

# Consultation response

## *Part 1: Your details*

**Original language of response:** English

**Name:** Tim Eaton

**Country of residence:** Canada

**Are you willing to let us publish your response publicly on the Global Tailings Review website?** Yes

**Please select which stakeholder group you are representing:** Government

**If 'Other', please specify below:**

**Are you responding on behalf of an organization?** Yes

**Please give the name of the organization:** Alberta Energy Regulator

**Your level within the organisation:** Officer

## *Part 2: Your views on each of the Principles and Requirements in the Standard*

### *Topic I: Knowledge Base*

#### *Principle 1*

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 1 do your comments relate to?**

**Your comments on Principle 1**

#### *Principle 2*

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 2 do your comments relate to?**

**Your comments on Principle 2**

### *Topic II: Affected Communities*

#### *Principle 3*

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 3 do your comments relate to?**

**Your comments on Principle 3**

## **Topic III: Design, Construction, Operation and Monitoring of the Tailings Facility**

### **Principle 4**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 4 do your comments relate to?**

Requirement 4.1

**Your comments on Principle 4**

Consequence classification drives the level of engineering effort and quality control. Having an accurate consequence classification is what's important; and knowing that the level of engineering and operation controls in place are aligned with the consequence classification. Assuming all tailings facilities are extreme consequence structures is not warranted.

### **Principle 5**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 5 do your comments relate to?**

Comments on the Principle itself, Requirement 5.3, Requirement 5.2

**Your comments on Principle 5**

Overall: sound motherhood statement, but what needs to be done differently? 5.2 Water balances and associated plans can be completely unreliable because there are often too many input assumptions for the model. Investigation and quantification of inputs may be based on feasibility assessments but carried forward into detailed design without updating. This will kill a robust geotechnical design. 5.3 What is robust? The language seems to distinguish social, economic and environmental from consequence classification; when an accurate consequence classification should represent the s, e, and e context.

### **Principle 6**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 6 do your comments relate to?**

Comments on the Principle itself, Requirement 6.3, Requirement 6.2

**Your comments on Principle 6:**

Overall: use of consequence classification is appropriate here, compared to Principle 5. 6.2 A designer must assume that tailings will liquefy and flow under static or dynamic conditions; until the designer can prove otherwise (supported by ITRB review). However if assumption 'tailings will liquefy' is carried throughout the operation phase, then the closure phase design is much easier and less costly to complete and implement. I work with tailings dam operators who have made these assumptions and now they are proceeding to prepare closure plans; reducing risk to ALARP is not so onerous. 6.3 Observational approach cannot be used for brittle failure mechanisms. This should be stated.

### **Principle 7**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 7 do your comments relate to?**

**Your comments on Principle 7**

### **Principle 8**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 8 do your comments relate to?**

**Your comments on Principle 8**

## **Topic IV: Management and Governance**

### **Principle 9**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 9 do your comments relate to?**

Comments on the Principle itself, Requirement 9.2

**Your comments on Principle 9**

I agree, but: Principle 9 seems at odds with Principle 4 w.r.t. consequence classification. I don't think we are minimizing consequences, rather we need to minimize likelihood. 9.2 so you want the Board or senior management to publish publicly?

### **Principle 10**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 10 do your comments relate to?**

Comments on the Principle itself, Requirement 10.3

**Your comments on Principle 10:**

The Accountable Executive needs to be clearly identified. The mining company corporate and site specific EHS policy statements need to include a statement like: "We will design, construct, operate and close our tailings facilities to be safe at all times." and signed off by the Accountable Executive(s). Dam Safety Management Plans (what you call TMS) need to be documented and standalone. In large companies they are buried and segmented in complex corporate information systems. Some companies do not have the formal training programs for dam safety specialists and it is difficult to provide if you are a single mine/tailings facility company. When you have multiple tailings facilities and a larger dam safety team it is easier to train. I get nervous when you suggest there should be a separate RTFE and EOR. If you truly want the tailings facilities to be safe make an experienced geotechnical engineer the EOR-RTFE. Many companies will make a mining engineer or tailings engineer the RTFE for convenience and to keep the facility operating, then dam safety becomes the secondary priority. 10.3 Why is RTFE defined here and EOR in Principle 12? The roles and responsibilities for these 2 positions overlap and may create confusion and conflict.

## **Principle 11**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 11 do your comments relate to?**

Requirement 11.4, Requirement 11.5

**Your comments on Principle 11:**

11.4 So you can see again why Principle 4 has to change w.r.t. mandatory 'extreme' consequence classification. If it's extreme that the dam owner has to do a DSR on the most frequent basis (in Canada CDA recommends a DSR every 5 years for extreme and very high consequence). 11.4 It is not practical to restrict a DSR contractor from performing another DSR on the same facility. If the facility operates for 50 years, is extreme consequence, it may require 15 different DSR contractors. There likely are not that many choices in any jurisdiction, then the operator is forced to retain a less than qualified DSR contractor. It is reasonable to restrict the DSR contractor from the next 2 DSR reviews. 11.5 an ITRB only gets to comment on what the company provides. An ITRB cannot mandate when and what it reviews. Suggest you change the working and put the onus on the dam owner and not the ITRB.

## **Principle 12**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 12 do your comments relate to?**

Comments on the Principle itself, Requirement 12.5

**Your comments on Principle 12:**

Roles of RTFE and EOR should be in same Principle section. I've worked using 3 different systems for EOR and DOR: 1. EOR and DOR are independent consultants (not necessarily from the same consultant) 2. EOR is in house and DOR is a consultant 3. EOR and the DOR are in house but different employees All three systems work based on my experience. However the EOR is responsible for ensuring the tailings facility is safe, constructed, operated, monitored according to the design or validation of design. There is a tailings operation manager who is responsible for implementing the approved design with the responsibilities the operations manager is assigned. For example: constructing hydraulically placed tailings sand for dam (cell) construction and maintaining above water beaches and freeboard (easy KPIs to measure). So I think the RTFE should be more of the tailings operation manager than as described in the GTS. The EOR should be clearly responsible for the safety of the dam with the ability to go straight to the Accountable Executive if dam safety concerns are not getting addressed; or even to the regulator. 12.5 here you are lumping EOR and DOR together so state both.

## **Principle 13**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 13 do your comments relate to?**

Yes

**Your comments on Principle 13:**

The EOR (RTFE) and mine general manager and operation managers (for mine waste, tailings,...) Need to dedicate time and effort to create awareness within mine shift teams of what is important to support dam safety, and where each equipment operator plays a role. Share lessons learned at these sessions. How often should mine shift teams be engaged, once/year?

## **Principle 14**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Yes

**Which aspects of Principle 14 do your comments relate to?**

**Your comments on Principle 14:**

## **Topic V: Emergency Response and Long-Term Recovery**

### **Principle 15**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

No

**Which aspects of Principle 15 do your comments relate to?**

Comments on the Principle itself

**Your comments on Principle 15:**

Emergency response readiness has little to do with preventing dam failures; rather it is all about responding as well as possible (timely and effectively) when such a catastrophe occurs. Companies I regulate have been reluctant to do tests with external stakeholders. However in December 2018 a new Dam and Canal Safety Directive (Alberta, Canada) made testing with external stakeholders a 'requirement'.

### **Principle 16**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

No

**Which aspects of Principle 16 do your comments relate to?**

Comments on the Principle itself

**Your comments on Principle 16:**

it's still very important. Most companies do not have the financial or physical resources to respond. What is the role of insurance here? What about mutual aid agreements?

## **Topic VI: Public Disclosure and Access to Information**

### **Principle 17**

**In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?**

Partially

**Which aspects of Principle 17 do your comments relate to?**

Comments on the Principle itself

**Your comments on Principle 17:**

Is it realistic to expect a mining company to publish this information? How do you think they should do it, on a corporate website? Even as a regulator there are challenges with being super transparent such that the information is taken in context. What is the lay person's language of

communication. Anti-mining NGO's will always cherry pick information to advance their causes. We, the AER, have a public facing map that shows where, who owns/operates, size and consequence classifications for the dams we regulate.

### **Part 3: Your views on the Standard**

#### **Your view as to whether the content of the Standard meets your expectations**

##### **Your view as to whether the content of the Standard meets your expectations (closed question):**

3: Meets my expectations

##### **Please summarize why you chose this option:**

There isn't much new compared to best practices in use by oilsand tailings facility operators. There appears to be good alignment with MAC, ICOLD and CDA guidance. I agree with Dr. Morgenstern's opinion that oilsands operators have the best dam safety management systems in the world.

#### **Your view on whether the Standard will create a step change for the industry in the safety and security of tailings facilities**

##### **Your view on whether the Standard will create a step change for the industry in the safety and security of tailings facilities (closed question):**

3: Will strengthen some but not all aspects of the safety and security of tailings facilities

##### **Please summarize why you chose this option:**

I think adoption of the GTS is great for corporate and investment governance. Compliance is however still somewhat voluntary, like the MAC guideline is only mandatory for MAC members and validation is done by MAC approved assessors/auditors. Who has to comply? How will you validate compliance? The devil is in the detail of how mining companies implement GTS and interpret compliance. You will need very experienced dam safety professionals to validate compliance with GTS. In 2016 developed a formal Leading Practices Assessment (audit style review) of tailings facility dam safety management systems based off of the MAC Guideline.

#### **Does the content of the Standard address all aspects of tailings facility management adequately?**

##### **Does the content of the Standard address all aspects of tailings facility management adequately (closed question)?**

Yes

##### **Please explain why and/or what is missing:**

In recent years I moved from dam safety operations to decommissioning, closure and abandonment (of extremely large tailings facilities constructed of sand) so I feel there should be specific boiler plate in the GTS about risks, and long term care and maintenance, in the closure and abandonment lifecycle phases.

### **Part 4: Suggestions for topics to be included in the accompanying Recommendations Report**

#### **On which topics would you expect to have further clarification or guidance in this document?**

I am can support with: ""how to achieve"" ""how to assure"", and with best practices. The last 33 years of my (40+) career have been focused on mine geotechnics and tailings facilities in

particular. In that time I've worked for major mining companies, tailings dam consultants and mine tailings dam regulators. I am uploading a copy of the province of Alberta's Dam and Canal Safety Directive (Dec 2018), which is an excellent regulatory document on dam safety, even though a few things could be stated clearer.

### **Other information**

**Non-fitting response text (text submitted which did was not in response to one of the questions above)**

**Attachment 1 reference (if applicable)**

ref:0000000735:Q83

**Attachment 2 reference (if applicable)**



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## Contents

<b>1. Part 1 General .....</b>	<b>3</b>
1.1 Definitions .....	3
1.2 Application .....	7
1.3 Submission of documents .....	7
1.4 Retention of records .....	7
<b>2. Part 2 – Applications and Authorization .....</b>	<b>7</b>
2.1 Information required for new dam or canal .....	7
2.2 Information required for other authorizations .....	9
2.3 Information required for Environmental Impact Assessment .....	10
2.4 Acceptance by Director .....	12
<b>3. Part 3 – Consequence Classification.....</b>	<b>12</b>
3.1 Consequence classification for a dam or canal.....	12
3.2 Requirements in determining consequence classification .....	12
3.3 Review and re-assessment of consequence classification .....	13
3.4 Director’s acceptance of consequence classification.....	14
3.5 Transition for existing dams and canals .....	14
<b>4. Part 4 - Safety Management.....</b>	<b>15</b>
4.1 Safety management plan.....	15
4.2 Review and update of safety management plan .....	16
4.3 Resources to support safety management plan.....	16
4.4 Public safety .....	16
4.5 Safety deficiencies.....	16
<b>5. Part 5 – Investigations, Design, Construction, Assessments and Evaluations.....</b>	<b>18</b>



5.1	Definitions of design and construction in this Part.....	18
5.2	Scope of site investigations .....	18
5.3	When site investigation required .....	19
5.4	Site investigation report.....	19
5.5	Dam or canal design requirements .....	20
5.6	Target stability criteria and selected factors of safety must be justified.....	20
5.7	Seismic analysis.....	22
5.8	Deformation analysis.....	22
5.9	Seepage analysis .....	23
5.10	Design of temporary structures.....	23
5.11	Foundation preparation.....	24
5.12	Erosion control .....	24
5.13	Pre-construction requirements.....	24
5.14	Construction .....	25
5.15	Construction quality assurance plan .....	25
5.16	Construction quality control plan .....	26
5.17	Construction completion report.....	27
5.18	Requirement to undertake assessments/evaluations .....	28
5.19	Engineering inspection .....	29
5.20	Annual performance review.....	29
5.21	Safety review .....	31
5.22	Risk assessment .....	32
<b>6.</b>	<b>Part 6 – Operation, Maintenance and Surveillance.....</b>	<b>33</b>
6.1	Operation, maintenance and surveillance manual .....	33
6.2	Submission and notification to Director .....	34
6.3	Documentation .....	34
<b>7.</b>	<b>Part 7 – Emergency Management .....</b>	<b>35</b>
7.1	Emergency management plan.....	35
7.2	Emergency contact information.....	36
7.3	Requirement to update emergency management plan .....	36
7.4	Testing, exercises and validation of emergency management plan.....	37
<b>8.</b>	<b>Part 8 – Notifications to Director .....</b>	<b>37</b>
8.1	Notification of dam or canal information .....	37
8.2	Notification of safety incident .....	38

<b>9. Part 9 – Decommissioning, Closure, Abandonment, etc.....</b>	<b>38</b>
9.1 Plan for cessation/resumption of dam or canal.....	38
9.2 Notification to Director prior to cessation/resumption.....	40
9.3 Obligations of dam/canal owner.....	40
9.4 Deviation from cessation/resumption plan.....	41
9.5 Post-implementation report following cessation/resumption.....	41
9.6 Plan for decommissioning, closure and abandonment.....	42
9.7 Notification to Director prior to decommissioning, closure, abandonment.....	44
9.8 Obligations of dam/canal owner for decommissioning, closure, abandonment.....	44
9.9 Deviation from decommissioning, closure and abandonment plan.....	45
9.10 Completion reports of decommissioning, closure, abandonment.....	46
9.11 Removal of structures from inventory.....	47
<b>Schedule 1 – Determining Consequence Classification.....</b>	<b>48</b>
<b>Schedule 2 – Form of Master Lists.....</b>	<b>50</b>

## 1. Part 1 General

### 1.1 Definitions

- (1) All definitions in the Water (Ministerial) Regulation and in section 1 of the *Water Act* apply except where expressly defined in this Directive.
- (2) In this Directive:
  - (a) “abandonment” means a dam or canal that is permanently removed from service and not maintained for later return to service;
  - (b) “accepted consequence classification” means the consequence classification of a dam or canal that is accepted by the Director pursuant to section 2.4;
  - (c) “accountable executive” means an individual who:
    - (i) is employed or retained by a dam/canal owner; and
    - (ii) has overall authority, including financial authority, for the safety management of the dam or canal;
  - (d) “as low as reasonably practicable” means a level at which it can be demonstrated that the time, costs, and efforts required to further reduce residual risks would be grossly disproportionate to the incremental reduction in residual risk that would be consequently gained;
  - (e) “cessation/resumption plan” means a plan that is prepared under section 9 and
    - (i) in the case of a dam or canal that has an accepted consequence classification of high, very high or extreme, is comprised of two separate plans being:
      - (A) a cessation plan; and
      - (B) a resumption plan; and

- (ii) in the case of a dam or canal that has an accepted consequence classification of significant, may be comprised either as specified in clause (i) or as a single composite document, as a qualified professional determines necessary and appropriate, having regard to the risk to factors at risk posed by the dam or canal;
- (f) “closure” means a process of modifying and establishing a configuration for a dam or canal with the objective of achieving long-term physical, chemical, ecological, and social stability, and a sustainable, environmentally appropriate after-use;
- (g) “decommissioning” means complete removal or breach of a dam or canal so that the structures can no longer retain, store, or divert water, including water containing another substance such as fluid waste or flowable tailings that may pose safety or environmental concerns;
- (h) “designer-of-record” means a qualified professional who:
  - (i) possesses the requisite knowledge and skills and has at least 15 years of appropriate experience in design, construction, performance analysis and operations of dam and canal structures;
  - (ii) is retained by a dam/canal owner; and
  - (iii) is responsible for the overall design of the structures in a dam or canal including:
    - (A) detailed analysis and design of structures;
    - (B) preparation of design reports and construction drawings;
    - (C) establishment of quantifiable performance objectives for structures;
    - (D) assessment of performance of the structures during construction;
    - (E) verification that structures are functioning consistent with their design intent;
- (i) “emergency drill” means a review undertaken by a dam/canal owner and persons responsible for operating a dam or canal, to test procedures and skills under an emergency management plan;
- (j) “engineer-of-record” means a qualified professional who:
  - (i) possesses the requisite knowledge and skills and has at least 15 years of appropriate experience in design, construction, performance analysis and operations of dam and canal structures;
  - (ii) is employed or retained by a dam/canal owner; and
  - (iii) is responsible to provide technical direction regarding the safety of a dam or canal, including:
    - (A) assessing conformance of the dam or canal with design, specifications, regulations and standards;
    - (B) confirming that the operation, maintenance and surveillance of the dam or canal is carried out in accordance with its design and the operation, maintenance and surveillance manual;
    - (C) supporting assessment of the safety performance of the dam or canal with reference to the quantifiable performance objectives;
    - (D) supporting changes in design or operation to maintain the safety of the dam or canal;
    - (E) supporting the safety manager and designer-of-record in identifying safety deficiencies and assessing risks associated with the safety of the dam or canal; and
    - (F) maintaining and submitting construction quality, performance, and dam safety documentation to the safety manager;
- (k) “functional exercise” means an event that:

- (i) simulates an emergency situation involving a dam or canal;
  - (ii) involves a dam/canal owner, persons responsible for operating a dam or canal, persons who are directly affected by a dam or canal, and persons who are assigned responsibilities under an emergency management plan;
  - (iii) takes place in locations at which the parties referred to in clause (ii) would likely be present immediately before, during and after an emergency situation;
  - (iv) involves time constraints as part of the simulation; and
  - (v) is used to review, test, and clarify roles, responsibilities, procedures and other information under an emergency management plan;
- (l) “incremental consequences of failure” means the risk to factors at risk, if there is a failure, that is above and beyond the risk to factors at risk from the same event or conditions but without a failure;
- (m) “major repair” means a planned repair or rehabilitation to a dam or canal that is not part of routine maintenance and that is required to address an outstanding safety deficiency or critical safety deficiency;
- (n) “master deficiencies list” means:
- (i) a consolidated list of all safety deficiencies and critical safety deficiencies that have been identified, wherein each deficiency has been prioritized in relation to other deficiencies based upon:
    - (A) the degree of potential the deficiency has to develop into a critical safety deficiency; and
    - (B) the nature and level of risks posed by the deficiency; and
  - (ii) is in a form consistent with Table 1 of Schedule 2 attached to and forming part of this Directive;
- (o) “master non-conformances list” means:
- (i) a consolidated list of all non-conformances that have been identified, wherein each non-conformance has been prioritized in relation to other non-conformances based upon:
    - (A) the degree of potential the non-conformance has to develop into a safety deficiency; and
    - (B) the nature and level of risks posed by the non-conformance; and
  - (ii) is in a form consistent with Table 2 of Schedule 2 attached to and forming part of this Directive;
- (p) “non-conformance” means a non-compliance with the Act, the Regulation, this Directive, or an authorization;
- (q) “orientation workshop” means an event that is arranged jointly between a dam/canal owner, and persons who are directly affected by a dam or canal, and persons who are assigned responsibilities under an emergency management plan, to review an emergency management plan;
- (r) “operations manager” means a qualified individual who
- (i) is employed or retained by a dam/canal owner;
  - (ii) is responsible for the safe operation, maintenance and surveillance of a dam or canal, including:
    - (A) implementing components of the operation, maintenance and surveillance manual;

- (B) communicating with the safety manager when technical input to the operation, maintenance and surveillance manual is required;
  - (C) securing resources required for the safe operation, maintenance and surveillance of all structures;
  - (D) addressing identified safety deficiencies, critical safety deficiencies and non-conformances;
  - (E) implementing recommended measures to manage and mitigate risks;
  - (F) reporting to the accountable executive regarding the condition and status of identified safety deficiencies, critical safety deficiencies and non-conformances;
- (iii) possesses the requisite knowledge and skills to perform their responsibilities and has at least 10 years of related experience;
- (s) “post-construction period” means the time period between:
- (i) the completion of construction of a dam or canal; and
  - (ii) when the first safety review is undertaken for that dam or canal;
- (t) “quantifiable performance objectives” means measurable indicators, including numerical values and allowable limits, that are used to judge the acceptability of the safety performance of a dam or canal throughout its lifecycle;
- (u) “Regulation” means the Water (Ministerial) Regulation AR 205/98, as amended;
- (v) “safety incident” means an operation or action at or in connection with a dam or canal that has the potential to create a hazardous condition or to be or become a hazard to factors at risk and includes:
- (i) controlled or uncontrolled release or controlled breach of stored contents due to improper operation, overtopping, excessive seepage or piping, regardless of whether downstream flooding occurs;
  - (ii) the inability of mechanical, electrical, electronic or other equipment to perform the safety functions for which it was intended; and
  - (iii) an action, omission or event that results in a non-conformance;
- (w) “safety manager” means a qualified professional who:
- (i) is retained by a dam/canal owner;
  - (ii) is responsible for oversight of safety management of a dam or canal including:
    - (A) planning safety management;
    - (B) tracking and reporting on dam safety regulatory requirements;
    - (C) securing resources for required safety assessments and safety evaluations;
    - (D) knowledge of best practices in safety;
    - (E) supporting assessment of the safety performance of a dam or canal with reference to quantifiable performance objectives;
    - (F) tracking non-conformances, safety deficiencies and critical safety deficiencies;
    - (G) assessing risks posed by non-conformances, safety deficiencies and critical safety deficiencies;
    - (H) communicating risks to the accountable executive; and
  - (iii) possesses the requisite knowledge and skills to perform their responsibilities and has at least 15 years of related experience;

- (x) “significant change”, in reference to the operations, maintenance or surveillance of a dam or canal, includes an operation, maintenance or surveillance activity that temporarily or permanently deviates from the latest version of the operation, maintenance and surveillance manual;
- (y) “tabletop exercise” means a simulated event that
  - (i) takes place in a conference room or similar environment;
  - (ii) involves a dam/canal owner, persons responsible for operating a dam or canal, persons who are directly affected by a dam or canal, and persons who are assigned responsibilities under an emergency management plan; and
  - (iii) is used to review and clarify the roles, responsibilities and response actions required of persons who are assigned responsibilities under an emergency management plan;

## **1.2 Application**

- (1) If there is any conflict between this Directive and the Act or the Regulation, the Act or the Regulation prevails over the Directive.

## **1.3 Submission of documents**

- (1) Where the Regulation or this Directive require that a dam/canal owner or any other person must submit information in writing to the Director, that submission must conform to the following:
  - (a) a submission must be made in electronic form;
  - (b) a submission must be in a format that allows for the making of comments by the Director;
  - (c) documents and spreadsheets must be submitted in formats compatible with Microsoft Office or Adobe Acrobat;
  - (d) maps and shapefiles must be submitted in formats that are compatible with ESRI applications; and
  - (e) notwithstanding clauses (a) through (d), a submission must be in any format or form as required in writing by the Director.

## **1.4 Retention of records**

- (1) A dam/canal owner must retain all records and other documentation for the lifecycle of a dam or canal, including:
  - (a) authorizations;
  - (b) designs, including as-built designs; and
  - (c) safety and emergency management records.

## **2. Part 2 – Applications and Authorization**

### **2.1 Information required for new dam or canal**

- (1) When applying for an authorization to construct a new dam or canal, a dam/canal owner must submit to the Director, in writing, all of the following information:
  - (a) general information about the dam or canal, including:
    - (i) a description of the scope of the project and its components;
    - (ii) a layout plan for structures;

- (iii) the principal dimensions of structures;
  - (iv) the capacities of structures;
  - (v) the surface areas at the maximum normal reservoir or pond levels;
  - (vi) the normal operating ranges and live storage capacity;
  - (vii) the normal operating reservoir or pond volume; and
  - (viii) the volume between the maximum and minimum normal reservoir or pond levels;
- (b) a proposed consequence classification that has been determined in accordance with this Directive;
- (c) site characterization information, including:
- (i) site investigation reports;
  - (ii) details regarding the physical characteristics of the reservoir or pond;
  - (iii) details regarding the suitability of the in-situ and borrow materials for use as construction materials; and
  - (iv) details regarding potential challenges or issues that could impact design and safety of the structures during their lifecycle;
- (d) details regarding the design of structures, including:
- (i) design base memorandum;
  - (ii) alternate assessments of various design concepts, technical options and locations to demonstrate the selection of best available technology;
  - (iii) inflow and earthquake design;
  - (iv) seepage analysis, control and drainage provisions;
  - (v) stability analysis and factors of safety;
  - (vi) freeboard requirements;
  - (vii) details of gaps in knowledge and understanding related to the design, including steps to address these gaps;
  - (viii) potential challenges/ issues that could impact the design of the proposed structure and potential mitigation measures;
  - (ix) details regarding performance monitoring, including:
    - (A) quantifiable performance objectives during construction;
    - (B) quantifiable performance objectives during the post-construction period;
    - (C) quantifiable performance objectives during other phases of the lifecycle of structures;
    - (D) an instrumentation and monitoring program;
    - (E) details regarding the expected performance of the structures under usual and unusual loading conditions, and the ability of the structures to withstand those conditions, including challenges and mitigation measures;
  - (x) a final design report;
  - (xi) final construction drawings and specifications; and
  - (xii) anticipated quantities of materials that will be used to construct structures;
- (e) details regarding the construction of structures, including:
- (i) a schedule of planned construction activities;
  - (ii) protocols for the management of design changes that will require authorization;
  - (iii) details for construction quality assurance and quality control;
  - (iv) details regarding site preparation, including:

- (A) site clearing and grubbing;
- (B) construction and operation of any temporary structures that will be required during construction of the dam or canal;
- (C) excavations, slope stabilization, foundation preparation and materials;
- (v) details on activities that will take place as part of construction, including:
  - (A) placing impervious lining;
  - (B) erosion protection efforts;
  - (C) installation of instrumentation, mechanical and electrical equipment;
  - (D) performance monitoring; and
  - (E) testing and commissioning; and
- (vi) a construction completion report;
- (f) details regarding emergency management, including:
  - (i) potential accidents, malfunctions and any other incidents that could occur and could impact the safety of the structures during construction;
  - (ii) proposed measures to manage or mitigate the impacts resulting from the accidents and malfunctions; and
  - (iii) risk management and emergency management plans;
- (g) details regarding first filling, including:
  - (i) the approach that will be used in filling the reservoir or depositing tailings, as the case may be;
  - (ii) how debris will be managed during reservoir filling or tailings deposition;
  - (iii) efforts that will be taken for shoreline stabilization during reservoir filling or tailings deposition;
  - (iv) a copy of the operation, maintenance and surveillance manual;
  - (v) performance monitoring, including quantifiable performance objectives during operation under usual and unusual loading conditions;
  - (vi) expected fluctuations in the reservoir;
  - (vii) the approach that will be used to manage the reservoir in unusual conditions;
  - (viii) a copy of the emergency management plan; and
  - (ix) a copy of the safety management plan;
- (h) details regarding decommissioning and closure of structures, including:
  - (i) details for the decommissioning and closure of any temporary structures that will be constructed and any associated reclamation;
  - (ii) a preliminary outline of how decommissioning and closure of permanent structures will be undertaken in the future;
  - (iii) an assessment of potential challenges, accidents, malfunctions or incidents that could impact the safety of structures during decommissioning and closure; and
  - (v) a summary of measures for mitigating the risks identified in clause (iii).

## 2.2 Information required for other authorizations

- (1) When applying for an authorization to undertake a major repair, decommissioning, closure, long-term cessation, or limited operation of a dam or canal, a dam/canal owner must submit to the Director, in writing, all of the following key information:



- (a) a detailed assessment of the need and objectives of repairs or rehabilitation, investigations, decommissioning, closure, long-term cessation or limited operation;
- (b) details regarding the project and planned activities; and
- (c) details regarding design as outlined in section 2.1(1)(d);
- (d) details regarding construction, as outlined in subsection 2.1(1)(e); and
- (e) in the case of an authorization for decommissioning, closure or abandonment, a copy of the decommissioning, closure and abandonment plan referred to in Part 9 of this Directive.

## 2.3 Information required for Environmental Impact Assessment

- (1) When an Environmental Impact Assessment is required to support an application for authorization in relation to a dam or canal, a dam/canal owner must submit to the Director, in writing, all of the following information:
  - (a) general information about the dam or canal, including:
    - (i) a description of the scope of the project and its components;
    - (ii) the overall approach used for design;
    - (iii) technical specifications;
    - (iv) the hypotheses and assumptions used in design;
    - (v) data collection methods, models and studies used in design;
    - (vi) the degree of uncertainty, reliability and sensitivity of models used to reach conclusions;
    - (vii) gaps in knowledge and understanding related to key conclusions, including steps to address these gaps;
    - (viii) the normal operating range;
    - (ix) spatial extent or overlap into other tributaries, if any;
    - (x) surface area at the maximum normal reservoir level;
    - (xi) normal operating water volume, and the volume between the maximum normal and minimum normal reservoir levels; and
    - (xii) alternate assessments of various technical options, concepts, and locations to demonstrate the selection of best available technology;
  - (b) details regarding potential accidents or malfunctions, including:
    - (i) the identification of potential accidents and malfunctions that could occur for all stages of the project, such as cofferdam leakage or failure, sediment control failure, or other dam safety incidents;
    - (ii) a description of the effects of a failure by tabulating the flow arrival time at downstream of the structures until the estimated contents of the reservoir are within the estimated 100-year flood level; and
    - (iii) if there are other dam or canal structures located downstream, an assessment of the potential for cascade failure and the impacts of such a cascade failure;
  - (c) details regarding the preliminary design of structures, including:
    - (i) a proposed consequence classification;
    - (ii) characteristics of the proposed site, including:
      - (A) the results of field and lab testing that have been performed to determine the suitability of materials; and

- (B) characteristics and geotechnical properties of the in-situ and construction materials and an assessment of their suitability for use as construction materials;
- (iii) information regarding the proposed design of structures, including:
  - (A) principal dimensions of the structures and related works;
  - (B) anticipated quantities of materials required for construction;
  - (C) seepage control and drainage provisions;
  - (D) stability under usual and unusual loading conditions;
  - (E) freeboard requirements;
  - (F) expected performance of the structures during and after extreme weather events, including the ability of the structures to withstand those events and potential challenges arising from those events;
  - (G) potential challenges that could impact the safety of the proposed structures; and
  - (H) proposed measures to mitigate challenges identified under clauses (F) and (G);
- (iv) a description of construction activities, including:
  - (A) site clearing and grubbing;
  - (B) construction and operation of any temporary structures required for construction;
  - (C) excavation and stockpiling of suitable material, including drilling, blasting, sorting and screening in rock quarries, and moisture conditioning of impervious material;
  - (D) excavations, slope stabilization and foundation preparation;
  - (E) construction of the structures;
  - (F) placing impervious lining and erosion protection;
  - (G) installation of instrumentation, mechanical and electrical equipment;
  - (H) testing and commissioning; and
  - (I) removal of temporary construction facilities;
- (v) a description of activities during operation of structures including:
  - (A) the approach that will be used in filling the reservoir or depositing tailings, as the case may be;
  - (B) how debris will be managed during reservoir filling or tailings deposition;
  - (C) efforts that will be taken for shoreline stabilization during reservoir filling or tailings deposition;
  - (D) the operation, maintenance and surveillance needs for safe operation of the structures;
  - (E) expected fluctuations in the reservoir; and
  - (F) the approach that will be used to manage the reservoir in usual and unusual conditions;
- (vi) a description of activities during decommissioning and closure, including:
  - (A) decommissioning and closure of any temporary structures that are constructed and associated reclamation;
  - (B) a preliminary outline of how decommissioning and closure of permanent structures will be undertaken in the future; and
  - (C) a description of potential challenges during decommissioning and closure of temporary and permanent structures.

## **2.4 Acceptance by Director**

- (1) If, in the opinion of the Director, the information submitted by the dam/canal owner under sections 2.1, 2.2 or 2.3 has been developed in accordance with this Directive and applicable best practices, the Director shall:
  - (a) complete a technical review of the information submitted by the dam/canal owner;
  - (b) determine if the information is acceptable to the Director; and
  - (c) determine and prescribe, in writing, any safety requirements that should form part of the authorization that has been applied for.
- (2) If, in the opinion of the Director, the information submitted by the dam/canal owner under sections 2.1, 2.2 or 2.3 has not been developed in accordance with this Directive or applicable best practices:
  - (a) the dam/canal owner must submit any and all additional information required by the Director in writing; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the information that was submitted by the dam/canal owner has been developed in accordance with the Directive and applicable best practices.

## **3. Part 3 – Consequence Classification**

### **3.1 Consequence classification for a dam or canal**

- (1) A dam/canal owner must propose a consequence classification for a dam or canal:
  - (a) prior to obtaining an authorization to construct a dam or canal; or
  - (b) prior to submitting an environmental impact assessment for a dam or canal.
- (2) No later than 60 days after the start of construction of a dam or canal, a dam/canal owner must establish an accepted consequence classification for that dam or canal.
- (3) To establish an accepted consequence classification, a dam/canal owner must determine a consequence classification in accordance with this Directive and submit the proposed consequence classification to the Director in accordance with section 3.4.

### **3.2 Requirements in determining consequence classification**

- (1) A dam/canal owner must determine a consequence classification in accordance with Schedule 1 attached to and forming part of this Directive.
- (2) A consequence classification must be prepared by a qualified professional.
- (3) A consequence classification must be based on the incremental consequences of failure.
- (4) Unless otherwise specified in writing by the Director, a dam/canal owner must use the following types of procedures in determining a consequence classification:
  - (a) a preliminary assessment that consists of a simple analysis of readily available data such as aerial photography, topographic maps, visual inspections of the dam or canal structures and/or dam or canal site, and the characterization of a hypothetical failure and downstream reach of the uncontrolled flow of contents of the dam or canal;
  - (b) a qualitative assessment that consists of a limited engineering evaluation that uses simplistic data sources with conservative assumptions such as rudimentary hydrological estimates, simplistic peak discharge calculations for a failure or misoperation such as weir equations or graphical solutions, open-channel flow calculations at discrete cross-sections along the downstream channel near the development, elevations at cross-section surveys;

- (c) a quantitative assessment that consists of:
  - (i) a detailed breach inundation study that includes failure mode evaluation, computerized dam-break and hydraulic-routing models, detailed hydrological estimates and high-quality input data; and
  - (ii) detailed scientific analyses and assessments of environmental and economic losses.
- (5) A quantitative assessment referred to in subsection (4) may be required by the Director when, in the opinion of the Director:
  - (a) a qualitative or semi-qualitative assessment does not result in a consequence classification that is acceptable to the Director;
  - (b) a dam/canal owner would face a substantial economic burden in complying with the legal requirements related to a consequence classification that is determined by way of a qualitative assessment;
  - (c) evaluation of the impacts of a failure are not apparent, such as a large dam or reservoir located a long distance upstream from a development that may not be located in an apparent flood plain; or
  - (d) details of breach inundation information are required for input to emergency management such as flood wave routing and arrival times, duration and quantity of flooding from the breach and inundation mapping.
- (6) If a dam or canal contains or is expected to contain flowable tailings, a breach inundation study must consider the effects of flowable tailings being entrained in the outflow.
- (7) If different consequence classifications are determined for various works, the highest consequence classification amongst those determined shall be the consequence classification for safety management of that dam or canal.
- (8) When more than one dam or canal is located along the perimeter of a reservoir, the highest consequence classification determined for any one of those dams or canals shall apply for safety management of all dams and canals along the perimeter of that reservoir.

### **3.3 Review and re-assessment of consequence classification**

- (1) A dam/canal owner must review and re-assess the consequence classification of a dam or canal, at a minimum:
  - (a) when there is a significant change in risk to the factors at risk for that dam or canal;
  - (b) when required in writing by the Director in the manner and time frame set out by the Director; and
  - (c) in any event, at a minimum:
    - (i) every 5 years for a dam or canal that has an accepted consequence classification of very high or extreme;
    - (ii) every 7 years for a dam or canal that has an accepted consequence classification of high; and
    - (iii) every 10 years for a dam or canal that has an accepted consequence classification of low or significant.
- (2) When a consequence classification is re-assessed, the dam/canal owner must, within 60 days of the completion of the re-assessment, submit the re-assessed consequence classification to the Director in accordance with section 3.4.

- (3) A dam/canal owner may at any time undertake a re-assessment of a consequence classification and may submit the re-assessed consequence classification to the Director in accordance with section 3.4.

### **3.4 Director's acceptance of consequence classification**

- (1) When submitting a consequence classification to the Director, a dam/canal owner must submit in writing to the Director a record that:
  - (a) sets out a consequence classification for the dam or canal, as the case may be; and
  - (b) sets out the methodology, assumptions, data sources, and references used in determining that consequence classification.
- (2) If, in the opinion of the Director, the consequence classification submitted by the dam/canal owner has not been determined in accordance with this Directive:
  - (a) the dam/canal owner must submit additional information regarding the methodology, assumptions, data sources, and references that were used in determining the consequence classification that was submitted by the dam/canal owner; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the consequence classification that was submitted by the dam/canal owner has been determined in accordance with the Directive.
- (3) If, in the opinion of the Director, the consequence classification submitted by the dam/canal owner has been determined in accordance with this Directive, that consequence classification shall be the accepted consequence classification for the purposes of this Directive.
- (4) A dam/canal owner must comply with the provisions of the Regulation and this Directive that apply in respect of an accepted consequence classification, as of the date specified in writing by the Director.

### **3.5 Transition for existing dams and canals**

- (1) For a dam or canal that exists for the purpose of storing flowable tailings, a consequence classification that:
  - (a) was accepted by the Director immediately prior to this Directive first being published; and;
  - (b) is significant, high, very high or extreme;is deemed to be the accepted consequence classification for that dam or canal, until the dam/canal owner obtains a different accepted consequence classification in accordance with this Directive.
- (2) In the event that a dam or canal that exists for the purpose of storing flowable tailings has a consequence classification of low that was accepted by the Director prior to this Directive first being published, that dam or canal is deemed to have a consequence classification of significant, until the dam/canal owner obtains a different accepted consequence classification in accordance with this Directive.
- (3) Except as set out in subsections (1) and (2), a consequence classification that was accepted by the Director for a dam or canal immediately prior to this Directive first being published is deemed to be the accepted consequence classification for that dam or canal, until the dam/canal owner obtains a different accepted consequence classification for that dam or canal in accordance with this Directive.

## 4. Part 4 - Safety Management

### 4.1 Safety management plan

- (1) A dam/canal owner must develop a safety management plan for every dam or canal that has an accepted consequence classification of significant, high, very high, or extreme.
- (2) The safety management plan must be prepared by:
  - (a) a qualified professional, in the case of a dam or canal having an accepted consequence classification of high, very high or extreme; or
  - (b) a qualified individual, in the case of a dam or canal having an accepted consequence classification of significant.
- (3) The scope of a safety management plan must be determined by a qualified professional or qualified individual, as the case may be, having regard to the risk to factors at risk posed by the dam or canal.
- (4) A safety management plan must, at a minimum, include all of the following information:
  - (a) the ownership and management structures for the dam or canal, including:
    - (i) general safety objectives and goals;
    - (ii) planning;
    - (iii) implementation;
    - (iv) checking;
    - (v) corrective actions; and
    - (vi) reporting;
  - (b) the roles and responsibilities of key individuals involved in the safe operation of the dam or canal including:
    - (i) the dam/canal owner;
    - (ii) the safety manager;
    - (iii) the engineer of record;
    - (iv) the designer of record;
    - (v) the regulatory reporting contact;
    - (vi) the operator; and
    - (vii) the emergency contact.
  - (c) policies and processes for reporting and decision-making in respect of operation, surveillance, repair, and maintenance;
  - (d) policies and processes for reporting and decision-making regarding safety assessments and safety evaluations;
  - (e) policies and processes for reporting and decision-making regarding the identification, tracking, monitoring, and mitigation and management of risks of safety deficiencies and critical safety deficiencies;
  - (f) the required education and training for individuals involved in operation, surveillance, repair, and maintenance, and processes to ensure that these individuals obtain and maintain that education and training;
  - (g) policies and processes for reporting and decision-making regarding emergency management;
  - (h) policies and processes for reporting and decision-making regarding the provision of financial and human resources needed to operate the dam or canal in accordance with all applicable legislation.

- (5) When required by the Director in writing, a dam/canal owner must submit, in writing, a copy of the safety management plan to the Director within the time frame specified by the Director.

#### **4.2 Review and update of safety management plan**

- (1) A dam/canal owner must review and update the safety management plan:
- (a) when there is a significant change in risk to the factors at risk posed by the dam or canal;
  - (b) when required in writing by the Director; and
  - (c) in any event, at a minimum:
    - (i) every 5 years for a dam or canal that has an accepted consequence classification of very high or extreme
    - (ii) every 7 years for a dam or canal that has an accepted consequence classification of high; and
    - (iii) every 10 years for a dam or canal that has an accepted consequence classification of significant.

#### **4.3 Resources to support safety management plan**

- (1) A dam/canal owner must ensure that adequate funding and other resources are available to implement the safety management plan.

#### **4.4 Public safety**

- (1) For a dam or canal that has an accepted consequence classification of significant, high, very high or extreme, a dam/canal owner must:
- (a) undertake, every 12 months, an assessment of potential hazards to public safety around the dam or canal;
  - (b) exercise due care to safeguard the public around the dam or canal;
  - (c) install appropriate engineering controls to address or mitigate the hazards identified under clause (a); and
  - (d) install signage around the dam or canal that:
    - (i) warns the public of identified hazards; and
    - (ii) provides information regarding the ownership of the dam or canal; and
    - (iii) provides emergency contact information for the dam or canal.

#### **4.5 Safety deficiencies**

- (1) Upon identifying a safety deficiency, a dam/canal owner must:
- (a) promptly document the deficiency in writing including, at a minimum, all of the following information:
    - (i) the nature of the safety deficiency;
    - (ii) its location;
    - (iii) the time and date that it was identified;
    - (iv) its priority rating; and
    - (v) its status;
  - (b) promptly enter the deficiency into the master deficiencies list; and

- (c) develop and implement measures to mitigate and manage risks posed by the deficiency.
- (2) Upon identifying a critical safety deficiency, a dam/canal owner must:
- (a) promptly document the deficiency in writing including, at a minimum, all of the following information:
    - (i) the nature of the critical safety deficiency;
    - (ii) its location;
    - (iii) the time and date that it was identified;
    - (iv) its priority rating; and
    - (v) its status;
  - (b) promptly enter the deficiency into the master deficiencies list;
  - (c) notify the Director, in writing, of the critical safety deficiency, including all of the information outlined in clause (a), as soon as possible;
  - (d) develop and implement measures to mitigate and manage risks posed by the critical safety deficiency, immediately;
  - (e) communicate risks to persons who are directly affected by a dam or canal, as soon as possible; and
  - (f) no later than 60 days after the critical safety deficiency is identified, submit a record to the Director, in writing, outlining the measures referred to in clause (d).
- (3) If, in the opinion of the Director, the measures submitted by the dam/canal owner under subsection 2(f) are appropriate for the circumstances, a dam/canal owner shall:
- (a) implement the measures, as may be amended by the Director, and as accepted in writing by the Director; and
  - (b) implement any additional directions that are made in writing by the Director.
- (4) If, in the opinion of the Director, the measures submitted by the dam/canal owner under subsection 2(f) are not appropriate for the circumstances:
- (a) the dam/canal owner must submit additional information regarding the measures to address the Director's concerns; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the measures submitted by the dam/canal owner are appropriate for the circumstances.
- (5) A dam/canal owner must:
- (a) maintain a master deficiencies list at all times;
  - (b) undertake ongoing surveillance of each safety deficiency, in a form and frequency that is commensurate with the level of risk presented by each deficiency;
  - (c) develop and implement measures to mitigate and manage risks posed by safety deficiencies and critical safety deficiencies with regard to the master deficiencies list, so that the residual risks of all deficiencies are kept as low as reasonably practicable; and
  - (d) make funding and other resources available to effectively implement the measures referred to in clause (c).
- (6) A dam/canal owner must not remove a safety deficiency from the master deficiencies list unless:
- (a) all relevant measures to mitigate and manage risks posed by the deficiency have been implemented;



- (b) an independent qualified professional has determined and documented that the hazardous condition which originally gave rise to the deficiency either
    - (i) no longer exists; or
    - (ii) no longer has the potential to develop into a critical safety deficiency over time; and
  - (c) the determination of the independent qualified professional referred to in clause (b) has been
    - (i) submitted, in writing, to the Director; and
    - (ii) accepted, in writing, by the Director.
- (7) A dam/canal owner must not remove a critical safety deficiency from the master deficiencies list unless:
- (a) all relevant measures to mitigate and manage risks posed by the deficiency have been implemented;
  - (b) an independent qualified professional has determined, documented and certified that the hazardous condition which originally gave rise to the deficiency:
    - (i) no longer has the potential to lead to imminent failure; or
    - (ii) no longer exists; and
  - (c) the determination of the independent qualified professional referred to in clause (b) has been
    - (i) submitted, in writing, to the Director; and
    - (ii) accepted, in writing, by the Director.

## **5. Part 5 – Investigations, Design, Construction, Assessments and Evaluations**

### **5.1 Definitions of design and construction in this Part**

- (1) In this Part, unless explicitly stated otherwise:
  - (a) a reference to the “design” of a dam or canal includes a design related to:
    - (i) a new dam or canal;
    - (ii) major repair of a dam or canal;
    - (iii) rehabilitation of a dam or canal; and
    - (iv) decommissioning, closure or abandonment of a dam or canal;
  - (b) a reference to “construction” of a dam or canal includes construction related to:
    - (i) a new dam or canal;
    - (ii) major repair of a dam or canal;
    - (iii) rehabilitation of a dam or canal; and
    - (iv) decommissioning, closure or abandonment of a dam or canal;

and any and all requirements set out in this Directive in relation to the design or construction of a dam or canal must be accordingly met, to the extent applicable.

### **5.2 Scope of site investigations**

- (1) A dam/canal owner must perform a site investigation in accordance with this Part.
- (2) A site investigation must:
  - (a) be planned and supervised by a qualified professional;

- (b) be performed with a level of effort that is commensurate with the risk to factors at risk posed by the dam or canal;
- (c) have a level of accuracy that is commensurate with the risk to factors at risk posed by the dam or canal;
- (d) have a scope that is consistent with
  - (i) the local geological regime; and
  - (ii) local industry best practices for structures of similar size and complexity;
- (e) minimize the use of assumptions regarding the foundation conditions and strength parameters, particularly those associated with the identified plausible failure modes of structures; and
- (f) identify and characterize the main factors that critically affect the safe performance of structures.

### 5.3 When site investigation required

- (1) A dam/canal owner must use a site investigation:
  - (a) to select appropriate material parameters for engineering analyses, including:
    - (i) stress history of the foundation soils;
    - (ii) soil response and its variation with confining stress and stress level, including the potential for brittle failure mechanisms;
    - (iii) bedrock response, including the influence of slickensides and other weak discontinuities, and its variation with confining stress and stress level, including the potential for brittle failure mechanisms;
    - (iv) time-dependent, deformation-dependent and stress-path-dependent processes that may affect the critical material properties such as the operational pore pressures and shear strengths; and
    - (v) strain-incompatibility of the different materials forming the dam or canal and its foundation;
  - (b) to identify the borrow materials, and their variations, available for use as fill materials for structures;
  - (c) to identify the soil, bedrock and dam fill response to the design seismic ground motions, whether natural or induced; and
  - (d) to enable selection of appropriate dynamic parameters for engineering analyses.
- (2) A dam/canal owner must undertake a site investigation when:
  - (a) a hazardous condition is believed or determined to exist and there is insufficient data available to resolve any geological or geotechnical issues related to that hazardous condition; or
  - (b) when a qualified professional advises that a site investigation is required for any technical reason.

### 5.4 Site investigation report

- (1) To support the design and construction of a new dam or canal, or the major repair, decommissioning or closure of a dam or canal, a dam/canal owner must develop and submit to the Director, in writing, a site investigation report that:
  - (a) is prepared by a qualified professional;

- (b) includes, at a minimum, all of the following information:
  - (i) a project location map;
  - (ii) a site geology map;
  - (iii) a reservoir/pond geology map;
  - (iv) a plan of all investigation boreholes, test pits, test trenches, and/or in situ testing locations;
  - (v) logs of all investigation boreholes, test pits, and test trenches, including classification of both bedrock and soil encountered and depths to water table, if applicable, with dates of measurement recorded;
  - (vi) where exploration is taken to bedrock, a top of bedrock contour map;
  - (vii) a geologic structure map, including identification of major faults;
  - (viii) geological cross-sections and profiles that
    - (A) show correlation of soil and bedrock units together with significant features including water levels, zones where water losses were observed, faults, shear zones, foliations, jointing, and solution zones; and
    - (B) emphasize geologic structure and show depths of primary and secondary weathering, and are superimposed with outlines of the principal structures and the depth of foundation excavation proposed or actually completed;
  - (ix) results of all laboratory tests and in situ field tests;
  - (x) a detailed geological, hydrogeological and geotechnical characterization of the site conditions based on the results of the field and laboratory investigations.

## 5.5 Dam or canal design requirements

- (1) A dam/canal owner must comply with all of the following in respect of the design of a dam or canal:
  - (a) the design of the dam or canal, including the design basis, inflow design flood, earthquake design ground motions, freeboard, and factors of safety for various failure modes, must be commensurate with the risk to factors at risk posed by the dam or canal, using the best available technology and best available practices;
  - (b) the design must use and apply either
    - (i) a standards-based approach; or
    - (ii) a performance-based approach that uses quantifiable performance objectives;
  - (c) the scope of the design base memorandum must cover the design criteria in detail, including methods of analysis, verification, and references;
  - (d) the best available technology and best available practices in hydrologic and hydraulic science must be applied to estimate the inflow design flood and its characteristics; and
  - (e) the stability of structures must be demonstrated using the best available technology and best available practices under a variety of loading conditions and objectives.

## 5.6 Target stability criteria and selected factors of safety must be justified

- (1) A dam/canal owner must demonstrate that the target stability criteria and selected factors of safety used in the design of structures for a dam or canal:
  - (a) are consistent with local industry and best practices;

- (b) are supported by a comprehensive risk management system;
  - (c) have been selected with oversight by independent qualified professionals; and
  - (d) are justifiable having regard to, at a minimum, all of the following:
    - (i) potential variability in material properties;
    - (ii) site and subsurface conditions;
    - (iii) modes of failure;
    - (iv) accumulated experience with a particular soil or rock mass;
    - (v) variable construction and operating conditions;
    - (vi) soil response and its variation with confining stress and stress level;
    - (vii) time-dependent, deformation-dependent and stress-path-dependent processes that may affect the critical material properties such as the operational pore pressures and shear strengths;
    - (viii) strain-incompatibility of different materials and its foundation; and
    - (ix) the ability and practicality of implementing an effective risk management system to reduce or mitigate the residual risks associated with the uncertainties of the selected factors over the lifecycle of the structures.
- (2) If a dam or canal will be incrementally constructed over several years, the comprehensive risk management system referred to in subsection (1)(b) must, at a minimum, incorporate an observational method.
- (3) If an observational method is to be used to assess the behaviour and safety performance of a dam or canal, a dam/canal owner must:
- (a) exercise due diligence in ensuring there is continuous communication among those responsible for design, construction and operation of the dam or canal such that observations made during construction and/or operation of the dam or canal inform whether and how changes are required to the design of the dam or canal;
  - (b) design, install and use instrumentation to enable effective monitoring and evaluation of the measured behavior of the dam or canal against the quantifiable performance objectives established for that dam or canal; and
  - (c) develop practical contingency measures.
- (4) A dam/canal owner must not use an observational method for a dam or canal:
- (a) that has a design which cannot be altered during construction;
  - (b) for which there are no practical contingency measures available; or
  - (c) that has a mode of failure that could occur in such a way that there is insufficient time to implement contingency measures when a hazardous condition arises.
- (5) A dam/canal owner must not use minimum factors of safety when:
- (a) an observational method cannot be used for the dam or canal;
  - (b) there are uncertainties in the material properties;
  - (c) there is sensitive strain-weakening soil behaviour;
  - (d) complex geological conditions cannot be fully defined for design;
  - (e) potential changes to soil properties or loading conditions can occur with time; or
  - (f) closure of the dam or canal is proposed.

- (6) When minimum factors of safety must not be used, in accordance with subsection (3), or any other reason, a dam/canal owner must use either:
  - (a) higher factors of safety; or
  - (b) lower bound shear strength parameters.
- (7) A dam/canal owner must apply stringent target stability criteria to shear surfaces that:
  - (a) could directly cause a release of the contained materials in dam or canal;
  - (b) could damage adjacent infrastructure; or
  - (c) could cause either (a) or (b) by retrogression starting from a smaller shear surface.
- (8) The stringency applied to target stability criteria for shear surfaces may be reduced when:
  - (a) the shear surface is small or shallow; and
  - (b) where worker safety and the overall function of the dam or canal will not be compromised.

## 5.7 Seismic analysis

- (1) To support the design of a dam or canal, a dam/canal owner must undertake a seismic analysis to demonstrate that structures are stable under the applicable design seismic loading conditions.
- (2) A dam/canal owner must undertake a seismic analysis in accordance with this section.
- (3) A seismic analysis must:
  - (a) be of a scope that is commensurate with the risk to factors at risk posed by the dam or canal;
  - (b) provide, at a minimum, all of the following information:
    - (i) a description of the seismic environment such as regional earthquake sources, historical activity, and recurrence rates, and site-specific geologic and topographic conditions;
    - (ii) characterization of the levels of potential ground motions such as duration, frequency, amplitude, and predominant period of ground vibrations;
    - (iii) an estimation of peak ground accelerations, as needed for design and monitoring during operation; and
    - (iv) evaluation of the potential for fault movements rupturing the surface at or near the structures, liquefaction, lateral ground spreading and cracking, and overtopping caused by the settlement or by seiches or waves induced by slope failures around the reservoir;
  - (c) be consistent with the following:
    - (i) the design earthquake loads must be commensurate with the accepted consequence classification of the structures;
    - (ii) pseudostatic analyses are acceptable only if the structures do not have liquefiable elements within a potential shear surface; and
    - (iii) the seismic coefficient used in a pseudostatic analysis is not the same as the peak ground acceleration and is selected as a fraction of the peak ground acceleration taking into consideration the relevant soil response to the seismic loading.

## 5.8 Deformation analysis

- (1) In the event that the pseudo-static factor of safety does not meet the stability criteria, or, as a result of the seismic loading, the deformation or dynamic response of the structures is a critical design consideration, then a dam/canal owner must use a method of deformation analysis that

- (a) is site-specific;
- (b) incorporates best available practices and technology; and
- (c) incorporates, at a minimum, determination of yield accelerations, determination of one-dimensional equivalent-linear site response and Newmark deformation analysis.

## 5.9 Seepage analysis

- (1) To support the design of a dam or canal, a dam/canal owner must undertake a seepage analysis to demonstrate the impacts of seepage on the safety of structures.
- (2) A dam/canal owner must undertake a seepage analysis in accordance with this section.
- (3) A seepage analysis must
  - (a) be of a scope that is commensurate with the risk to factors at risk posed by the dam or canal;
  - (b) include estimation of the permeability of the materials selected for construction, and the foundations of the structures, consistent with the following:
    - (i) sufficient index testing must be completed to accurately classify all materials to be used in construction;
    - (ii) appropriate in-situ and laboratory testing must be used to estimate permeability and index properties of the fine-grained materials selected for construction and the foundations for structures that have consequence classifications of high, very high, or extreme;
    - (iii) published permeability values may be used for coarse-grained materials.
  - (c) include appropriate seepage cutoff or reduction measures such as filters and drains to:
    - (i) control seepage and limit gradients, including uplift along penetrations through the embankments of a dam or a canal or at contact planes between different materials, such as the interface between concrete and soil fill pressures;
    - (ii) prevent piping and internal erosion by ensuring that the seepage exit gradients are within acceptable limits for the embankments;
  - (d) if filters are included in the seepage analysis, demonstrate the filter criteria based on actual gradation tests and include references to filter criteria standards;
  - (e) include a numerical analysis, where seepage control is a primary performance parameter for the structures; and
  - (f) evaluate the potential environmental impacts of seepage, including impacts from oxidation and other chemical changes, over the lifecycle of the structures.

## 5.10 Design of temporary structures

- (1) If the construction of a dam or canal will involve the construction of a temporary structure such as a cofferdam, spillway or conduit, a dam/canal owner must submit all of the following information to the Director, in writing, as part of the design of that temporary structure:
  - (a) design drawings and specifications for cofferdams, weirs, conduits, and other temporary structures;
  - (b) the consequence classification of the structures;
  - (c) justification for the selected design criteria for the structures;
  - (d) hydraulic analyses of the temporary structures that are used to control or divert water during construction, with supporting hydrologic data;

- (e) stability analyses of the temporary structures under design usual and unusual loading conditions;
- (f) seepage analyses of the temporary structures and details on seepage control during construction, including the use of pumping;
- (g) an operation, maintenance and surveillance manual for the temporary structure;
- (h) an emergency management plan for the temporary structure; and
- (i) the removal of the temporary structures that are used to control or divert water during construction.

### **5.11 Foundation preparation**

- (1) If the design of a dam or canal will require foundation preparation, then the dam/canal owner must submit in writing to the Director, at a minimum, details and specifications regarding that foundation preparation including details and specifications related to:
  - (a) cleaning;
  - (b) slush grouting;
  - (c) pressure grouting; and
  - (d) dental concrete.
- (2) A dam/canal owner must submit to the Director, in writing, any additional information regarding foundation preparation as requested in writing by the Director.

### **5.12 Erosion control**

- (1) A dam/canal owner must submit to the Director, in writing, information identifying how erosion control and environmental monitoring will be undertaken during construction of the dam or canal, including:
  - (a) a description of the measures that will be used during and after construction to limit erosion both within the site and the downstream channel in the vicinity of construction;
  - (b) a description of the measures that will be undertaken to monitor change in risk to factors at risk due to erosion; and
  - (c) a description of risk mitigation or management measures that will be undertaken in the event that the risk is not tolerable.

### **5.13 Pre-construction requirements**

- (1) Before commencing construction of a dam or canal, a dam/canal owner must comply with all pre-construction requirements that are specified in the authorization of the structures.
- (2) If, under subsection (1), a dam/canal owner is required to provide a schedule of activities related to the construction of a dam or canal, the dam/canal owner must:
  - (a) submit to the Director, in writing, a schedule that outlines the proposed sequence, timing and duration of construction activities; and
  - (b) if any deviations from that schedule are anticipated or become necessary, notify the Director in writing of such deviations as soon as practicable.

## 5.14 Construction

- (1) A dam/canal owner must construct a dam or canal in conformity with all designs, plans and specifications that have been accepted as part of applicable authorizations.
- (2) If it is believed, expected or determined that the construction of a dam or canal will deviate in any way from the designs, plans and specifications referred to in subsection (1), the dam/canal owner must:
  - (a) promptly notify the Director in writing; and
  - (b) outline in writing the steps that are proposed to be taken to address the deviation.
- (3) If, in the opinion of the Director, the steps submitted by the dam/canal owner under subsection (2) are acceptable to the Director, a dam/canal owner shall implement the steps as accepted in writing by the Director.
- (4) If, in the opinion of the Director, the steps submitted by the dam/canal owner under subsection (3) are not acceptable to the Director:
  - (a) the dam/canal owner must submit additional information regarding the steps that were submitted by the dam/canal owner; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the steps that were submitted by the dam/canal owner have been developed in accordance with the Directive and applicable best practices.
- (5) No aspect of construction that directly or indirectly relates to the deviation referred to in subsection (2) may commence except in accordance with the acceptance in writing by the Director under subsection (3).
- (6) Nothing in this section derogates or abrogates from an obligation on a dam/canal owner to obtain any authorization that is required in relation to deviations in the construction of a dam or canal.

## 5.15 Construction quality assurance plan

- (1) A dam/canal owner must develop a construction quality assurance plan for a dam or canal that has an accepted consequence classification of high, very high or extreme.
- (2) A construction quality assurance plan referred to in subsection (1) must:
  - (a) be prepared by a qualified professional;
  - (b) be certified by a qualified professional;
  - (c) have a scope that is commensurate with the risk to factors at risk posed by the dam or canal;
  - (d) set out the activities that will be undertaken during construction of the dam or canal to assure the quality of the finished structures; and
  - (e) outline the responsibilities assigned to key individuals for specific work that will be undertaken to monitor, assess and evaluate the performance of the structures.
- (3) A dam/canal owner must submit a construction quality assurance plan to the Director, in writing, no later than 60 days after:
  - (a) the construction quality assurance plan has been developed; or
  - (b) construction commences on the dam or canal,whichever is earlier.



- (4) If, in the opinion of the Director, the construction quality assurance plan submitted by the dam/canal owner has been developed in accordance with this Directive, a dam/canal owner shall implement the construction quality assurance plan as accepted in writing by the Director.
- (5) If, in the opinion of the Director, the construction quality assurance plan submitted by the dam/canal owner has not been developed in accordance with this Directive:
  - (a) the dam/canal owner must submit additional information regarding the methodology, assumptions, data sources, and references that were used in developing the construction quality assurance plan that was submitted by the dam/canal owner; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the construction quality assurance plan that was submitted by the dam/canal owner has been developed in accordance with this Directive.
- (6) For a dam or canal that has an accepted consequence classification of low or significant, a dam/canal owner must:
  - (a) have a qualified professional determine whether, and to what extent, elements of a construction quality assurance plan are required for the dam or canal, having regard to the risk to factors at risk posed by that dam or canal; and
  - (b) if a qualified professional determines under clause (a) that elements of a construction quality assurance plan are required, have a qualified professional incorporate such elements into the construction quality control plan for that dam or canal.

#### **5.16 Construction quality control plan**

- (1) A dam/canal owner must develop a construction quality control plan for a dam or canal.
- (2) A construction quality control plan must:
  - (a) be prepared by a qualified professional;
  - (b) be certified by a qualified professional;
  - (c) have a scope that is commensurate with the risk to factors at risk posed by that dam or canal;
  - (d) set out the activities that will be undertaken during construction of the dam or canal to control the quality of the finished structures; and
  - (e) outline the responsibilities assigned to key individuals for specific work that will be undertaken to monitor, assess and evaluate the performance of the structures.
- (3) A dam/canal owner must submit a construction quality control plan to the Director, in writing, no later than 60 days after:
  - (a) the construction quality control plan has been developed; or
  - (b) construction commences on the dam or canal,whichever is earlier.
- (4) If, in the opinion of the Director, the construction quality control plan submitted by the dam/canal owner has been developed in accordance with this Directive, a dam/canal owner shall implement the construction quality control plan as accepted in writing by the Director.
- (5) If, in the opinion of the Director, the construction quality control plan submitted by the dam/canal owner has not been developed in accordance with this Directive:

- (a) the dam/canal owner must submit additional information regarding the methodology, assumptions, data sources, and references that were used in developing the construction quality control plan that was submitted by the dam/canal owner; and/or
- (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the construction quality control plan that was submitted by the dam/canal owner has been developed in accordance with this Directive.

## 5.17 Construction completion report

- (1) A dam/canal owner must
  - (a) develop a construction completion report within 90 days of:
    - (i) the completion of construction; or
    - (ii) in the case of a dam or canal that will be incrementally constructed over several years, the completion of a phase of construction of the structures; and
  - (b) submit the construction completion report to the Director, in writing, promptly after the report has been developed.
- (2) A construction completion report must:
  - (a) be prepared by a qualified professional;
  - (b) be certified by a qualified professional;
  - (c) have a scope that is commensurate with the complexity of the structures and the risk to factors at risk posed by the dam or canal;
  - (d) include, at a minimum, all of the following information:
    - (i) a description of the implementation of the designs, plans and specifications that were accepted as part of applicable authorizations;
    - (ii) a description of the deviations and non-conformances from designs, plans and specifications referred to in clause (i), and potential impacts of those deviations and non-conformances;
    - (iii) a description of the measures taken to address deviations and non-conformances referred to in clause (ii);
    - (iv) a description of works that are not yet completely constructed, along with estimated dates for the completion of their construction;
    - (v) a description of the types of materials used for construction, including the brand names or catalog sheets of components, and other descriptive information;
    - (vi) a description of the methodologies used for construction;
    - (vii) a description of the methodologies that were used in addressing any unexpected conditions that were encountered during construction;
    - (viii) inspection reports;
    - (ix) field and laboratory test results, including sample locations and test standards or methodologies;
    - (x) a summary of all testing that was undertaken under construction quality assurance and construction quality control plans, including
      - (A) grain-size analysis;
      - (B) proctor testing;
      - (C) in situ density testing;
      - (D) plasticity testing;

- (E) strength testing; and
- (F) if applicable, geo-synthetic materials testing;
- (xi) an assessment of the adequacy of the frequencies and results of testing referred to in clause (x);
- (xii) photographs documenting the progress of construction and the final conditions, with accompanying information about key observations that were made during construction;
- (xiii) record drawings of the as-built conditions;
- (xiv) a formal statement indicating that the structures were constructed in accordance with the designs, plans and specifications that were accepted as part of applicable authorizations, and their intent;
- (xv) details of site and foundation preparation and mapping of foundation materials;
- (xvi) surveyed plans and representative cross-sections;
- (xvii) locations, types and depths of instrumentation, and a discussion on the rationale and basis for any significant changes in the as-built information relative to original design recommendations;
- (xviii) the start date and end date of construction;
- (xix) a summary of weather during construction, including weather-related shutdowns;
- (xx) dates of site visits and inspections by a qualified professional during construction; and
- (xxi) field reviews by a qualified professional.

### **5.18 Requirement to undertake assessments/evaluations**

- (1) For a dam or canal that has an accepted consequence classification of significant, high, very high or extreme, a dam/canal owner must, in accordance with this Directive, undertake:
  - (a) engineering inspections;
  - (b) annual performance reviews;
  - (c) safety reviews; and
  - (d) risk assessments.
- (2) A dam/canal owner must:
  - (a) enter into the master deficiencies list any safety deficiencies and critical safety deficiencies that are identified through annual engineering inspections, annual performance reviews, safety reviews, risk assessments, and other safety assessments and safety evaluations; and
  - (b) enter into the master non-conformances list any non-conformances that are identified through annual engineering inspections, annual performance reviews, safety reviews, risk assessments, and other safety assessments and safety evaluations.
- (3) When required by the Director in writing, a dam/canal owner must undertake a safety assessment or safety evaluation in the manner and time frames specified by the Director.
- (4) In the event that a qualified professional determines that a safety assessment or a safety evaluation is required for a dam or canal, a dam/canal owner must undertake the safety assessment or safety evaluation in accordance with the safety management plan.

## 5.19 Engineering inspection

- (1) A dam/canal owner must undertake an engineering inspection of a dam or canal at least once every twelve months unless:
  - (a) an annual performance review of that dam or canal has been undertaken during the previous twelve months; or
  - (b) a safety review of that dam or canal has been undertaken during the previous twelve months.
- (2) An engineering inspection must:
  - (a) be prepared by a qualified professional;
  - (b) have a scope and a level of detail that is commensurate with
    - (i) the risk to factors at risk posed by the dam or canal; and
    - (ii) the complexity of the structures of the dam or canal;
  - (c) be performed based on current industry standards and best practices;
  - (d) include a detailed engineering inspection to examine and document the condition of the structures;
  - (e) include a review and assessment of instrumentation monitoring data used to monitor performance of the structures;
  - (f) assess behaviour of the structures by reviewing and comparing any anomalies with previous inspections, previous instrumentation monitoring, and existing safety deficiencies and critical safety deficiencies; and
  - (g) recommend appropriate measures to mitigate and manage the risks of any safety deficiencies and critical safety deficiencies that are identified.
- (3) A dam/canal owner must submit the annual engineering inspection, in writing, to the Director not less than 90 days after the annual engineering inspection has been completed if a new safety deficiency is found.
- (4) If, in the opinion of the Director, the annual engineering inspection submitted by the dam/canal owner has been developed in accordance with this Directive, a dam/canal owner shall implement measures outlined in the annual engineering inspection as accepted in writing by the Director.
- (5) If, in the opinion of the Director, the annual engineering inspection submitted by the dam/canal owner has not been developed in accordance with this Directive:
  - (a) the dam/canal owner must submit additional information regarding the engineering inspection that was submitted by the dam/canal owner to address the Director's concerns; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the annual engineering inspection that was submitted by the dam/canal owner has been developed in accordance with this Directive.

## 5.20 Annual performance review

- (1) A dam/canal owner must undertake an annual performance review of a dam or canal at least once every twelve months if:
  - (a) the dam or canal is under construction or rehabilitation;

- (b) the dam or canal is in the post-construction period;
  - (c) at least one critical safety deficiency has been identified for the dam or canal; or
  - (d) required in writing by the Director.
- (2) Notwithstanding subsection (1), an annual performance review is not required for a dam or canal if a safety review for that dam or canal has been undertaken during the previous twelve months.
- (3) An annual performance review must be performed and documented by:
- (a) the designer of record, if the dam or canal is under construction or rehabilitation or is in the post-construction period; or
  - (b) a qualified professional, if the dam or canal is in any other stage of its lifecycle.
- (4) An annual performance review must:
- (a) have a scope and a level of detail that is commensurate with
    - (i) the risk to factors at risk posed by the dam or canal; and
    - (ii) the complexity of the structures of the dam or canal;
  - (b) be performed based on current industry standards and best practices;
  - (c) include a detailed engineering inspection to examine and document the condition of the structures;
  - (d) include a detailed review, analysis and assessment of instrumentation monitoring data used to monitor performance of the structures;
  - (e) assess performance of the structures by reviewing and comparing any observed anomalies with established quantifiable performance objectives and previously documented performance and inspections of the structures; and
  - (f) make recommendations for appropriate measures to monitor, mitigate and manage the risks posed by identified safety deficiencies and critical safety deficiencies, including
    - (i) a detailed review and re-adjustment of established quantifiable performance objectives; and
    - (ii) a detailed review and re-adjustment of the design of the structures.
- (5) A dam/canal owner must submit the annual performance review to the Director, in writing, not less than 90 days after the annual performance review has been completed.
- (6) If, in the opinion of the Director, the annual performance review submitted by the dam/canal owner has been developed in accordance with this Directive, a dam/canal owner shall implement measures outlined in the annual performance review as accepted in writing by the Director.
- (7) If, in the opinion of the Director, the annual performance review submitted by the dam/canal owner has not been determined in accordance with this Directive:
- (a) the dam/canal owner must submit additional information regarding the methodology, assumptions, data sources, and references that were used in assessing the performance of the dam or canal; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the annual performance review that was submitted by the dam/canal owner has been developed in accordance with this Directive.

## 5.21 Safety review

- (1) A dam/canal owner must undertake a safety review of a dam or canal at least:
  - (a) every 5 years for a dam or canal that has an accepted consequence classification of very high or extreme;
  - (b) every 7 years for a dam or canal that has an accepted consequence classification of high; and
  - (c) every 10 years for a dam or canal that has an accepted consequence classification of significant.
- (2) Unless otherwise required in writing by the Director, a safety review is not required for a dam or canal that is:
  - (a) under construction;
  - (b) under rehabilitation;
  - (c) is in the post-construction period.
- (3) A safety review must:
  - (a) be prepared by an independent qualified professional;
  - (b) have a scope and a level of detail that is commensurate with
    - (i) the risk to factors at risk posed by the dam or canal; and
    - (ii) the complexity of the structures of the dam or canal;
  - (c) be performed based on current industry standards and best practices;
  - (d) include a detailed engineering inspection to examine and document the condition of the structures;
  - (e) include a review and assessment of the consequence classification of the structures, including, if applicable, any cascade impacts;
  - (f) include a review of site investigations information of the structures;
  - (g) include a review of the design and construction information of the structures;
  - (h) include a review and assessment of all available instrumentation monitoring and information surveillance data;
  - (i) include an analysis and assessment of design of the structures including:
    - (i) hydrology and hydraulics;
    - (ii) stability under applicable usual and unusual loading; and
    - (iii) flow control equipment functionality and capacity;
  - (j) include a review and assessment of the adequacy of the operation, maintenance and surveillance manual;
  - (k) include a review and assessment of the adequacy of the emergency management plan;
  - (l) include a review of measures to manage the contents
    - (i) stored in the reservoir or pond of the dam; or
    - (ii) conveyed by the canal;
  - (m) include a review and assessment of the adequacy of the safety management plan currently in place;

- (n) include a review of previously identified safety deficiencies and non-conformances, and an assessment of the adequacy of the measures that have been taken by the dam/canal owner to mitigate and manage the risks posed by deficiencies;
  - (o) identify safety deficiencies and non-conformances of the structures;
  - (p) identify credible potential failure modes related to the deficiencies referred to in clause (l); and
  - (q) recommend appropriate measures to monitor, mitigate and manage the risks posed by the deficiencies referred to in clause (l).
- (4) A dam/canal owner must submit the safety review to the Director, in writing, not less than 90 days after the safety review has been completed.
  - (5) If, in the opinion of the Director, the safety review submitted by the dam/canal owner has been developed in accordance with this Directive, a dam/canal owner shall implement measures outlined in the safety review as authorized in writing by the Director.
  - (6) If, in the opinion of the Director, the safety review submitted by the dam/canal owner has not been determined in accordance with this Directive:
    - (a) the dam/canal owner must submit additional information regarding the methodology, assumptions, data sources, and references that were used in assessing the safety of the dam or canal; and/or
    - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the safety review that was submitted by the dam/canal owner has been developed in accordance with this Directive.

## 5.22 Risk assessment

- (1) A dam/canal owner must undertake a formal risk assessment regarding the safety of a dam or canal when:
  - (a) a critical safety deficiency is identified for that dam or canal; or
  - (b) an established quantifiable performance objective for that dam or canal is not met.
- (2) A risk assessment must be performed and documented by a qualified individual.
- (3) A risk assessment must, at a minimum:
  - (a) have a scope and a level of detail that is commensurate with
    - (i) the risk to factors at risk posed by the dam or canal; and
    - (ii) the complexity of the structures of the dam or canal;
  - (b) be performed based on current industry standards and best practices;
  - (c) describe the process and approach that were used in undertaking the risk assessment;
  - (d) include a determination of all potential failure modes of the structures;
  - (e) identify all credible failure modes of the structures and their possible consequences by utilizing a formal failure mode and effects analysis process;
  - (f) include an assessment of the probability of each credible failure mode under various triggering events;

- (g) using qualitative or semi-quantitative methods and current safety standards and best practices, assess the level of residual risk related to the identified credible failure modes of the structures;
  - (h) determine appropriate risk categories, using sound engineering principles and judgments;
  - (i) confirm that the ongoing residual risks related to the credible failure modes of the structures are tolerable, based on
    - (i) current safety standards and best practices; and
    - (ii) the risk matrix used for the assessment, or the criteria used for determining tolerability of risk;
  - (j) should the structures not meet the adopted tolerable residual risk criteria, recommend appropriate risk management or mitigation measures that should be taken to keep the residual risks as low as reasonably practicable until the structures meet the adopted residual risk criteria.
- (4) A dam/canal owner must submit the risk assessment to the Director, in writing, not less than 90 days after the risk assessment has been completed.
  - (5) If, in the opinion of the Director, the risk assessment submitted by the dam/canal owner has been developed in accordance with this Directive, a dam/canal owner shall implement measures outlined in the risk assessment as authorized in writing by the Director.
  - (6) If, in the opinion of the Director, the risk assessment submitted by the dam/canal owner has not been determined in accordance with this Directive:
    - (a) the dam/canal owner must submit additional information regarding the methodology, assumptions, data sources, and references that were used to assess the risk; and/or
    - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the risk assessment that was submitted by the dam/canal owner has been developed in accordance with this Directive.

## **6. Part 6 – Operation, Maintenance and Surveillance**

### **6.1 Operation, maintenance and surveillance manual**

- (1) If a dam or canal has an accepted consequence classification of significant, high, very high, or extreme, a dam/canal owner must develop an operation, maintenance and surveillance manual for that dam or canal.
- (2) An operation, maintenance and surveillance manual referred to in subsection (1) must:
  - (a) be prepared by a qualified professional;
  - (b) have a scope that is commensurate with the risk to factors at risk posed by the dam or canal;
  - (c) describe the procedures for safe operation of the dam or canal during:
    - (i) normal conditions; and
    - (ii) unusual conditions;
  - (d) provide technical guidance and procedures for long-term maintenance, monitoring, inspections and surveillance;
  - (e) include procedures and technical guidance to address:



- (i) management of the contents of the dam or canal;
  - (ii) routine operation, maintenance, instrumentation monitoring, and inspections;
  - (iii) operation, maintenance, instrumentation monitoring, and inspections during
    - (A) extreme weather; and
    - (B) during other unusual or special conditions;
  - (iv) testing of flow control equipment;
  - (v) testing of the emergency preparedness plan and the emergency response plan; and
  - (vi) communication and reporting, including incident reporting.
- (3) A dam/canal owner must review and update the operation, maintenance and surveillance manual:
- (a) throughout the lifecycle;
  - (b) when there is a major repair or significant change to the operation, maintenance or surveillance of the dam or canal, including cessation, suspension, decommission or closure;
  - (c) when required by the Director in writing; and
  - (d) in any event, at a minimum:
    - (i) every 5 years for a dam or canal that has an accepted consequence classification of very high or extreme
    - (ii) every 7 years for a dam or canal that has an accepted consequence classification of high; and
    - (iii) every 10 years for a dam or canal that has an accepted consequence classification of significant.
- (4) If a dam or canal has an accepted consequence classification of low, the dam/canal owner must:
- (a) have a qualified professional determine whether an operation, maintenance and surveillance manual is required, having regard to the risk to factors at risk posed by the dam or canal; and
  - (b) if a qualified professional determines under clause (a) that a manual is required, develop an operation, maintenance and surveillance manual in accordance with subsection (2).

## 6.2 Submission and notification to Director

- (1) When an operation, maintenance and surveillance manual is updated, a dam/canal owner must, within 60 days of that update, notify the Director in writing that the update has occurred.
- (2) When required in writing by the Director, a dam/canal owner must submit a copy of the operation, maintenance and surveillance manual to the Director within the time period specified by the Director.

## 6.3 Documentation

- (1) A dam/canal owner must document, using best practices, all activities called for under an operation, maintenance and surveillance manual, including all of the following activities:
  - (a) the first fill of the reservoir, if applicable;
  - (b) tailings deposition and tailings management, if applicable;
  - (c) routine operation, maintenance, instrumentation monitoring, and inspections;
  - (d) operation, maintenance, instrumentation monitoring, and inspections during

- (i) extreme weather; and
  - (ii) during other unusual or special conditions;
  - (e) testing of flow control equipment;
  - (f) testing and exercises of emergency preparedness and response plans; and
  - (g) communication and reporting, including incident reporting.
- (2) A dam/canal owner must retain all documentation referred to in subsection (1) for the lifecycle of the dam or canal.

## 7. Part 7 – Emergency Management

### 7.1 Emergency management plan

- (1) A dam/canal owner must develop an emergency management plan for a dam or canal:
- (a) that has an accepted consequence classification of significant, high, very high or extreme; and
  - (b) that has an accepted consequence classification of low, if a qualified individual has determined that an emergency management plan is required, having regard to the risk to factors at risk posed by the dam or canal.
- (2) An emergency management plan referred to in subsection (1) must:
- (a) have a scope that is commensurate with the risk to factors at risk posed by the dam or canal, as determined by a qualified individual;
  - (b) identify potential emergency situations related to the safety of the dam or canal;
  - (c) describe the procedures to be used in order to manage emergency situations referred to in clause (d) and minimize the risks to factors at risk in the event of a failure;
  - (d) identify key personnel who have roles during emergency situations referred to in clause (d) and outline each of their responsibilities;
  - (e) cover all aspects of emergency management, including prevention, mitigation, preparedness, response, and recovery; and
  - (f) in the case of a dam or canal with an accepted consequence classification of high, very high or extreme, be comprised of:
    - (i) an emergency preparedness plan;
    - (ii) an emergency response plan; and
    - (iii) a flood action plan; and
  - (g) in the case of a dam or canal with an accepted consequence classification of significant, be comprised of a single composite document containing elements of the plans referred to in clause (f) that a qualified individual determines are necessary, having regard to the risk to factors at risk posed by the dam or canal.
- (3) A dam/canal owner must submit in writing to the Director, no later than 60 days after the emergency management plan has been completed, all of the following:
- (a) a copy of the emergency preparedness plan;
  - (b) all maps, including inundation maps, that form part of, are referred to by, or are related to, the emergency preparedness plan; and

- (c) at the request in writing of the Director, any other components of the emergency management plan.
- (4) If, in the opinion of the Director, the emergency preparedness plan submitted by the dam/canal owner has been developed in accordance with this Directive, a dam/canal owner shall:
  - (a) upon receiving acceptance in writing by the Director, communicate to persons who are directly affected by a dam or canal any information from the emergency preparedness plan that is relevant to them, in accordance with any instructions made by the Director in writing; and
  - (b) inform all individuals who have responsibilities under the emergency management plan, in writing, of the location of that emergency management plan.
- (5) If, in the opinion of the Director, the emergency preparedness plan submitted by the dam/canal owner has not been determined in accordance with this Directive:
  - (a) the dam/canal owner must submit additional information regarding the emergency management plan to address the Director's concerns; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the emergency preparedness plan that was submitted by the dam/canal owner has been developed in accordance with this Directive.
- (6) When requested in writing by the Director, a dam/canal owner must submit a copy of an emergency management plan in the time frame specified by the Director.

## **7.2 Emergency contact information**

- (1) A dam/canal owner must review and update all emergency contact information contained in an emergency management plan:
  - (a) at least once every twelve months; and
  - (b) whenever the emergency management plan is updated.
- (2) When there is a change to emergency contact information in an emergency management plan, a dam/canal owner must, no later than 14 days after the change occurs:
  - (a) submit the updated information in writing to the Director; and
  - (b) provide the updated information, in writing, to persons who are directly affected by a dam or canal.

## **7.3 Requirement to update emergency management plan**

- (1) A dam/canal owner must review and update the emergency management plan:
  - (a) when there is a major repair or significant change to the operations, maintenance or surveillance of the dam or canal, including
    - (i) construction;
    - (ii) major rehabilitation;
    - (iii) cofferdam construction;
    - (iv) decommissioning; and
    - (v) closure;
  - (b) when there is a change in the accepted consequence classification of the dam or canal; and

- (c) in any event, at a minimum:
  - (i) every 5 years for a dam or canal that has an accepted consequence classification of very high or extreme
  - (ii) every 7 years for a dam or canal that has an accepted consequence classification of high; and
  - (iii) every 10 years for a dam or canal that has an accepted consequence classification of significant.
- (2) A dam/canal owner must submit to the Director, in writing, a copy of the updated emergency preparedness plan no later than 60 days after the emergency management plan has been updated.

#### **7.4 Testing, exercises and validation of emergency management plan**

- (1) For a dam or canal that has an accepted consequence classification of extreme, very high or high, a dam/canal owner must:
  - (a) hold an orientation workshop
    - (i) within 12 months of receiving written authorization from the Director under section 7.1(4); and
    - (ii) at least once every 12 months thereafter;
  - (b) hold an emergency drill
    - (i) within 12 months of receiving written authorization from the Director under section 7.1(4); and
    - (ii) at least once every 12 months thereafter;
  - (c) hold, within 60 months of receiving written authorization from the Director under section 7.1(4), either:
    - (i) a tabletop exercise; or
    - (ii) a functional exercise; andat least once every 60 months thereafter, hold the events in clauses (i) and (ii) in alternating fashion, such that during every 120 month period at least one of each type of event is held;
- (2) For a dam or canal that has an accepted consequence classification of significant, a dam/canal owner must test an emergency management plan in the form, manner and frequency that a qualified individual determines appropriate having regard to the risk to factors at risk posed by the dam or canal.

### **8. Part 8 – Notifications to Director**

#### **8.1 Notification of dam or canal information**

- (1) When there is a change to:
  - (a) the name of a dam or canal, according to its authorization;
  - (b) its consequence classification;
  - (c) its height;
  - (d) its capacity; or
  - (e) its purpose,

the dam/canal owner must,

- (a) as soon as possible, submit to the Director, in writing, a statement that information regarding the dam/canal has changed; and
- (b) no later than 90 days after the change has occurred, submit to the Director, in writing, the updated information in the manner instructed by the Director.

## **8.2 Notification of safety incident**

- (1) When there is a safety incident, a dam/canal owner must, no later than 30 days after the safety incident, submit to the Director, in writing, all of the following information:
  - (a) a chronology of events before, during and after the safety incident;
  - (b) a description of the performance of the dam or canal during the safety incident, along with supporting photographs;
  - (c) a description of any damage to the dam or canal caused by the safety incident;
  - (d) a description of the impact of the safety incident on factors at risk;
  - (e) a description of the actions taken by the dam/canal owner during and after the safety incident;
  - (f) a description of the activities that have been and will be taken as a result of the safety incident, including repairs or changes in the operation of the dam or canal;
  - (g) an estimate of the economic and social impacts of the safety incident on the dam/canal owner.

## **9. Part 9 – Decommissioning, Closure, Abandonment, etc.**

### **9.1 Plan for cessation/resumption of dam or canal**

- (1) A dam/canal owner must develop a cessation/resumption plan if:
  - (a) the dam/canal owner intends to cease, suspend, restrict or limit the operation of the dam or canal for more than 365 consecutive days; or
  - (b) the dam/canal owner intends to resume the operation of a dam or canal that has been ceased, suspended, restricted or limited in operation for more than 365 consecutive days; and
  - (c) the dam or canal has an accepted consequence classification of significant, high, very high, or extreme.
- (2) A cessation/resumption plan for a dam or canal referred to in subsection (1) must:
  - (a) be based on industry standards and best practices;
  - (b) be in alignment with local practices;
  - (c) have a scope and a level of accuracy that is commensurate with
    - (i) the risk to factors at risk posed by the dam or canal; and
    - (ii) the complexity of the structures of the dam or canal;
  - (d) include all of the following information:
    - (i) a project plan and location map;
    - (ii) a site geology map;

- (iii) a reservoir/pond geology map;
  - (iv) details regarding the intended duration of the cessation, suspension, restriction or limitation of operation of the dam or canal;
  - (v) a detailed description of the activities that are planned as part of
    - (A) the cessation, suspension, restriction or limitation of operation of the dam or canal; and
    - (B) the resumption of operation of the dam or canal;
  - (vi) a detailed description of measures that will be taken to manage the contents of the dam or canal;
  - (vii) a review and assessment of how the activities referred to in clause (v) will impact the consequence classification of the dam or canal;
  - (viii) a review and assessment of how the activities referred to in clause (v) will impact the safety of the dam or canal, the scope of which must include:
    - (A) review of design and construction of the structures;
    - (B) review and assessment of all available instrumentation monitoring and surveillance data;
    - (C) analysis and assessment of the design of the structures including
      1. stability under applicable usual and unusual loading;
      2. hydrology and hydraulics; and
      3. flow control equipment functionality and capacity;
    - (D) review and identification of safety deficiencies, critical safety deficiencies and non-conformances; and
    - (E) review and identification of credible potential failure modes related to the safety deficiencies and critical safety deficiencies;
  - (ix) a comprehensive assessment of risks to the safety of the structures that are presented by the activities referred to in clause (v); and
  - (x) a detailed description of measures that will be taken to mitigate and manage the risks referred to in clause (ix) including:
    - (A) measures to address safety deficiencies, critical safety deficiencies and non-conformances;
    - (B) measures for monitoring, maintenance and surveillance of the structures; and
    - (C) measures, policies and procedures for emergency management of the structures; and
  - (xi) the safety management plan for dam or canal;
- (3) A dam/canal owner must submit the cessation/resumption plan to the Director, in writing, prior to
- (a) the cessation, suspension, restriction or limitation of the operation of the dam or canal; and
  - (b) the resumption of operation of the dam or canal.
- (4) If, in the opinion of the Director, the cessation/resumption plan submitted by the dam/canal owner has been developed in accordance with this Directive, a dam/canal owner shall implement the cessation/resumption plan as accepted in writing by the Director.
- (5) If, in the opinion of the Director, the cessation/resumption plan submitted by the dam/canal owner has not been developed in accordance with this Directive:

- (a) the dam/canal owner must submit additional information regarding the methodology, assumptions, data sources, and references that were used in developing the cessation/resumption plan that was submitted by the dam/canal owner; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the cessation/resumption plan that was submitted by the dam/canal owner has been developed in accordance with the Directive.
- (6) If a dam/canal owner intends to cease, suspend, restrict, limit the operation or resume the operation, as contemplated under subsection (1), of a dam or canal that has an accepted consequence classification of low, then the dam/canal owner must:
- (a) have a qualified professional determine whether a cessation/resumption plan is required; and
  - (b) if a qualified professional determines a plan is necessary under clause (a), develop and submit a cessation/resumption plan in accordance with this section.

## **9.2 Notification to Director prior to cessation/resumption**

- (1) Before ceasing, suspending, restricting or limiting the operation of a dam or canal, a dam/canal owner must submit to the Director, in writing, all of the following information:
- (a) a statement that the dam/canal owner intends to cease, suspend, restrict or limit the operation of the dam or canal;
  - (b) the reasons for that cessation, suspension, restriction or limitation of operation;
  - (c) the date on which the dam/canal owner intends to cease, suspend, restrict or limit the operation of the dam or canal;
  - (d) the estimated length of time for which the dam/canal owner will cease, suspend, restrict or limited in operation of the dam or canal; and
  - (e) if known, the date on which the dam/canal owner expects to resume the operation of the dam or canal;
- not less than 14 days before the date on which the dam/canal owner expects to cease, suspend, restrict or limit the operation of the dam or canal.
- (2) Before resuming the operation of a dam or canal that has been ceased, suspended, restricted or limited in operation, a dam/canal owner must submit to the Director, in writing, all of the following information:
- (a) a statement that the dam/canal owner intends to resume the operation of the dam or canal; and
  - (b) the date on which the dam/canal owner intends to resume the operation of the dam or canal;
- not less than 14 days before the date on which the dam/canal owner expects to resume the operation of the dam or canal.

## **9.3 Obligations of dam/canal owner**

- (1) A dam/canal owner must cease, suspend, restrict or limit the operation of a dam or canal:
- (a) in a safe manner at all times;
  - (b) in accordance with the terms and conditions of all applicable authorizations;
  - (c) in accordance with the Regulation and this Directive;

- (d) in accordance with a cessation/resumption plan that has been accepted by the Director, if a cessation/resumption plan is required under this Directive; and
  - (e) in accordance with any additional requirements prescribed in writing by the Director.
- (2) A dam/canal owner must resume the operation of a dam or canal:
- (a) in a safe manner at all times;
  - (b) in accordance with the terms and conditions of all applicable authorizations;
  - (c) in accordance with the Regulation and this Directive;
  - (d) in accordance with a cessation/resumption plan that has been accepted by the Director, if a cessation/resumption plan is required under this Directive;
  - (e) under the supervision of a qualified professional, if a cessation/resumption plan is required under this Directive; and
  - (f) in accordance with any additional requirements prescribed in writing by the Director.

#### **9.4 Deviation from cessation/resumption plan**

- (1) If a dam/canal owner has reason to believe that
- (a) the cessation, suspension, restriction or limitation of operation of a dam or canal will deviate from a cessation/resumption plan that has been accepted by the Director; or
  - (b) the resumption of operation of a dam or canal will deviate from a cessation/resumption plan that has been accepted by the Director,
- then the dam/canal owner must, prior to undertaking any work that is directly or indirectly related to that deviation, submit to the Director, in writing, all of the following information:
- (a) a statement that the dam/canal owner has reason to believe that there will be a deviation from a cessation/resumption plan that has been accepted by the Director;
  - (b) details regarding the nature and scope of that deviation with reference to the cessation/resumption plan that has been accepted by the Director; and
  - (c) details regarding the measures that the dam/canal owner proposes to take to mitigate or manage the risks posed by the deviation.
- (2) If, in the opinion of the Director, the measures submitted by the dam/canal owner under subsection (1) are acceptable to the Director, a dam/canal owner shall implement the measures as accepted in writing by the Director.
- (3) If, in the opinion of the Director, the measures submitted by the dam/canal owner under subsection (1) are not acceptable to the Director:
- (a) the dam/canal owner must submit additional information regarding the measures that were submitted by the dam/canal owner; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the measures that were submitted by the dam/canal owner have been developed in accordance with the Directive and applicable best practices.

#### **9.5 Post-implementation report following cessation/resumption**

- (1) A dam/canal owner must



- (a) develop a post-implementation report no later than 60 days after a cessation/resumption plan has been implemented; and
  - (b) submit the post-implementation report to the Director, in writing, no later than 30 days after the post-implementation report has been developed.
- (2) A post-implementation report referred to in subsection (1) must:
- (a) be prepared by a qualified professional;
  - (b) be certified by a qualified professional; and
  - (c) have a scope and level of accuracy that is commensurate with
    - (i) the risk to factors at risk posed by the dam or canal; and
    - (ii) the complexity of the structures of the dam or canal.

## **9.6 Plan for decommissioning, closure and abandonment**

- (1) A dam/canal owner must develop a decommissioning, closure and abandonment plan for a dam or canal that has an accepted consequence classification of significant, high, very high or extreme.
- (2) A decommissioning, closure and abandonment plan referred to in subsection (1) must:
- (a) be based industry standards and best practices;
  - (b) be aligned with local practices;
  - (c) have a scope and level of accuracy that is commensurate with
    - (i) the risk to factors at risk posed by the dam or canal; and
    - (ii) the complexity of the structures of the dam or canal;
  - (d) address all stages of decommissioning, closure and abandonment of the dam or canal;
  - (e) include, at a minimum, all of the following information:
    - (i) key project and site-specific information including:
      - (A) a project plan;
      - (B) a location map;
      - (C) site characterization and related geology maps;
      - (D) reservoir/ pond characteristics and related geology maps;
    - (ii) a summary of design and construction of the structures;
    - (iii) a summary of safety assessments and safety evaluations;
    - (iv) a summary of all available instrumentation monitoring and surveillance data;
    - (v) a summary of all identified safety deficiencies, critical safety deficiencies and non-conformances;
    - (vi) a summary of measures to mitigate or manage the risk posed by safety deficiencies and critical safety deficiencies;
    - (vii) a summary of measures to address non-conformances;
    - (viii) a summary of all identified credible potential failure modes related to the identified safety deficiencies and critical safety deficiencies; and
    - (ix) a summary of safety management activities that are in place, including monitoring and surveillance activities;

- (f) outline the stages of work that will be involved in decommissioning, closure and abandonment;
  - (g) provide details of the activities planned for each stage referred to in clause (f), including:
    - (i) design of works for each stage including all of the following information:
      - (A) analysis and design of full or partial removal of the structures;
      - (B) method and means to dewater or stabilize the reservoir or pond along with breach, removal, or abandonment of the structures;
      - (C) analysis and assessment of the stability of the remaining permanent structures under applicable usual and unusual loading conditions;
      - (D) amount and effects of consolidation of the reservoir or pond contents;
      - (E) analysis and assessment of seepage monitoring and control measures for the remaining permanent structures, including phreatic surface and internal drainage system within the final configuration of the structures;
      - (F) hydrologic and hydraulic evaluation of the proposed final configuration of the structures during the probable maximum flood or other inflow design flood; and
      - (G) flow control equipment functionality and discharge capacity;
    - (ii) short-term and long-term quantifiable performance objectives;
    - (iii) short-term and long-term performance monitoring and surveillance; and
    - (iv) periodic safety assessments and safety evaluations;
  - (h) provide a detailed description of the measures that will be taken to safely manage the contents of the dam or canal during the activities referred to in clause (g);
  - (i) include a review and assessment of how the activities referred to in clause (g) will impact the consequence classification of the dam or canal;
  - (j) include a comprehensive assessment of risks to the safety of the structures posed by the activities referred to in clause (g);
  - (k) provide a detailed description of the measures that will be taken to mitigate and manage the risks posed by the activities referred to in clause (g), including:
    - (i) measures for performance monitoring, maintenance and surveillance of the structures;
    - (ii) measures to address safety deficiencies, critical safety deficiencies and non-conformances; and
    - (iii) measures, policies and procedures for emergency management of the structures; and
  - (l) provide a detailed description of short-term and long-term safety and risk management and mitigation measures after completion of activities referred to in clause (g).
- (3) A dam/canal owner must submit a decommissioning, closure and abandonment plan to the Director, in writing, in order to obtain authorization for any decommissioning, closure or abandonment activities.
- (4) If, in the opinion of the Director, the decommissioning, closure and abandonment plan submitted by the dam/canal owner has been developed in accordance with this Directive and applicable best practices:
- (a) the Director shall complete a technical review of the plan that was submitted by the dam/canal owner;
  - (b) the Director shall determine if the plan submitted by the dam/canal owner is acceptable to the Director; and

- (c) the Director shall determine and prescribe in writing any safety requirements that should form part of an authorization for the decommissioning, closure and abandonment of the dam or canal.
- (5) If, in the opinion of the Director, the decommissioning, closure and abandonment plan submitted by the dam/canal owner has not been developed in accordance with this Directive or applicable best practices:
  - (a) the dam/canal owner must submit all additional information required by the Director; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the plan that was submitted by the dam/canal owner has been developed in accordance with the Directive and applicable best practices.
- (6) For a dam or canal that has an accepted consequence classification of low, a dam/canal owner must:
  - (a) have a qualified professional determine whether a decommissioning, closure and abandonment plan is required for that dam or canal; and
  - (b) if a qualified professional determines under clause (a) that a plan is required,
    - (i) develop a decommissioning, closure and abandonment plan that is:
      - (A) prepared by a qualified professional;
      - (B) certified by a qualified professional;
      - (C) based industry standards and best practices;
      - (D) supported by local practices; and
      - (E) has a scope and level of accuracy that is commensurate with
        - 1. the risk to factors at risk posed by the dam or canal; and
        - 2. the complexity of the structures of the dam or canal; and
    - (ii) submit that decommissioning, closure and abandonment plan to the Director in accordance with this section.

## **9.7 Notification to Director prior to decommissioning, closure, abandonment**

- (1) Before undertaking decommissioning, closure or abandonment of a dam or canal, a dam/canal owner must submit to the Director, in writing,
  - (a) a statement that the dam/canal owner intends to undertake decommissioning, closure or abandonment of a dam or canal; and
  - (b) the date on which the dam/canal owner intends to commence the decommissioning, closure or abandonment,not less than 14 days before the date on which the dam/canal owner expects to commence the decommissioning, closure or abandonment of the dam or canal.

## **9.8 Obligations of dam/canal owner for decommissioning, closure, abandonment**

- (1) Prior to the decommissioning, closure or abandonment of a dam or canal, a dam/canal owner must:

- (a) clearly define the purpose, objectives and goals of the decommissioning, closure or abandonment in relation to:
    - (i) public safety;
    - (ii) risk to factors at risk;
    - (iii) liability;
    - (iv) change in use or function of the dam or canal;
    - (v) risk management and mitigation; and
    - (vi) reclamation;
  - (b) identify all major issues and concerns regarding the decommissioning, closure or abandonment of the dam or canal, including economic, social, management, legal, administrative, technical, and environmental issues and concerns; and
  - (c) plan the stages of work for decommissioning, closure or abandonment of the dam or canal, and the activities to be undertaken in each of those stages, using approaches and criteria that are commensurate with
    - (i) the risk to factors at risk posed by the dam or canal; and
    - (ii) the complexity of the structures of the dam or canal.
- (2) A dam/canal owner must undertake decommissioning, closure or abandonment a dam or canal:
- (a) in a safe manner at all times;
  - (b) in accordance with the terms and conditions of all applicable authorizations;
  - (c) in accordance with the Regulation and this Directive;
  - (d) in accordance with a decommissioning, closure and abandonment plan that has been accepted by the Director, if a decommissioning, closure and abandonment plan is required under this Directive;
  - (e) under the supervision of a qualified professional, if a decommissioning, closure and abandonment plan is required under this Directive;
  - (f) in accordance with any additional requirements prescribed in writing by the Director; and
  - (g) in such a way that, after decommissioning, closure or abandonment of the dam or canal has been completed, the final configuration of any remaining permanent structures
    - (i) does not impound a reservoir;
    - (ii) is sufficient to pass a design storm event, based on the risk to factors at risk posed by the structures, without restricting the flow of water and without backing up water;
    - (iii) is not susceptible to clogging from sedimentation or debris; and
    - (iv) demonstrates long-term stability, including in respect of erosion control and sediment transportation control.

## **9.9 Deviation from decommissioning, closure and abandonment plan**

- (1) If a dam/canal owner has reason to believe that the decommissioning, closure or abandonment of a dam or canal will deviate from a decommissioning, closure and abandonment plan that has been accepted by the Director, then the dam/canal owner must, prior to undertaking any work that is directly or indirectly related to that deviation, submit to the Director, in writing, all of the following information:

- (a) a statement that the dam/canal owner has reason to believe that there will be a deviation from a decommissioning, closure and abandonment plan that has been accepted by the Director;
  - (b) details regarding the nature and scope of that deviation with reference to the decommissioning, closure and abandonment plan that has been accepted by the Director; and
  - (c) details regarding the measures that the dam/canal owner proposes to take to mitigate or manage the risks posed by the deviation.
- (2) If, in the opinion of the Director, the measures submitted by the dam/canal owner under subsection (1) are acceptable to the Director, a dam/canal owner shall implement the measures as accepted in writing by the Director.
- (3) If, in the opinion of the Director, the measures submitted by the dam/canal owner under subsection (1) are not acceptable to the Director:
- (a) the dam/canal owner must submit additional information regarding the measures that were submitted by the dam/canal owner; and/or
  - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the measures that were submitted by the dam/canal owner have been developed in accordance with the Directive and applicable best practices.

#### **9.10 Completion reports of decommissioning, closure, abandonment**

- (1) A dam/canal owner must, after decommissioning, closure and abandonment activities have been completed for a phase of a decommissioning, closure and abandonment plan,
- (a) develop a completion report within 60 days; and
  - (b) submit the completion report to the Director, in writing, within 30 days after the report has been completed.
- (2) A completion report referred to in subsection (1) must:
- (a) be prepared by a qualified professional;
  - (b) be certified by a qualified professional;
  - (c) have a scope and level of accuracy that is commensurate with
    - (i) the risk to factors at risk posed by the dam or canal; and
    - (ii) the complexity of the structures of the dam or canal;
  - (d) be based upon the decommissioning, closure and abandonment plan that has been accepted by the Director;
  - (e) include, at a minimum, all of the following information:
    - (i) a summary of the construction of structures for decommissioning, closure or abandonment;
    - (ii) a summary of performance monitoring, surveillance, and safety assessments and safety evaluations during decommissioning, closure or abandonment;
    - (iii) a summary of identified safety deficiencies, critical safety deficiencies and non-conformances;
    - (iv) a summary of measures taken to mitigate and manage the risks posed by identified safety deficiencies and critical safety deficiencies;

- (v) a summary of measures taken to address identified non-conformances;
  - (vi) design details, including drawings and specifications, for the final configuration of the remaining permanent structures;
  - (vii) a description of how removal or abandonment activities were conducted;
  - (viii) a description of unexpected conditions that were encountered;
  - (ix) photographs documenting construction or demolition progress and final conditions of the remaining permanent structures,
  - (x) a description of the chemical and geotechnical nature of the remaining permanent contents of the reservoir;
  - (xi) a summary of the performance of the underdrainage system and the quantity and characteristics of seepage;
  - (xii) details of any grading and soil stabilization, including contour maps and cross sections of the final configuration of the remaining permanent structures; and
  - (xiii) an assessment of the consequence classification of the remaining permanent structures;
- (f) provide a risk assessment;
  - (g) provide a detailed description of short-term and long-term requirements in respect of performance monitoring, surveillance, and safety assessments and safety evaluations, to manage and mitigate residual risks posed by any remaining permanent structures;
  - (h) include a certification that the final configuration of the remaining permanent structures conforms to all applicable legal requirements, including requirements under the Act, the Regulation and this Directive; and
  - (i) include a certification that there is an extremely low probability that the final configuration of the remaining permanent structures will revert to a condition that does not conform to all applicable legal requirements, including requirements under the Act, the Regulation and this Directive.
- (3) If, in the opinion of the Director, the completion report submitted by the dam/canal owner has been developed in accordance with this Directive, a dam/canal owner shall implement completion report as accepted in writing by the Director.
  - (4) If, in the opinion of the Director, the completion report submitted by the dam/canal owner has not been developed in accordance with this Directive:
    - (a) the dam/canal owner must submit additional information regarding the completion report to address the Director's concerns; and/or
    - (b) the dam/canal owner must submit additional information for the purposes of demonstrating that the completion report that was submitted by the dam/canal owner has been developed in accordance with the Directive.

### **9.11 Removal of structures from inventory**

- (1) A dam/canal owner must not formally remove a structure from the inventory of dams and canals until a completion report that pertains to that structure is accepted in writing by the Director under section 8.10(3).

# Schedule 1 – Determining Consequence Classification

## 1. Definitions

- (1) In this Schedule,
- (a) “category” means, in relation to the incremental consequences of failure, one of the following:
- (i) loss of life;
  - (ii) environmental and cultural values;
  - (iii) infrastructure, economics and other property.

## 2. Determination of consequence classification

- (1) For the purposes of the Regulation and this Directive, the consequence classification of a dam or canal is to be determined in accordance with the following:
- (a) for each category of incremental consequences of failure in columns 3, 4 and 5 of the table, identify the losses or damages specified in the applicable column that most closely describe the losses or damages that are the most severe potential consequences of a failure of the dam or canal;
  - (b) identify the consequence classification that is specified in column 1 of the table for the losses or damages referred to in clause (a) for each category;
  - (c) the consequence classification identified under paragraph (b) with the most severe potential consequences is the consequence classification of the dam or canal.
- (2) For the purposes of identifying the incremental consequences of failure in column 3 of the table, the descriptions in column 2 of the table, being the population of individuals that may be at risk if there were a failure of the dam or canal, are to be considered.

**Table**

Column 1	Column 2	Column 3	Column 4	Column 5
<b>Consequence classification</b>	<b>Population at risk</b>	<b>Incremental consequences of failure</b>		
		<b>Loss of life</b>	<b>Environmental and cultural values</b>	<b>Infrastructure, economics, and other property</b>
Low	None Identifiable	No possibility of loss of life other than through unforeseeable misadventure	Minimal short-term loss or damage and no long-term loss or damage to: <ul style="list-style-type: none"> <li>a) Fisheries</li> <li>b) Wildlife habitats</li> <li>c) Rare or endangered species,</li> <li>d) Unique landscapes, or</li> <li>e) Sites of cultural significance</li> </ul>	Minimal economic losses mostly limited to the dam owner’s property, and no potential for development within the dam inundation zone.

Significant	Temporary only <sup>1</sup>	Low potential for loss of life	<p>No significant loss or damage to:</p> <ul style="list-style-type: none"> <li>a) Important fisheries</li> <li>b) important wildlife habitats</li> <li>c) Rare or endangered species,</li> <li>d) Unique landscapes, or</li> <li>e) Sites of cultural significance.</li> </ul> <p>Restoration or compensation in kind for losses and damages highly possible.</p>	Low economic losses affecting limited infrastructure and residential buildings, public transportation or services or commercial facilities, or some destruction or damage to locations used occasionally and irregularly for temporary purposes.
High	Permanent <sup>2</sup>	10 or fewer	<p>Significant loss or damage to:</p> <ul style="list-style-type: none"> <li>a) important fisheries</li> <li>b) important wildlife habitats</li> <li>c) rare or endangered species, or</li> <li>d) unique landscapes</li> <li>e) sites of cultural significance,</li> </ul> <p>Restoration or compensation in kind for losses and damages highly possible.</p>	High economic losses affecting infrastructure, public transportation or services or commercial facilities, or some destruction or severe damage to scattered residential buildings.
Very High	Permanent <sup>2</sup>	100 or fewer	<p>Significant loss or damage to:</p> <ul style="list-style-type: none"> <li>a) critical fisheries</li> <li>b) critical wildlife habitats</li> <li>c) rare or endangered species, or</li> <li>d) unique landscapes</li> <li>e) sites of cultural significance,</li> </ul> <p>Restoration or compensation in kind for losses and damages possible but impractical.</p>	Very high economic losses affecting important infrastructure, public transportation or services or commercial facilities, or some destruction or severe damage to residential areas.
Extreme	Permanent <sup>2</sup>	More than 100	<p>Major loss or damage to:</p> <ul style="list-style-type: none"> <li>a) critical fisheries</li> <li>b) critical wildlife habitats</li> <li>c) rare or endangered species, or</li> </ul>	Extremely high economic losses affecting critical infrastructure, public transportation or services or commercial facilities, or some destruction or



			d) unique landscapes e) sites of cultural significance, Restoration or compensation in kind for losses and damages is impossible.	damage to residential areas.
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## Schedule 2 – Form of Master Lists

**Table 1 – Master deficiencies list**

No.	Dam Safety Deficiency	Recommendation	Priority Rating	Existing Status	Updated Status	Comment <sup>1</sup>
1						
2						
3						

<sup>1</sup>Comments should also address whether or not the previously identified deficiencies be still considered as dam safety deficiencies. If previously identified deficiencies have been addressed by the owner, comment whether or not the deficiencies have been addressed comprehensively and should be removed from the deficiency tracking list.

**Table 2 – Master non-conformances list**

No.	Non-Conformance	Recommendation	Priority Rating	Existing Status	Updated Status	Comment <sup>1</sup>
1						
2						
3						

<sup>1</sup>Comments should address whether or not the previously identified non-conformances be still considered as non-conformances or dam safety deficiencies. If previously identified non-conformances have been addressed by the owner, comment whether or not the non-conformances have been addressed comprehensively and should be removed from the deficiency tracking list.

Original signed by: \_\_\_\_\_

Date: December 11, 2018

Bev Yee  
 Deputy Minister  
 Environment and Parks