



Technical Bulletin: Emergency Management for Dam Safety

Ontario Flood Risk Management Workshop

Toronto, Ontario

September 19th - 20th, 2018

VALUES • SAFETY • INTEGRITY • EXCELLENCE • PEOPLE AND CITIZENSHIP



BEHAVIOURS • SAY IT DO IT • SIMPLIFY IT • THINK TOP AND BOTTOM LINE • INTEGRATE AND COLLABORATE • TELL IT AS IT IS

John Perdikaris, M.Eng., PhD., P.Eng.





1. Understanding/identifying the need for Emergency Management guidance
2. Objectives of the Draft *CDA Technical Bulletin Emergency Management for Dam Safety*
3. Contents of the draft Bulletin
4. Next steps in developing the final Bulletin



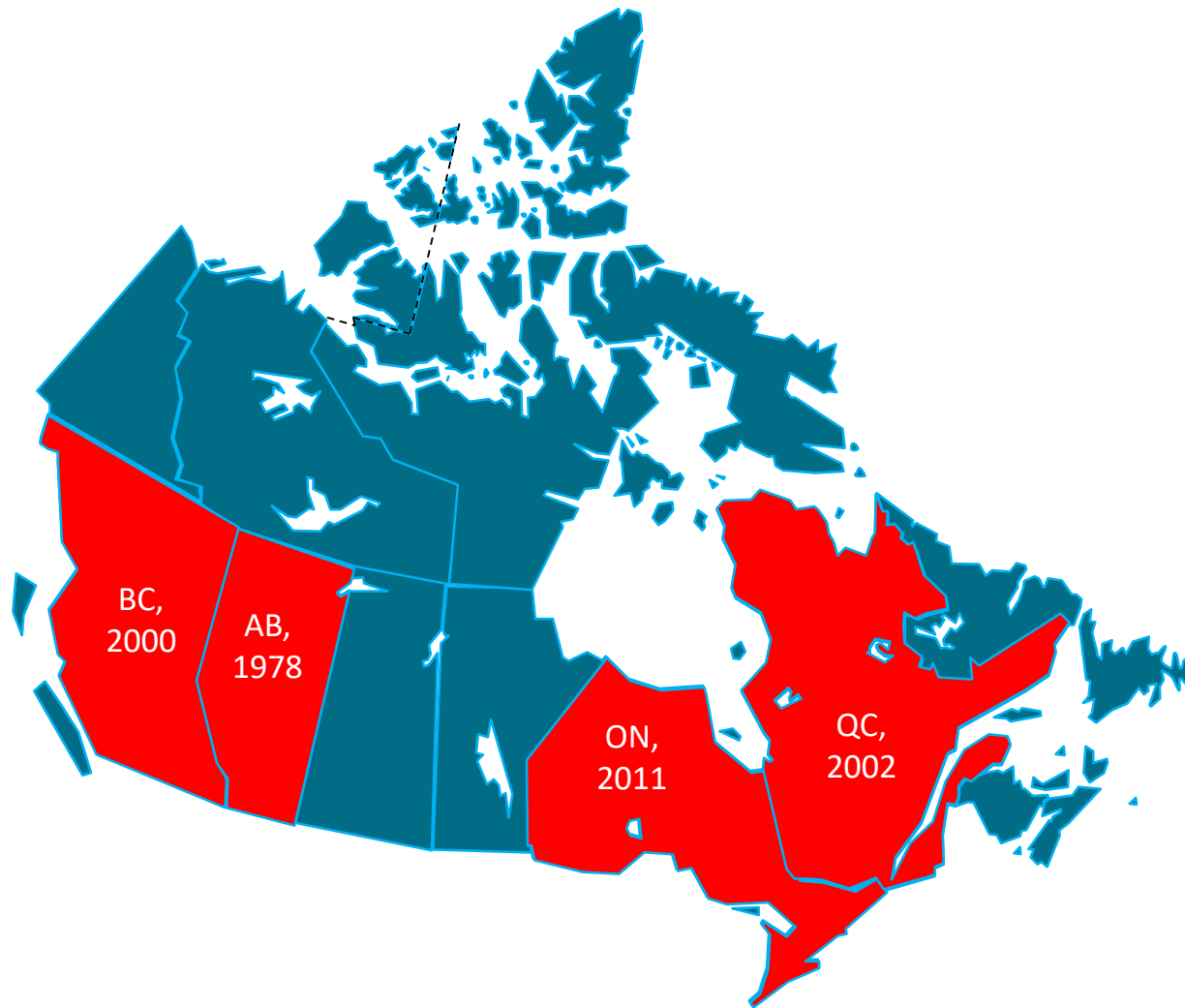


1. Understanding/Identifying the need for Emergency Management Guidance





Canadian Dam Safety Regulations





Province of British Columbia

A dam owner of a dam that has a classification of significant, high, very high or extreme must...

3.1(1)

- (a) **prepare a plan that describes the actions to be taken by the dam owner in the event of an emergency at the dam, and**
- (b) submit the plan to a dam safety officer for acceptance.

3.1(3)

- (a) **review, and revise if necessary, the emergency preparedness plan** for the dam no less frequently than is specified for the classification of the dam, and
- (b) submit any revisions to a dam safety officer for acceptance





- Only 3 Provinces (Alberta, Quebec, BC) require owners to document an emergency response plan, for the rest of Canada it is voluntary
- Only 50% of dam owners have an emergency plan to manage response to the failure of a dam which could result in loss of life
- Only 30% of dam owners indicated that they routinely exercised emergency plans, with 45% indicating 'Never', or that it has been 'More than 3 years'
- 70% of dam owners do not meet with the communities that may be impacted by failure to discuss emergency plans



CDA Survey of Practice (2016) Sample Question

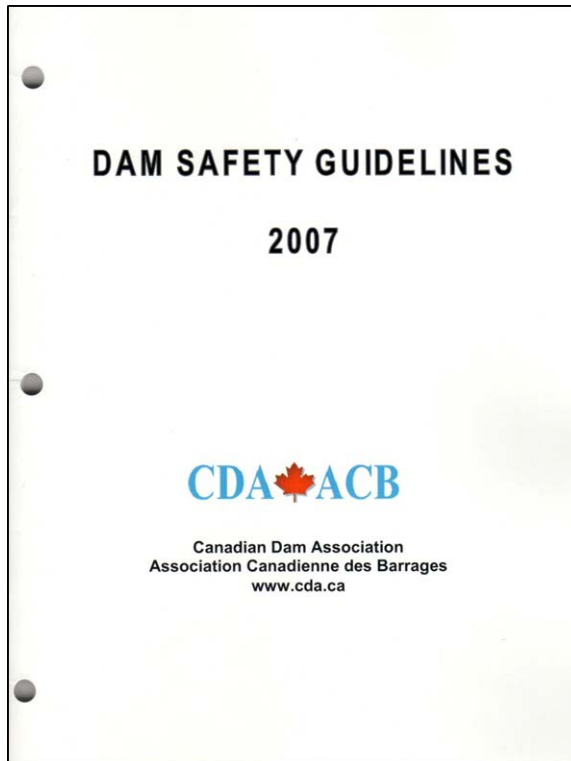


Training and Exercising – Plans not being exercised

70% of owners are either not exercising their plans or are doing so less than annually

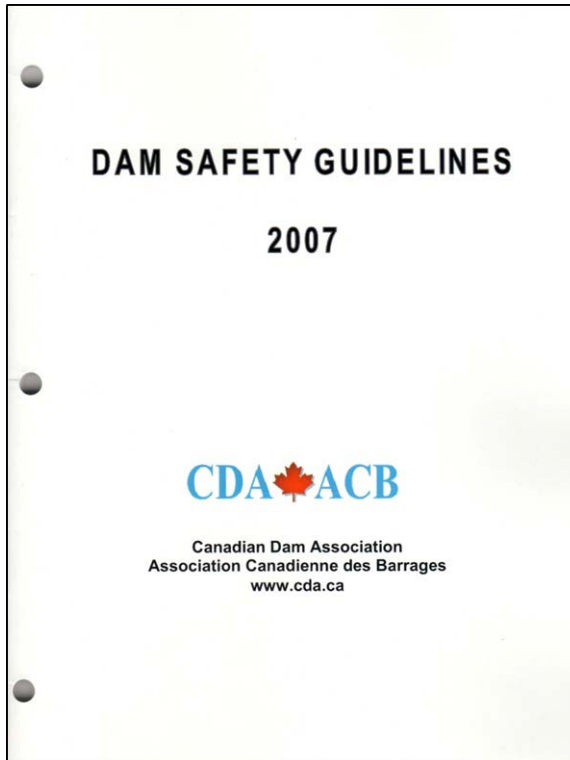
Answer Choices	Responses	
Yes, with a frequency of at least one exercise per year	26.19%	11
Yes, with a frequency of less than one exercise per year	28.57%	12
The last exercise our organization participated in was more than 3 years ago	14.29%	6
No, we have not participated in exercises for dam safety	30.95%	13
Total		42





- Provide industry guidance, complementary to Provincial Regulations
- Part of a set of industry guidance that includes:
 - i. Principles
 - ii. Guidelines
 - iii. Technical Bulletins
- Published in 1995, revised in 1999, 2007 and 2013
- “Sets the bar” for Owner’s due diligence





Section 4. Emergency Preparedness

- Basically unchanged from 1999 version of CDA Dam Safety Guidelines (i.e. no updates in 2007 or 2013 revisions)
- No separate Bulletin associated with this Section providing the details
- Key elements missing, which has led to inconsistencies in practice



CDA – Emergency Management



EPRP Guidance (requirements for Preparedness, Response and Recovery)	Guidelines for Dams			General Industry	
	CDA ¹ Guidelines	FERC ² Guidelines	FEMA ³	Public Safety Canada ⁴	CSA Z1600 ⁵
Managed System Framework	X	X	X		✓
EPRP Contents and Format	✓	✓	✓	✓	✓
Activation Guidelines	✓	✓	✓	N/A	N/A
Inundation Mapping	X	✓	✓	N/A	N/A
Drills/ Exercises	✓	✓	✓	✓	✓
Recovery Planning	X	X	X	✓	✓
Community Engagement	X	X	X	✓	✓

Table 1

COMPARISON OF NORTH AMERICAN GUIDELINES

Ref. 1. Canadian Dam Association - Dam Safety Guidelines (2007)

Ref. 2. FERC Chapter VI, Emergency Action Plan Guidelines (2007)

Ref. 3. FEMA 64, Federal Guidelines for Dam Safety: EAPs for Dam Owners (2013)

Ref. 4. Public Safety Canada Emergency Management Planning Guide (2011)

Ref. 5. CSA Emergency Management and Business Continuity Programs (2008)



2. Objectives of *CDA Technical Bulletin Emergency Management for Dam Safety*





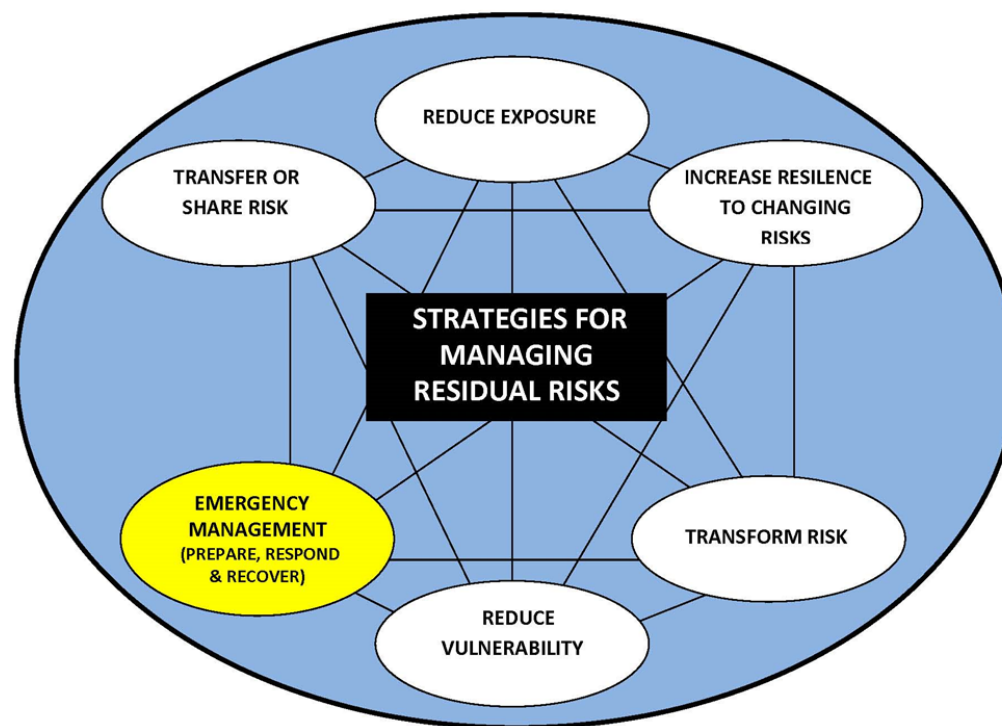
OBJECTIVES

1. Assist dam owners in preparing emergency preparedness and response plans
2. Establish clear guidance on:
 - Activation levels
 - Inundation mapping
3. Address aspects of emergency management beyond planning and response (i.e. mitigation and recovery phases)
4. Outline strategies to enhance understanding of hazards posed by a dam, in order to reduce vulnerability of stakeholders – building community resilience





- **Objective 4.** Outline strategies to enhance the understanding of hazards posed by a dam to reduce vulnerability of stakeholders – building community resilience





3. Contents of Draft Bulletin



Bulletin: Table of Contents



1. Introduction
2. Emergency Management Framework
3. Risk Assessment and Controls
4. Maintaining State of Readiness
5. Response to Dam Emergency Events
6. Recovery

References

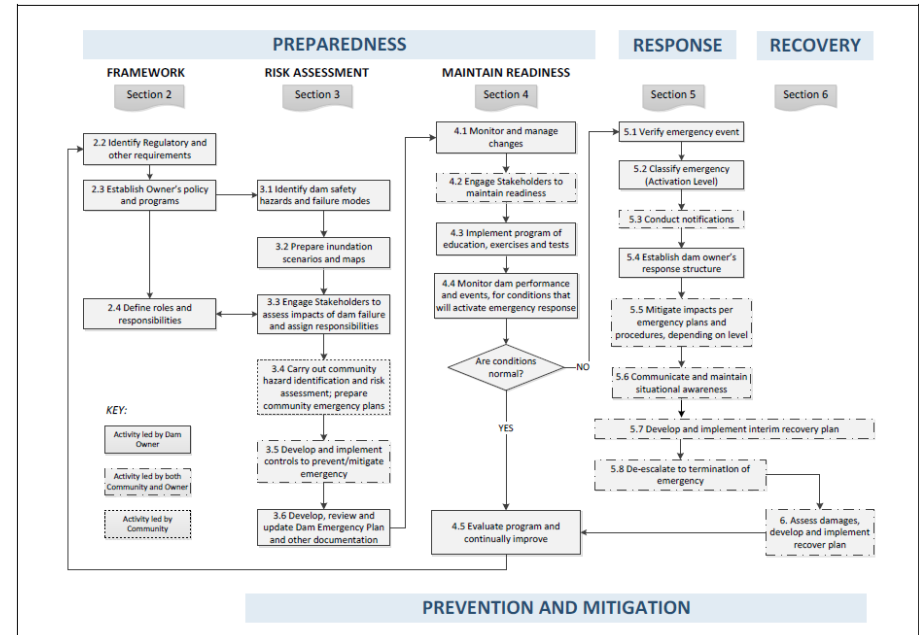
Glossary

Appendix A. Sample Inundation Maps

Appendix B. Typical Contents of Emergency Plan

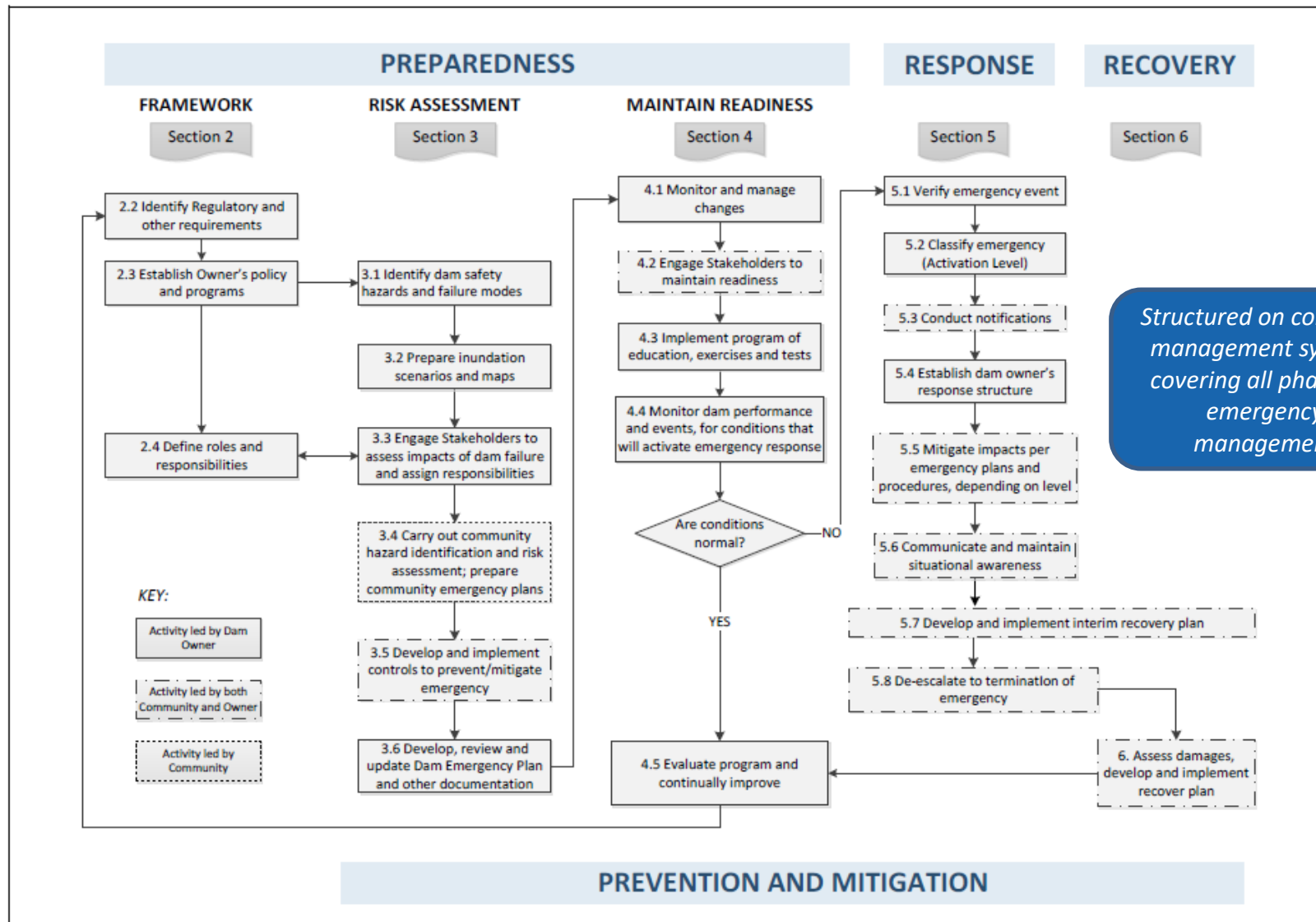
Appendix C. Dam Safety Emergency Activation Levels

Appendix D. Examples of Failure Modes, Conditions and Response

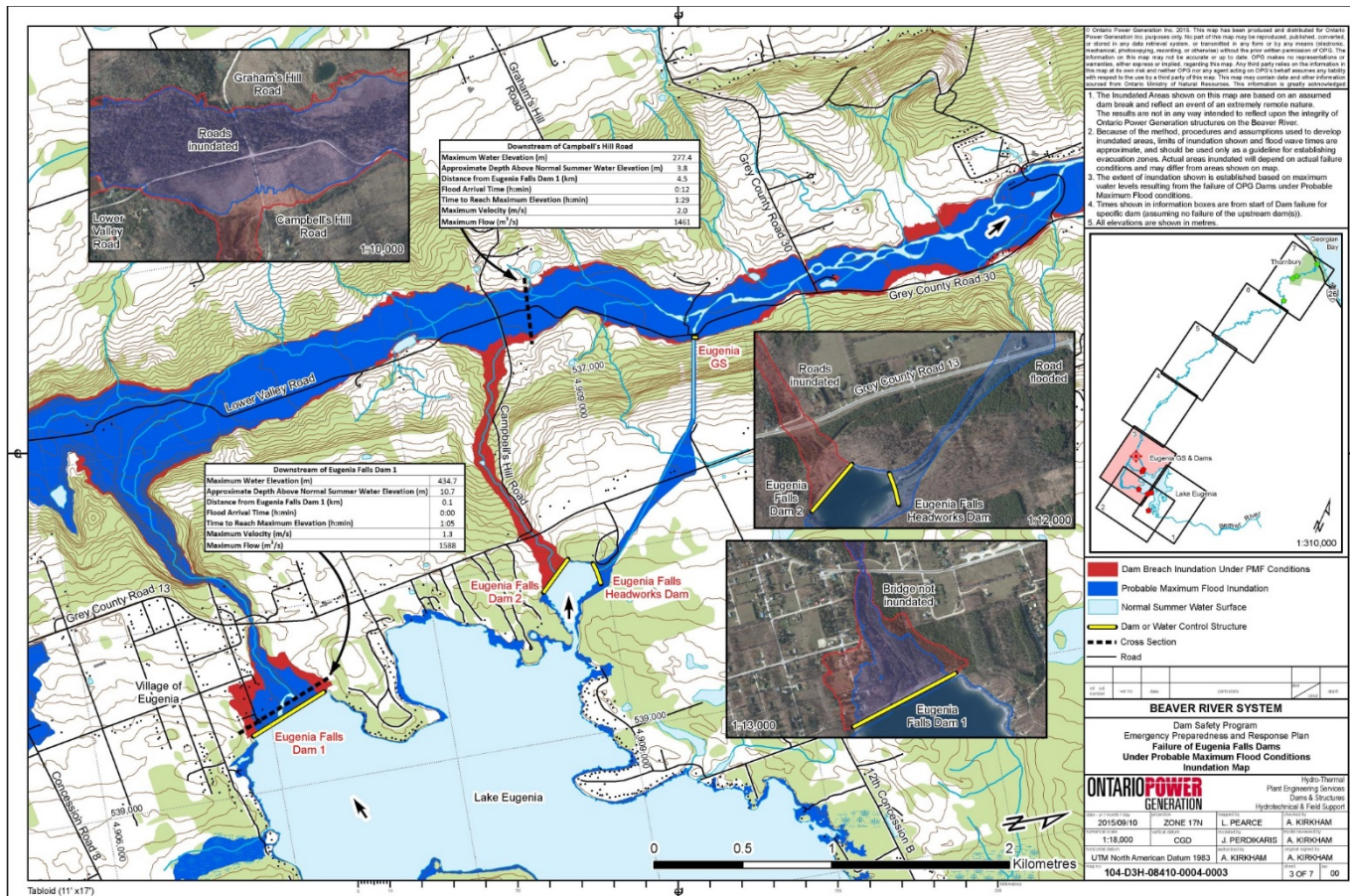


Structured on complete management system, covering all phases of emergency management



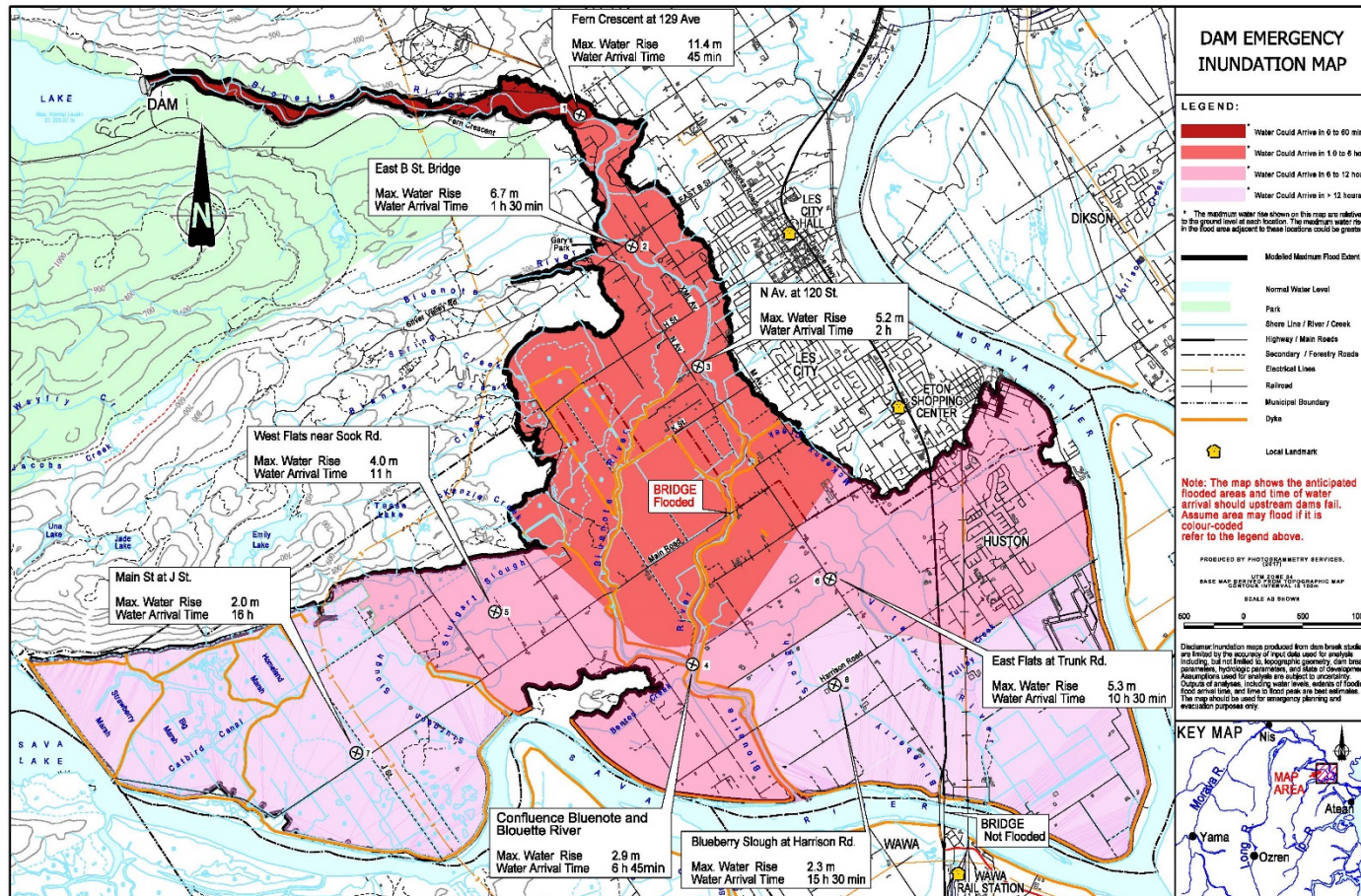


Dam Emergency Planning Maps



- Information for dam owner and community to plan response
- Maps prepared for:
 - 'Worse case'
 - Plausible scenarios involving other dam sections, as well as ancillary structures

Dam Breach Emergency Response Maps



- Information for use by First Responders during an event
- Simple, intended to provide information to assist in prioritizing evacuation areas

Emergency Classification Levels



Dam Safety Code	Condition	
	Hydrologic Event	Other Events
NORMAL RIVER CONDITION	River conditions are normal, in that no Flood Warning is appropriate/necessary.	
FLOOD SITUATION (Blue) Out-of-bank water levels	A 'Flood Warning' has been issued by Regulatory authority or municipality, or owner, but situation is not immediately threatening dam integrity.	Not applicable <i>Note: The owner has discretion to declare a Code Blue for any other abnormal flows.</i>
DAM ALERT (Yellow) Abnormal condition that poses a threat	(a) Maximum operating water level has been exceeded and is expected to continue to rise. (b) Maximum operating water level is expected to be exceeded due to inability to operate flow control equipment. (c) Telemetry is lost and it is expected that maximum operating water level will be exceeded.	Abnormal condition affecting dam performance has been identified as requiring response, e.g. <ul style="list-style-type: none"> • Signs of internal erosion • Earthquake damage • Increased leakage • Structural deformation or deterioration
DAM EMERGENCY (Orange) Potential failure is developing	Maximum operating water level has been exceeded, and potential for dam overtopping has been identified.	Water level readings are indicative of potential dam failure. Abnormal condition creates threat to safety of dam, requiring immediate attention. If implemented, remediation is expected to be effective.
DAM FAILURE (Red) Failure is Imminent or occurring	Control of water levels and flows has been lost and overtopping is occurring or imminent.	Upstream water level is decreasing rapidly, indicative of dam failure. Failure of dam is occurring or imminent.





Intended to provide illustrative examples (not templates)

- Sample Inundation Maps
- Typical Contents of an Emergency Plan
- Dam Safety Emergency Activation Levels
- Examples of Failure Modes, Conditions and Response



Next Steps



- Workshop to be delivered at the upcoming CDA Conference in Quebec City on the Bulletin
- Training to present practical examples as illustrated in the appendices

