage level 268.36 m — EAP activated for overturning or sliding of monoliths at Stand Up 2 (Section 8)	• If required, forward all relevant communication, including emails for EER to: [redacted] • Return to routine activities
Notifications	IC DDO DSR	IC DDO DSR	IC DDO DSR	IC DDO DSR	IC DDO DSR	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

Table 11: Flood operations — FODM emergency action						
Activation level	**Alert**	**Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Up — 3 greater than flood of record**	**Stand Down**
Activation trigger	• EL 265.70 m and rising • (0.1m below FSL)	• Storage above FSL 265.80 m	• Storage above EL 267.08 m (750 m^3/s)	• Storage above EL 267.78 m (1500 m^3/s)	• Storage above EL 268.36 m (greater than 2250 m^3/s)	• Storage EL 266.00m and falling with no forecast increase in EL for 48 hours
Action	• Record all communication • Extract relevant data from available sources • Update Flood models as per SOP of OC • Update and issue flood operations report • Liaise with BOM • Update DSTDM and IC re: current flood situation and PFRM results	• As per previous activation level • Monitor and inform DSTDM for next Stand-Up levels as new forecast and observed data becomes available NOTE: Consider interdependency and coincident flooding with Callide Dam and relevant messaging to D/S Residents	• As per previous activation level NOTE: At storage level 267.5 m —EAP activated for overturning or sliding of monoliths at Lean Forward (Section 8)	• As per previous activation level NOTE: At storage level 268.0 m —EAP activated for overturning or sliding of monoliths at Stand Up 1 (Section 8)	• As per previous activation level NOTE: At storage level 268.36 m — EAP activated for overturning or sliding of monoliths at Stand Up 2 (Section 8)	• If required, forward all relevant communication, including emails for EER to: [redacted] • Return to routine activities
Notifications	IC DSTDM BOM	IC DSTDM BOM	IC DSTDM DOM	IC DSTDM BOM	IC DSTDM BOM	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

6. Dam hazard — piping: embankment, foundation, or abutments

6.1 Overview

The emergency action described in this section relates to a potential dam hazard due to a piping condition through the embankment, foundations, or dam abutment. An early indicator of a piping condition can be an increase in seepage or a new area of seepage. If the seepage water is cloudy or has become cloudy, this may indicate that material is being transported and a pipe is being established.

If a pipe is established and progresses, then a dam failure may result. If a potential pipe is detected early, remedial repairs may be possible in the form of constructing a filter and weighting zone over the pipe exit if safe to do so.

The flood outlines in Appendix B3 are there to provide indicative outlines of the maximum potentially affected area of a dam hazard caused by piping. The use of these flood outlines is prescribed below:

- Use the Sunny Day Failure (SDF) outline when a dam failure is in progress or likely due to piping and no concurrent flooding or downstream releases are occurring or expected to occur, or
- Use the Probable Maximum Flood (PMF) outline when a dam failure is in progress or likely due to piping and concurrent flooding or downstream releases are occurring or expected to occur.

NOTE: Definitions for *Concurrent Flooding* and *Downstream Releases* are provided in Section 1.3.

6.1.1 Assessment of circumstances that indicate an increase in the likelihood of piping

An increase in seepage or a new area of seepage is a circumstance that could indicate an occurrence of piping. This circumstance is the trigger for the Alert status for piping.

Cloudy seepage water is a circumstance that could indicate an increased likelihood of piping. This circumstance is the trigger for the Lean Forward status for piping.

6.2 Emergency action roles

Table 12 to Table 16 specify emergency actions for the following roles.

- Dam Duty Officer (DDO)
- Local Event Coordinator (LEC)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM).

Figure 2: Piping: embankment, foundation, or abutments flowchart

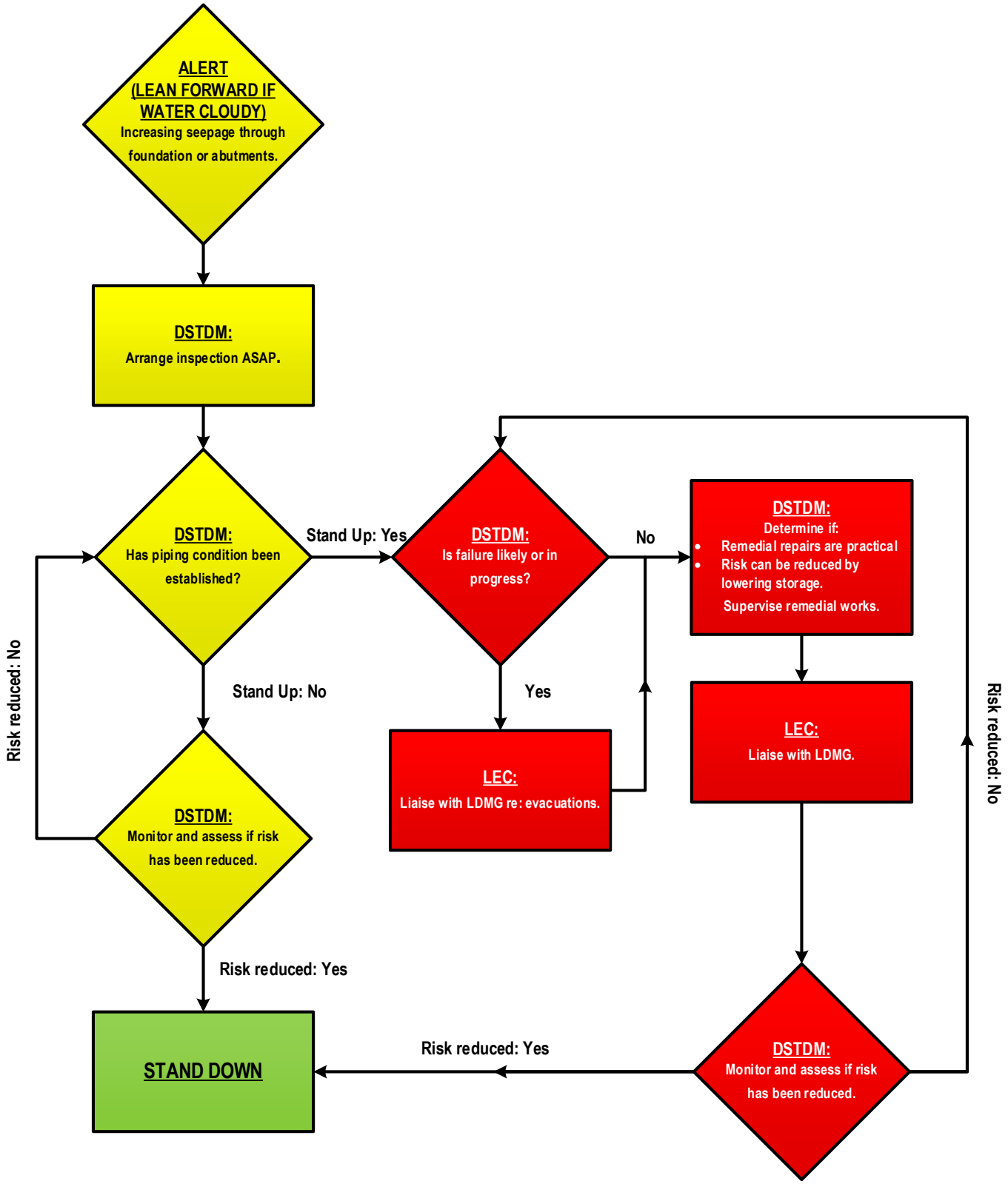


Table 12: Piping: embankment, foundation, or abutments — DDO emergency action					
Activation level	**Alert**	**Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Down**
Activation trigger	• Increasing leakage through an embankment, the foundations, or abutments	• Increasing leakage through an embankment, the foundations, or abutments WITH cloudy water	• Piping condition has been established	• Failure in progress or likely due to piping, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Actions	• Record all communication • Monitor flows every 6 hours (or as otherwise instructed by the DSTDM) • Photograph/video the piping from a safe point and record using approved forms and send to DSTDM, IC & Hydrographers • Notify SO • Update Dam Logbook as per SOP 12 (ref AA)	• As per previous activation level	• As per previous activation level, AND • Support/supervise remedial works as required • Lower the storage if directed • Close any affected roads if not already closed by others • Maintain surveillance of area immediately downstream of dam (if safe to do so) and move on any members of the public	• As per previous activation level, AND • Vacate the immediate vicinity of the piping condition	• Inspect the dam for any damage and photograph any damage identified during the event • If required, forward all relevant communication including emails, and inspection sheets for EER to: [redacted] • Update Dam Logbook as per SOP 12 (ref AA) • Return to routine surveillance activities and frequencies
Notifications	DSTDM IC SO LEC	DSTDM IC SO	DSTDM IC SO	DSTDM IC SO	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

Table 13: Piping: embankment, foundation, or abutments — LEC emergency action					
Activation level	**Alert**	**Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Down**
Activation trigger	• Increasing leakage through an embankment, the foundations, or abutments	• Increasing leakage through an embankment, the foundations, or abutments WITH cloudy water	• Piping condition has been established	• Failure in progress or likely due to piping, and • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Actions	• Record all communication *NOTE: IC to contact LDMGs unless LDMG1 is *Stood Up*	• As per previous activation level	• As per previous activation level, AND • Liaise with relevant council(s) regarding potential road/bridge closures	• As per previous activation level	• If required, forward all relevant communication, including emails for EER to: [redacted] • Return to routine activities
Notifications	DDO DSTDM IC LDMG*	DDO DSTDM IC LDMG*	DDO DSTDM IC LDMG*	DDO DSTDM IC LDMG*	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

Table 14: Piping: embankment, foundation, or abutments — IC emergency action

Activation level	Alert	Lean Forward	Stand Up — 1	Stand Up — 2	Stand Down
Activation trigger	• Increasing leakage through an embankment, the foundations, or abutments	• Increasing leakage through an embankment, the foundations, or abutments WITH cloudy water	• Piping condition has been established	• Failure in progress or likely due to piping, and • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Actions	• Record all communication • Create Incident Report record • Update intranet with EAP status *NOTE: IC to contact LDMGs unless LDMG1 is *Stood Up*	• As per previous activation level, AND • Investigate availability of machinery and materials (if insufficient stockpiles available) • Place machinery operators on standby if directed by DSTDM	• As per previous activation level, AND • Liaise with Sunwater Customer Support to send SMS to D/S residents and phone those without mobiles • Mobilise resources to undertake remedial works if directed by DSTDM	• As per previous activation level, AND • Liaise with the DSTDM to confirm that dam failure is in progress • Direct remedial works to cease if directed by the DSTDM and plant and personnel to be moved to a safe location • Liaise with DDO and DSTDM re: potential for evacuations	• Deactivate EAP • Complete all internal and external notifications • Forward all relevant communication, including emails for EER to: [redacted] • Close out Incident Report record • Update intranet with EAP status • Return to routine activities
Notifications	DDO LEC/ORR DSTDM SMT LDMG* DDMG SRT	DDO LEC/ORR DSTDM SMT LDMG* DDMG SRT	DDO LEC/ORR DSTDM SMT SDCC (if required) D/S Residents LDMG* DDMG SRT	DDO LEC/ORR DSTDM SMT SDCC D/S Residents LDMG* DDMG SRT	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

Table 15: Piping: embankment, foundation, or abutments — LEC and IC external communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
Alert	• Increasing leakage through an embankment, the foundations, or abutments	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? *(Unconfirmed piping risk)* What is the status? (Unconfirmed leakage — Investigation continues) Advise of current storage level Advise any issues you are aware of Standby for further advice
Lean Forward	• Increasing leakage through an embankment, the foundations, or abutments with cloudy water	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? *(Unconfirmed piping risk)* What is the status? (Unconfirmed leakage — Investigation continues) Advise of current storage level Advise any issues you are aware of Standby for further advice
Stand Up — 1	• Piping condition has been established	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? *(Confirmed piping risk).* What is the status? (Confirmed piping/leakage) Advise of current storage level Advise any issues you are aware of. Discuss any potential road/bridge closures Prepare for possible evacuations
		• SDCC Watch Desk	• Email & Phone	Complete Emergency Alert Request Form if required (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.
Stand Up — 2 (Failure likely)	• Failure likely due to piping; AND • Sufficient water in storage to create a dam hazard	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? *(Confirmed piping risk)* What is the status? (Possible Dam Failure) Advise of current storage level Prepare coordinated evacuations
		• SDCC Watch Desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.

Table 15: Piping: embankment, foundation, or abutments — LEC and IC external communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.
Stand Up — 2 (Failure in progress)	• Dam Failure in progress	• LDMG • DDMG • QPS	• Phone	Describe current situation with dam: What is the event? *(Confirmed piping risk)* What is the status? *(Dam Failure in Progress*) Advise of current storage level Coordinate evacuations of affected Downstream Residents and move people to higher ground
		• SDCC Watch Desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.
Stand Down	• Risk assessment has determined that failure risk has reduced	• LDMG • DDMG	• Phone	Describe current situation with Dam: What is the event? *(Dam Safety Risk — piping)* What is the status? (Dam hazard stood down) Advise risk assessment has determined that piping risk has reduced and EAP has been deactivated
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.

Table 16: Piping: embankment, foundation, or abutments — DSTDM emergency action					
Activation level	**Alert**	**Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Down**
Activation trigger	• Increasing leakage through an embankment, the foundations, or abutments	• Increasing leakage through an embankment, the foundations, or abutments with cloudy water	• Piping condition has been established	• Failure in progress or likely due to piping, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Action	• Record all communication • Arrange an inspection of the dam to assess its condition as soon as possible, when safe to do so • Determine if piping condition has been established • Monitor situation and assess risks • Advise DSR of EAP activation	• As per previous activation level	• As per previous activation level, AND • Assess risk and determine if failure likely or in progress • Determine if remedial repairs are practical • Determine if risks can be reduced by lowering storage (if the storage is required to be drawn down, then the DSTDM needs to assess the maximum rate of drawn down based on latest available data and advise in writing to IC and DDO) • Supervise* remedial repairs (if applicable)	• As per previous activation level, AND • Liaise with the IC and advise on need to recommend evacuations	• If required, forward all relevant communication, including emails for EER to: [redacted] • Return to routine activities
Notifications	DDO IC DSR	DDO IC DSR	LEC DDO IC DSR	LEC DDO IC DSR	Inform all previously notified contacts of stand down

* Supervision means provide technical oversight to the work. It does not necessarily mean on-site supervision.

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

7. Dam hazard — earthquake

7.1 Overview

The emergency action described in this section relates to a potential dam hazard due to an earthquake causing damage to the dam embankment, foundations, or dam abutment. Damage could take the form of cracking or slumping of the embankment, deformation or land slip, or increased seepage.

If damage does occur, then a dam failure may result. If damage is detected early, remedial repairs may be possible depending on the nature of the damage.

The flood outlines in Appendix B3 are there to provide indicative outlines of the maximum potentially affected area of a dam hazard caused by earthquake damage. The use of these flood outlines is prescribed below:

- Use the SDF outline when a dam failure is in progress or likely due to earthquake damage and no concurrent flooding or downstream releases are occurring or expected to occur, or
- Use the PMF outline when a dam failure is in progress or likely due to earthquake damage and concurrent flooding or downstream releases are occurring or expected to occur.

7.2 Emergency action roles

Table 17 to Table 21 to specify emergency actions for the following roles.

- Dam Duty Officer (DDO)
- Local Event Coordinator (LEC)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM).

Figure 3: Earthquake flowchart

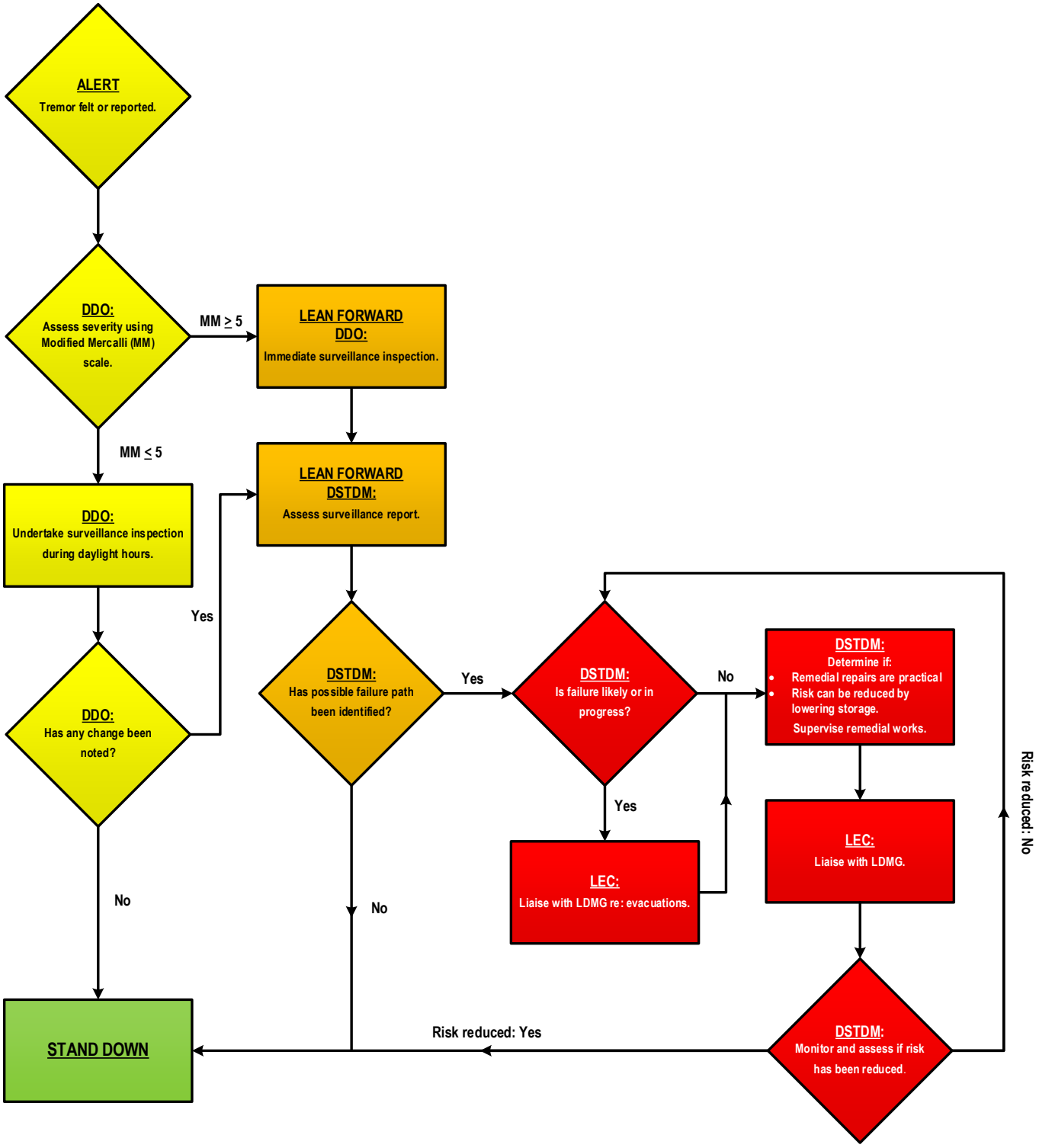


Table 17: Earthquake — DDO emergency action					
Activation level	**Alert**	**Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Down**
Activation trigger	• Earthquake confirmed (by DSTDM) or felt in the area, AND • Intensity less than 5MM~ ~DDO to assess magnitude (MM scale) at dam location	• Earthquake confirmed (by DSTDM) or felt in the area, AND • Intensity greater than or equal to 5MM~ OR • Intensity less than 5MM~ and change detected during surveillance inspection	• Earthquake confirmed (by DSTDM) or felt in the area, AND • A possible failure path has been identified	• Failure in progress or likely due to earthquake, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has been determined that failure risk has reduced
• Actions *'Confirmed' is defined as an alert received from Geoscience Australia or other source that advises an earthquake >4.9ML (Richter Scale) has occurred within a 200km radius of the dam.	• Record all communication • Inspect the dam wall, spillway structure and abutments in daylight hours (if safe to do so) and report to the DSTDM and IC—photograph/video and record using approved forms and send to IC & DSTDM • Check for leaks, deformation, erosion, and concrete damage • Maintain photographic record • Notify SO • Update Dam Logbook as per SOP 12 (ref AA)	• As per previous activation level, AND • Inspect the dam wall, spillway structure and abutments (if safe to do so) and report to the DSTDM and IC (unless inspection completed in Alert Stage) —photograph/video and record using approved forms and send to IC & DSTDM • Repeat the inspection as directed	• As per previous activation level, AND • Support/supervise remedial work as required • Lower the storage if directed • Close any affected roads if not already closed by others • Maintain surveillance of area immediately downstream of dam (if safe to do so) and move on any members of the public • Vacate the immediate vicinity of the embankment	• As per previous activation level	• Inspect the dam for any damage and photograph any damage identified during the event • If required, forward all relevant communication including emails, and inspection sheets for EER to: [redacted] • Update Dam Logbook as per SOP 12 (ref AA) • Return to routine surveillance activities and frequencies
Notifications	DSTDM IC SO LEC	DSTDM IC SO	DSTDM IC SO	DSTDM IC SO	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

Table 18: Earthquake — LEC emergency action					
Activation level	**Alert**	**Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Down**
Activation trigger	• Earthquake confirmed (by DSTDM) or felt in the area, AND • Intensity less than 5MM~ ~DDO to assess magnitude (MM scale) at dam location.	• Earthquake confirmed (by DSTDM) or felt in the area, AND • Intensity greater than or equal to 5MM~ OR • Intensity less than 5MM~ and change detected during surveillance inspection	• Earthquake confirmed (by DSTDM) or felt in the area, AND • A possible failure path has been identified	• Failure in progress or likely due to earthquake, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has been determined that failure risk has reduced
Actions	• Record all communication *NOTE: IC to contact LDMGs unless LDMG1 is *Stood Up*	• As per previous activation level	• As per previous activation level, AND • Liaise with DDO and relevant council(s) regarding potential road/bridge closures	• As per previous activation level	• If required, forward all relevant communication, including emails for EER to: [redacted] • Return to routine activities
Notifications	DDO IC LDMG*	DDO IC LDMG*	DDO IC LDMG*	DDO IC LDMG*	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

Table 19: Earthquake — IC emergency action

Activation level	Alert	Lean Forward	Stand Up — 1	Stand Up — 2	Stand Down
Activation trigger	• Earthquake confirmed* or felt in the area, AND • Intensity less than 5MM~ ~DDO to assess magnitude (MM scale) at dam location	• Earthquake confirmed* or felt in the area, AND • Intensity greater than or equal to 5MM~ OR • Intensity less than 5MM~ and change detected during surveillance inspection	• Earthquake confirmed* or felt in the area, AND • A possible failure path has been identified	• Failure in progress or likely due to earthquake, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has been determined that failure risk has reduced
Actions	• Record all communication • Create Incident Report Record • Update intranet with EAP status *'Confirmed' is defined as an alert received from Geoscience Australia or other source that advises an earthquake >4.9ML (Richter Scale) has occurred within a 200km radius of the dam. ***NOTE**: IC to contact LDMGs unless LDMG1 is *Stood Up*	• As per previous activation level, AND • Investigate availability of machinery and materials (if insufficient stockpiles available) • Place machinery operators on standby if directed by DSTDM	• As per previous activation level, AND • Liaise with Sunwater Customer Support to send SMS and email to D/S residents and phone those without mobiles • Mobilise resources to undertake remedial works if directed by DSTDM	• As per previous activation level, AND • Liaise with the DSTDM to confirm that dam failure is in progress • Cease remedial works if directed by the DSTDM and plant and personnel to be moved to a safe location	• Deactivate EAP • Complete all internal and external notifications • Forward all relevant communication, including emails for EER to: [redacted] • Close out Incident Report record • Update intranet with EAP status • Return to routine activities
Notifications	DDO LEC/ORR DSTDM SMT LDMG* DDMG SRT	DDO LEC/ORR DSTDM SMT LDMG* DDMG SRT	DDO LEC/ORR DSTDM SMT SDCC D/S Residents LDMG* DDMG SRT	DDO LEC/ORR DSTDM SMT SDCC D/S Residents LDMG* DDMG SRT	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

Table 20: Earthquake — LEC and IC external communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
Alert	• Earthquake confirmed or felt in the area, AND • Intensity less than 5MM	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? (*Dam Safety Risk — Earthquake damage*) What is the status? (Under investigation) Advise of current storage level Advise EAP has been activated Stand by for further information
Lean Forward	• Earthquake confirmed or felt in the area, AND • Intensity greater than or equal to 5MM, OR • Intensity less than 5MM and change detected during surveillance inspection	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? (*Dam Safety Risk — Earthquake damage*) What is the status? (Under investigation) Advise of current storage level Advise EAP has been activated Stand by for further information
Stand Up — 1	• Earthquake confirmed or felt in the area, AND • A possible failure path has been identified	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? (*Dam Safety Risk — Earthquake felt or reported in area*) What is the status? (Possible earthquake damage to dam) Advise current storage level. Discuss any potential road/ bridge closures Activate emergency response
		• SDCC Watch Desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form if required (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.

Table 20: Earthquake — LEC and IC external communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
Stand Up — 2 (Failure likely)	• Failure likely due to earthquake, AND • Sufficient water in storage to create a dam hazard	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? (*Dam Safety Risk — Earthquake damage*) What is the status? (Dam Failure Likely) Advise of current storage level. Discuss any potential road/bridge closures Prepare coordinated evacuation
		• SDCC Watch Desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.
Stand Up — 2 (Failure in progress)	• Dam Failure in progress	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? (*Dam Safety Risk — Earthquake damage*) What is the status? (Dam Failure in Progress) Advise of current storage level Coordinate evacuation of Downstream Residents and move people to higher ground
		• SDCC Watch Desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.
Stand down	• Risk assessment has been determined that failure risk has reduced	• LDMG • DDMG	• Phone	Describe current situation with dam — What is the event? *(Dam Safety Risk — Earthquake damage)* What is the status? (Dam hazard Stood Down) Advise risk assessment has been determined that failure risk has reduced and that EAP has been deactivated
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.

Table 21: Earthquake — DSTDM emergency action					
Activation level	**Alert**	**Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Down**
Activation trigger	• Earthquake confirmed* or felt in the area, AND • Intensity less than 5MM~ ~DDO to assess magnitude (MM scale) at dam location	• Earthquake confirmed* or felt in the area, AND • Intensity greater than or equal to 5MM~ OR • Intensity less than 5MM~ and change detected during surveillance inspection	• Earthquake confirmed* or felt in the area, AND • A possible failure path has been identified	• Failure in progress or likely due to earthquake, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has been determined that failure risk has reduced
Action	• Record all communication • Review surveillance inspection of the dam and assess its condition as soon as possible • Review instrumentation data and determine if any additional responses are required • Monitor situation and assess risks • Advise DSR of EAP activation *'Confirmed' is defined as an alert received from Geoscience Australia or other source that advises an earthquake >4.9ML (Richter Scale) has occurred within a 200km radius of the dam.	• As per previous activation level, AND • Determine if there are any possible failure paths from reported damage	• As per previous activation level, AND • Assess risk and determine if failure likely or in progress • Determine if remedial repairs are practical • Determine if risks can be reduced by lowering storage — if the storage is required to be drawn down, then the DSTDM needs to assess the maximum rate of drawn down based on latest available data and advise in writing to IC and DDO • Supervise^ remedial repairs (if applicable) ^Supervision means provide technical oversight to the work. It does not necessarily mean on-site supervision.	• As per previous activation level	• If required, forward all relevant communication, including emails for EER to: [redacted] • Return to routine activities
Notifications	DDO IC DSR	DDO IC DSR	LEC/ORR DDO IC DSR	LEC/ORR DDO IC DSR	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

8. Dam hazard — terrorist threat/activity or high energy impact

8.1 Overview

The emergency action described in this section relates to a potential dam hazard due to a terrorist threat or activity or a high energy impact on the dam such as a plane crash or meteorite.

The vulnerability of Kroombit Dam to a terrorist attack is low.

The flood outlines in Appendix B3 are there to provide indicative outlines of the maximum potentially affected area of a dam hazard caused by a terrorist attack. The use of these flood outlines is prescribed below:

- Use the SDF outline when a dam failure is in progress or likely due to a terrorist attack and no concurrent flooding or downstream releases are occurring or expected to occur, or
- Use the PMF outline when a dam failure is in progress or likely due to a terrorist attack and concurrent flooding or downstream releases are occurring or expected to occur.

8.1.1 Assessment of circumstances that indicates an increase in the likelihood of terrorist activity or high energy impact

Advice from authorities of a specific risk to water infrastructure is a circumstance that could indicate increased likelihood of a terrorist threat. If this were specific enough to name a dam, this circumstance would trigger Stand Up — 1 activation level.

8.2 Emergency action roles

Table 22 to Table 26 specify emergency actions for the following roles.

- Dam Duty Officer (DDO)
- Local Event Coordinator (LEC)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM).

Figure 4: Terrorist threat/activity or high energy impact flowchart

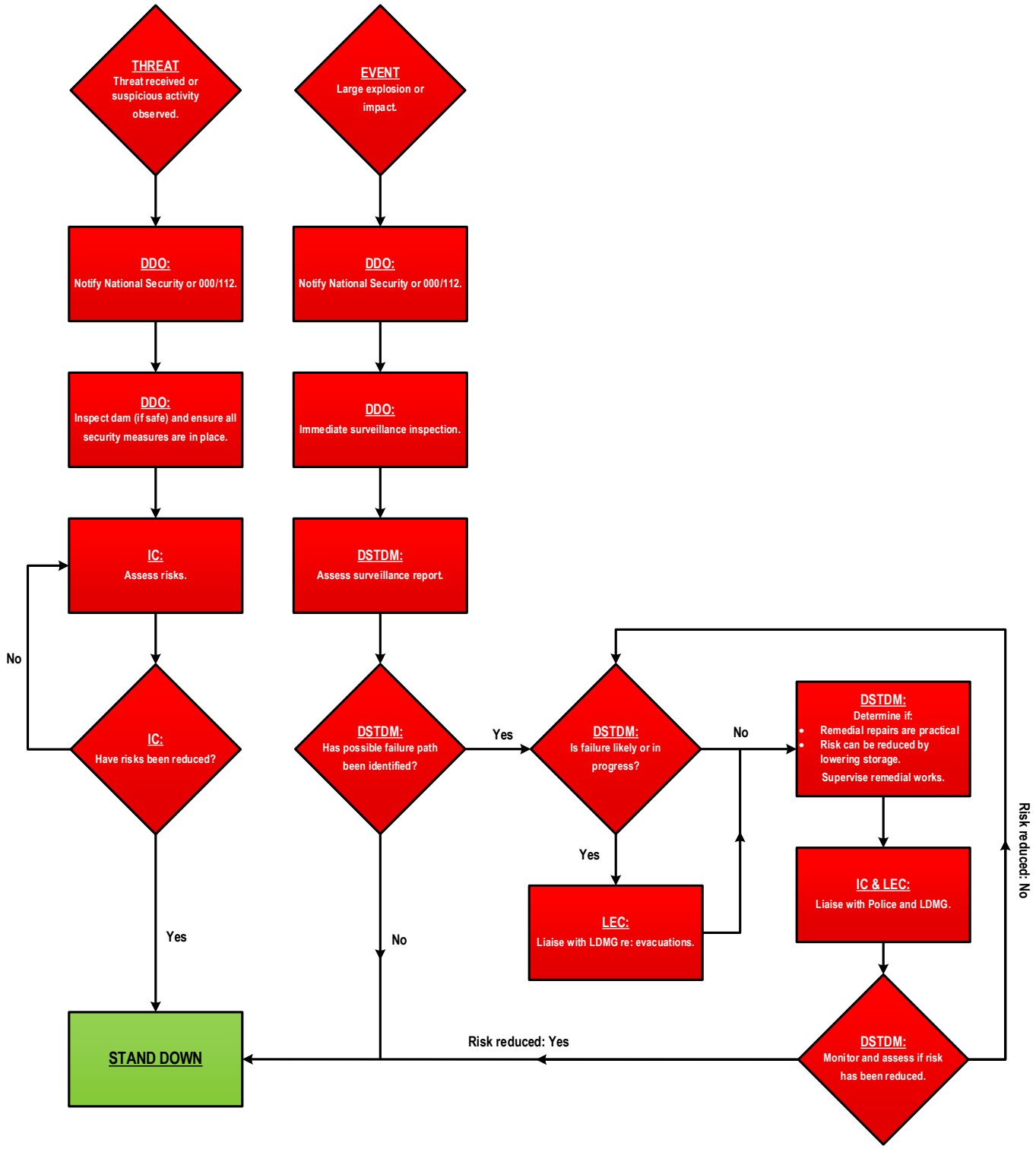


Table 22: Terrorist threat/activity or high energy impact — DDO emergency action					
Activation level	**Alert/Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Up — 3**	**Stand Down**
Activation trigger	• Not applicable	**THREAT** • Possible terrorist activity/suspicious behaviour noticed at the dam, OR • Threat received	**EVENT** • Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit)	**RESPONSE** • Failure in progress or likely due to impact or explosion, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Actions	• Not applicable	• In an emergency call 000. • Record all communication • If any suspicious behaviour noticed, contact DSTDM for advice and if instructed or if threat received, complete the following: • Inspect dam (if safe) and ensure all security measures are in place (locked gates, etc.) • Photograph/video the damage from a safe point and record using approved forms and send to DSTDM, IC & Hydrographers • If Police appoint Incident Manager support and follow instructions • Close any affected roads as directed and move on any members of the public • Notify SO • Update Dam Logbook as per SOP 12 (ref AA)	• As per previous activation level, AND • Vacate the immediate vicinity of the affected area	• As per previous activation level, AND • Lower reservoir level, if directed by DSTDM	• Inspect the dam for any damage and photograph any damage identified during the event • If required, forward all relevant communication including emails, and inspection sheets for EER to: [redacted] • Update Dam Logbook as per SOP 12 (ref AA) • Return to routine surveillance activities and frequencies
Notifications	Not applicable	#000 Emergency DSTDM IC SO LEC	#000 Emergency DSTDM IC SO	#000 Emergency DSTDM IC SO	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

Table 23: Terrorist threat/activity or high energy impact — LEC emergency action					
Activation level	**Alert/Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Up — 3**	**Stand Down**
Activation trigger	• Not applicable	**THREAT** • Possible terrorist activity/suspicious behaviour noticed at the dam, OR • Threat received	**EVENT** • Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit)	**RESPONSE** • Failure in progress or likely due to impact or explosion, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Actions	• Not applicable	• Record all communication • If Police appoint Incident Manager support and follow instructions • Monitor situation and assess risks • Liaise with relevant council(s) regarding possible road/bridge closures *NOTE: IC to contact LDMGs unless LDMG1 is *Stood Up*	• As per previous activation level	• As per previous activation level, AND • Liaise with DDO, DSTDM, and LDMG re: potential for evacuations	• If required, forward all relevant communication, including emails for EER to: [redacted] • Return to routine activities
Notifications	• Not applicable	DDO IC LDMG*	DDO IC LDMG*	DDO IC LDMG*	As required

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

Table 24: Terrorist threat/activity or high energy impact — IC emergency action

Activation level	Alert/Lean Forward	Stand Up — 1	Stand Up — 2	Stand Up — 3	Stand Down
Activation trigger	• Not applicable	**THREAT** • Possible terrorist activity/suspicious behaviour noticed at the dam, OR • Threat received	**EVENT** • Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit)	**RESPONSE** • Failure in progress or likely due to impact or explosion, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Actions	• Not applicable	• Record all communication • If Police appoint Incident Manager support and follow instructions • Monitor situation and assess risks • Create Incident Report record • Update intranet with EAP status *NOTE: IC to contact LDMGs unless LDMG1 is *Stood Up*	• As per previous activation level, AND • Liaise with Sunwater Customer Support to send SMS and email to D/S residents and phone those without mobiles	• As per previous activation level, AND • Liaise with DDO, DSTDM, and LEC re: potential for evacuations • Mobilise resources to undertake remedial works if directed by DSTDM	• Deactivate EAP • Complete all internal and external notifications • If required, forward all relevant communication, including emails for EER to: [redacted] • Close out Incident Report Record • Update intranet with EAP status • Return to routine activities
Notifications	Not applicable	CTG (if required) DDO LEC/ORR DSTDM SMT LDMG* DDMG SRT	CTG (if required) DDO LEC/ORR DSTDM SMT SDCC D/S Residents LDMG* DDMG SRT	CTG (if required) DDO LEC/ORR DSTDM SMT SDCC D/S Residents LDMG* DDMG SRT	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

Table 25: Terrorist threat/activity or high energy impact — LEC and IC external communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
Alert	**ALERT NOT APPLICABLE**			
Lean Forward	**LEAN FORWARD NOT APPLICABLE**			
Stand Up — 1	**THREAT** • Possible terrorist activity/suspicious behaviour noticed at the dam, OR • Threat received	• LDMG • DDMG • CTG	• Phone	Describe current situation with dam: What is the event? (*Dam Safety Risk — Security threat/ impact/explosion, etc.*) What is the status? (Received/noted terrorist threat) Discuss any potential road/bridge closures Activate emergency response
Stand Up — 2	**EVENT** • Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit)	• LDMG • DDMG • CTG	• Phone	Describe current situation with dam: What is the event? (*Dam Safety Risk — Security threat/ impact/explosion, etc.*) What is the status? (Under Investigation) Discuss any potential road/bridge closures (if not discussed at Stand Up — 1) Prepare coordinated evacuation
		• SDCC Watch desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form if required (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.

Table 25: Terrorist threat/activity or high energy impact — LEC and IC external communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
Stand Up — 3	**RESPONSE** • Failure in progress or likely due to impact or explosion, AND • Sufficient water in storage to create a dam hazard	• LDMG • DDMG • CTG	• Phone	Describe current situation with dam: What is the event? (*Dam Safety Risk — Security threat/ impact/ explosion, etc.*) What is the status? (Dam Failure Likely/In Progress) Initiate evacuations
		• SDCC Watch Desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.
Stand Down	• Risk assessment has determined that failure risk has reduced	• LDMG • DDMG • CTG	• Phone	Describe current situation with dam: What is the event? (Dam Safety Risk — Security threat/ impact/explosion, etc.) What is the status? (Dam hazard Stood Down) Advise that failure risk has been reduced and EAP has been deactivated
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.

Table 26: Terrorist threat/activity or high energy impact — DSTDM emergency action					
Activation level	**Alert/Lean Forward**	**Stand Up — 1**	**Stand Up — 2**	**Stand Up — 3**	**Stand Down**
Activation trigger	• Not applicable	**THREAT** • Possible terrorist activity/suspicious behaviour noticed at the dam, OR • Threat received	**EVENT** • Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit)	**RESPONSE** • Failure in progress or likely due to impact or explosion, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Action	• Not applicable	• Record all communication • Advise DSR of EAP activation	• As per previous activation level, AND • Arrange an inspection of the dam and assess its condition as soon as possible, when safe to do so • Monitor situation, assess risks, and determine if failure likely or in progress • Determine if remedial repairs are practical • Determine if risks can be reduced by lowering storage — if the storage is required to be drawn down, then the DSTDM needs to assess the maximum rate of drawn down based on latest available data and advise in writing to IC and DDO • Supervise^ remedial repairs (if applicable)	• As per previous activation level, AND • Liaise with the IC and LEC and advise on need to recommend evacuations ^Supervise means provide technical oversight to the work. It does not necessarily mean on-site supervision.	• If required, forward all relevant communication, including emails for EER to: [redacted] • Return to routine activities
Notifications	Not applicable	IC DDO DSR	IC DDO LEC/ORR DSR	IC DDO LEC/ORR DSR	As required

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

9. Dam hazard—overturning or sliding of monoliths

9.1 Overview

The emergency action described in this section relates to a potential dam hazard due to overturning or sliding of one or more of the concrete monoliths.

If one or more monoliths become unstable, a dam failure may result. If movement is detected early, remedial actions may be possible depending on the nature of the damage.

The stability of the dam in its current configuration has been fully evaluated. Overturning or sliding of a monolith may be possible for the levels outlined in the Emergency Action Tables.

It is possible that an unstable situation could eventuate that would lead to a dam failure. The most likely cause of a change that could lead to an unstable situation would be scouring at or near the toe of a monolith during a flood.

The area likely to be affected by this dam hazard is described as:

if dam failure does not occur then there will not be any area affected

if dam failure does occur with no concurrent flooding, then the maximum affected area is the level shown by the SDF line on the maps in Appendix B3

if dam failure does occur with concurrent flooding, then the maximum possible affected area is the level shown by the PMF (with dam break) line on the maps in Appendix B3

If the DSTDM forms the view that significant scouring is occurring, then the need for evacuations should be considered by disaster management authorities.

9.1.1 Assessment of circumstances that potentially indicates an increase in the likelihood of overturning

An earthquake is a circumstance that could indicate an increased likelihood of overturning. Inspections following an earthquake would identify if any movement had taken place which is the alert status for overturning.

An increase in lake level beyond 268.36 m is a circumstance that could indicate an increased likelihood of overturning. This circumstance is the trigger for the lean forward status for overturning or sliding.

An increase in seepage is a circumstance that could indicate an increased likelihood of overturning. This circumstance is the alert status for overturning.

9.2 Emergency action roles

Table 27 to Table 31 specify emergency actions for the following roles:

- Dam Duty Officer (DDO)
- Local Event Coordinator (LEC)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM).

Figure 5: Overturning or sliding of monoliths flowchart

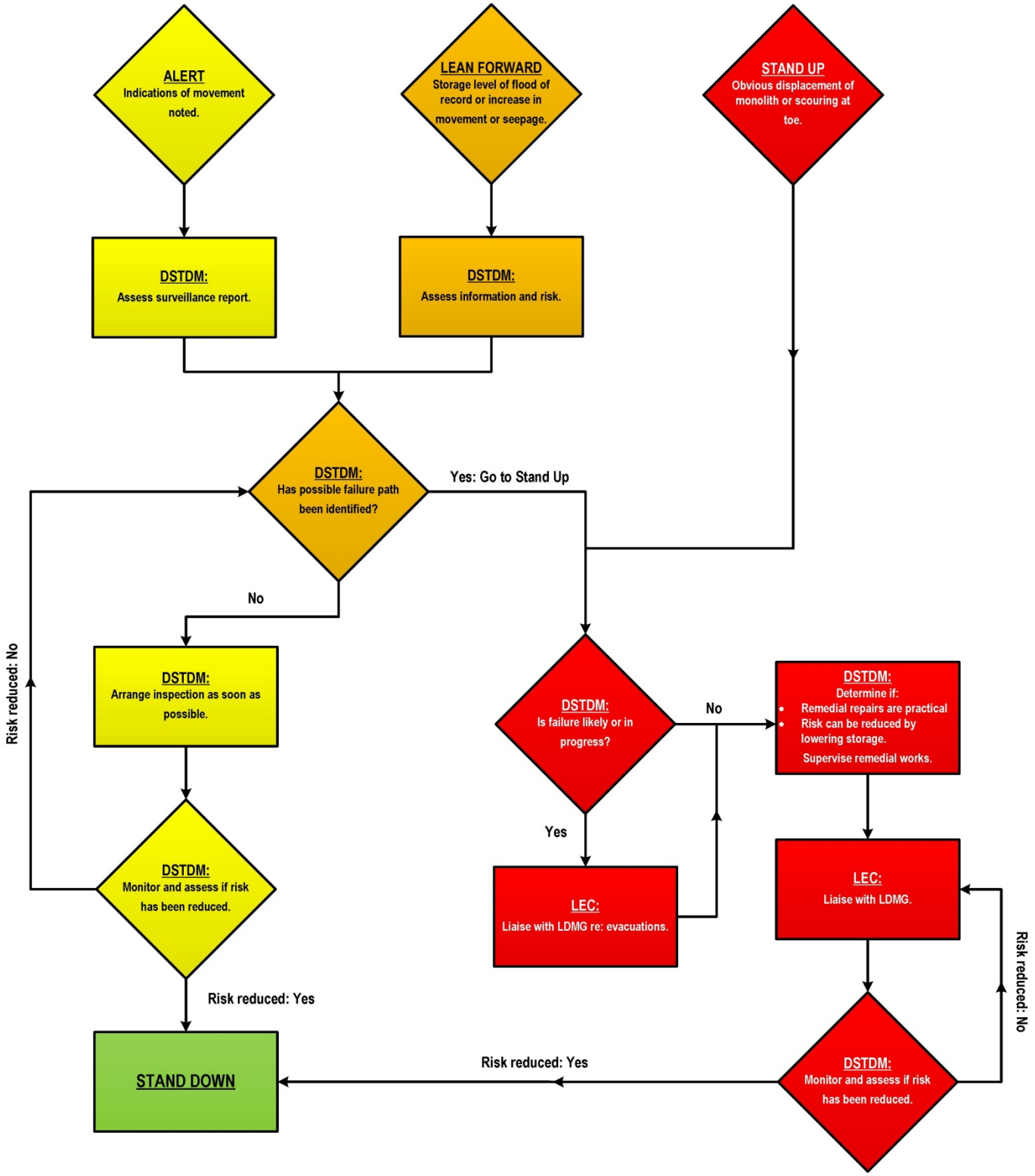


Table 27: Overturning or sliding of monoliths—DDO emergency action						
Activation level	**Alert**	**Lean Forward**	**Stand Up — 1 (Failure Possible)**	**Stand Up — 2 (Failure Likely)**	**Stand Up – 3 (Failure Underway)**	**Stand Down**
Activation trigger	• Indications of movement of monoliths noted such as cracking, increased seepage, or opening of joints	• Observed increasing seepage from spillway structure, OR • At or above Kroombit Dam HW EL 267.5 m	• Spillway failure possible due to sliding or overturning (e.g., due to obvious displacement or concrete scour at the toe of one or more monoliths), AND • Sufficient water in storage to create a dam hazard, OR • At or above Kroombit Dam HW EL 268.0 m	• Spillway failure likely due to sliding or overturning, AND • Sufficient water in storage to create a dam hazard, OR • At or above Kroombit Dam HW EL 268.36 m	• Spillway failure in progress due to sliding AND • Sufficient water in storage to create a dam hazard	• Stability assessment determines that sliding or overturning is unlikely
Actions	• Record all communication • Measure, record and report foundation drain pressures to DSTDM. • Monitor dam every 6 hours (or as otherwise instructed by the DSTDM) until a decreasing trend is observable • Photograph/video the piping from a safe point and record using approved and send to IC & DSTDM • Notify SO • Update Dam Log- Book as per SOP 12 (ref AA)	• As per previous activation level	• As per previous activation level, AND • Lower the storage if directed • Close any affected roads if not already closed by others • Maintain surveillance of area immediately downstream of dam (if safe to do so) and move on any members of the public	• As per previous activation level, AND • Vacate the immediate vicinity of the dam	• As per previous activation level	• If required, forward all relevant communication, including emails for EER to: [redacted] • Update Dam Logbook as per SOP 12 (ref AA) • Return to routine activities
Notifications	DSTDM IC SO LEC	DSTDM IC SO	DSTDM IC SO	DSTDM IC SO	DSTDM IC SO	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

Table 28: Overturning or sliding of monoliths—LEC emergency action						
Activation level	**Alert**	**Lean Forward**	**Stand Up — 1 (Failure Possible)**	**Stand Up — 2 (Failure Likely)**	**Stand Up — 3 (Failure Underway)**	**Stand Down**
Activation trigger	• Indications of movement of monoliths noted such as cracking, increased seepage, or opening of joints	• Observed increasing seepage from spillway structure, OR • At or above Kroombit Dam HW EL 267.5 m	• Spillway failure possible due to sliding or overturning (e.g., due to obvious displacement or concrete scour at the toe of one or more monoliths), AND • Sufficient water in storage to create a dam hazard, OR • At or above Kroombit Dam HW EL 268.0 m	• Spillway failure likely due to sliding or overturning, AND • Sufficient water in storage to create a dam hazard, OR • At or above Kroombit Dam HW EL 268.36 m	• Spillway failure in progress due to sliding or overturning, AND • Sufficient water in storage to create a dam hazard	• Stability assessment determines that sliding or overturning is unlikely
Actions	• Record all communication *NOTE: IC to contact LDMGs unless LDMG1 is *Stood Up*	• As per previous activation level	• As per previous activation level, AND • Liaise with relevant council(s) regarding potential road/bridge closures	• As per previous activation level, AND • Liaise with IC and LDMG re: potential for evacuations	• As per previous activation level	• If required, forward all relevant communication, including emails for EER to: [redacted] • Return to routine activities
Notifications	IC DDO LDMG*	IC DDO LDMG*	IC DDO LDMG*	IC DDO LDMG*	IC DDO LDMG*	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings [redacted]

Table 29: Overturning or sliding of monoliths—IC emergency action

Activation level	Alert	Lean Forward	Stand Up — 1 (Failure Possible)	Stand Up — 2 (Failure Likely)	Stand Up —3 (Failure Underway)	Stand Down
Activation trigger	• Indications of movement of monoliths noted such as cracking, increased seepage, or opening of joints	• Observed increasing seepage from spillway structure, OR • At or above Kroombit Dam HW EL 267.5 m	• Spillway failure possible due to sliding or overturning (e.g., due to obvious displacement or concrete scour at the toe of one or more monoliths), AND • Sufficient water in storage to create a dam hazard, OR • At or above Kroombit Dam HW EL 268.0 m	• Spillway failure likely due to sliding or overturning, AND • Sufficient water in storage to create a dam hazard, OR • At or above Kroombit Dam HW EL 268.36 m	• Spillway failure in progress due to sliding or overturning, AND • Sufficient water in storage to create a dam hazard	• • Stability assessment determines that sliding or overturning is unlikely
Actions	• Create Incident Report Record • Update Sunwater intranet with dam status • Record all communication *NOTE: IC to contact LDMGs unless LDMG1 is *Stood Up*	• As per previous activation level, AND • Place machinery operators on standby if directed by DSTDM • Consider the need to appoint a Recovery Coordinator. The Recovery Coordinator is then responsible for the follow through on actions to close out all matters and works outstanding after the initial emergency is over	• As per previous activation level, AND • Mobilise resources to undertake remedial works if directed by DSTDM • Liaise with the DSTDM to determine when/if dam failure is possible and if emergency alert is appropriate • Liaise with DDO, LEC & DSTDM re potential for evacuations NOTE: Confirm failure (EA) messaging is prepared in advance	• As per previous activation level • Liaise with the DSTDM and seek advice on need to recommend evacuations • Confirm with LDMG and DDMG that directed evacuations are recommended	• As per previous activation level	• Deactivate EAP • Complete all internal and external notifications • If required, forward all relevant communication, including emails for EER to: [redacted] • Close Incident Report Record • Update Sunwater intranet with dam status • Return to routine activities
Notifications	DDO LEC/ORR DSTDM SMT LDMG* DDMG SRT	DDO LEC/ORR DSTDM SMT LDMG* DDMG SRT	DDO LEC/ORR DSTDM SMT SDCC D/S Residents LDMG* QPS DDMG SRT	DDO LEC/ORR DSTDM SMT SDCC D/S Residents LDMG* QPS DDMG SRT	DDO LEC/ORR DSTDM SMT SDCC D/S Residents LDMG* QPS DDMG SRT	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings [redacted]

Table 30: Overturning or sliding of monoliths—LEC and IC communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
Alert	• Indications of movement of monoliths noted such as cracking, increased seepage, or opening of joints	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? *(Unconfirmed instability of dam)* What is the status? *(Under investigation)* Advise of current storage level Advise of any forecasts you are aware of
Lean Forward	• Observed increasing seepage from spillway structure, OR • At or above Kroombit Dam HW EL 267.5 m	• LDMG • DDMG	• Phone	Describe current situation with dam: What is the event? *(Unconfirmed instability of dam)* What is the status? Unconfirmed instability but being assessed *(under investigation)* Advise of current storage level Advise of any forecasts you are aware of
Stand Up — 1 (Failure possible)	• Spillway failure possible due to sliding or overturning (e.g., due to obvious displacement or concrete scour at the toe of one or more monoliths), AND • Sufficient water in storage to create a dam hazard, OR • At or above Kroombit Dam HW EL 268.0 m	• LDMG • QPS • DDMG	• Phone	Describe current situation with dam: What is the event? *(Possible instability of dam)* What is the status? Instability not confirmed but possible *(prepare for possible evacuations)* Advise of current storage level Advise of any forecasts you are aware of Discuss any potential road/ bridge closures
		• SDCC Watch Desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form if required (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.
		• D/S Residents	• SMS • Phone for those without mobile)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS
Stand Up — 2 (Failure likely)	• Spillway failure likely due to sliding or overturning, AND • Sufficient water in storage to create a dam hazard, OR • At or above Kroombit Dam HW EL 268.36 m	• LDMG • QPS • DDMG	• Phone	Describe current situation with dam: What is the event? *(Possible dam failure)* What is the status? Dam failure not observed but likely; be prepared to evacuate *(prepare coordinated evacuation)* Advise of current storage level Advise of any issues you are aware of Confirm understanding that failure is now likely at this trigger Advise directed evacuations should be implemented for the D/S residents (Appendix A4 of the EAP) who will be impacted by dam failure. Advise directed evacuations should be implemented for those areas assessed by the DDC to be impacted by dam failure.
		• SDCC Watch Desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.
		• D/S Residents	• SMS • Phone for those without mobile)	Liaise with Sunwater Customer Support and Communications o send appropriate messaging via SMS.

Table 30: Overturning or sliding of monoliths—LEC and IC communication plan				
Activation level	**Trigger for communications**	**Group to contact**	**Method**	**Message text**
Stand Up — 3 (Failure underway)	• Spillway failure in progress due to sliding or overturning, AND • Sufficient water in storage to create a dam hazard	• LDMG • QPS • DDMG	• Phone	Describe current situation with dam: What is the event? *(Dam failure)* What is the status? Dam failure underway; evacuate now *(dam failure in progress move to higher ground—LDMG coordinate evacuation of affected downstream residents)* Advise of current storage level Advise of any forecasts you are aware of Confirm understanding that failure is now underway at this trigger
		• SDCC Watch desk	• Initiate Emergency Alert procedure	Complete Emergency Alert Request Form (pre-filled in Appendix A8) and email to SDCC Watch Desk to distribute to Polygon.
		• D/S Residents	• SMS • (Phone for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.
Stand Down	• Stability assessment determines that sliding or overturning is unlikely.	• LDMG • QPS (if from Stand Up) • DDMG	• Phone	Describe current situation with dam: What is the event? (*Sliding or overturning unlikely after assessment*) What is the status? *Stand Down* Advise of current storage level Advise risk assessment has determined that risk reduced and EAP has been deactivated
		• D/S Residents (if from Stand Up)	• SMS • (Phone for those without mobiles)	Liaise with Sunwater Customer Support and Communications to send appropriate messaging via SMS.

Table 31: Overturning or sliding of monoliths—DSTDM emergency action						
Activation level	**Alert**	**Lean Forward**	**Stand Up—1 (Failure Possible)**	**Stand Up—2 (Failure Likely**	**Stand Up—3 (Failure Underway)**	**Stand Down**
Activation trigger	• Indications of movement of monoliths noted such as cracking, increased seepage, opening of joints	• Observed increasing seepage from spillway structure, OR • At or above Kroombit Dam HW EL 267.5 m	• Spillway failure possible due to sliding or overturning (e.g., due to obvious displacement or concrete scour at the toe of one or more monoliths), AND • Sufficient water in storage to create a dam hazard, OR • At or above Kroombit Dam HW EL 268.0 m	• Spillway failure likely due to sliding or overturning, AND • Sufficient water in storage to create a dam hazard, OR • At or above Kroombit Dam HW EL 268.36 m	• Spillway failure in progress due to sliding AND • Sufficient water in storage to create a dam hazard	• Stability assessment determines that sliding or overturning is unlikely
Action	• Record all communication • Review surveillance inspection of the dam and assess its condition as soon as possible • Determine if there are possible failure paths from reported damage • Assess results from foundation drain pressure measurements • Arrange an inspection of the dam and assess its condition as soon as possible, when safe to do so • Monitor situation and assess risks • Notify DSR	• As per previous activation level	• Review surveillance inspection of the dam and assess its condition as soon as possible • Assess risk and determine if failure likely or in progress • Arrange an inspection of the dam and assess its condition as soon as possible, when safe to do so • Determine if risks can be reduced by lowering storage • Determine if remedial repairs are practical	• As per previous activation level, AND • Liaise with the IC and advise on need to recommend evacuations	• As per previous activation level	• Undertake stability assessment considering: o no obvious deformation of monoliths o any evidence of significant scour o spillway flow patterns which could indicate abnormal behaviour o any other Dam Safety issues that could influence the stability of Kroombit Dam monoliths • If required, forward all relevant communication, including emails for EER to: [redacted] • Return to routine activities
Notifications	DDO IC DSR	DDO IC DSR	DDO LEC/ORR IC DSR	DDO LEC/ORR IC DSR	DDO LEC/ORR IC DSR	Inform all previously notified contacts of stand down

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

[redacted]

10. Other emergency situation — communications failure

10.1 Overview

The emergency action described in this section (Other emergency situation — communications failure) relates to either:

- An emergency situation where all means of communication at the dam site have been lost.
- An emergency situation where all means of communication with the local area have been lost.
- An emergency situation where all means of communication with Brisbane site have been lost.

This section specifies actions and provides guidance for the three situations.

10.2 Emergency actions

Due to the large number of different possible scenarios, the table below only covers the most common or likely conditions.

10.2.1 Activation triggers

Table 32: Communications failure emergency activation trigger summary

Comms Failure – Site	• Unable to communicate to or from dam site (usually affects DDO)
Comms Failure – Local area	• Unable to communicate to or from local area (likely to affect LEC/ORR)
Comms Failure – Brisbane	• Unable to communicate to or from Sunwater Brisbane (could affect DSTDM or FODM & will affect IC)

10.2.2 Emergency action roles

Table 33 to Table 38 specify emergency actions for the following roles.

- Dam Duty Officer (DDO)
- Local Event Coordinator (LEC)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM)
- Flood Operations Decision Maker (FODM).

Table 33: Communications failure — DDO emergency action		
Activation level	**Comms Failure – Local Area**	**Comms Failure – Brisbane**
Activation trigger	• Unable to communicate to local area including LEC/ORR	• Unable to communicate to Sunwater Brisbane including IC or DSTDM or FODM
Actions	• As much as practicable, assume the role of LEC • Continue tasks in accordance with any other current emergency action • Every hour, attempt communications by all means noting the following: • Mobile phone - try texting instead of voice, much higher probability of success • Satellite phone - needs to access open sky unless external antenna fitted • Fax - generally uses fixed landline and is therefore less likely to have failed • Social media - e.g. Facebook (Internet may be available via landline) • Record all communication and attempts via Dam Logbook entries as per SOP 12 (ref AA) and communications log if EAP event is current	• Determine if LEC is in communication and if not, assume the LEC role as much as is practicable • Continue tasks in accordance with any other current emergency action • Every hour, attempt communications by all means noting the following: • Mobile phone - try texting instead of voice, much higher probability of success • Satellite phone - needs to access open sky unless external antenna fitted • Fax - generally uses fixed landline and is therefore less likely to have failed • Social media - e.g. Facebook (Internet may be available via landline) • Record all communication and attempts via Dam Logbook entries as per SOP 12 (ref AA) and communications log if EAP event is current
Internal Notifications	• IC • SO – if available	• LEC • SO – if available
External Notifications	• As required	• As required

Table 34: Communications failure — LEC emergency action		
Activation level	**Comms Failure – Dam Site**	**Comms Failure – Brisbane**
Activation trigger	• Unable to communicate to dam site	• Unable to communicate to Sunwater Brisbane including IC, DSTDM or FODM
Actions	• Every hour, attempt communications by all means noting the following: • Mobile phone - try texting instead of voice, much higher probability of success • Satellite phone - needs to access open sky unless external antenna fitted • Record all communication and attempts • Assume that the DDO is carrying out LEC role at site as much as practicable • Liaise with IC • Liaise with DSTDM • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action	• Create Incident Report Record • Every hour, attempt communications by all means noting the following: • Mobile phone - try texting instead of voice, much higher probability of success • Satellite phone - needs to access open sky unless external antenna fitted • Record all communication and attempts • Liaise with the DDO and assume IC role • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action
Internal Notifications	• IC • DSTDM • SO – if available	• DDO • DSTDM – if available • SO
External Notifications	• LDMG	• LDMG • DDMG

Table 35: Communications Failure – IC emergency action			
Activation level	**Comms Failure – Dam Site**	**Comms Failure – Local Area**	Comms Failure – No data from dam
Activation trigger	• Unable to communicate to dam site	• Unable to communicate to local area including LEC/ORR	• No data transmission from remote monitoring camera • No data from dam level recorder • No data from headwater of tailwater gauge
Actions	• Issue Sunwater Incident Alert • Every hour, attempt communications by all means noting the following: • Mobile phone - try texting instead of voice, much higher probability of success • Satellite phone - needs to access open sky unless external antenna fitted • Record all communication and attempts • Liaise with LEC • Liaise with DSTDM • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action	• Issue Sunwater Incident Alert • Every hour, attempt communications by all means noting the following: • Mobile phone - try texting instead of voice, much higher probability of success • Satellite phone - needs to access open sky unless external antenna fitted • Record all communication and attempts • Liaise with the DDO and carry out functions of the LEC as much as practicable • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action	• Issue Sunwater Incident Alert • If telemetry is not operating, the receipt of local intelligence and monitoring of the Bureau of Meteorology web site (www.bom.gov.au) on predicted rainfall and weather conditions will provide updates to any situation until telemetry and communications resume. • Investigate back-up data feeds such as linkages to the VHF (two-way) system/BOM sites • Consider using rotary wing aircraft for dam monitoring and inspection (dependant on temporal and prevailing weather conditions
Internal Notifications	• LEC/ORR • DSTDM • SO – if available	• DDO – if available • DSTDM • SO – if available	• DDO – if available • DSTDM • SO – if available • SRT – if required
External Notifications	• DDMG	• LDMG – if available • DDMG – if available	• LDMG – if available • DDMG if available

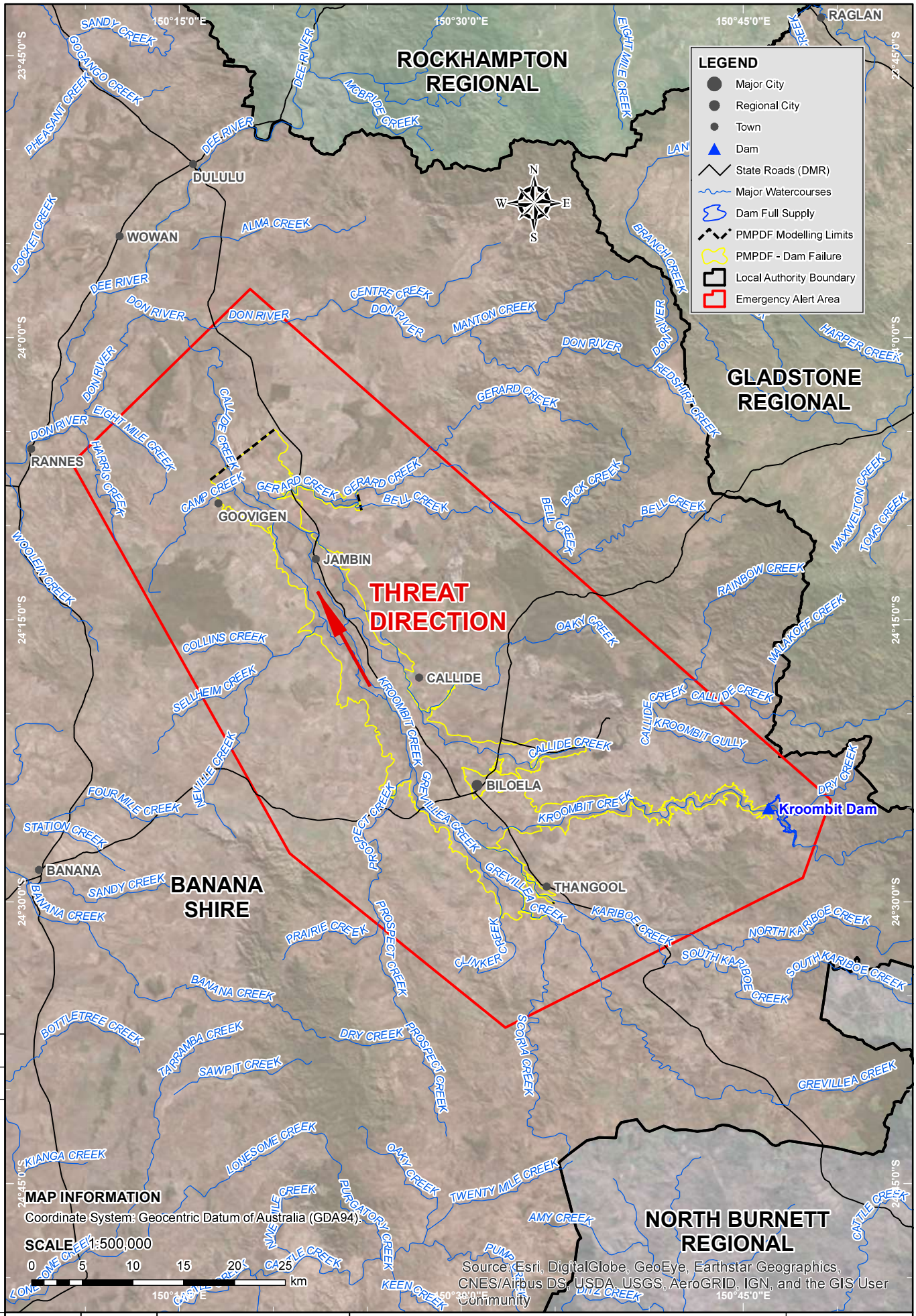
Table 36: Communications failure — LEC and IC communication plan				
Activation level	Trigger for communications	Group to contact	Method	Message text
Comms Failure – Site	• Unable to communicate to or from dam site, AND • DDO is at dam site	IC/LEC DSTDM SO – if available LDMG DDMG	Phone	Describe current situation with dam communications. What is the status – estimated time to restore communications?
		IC to create Incident Report record		EAP Alert Notification — Kroombit Dam — Site Communications Failure
Comms Failure – Local Area	• Unable to communicate to or from local area including LEC and ORR	DDO – if available DSTDM SO – if available LDMG – if available DDMG – if available	Phone	Describe current situation with dam communications. What is the status – estimated time to restore communications?
		IC to create Incident Report record		EAP Alert Notification — Kroombit Dam — Local Area Communications Failure
Comms Failure – Brisbane	• Unable to communicate to or from Sunwater Brisbane	DSTDM – if available LDMG DDMG	Phone	Describe current situation with dam communications. What is the status – estimated time to restore communications?
		LEC to create Incident Report record		EAP Alert Notification — Sunwater Brisbane Communications Failure

Table 37: Communications failure — DSTDM emergency action		
Activation level	**Comms Failure – Site**	**Comms Failure – Local Area**
Activation trigger	• Unable to communicate to dam site	• Unable to communicate to local area including LEC and ORR
Actions	• Provide technical advice to IC/LEC on a need's basis • Record all communication • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action	• Provide technical advice to IC on a need's basis • Record all communication • Assume that the DDO is assisting IC with LEC role • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action
Internal Notifications	• IC • LEC • SRT	• IC • DDO – if available • SRT
External Notifications	• DSR – if applicable	• DSR – if applicable

Table 38: Communications failure — FODM emergency action		
Activation level	**Comms Failure – Site**	**Comms Failure – Local Area**
Activation trigger	• Unable to communicate to dam site,	• Unable to communicate to local area including LEC and ORR
Actions	• Liaise with IC • Record all communication • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action	• Liaise with IC • Record all communication • Assume that the DDO is assisting IC with LEC role • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action
Internal Notifications	• IC • LEC • DSTDM	• IC • DDO – if available • DSTDM
External Notifications	• Not applicable	• Not applicable

APPENDIX A Notification and communication lists

Appendix A1 to Appendix A6 have been redacted



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Printed: Monday, 03/09/2018 03:34:36 PM

MAP PRODUCED BY:
WATER RESOURCES & DAM SAFETY
TEL. (07)3120 0000

REVISION	DATE	REMARKS		
B	03/09/18	ALERT AREA AMENDED	MB	MH
A	23/01/18	ISSUED FOR USE	MB	MH

DRAWN	DESIGNED
IDH	
CHECKED	CHECKED
MB	
APPROVED	
M. HUGHES	
23/1/2018	

SunWater

KROOMBIT DAM
EMERGENCY ACTION PLAN
EMERGENCY ALERT AREA

CONTRACT NUMBER	
DRAWING NUMBER	REV.
249581	B
SHEET 1 OF 1	
DATE JANUARY 2018	

Appendix A8: Dam failure emergency alert request

Queensland emergency alert request guidelines

An Emergency Alert (EA) Request form should be completed, if required (see dam hazard sections for actions) and sent to the SDCC Watch Desk to activate the Kroombit Dam Emergency Polygon.

Instructions

1. EA Request forms are not to be used for flood UNLESS a flood has triggered an Emergency Event.
2. Log on to the Disaster Management Portal in the EA area to complete the appropriate MS Word format form for Kroombit Dam.
3. Telephone the SDCC Watch Desk on [redacted] and tell them your intention to use the EA for an Emergency Event for Kroombit Dam.
   a. A Polygon for this dam is stored in the Disaster Management Portal in the EA area. Ask the SDCC operative to locate the polygon. It will be a KML file called [redacted]
   b. Give them your phone number, confirm their name, and end the call after advising the form/s will be sent shortly.
4. IC and DSTDM (and Media) will work together to craft a message relevant to the hazard and discuss with the LDMG if there is time. If time does not permit THIS DISCUSSION; use approved pre-filled form/s on the Disaster Management Portal.
5. Send filled out EA form/s and the Kroombit Threat Direction polygon to SDCC watch desk email: [redacted] The form/s MUST be sent from a Sunwater email address and come from the IC, DSTDM, or member of the Sunwater Executive.
6. Phone back SDCC to check that the message has been sent and ask for email confirmation.
7. Create an Incident Report Record to advise of completion of EA campaign.

Filename:	Voice Message:	SMS
[redacted]	FLOOD EMERGENCY WARNING from Sunwater: People downstream of Kroom bit Dam including Valentine Plains and low-lying areas of Bill Oh Ee Lah must LEAVE IMMEDIATELY. Kroom bit Dam possible failure/is failing. Major flooding is happening now. Your life is at risk. Go now to a safe place away from the flood. XX and XX are safe. More information available at Banana Shire Council ee em dee dot banana dot que el tee plus dot com	FLOOD EMERGENCY WARNING from Sunwater: People downstream of Kroombit Dam including Valentine Plains and low-lying areas of Biloela must LEAVE IMMEDIATELY. Kroombit Dam possible failure/is failing. Major flooding is happening now. Your life is at risk. Go now to a safe place away from the flood. XX and XX are safe. More information at Banana Shire Council http://emd.banana.qitplus.com/

Queensland Government

PHONE THE SDCC WATCH DESK [redacted] – ADVISE EA IS BEING DEVELOPED

EMERGENCY ALERT REQUEST

Location of Alert: Kroombit Dam (e.g. Suburb, Town)	**Date:**
LGA/Agency requesting:	**Time:**

Requesting Officer (e.g. Disaster Coordinator/Incident Controller)
Name:
Agency/Position:

Telephone:
(SDCC Watch Desk may telephone you)

Email:

Advised **LDC/LDMG**: ☐ YES **DDC/DDMG**: ☐ YES **Neighbouring LDMG/LGA**: ☐ YES ☐ N/A

Send Alert **Immediately**: ☐ YES **Scheduled**: ☐ YES Date & Time / / : hrs

Event Type
☐ Cyclone ☐ Storm Tide ☐ Flash Flood ☐ Flood
☐ Bushfire ☐ Fire Incident ☐ Smoke / Toxic Plume ☐ Chemical Spill
☐ Tsunami (Sent as Location Based Text Message ONLY)
☒ Other (please specify): Catastrophic Dam Failure

Distributed by: (Channel)
☒ Voice (Landline only) ☒ SMS – Location Based (Location of phone at time of distribution) ☐ SMS – Service Address Based (Registered billing address)

Message Severity
☒ Emergency Warning (Activates SEWS) ☐ Watch & Act ☐ Advice

Threat Direction Required? (e.g. Fire, Chemical Spill, Dam Spill) ☐ YES ☐ N/A

Threat location indicated on map? Only For Emergency Warning Voice & Service Address SMS ☒ YES ☐ N/A

EA Messaging Filename (Doc, Pdf):

Polygon Filename, (Kml, Kmz, Gml, GeoJSON):

Number of polygons _____ (if multiple, attach list in order of priority)

Supplied via: ☒ DM Portal ☐ Email ☐ Verbal ☐ Other
Other (please specify):

Supplied via: ☒ DM Portal ☐ Email ☐ Verbal ☐ Other
Other (please specify):

Voice: Type or handwrite, max 4000 characters incls spaces. (Ideally message should be < 450 characters)

FLOOD EMERGENCY WARNING from Sunwater: People downstream of Kroom bit Dam including Valentine Plains and low-lying areas of Bill Oh Ee Lah must LEAVE IMMEDIATELY. Kroom bit Dam possible failure/is failing. Major flooding is happening now. Your life is at risk. Go now to a safe place away from the flood. XX and XX are safe. More information available at Banana Shire Council ee em dee dot banana dot que el tee plus dot com.

SMS: Type or handwrite, use capitals for clarity, max 612 characters incls spaces. (Ideally should be < 160 characters incl. spaces)

FLOOD EMERGENCY WARNING from Sunwater: People downstream of Kroombit Dam including Valentine Plains and low-lying areas of Biloela must LEAVE IMMEDIATELY. Kroombit Dam possible failure/is failing. Major flooding is happening now. Your life is at risk. Go now to a safe place away from the flood. XX and XX are safe. More information at Banana Shire Council http://emd.banana.qitplus.com/

Remove EA from websites:
☐ 12 hrs ☐ 24 hrs ☐ 48 hrs ☐ Specify Date & Time: ☐ Check back in 12 hrs:
☐ Replace previous EA message / / : hrs Contact #:_____

Requesting Officer: **Signature:** **Date:** / /

Send to [redacted] to confirm receipt

FOR USE BY SDCC

EA Request Form completed by: SDCC Watch Desk ☐ Requesting Officer ☐

Notification of any delays provided to Requestor: ☐ YES ☐ NO

EA User Name:
Signature: Date: / /

Emergency Alert No:

Authorising Officer Name:
Signature: Date: / /

EMS EA Campaign Report ID:

Report provided to Requestor on EA outcomes: ☐ YES ☐ NO

The EA Manual, EA Quick Reference Guide, EA Request Form Template are available at: www.disaster.qld.gov.au

DO NOT SEND THIS PAGE

(Sunwater internal use only)

Emergency Alert (EA) Request instructions

Complete ALL initial fields, especially contact details, and check applicable boxes.

STEP 1.	EA Polygon Area (e.g., detailed description and location reference to allow positive identification of message area, including street names with cross street, areas of interest such as parks, rivers, dams, coastal areas) it is preferable to attach a map identifying the message area. If a Threat Direction has been requested, please clearly indicate it on the map. Check applicable box.
STEP 2.	Enter the Polygon file name/s.
STEP 3.	*Sunwater Polygons are all in *.kml format.* Check applicable box.
STEP 4.	*Sunwater Messaging/spatial data is always supplied via DMportal.* Check applicable box. Enter the file name.

Voice Message: Either type or handwrite the required message in CAPITALS. As the message will be translated by a text-to-speech process it is important that words are not unintelligible when translated e.g., "qld" used in a web site address must be entered as "Q L D", similarly the word "DOT" must be entered into a web address instead of a full stop.
An Emergency Warning message must start with "EMERGENCY EMERGENCY" Do not use special characters.

SMS: Either type the message or handwrite the characters into the boxes.
Capitals only required as per normal grammar rules, but an Emergency Warning message must start with "EMERGENCY EMERGENCY" (in capitals). Do not use special characters.

Voice example:

EMERGENCY. EMERGENCY. SUN WATER ADVISE IMMINENT FAILURE OF CANIA DAM. RESIDENTS DOWNSTREAM OF THE DAM NEED TO ACT TO PROTECT LIFE AND LEAVE IMMEDIATELY. FAILURE OF THE DAM WILL RESULT IN EXTREMELY DANGEROUS FLOODING DOWNSTREAM INCLUDING: MOONFORD AND MONTO. DO NOT DELAY. LEAVE NOW. CENTRAL MONTO AND BILOELA ARE SAFE LOCATIONS.

SMS example:

EMERGENCY. EMERGENCY. Sunwater advise imminent failure of Cania Dam. Take action to protect life and leave now. Moonford and Monto are at risk. Info on ABC Radio. Central Monto & Biloela are safe.

If using template EA messages, please provide the appropriate variables that are in the template message guides. Refer to the Queensland EA Manual for copies of the template message guides.

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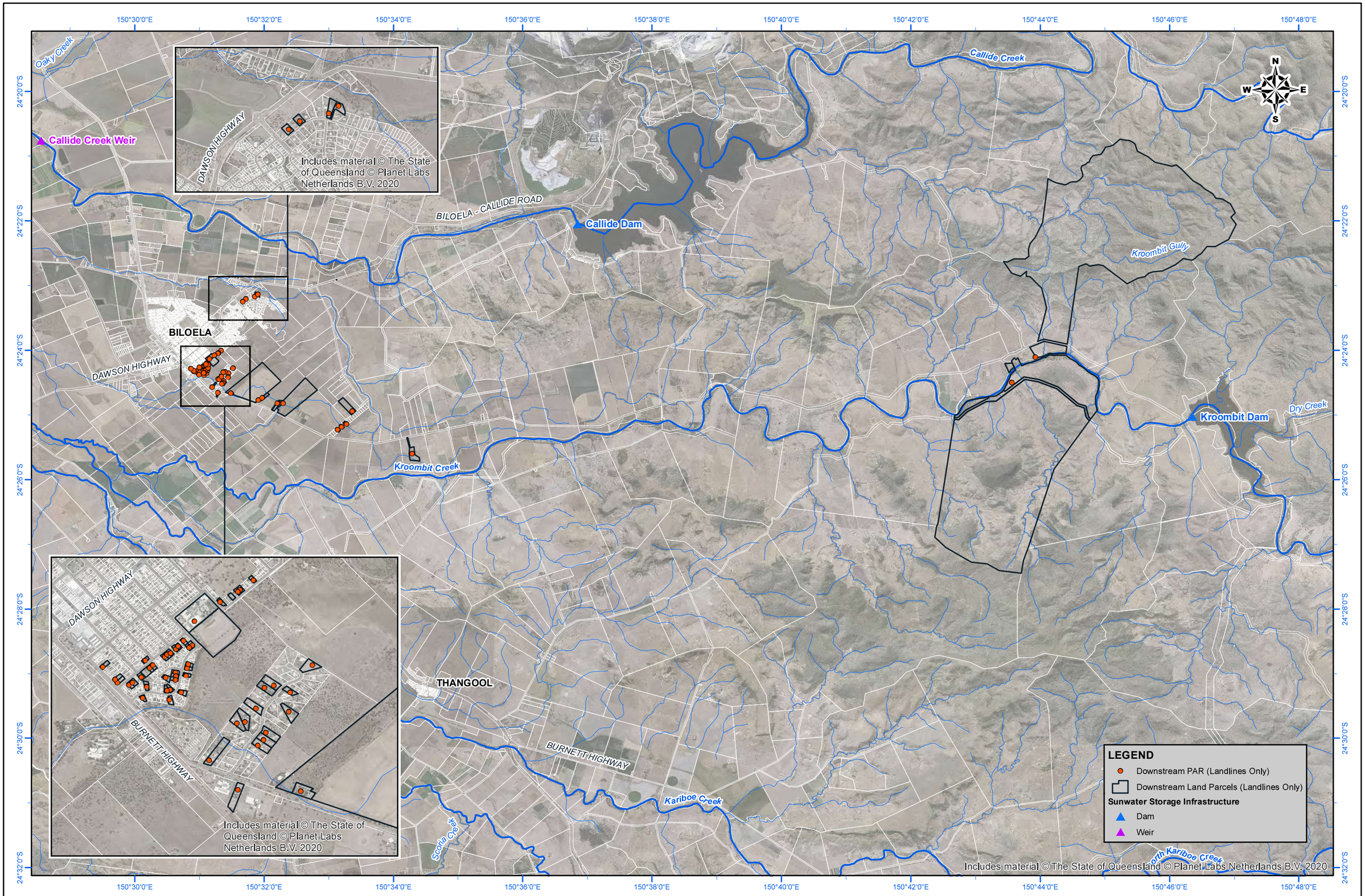

MAP PRODUCED BY:
SUNWATER LTD
TEL: (07) 3120 0000

REVISION					
06/10/22	A	ISSUED FOR USE	MS	RJ	
DATE		REMARKS	CKD	PSD	

MAP INFORMATION
Coordinate System: Geocentric Datum of Australia (GDA2020)

SCALES (A3 SIZE)
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1:100,000

DRAWN	DESIGNED
IDH	
CHECKED	CHECKED
MS	RJ
APPROVED	
R. JENSEN 6/10/2022	
RPEQ: 23733	

sunwater

KROOMBIT DAM
EMERGENCY ACTION PLAN
DOWNSTREAM RESIDENTS
LANDLINE CONTACT ONLY
LOCATION PLAN

CONTRACT NUMBER
DRAWING NUMBER 256382
REV. A
SHEET 1 OF 1
DATE OCTOBER 2022

APPENDIX B Drawings and Maps

Appendix B1: General Arrangement drawing

Appendix B2: Downstream Notification area

Appendix B3: Inundation maps

Appendix B4: Emergency Access routes

Appendix B5: Locality plan

Appendix B6: Catchment area

Appendix B7: Map of Kroombit Dam

NOTE: Actual levels may differ from those shown in flood inundation maps due to variations in assumptions made in the models to actual flood events.

10

KROOMBIT

CREEK

273 868.000 E
7 298 000.000 N

158° 11' 55"

RCC SPILLWAY

169° 31' 09"

IP 274 135.601 E
7 297 331.497 N

IP 740.089

IP 722.247

ROCK PROTECTION (2016)
SEE DRG 246691

274 000 E

274 200 E

273 800 E

7 298 000 N

7 297 800 N

7 297 600 N

7 297 400 N

7 297 200 N

PLAN

FOR CAMBER ALLOWANCE SEE
CAMBER DIAGRAM ON A1-98363

A 98363

B 98363

A 98363

1 ON 2.3 DOWNSTREAM BATTER

TRANSITION

1 IN 1.6

1 IN 1.6

TRANSITION

1 ON 2.3 DOWNSTREAM BATTER

100 APPROX

310 APPROX

0.0

275

300

325

575

600

625

DESIGN CREST EL 270.70

SPILLWAY CREST EL 265.80

DESIGN CREST EL 270.70

PFL

ROAD EL 253.70

ELEVATION (metres)

300
250
200

-100
0
100
200
300
400
500
600
700
800

AXIS DISTANCE (metres)

LONGITUDINAL SECTION

NOTES:

1. LEVELS DATUM: AHD DERIVED - PM 41358 EL 248.494 AHD
   WRC BM 891305 EL 255.640 AHD DERIVED
2. AZIMUTH DATUM: AMG
   WRC BM's 892897 to 892890 :- 166° 41' 11"

COORDINATES: PLANE COORDINATES BASED ON
WRC BM 892897 E 4,236.897 N 97,142.000
DEDUCED FROM AMG COORDINATES - AGD84
- ZONE 56
WRC BM 892897 E 274,236.697 N 7 297,142.000

REVISION					SCHEDULE		
					A1-98743	WORKS AREA	
FEB 2016	A	ROCK PROTECTION (2016)	AN	JKR	A1-98742	SPILLWAY ARRANGEMENT	
DATE		REMARKS	ZONE	CKD	A1-98363	EMBANKMENT - SECTION DETAILS	

SCALES RATIOS BEFORE REDUCTION

0 50 100 150 METRES
1:1500

THINK SAFETY - WORK SAFELY

Water Resources

DRAFTING		DESIGN	
DR	AN	PMP	
CKD	GPC	CKD	
SUPV	GPC	SUB	

RECOMMENDED

MANAGER CIVIL DESIGN

APPROVED

GEN MANAGER DEV'T DIVISION

KROOMBIT DAM

GENERAL ARRANGEMENT

CONTRACT NUMBER 2833

DRAWING NUMBER 98362-A

DATE

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Printed: Monday, 26/09/2022 03:02:53 PM

MAP PRODUCED BY:
ASSET DELIVERY
TEL: (07) 3120 0000

150°28'0"E 150°30'0"E 150°32'0"E 150°34'0"E 150°36'0"E 150°38'0"E 150°40'0"E 150°42'0"E 150°44'0"E 150°46'0"E 150°48'0"E

24°18'0"S 24°20'0"S 24°22'0"S 24°24'0"S 24°26'0"S 24°28'0"S 24°30'0"S

GREVELLS ROAD
Oaky Creek
DUDARKOS ROAD
DAWSON HIGHWAY
JAMBIN DAKENBA ROAD
Callide Creek Weir
SHEPHERDSONS ROAD
Dakenba
BILOELA CALLIDE ROAD
SHORTS ROAD
MUIRS ROAD
LINKES ROAD
Callide Creek
CALLIDE DAM
COAL ROAD
Rainbow Creek
CALLIDE CREEK
ZANGARIS ROAD
ZANGARIES ROAD
ROAD
Malakoff Creek
Stag Creek
CALVALE ROAD
Kroombit Gully
PAINES ROAD
CALLIDE STREET
BILOELA
BAILEYS LANE
Westpool Gully
SARAS LANE
VALENTINE PLAINS ROAD
KROOMBIT CREEK
KROOMBIT DAM
Dry Creek
SCHLOSS ROAD
GREVILLEA CREEK
MEISSNERS ROAD
BURNETT HIGHWAY
MULLERS ROAD
EICHMANNS ROAD
Greville Creek
MULLERS LANE
SEMPLES ROAD
HINTONS LANE
Clinker Creek
BLANCHS ROAD
THANGOOL
COX MILLARD ROAD
RUSSIAN CLUB ROAD
KARIBOE CREEK
DRUMBURLE ROAD
BLACKS ROAD

LEGEND
- Major Road
- Secondary Road
- Qld Rail Network
- Downstream Notification Extent
- Flood extent for 750m³/s dam outflow
- Flood extent for 1500m³/s dam outflow
- Flood extent for 2250m³/s dam outflow

Sunwater Storages
- Dam
- Weir
- Dam Full Supply Level

REVISION				
DATE		REMARKS	CKD	PSD
26/09/22	A	ISSUED FOR USE	IF	RJ

MAP INFORMATION
Coordinate System: Geocentric Datum of Australia (GDA2020).

N W E S

SCALES (A3 SIZE)
0 1,000 2,000 3,000 4,000 5,000 Meters 1:100,000

DRAWN	DESIGNED
IDH	
CHECKED	CHECKED
IF	RJ
APPROVED	
R. JENSEN 26/9/2022	
RPEQ: 23733	

sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS
APRIL 2022
DOWNSTREAM NOTIFICATION AREA

CONTRACT NUMBER

DRAWING NUMBER	REV.
256350	A

SHEET 1 OF 1

DATE SEPTEMBER 2022

Appendix B3: Inundation maps

The following pages contain the Inundation Maps for Kroombit Dam

Drawings:

- Key Map
- Sunny Day Failure
- Dam Crest Flood
- Probable Maximum Precipitation Design Flood
- Dam Failure analysis outflow flood impacts– Overtopping Failure

Disclaimer: Every effort has been made to ensure the currency of the flood inundation maps reproduced in this EAP. However, as the maps have been extracted from external sources, their accuracy cannot be guaranteed.

Document: S:\BW_WaterResources\GIS_Data\SW_Callide Valley WSS\KroombitDam_EAP2022\DrawingsArcMap\255348-A.mxd
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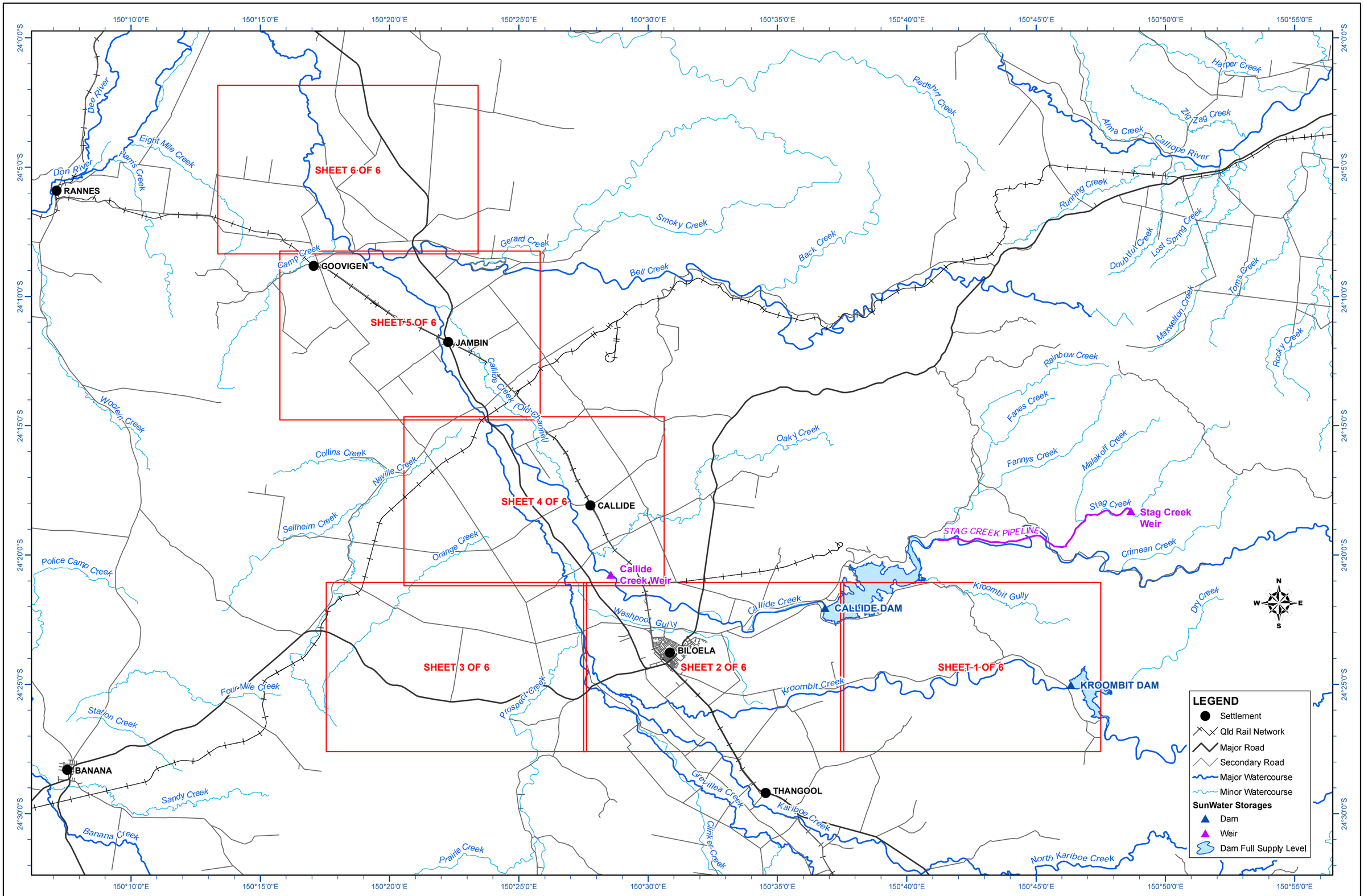

REVISION					
01/06/22	A	ISSUED FOR USE	JJ	RJ	
DATE		REMARKS	CKD	PSD	

MAP INFORMATION
Coordinate System: Geocentric Datum of Australia (GDA2020).

REFERENCE DRAWINGS
255349 - Sunny Day Failure
255350 - Dam Crest Flood (No Failure)
255351 - Dam Crest Flood (Overtopping Failure)
255352 - Probable Maximum Flood (No Failure)
255353 - Probable Maximum Flood (Overtopping Failure)

SCALES (A3 SIZE)
0 2.5 5 7.5 10 12.5 km
1:250,000

DRAWN	DESIGNED
IDH	JJ
CHECKED	CHECKED
	RJ

APPROVED
R. JENSEN
1/6/2022
RPEQ: 23733

sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS
APRIL 2022
INUNDATION MAPPING
KEYMAP

CONTRACT NUMBER

DRAWING NUMBER	REV.
255348	A

SHEET 1 OF 1
DATE APRIL 2022

MAP PRODUCED BY:
ASSET DELIVERY
TEL: (07) 3120 0000

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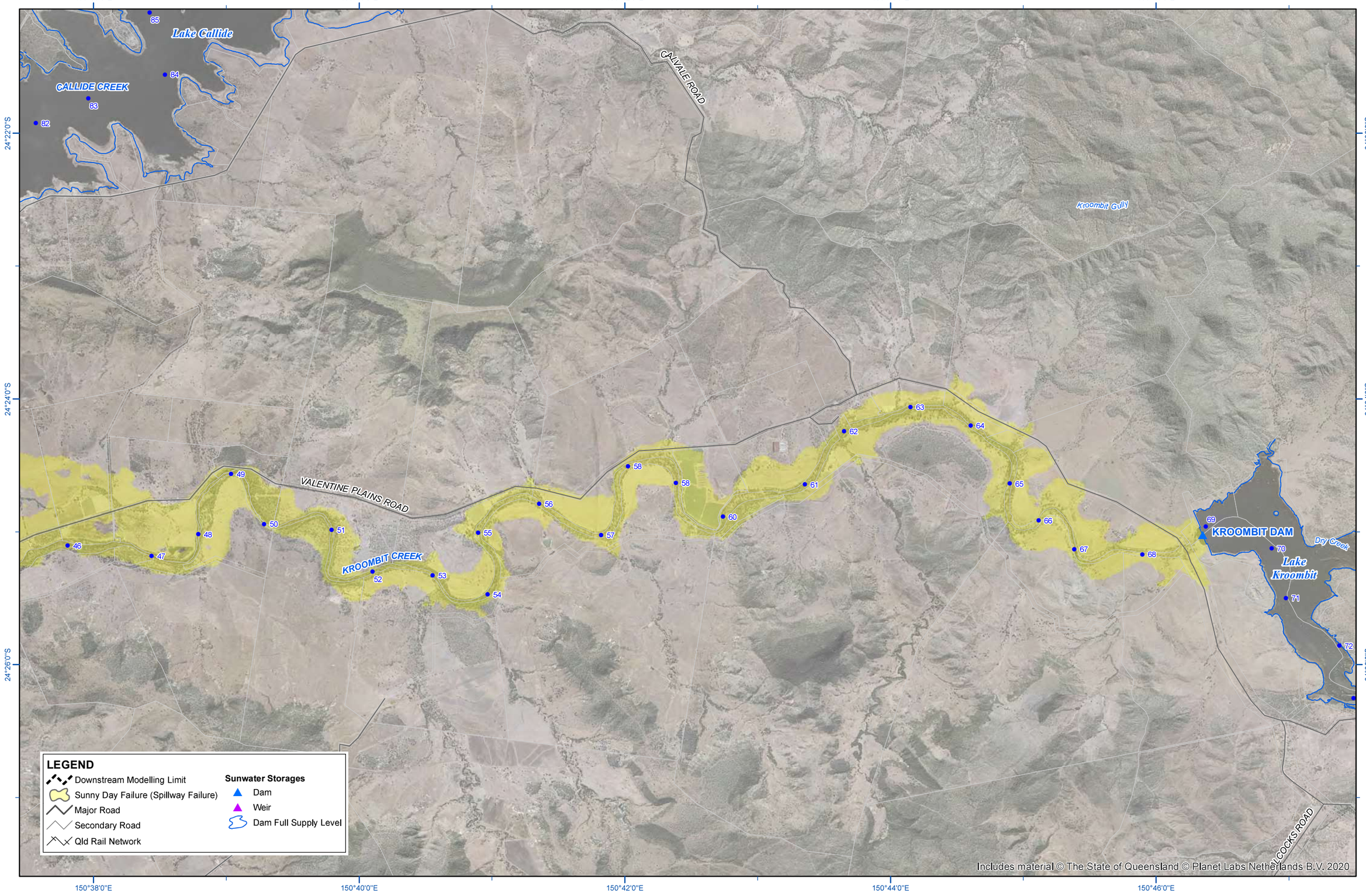
ASSET DELIVERY
TEL: (07) 3120 0000



REVISION					
01/06/22	A	ISSUED FOR USE	JJ	RJ	
DATE		REMARKS	CKD	PSD	

MAP INFORMATION
Coordinate System: Geocentric Datum of Australia (GDA2020)

REFERENCE DRAWINGS
255348 - Keymap

N W E S

SCALES (A3 SIZE)
0 500 1,000 1,500 2,000 2,500 Meters 1:50,000

DRAWN	DESIGNED
IDH	JJ
CHECKED	CHECKED
	RJ

APPROVED
R. JENSEN
1/6/2022
RPEQ: 23733

sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
SUNNY DAY FAILURE
SPILLWAY FAILURE
INUNDATION PLAN

CONTRACT NUMBER

DRAWING NUMBER	REV.
255349	A

SHEET 1 OF 6

DATE APRIL 2022

Document: S:\BW_WaterResources\GIS_Data\SW_Callide Valley WSS\KroombitDam_EAP2022\Drawings\ArcMap\255349-A.mxd
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MAP PRODUCED BY:
ASSET DELIVERY
TEL: (07) 3120 0000

150°28'0"E 150°30'0"E 150°32'0"E 150°34'0"E 150°36'0"E

24°22'0"S 24°24'0"S 24°26'0"S

Dakenba
CALLIDE CREEK
SHEPHERDSONS ROAD
BILOELA CALLIDE ROAD
SHORTS ROAD
COCUPS ROAD
Callide Creek
CALLIDE DAM
Lake Callide
LAKE CALLIDE DRIVE
JAMBIN DAKENBA ROAD
MUIRS ROAD
LINKES ROAD
ZISCHKES LANE
PAINES ROAD
TOGNOLINI BALDWIN ROAD
CALVALE ROAD
TAN DRIVE
ROAD
QUARRIE ROAD
THALBERG AVENUE
ALEXANDRA AVENUE
STATE FARM ROAD
TIAMBY STREET
KARIBOE STREET
CALLIDE STREET
DUNN STREET
BILOELA
GLADSTONE ROAD
WASHPOOL GULLY
HILLS AVENUE
BAILEYS LANE
PEAKES HUNGERFORD ROAD
BOWKETTS LANE
DAWSON HIGHWAY
SARAS LANE
BURNETT HIGHWAY
VAN ITALLIES ROAD
VALENTINE PLAINS ROAD
GREVILLEA CREEK
KROOMBIT CREEK
SCHLOSS ROAD
MEISSNERS ROAD
MULLERS ROAD
MULLERS LANE
Grevillea Creek
KARIBOE CREEK
EICHMANNS ROAD

62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81
22 23 24 25 26 27 28 0 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
1 2 3 4 5 6

LEGEND

- Downstream Modelling Limit
- Sunny Day Failure (Spillway Failure)
- Major Road
- Secondary Road
- Qld Rail Network

Sunwater Storages

- Dam
- Weir
- Dam Full Supply Level

REVISION					
01/06/22	A	ISSUED FOR USE	JJ	RJ	
DATE		REMARKS	CKD	PSD	

MAP INFORMATION
Coordinate System: Geocentric Datum of Australia (GDA2020).

REFERENCE DRAWINGS
255348 - Keymap

SCALES (A3 SIZE)
0 500 1,000 1,500 2,000 2,500 Meters 1:50,000

DRAWN	DESIGNED
IDH	JJ
CHECKED	CHECKED
	RJ

APPROVED
R. JENSEN
1/6/2022
RPEQ: 23733

sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
SUNNY DAY FAILURE
SPILLWAY FAILURE
INUNDATION PLAN

CONTRACT NUMBER

DRAWING NUMBER	REV.
255349	A

SHEET 2 OF 6
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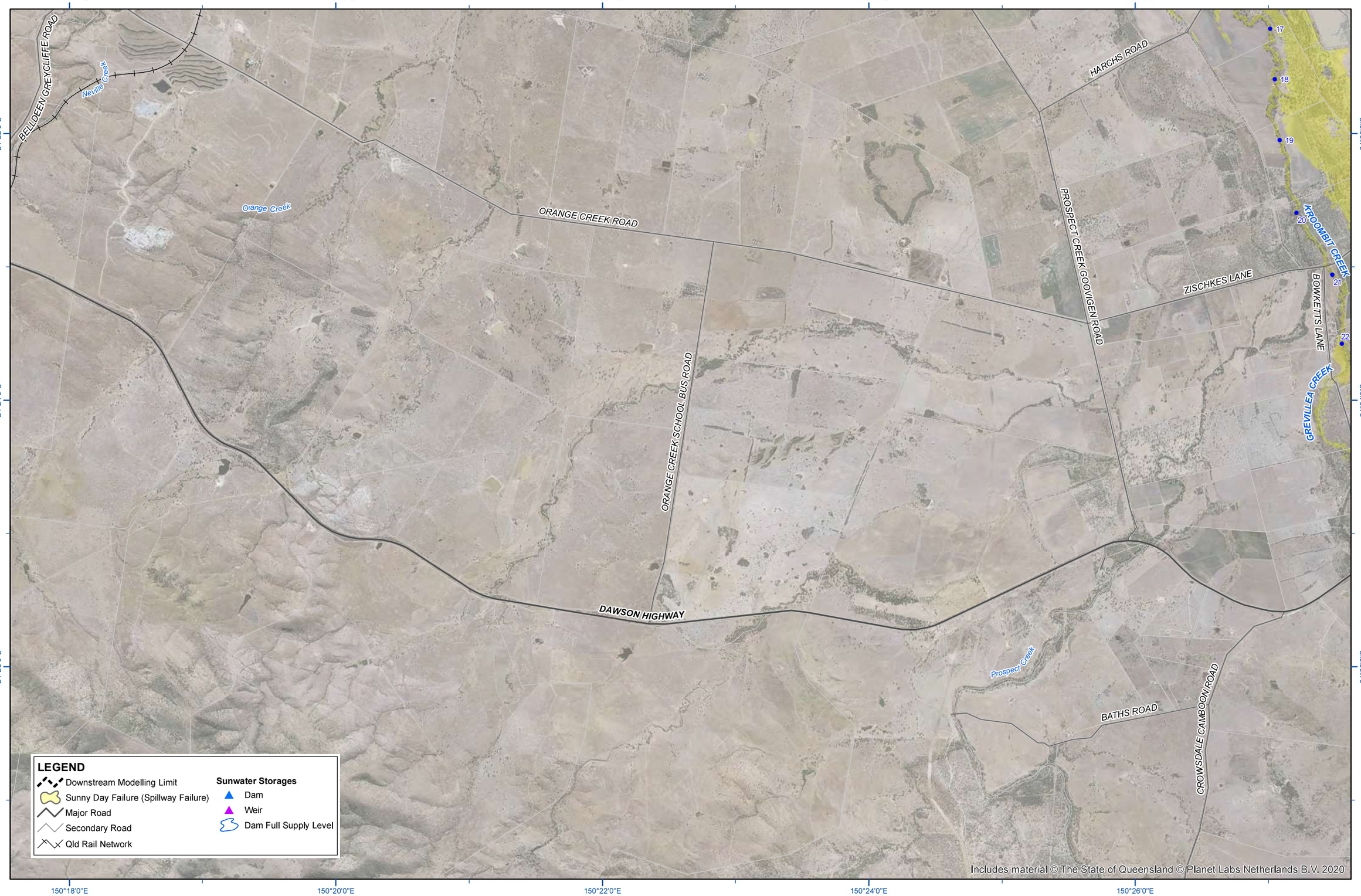

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RPEQ: 23733	

sunwater

KROOMBIT DAM
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SUNNY DAY FAILURE
SPILLWAY FAILURE
INUNDATION PLAN

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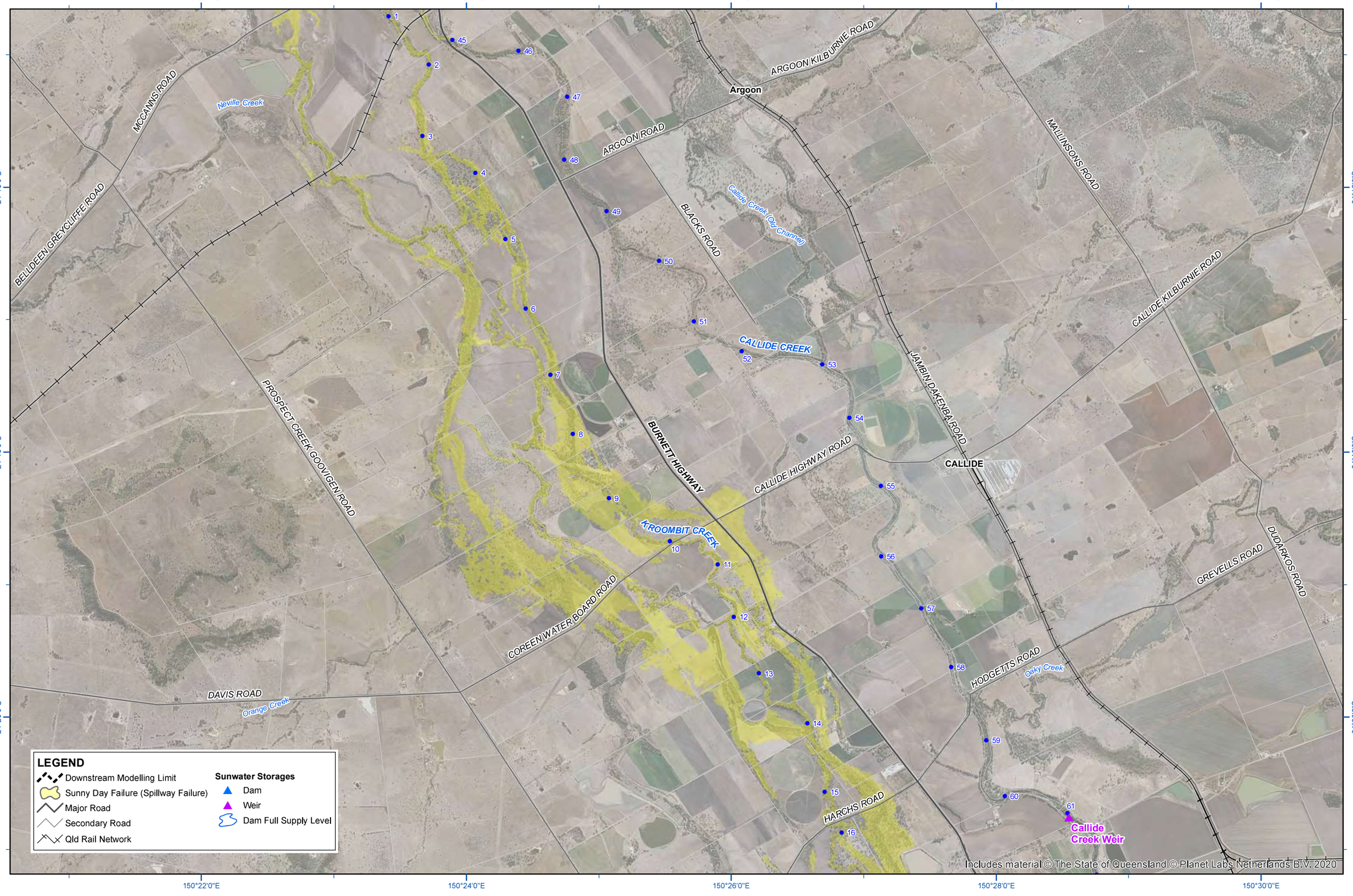

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SUNNY DAY FAILURE
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INUNDATION PLAN

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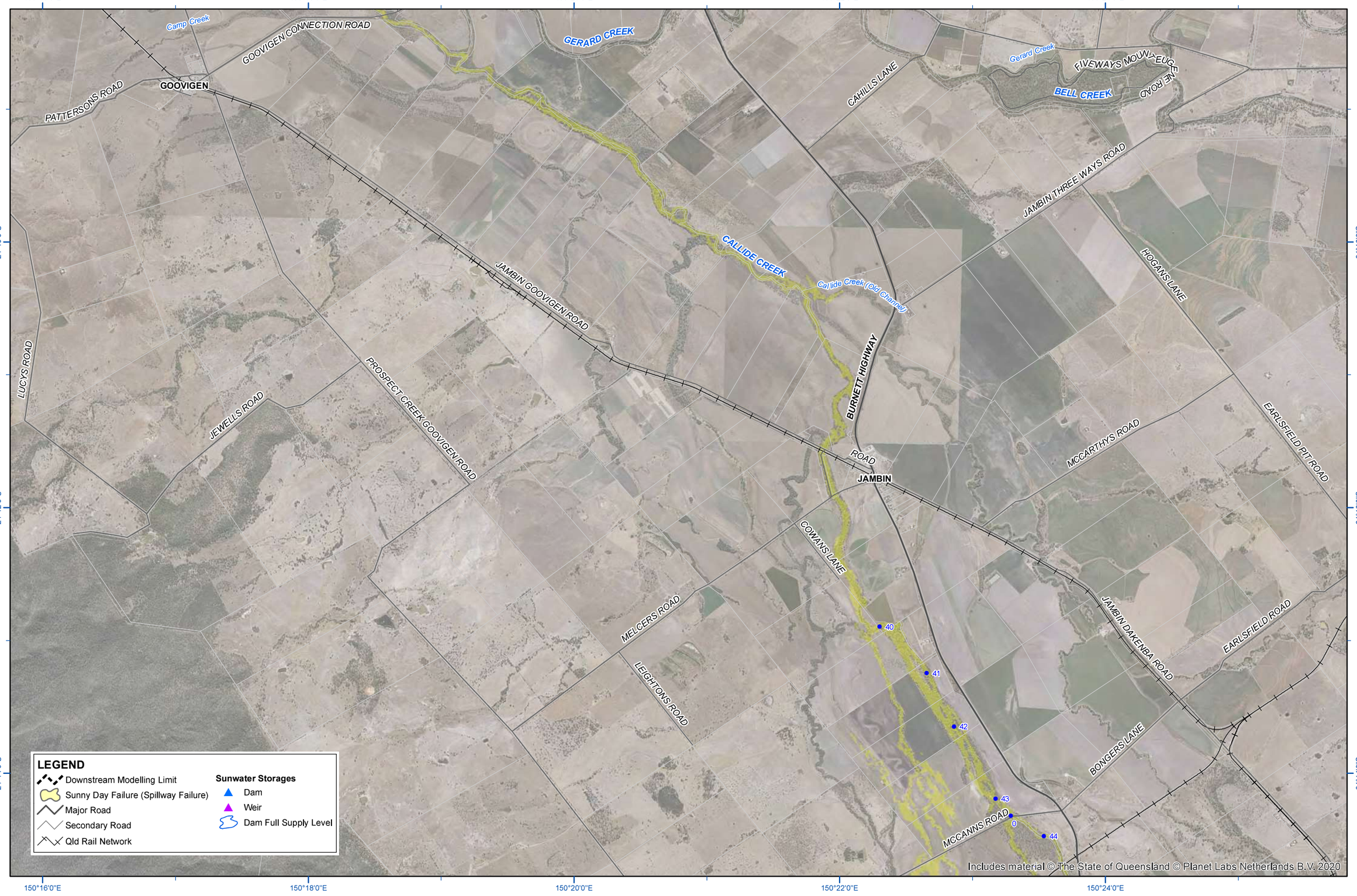

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KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
SUNNY DAY FAILURE
SPILLWAY FAILURE
INUNDATION PLAN

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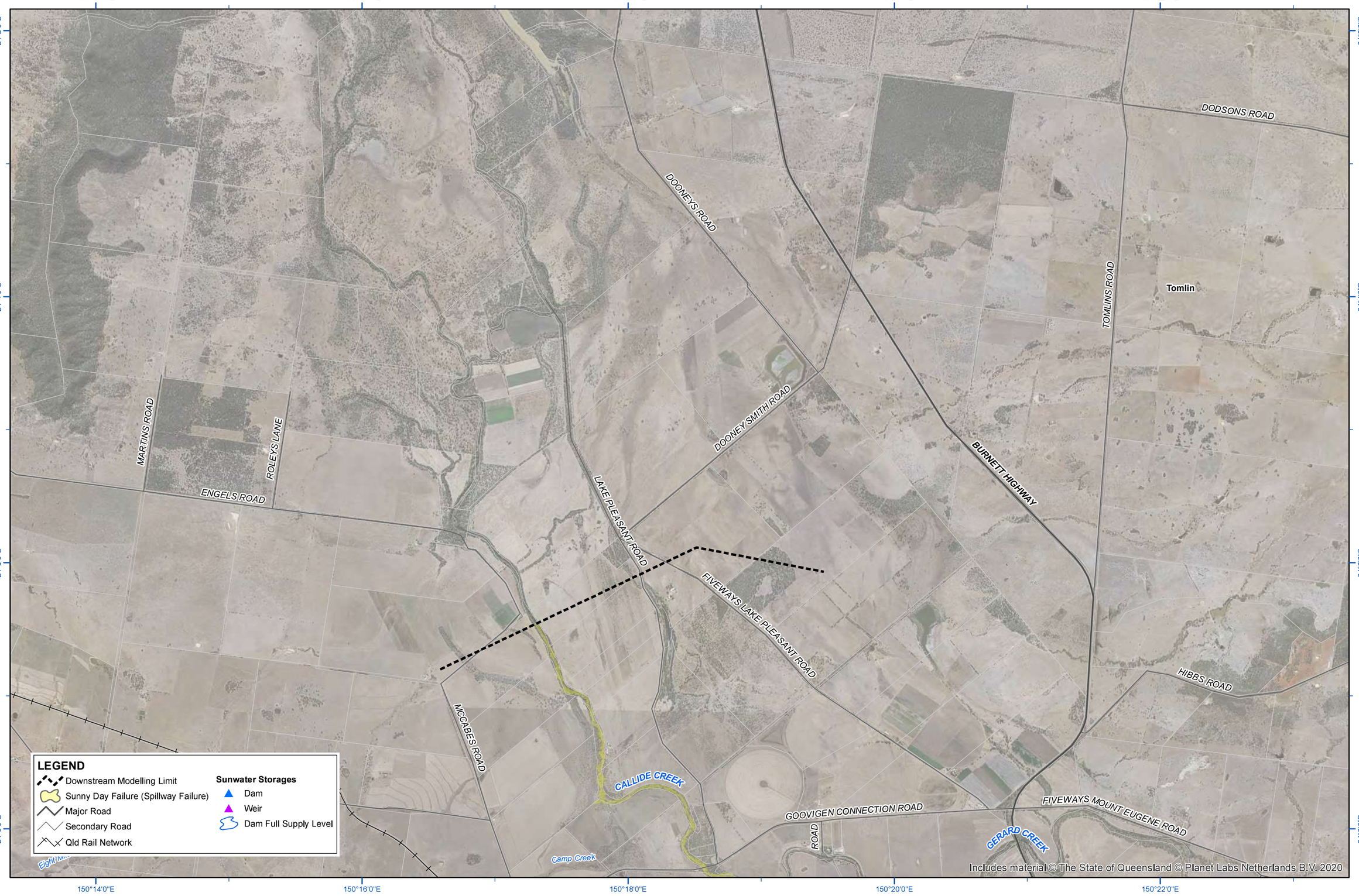

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SUNNY DAY FAILURE
SPILLWAY FAILURE
INUNDATION PLAN

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MAP PRODUCED BY:
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150°38'0"E 150°40'0"E 150°42'0"E 150°44'0"E 150°46'0"E

24°22'0"S 24°24'0"S 24°26'0"S

Lake Callide
CALLIDE CREEK
CALVALE ROAD
Kroombit Gully
VALENTINE PLAINS ROAD
KROOMBIT CREEK
KROOMBIT DAM
Dry Creek
Lake Kroombit
COCKS ROAD

85 84 83 82 49 50 51 48 46 47 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72

LEGEND

- Downstream Modelling Limit
- Dam Crest Flood (No Failure)
- Major Road
- Secondary Road
- Qld Rail Network

Sunwater Storages

- Dam
- Weir
- Dam Full Supply Level

REVISION				
01/06/22	A	ISSUED FOR USE	JJ	RJ
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sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
DAM CREST FLOOD
NO FAILURE
INUNDATION PLAN

CONTRACT NUMBER

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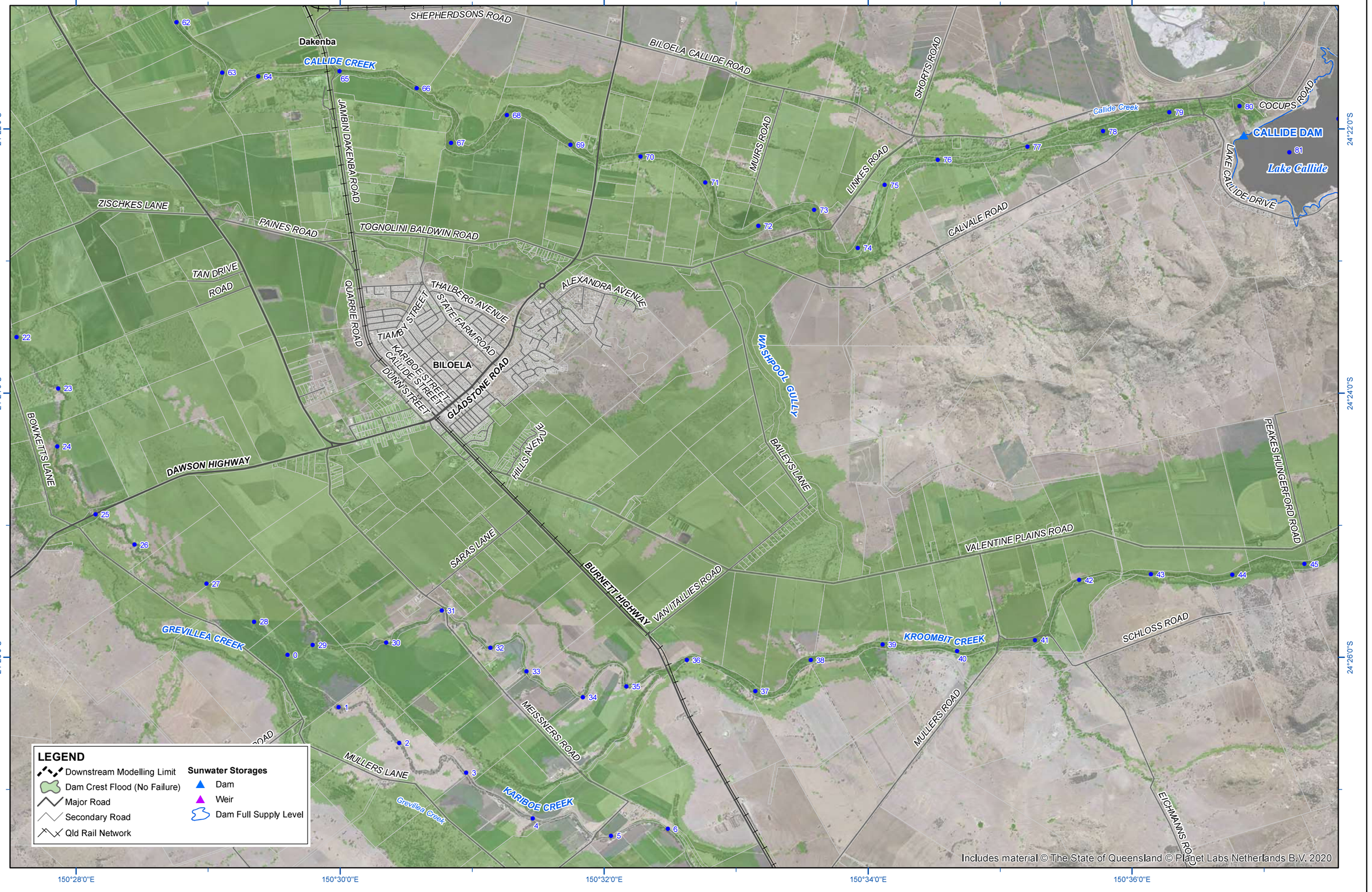

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	RJ
APPROVED	
R. JENSEN 1/6/2022	
RPEQ: 23733	

sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
DAM CREST FLOOD
NO FAILURE
INUNDATION PLAN

CONTRACT NUMBER

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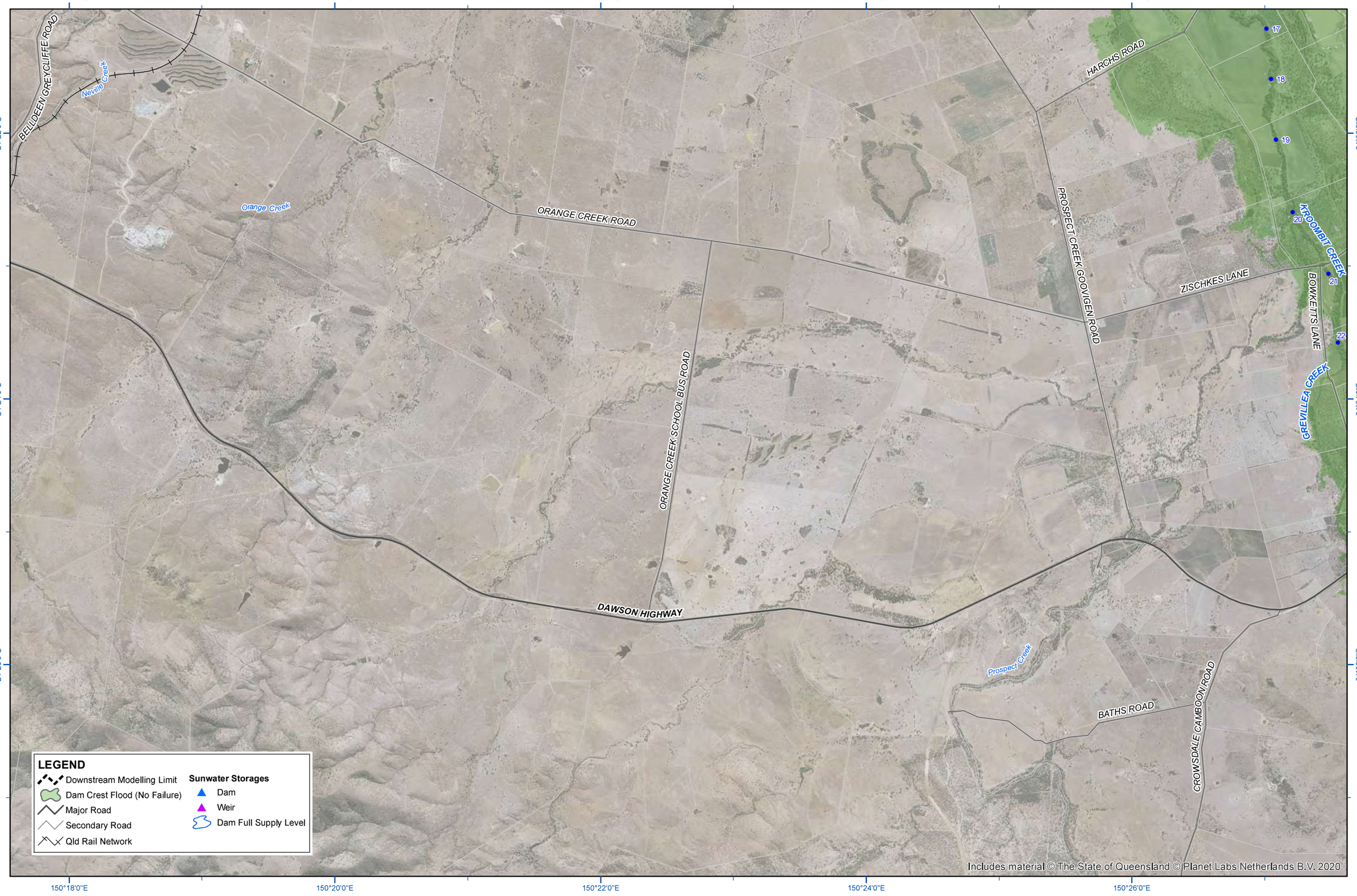

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1/6/2022
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sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
DAM CREST FLOOD
NO FAILURE
INUNDATION PLAN

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150°22'0"E 150°24'0"E 150°26'0"E 150°28'0"E 150°30'0"E

24°16'0"S 24°18'0"S 24°20'0"S

Argoon
CALLIDE
Callide Creek Weir

ARGOON KILBURNIE ROAD
MALLINSONS ROAD
CALLIDE KILBURNIE ROAD
MCCANNS ROAD
BELLDEEN GREYCLIFFE ROAD
ARGOON ROAD
BLACKS ROAD
PROSPECT CREEK GOOVIGEN ROAD
BURNETT HIGHWAY
CALLIDE HIGHWAY ROAD
JAMBIN DAKENBA ROAD
GREVELLS ROAD
DUDARKOS ROAD
COREEN WATER BOARD ROAD
HODGETTS ROAD
HARCHS ROAD
DAVIS ROAD

Neville Creek
Callide Creek (Old Channel)
CALLIDE CREEK
KROOMBIT CREEK
Oaky Creek
Orange Creek

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61

LEGEND

- Downstream Modelling Limit
- Dam Crest Flood (No Failure)
- Major Road
- Secondary Road
- Qld Rail Network

Sunwater Storages

- Dam
- Weir
- Dam Full Supply Level

REVISION					
01/06/22	A	ISSUED FOR USE	JJ	RJ	
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IDH	JJ
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APPROVED
R. JENSEN
1/6/2022
RPEQ: 23733

sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
DAM CREST FLOOD
NO FAILURE
INUNDATION PLAN

CONTRACT NUMBER

DRAWING NUMBER 255350 | REV. A

SHEET 4 OF 6

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Printed: Wednesday, 01/06/2022 08:52:37 AM

MAP PRODUCED BY:
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TEL: (07) 3120 0000

150°16'0"E 150°18'0"E 150°20'0"E 150°22'0"E 150°24'0"E

24°10'0"S 24°12'0"S 24°14'0"S

Camp Creek
GOOVIGEN CONNECTION ROAD
GERARD CREEK
Gerard Creek
FIVEWAYS MOUNTAUGH LINE ROAD
BELL CREEK
CAHILLS LANE
PATTERSONS ROAD
GOOVIGEN
JAMBIN THREE WAYS ROAD
CALLIDE CREEK
Callide Creek (Old Channel)
JAMBIN GOOVIGEN ROAD
HOGANS LANE
LUCYS ROAD
PROSPECT CREEK GOOVIGEN ROAD
BURNETT HIGHWAY
JEWELLS ROAD
ROAD
JAMBIN
MCCARTHYS ROAD
EARLSFIELD PIT ROAD
COWANS LANE
MELCERS ROAD
JAMBIN DAKENBA ROAD
EARLSFIELD ROAD
LEIGHTONS ROAD
40
41
42
BONGERS LANE
43
MCCANNS ROAD
0
44

LEGEND

- Downstream Modelling Limit
- Dam Crest Flood (No Failure)
- Major Road
- Secondary Road
- Qld Rail Network

Sunwater Storages

- Dam
- Weir
- Dam Full Supply Level

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KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
DAM CREST FLOOD
NO FAILURE
INUNDATION PLAN

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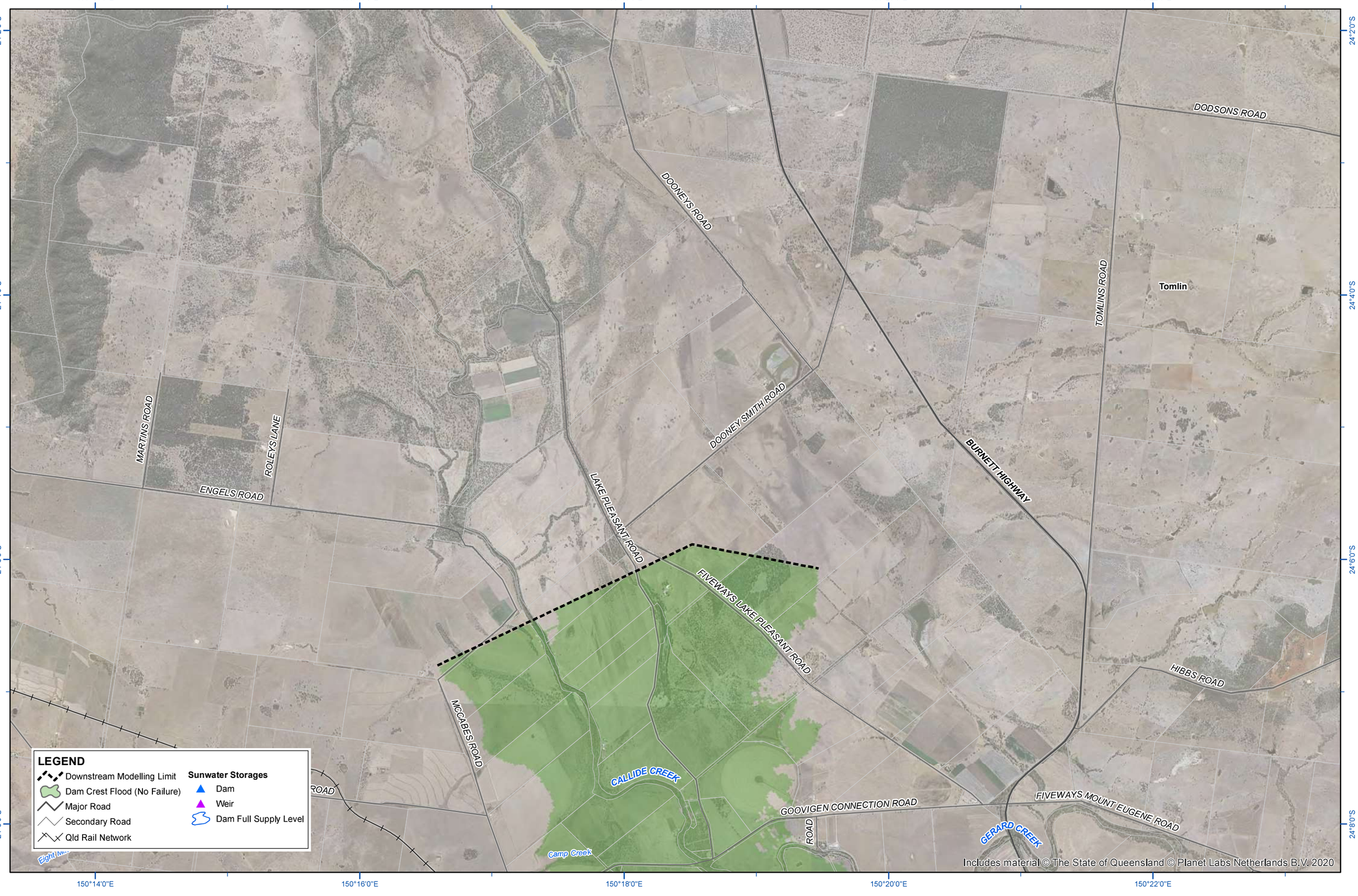

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DAM CREST FLOOD
NO FAILURE
INUNDATION PLAN

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150°38'0"E 150°40'0"E 150°42'0"E 150°44'0"E 150°46'0"E

24°22'0"S 24°24'0"S 24°26'0"S

Lake Callide
CALLIDE CREEK
CALVALE ROAD
Kroombit Gully
VALENTINE PLAINS ROAD
KROOMBIT CREEK
KROOMBIT DAM
Dry Creek
Lake Kroombit
WILCOCKS ROAD

82 83 84 85 46 47 48 49 50 51 52 53 54 55 56 57 58 58 60 61 62 63 64 65 66 67 68 69 70 71 72

LEGEND

- Downstream Modelling Limit
- Dam Crest Flood (Overtopping Failure)
- Major Road
- Secondary Road
- Qld Rail Network

Sunwater Storages

- Dam
- Weir
- Dam Full Supply Level

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KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
DAM CREST FLOOD OVERTOPPING FAILURE INUNDATION PLAN

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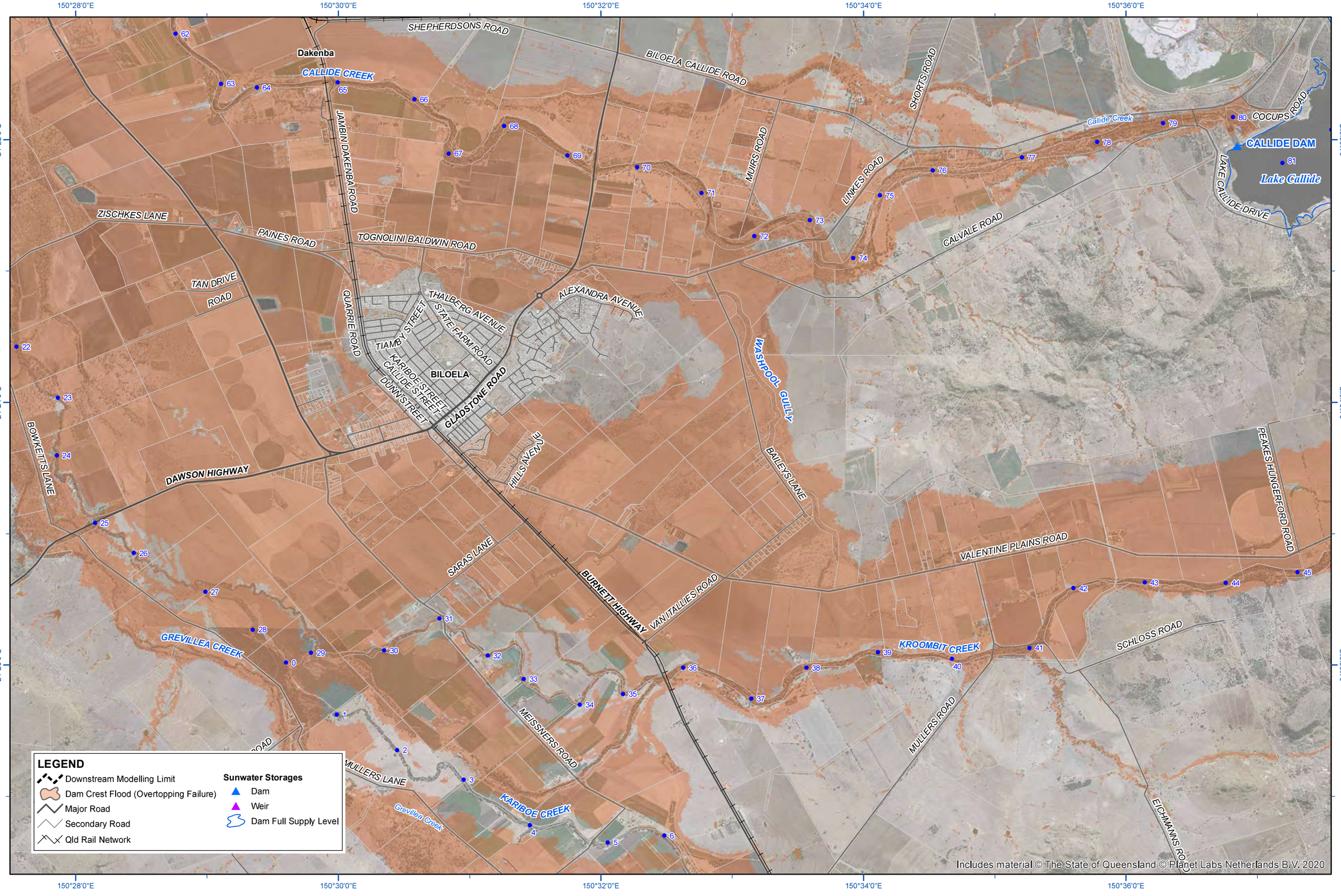

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24°22'0"S 24°24'0"S 24°26'0"S

BELLDEEN GREYCLIFFE ROAD
Neville Creek
Orange Creek
ORANGE CREEK ROAD
ORANGE CREEK SCHOOL BUS ROAD
DAWSON HIGHWAY
HARCHS ROAD
PROSPECT CREEK GOOVIGEN ROAD
ZISCHKES LANE
BOWKETTS LANE
KROOMBIT CREEK
GREVILLEA CREEK
Prospect Creek
BATHS ROAD
CROWSDALE CAMBOON ROAD

17
18
19
20
21
22

LEGEND

- Downstream Modelling Limit
- Dam Crest Flood (Overtopping Failure)
- Major Road
- Secondary Road
- Qld Rail Network

Sunwater Storages

- Dam
- Weir
- Dam Full Supply Level

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DAM CREST FLOOD OVERTOPPING FAILURE INUNDATION PLAN

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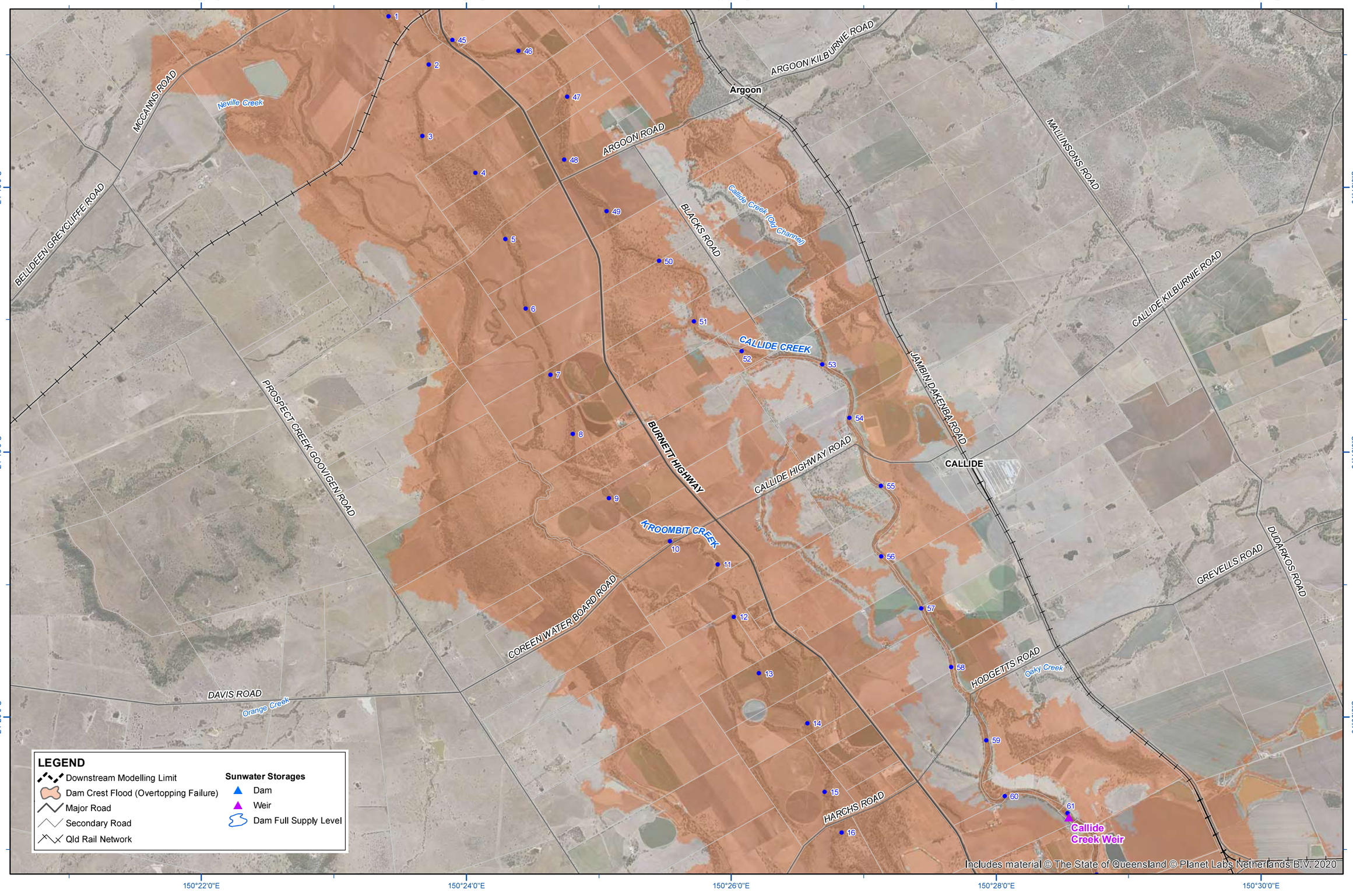

REVISION					
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DATE		REMARKS	CKD	PSD	

MAP INFORMATION
Coordinate System: Geocentric Datum of Australia (GDA2020)

REFERENCE DRAWINGS
255348 - Keymap

N W E S

SCALES (A3 SIZE)
0 500 1,000 1,500 2,000 2,500 Meters 1:50,000

DRAWN	DESIGNED
IDH	JJ
CHECKED	CHECKED
	RJ

APPROVED
R. JENSEN
1/6/2022
RPEQ: 23733

sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
DAM CREST FLOOD OVERTOPPING FAILURE INUNDATION PLAN

CONTRACT NUMBER

DRAWING NUMBER **255351** REV. **A**

SHEET **4 OF 6**

DATE **APRIL 2022**

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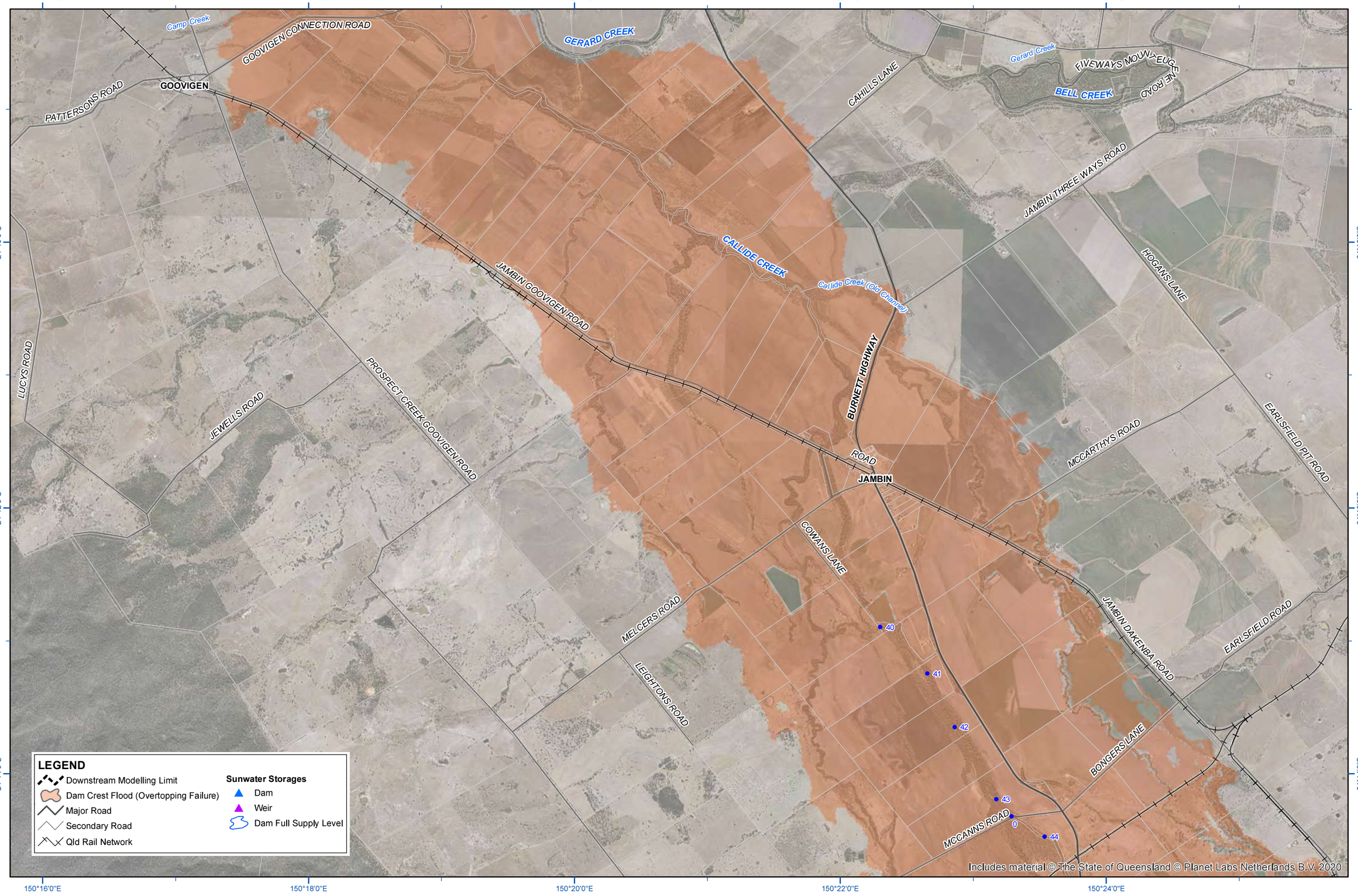

REVISION				
01/06/22	A	ISSUED FOR USE	JJ	RJ
DATE		REMARKS	CKD	PSD

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Coordinate System: Geocentric Datum of Australia (GDA2020).

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255348 - Keymap

SCALES (A3 SIZE)
0 500 1,000 1,500 2,000 2,500 Meters 1:50,000

DRAWN	DESIGNED
IDH	JJ
CHECKED	CHECKED
	RJ
APPROVED	
R. JENSEN 1/6/2022	
RPEQ: 23733	

sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
DAM CREST FLOOD OVERTOPPING FAILURE INUNDATION PLAN

CONTRACT NUMBER

DRAWING NUMBER	REV.
255351	A

SHEET 5 OF 6

DATE APRIL 2022

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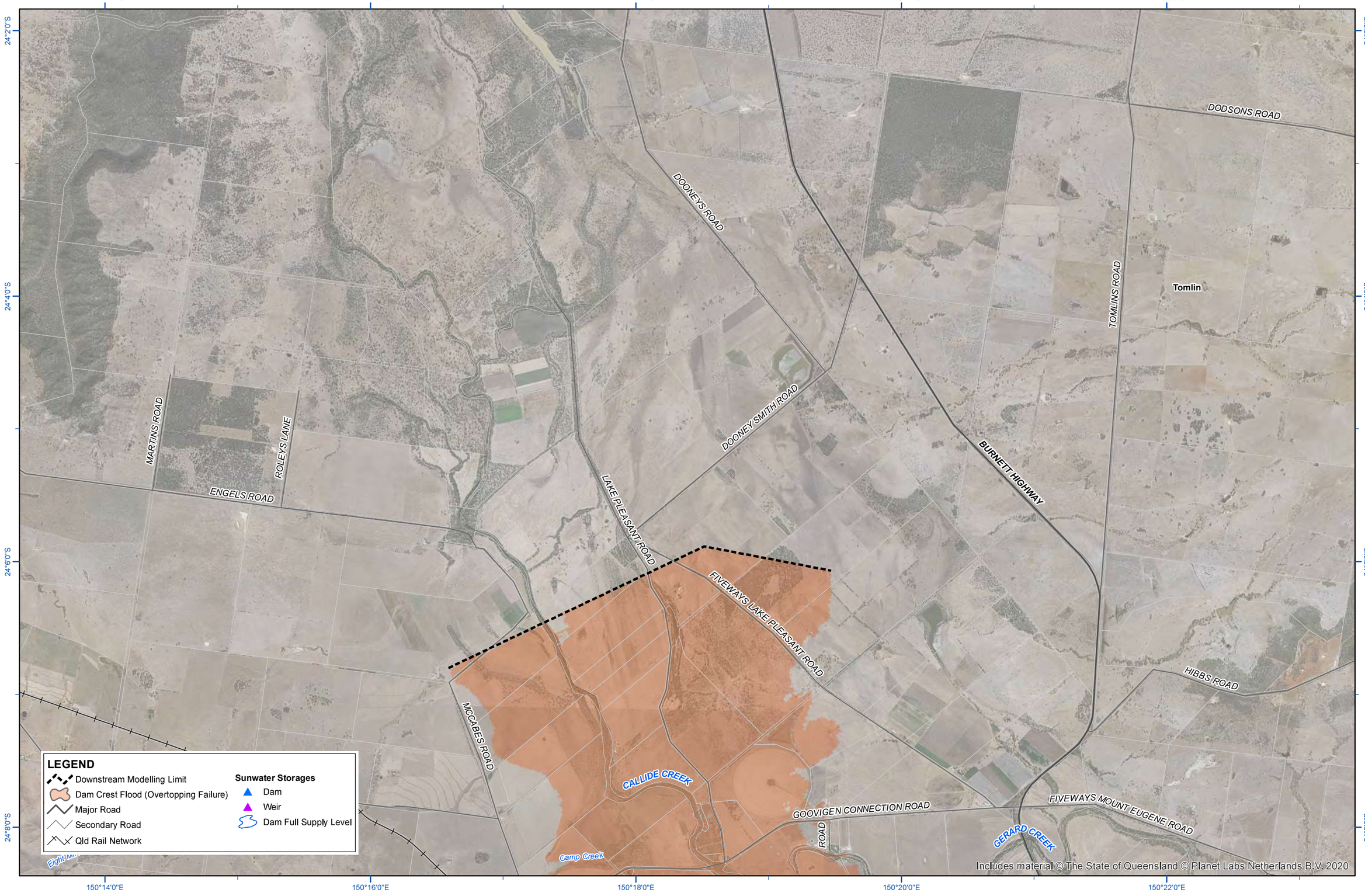

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KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
DAM CREST FLOOD
OVERTOPPING FAILURE
INUNDATION PLAN

CONTRACT NUMBER

DRAWING NUMBER	REV.
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SHEET **6 OF 6**
DATE **APRIL 2022**

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MAP PRODUCED BY:
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150°38'0"E 150°40'0"E 150°42'0"E 150°44'0"E 150°46'0"E

24°22'0"S 24°24'0"S 24°26'0"S

Lake Callide
CALLIDE CREEK
CALVALE ROAD
Kroombit Gully
VALENTINE PLAINS ROAD
KROOMBIT CREEK
KROOMBIT DAM
Dry Creek
Lake Kroombit
COCKS ROAD

82 83 84 85 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72

LEGEND

- Downstream Modelling Limit
- Probable Max. Flood (No Failure)
- Major Road
- Secondary Road
- Qld Rail Network

Sunwater Storages

- Dam
- Weir
- Dam Full Supply Level

REVISION					
01/06/22	A	ISSUED FOR USE	JJ	RJ	
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PROBABLE MAXIMUM FLOOD
NO FAILURE
INUNDATION PLAN

CONTRACT NUMBER

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SHEET 1 OF 6

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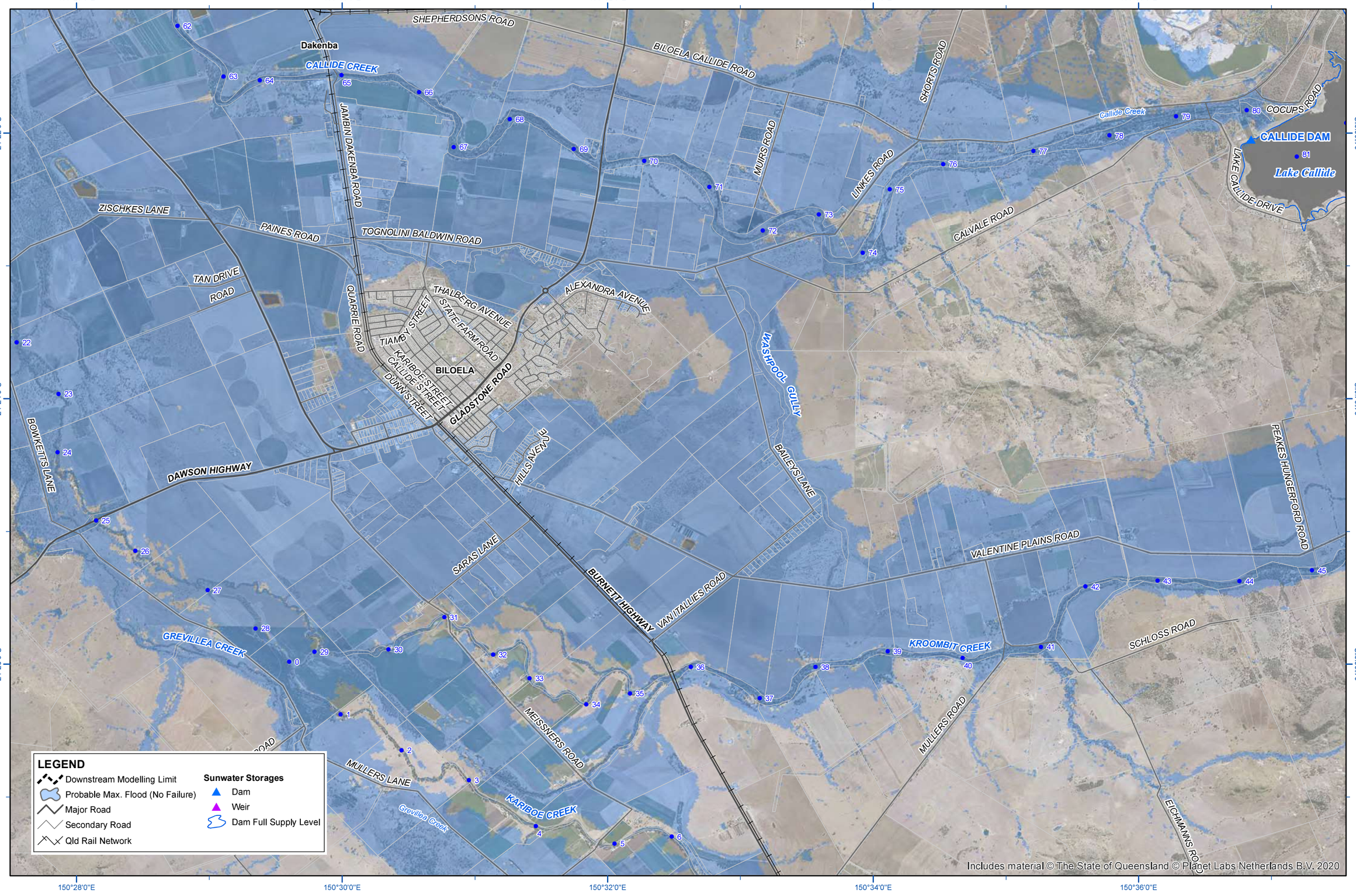

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KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
PROBABLE MAXIMUM FLOOD
NO FAILURE
INUNDATION PLAN

CONTRACT NUMBER

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255352	A

SHEET 2 OF 6

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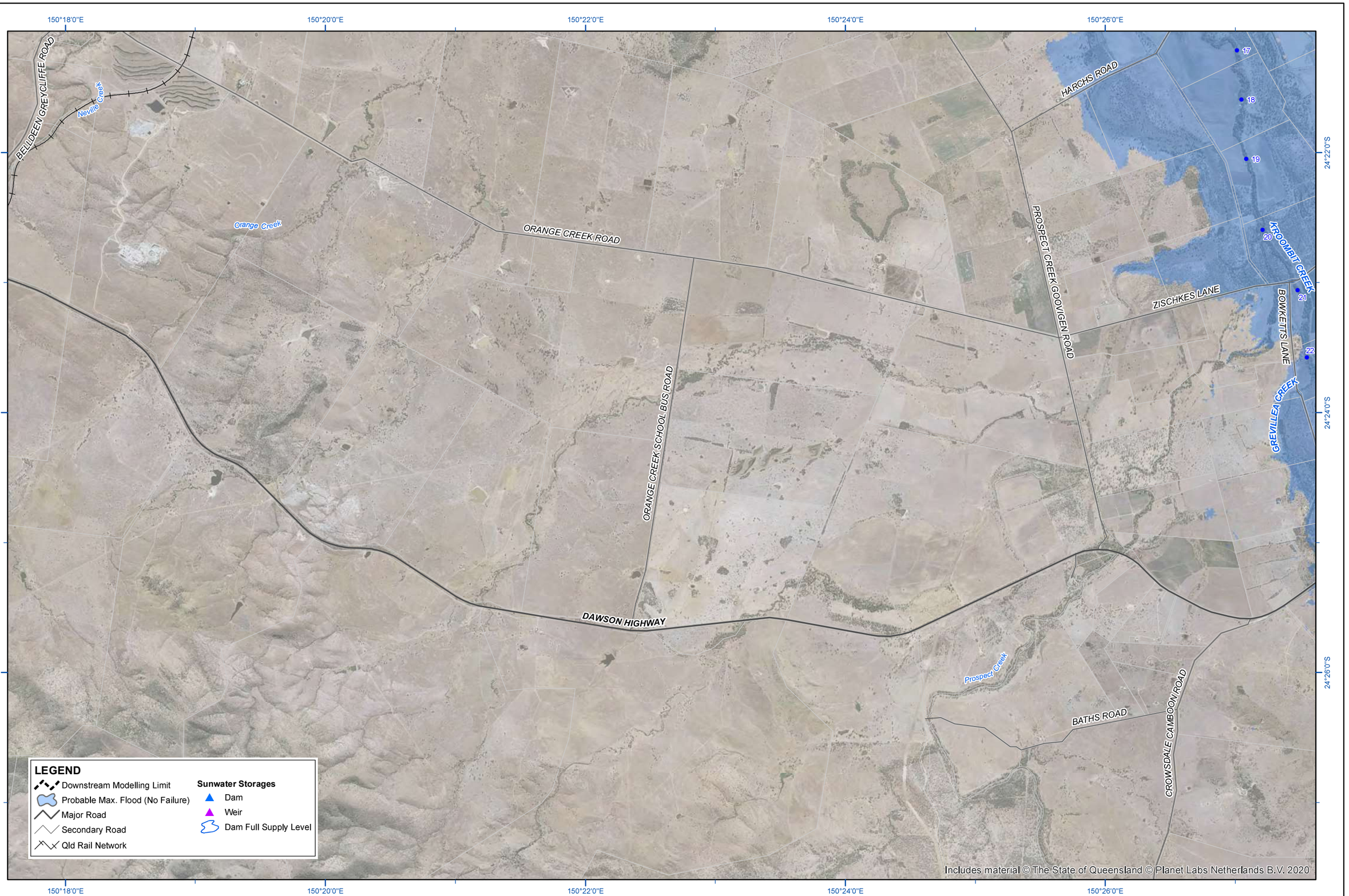

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KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
PROBABLE MAXIMUM FLOOD
NO FAILURE
INUNDATION PLAN

CONTRACT NUMBER

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255352	A

SHEET 3 OF 6

DATE APRIL 2022

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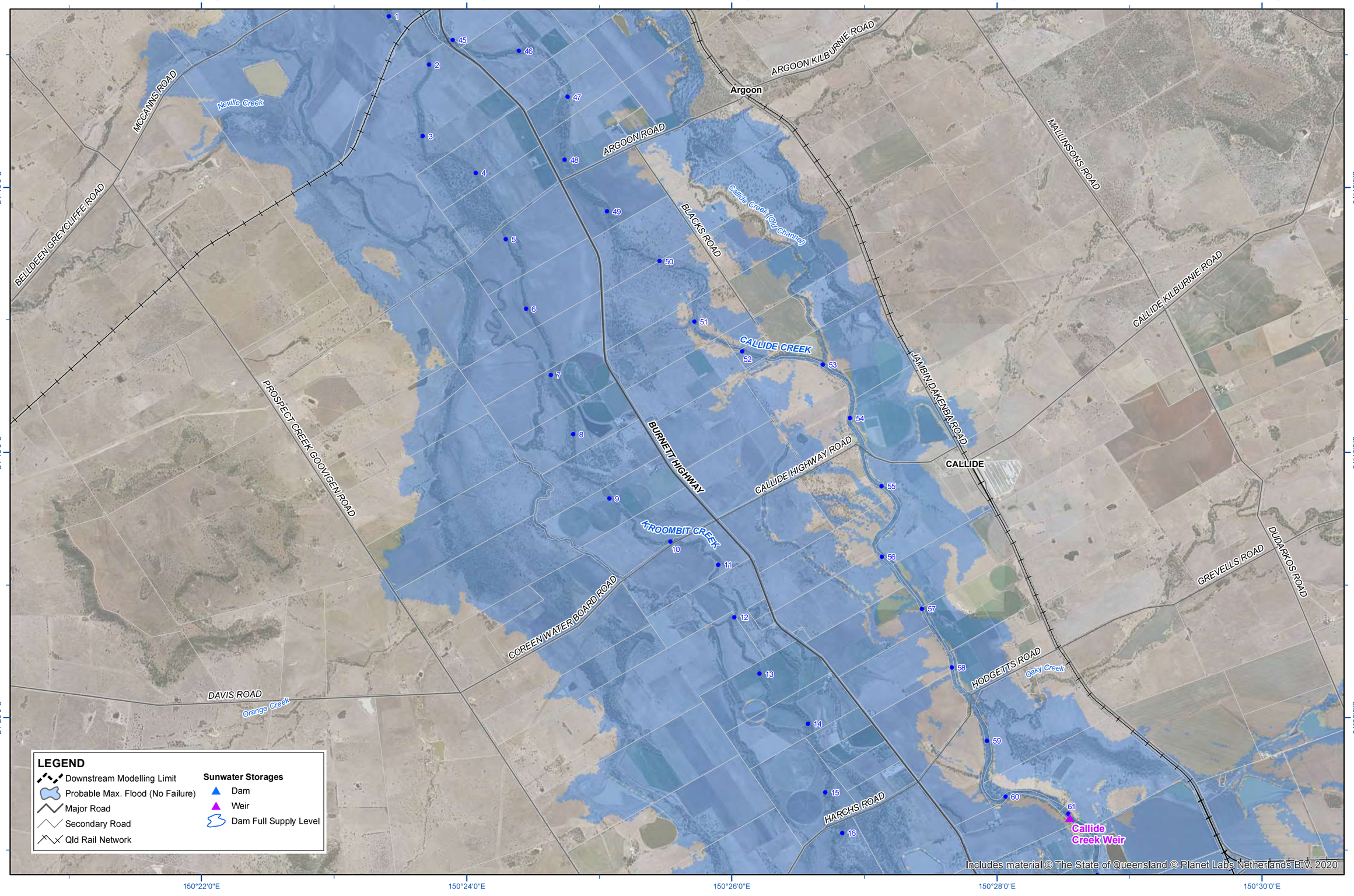

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KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
PROBABLE MAXIMUM FLOOD
NO FAILURE
INUNDATION PLAN

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SHEET **4 OF 6**

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TEL: (07) 3120 0000

150°16'0"E 150°18'0"E 150°20'0"E 150°22'0"E 150°24'0"E

24°10'0"S 24°12'0"S 24°14'0"S

Camp Creek
GOOVIGEN CONNECTION ROAD
GERARD CREEK
Gerard Creek
FIVEWAYS MOUNTAUGH LINE ROAD
BELL CREEK
CAHILLS LANE
PATTERSONS ROAD
GOOVIGEN
JAMBIN THREE WAYS ROAD
CALLIDE CREEK
Callide Creek (Old Channel)
JAMBIN GOOVIGEN ROAD
HOGANS LANE
LUCYS ROAD
PROSPECT CREEK GOOVIGEN ROAD
BURNETT HIGHWAY
JEWELLS ROAD
ROAD
JAMBIN
MCCARTHYS ROAD
EARLSFIELD PIT ROAD
COWANS LANE
MELCERS ROAD
LEIGHTONS ROAD
40
41
42
43
0
44
JAMBIN DAKENBA ROAD
EARLSFIELD ROAD
BONGERS LANE
MCCANNS ROAD

LEGEND

- Downstream Modelling Limit
- Probable Max. Flood (No Failure)
- Major Road
- Secondary Road
- Qld Rail Network

Sunwater Storages

- Dam
- Weir
- Dam Full Supply Level

REVISION				
01/06/22	A	ISSUED FOR USE	JJ	RJ
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DAM FAILURE ANALYSIS - APRIL 2022
PROBABLE MAXIMUM FLOOD
NO FAILURE
INUNDATION PLAN

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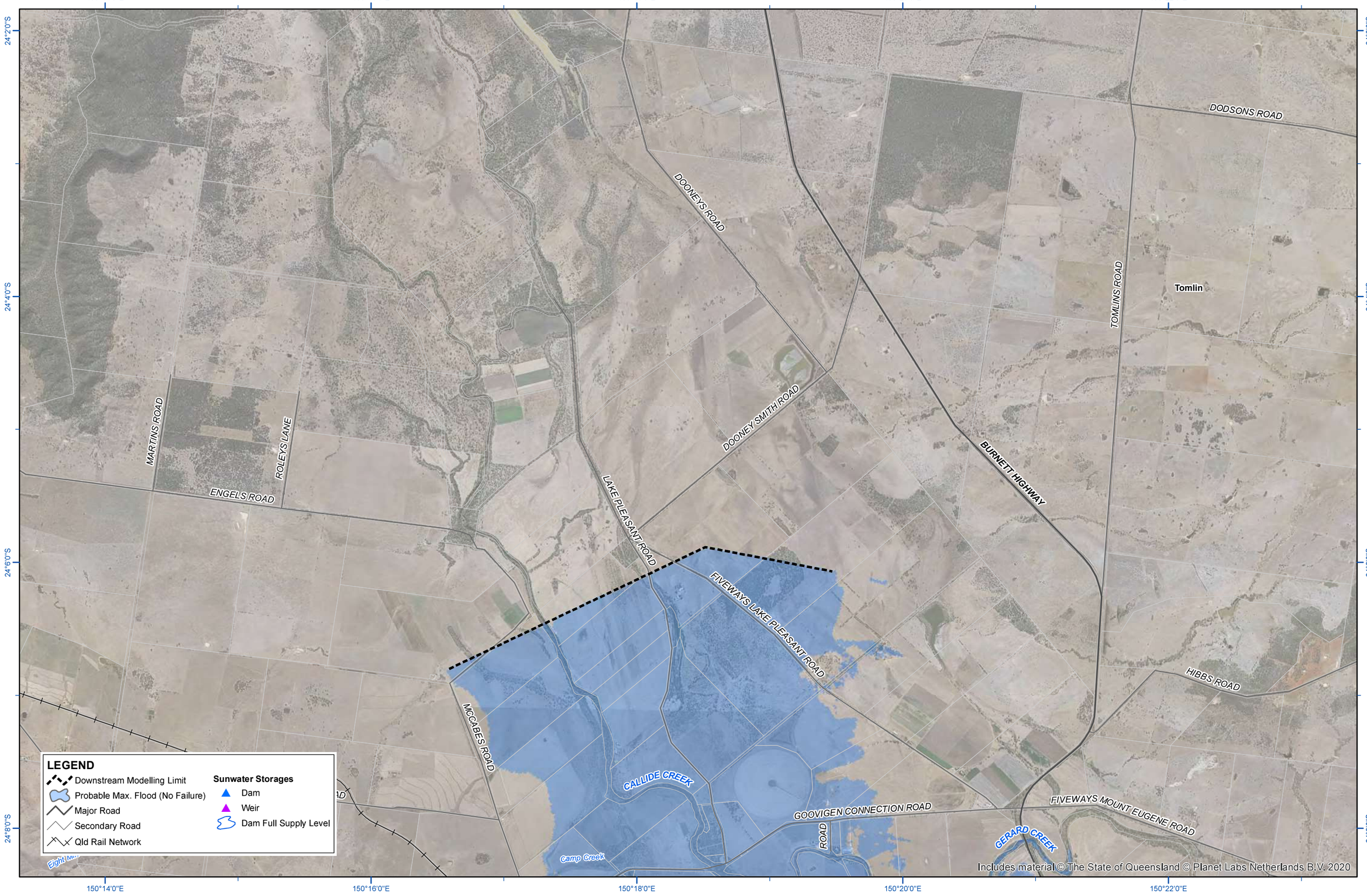

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APPROVED	
R. JENSEN 1/6/2022	
RPEQ: 23733	

sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
PROBABLE MAXIMUM FLOOD
NO FAILURE
INUNDATION PLAN

CONTRACT NUMBER

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255352	A

SHEET 6 OF 6

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Printed: Wednesday, 01/06/2022 09:08:22 AM

MAP PRODUCED BY:
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TEL: (07) 3120 0000

150°38'0"E 150°40'0"E 150°42'0"E 150°44'0"E 150°46'0"E

24°22'0"S 24°24'0"S 24°26'0"S

Lake Callide
CALLIDE CREEK
CALVALE ROAD
Kroombit Gully
VALENTINE PLAINS ROAD
KROOMBIT CREEK
KROOMBIT DAM
Dry Creek
Lake Kroombit
COCKS ROAD

85 84 83 82 49 48 50 51 46 47 52 53 54 55 56 57 58 58 60 61 62 63 64 65 66 67 68 69 70 71 72

LEGEND

- Downstream Modelling Limit
- Probable Max. Flood (Overtopping Failure)
- Major Road
- Secondary Road
- Qld Rail Network

Sunwater Storages

- Dam
- Weir
- Dam Full Supply Level

REVISION					
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APPROVED
R. JENSEN
1/6/2022
RPEQ: 23733

sunwater

KROOMBIT DAM
DAM FAILURE ANALYSIS - APRIL 2022
PROBABLE MAXIMUM FLOOD OVERTOPPING FAILURE INUNDATION PLAN

CONTRACT NUMBER

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Map Produced By:
Asset Delivery
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150°28'0"E 150°30'0"E 150°32'0"E 150°34'0"E 150°36'0"E

24°22'0"S 24°24'0"S 24°26'0"S

Dakenba
CALLIDE CREEK
SHEPHERDSONS ROAD
BILOELA CALLIDE ROAD
SHORTS ROAD
COCUPS ROAD
Callide Creek
CALLIDE DAM
Lake Callide
LAKE CALLIDE DRIVE
JAMBIN DAKENBA ROAD
MUIRS ROAD
LINKES ROAD
CALVALE ROAD
ZISCHKES LANE
PAINES ROAD
TOGNOLINI BALDWIN ROAD
TAN DRIVE
ROAD
QUARRIE ROAD
THALBERG AVENUE
STATE FARM ROAD
TIAMBY STREET
KARIBOE STREET
CALLIDE STREET
DUNN STREET
BILOELA
GLADSTONE ROAD
ALEXANDRA AVENUE
WASHPOOL GULLY
HILLS AVENUE
BAILEYS LANE
PEAKES HUNGERFORD ROAD
BOWKETTS LANE
DAWSON HIGHWAY
SARAS LANE
BURNETT HIGHWAY
VAN'ITALLIES ROAD
VALENTINE PLAINS ROAD
GREVILLEA CREEK
MEISSNERS ROAD
KROOMBIT CREEK
SCHLOSS ROAD
MULLERS ROAD
EICHMANNS ROAD
Grevillea Creek
KARIBOE CREEK

0 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 1 2 3 4 5 6

LEGEND

- Downstream Modelling Limit
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Sunwater Storages

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- Dam Full Supply Level

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1/6/2022
RPEQ: 23733

sunwater

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DAM FAILURE ANALYSIS - APRIL 2022
PROBABLE MAXIMUM FLOOD OVERTOPPING FAILURE INUNDATION PLAN

CONTRACT NUMBER

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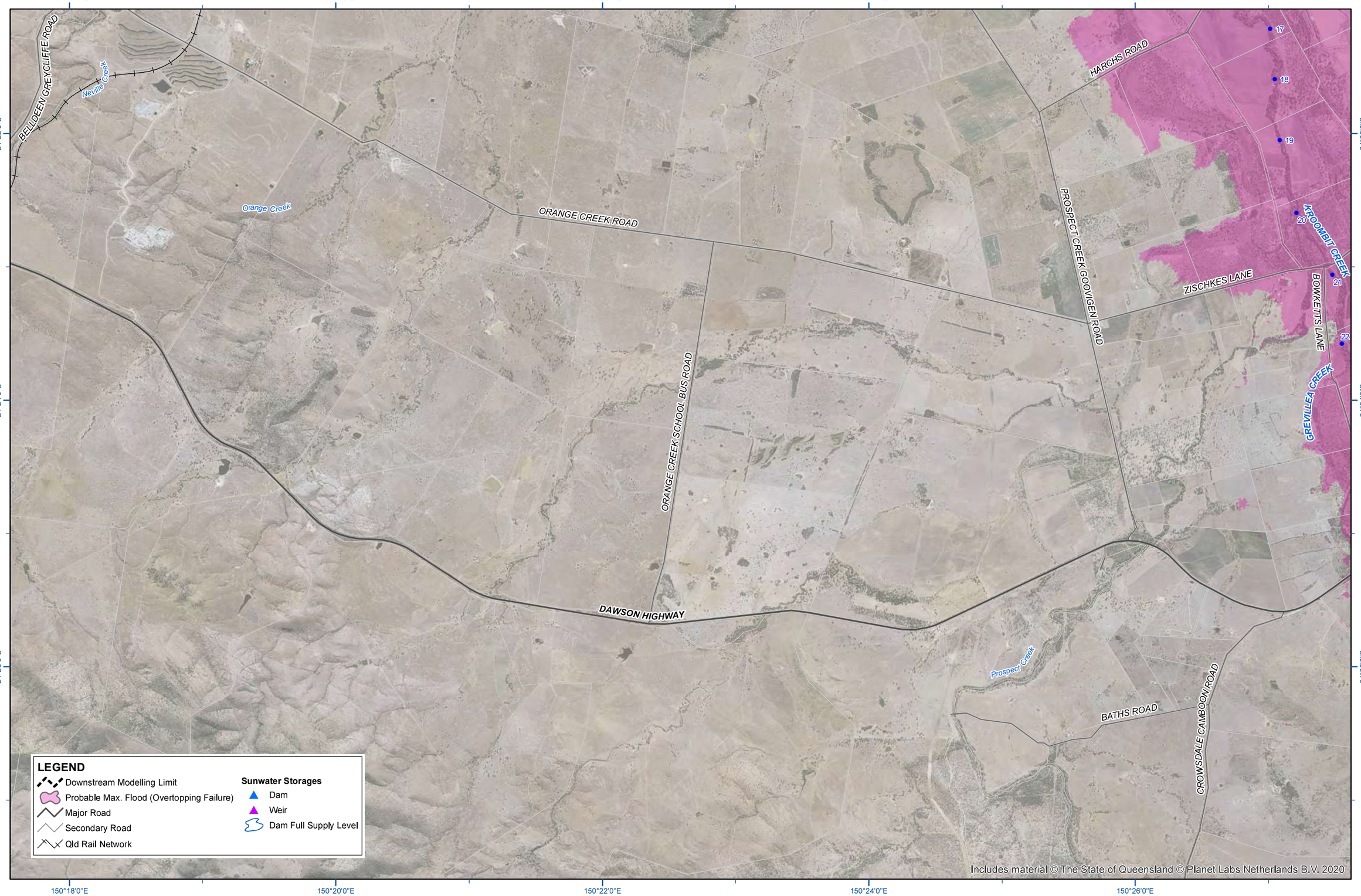

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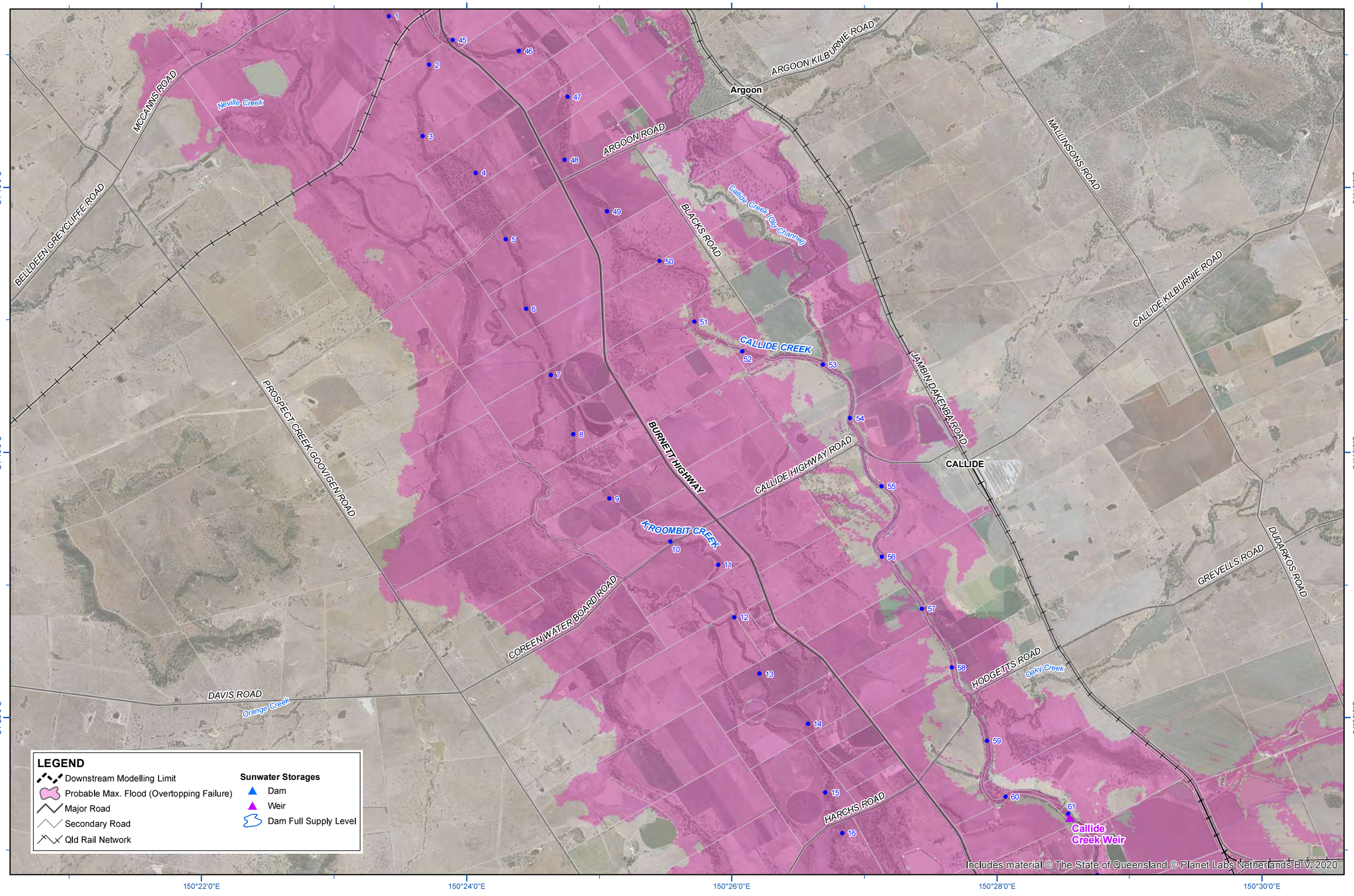

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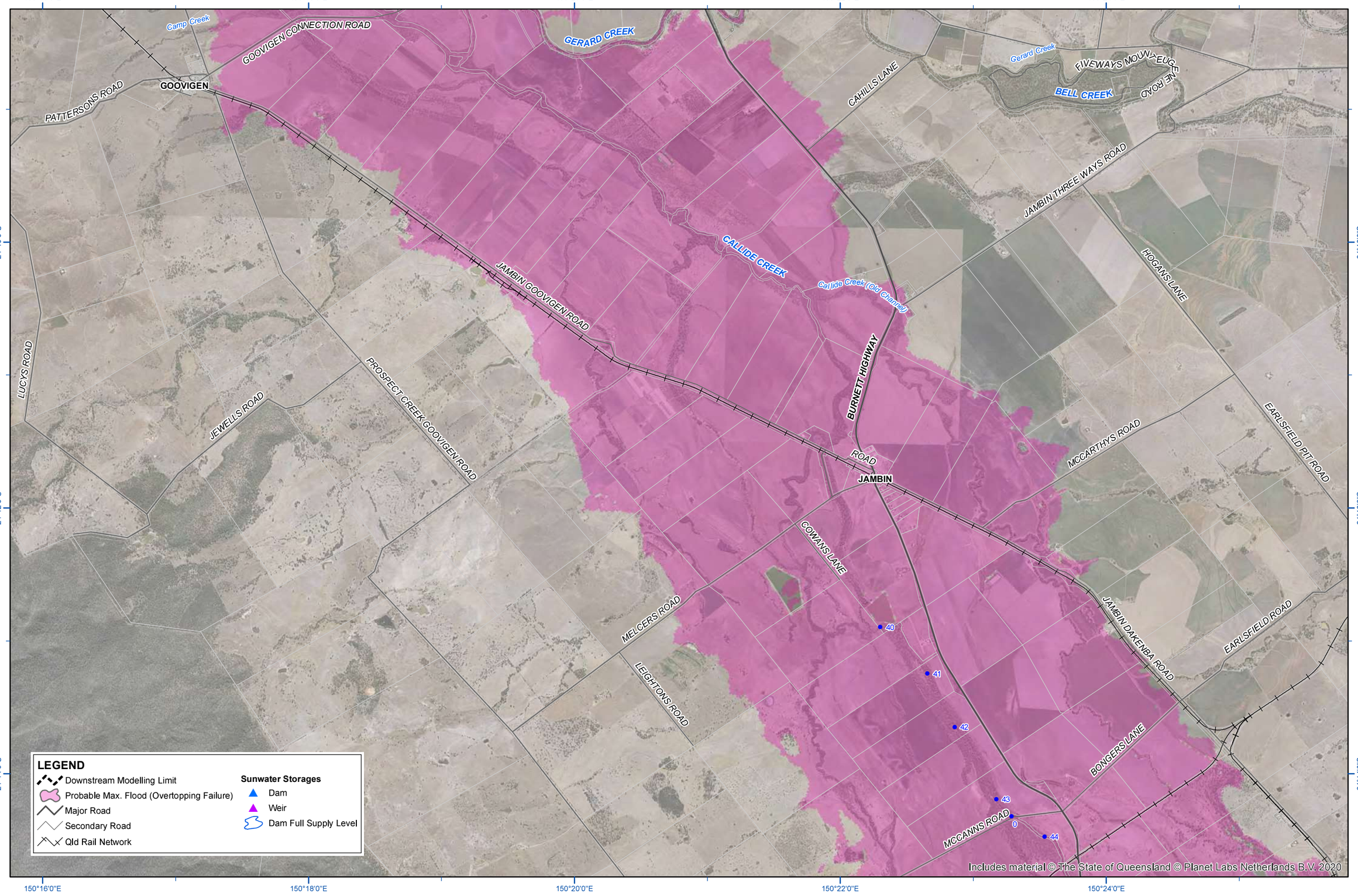

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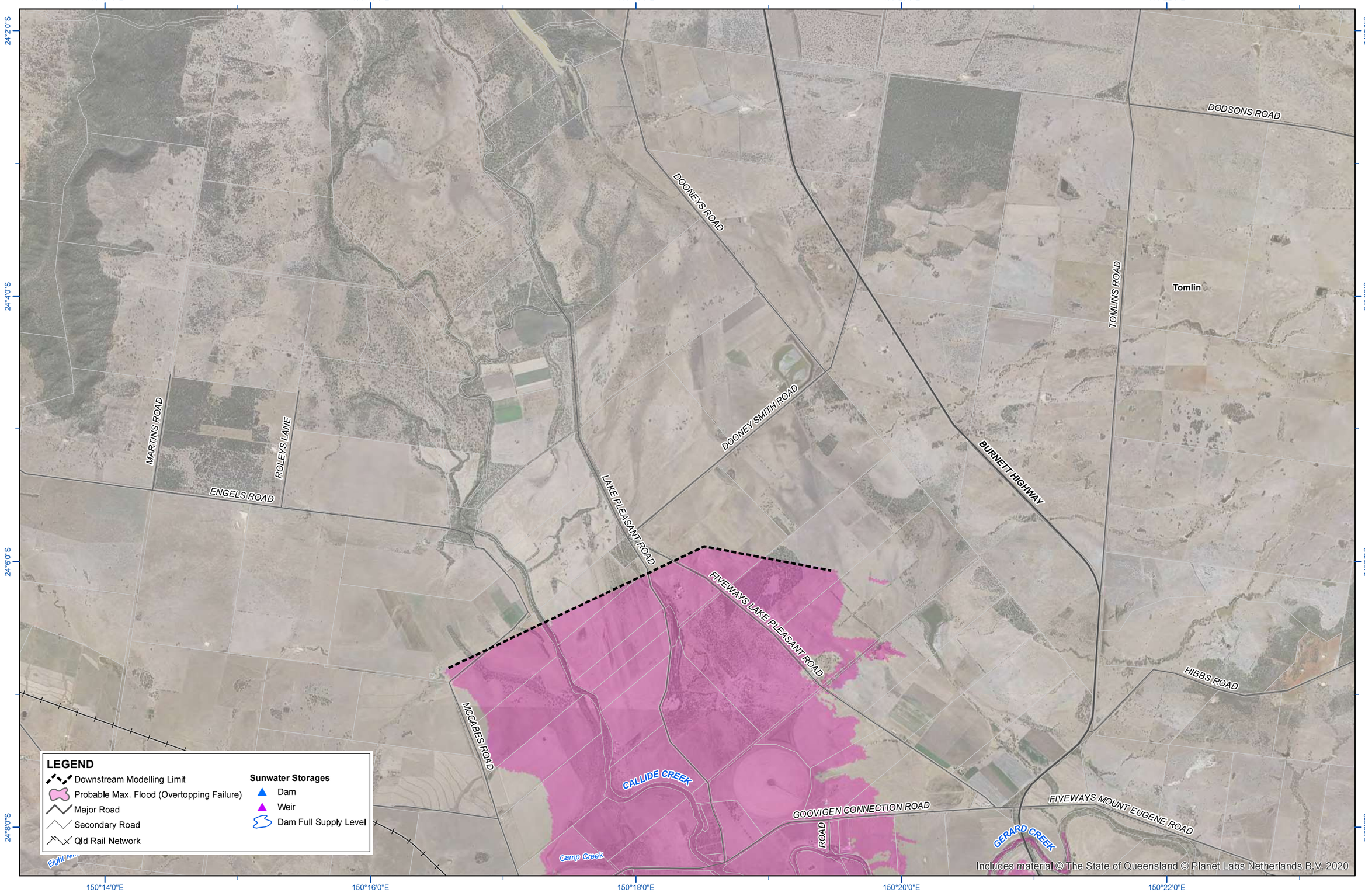

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24°18'0"S 24°20'0"S 24°22'0"S 24°24'0"S 24°26'0"S 24°28'0"S 24°30'0"S

Depth Over Road
750m³/s - 0.80m
1500m³/s - 2.00m
2250m³/s - 2.05m

Depth Over Road
750m³/s - 2.30m
1500m³/s - 4.03m
2250m³/s - 4.06m

Depth Over Road
750m³/s - 0.00m
1500m³/s - 3.64m
2250m³/s - 3.70m

Depth Over Road
750m³/s - 0.91m
1500m³/s - 4.19m
2250m³/s - 4.26m

Depth Over Road
750m³/s - 0.57m
1500m³/s - 1.68m
2250m³/s - 3.02m

Depth Over Road
750m³/s - 5.71m
1500m³/s - 6.58m
2250m³/s - 6.68m

Depth Over Road
750m³/s - 0.40m
1500m³/s - 0.52m
2250m³/s - 0.53m

Depth Over Road
750m³/s - 5.90m
1500m³/s - 5.93m
2250m³/s - 5.93m

Depth Over Road
750m³/s - 4.57m
1500m³/s - 6.24m
2250m³/s - 7.23m

Areas along Callide Creek may also be impacted by Callide Dam outflows. Refer to separate Fact Sheet and Flood Map for Callide Dam.

Callide Creek Weir
Dakenba
BILOELA
THANGOOL
CALLIDE DAM
KROOMBIT DAM

GREVELLS ROAD
DUDARKOS ROAD
DAWSON HIGHWAY
JAMBIN DAKENBA ROAD
SHEPHERDSONS ROAD
SHORTS ROAD
MUIRS ROAD
LINKES ROAD
BILOELA CALLIDE ROAD
CALVALE ROAD
COAL ROAD
ZANGARIS ROAD
PAINES ROAD
CALLIDE STREET
BAILEYS LANE
SARAS LANE
VALENTINE PLAINS ROAD
KROOMBIT CREEK
MULLERS ROAD
SCHLOSS ROAD
MEISSNERS ROAD
BURNETT HIGHWAY
MULLERS LANE
SEMPLES ROAD
HINTONS LANE
BLANCHS ROAD
EICHMANNS ROAD
COX MILLARD ROAD
RUSSIAN CLUB ROAD
BLACKS ROAD
DRUMBURLE ROAD
KARIBOE CREEK

Oaky Creek
Callide Creek
CALLIDE CREEK
Rainbow Creek
Malakoff Creek
Stag Creek
Kroombit Gully
Westpool Gully
Dry Creek
Grevillea Creek
Clinker Creek

LEGEND
- Downstream Modelling Limit
- Major Road
- Secondary Road
- Qld Rail Network
- Flood extent for 750m³/s dam outflow
- Flood extent for 1500m³/s dam outflow
- Flood extent for 2250m³/s dam outflow

Sunwater Storages
- Dam
- Weir
- Dam Full Supply Level

REVISION				
06/10/22	B	TITLE REVISED	IDH	RJ
01/06/22	A	ISSUED FOR USE	JJ	RJ
DATE		REMARKS	CKD	PSD

MAP INFORMATION
Coordinate System: Geocentric Datum of Australia (GDA2020).

SCALES (A3 SIZE)
0 1,000 2,000 3,000 4,000 5,000 Meters 1:100,000

DRAWN	DESIGNED
IDH	JJ
CHECKED	CHECKED
	RJ

APPROVED
R. JENSEN
1/6/2022
RPEQ: 23733

sunwater

KROOMBIT DAM

OUTFLOW FLOOD IMPACTS INUNDATION PLAN

CONTRACT NUMBER

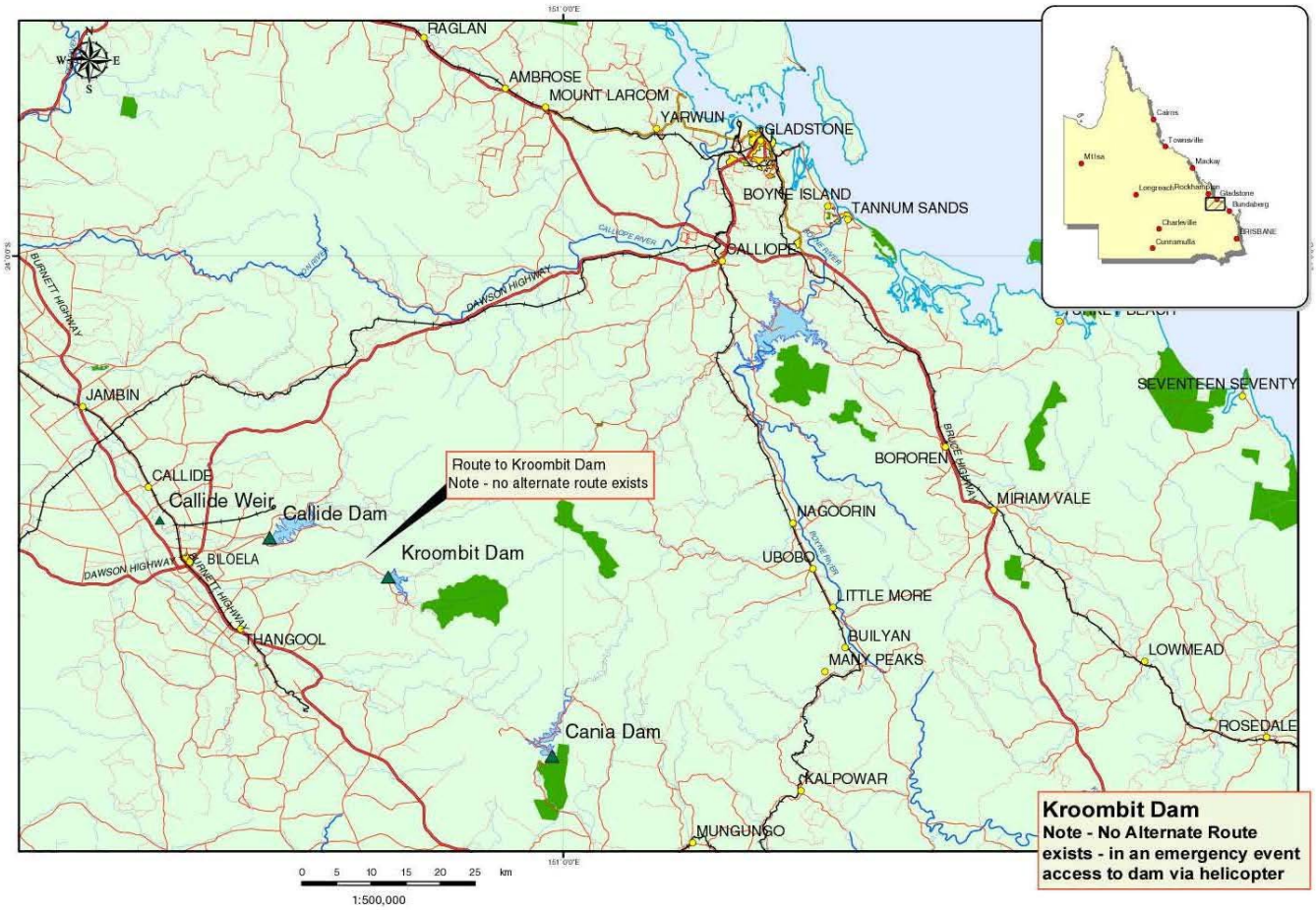
DRAWING NUMBER 255354 | REV. B

SHEET 1 OF 1

DATE APRIL 2022

Appendix B4: Emergency access routes

Figure B3: Access routes during fair and adverse weather conditions



Major access route information (Dry weather only)

Access via Valentine Plains Road from Biloela. Road conditions are dependent on weather conditions.

- Distance: Approx. 30 kms.
- Road Type: Bitumen on Valentine Plains Road then last 5 kms dirt/gravel road to dam
- Speed Limit: 100km/h generally on bitumen (drive to suit conditions).
- Road cut off in wet weather
- NOTE: If Operators need to access the dam for any preparation before a flood event, this should be done early as local roads in the area will usually become flooded, cutting access to the site

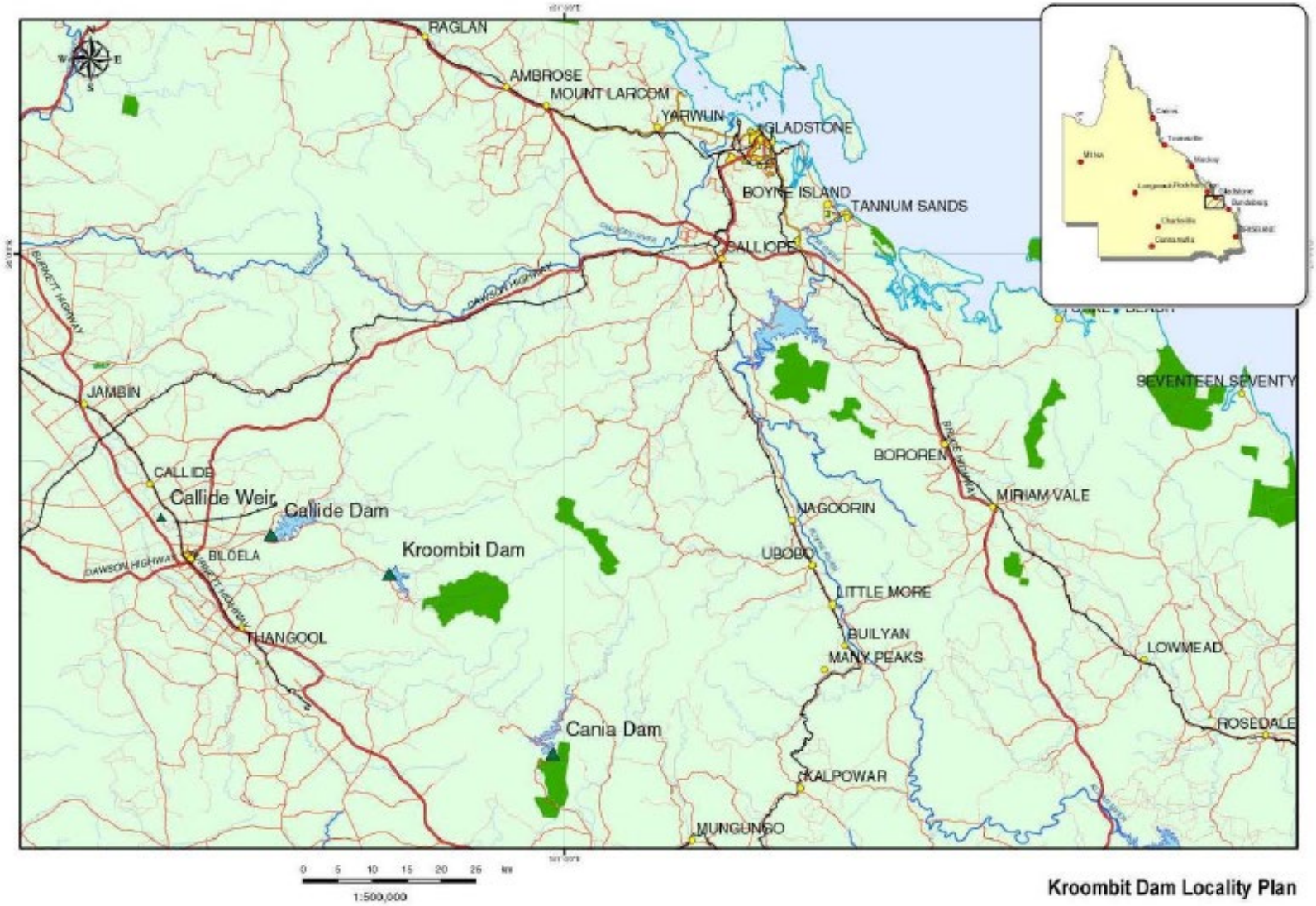
Emergency access route information

No alternative route exists during fair and adverse weather conditions. In a flood event access to the dam is via helicopter only due to local runoff and Kroombit Creek overflow inundating Valentine Plains Road.

- NOTE: Access to dam will be by helicopter.
- **Helipad coordinates: Latitude. -24.41670 Longitude. 150.77120**

Appendix B5: Locality plan

Figure B4: Kroombit Dam locality plan



Document: S:\BW Asset Delivery\GIS_Data\Enterprise_GIS\Water_Supply_Schemes\Callide Valley\Drawings\ArcMap\253495-A.mxd
Printed: Friday, 16/10/2020 09:00:06 AM

Map Produced By:
SunWater Ltd
Tel: (07) 3120 0000

150°45'0"E 150°50'0"E 150°55'0"E 151°0'0"E

24°20'0"S 24°25'0"S 24°30'0"S

N W E S

LEGEND
- Rainfall Station
- Rainfall & River Station
- River Station

Sunwater Storage Infrastructure
- Sunwater Dam

KROOMBIT TOPS TM

BOOLAROO TOPS TM

KROOMBIT CREEK

DRY CREEK

130360A - KROOMBIT CK AT KROOMBIT DAM HW

KROOMBIT DAM

KROOMBIT DAM HW TM

UPPER KROOMBIT TM

100008A - MID-KROOMBIT TBR

130379A - KROOMBIT CK AT LOCHENBAR

MAP INFORMATION
Coordinate System: Geocentric Datum of Australia (GDA94).

SCALES (A3 SIZE)
0 1 2 3 4 5 km 1:90,000

sunwater

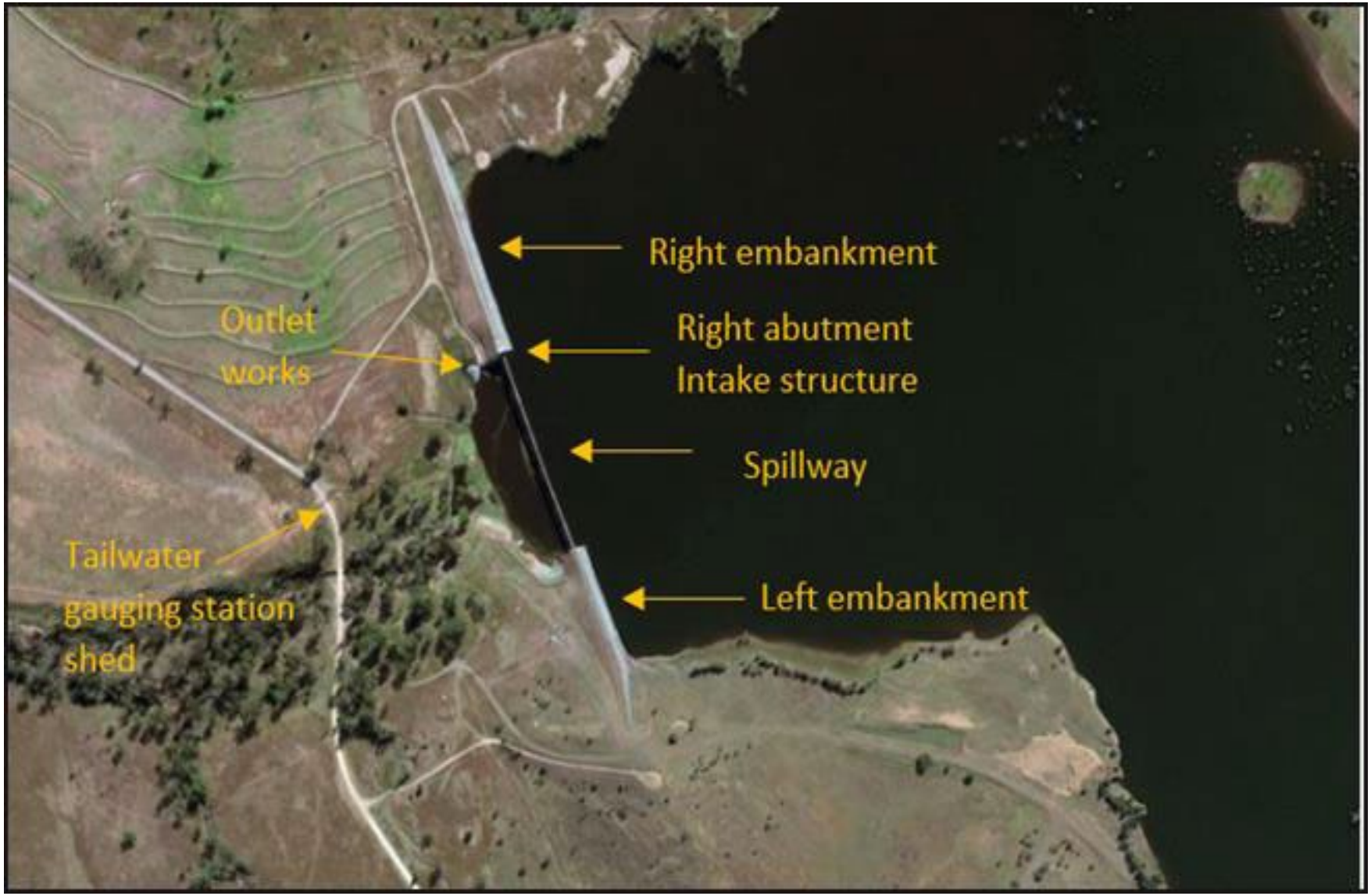
KROOMBIT DAM
KROOMBIT CREEK
CATCHMENT MAP

Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

DRAWING No. 253495 A

Appendix B7: Map of Kroombit Dam

Figure B6: Map of Kroombit Dam



APPENDIX C Equipment and technical information

Appendix C1: List of equipment available during an emergency

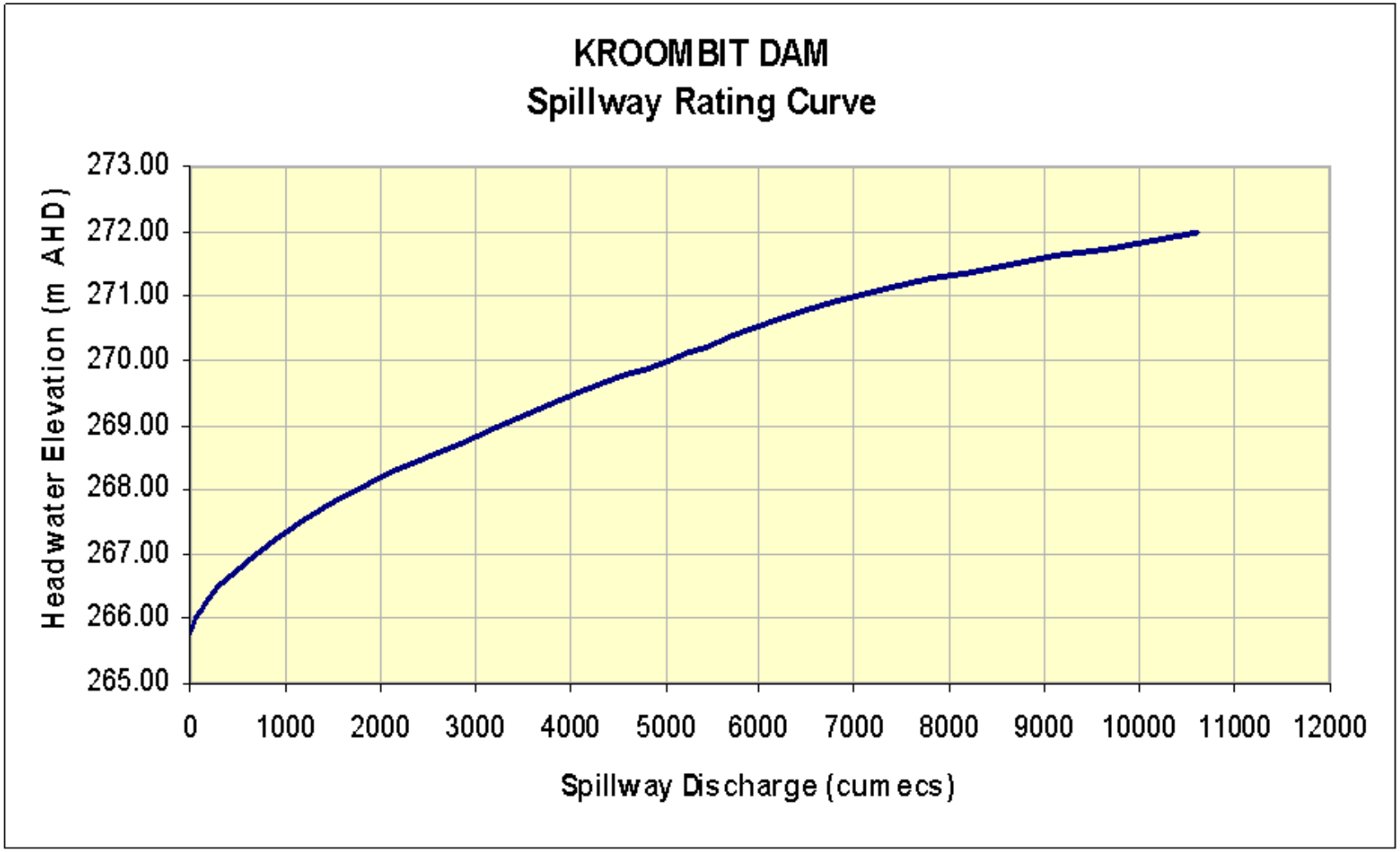
Appendix C2: Kroombit Dam Spillway Discharge Rating Curve

Appendix C3: Kroombit Dam Storage Curve

Appendix C1 has been redacted

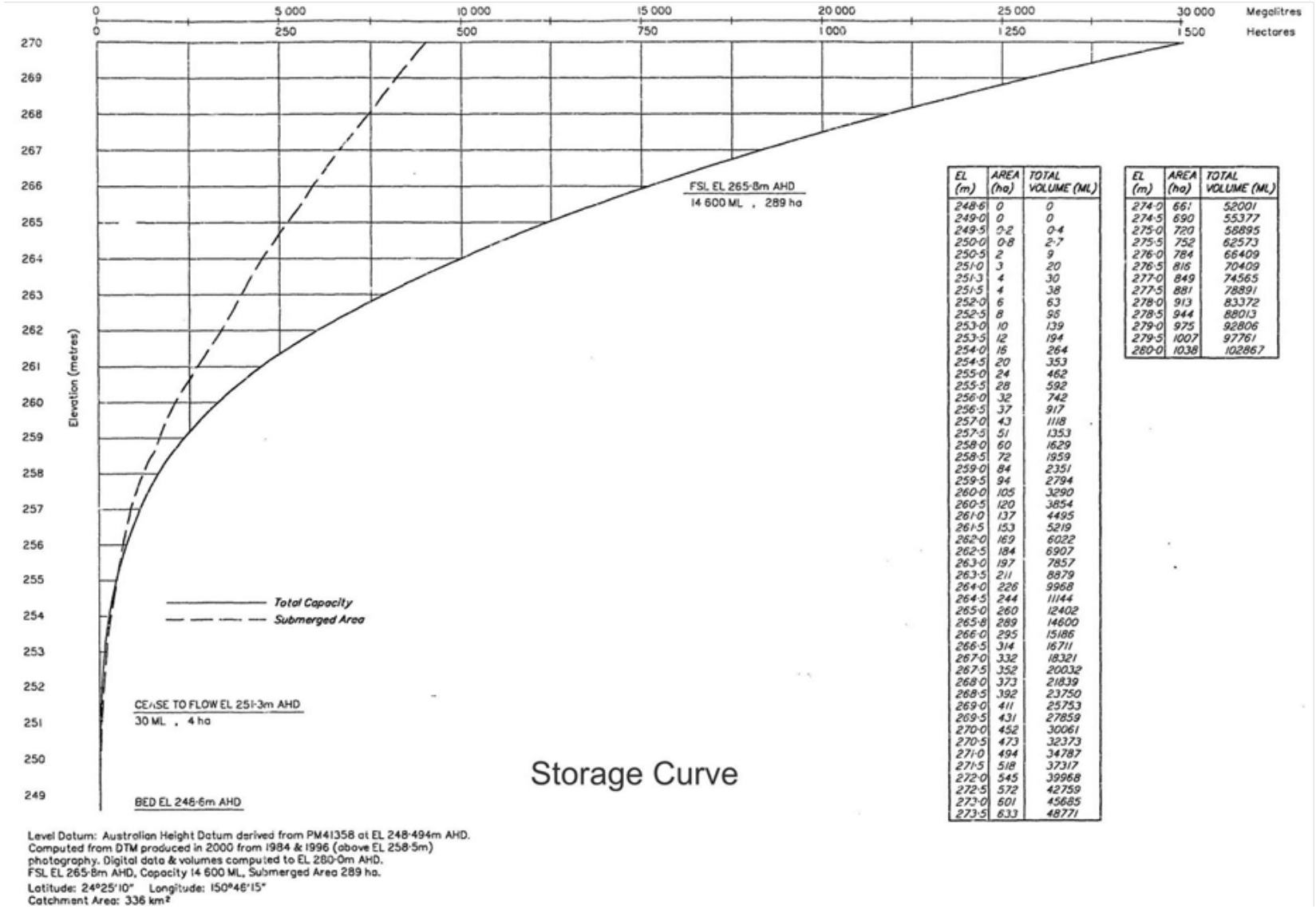
Appendix C2: KROOMBIT Dam discharge curve

Figure C2: Kroombit Dam Spillway Discharge Rating Curve



Appendix C3: KROOMBIT Dam Storage Curve

Figure C3: Kroombit Dam Storage Curve



EL (m)	AREA (ha)	TOTAL VOLUME (ML)
248·6	0	0
249·0	0	0
249·5	0·2	0·4
250·0	0·8	2·7
250·5	2	9
251·0	3	20
251·3	4	30
251·5	4	38
252·0	6	63
252·5	8	98
253·0	10	139
253·5	12	194
254·0	15	264
254·5	20	353
255·0	24	462
255·5	28	592
256·0	32	742
256·5	37	917
257·0	43	1118
257·5	51	1353
258·0	60	1629
258·5	72	1959
259·0	84	2351
259·5	94	2794
260·0	105	3290
260·5	120	3854
261·0	137	4495
261·5	153	5219
262·0	169	6022
262·5	184	6907
263·0	197	7857
263·5	211	8879
264·0	226	9968
264·5	244	11144
265·0	260	12402
265·8	289	14600
266·0	295	15186
266·5	314	16711
267·0	332	18321
267·5	352	20032
268·0	373	21839
268·5	392	23750
269·0	411	25753
269·5	431	27859
270·0	452	30061
270·5	473	32373
271·0	494	34787
271·5	518	37317
272·0	545	39968
272·5	572	42759
273·0	601	45685
273·5	633	48771

EL (m)	AREA (ha)	TOTAL VOLUME (ML)
274·0	661	52001
274·5	690	55377
275·0	720	58895
275·5	752	62573
276·0	784	66409
276·5	816	70409
277·0	849	74565
277·5	881	78891
278·0	913	83372
278·5	944	88013
279·0	975	92806
279·5	1007	97761
280·0	1038	102867

Level Datum: Australian Height Datum derived from PM41358 at EL 248·494m AHD.
Computed from DTM produced in 2000 from 1984 & 1996 (above EL 258·5m) photography. Digital data & volumes computed to EL 280·0m AHD.
FSL EL 265·8m AHD, Capacity 14 600 ML, Submerged Area 289 ha.
Latitude: 24°25'10" Longitude: 150°46'15"
Catchment Area: 336 km²

APPENDIX D Interaction with local government and district groups

To be populated when EAP next completes a substantial review

Annexe — Kroombit Dam AWS SMS Messages

	Advice Stay informed 	**Watch and Act** Prepare to leave 	**Emergency** Leave immediately To be issued in consultation with council 
SMS	ADVICE from Sunwater. Kroombit Dam is spilling excess water. People downstream of Kroombit Dam should STAY INFORMED and MONITOR CONDITIONS. Water flows from Kroombit Dam expected to remain within beds and banks of river / may contribute to widespread/ localised/ overland flooding. Expect increased river flows in 6-12 hours / later today/ overnight/ tomorrow. There is no immediate danger. More information here: bit.ly/RecandSafety	FLOOD WATCH AND ACT from Sunwater. Excess water spilling from Kroombit Dam has increased significantly. Water flows from Kroombit Dam may contribute to dangerous/widespread flooding downstream. Expect increased river flows in 6-12 hours / later today/ overnight/ tomorrow. People downstream of Kroombit Dam must PREPARE TO LEAVE in case the flood gets worse. Call Triple Zero (000) if your life is in danger. Call the SES on 132500 for flood help. More information here: bit.ly/RecandSafety	FLOOD EMERGENCY WARNING from Sunwater: People downstream of Kroombit Dam including Valentine Plains and low-lying areas of Biloela must LEAVE IMMEDIATELY. Kroombit Dam possible failure/is failing. Major flooding is happening now. Your life is at risk. Go now to a safe place away from the flood. XXX and XXX are safe. More information here: Banana Shire Council http://emd.banana.qitplus.com