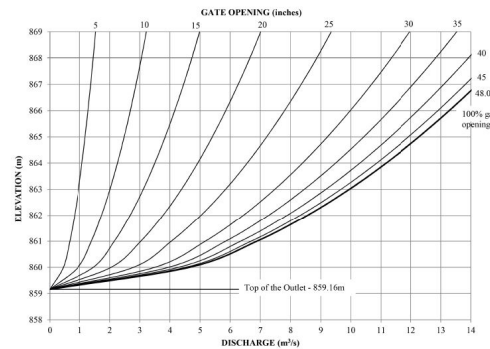
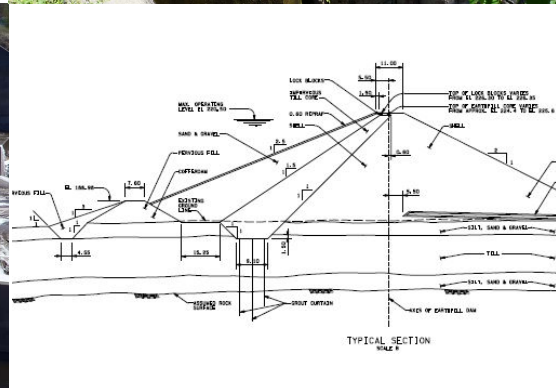
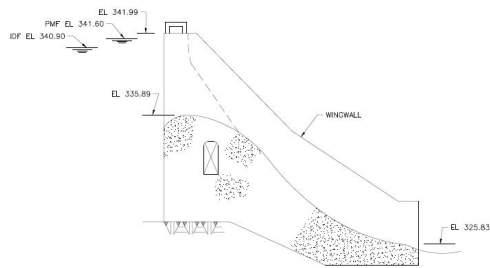


## Technical Bulletin: Dam Safety Reviews



Main entry under title: Canadian Dam Association Technical Bulletin: Dam Safety Reviews

Issued also in French under title: Association canadienne des barrages Bulletin technique: Examens de la sécurité des barrages.

ISBN 978-0-9936319-4-8

Copyright © 2016 by the Canadian Dam Association. All rights reserved. No part of this publication may be reproduced, copied, stored, distributed or transmitted in any form or by any means without the prior written permission of the Canadian Dam Association. Requests for permission should be addressed to the Executive Director at the contact address provided at [www.cda.ca](http://www.cda.ca).

# Table of Contents

List of Tables .....	i
List of Figures .....	ii
Acknowledgements .....	iii
Preface .....	v
<b>1 Introduction.....</b>	<b>1</b>
<b>2 Preparation by Dam Owner .....</b>	<b>3</b>
2.1 Initiate Dam Safety Review.....	3
2.2 Gather Information .....	3
2.3 Define Objectives and Scope .....	4
2.3.1 Objectives .....	4
2.3.2 Scope Considerations.....	4
2.3.3 Scope Statement .....	6
2.3.4 Reporting Requirements .....	6
2.4 Retain Review Engineer .....	7
2.4.1 Information for Procurement.....	7
2.4.2 Qualifications of Review Engineer .....	7
2.4.3 Independence of the Review Engineer .....	8
<b>3 Work by Dam Safety Review Engineer.....</b>	<b>9</b>
3.1 Confirm Scope and Contract.....	9
3.2 Review Information and Identify Gaps .....	9
3.3 Understand Current Consequence Classification .....	9
3.4 Establish Dam Safety Criteria for Assessment .....	10
3.5 Understand Physical Dam System .....	11
3.6 Understand Dam Safety Management System .....	11
3.7 Conduct Site Visit and Inspections.....	12
3.7.1 Preparation for Site Visit.....	12
3.7.2 Site Inspection.....	12
3.7.3 Report on Site Visit.....	14
3.8 Interview Staff.....	14
3.9 Check Documentation and Records .....	15
3.10 Confirm Functioning of Critical Equipment.....	15
3.11 Evaluate Performance Based on Surveillance .....	15
3.12 Analyze Dam Safety .....	16
3.12.1 General.....	16
3.12.2 Hazards .....	16
3.12.3 Failure Modes .....	16
3.12.4 Dam Safety Risk Controls.....	16
3.13 Identify Findings and Assess Safety of Dam System.....	17
3.14 Recommend Actions and Priorities .....	17
3.15 Prepare Dam Safety Review Report .....	18

<b>4</b>	<b>Follow-Up Action by Dam Owner</b> .....	20
4.1	Review and Communicate Findings.....	20
4.2	Investigate, Analyze and Assess Options.....	20
4.3	Make Decisions and Implement Improvements .....	20
	<b>References</b> .....	21
	<b>Glossary</b> .....	22
	<b>Appendix A - Scope Statement</b> .....	23
	<b>Appendix B - Evaluation of Proposals</b> .....	25
	<b>Appendix C - Staff Interviews</b> .....	26
	<b>Appendix D - Dam Safety Analysis Framework</b> .....	27
D.1	General .....	27
D.2	Hazards.....	30
D.3	Failure Modes .....	33
D.4	Dam Safety Risk Controls .....	36

## List of Tables

Table 3.1 - Sample Format to List Issues.....	18
Table 3.2 - Sample Format to List Failure Modes .....	19
Table D.1 - Example of External Hazards.....	31
Table D.2 - Example of Internal Hazards .....	32
Table D.3 - Example of Overtopping Failure Mode.....	34
Table D.4 - Example of Loss of Strength Failure Mode .....	35
Table D.5 - Example of Contaminated Seepage Failure Mode .....	35
Table D.6 - Example of Dam Safety Risk Controls .....	37

## List of Figures

Figure 1.1 - Overview of the Dam Safety Review Process .....	2
Figure D.1- Bow-Tie Model (Adapted from ICOLD 2011) .....	28
Figure D.2 - Fault Tree Model of Hazards and Failure Modes (Adapted from ICOLD 2011) .....	29