AUDIT OF CODE REQUIREMENTS FOR TAILINGS STORAGE FACILITIES

BRITISH COLUMBIA | Mine Audits and Effectiveness Unit

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* The List of References contains references cited throughout report

EXECUTIVE SUMMARY

Background

On July 20, 2016, the Ministry of Energy, Mines and Low Carbon Innovation (the Ministry) published and implemented revisions to Part 10 of the Health, Safety and Reclamation Code for Mines in British Columbia (the Code).

A Code Review Committee was struck in 2015 to implement the recommendations from the Independent Expert Engineering Investigation and Review Panel following their investigations into the Mount Polley tailings dam failure. The Code Review Committee recommended the introduction of new requirements for the design and management of tailings storage facilities (TSFs) which included establishing elements of best practice for TSFs as legal requirements. The revisions to Part 10 of the Code were accompanied by a guidance document (the Code Guidance Document) intended to provide context for the application of, and what constitutes compliance with, the 2016 Code revisions.

The expanded requirements for TSFs have been in place for over four years. During this time, stakeholders and investors in the mining sector have continued to focus on TSF design, management and regulation as key issues in the mining sector. In the wake of additional TSF failures since Mount Polley, including the 2019 failure of the Córrego do Feijão TSF in Brazil, the regulation of TSFs has also garnered increased attention worldwide and has compelled mining jurisdictions globally to continue evaluating how TSFs are regulated.

The Ministry, through authorities derived from the *Mines Act*, is responsible for compliance verification and enforcement of Code requirements. Mine operators implement Code requirements on their sites with the involvement of site personnel, contractors and individuals appointed to oversight roles (such as engineers of record or Independent Tailings Review Boards).

Audit Purpose and Approach

The purpose of this audit, termed the "Audit of Code Requirements for Tailings Storage Facilities", is summarized by the audit objective statement:

The objective of this audit was to determine whether the 2016 revisions to the Health, Safety and Reclamation Code for Mines in British Columbia pertaining to tailings storage facilities were consistent with the objectives of the Code Review Committee, have provided the Ministry with clear and enforceable regulations that are consistent with industry best practice and among the best in the world, are systematically verified and enforced by the Ministry, and are being complied with by industry.

In conducting this audit, the audit team relied on publicly available documentation (including legislation and regulations), Ministry data, industry publications, interviews, surveys and other engagements. These data were analysed to determine how effectively the 2016 Code revisions related to TSFs fulfilled the audit objective.

Conclusion, Discussion and Recommendations

OVERALL CONCLUSION

Overall, the 2016 Code revisions generally met the audit objective. The 2016 Code revisions pertaining to TSFs, and their implementation, are having positive impacts on the management and operation of TSFs in B.C. The general commitment to TSF safety by inspectors, operators and people in the mandated roles has supported the implementation of the 2016 Code revisions.

The 2016 Code revisions related to TSFs are consistent with the objectives of the Code Review Committee struck in 2015. Many of the revisions were drawn from established best practice for TSFs, which has resulted in Code requirements that place B.C.'s regulatory framework for TSFs in alignment with industry best practice and makes it "as good as exists anywhere in the world."

Code requirements for TSFs are generally clear when considered alongside guidance and industry best practice. However, several key terms in the Code have vague definitions or are not defined and some Code provisions are subject to multiple reasonable interpretations, all of which can introduce confusion and present challenges for compliance verification and enforcement.

The Ministry has taken a systematic approach to compliance verification and enforcement for mines with operating TSFs but is inconsistent in its approach to enforcing specific Code provisions and in its overall approach to non-operating TSFs. Mine operators largely comply with Code requirements for TSFs and demonstrate that they share the Ministry's goal of ensuring that TSFs in their care remain safe and stable.

The following sections discuss the specific conclusions of the audit objective together with any resulting recommendations.

Consistency with objectives of the Code Review Committee, other Provincial regulations, and industry best practice

The 2016 Code revisions related to TSFs are consistent with the objectives of the Code Review Committee; namely, to implement the recommendations of the Independent Expert Engineering Investigation and Review Panel and the Chief Inspector of Mines following their investigations into the Mount Polley tailings dam failure. The Code Review Committee, which included First Nation technical representatives as partners, government, industry and unions, added or revised Code provisions in response to nearly all recommendations.

Regulatory requirements specific to TSFs are contained in the Code, but the Dam Safety Regulation under the *Water Sustainability Act* describes numerous requirements for "dams", a set of structures that includes most types of TSFs. Non-TSF dams are also subject to requirements in both the Code and the Dam Safety Regulation. While there is a Memorandum of Understanding (MoU) between the Ministry, the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNR) and the Ministry of Environment and Climate Change Strategy (ENV) that attempts to address each ministry's responsibility for dams, the MoU is outdated and does not resolve potential regulatory inconsistencies pertaining to TSFs and dams that were identified in the audit.

The revised Code is aligned with industry best practice, with a few exceptions. The 2016 Code review process drew from established best practices for TSFs, and the revised Code generally sets effective regulatory minimums while providing flexibility for TSF operators and professionals to implement site-specific solutions and exercise their professional judgement. However, best practice for TSFs is a rapidly evolving field and the Ministry's regulatory program also needs to evolve to maintain alignment with best practice.

RECOMMENDATION 1

The Ministry, in collaboration with FLNR and ENV, should revisit the MoU regarding the Dam Safety Regulation and its application to TSFs and other structures on mine sites to create a common understanding between Government, TSF operators and TSF Engineers of Record regarding the regulatory roles of the Ministry, FLNR and ENV and the application of existing regulatory requirements to TSFs in B.C.

RECOMMENDATION 2

The Ministry should develop and document a change management process for determining when and how B.C.'s regulatory framework for TSFs (including the Code and the Code Guidance Document) will be updated to reflect new management programs, guidelines, standards, external regulations and other sources that inform or seek to inform industry best practice or regulation relating to TSFs.

Comparison to regulatory requirements of other major mining jurisdictions

Based on a comparison of the Code with similar regulations in seven other major mining jurisdictions (Alberta, Quebec, Alaska, Montana, Australia [New South Wales], Peru and Brazil) that focused on 13 elements of TSF management and engineering best practice, B.C.'s regulatory framework for TSFs is among the best in the world.

Clarity and enforceability of Code requirements

Code provisions related to TSFs are generally clear when considered alongside industry best practice publications and guidance. However, as a standalone document, the Code is lacking in definitions and several Code requirements are ambiguous, with multiple reasonable interpretations that may complicate the Ministry's compliance verification and enforcement efforts.

The Ministry has provided guidance to users of Part 10 of the Code in the Code Guidance Document. While the Code Guidance Document is a useful tool that provides details of the Ministry's expectations along with references to best practice resources, it was found to contain occasional inconsistencies with the Code, errors and omissions, and has not been updated since its publication in 2016 while industry best practice has continued to evolve.

Clarity and enforceability have a close relationship; if a Code requirement is unclear, the Ministry may be challenged in enforcing a specific interpretation. Enforceability is also limited by the specific outcomes defined in each Code requirement and how those outcomes may be verified. While Code provisions are generally verifiable and enforceable, they do not typically prescribe (and therefore, allow verification or enforcement of) aspects like quality or implementation. The Ministry has documented certain expectations (e.g., content of Code required reports) in the Code Guidance Document but has not clearly documented how and under what authority these expectations may be enforced. The result is an inconsistent approach to compliance verification and enforcement of the 2016 Code revisions.

RECOMMENDATION 3

The Ministry should develop a list of and rationale for priority revisions to TSF provisions in the Code to improve clarity, including but not limited to definitions, consistency of terms and the use of vague language.

RECOMMENDATION 4

The Ministry should revise the Code Guidance Document to be consistent with the Code, to supply the Ministry's interpretation of ambiguous Code requirements and to reference the most current sources of external guidance that the Ministry considers significant.

RECOMMENDATION 5

The Ministry should review its current practices respecting TSFs for consistency with the Code and document its interpretations and expectations regarding compliance with Code requirements to ensure that Ministry staff and regulated parties have a common understanding of the Ministry's compliance verification and enforcement approach.

Ministry compliance verification and enforcement activities and industry compliance

The Ministry's geotechnical engineering team has a broad portfolio of responsibilities, including document review, permitting activities, inspections and other compliance verification activities. The geotechnical engineering team has documented targets for inspecting operating mines with TSFs, which they are achieving. However, there is a lack of documented priorities, policies or procedures for most of the work that the geotechnical engineering team routinely performs with respect to TSFs (including inspections, managing annual reporting and review of permit applications), and a lack of formal strategy for addressing compliance issues at non-operating TSFs.

Most mine sites with TSFs were in compliance with reviewed Code requirements (specifically, completion of Dam Safety Inspections and assignment of mandated oversight roles such as Engineer of Record). To complete this assessment, a manual search of records was required as the data sets generated from the Ministry's data systems were incomplete. This is partially a result of inconsistent entry and uploading of records, which does not align with Ministry policies and procedures. The data systems that the Ministry now uses are improving the ability of the Ministry to systematically track, verify, enforce and promote compliance with regulatory requirements, but consistent use of these systems is integral to ensuring their usefulness.

RECOMMENDATION 6

The Ministry should develop written policies and procedures governing expectations for the geotechnical group regarding prioritization of work across the lifecycle of a mine, including TSF document review and inspections, to support the systematic verification and enforcement of regulatory requirements for TSFs at mines in B.C.

RECOMMENDATION 7

The Ministry should ensure that data systems are used in a manner that is in accordance with policies and procedures, including the Compliance and Enforcement Policy (2020) and the Mine Inspection Procedure (2018). Data systems should be used consistently across the inspectorate to support systematic compliance verification and enforcement of regulatory requirements for TSFs at mines in B.C.

ACKNOWLEDGMENTS

The Audit Unit would like to thank the Williams Lake Indian Band, Xatśūll First Nation, and First Nations Energy and Mining Council for their availability and input during this audit.

The Audit Unit would also like to acknowledge the input and assistance provided by many individuals within the Ministry, especially the Ministry's Geotechnical Engineering team members for their willingness to share their knowledge and time for the benefit of the audit. Klohn Crippen Berger Ltd. provided ongoing expert advice on TSF engineering and regulation throughout the audit. The audit also benefited greatly from the expert input provided by representatives of Knight Piésold Ltd., Golder Associates Inc., and BGC Engineering Inc. Staff and members of the Mining Association of BC provided input to assist the Audit Unit in understanding the perspectives of the mining industry. Engineers and Geoscientists of BC provided useful background on professional obligations for engineers in the mining sector.

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Chief Auditor

LIST OF ABBREVIATIONS

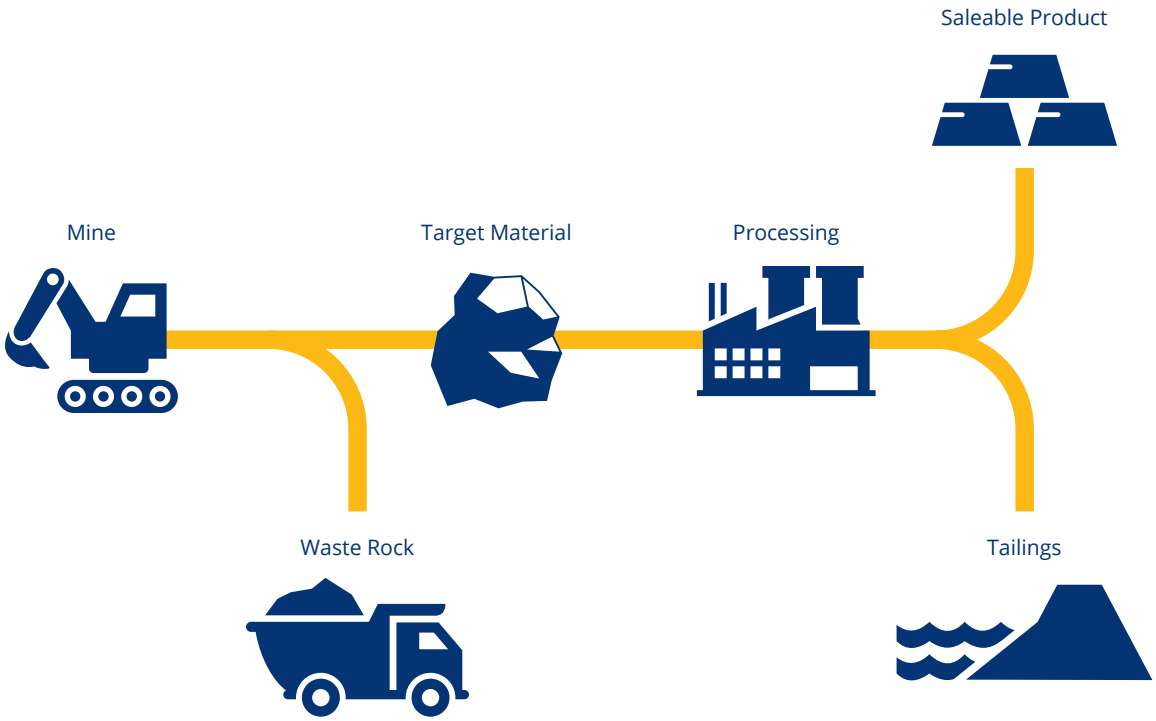
Act	The *Mines Act*
Audit Unit	Mine Audits and Effectiveness Unit
BAT	Best Available Technology
B.C.	British Columbia
CDA	Canadian Dam Association
Chief Inspector	Chief Inspector of Mines
Code	Health, Safety and Reclamation Code for Mines in British Columbia
CRC	Code Review Committee
EGBC	Engineers and Geoscientists BC
ENV	BC Ministry of Environment and Climate Change Strategy
EoR	Engineer of Record
FLNR	BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Global Tailings Standard	Global Industry Standard on Tailings Management
Code Guidance Document	Health, Safety and Reclamation Code for Mines in British Columbia Guidance Document
IEEIRP	Independent Expert Engineering Investigation and Review Panel
Inspector	Inspector of Mines
ISO	International Organization for Standardization
ITRB	Independent Tailings Review Board
MAC	Mining Association of Canada
Ministry	B.C. Ministry of Energy, Mines and Low Carbon Innovation
MoU	Memorandum of Understanding
NRIS	Natural Resource Inspection System
OMS	Operations, Maintenance and Surveillance
OSPG	Office of the Superintendent of Professional Governance
QPO	Quantifiable Performance Objective
Safety First	Safety First: Guidelines for Responsible Mine Tailings Management
ToR	Terms of Reference
TSF	Tailings Storage Facility

INTRODUCTION

An operational mine generally produces three streams of materials: waste rock, tailings, and saleable product(s). The saleable product(s), such as metals, minerals or coal, are contained within a target material (typically termed the ore body or deposit). Waste rock has no economic value and must be removed to access the target material. The target material must be processed to extract or concentrate the saleable product(s). The waste stream remaining from processing the target material is the tailings, which are typically stored locally on the mine site in one or more TSFs.

Tailings storage facilities, or TSFs, are structures on mine sites that contain waste from mining. TSFs can take different forms but commonly include dam structures that prevent the uncontrolled release of water and/or saturated tailings materials. TSFs vary significantly both in area and height based on local conditions with some TSFs incorporating dams over 100 metres tall.

Tailings are composed of finely ground rocks and water and often contain reagents or chemicals used in the processing of the target material (ore). The characteristics of a specific tailings material—such as water content, mineralogy, size distribution, physical and chemical stability, geotechnical strength, and permeability—will influence the form and stability of the TSF. The form of the TSF will further be defined by topography, end land use, climate, economics, and available construction materials. TSFs must also remain safe and stable after mining operations cease and the mine is closed. Due to the typical water content of tailings and the potential difficulties and expense associated with desaturating tailings, TSFs commonly incorporate a dam that can contain saturated materials.



In B.C., activities related to tailings, including storage, are governed by the *Mines Act* (the Act) under the definitions of "mine" and "mining activity", and by the Health, Safety and Reclamation Code for Mines in British Columbia (the Code), which is established under Section 34 of the Act. Most of the requirements relating to TSFs are contained in Part 10 of the Code. Part 10 of the Code includes many provisions related to professional reliance, geotechnical stability, water management, safe operation, emergency management, prediction of risks, independent oversight and design standards for TSFs at all stages in their lifecycle, including construction, operation, closure and post-closure.

Following the failure of the TSF at the Mount Polley mine in August 2014, the Government of B.C. commissioned separate reviews by the Independent Expert Engineering Investigation and Review Panel (IEEIRP)[1] and the Chief Inspector of Mines (Chief Inspector),[2] both of which provided recommendations to improve tailings management and regulation in B.C. with the goal of preventing further TSF failures in the province.

In June 2015, a Code Review Committee (CRC), with membership from First Nation technical representatives as partners, government, industry and unions was struck to implement the recommendations of the IEEIRP that are most appropriately addressed through the Code. The Chief Inspector's report on the Mount Polley TSF failure was released in December 2015 and some of the Chief Inspector's recommendations were also implemented incidentally through the work of the CRC. As a result of the CRC's work, on July 20, 2016, the Ministry published and implemented revisions to Part 10 of the Code (referred to here as the 2016 Code revisions), accompanied by a guidance document (the Health, Safety and Reclamation Code Guidance Document [Code Guidance Document]) intended to support interpretation and implementation of the 2016 Code revisions.

The global state of practice in tailings storage and management is continuously evolving. Since 2014, Canadian professional and industry organizations, such as the Canadian Dam Association (CDA), the Mining Association of Canada (MAC) and Engineers and Geoscientists British Columbia (EGBC) have all updated guidelines and standards pertaining to tailings storage and management. Events such as the failures of TSFs at the Germano and Córrego de Feijão mines in Brazil in 2015 and 2019 (commonly referred to as the Fundão/Samarco and Brumadinho failures, respectively) have raised worldwide awareness of the hazards associated with TSFs impounding saturated tailings. At the global scale, one response to the issue of tailings storage and management was the convening of the Global Tailings Review by the United Nations Environmental Programme and its partners in March 2019. These and other responses by regulators in other jurisdictions and by environmental advocacy groups reflect the evolution of practice and level of interest in tailings storage and management.

AUDIT PURPOSE AND APPROACH

Audit Objective

The objective of this audit was to determine whether the 2016 revisions to the Health, Safety and Reclamation Code for Mines in British Columbia pertaining to tailings storage facilities were consistent with the objectives of the Code Review Committee, have provided the Ministry with clear and enforceable regulations that are consistent with industry best practice and among the best in the world, are systematically verified and enforced by the Ministry, and are being complied with by industry.

The performance and safety of TSFs is a complex subject that includes many aspects of mine management, design, engineering and regulation. The regulatory framework for TSFs in B.C. is centred on the Act and Code and involves an inter-related network of legislation (and subordinate regulations, schedules, etc.), people (including provincial regulators, operators, Indigenous groups, professionals and stakeholders) and standards (industry best practices and professional standards). The relationships between these components have implications for how regulation is interpreted and applied, and no single component, including regulations, can be relied upon solely to ensure TSF safety.

The scope of this audit, as outlined in the objective, was built around the 2016 Code revisions related to TSFs and included an examination of the following:

- The 2016 Code revisions, with a focus on clarity, enforceability, and consistency with current industry best practices and the objectives of the 2015/2016 Code review (see Sections 1.1, 1.4, 2.1 and 2.2);
- The state of industry compliance with Code requirements introduced in 2016 (see Section 3.2);
- The Ministry's compliance verification and enforcement activities related to Code requirements introduced in 2016 (see Sections 2.3 and 3.1); and,
- Comparisons of B.C.'s TSF regulatory requirements post-2016 to other B.C. regulations and regulations in major mining jurisdictions worldwide (see Sections 1.2 and 1.3).

Key sources of information examined as part of this audit include:

- The Code (2017);
- The Code Guidance Document (2016);
- Industry best practice documents including:
  - Dam Safety Guidelines (CDA, 2013) and Application of Dam Safety Guidelines to Mining Dams (CDA, 2014),
  - A Guide to the Management of Tailings Facilities (MAC, 2017 and 2019),
  - Site Characterization for Dam Foundations in BC (EGBC., 2016);
- The *Water Sustainability Act* and the Dam Safety Regulation;
- Enactments and related documents from other Canadian and international jurisdictions;

- Ministry data on TSF inspections, including inspection frequencies, observations, orders, warnings and advisories;
- Ministry data on TSF documentation submitted by operators since 2015, including Dam Safety Inspections, Dam Safety Reviews, Independent Tailings Review Board (ITRB) reporting and other annual reports, and compliance submissions;
- Interviews with:
  - Ministry geotechnical inspectors, and
  - Engineers of Record (EoRs) active in TSF management in B.C.;
- Survey of industry opinions and TSF operators (via the Mining Association of British Columbia) on TSF regulation; and,
- Following their release, the Global Industry Standard on Tailings Management (Global Tailings Standard) and responses such as Safety First: Guidelines for Responsible Mine Tailings Management (Safety First).

For more information on the audit process and approach, see Appendix A.

Evidence for the conclusions and the recommendations that follow in this report are sometimes presented as specific examples. These examples are provided to support the conclusion and recommendations of the audit and are not intended to be an exhaustive list of items that may be revised or reconsidered.

AUDIT CONCLUSION

Overall, the 2016 Code revisions generally met the audit objective. The 2016 Code revisions pertaining to TSFs and their implementation are having positive impacts on the management and operation of TSFs in B.C. The addition of a network of mandated roles to the Code (EoR, TSF Qualified Person and the ITRB) is a significant part of these positive impacts. The general commitment to TSF safety by inspectors, operators and people in the mandated roles has supported the implementation of the 2016 Code revisions. While there have been improvements made to the management and operation of TSFs in the province, there are also opportunities to improve the overall clarity, guidance and application of the Code requirements for these facilities.

To address the audit objective, the conclusions have been grouped into three broad themes, which are: consistency, clarity, and compliance verification and enforcement. Consistency discusses how the 2016 Code revisions align with the objectives of the CRC, as well as other regulations, standards and practices. Clarity includes consideration of language and requirements for compliance. Finally, compliance verification and enforcement examines the actions of the Ministry and industry compliance with Code requirements for annual TSF safety inspections and mandated roles included in the 2016 Code revisions.

Table 1 provides a summary of the audit conclusion related to the 2016 Code revisions pertaining to TSFs and identifies the relevant sections of this report that contain further information.

TABLE 1: THE AUDIT CONCLUSION

Theme	The 2016 Code revisions related to TSFs are:	Audit Report Section
Consistency	▸ consistent with the objectives of the Code Review Committee struck in 2015	1.1
	▸ consistent with the statement that "our standards for TSFs are as good as exists anywhere in the world"[3]	1.2
	▸ consistent with documented industry best practice and other B.C. regulations, with a few exceptions	1.4
Clarity	▸ clearly understood in principle by inspectors, TSF operators and professionals but, in some cases, may be subject to differing interpretations under specific circumstances	1.3, 2.1, and 2.2
	▸ written using enforceable language, but do not support the enforcement of some of the Ministry's expectations of quality or implementation	2.3
Compliance Verification and Enforcement	▸ inconsistently verified and enforced by the Ministry due, in part, to unclear priorities for managing the associated workload	3.1
	▸ being complied with by the majority of operating facilities in B.C., based on a review against Code requirements for annual TSF safety inspections and mandated roles.	3.2

AUDIT DISCUSSION AND RECOMMENDATIONS

The discussion and recommendations are presented in the following sections based on the themes of consistency, clarity, and compliance verification and enforcement. Each theme is broken into sections based on the points of the audit conclusion and the documents evaluated. For additional context and information, some sections also include discussion of topics relevant to the regulation of TSFs that do not have a direct relationship to the audit objective.

1 Consistency

The theme of consistency discusses the Code in the context of the objectives of the CRC and compares the contents of the Code to regulations from other jurisdictions, other B.C. regulations and industry best practice.

1.1 OBJECTIVES OF THE CRC

The 2015 CRC operated under the publicly available Terms of Reference (ToR)[4]. In the ToR, the scope of the review regarding TSFs was limited to the recommendations of the IEEIRP most appropriately addressed through the Code. However, according to the B.C. government website[5], "The Code Review Committee was appointed to determine how to best implement the 26 recommendations made by the Independent Expert Engineering Panel and the Chief Inspector of Mines following their investigations into [the TSF failure at Mount Polley]." Therefore, the implementation of both sets of recommendations were examined by the audit. The 2016 Code revisions were consistent with these objectives. For more information regarding the CRC, see Appendix C.

The IEEIRP and Chief Inspector's recommendations covered a wide range of topics relating to TSFs, from technical design criteria to management systems. The 2016 Code revisions reflect these recommendations by including items such as the use of best available technology (BAT), mandating roles such as EoRs, ITRBs, and dam safety managers (implemented as the TSF qualified person), and requiring the development of emergency response plans and design objectives. The CRC's ToR and the recommendations of the IEEIRP and Chief Inspector provided the subject matter experts on the CRC and its TSF technical review sub-committee flexibility in implementing the recommendations in the 2016 Code revisions.

While the revisions are generally consistent with the CRC's ToR, there are instances where the specifics of implementation do not match the intent of the original recommendations. For example, the IEEIRP recommended the Ministry maintain up-to-date records and data regarding TSFs. The 2016 Code revisions require the creation of many of the documents (including reports and plans) mentioned in the recommendations. However, a number of these Code provisions do not require operators to submit these documents to the Ministry or notify the Ministry when these reports are updated (see Section 2.3), which may present challenges to the Ministry's efforts to maintain up-to-date records for TSFs.

Another example involves the development and monitoring of quantifiable performance objectives (QPOs). The IEEIRP recommendations called for both the QPOs and the relevant monitoring data to be provided to the Ministry and maintained in a database. However, the Code only requires that QPOs be proposed and provided at the time of application for a permit under the Act and does not require submission of QPO monitoring data or resubmission of QPOs that are subsequently revised following permit issuance. Additionally, the definition of BAT used in the Code also differs from the IEEIRP report. Further details on BAT are discussed below (see Related Topic: Best Available Technology).

The 2015 review of the Code was a process of consultation, discussion and dialogue involving First Nation technical representatives as partners, government, industry and unions. Therefore, it would be unrealistic to expect every recommendation to be implemented consistently with the interpretations of every individual who reads them. The overarching intent of the revisions, as stated in the ToR, was to "reduce the potential for future failures." Parties interviewed and surveyed during the audit, including EoRs, inspectors, and members of industry involved with TSFs, generally share the opinion that the changes to the Code and the addition of mandated oversight roles have had a positive impact on the operation and safety of TSFs in B.C.

RELATED TOPIC: BEST AVAILABLE TECHNOLOGY

The IEEIRP report recommended the implementation of BAT for TSFs using a phased approach where BAT principles would be used for new mines and "applied to closure of active impoundments", but currently operating facilities would rely on best practices. This phased approach recommended by IEERP is reflected in Code section 10.1.3(f), which requires "an alternatives assessment for the proposed tailings storage facilities that assesses best available technology" as part of any *Mines Act* permit application. This alternatives assessment would require the consideration of BAT for any new mine (requiring a new permit application), major changes to existing mines (requiring a permit amendment application) and closure of existing mines (requiring a permit amendment application).

The IEEIRP considered BAT to include three fundamental components, derived from first principles of soil mechanics: elimination of surface water, promotion of unsaturated conditions and achieving dilatant conditions. The IEEIRP specifically noted the use of filtered tailings (sometimes referred to as "dry stack") as embodying these three components. While these components were not specifically included in the revisions to the Code, Section 3.1 of the Code Guidance Document includes guidance related to alternatives assessments, indicating that "all available technologies should be considered", "efforts to reduce and remove water" from TSFs should be made, and "alternatives to water covers should be considered".

The approach outlined by the Code and the Code Guidance Document to incorporate BAT on mines views BAT selection as part of a process to develop a site-specific solution based on risk, reliability, effectiveness and cost, rather than prescribing a list of technologies that are considered "best". This is similar to the approach that the B.C. Ministry of Environment and Climate Change Strategy (ENV) has adopted for discharges to the environment[6], the process outlined in the Government of Canada in their "Guidelines for the Assessment of Alternatives for Mines Waste Disposal" (which is referenced in the Code Guidance Document), and the approach proposed by Dr. Dirk van Zyl (member of the IEEIRP) who noted that "BAT is not a single technology; its selection is based on site-specific risk management"[7]. However, it is important to mention that Dr. van Zyl's opinion is his own and "does not represent the opinions of the other Panel members."[8]

While less prescriptive than the list of fundamental components of BAT in the IEEIRP report, we consider the approach to incorporate BAT into the Code and Code Guidance Document to be consistent with the phased approach and intent of the recommendation from the IEEIRP. Adding guidance on what should be considered in an alternatives assessment to the Code Guidance Document affords the Ministry flexibility to update this guidance to reflect evolving best practice or emerging technologies.

1.2 COMPARISON TO EXTRA-PROVINCIAL REGULATIONS

When the February 2017 version of the Code (which included the 2016 revisions) was released, the accompanying Message from the Minister[9] stated that "our standards for TSFs are as good as exists anywhere in the world". As a

result, it would be reasonable for any person reading the Code to expect that its contents relating to TSFs are among the best in the world.

A third party with technical expertise and international experience in TSFs was contracted to perform a comparative analysis of B.C.'s regulations and guidance for TSFs (including the Act, the Code and the Code Guidance Document) to the mining regulations in seven jurisdictions from within Canada and around the world, including Alberta, Quebec, Alaska, Montana, New South Wales, Peru, and Brazil. These jurisdictions were selected for comparison because they are similar Canadian or neighbouring jurisdictions (Alberta, Quebec, Alaska), have recently updated their regulations (Alberta, Montana), are jurisdictions with mature mining industries (Quebec, New South Wales, Peru) or are potential source of learnings from recent dam failures (Brazil).

The analysis included determining whether each jurisdiction required 13 key elements of TSF design, construction, management and operations (see sidebar). The list of 13 elements used for the comparison was developed based on alignment with best practices and the requirements of safe design, good governance and good management of TSFs. The scope of the comparison was restricted to the contents of the regulations and did not include evaluating either the state of compliance with the regulations or their effect on TSF safety in any of the jurisdictions. For more information on the jurisdictional scan, including details of the 13 elements examined, see Appendix D.

The results of this comparative analysis indicate that, of the eight jurisdictions considered, only B.C. requires all 13 elements in regulation. The comparison also found that, in contrast to many other jurisdictions, B.C.'s legal framework for TSFs is clearly laid out and straightforward in its organization due to it consisting of two sources of regulatory requirements, the Act and the Code, and one set of guidance, contained in the Code Guidance Document. As well, the comparison highlighted two unique and important features of the Code, including the requirement for TSF site characterization (Code section 10.1.4[3]) and the Duty to Report Safety Issues at Tailings Storage Facilities placed on the EoR (Code section 10.1.6).

The comparison noted that the Code does not identify a specific person (e.g., corporate executive or director) to be accountable for TSF safety; however, this may be addressed by the ability to hold corporate executives responsible for penalties under the Act, as discussed in Related Topic: The Accountable Executive. The comparison also noted several areas where B.C.'s regulatory framework might benefit from additional requirements regarding design methodologies and acceptance criteria, such as dam break studies and closure requirements. However, because compliance with, and the effectiveness of, regulations in other jurisdictions was not evaluated as part of the comparison, we do not make any recommendations to include any specific elements from other jurisdictions as part of this audit.

The results of the comparison show that B.C.'s regulatory framework compares favourably with other jurisdictions worldwide. This opinion was corroborated by Dr. Morgenstern, chair of the IEEIRP, who, at the 6th Victor de Mello lecture[10] in 2018, stated that, "The revised Code reflects the response of a multi-stakeholder committee to the findings from the inquiries [of the IEEIRP and the Chief Inspector into the TSF failure at Mount Polley]. This is an important document and, in my view, constitutes the best revision of any regulatory document in response to the crisis." Additionally, the 2016 Code revisions related

13 Elements of Extra-Provincial Regulations Comparison

TSF Design

1. Dam Break Study
2. Consequence Classification
3. Geotechnical criteria
4. Hydrotechnical criteria
5. Closure

TSF Governance

6. Accountability
7. Engineer of Record
8. TSF Qualified Person
9. Independent Review Board
10. OMS Manual
11. Pre-defined Action Plans
12. Risk Assessment
13. Emergency Response Plan

to TSFs are consistent with industry best practice; for discussion on this conclusion, see Section 1.4. Therefore, B.C.'s regulatory framework for TSFs may be considered to be among the best in the world. However, as both the comparison and further discussion in this report shows, this statement does not mean there is not room for improvement. Industry and regulatory best practice continue to evolve and if B.C.'s regulatory framework for TSFs is to retain its place of relative merit in the world, then it must evolve as well.

RELATED TOPIC: THE ACCOUNTABLE EXECUTIVE

The jurisdictional comparison noted that some jurisdictions identify the need for a senior ranking agent of a company to hold "ultimate responsibility" for a TSF. Similar concepts are included in the 2019 Mining Association of Canada publication "A Guide to the Management of Tailings Facilities", referred to as the Accountable Executive Officer, and in the 2020 publication "Global Industry Standard on Tailings Management", referred to as the Accountable Executive. Another 2020 publication, Safety First, refers to the entire corporate Board of Directors instead of a single person when assigning this accountability. [For further discussion on these 2020 publications, see Related Topic: Recent Developments in Tailings Management Practices.]

The concept of an Accountable Executive was not included in the CRC's ToR, nor has it been widely adopted by regulators. However, the recent interest in this concept warrants it being acknowledged and discussed given the context of this audit.

In B.C., the Act, regulations under Section 38 of the Act, and Code do not mandate the role of an Accountable Executive, or similar, specific to TSFs. In general, when the Act assigns responsibilities to people, it names the owner, agent, manager or permittee, while the Code generally names the mine manager but also mentions other persons including operators and EoRs. The Act includes mechanisms for extending liability to directors, officers or agents of a corporation in Sections 36.1(2) and 37(5):

> ***36.1(2): If a corporation contravenes or fails to comply with a provision referred to in subsection (1) [which includes provisions of the Act, the regulations and the Code, orders made under the Act and terms or conditions imposed by the Chief Inspector under the Act], a director, officer or agent of the corporation who authorized, permitted or acquiesced in the contravention or failures also contravenes or fails to comply with the provision and is also liable to an administrative penalty under section 36.2***
>
> ***37(5): If a corporation commits an offence, a director or officer of the corporation who authorized, permitted or acquiesced in the offence is, even if the corporation is convicted, liable to the penalty set out in subsection (3) [which includes fines of not more than $1 000 000 or imprisonment for not more than 3 years or both]***

While the Act, regulations and Code do not identify a specific role of Accountable Executive for TSFs, Sections 36.1(2) and 37(5) of the Act extends accountability for contraventions and failures to comply to corporate executives that authorized, permitted or acquiesced to work that leads to a contravention or failure to comply. Therefore, it is possible under the Act and Code to hold a corporate executive (assuming they are a director or officer of the corporation) responsible for penalties related to a contravention or failure to comply. Penalties that can be extended to the director or officer of a corporation are the same as those that are applicable to a person who has committed an offence.

The audit did not examine details related to implementation or results of Accountable Executive provisions in other jurisdictions. Without evidence regarding the impacts of mandating a TSF Accountable Executive in other jurisdictions, and given the ability in B.C. to find that officers and agents have contravened or failed to comply in the Act and Code and is liable to administrative and other penalties, it is not apparent that the addition of such a role is necessary at this time.

1.3 INTERACTION WITH OTHER PROVINCIAL REGULATION

The Code is given regulatory force by the Act and is the primary regulatory tool governing activities that relate to TSFs on mine sites. However, other provincial regulations or legislation may also include requirements for TSFs on mine sites in B.C. The Dam Safety Regulation under the *Water Sustainability Act* (administered by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development [FLNR]), was identified as having potential interaction with the TSF requirements in the Code. While other provincial regulations or legislation may also include requirements related to TSFs (e.g., requirements regarding effluent and remediation under the *Environmental Management Act*), only the Dam Safety Regulation was identified as having interaction with the aspects of performance and safety of TSFs that were addressed in the 2016 Code revisions.

The Dam Safety Regulation sets requirements for dam design, construction, operation, maintenance, removal and decommissioning, and these requirements apply to structures on mine sites that meet the definition of a "dam" in the Dam Safety Regulation. While this is not an issue if the Dam Safety Regulations and the Code are aligned, it presents challenges to regulatory consistency when they differ.

The Code and Dam Safety Regulation include many similar sections, but often differ in their definitions, applicability and specific requirements or prescriptions. For example, both regulations have definitions for "dam" (Table 2). Under the Dam Safety Regulation, many (but not all) TSFs in B.C. meet the definition of a "dam."

TABLE 2: DEFINITIONS OF "DAM"

Regulation	Definition
Dam Safety Regulation	"dam" means (a) a barrier constructed for the purpose of enabling the storage or diversion of water diverted from a stream or an aquifer, or both, and (b) other works that are incidental to or necessary for the barrier described in paragraph (a)
Health Safety and Reclamation Code for Mines in British Columbia	"Dam" means a barrier on the surface preventing uncontrolled release of either water, slurry or solids or a barrier underground to prevent the uncontrolled flow of water, slurry or solids.

Other notable differences between these two regulations include:

- Both regulations require Operation, Maintenance and Surveillance (OMS) manuals, but the Dam Safety Regulation includes additional prescriptions, such as implementation and reporting schedules that the Code does not; and,
- The Dam Safety Regulation includes specific criteria excluding facilities from some requirements based on height, volume or consequence classification (see Sections 2[1] and 7 of the Dam Safety Regulation), whereas the Code does not contain any such criteria in its definition of a "dam" (for discussion of the Code definition of "Dam", see Section 2.1).

Based on the research conducted as part of this audit, it is not clear whether meeting the requirements of the Code would be sufficient to satisfy the Dam Safety Regulation or *vice versa*. Therefore, the fact that a TSF may be considered a dam under both the Code and the Dam Safety Regulation may result in inconsistent regulatory requirements applying to the same facility. For more information regarding the Dam Safety Regulation, see Appendix E.

There is a Memorandum of Understanding (MoU) between the Ministry, FLNR and ENV that acknowledges joint responsibilities for the regulation of dams that form part of a TSF. However, the MoU does not resolve any of the

inconsistencies between regulatory requirements. Additionally, the MoU is dated 2013, which predates updates to the Act, the *Water Sustainability Act* (previously the *Water Act*), the Code and the Dam Safety Regulation.

RECOMMENDATION 1

The Ministry, in collaboration with FLNR and ENV, should revisit the MoU regarding the Dam Safety Regulation and its application to TSFs and other structures on mine sites to create a common understanding between Government, TSF operators, and TSF EoRs regarding the regulatory roles of the Ministry, FLNR and ENV and the application of existing regulatory requirements to TSFs in B.C.

1.4 COMPARISON TO INDUSTRY BEST PRACTICE

The audit analyzed the 2016 Code revisions for alignment and consistency with industry best practice. For the purpose of this examination, industry best practices are defined by aggregated guidance and reference materials in use by professionals working on TSFs in B.C. at the time of the audit, not by any single document. Based on this definition, publications by CDA, MAC and EGBC were selected based on their use as reference materials in 2018 Dam Safety Inspection reports, their use as references in the Code Guidance Document and references made during interviews with EoRs and Ministry staff. The objective of this comparison was not to exhaustively define what constitutes industry best practice for TSFs, but to check if the contents of the Code are consistent with industry best practice.

The Code and the Code Guidance Document are regulatory tools that exist alongside, and not in lieu of, industry best practice. Neither the Code nor the Code Guidance Document define best practice, and the fact that the Code Guidance Document references many external documents supports this opinion. Best practice is established over time by the community of practicing professionals. The Code and related guidance documents should complement industry best practice by establishing a minimum standard for compliance with regulatory requirements, while allowing TSF operators to develop innovative solutions that are aligned with best practices.

The Code is aligned with established industry best practice and nearly all relevant Code provisions have analogues in industry best practice. Examples of Code requirements that reflect best practice include (but are not limited to):

- Retaining an EoR for all TSFs (Code section 10.1.5) and assigning a TSF Qualified Person (Code section 10.4.2);
- Conducting annual Dam Safety Inspections (Code section 10.5.3) and Dam Safety Reviews every five years (Code section 10.5.4);
- Establishing an ITRB (Code section 10.4.2);
- Producing "as built" reports for each phase of TSF construction (Code section 10.5.1); and,
- Maintaining and updating an OMS Manual for all TSFs (Code section 10.5.2).

Industry best practice guidance reviewed as part of the audit was more detailed than the requirements in the Code. The Code generally mandates items, processes and roles present in best practice without specifying the details of content, implementation or qualifications; these details are often left to complimentary guidance or standards from other regulatory or industry bodies. This approach affords flexibility in regulation in a constantly evolving environment. For example, in the Code, the EoR is required to be a registered Professional Engineer who is "qualified to practice in the relevant discipline" and to complete certain tasks. These requirements are consistent with the responsibilities and expected qualifications for EoRs discussed in EGBC guidance (Dam Safety Reviews[11] and site characterization[12]) and industry best practice literature.

Because the only requirement in the Code is for the EoR to be "qualified to practice in the relevant discipline", this requirement is unlikely to conflict with changing industry best practice, guidance from professional regulatory associations such as EGBC, the varied needs of TSFs and the availability of qualified personnel. For example, EGBC has created relatively prescriptive guidance regarding the qualifications of EoRs compared to the Code. The audit compared the qualifications of known EoRs against Code requirements and EGBC guidance and found that all known EoRs were both compliant with the Code and met or exceeded EGBC's guidance for qualifications of EoRs. In addition, because the Code requires registration with EGBC and qualification in a relevant discipline, the Code will likely be compatible with any future qualification requirements EGBC may introduce.

The analysis also identified some Code requirements that are not consistent with current best practice. The Code-required timing for breach and inundation studies, "prior to commencing operation," (Code section 10.1.11) is not aligned with industry best practice, which indicates these studies inform the design process. The Code also refers to construction and operation of TSFs as distinct phases, but industry best practice literature (e.g., A Guide to the Management of Tailings Facilties, MAC 2019[13]) recognizes that TSF construction activities typically occur simultaneously with, or as a result of, operation throughout a TSF's operating life. The responsibilities of the EoR in the Code do not explicitly extend into closure, which is not consistent with industry best practice.

Complete alignment of regulations with industry best practice is not necessarily required for the regulatory framework to be effective. Industry best practice is one part of the context in which regulations exist, and it is a policy decision as to how much of industry best practice to include, or rely upon, in the regulatory framework. Those responsible for creating regulatory requirements will often need to consider perspectives and issues that are beyond the scope of industry best practice when designing regulations. For example, the Code's requirements for minimum design criteria, including downstream slopes (Code section 10.1.9) and static factors of safety (Code section 10.1.10), are not wholly aligned with industry best practice but may improve public confidence in the safety of TSFs. Minimum downstream slopes and static factors of safety are also easily verified through document review and, in the case of slopes, physical inspection. The Code allows for TSF operators and EoRs to propose and justify less conservative design criteria for approval, although it may be challenging for them to do so if they risk being perceived as proposing an approach that is less safe than baseline Code requirements. This example illustrates that consistency of a requirement with industry best practice is not the sole consideration in determining whether it should be included in regulatory requirements.

The 2016 Code revisions introduced elements of industry best practice, such as the EoR, into the Code. Industry best practice continues to evolve, and elements that were added to the Code may drop out of practice, or new elements may be added that suggest changes to the regulatory framework as they become widely adopted. As a result, the relationship between the regulatory framework and industry best practice will need to be revisited as best practice evolves over time. However, the Ministry has not documented a change management process to address the evolution of best practice over time.

For a discussion of some recent developments that may impact industry best practice, see Related Topic: Recent Developments in Tailings Management Practices. For more information on industry best practice, see Appendix F.

RECOMMENDATION 2

The Ministry should develop and document a change management process for determining when and how B.C.'s regulatory framework for TSFs (including the Code and the Code Guidance Document) will be updated to reflect new management programs, guidelines, standards, external regulations and other sources that inform or seek to inform industry best practice or regulation relating to TSFs.

RELATED TOPIC: RECENT DEVELOPMENTS IN TAILINGS MANAGEMENT PRACTICES

The subject of management and operation of TSFs is evolving. For example, many Canadian associations have released new or updated publications related to TSFs since 2014, including CDA (Dam Safety Reviews[14]), MAC (OMS Manuals and Management of TSFs[15]) and EGBC (Site Characterization and Dam Safety Reviews[16]). Many of these newer publications are being used by industry and professionals and were therefore considered during the examination comparing the Code to industry best practice. More recent publications from 2020 were not considered in the examination of industry best practice because they have yet to enter widespread use and, therefore, did not meet the audit's definition of industry best practice. However, these recent publications may illustrate how regulations may need to be updated or revised as the state of practice for the management and operation of TSFs evolves.

Two recently released publications that seek to inform industry best practice include:

- "Global Industry Standard on Tailings Management" (the Global Tailings Standard), released on August 5, 2020, by the United Nations Environmental Programme, Principles for Responsible Investment and the International Council on Mining and Metals; and,
- "Safety First: Guidelines for Responsible Mine Tailings Management" (Safety First), released on June 30, 2020, by MiningWatch Canada and EarthWorks.

The Global Tailings Standard is the product of the 18-month Global Tailings Review, which was launched in response to the January 25, 2019, Córrego de Feijão TSF failure in Brazil. The Global Tailings Review also intends to release an implementation guide for the Global Tailings Standard at some point in the future and any entity wishing to implement the Global Tailings Standard may wish to wait for this guide to ensure their implementation is consistent with the Global Tailings Standard. Several of the mining companies operating in B.C. are members of the International Council on Mining and Metals and adoption of the Global Tailings Standard by these and other companies worldwide may result in the Global Tailings Standard affecting industry best practice. As a result, regulators around the world may choose to update their requirements based on the contents of the Global Tailings Standard.

Safety First, which was released partially in response to the draft version of Global Tailings Standard, was developed using publicly available data and interviews, including the IEEIRP report on the Mount Polley TSF failure, the Code Guidance Document and the 2019 MAC tailings management guide. Safety First,[17] which takes the position that the final version of Global Tailings Standard is inadequate to protect communities and ecosystems, is endorsed by over 130 entities, including Indigenous groups; communities; and environmental and legal reform advocates in B.C.

Both the Global Tailings Standard and Safety First share the ultimate goals of "zero harm to people and the environment" and "zero tolerance for human fatalities". These goals are consistent with the purpose of the Code which is to "protect employees and all other persons from undue risks", "safeguard the public from risks" and "protect and reclaim the land and watercourses". The Global Tailings Standard is directed towards TSF operators and tends to be aspirational (though this may change based on the release of the implementation guide.) The language in Safety First is generally more conservative and prescriptive.

The audit performed the same analysis with the Global Tailings Standard and Safety First as was performed with industry best practice as defined in Section 1.4 (for more information on this analysis, see Appendix F). The contents of the Code were compared to the Global Tailings Standard and Safety First to determine the alignment of the Code with each document. The purpose of the analysis was to evaluate how the potential

adoption of elements of the Global Tailings Standard or Safety First into industry best practice in the future might change the alignment of the Code with industry best practice in that possible future state. The influence of these publications on industry best practice will ultimately be determined by TSF operators and the community of practising professionals in the field of TSFs. It is the role of the regulator to determine how updates to industry best practice are considered in regulatory frameworks (see Recommendation #2).

The analysis of the Code against the Global Tailings Standard and Safety First show that the Code is equally aligned with the Global Tailings Standard as it is with current industry best practice but is less aligned with Safety First. Examples of alignment between the Code, industry best practice and the Global Tailings Standard include requirements or analogues for EoRs, TSF Qualified Persons, ITRBs, OMS Manuals, management and emergency plans, and QPOs. Areas where the Code does not align with the Global Tailings Standard are similar to those where it does not align with industry best practice, such as the area of design criteria. Examples of more conservative or prescriptive elements in Safety First include higher minimum design criteria, banning of upstream dams and higher frequency of Dam Safety Reviews.

2 Clarity

The theme of clarity discusses the contents of the revised Code and the Code Guidance Document in terms of their interpretation, specificity, application and enforceability. Enforceability deals with what may be enforced, and to what degree, based on how the requirements are written.

2.1 THE CODE

The Code should be clear and unambiguous so that all parties have a common understanding of what is required, allowing both the Ministry and operators to have confidence that their actions are supported by, and compliant with, the Code. A lack of clarity may result in multiple reasonable interpretations of Code provisions, which has a range of possible consequences such as time spent clarifying interpretations, effort spent on activities that do not meet the requirements of the Code, or challenges to Ministry enforcement actions based on differing interpretations.

Clarity is a question of language, context and intent. Provisions that are grammatically clear may lead to multiple interpretations if the intent is not clear. Likewise, where the intent seems clear, but the language of the provision is vague, the Ministry could face challenges in enforcing requirements. Based on comparative analysis and interviews, most Code requirements for TSFs are clear when considered alongside accepted standards of practice and guidance documents. However, several Code requirements and definitions are ambiguous and are subject to multiple interpretations.

Definitions for common or technical terms can provide clarity by creating a common understanding or interpretation, by delineating what will/won't be subject to a requirement and by providing consistency with other regulations (e.g., the Dam Safety Regulations discussed in Section 1.3) and industry guidance or standards (e.g., CDA, MAC, EGBC discussed in Section 1.4).

Several terms related to TSFs in the Code are undefined or poorly defined, including but not limited to key terms such as "dam", "tailings storage facility" and "water management facility" (Table 3).

TABLE 3: EXAMPLES OF TERMS RELATED TO TSFS AND THE DEFINITIONS PROVIDED IN THE CODE

Term	Definition in Code
Dam	"Dam" means a barrier on the surface preventing uncontrolled release of either water, slurry or solids or a barrier underground to prevent the uncontrolled flow of water, slurry or solids.
Tailings Storage Facility	"Tailings storage facility" or "TSF" means a facility that stores tailings.
Water Management Facility	No definition provided in the Code

Definitions of "dam" and "tailings storage facility" could be interpreted to apply to facilities with minimal capacity, that are temporary or that have few safety concerns. The Code does not include any provisions that exclude such facilities from requirements related to TSFs. This approach is different from the approach used for dams in the Dam Safety Regulation (Section 1.3), which includes provisions to exclude facilities based on low height, capacity or consequence classification from some requirements. Similarly, the Code definition for "tailings storage facility" fails to add clarity for a reader because the definition is a reordering of the words of the term itself (tailings, storage and facility) and Code provisions may be interpreted to presuppose a "TSF" is or includes a "dam". The term "water management facility" appears in multiple locations in the Code, but the lack of definition makes it unclear what facilities these requirements are intended to apply to.

Furthermore, inconsistent or ambiguous use of these and other terms throughout the Code, without a clear purpose for the differences in use, may create additional confusion. For example, the following phrases occur in Code sections 10.5.1 to 10.5.4:

- "tailings storage or water management facility" (Code section 10.5.1[1])
- "tailings storage or water storage facility" (Code section 10.5.1[2])
- "tailings storage facility or dam" (Code section 10.5.1[4] and 10.5.2[1])
- "tailings storage [and] water management facilities and associated dams" (Code section 10.5.3 and 4)

The reasons for these variations are not explained or apparent and, as a result, it is not clear whether these requirements apply to the same facilities or to different subsets of similar facilities. Inconsistent use of terms in the Code may lead to disagreements between the regulator and operators regarding which requirements apply to a given structure.

Some Code requirements related to TSFs include vague language that may lead to multiple interpretations of the intent or application of a provision and, as a result, may complicate compliance verification by the Ministry. For example, Code section 10.1.6(3) indicates that an EoR must report safety issues at a TSF to the Chief Inspector in a "timely fashion" and Code section 10.5.2(4) indicates that OMS Manuals must be "revised as required". The use of vague terms "timely" and "as required" introduces discretion and makes it difficult to verify compliance with these provisions because the timeline for reporting safety issues or triggers for updating OMS manuals are not clear. Recommendation 103 of the Professional Reliance Review[18] also noted the use of the words "timely fashion" in the Duty to Report Safety Issues at Tailings Storage Facilities (Code section 10.1.6). These terms could be clarified by adding context in either the Code or Code Guidance Document, but compliance verification (and enforcement, if required) may be challenging in the absence of support in the Code itself.

The Code includes requirements for the mandated roles of the EoR, TSF Qualified Person, and ITRB. Requirements for mandated roles fall into two categories: qualifications (e.g., education, knowledge and experience) and responsibilities (e.g., tasks and duties of these roles). The qualification requirements of the EoR and TSF Qualified

Person are broad but clear given the definitions of "Professional Engineer," "qualified professional," and "qualified person." The expectations on the members of the ITRB are less clear as the composition of the board must be "commensurate with the complexity" of the TSF, but there are no qualification requirements for individual members in the Code. While the qualifications of members of the ITRB are subject to approval by the Chief Inspector, without specific guidance on expectations related to their qualifications, it is not clear on what basis the approval decision will be made. Of these three roles, only the ITRB is subject to approval by the Chief Inspector.

The clarity of the responsibilities outlined in the Code for each mandated role varies. The responsibilities of the EoR are generally clear, but some provisions present challenges. For example, it is unclear how compliance with Code section 10.1.5(2) would be demonstrated given the use of the phrases "professional responsibility" and "assure", or what compliance verification action could be taken under this provision (see further discussion in Sections 2.2 and 2.3). It is generally the mandate of EGBC (or the applicable regulatory body of the professional) to determine what constitutes the "professional responsibility" of its members and it is not clear how this "professional responsibility" differs from specific responsibilities under the Code. As well, standards for assurance are not clarified in the Code. EGBC has some guidance for professionals who wish to supply assurance related to TSFs, but by placing this language in the Code it raises the question whether the Ministry wishes to provide direction regarding the nature of assurance or if the Ministry wishes to refer to direction on assurance created by EGBC (see Related Topic: Professional Reliance).

The Code indicates that the responsibility of the TSF Qualified Person is "for safe management" of TSFs (Code section 10.4.2[1]), with no additional specifics on what "safe management" means (the responsibilities of the TSF Qualified Person are discussed further in Section 2.2). The ITRB has responsibilities that may reasonably be inferred from ITRB reporting requirements under Code section 10.4.4, though these responsibilities are not defined directly in the Code (e.g., by stating that, "The ITRB shall…"). However, the responsibilities of the ITRB may be further clarified in their ToR, which is subject to approval by the Chief Inspector.

Part 10 of the Code is divided into seven categories that, based on their titles, refer to different parts of the mine and TSF lifecycle, including "Operations" and "Mine Closure." There are also references throughout Part 10 to "stop work" (Code section 10.6.1), "ceases operation" (Code section 10.6.2) and "closure of a TSF" (Code section 10.6.7). Definitions provided in the Act for "mine", "mining activity" and "closed mine" (Table 4) do not clarify what is meant by "stop work", "ceases operation" or "closure of a TSF" and whether these stages are considered "Mine Closure".

Some Code provisions in the "Mine Closure" section (Code section 10.6) include requirements that are not specific to closure, such as the requirement for TSF OMS manuals to "define appropriate resources and staffing" (Code section 10.6.8[2]). Likewise, requirements in the "Operations" section (Code section 10.5), may include requirements that would continue to apply in closure, such as the requirements for Dam Safety Inspections (Code section 10.5.3) and Dam Safety Reviews (Code section 10.5.4). In general, the Code provisions and terms used make it unclear what requirements apply to TSFs at different stages of a TSF lifecycle and how these stages are determined.

TABLE 4: *MINES ACT* DEFINITIONS OF MINE, MINING ACTIVITY AND CLOSED MINE

Term	Definition in Act
Mine	Includes (c) a place where mechanical disturbance of the ground or any excavation is made to explore for or to produce coal, mineral bearing substances, placer minerals, rock, limestone, earth, clay, sand or gravel, (d) all cleared areas, machinery and equipment for use in servicing a mine or for use in connection with a mine and buildings other than bunkhouses, cook houses and related residential facilities, (e) all activities including exploratory drilling, excavation, processing, concentrating, waste disposal and site reclamation, (f) closed and abandoned mines, and (g) a place designated by the chief inspector as a mine.
Mining Activity	Means any activity related to (a) the exploration and development of a mineral, a placer mineral, coal, sand, gravel or rock, or (b) the production of a mineral, a placer mineral, coal, sand, gravel or rock, and includes the reclamation of a mine.
Closed Mine	Means a mine at which all mining activities have ceased but in respect of which the owner, agent, manager or permittee remains responsible for compliance with this Act, the regulations, the code and that person's obligations under the permit for that mine.

For more information regarding the contents of the Code, including definitions, please see Appendix B.

The contents of the Code encompass far more than TSFs alone and, as such, revisions to the Code must be carefully prioritized. The Ministry will need to balance the value of improved clarity and specificity against considerations such as:

- How changing a regulatory requirement will impact the workload of industry or inspectors;
- What relationship the Ministry wishes its regulatory requirements to maintain with other regulatory bodies' requirements or guidelines;
- The risk to successful compliance verification and enforcement action if clarity is provided in guidance instead; and,
- Other potential considerations including those raised by the public or Indigenous groups.

RECOMMENDATION 3

The Ministry should develop a list of and rationale for priority revisions to TSF provisions in the Code to improve clarity, including but not limited to definitions, consistency of terms and the use of vague language.

2.2 THE CODE GUIDANCE DOCUMENT

The Code Guidance Document was published by the Ministry in July 2016 to provide context for the application of, and what constitutes compliance with, the revised provisions. The Ministry intended to prepare periodic updates to the Code Guidance Document, but the document has not been revised since its original release in July 2016 while the industry best practice that it references has continued to evolve.

The Code Guidance Document states that it is intended to be "general and not prescriptive in nature", which reflects the Code requirements to "consider" the Code Guidance Document (e.g., Code sections 10.1.4, 10.1.8, 10.4.2). "Consideration" does not require strict adherence to the contents of the guidance, and the requirement to "consider" the referenced Code Guidance Document is likely not verifiable or enforceable as it is not clear how consideration would be demonstrated.

Despite this intention to not be prescriptive, several sections of the Code Guidance Document are presented as requirements that are not supported by the Code. For example, some sections specify work or document content not required in the Code (e.g., Design Criteria in Section 3.3.1 of the Code Guidance Document), and some refer to Code provisions that do not require consideration of the Code Guidance Document (e.g., Annual Manager's Report requirements in Section 4.1 of the Code Guidance Document). This inconsistency may create confusion between the Code and Code Guidance Document regarding what is and is not necessary for compliance with the Code.

In cases where there could be multiple reasonable interpretations of a Code provision, the most effective solution is to update the contents of the Code itself. While it may be possible to use the Code Guidance Document to state the Ministry's interpretation of unclear Code requirements to help operators understand the intent or application of provisions, without enabling language in the Code, the contents of guidance do not generally support compliance verification and enforcement in and of themselves. Some Code sections that may be targets for stating the Ministry's interpretation in the Code Guidance Document include:

- The use of terms "dam", "tailings storage facility", and "water management facility" (see Section 2.1);
- "Justification by the engineer of record" for non-standard design slopes and static factor of safety in Code sections 10.1.9 and 10.1.10 and at which points in a TSF lifecycle these requirements are expected to apply;
- The appropriate composition of an ITRB and contents to include in an ITRB ToR (Code sections 10.4.2[2] and [3]); and,
- How the exemptions in Code section 10.1.19 will be implemented.

Where the Code Guidance Document is used to supplement the Code and aid operators, it is important that this guidance is consistent with the Code and does not introduce new ambiguity. For example, Section 2 of the Code Guidance Document lists some example roles and responsibilities for EoRs, which include subtle differences from requirements in the Code. For example, Code section 10.5.1(2) states that an EoR is responsible for "*assuring* that a TSF or dam has been designed and constructed *in accordance* with applicable guidance, standards and regulations", whereas the Code Guidance Document states the responsibilities as "*evaluating the adequacy* of the as-built facility *relative to* the design as well as applicable standards, criteria and guidelines" (emphasis added). It may be unclear to a reader whether these responsibilities are the same and/or what the Ministry's expectations for the position are.

The guidance for the mandated role of TSF Qualified Person provides a good illustration of how guidance can provide clarification of Code provisions. Section 2 of the Code Guidance Document lists some suggested roles and responsibilities of the TSF Qualified Person, including developing tailings and water management plans and construction. The guidance notes that these roles and responsibilities "may vary according to the needs of the site", which is consistent with the definition of "qualified person" in the Act. While not being an enforceable set of requirements for TSF Qualified Persons (see further discussion in Section 2.3), the Code Guidance Document may provide helpful context and clarity for operators and Mine Managers to understand the role for a TSF Qualified Person and some of the responsibilities that may be assigned to this role. There is general consensus that the value of the TSF Qualified Person lies less in the role meeting universal qualification and responsibility expectations and more in defining a single point of contact with tailored responsibilities for a given TSF.

Guidance can also be used to expand upon or explain the requirements and processes for discretionary decisions, such as authorizations. If the Ministry has specific content preferences for input relating to discretionary decisions,

both operators and Ministry decision makers can benefit from detailed guidance. For example, the Code requires various TSF related information in permit applications, including "designs and details for tailings storage and a description of proposed QPOs" (Code section 10.1.3[d]), "an alternatives assessment for the proposed TSF that assesses best available technology" (Code section 10.1.3[g]) and "a closure plan for the TSF" (Code section 10.1.3[h]). Guidance on these topics can be found in the Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits.[19] The contents of this guidance can then be used by decision makers in evaluating permit applications.

Information provided in the Code Guidance Document to aid operators may also reference external documents, such as guidelines and standards. The current Code Guidance Document refers to documents produced by organizations such as EGBC, CDA, MAC and the International Organization for Standardization (ISO). These references remain useful so long as they are maintained with up-to-date references and the contents of the referred documents are consistent with the Code requirements. As discussed previously, the state of practice in management of TSFs is evolving (see Section 1.4). As new documentation is created and brought into general use, references in the Code Guidance Document may create confusion unless they are regularly updated.

For guidance to achieve an objective of providing clarity and context for regulatory requirements, it cannot contradict the Code or create requirements that are not supported by the Code. For example, if a term is defined in the Code then that definition should not be modified or substituted in accompanying guidance. As well, if a Code provision does not specify that something must be approved by the Ministry, guidance should not state that it is subject to approval.

RECOMMENDATION 4

The Ministry should revise the Code Guidance Document to be consistent with the Code, to supply the Ministry's interpretation of ambiguous Code requirements and to reference the most current sources of external guidance that the Ministry considers significant.

2.3 ENFORCEABILITY AND ENFORCEABLE ELEMENTS

The clarity and language of the Code supplies the basis for compliance verification and enforcement. The language of Code provisions constrains how compliance with requirements may be verified and affects the limits of what can and cannot be enforced. A lack of clarity in the Code may complicate compliance verification and/or enforcement efforts by allowing for multiple reasonable interpretations of Code provisions and potential challenges of Ministry enforcement actions.

Most 2016 Code revisions include clear, measurable actions to be taken by the Mine Manager, EoR or other party. Many Code provisions require the development of TSF reports, plans or other documents, such as: OMS Manuals; Dam Safety Inspections and Dam Safety Reviews; water balances and water management plans; and, ITRB terms of reference. However, the Code varies in the requirements to notify the Ministry when documents are developed or updated, to submit these documents to the Ministry in full or in summary form and whether they are subject to Ministry approval. In addition, there is a lack of clarity in several Code provisions regarding when (e.g., "as required"), and for what facilities (e.g., "water management facilities", which is not defined in the Code) compliance is required (see Section 2.1).

The audit identified four actions that are specified in relation to many documentation requirements associated with TSFs. Based on plain language interpretation, these actions may place limitations on compliance verification and enforcement activities taken with respect to Code requirements:

- Maintain: the Code requires a document or report be developed or exist, but does not require any information be provided to the Ministry regarding its development or contents (e.g., Code section 10.4.3[1]);
- Notify: the Code requires some form of notification to the Ministry, but does not require providing any detailed documentation (e.g., Code section 10.1.5[3]);
- Submit: the Code requires that documents be provided to the Ministry in the form specified in the Code, allowing the Ministry to retain a copy of a document in its files for reference (e.g., Code section 10.5.1[1]); and,
- Submit for approval: the Code requires that documents be provided to the Ministry and requires the Ministry to approve those submissions, allowing the Ministry to review and request revisions to submitted material as a pre-condition to granting its approval (e.g., Code section 10.4.2[3]).

Other parts of the Code and other regulations (e.g., the Dam Safety Regulation) include requirements to implement, apply or follow the contents of a document. However, there are no Code provisions for TSFs that explicitly state a requirement to implement, apply, or follow plans or documents that are otherwise required to exist.

The Code often does not prescribe quality or content expectations for plans, reports and other documents. This approach to regulation provides flexibility for TSF operators to apply their knowledge of site-specific concerns and industry best practice towards developing TSF documentation required by the Code but may limit the Ministry's ability to enforce any specific level of quality or detail in documentation. Most of these documents require the involvement of, if not authorship by, qualified professionals (e.g., professional engineer or EoR), consistent with the model of professional reliance (see Related Topic: Professional Reliance). As a result, it may be reasonable to expect such documents to meet minimum standards as required by the professional's regulatory body. However, there are exceptions to professional involvement outlined in Code requirements, such as water balances and water management plans (Code section 10.1.12[1]), which do not require the involvement of a qualified professional and, therefore, may not be subject to the same assumptions regarding minimum quality.

Because the Code frequently does not include requirements related to the quality or content of documentation, the Ministry's ability to prescribe quality or content through orders or other feedback may be limited. In the absence of a defined regulatory standard to judge a document against, the Ministry may not have the statutory authority to require changes to the quality or contents of documentation as a matter of compliance verification or enforcement. For example, where the Code requires submission of a document but not approval by the Ministry or implementation by the operator, there may be no mechanism to require changes to the document prior to its use at the mine or to enforce the implementation of the contents of the document through orders (for further discussion on this point, see Section 3.1). Permit conditions can define specific content requirements, but care should be taken to ensure that those requirements are consistent with the Code and the Ministry's professional reliance model. It may be possible to use the Code Guidance Document to provide guidance regarding content and/or quality expectations for documents; however, the enforceability of this guidance may be limited, as discussed in Section 2.2.

The Code requirements for mandated roles (EoRs, TSF Qualified Persons and ITRBs) are a good illustration of the limits of enforceability in the use of the Code Guidance Document. Detailed discussion of the activities each mandated role may be expected to undertake is outlined in the Code Guidance Document, which also notes that roles and responsibilities of EoRs, TSF Qualified Persons and ITRBs "vary according to the needs of the site". While this guidance may be helpful for mine managers, it is arguably not enforceable, and compliance verification by the Ministry would generally stop at verification that these roles exist, not that they are performing all the activities listed in the guidance.

These examples demonstrate the interdependency of the Code and the Code Guidance Document and illustrates the importance of ensuring a holistic and complementary approach to their mutual revision. Updates to the Code (Recommendation 3) and the Code Guidance Document (Recommendation 4) will work best to improve the

regulatory framework when updates to each individual document are supported and reinforced by the other. For example, if the Ministry wishes to enforce the responsibilities of a TSF Qualified Person, the qualifications of an EoR or the quality, content or implementation of a document, these should be reflected in appropriate Code requirements and supported with guidance on the Ministry's expectations associated with these requirements.

RECOMMENDATION 5

The Ministry should review its current practices respecting TSFs for consistency with the Code and document its interpretations and expectations regarding compliance with Code requirements to ensure that Ministry staff and regulated parties have a common understanding of the Ministry's compliance verification and enforcement approach.

RELATED TOPIC: PROFESSIONAL RELIANCE

The Code frequently requires the involvement of qualified professionals, including professional engineers, in the development of plans and documents, the design and construction of facilities, quality assurance and reporting of safety issues. The requirement for the involvement of professionals in the Code creates a "professional reliance model." The phrase "professional reliance model" refers, in part, to the fact that some professionals are regulated by their respective governing body or association to ensure members meet a standard of conduct, minimum experience, code of ethics and other requirements under empowering legislation or association bylaws. In the case of engineers and geoscientists in B.C., this governing body is EGBC. Professionals in BC are also governed by the requirements of the *Professional Governance Act*, which came substantially into force in February 2021 and is administered by the Office of the Superintendent of Professional Governance (OSPG). The work completed by these professionals is now subject to a consistent governance framework that incorporates best practices of professional governance, including a consistent set of ethical principles and expectations regarding conduct. This framework is enforced by regulatory bodies, under the oversight of the OSPG.

The significance of the professional reliance model becomes clear when the quality of work completed by or the conduct of a qualified professional becomes a controlling factor in achieving safety and environmental protection on mine sites. Generally, the former (quality and conduct) are the responsibility of the professional's governing body, while the latter (safety and environmental protection) are the responsibility of the Ministry. The Ministry may wish to carefully consider over which elements of the work completed by professionals it wishes to exercise regulatory authority. The EoR's duty to report safety issues at TSFs is an example of the Code providing the Ministry with the ability to enforce specific actions by professionals, without reliance upon EGBC, OSPG or any other body.

3 Compliance Verification and Enforcement

This section discusses the compliance verification and enforcement actions taken by the Ministry and the state of compliance of TSFs with the Act and the Code. The role of the Ministry is to verify and enforce compliance with the regulatory requirements, while it is the responsibility of the regulated parties to maintain a state of compliance with the regulatory requirements.

3.1 MINISTRY ACTIONS AND POLICIES

Inspectors are the Ministry's front line in verifying compliance with the Act, the Code and *Mines Act* permits. Inspectors are appointed by the Chief Inspector under Section 5 of the Act and empowered to conduct inspections at mines and issue orders under Sections 15, 18 and 35 of the Act. How the work of the inspectors is managed and structured can impact whether the 2016 revisions to the Code are being systematically verified and may affect the operation and management of TSFs.

The geotechnical group of the inspectorate (located in the Major Mines Office in the Mines Authorizations and Competitiveness Division at the time of this audit) includes subject matter experts and professionals in the area of TSFs and dams. The workload of this group includes, but is not limited to, inspecting mines throughout the province, follow up compliance work, review of annual reporting, review of permit applications and development of policies, procedures and guidance related to geotechnical topics including, but not limited to, TSFs.

Currently, inspection priorities of the geotechnical group are guided by an internal inspection procedure manual written in 2009 (2009 Ministry Inspection Procedures), which prescribes geotechnical inspection frequencies, including that "all major producing metal and coal mines shall receive a geotechnical inspection at least once per year." The audit did not find any more recent procedures that would apply to TSF inspections or document review more specifically. Additionally, a more recent procedure, the 2018 Mine Inspection Procedure, does not include any specific frequencies or objectives for geotechnical inspections. Annual reporting by the Chief Inspector indicates that the Ministry has conducted between 38 and 62 geotechnical inspections each year since 2014. Based on inspection records from 2018 and 2019, all operating mines with a TSF have been inspected at least once over these two years by the geotechnical group and most operating mines with a TSF (80%) have been inspected annually. For more information on Ministry compliance verification and enforcement procedures, see Appendix G.

The audit examined orders made as a result of geotechnical inspections of TSFs. Orders generally had tangible and positive results at mines and followed relevant policies and guidelines, including the 2020 Compliance and Enforcement Policy, the 2019 *Mines Act* Order Writing Procedure and the 2018 Mine Inspection Procedure. Orders generally contained the components required by the Compliance and Enforcement Policy;[20] however, in some cases, the remedies required in orders included details or prescriptions that may be inconsistent with the cited Code provision or be outside of the authority of an Inspector. Examples include requiring specific content in reports such as OMS Manuals or Closure Plans, or installation of specific monitoring equipment such as staff gauges. Orders that prescribe detail or actions not required by the Act, the Code or a permit may result in an appeal pursuant to Section 33 of the Act.

Ministry geotechnical inspectors also review permit applications and provide draft permit condition recommendations to the permitting statutory decision maker. TSF-specific information required in permit applications is listed in Code section 10.1.3, and includes designs and details for tailings storage, proposed QPOs, management of risks associated with TSFs, closure plans and an alternatives assessment. While most permit conditions related to TSFs in permits issued in 2018 to 2019 supplement or clarify Code requirements, approximately one quarter of the permit conditions analyzed introduce redundancy or inconsistency with Code requirements. Examples of redundancy include permit conditions that specify submission deadlines or reporting updates that are already required by the Code, or creation of documents that are similar to those already specified in the Code (e.g. Issued for Construction drawings or "as built" reports). An example of inconsistency with Code requirements is a permit condition that specifies thresholds for when a structure may be considered a "dam" with respect to the Code, while the Code definition of a "dam" does not include any such thresholds.

The Ministry's geotechnical group is also tasked with review of Code required TSF documents; however, the Ministry does not have formal written policies or procedures governing these review responsibilities. As a result, TSF document review activities are not conducted in a regular, consistent manner. When reviewing document

submissions related to TSFs, the Ministry commonly responds with comments on content or requires changes through statutory powers such as orders, even where the Code does not include content related or approval requirements.

Code requirements for document submissions related to TSFs do not include authorization or approval mechanisms for the Ministry, except for permit applications authorizations under Code sections 10.1.9-10 and ITRB ToRs. The Ministry practice of providing commentary on some submissions has created an expectation in industry that feedback will be provided by the Ministry and that quality of submissions will be assessed. The Ministry does not have the resources, nor the obligation, to provide detailed commentary on all TSF-related submissions, which would account for over 600 documents annually if all mines submitted all required documents for all TSFs. This figure does not include permit applications, permit required documents, periodic updates or documents required by compliance actions. Many Code requirements for submitted documents and reports prescribe the involvement of registered professionals in their development, which may imply that these professionals have performed their own detailed review (see Related Topic: Professional Reliance). Ministry staff and document owners do not have common expectations for how the Ministry prioritizes documents for review or what feedback the Ministry will provide when it reviews documents, and no policy or procedure exists to govern document review and set these expectations.

Although the Ministry appears to be meeting its written objectives for geotechnical inspections, interviews conducted as part of this audit indicate that the Ministry does not have sufficient resources to both inspect all TSFs and provide detailed review of all TSF submissions while balancing all the remaining responsibilities of geotechnical inspectors. The 2009 Ministry Inspection Procedures includes objectives for inspections at major mines, which has led the geotechnical group to prioritize inspections at major operating mines rather than document review or inspections at regional or non-operating mines (e.g., care and maintenance, closed or abandoned mines). Because this procedure predates the TSF failure at Mount Polley and subsequent updates to the Code, it is not an up-to-date decision making or prioritization tool, nor does it reflect perceived risks associated with various types of mines. Geotechnical inspectors noted a perceived risk with the relative lower level of oversight for care and maintenance, closed, and abandoned mines due to the prioritization of resources to operating major mines.

RECOMMENDATION 6

The Ministry should develop written policies and procedures governing expectations for the geotechnical group regarding prioritization of work across the lifecycle of a mine, including TSF document review and inspections, to support the systematic verification and enforcement of regulatory requirements for TSFs at mines in B.C.

3.2 COMPLIANCE

The audit included a limited review of TSF compliance data. Specifically, the audit examined whether a given TSF had a recent Dam Safety Inspection and had persons in the roles of EoR, TSF Qualified Person and ITRB. These Code provisions were selected as they reflect some of the most valuable changes made in relation to TSFs in the 2016 Code revisions. The review was completed in early March 2020, before Dam Safety Inspections for the previous year (2019) were due, as per Code section 10.4.4(b). As a result, the review of Dam Safety Inspections for this audit was based on Dam Safety Inspections for 2018. The majority of TSFs (72%) were in compliance with these requirements as of March 2020. For more information on compliance data, see Appendix G.

The regulation of mining creates vast amounts of data through mandated reporting, permitting and compliance verification activities. The ability of the Ministry to record, manage and utilize these data are critical to ensuring that requirements are systematically verified and enforced. Activities such as proper documentation of inspections,

enforcement and escalation of orders, review and archiving of submissions, and maintaining records of communications and contact persons are all enabled by modern information technology tools. The identities of persons in mandated roles, such as those identified in the compliance review for this audit, provide an example of the data that can be stored and acted upon by inspectors. This review found that most roles were appropriately filled (e.g., 92% of TSFs had EoRs). However, these data were not represented in a single system and had to be pieced together from multiple sources, including review of individual documents, which is time consuming and increases the potential for omissions or errors in compliance verification actions.

The Ministry has made significant improvements to data management, including the introduction of Core (an internal information management system), the public-facing interface BC Mine Information Website[21] (an external information management system for public use), the proponent interface MineSpace (an external information management system), and adoption of the Natural Resources Inspection System (NRIS). The September 2018 Mine Inspection Procedure notes that "as of March 1, 2018, inspection reports must be written using NRIS" and the Compliance and Enforcement Policy indicates that "most enforcement actions will be recorded in NRIS". Through these documents, the Ministry has articulated that with few exceptions (e.g., escalated enforcement actions such as administrative monetary penalties), all recent records pertaining to compliance verification and enforcement activities should be in NRIS. These systems are improving the ability of inspectors and operators to systematically track, verify, enforce and promote compliance with the Act, the Code and *Mines Act* permits. Correct and consistent use of these systems is integral to ensuring their usefulness.

While we found that the Ministry's adoption of new systems is improving, there were instances of incomplete data, inappropriately completed fields, unfiled reports and discrepancies between new and legacy systems. The overall conclusion and recommendations of this audit are not expected to have been significantly affected by these discrepancies or unavailable data because the rationale for the conclusions and recommendations were based on pooling data from multiple sources (to catch data missing from any individual data source) and overall trends are unlikely to be affected by missing a small number of individual data points. However, if these instances or recording errors continue, the ability of these new systems to become the resilient and complete tools required to support systematic verification and enforcement will be challenged, thus impeding the Ministry's ability to easily access and verify reliable compliance data.

RECOMMENDATION 7

The Ministry should ensure that data systems are used in a manner that is in accordance with policies and procedures, including the Compliance and Enforcement Policy (2020) and the Mine Inspection Procedure (2018). Data systems should be used consistently across the inspectorate to support systematic compliance verification and enforcement of regulatory requirements for TSFs at mines in B.C.

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APPENDIX A: ABOUT THE AUDIT

Audit Objective

The objective of this audit was to determine whether the 2016 revisions to the Health, Safety and Reclamation Code for Mines in British Columbia pertaining to tailings storage facilities were consistent with the direction given to the Code Review Committee, have provided the Ministry with clear and enforceable regulations that are consistent with industry best practice and among the best in the world, are systematically verified and enforced by the Ministry, and are being complied with by industry.

Audit Conclusion

The 2016 Code revisions pertaining to TSFs and the implementation of the revisions are having positive impacts on the management and operation of TSFs in B.C. The addition of a network of mandated roles to the Code (Engineer of Record [EoR], TSF Qualified Person [TSF QP] and the Independent Tailings Review Board [ITRB]) is a significant part of these positive impacts. The general commitment to TSF safety by inspectors, operators and people in the mandated roles has supported the implementation of the 2016 Code revisions. While there have been improvements made to the management and operation of TSFs in the province, there are also opportunities to improve the overall clarity, guidance and application of the Code requirements for these facilities.

Audit Criteria

Audit criteria are statements created during audit planning that guide the investigation and analysis of the audit. By comparing the current state determined through examination with the criteria, the audit can answer the audit objective.

The following criteria were developed for this audit:

- Code requirements are clear and unambiguous, supported by guidance from the Ministry where required;
- The Ministry's regulatory framework does not conflict with other B.C. government ministries and regulations as they pertain to TSFs;
- Code requirements match or exceed defined best practices for TSF design, construction, operation, and closure;
- The Code requires that TSFs have design parameters that inform how they are constructed at all stages of their lifecycle;
- The Code requires multiple layers of oversight to be in place for TSFs that complement each other in ensuring TSF safety;
- The Code requires that reports and plans be produced by individuals with appropriate subject matter expertise and knowledge of the subject TSF;
- Qualified personnel fulfil all mandated roles and responsibilities at operations;
- Code requirements have a clear purpose and contribute to an overarching objective of improving TSF safety;

- The Code requires submission of reports and plans that allow the Ministry to track the design, construction and operation of a TSF at any point in its lifecycle;
- Where *Mines Act* permit conditions pertain to TSFs, they predominantly act to clarify or supplement the requirements of the Code;
- Code requirements allow for enforcement action by the Ministry in the event of non-compliance;
- Code requirements allow for the Ministry to assess quality of submissions as part of compliance verification;
- Ministry staff are writing orders (pertaining to TSFs) that are consistent with requirements and authorities detailed in the Act, Code and Ministry policy;
- The Ministry's enforcement activities are consistent across the inspectorate, for all sites with TSFs;
- The Ministry is sufficiently resourced to ensure that inspection and review objectives are met for TSFs;
- Ministry staff are prioritizing TSF document review activities in line with requirements of the Code, permits and Ministry policy;
- The Ministry is visiting all sites with TSFs on a regular basis, with sufficient frequency to verify compliance with 2016 Code provisions;
- Operators are in compliance with Code requirements; and
- Actions taken by operators to achieve compliance with the Code are perceived to be reducing the risk of TSF failures.

Audit Scope

The 2016 Code revisions pertaining to TSFs principally related to:

- Facility design;
- Plans and Reporting; and
- Management and oversight responsibilities.

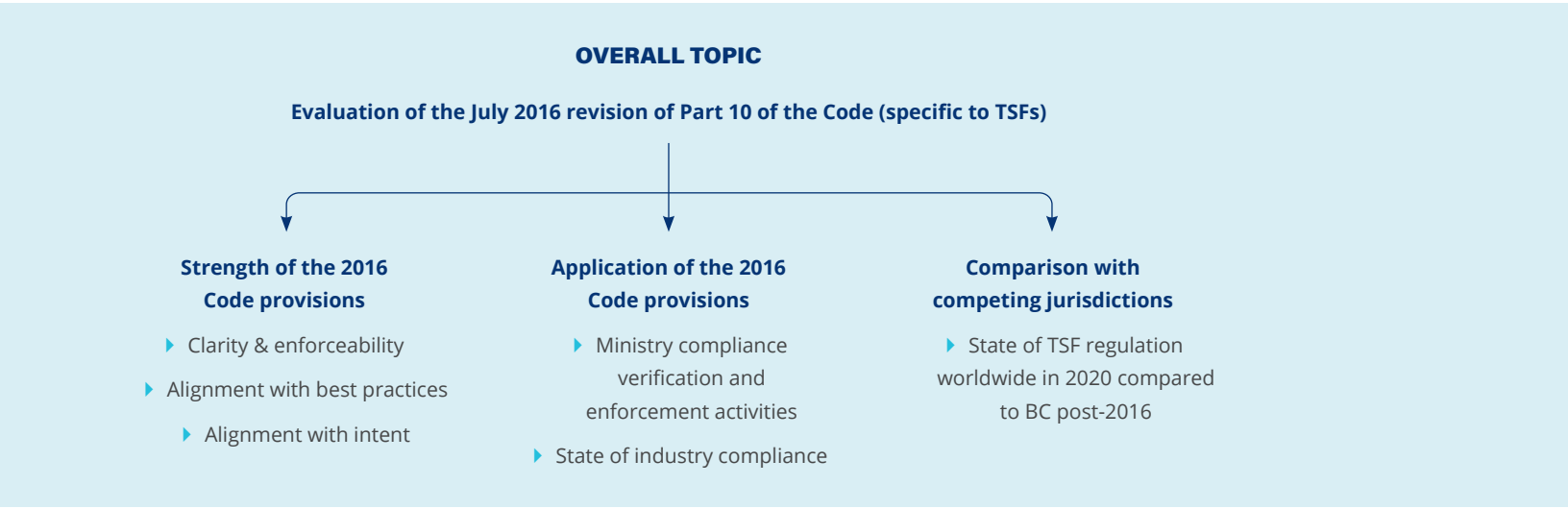
The scope of this audit, as outlined in the objective, was built around the 2016 Code revisions related to TSFs and included an examination of the following:

- The 2016 Code revisions, with a focus on clarity, enforceability, and consistency with current industry best practices and the objectives of the 2015/2016 Code;
- The state of industry compliance with Code requirements introduced in 2016;
- The Ministry's compliance verification and enforcement activities related to Code requirements introduced in 2016; and,
- The state of TSF regulatory requirements and best practices in major mining jurisdictions worldwide compared to B.C.'s TSF regulatory requirements post-2016

Audit Approach

The audit focused on three lines of inquiry. The audit involved an examination of the full suite of 2016 Code provisions as they fit into each of the lines of inquiry. These lines of inquiry are: the Code provisions themselves; how the Ministry has been applying the Code provisions and how industry has been complying with them; and how the Ministry's regulatory program compares to that of other major mining jurisdictions throughout Canada and worldwide.

This is illustrated as:



Key sources of information examined as part of this audit include:

- The Health, Safety and Reclamation Code for Mines in British Columbia (2017);
- The Code Guidance Document (2016);
- Industry best practice documents including:
  - Dam Safety Guidelines (Canadian Dam Association, 2013) and Application of Dam Safety Guidelines to Mining Dams (Canadian Dam Association, 2014),
  - A Guide to the Management of Tailings Facilities (Mining Association of Canada, 2017 and 2019),
  - Site Characterization for Dam Foundations in BC (Association of Professional Engineers and Geoscientists of B.C., 2016);
- The *Water Sustainability Act* and the Dam Safety Regulation;
- Enactments and related documents from other Canadian and international jurisdictions;
- Ministry data on TSF inspections, including inspection frequencies, observations, orders, warnings and advisories, including:
  - Annual Reports of the Chief Inspector of Mines from 2001
  - 92 geotechnical inspection reports issued since 2018, including
    - 307 total orders, 71 of which were related to 2016 Code revisions
    - 479 warnings and advisories, 99 of which were related to 2016 Code revisions
- Ministry data on TSF documentation submitted by operators since 2015, including Dam Safety Inspections, Dam Safety Reviews, Independent Tailings Review Board (ITRB) reporting and other annual reports, and compliance submissions;
- Interviews with:
  - Ministry geotechnical inspectors, and
  - Engineers of Record (EoRs) active in TSF management in B.C.;
- Survey of industry opinions and TSF operators (via the Mining Association of British Columbia) on TSF regulation; and,

- Following their release, the Global Industry Standard on Tailings Management and responses such as Safety First: Guidelines for Responsible Mine Tailings Management.

Audit Methodology

Consistent with the Mine Audits and Effectiveness Unit Program Charter,[22] this audit was conducted in accordance with commitments to:

- align with auditing practices and procedures drawn from a range of audit standards;
- ensure, consistency and transparency in communications;
- encourage continuous improvement of the mining regulatory framework;
- engage with Indigenous groups and stakeholders; and,
- develop recommendations that add value to the Ministry, produce tangible results for the public, workers and the environment, and help the industry operate safely and successfully in B.C.

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APPENDIX B: PART 10 OF THE 2016 CODE

Legislation and Code

The *Mines Act*[23] (amended August 14, 2020) and the accompanying Health, Safety and Reclamation Code for Mines in British Columbia (the Code)[9] (revised June 2017) protect workers and the public through provisions for minimizing the health, safety and environmental risks related to mining activities.

Specifically, provisions for the design, construction, operation, maintenance and closure of Tailings Storage Facilities (TSFs) are in Part 10 of the Code. Sections of Part 10 that were revised in 2016 are presented in Table B1.

As discussed in Section 2 of the audit report, several Code requirements and definitions in the current edition of the Code are ambiguous and are subject to multiple interpretations. The audit report contains several examples to support the reasoning, findings, conclusions and recommendations. This appendix provides a larger list of areas where we found the Code to be unclear or ambiguous based on evidence collected during the audit.

A list of terms introduced in Part 10 of the Code, including definitions provided in the Code and Code Guidance Document, is provided in Table B2. If a definition varies between the Code and the Code Guidance Document, the Code definition takes precedence.

A list of example Code provisions containing ambiguous language (other than definitions) is provided in Table B3.

The information contained in Tables B-2 and -3 is not intended to provide an exhaustive description of all areas where the Code is unclear or ambiguous or to provide specific solutions. The relative clarity of any single part of the Code is a matter of objective and subjective judgements.

Many of the Code provisions for TSFs include documentation requirements. Table B4 lists these requirements, along with an explanation of whether the documents need to be maintained on site, submitted to the Ministry or approved.

Code Guidance Document

The Health, Safety and Reclamation Code Guidance Document[24] (July 20, 2016) was developed to accompany the 2016 Revisions to the Code, and provides guidance and context to owners, engineers of record, regulators, consultants and auditors on applying Part 10 of the Code.

TABLE B1: 2016 CODE PROVISIONS RELATING TO TSFS

Section	Title	Text
10.1.3	Application Requirements	The application shall include the following unless otherwise authorized by the chief inspector: (a) a regional map showing the location of the mine property, along with a map or air photo showing the location and extent of the mine; (b) the present use and condition of the land and watercourses including: (i) land ownership, including surface and mineral rights, licensed or permitted users such as water users, guides, outfitters, trappers and grazing licenses, (ii) climate, (iii) general geology and detailed geological descriptions of the deposit, (iv) surface water and groundwater quality and flow, (v) fisheries and aquatic resources, (vi) air quality, (vii) surficial geology and terrain mapping, (viii) soil survey and soil characterization, (ix) vegetation, (x) wildlife, (xi) land capability and present land uses such as agriculture, forestry, fisheries, wildlife, recreation, industrial, commercial and residential, and (xii) inhabited places in the vicinity of the mine; (c) established and asserted aboriginal and treaty rights; (d) a mine plan including: (i) a map at a scale of 1:10,000 or less showing topographic contours, surface drainage features, claims, leases or licences, buildings, roads, railways, power transmission lines, pipelines, and other relevant features and the locations of all proposed or existing surface and underground mining developments, waste disposal areas, stockpiles, processing facilities, mine buildings and other mining related disturbances or infrastructure, (ii) an inventory of areas disturbed to date, and projected over the next 5 years and over the projected life of the mine, (iii) descriptions of mining methods, mining rates, projected mine life, processing methods and infrastructure requirements, (iv) development schedule for construction and mine sequencing, (v) detailed geology and ore reserves, and projected volumes of ore and waste to be produced and relative time of production, (vi) designs and details for dumps, open pits, impoundments, underground workings including areas that may be affected by subsidence, stockpiles, processing facilities, water management structures, water storage and water treatment facilities, haulage roads, road construction and significant transportation or utilities infrastructure, compatible with environmental protection, reclamation and mine closure, (vii) designs and details for tailings storage and a description of proposed quantifiable performance objectives, (viii) designs for material handling and waste disposal procedures, (ix) salvaging and stockpiling of surface soils and overburden materials, (x) source, use and water balance for any water required in the operation, (xi) overall site water balance, and

TABLE B1: 2016 CODE PROVISIONS RELATING TO TSFS (CONTINUED)

Section	Title	Text
10.1.4	Design Standards	(1) Impoundments, tailings storage facilities and water management facilities and dams shall be designed by a Professional Engineer. (2) The Professional Engineer shall develop design criteria for each facility referred to in subsection (1) that considers the HSRC Guidance Document. (3) Site characterizations for support of the design of a tailings storage facility or dam shall be carried out by a Professional Engineer and in consideration of the HSRC Guidance Document.
10.1.5	Engineer of Record	(1) The manager shall ensure that a Professional Engineer is retained as the engineer of record for each tailings storage facility and dam under their management. (2) The engineer of record, as a qualified professional, has professional responsibility for assuring that a tailings storage facility or dam has been designed and constructed in accordance with the applicable guidelines, standards and regulations. (3) The manager shall notify the chief inspector of the retained engineer of record, of changes in the engineer of record, and the notification shall include an acknowledgement by the engineer of record.
10.1.6	Duty to Report Safety Issues at Tailings Storage Facility	(1) The engineer of record shall immediately notify the manager in writing of any unresolved safety issue that compromises the integrity of a tailings storage facility. (2) If the engineer of record and manager are unable to resolve the safety issue, the manager must report the issue to the chief inspector and provide a copy of the report to the engineer of record. (3) If the manager does not provide the report under subsection (2) in a timely fashion, the engineer of record shall report the issue to the chief inspector.
10.1.7	Consequence Classification	The consequence classification for a tailings storage facility shall be determined by the engineer of record in consideration of the HSRC Guidance Document.
10.1.8	Seismic and Flood Design Criteria	(1) Seismic and flood design criteria for tailings storage facilities and dams shall be determined by the engineer of record based on the consequence classification determined under section 10.1.7 of this code in consideration of the HSRC Guidance Document, subject to the following criteria: (a) for tailings storage facilities that store water or saturated tailings, (i) the minimum seismic design criteria shall be a return period of 1 in 2475 years, (ii) the minimum flood design criteria shall be a return period 1/3rd of the way between the 1 in 975-year event and the probable maximum flood, and (iii) a facility that stores the inflow design flood shall use a minimum design event duration of 72 hours; (b) for tailings storage facilities that cannot retain water or saturated tailings, (i) the minimum seismic design criteria shall be a return period of 1 in 975-years, and (ii) the water management design shall include an assessment of tailings facility erosion and surface water diversions as well as measures to prevent impounded tailings from becoming saturated that consider the consequence classification as determined under section 10.1.7 of this code. (2) The environmental design flood criteria shall be determined by a Professional Engineer in consultation with other qualified professionals.
10.1.9	Design Slopes	For a tailings storage facility design that has an overall downstream slope steeper than 2H:1V, the manager shall submit justification by the engineer of record for the selected design slope and receive authorization by the chief inspector prior to construction.
10.1.10	Minimum Static Factor of Safety	For a tailings storage facility design that has a calculated static factor of safety of less than 1.5, the manager shall submit justification by the engineer of record for the selected factor of safety and receive authorization by the chief inspector prior to construction.

TABLE B1: 2016 CODE PROVISIONS RELATING TO TSFS (CONTINUED)

Section	Title	Text
10.1.11	Breach and Inundation Study/ Failure Runout Assessment	A tailings storage facility shall have a breach and inundation study or a failure runout assessment prior to commencing operation, or as required by the chief inspector.
10.1.12	Water Balance and Water Management Plan	(1) The manager shall ensure that a tailings storage facility has a water balance and water management plan for the permitted life of mine that is prepared by a qualified person. (2) The manager shall notify the chief inspector if any unpermitted discharge of water occurs or is required.
10.1.13	Quantifiable Performance Objectives	The manager shall ensure that quantifiable performance objectives for a tailings storage facility are determined and reviewed by the engineer of record and the TSF qualified person.
10.1.14	Underground Openings and Workings	(1) Tailings storage facility designs that use underground openings shall comply with 6.14.1 of this code. (2) Tailings storage facility designs shall consider the potential effects on and interactions with underground workings.
10.1.17	Preparation of Plans and Programs	Mine, environmental protection, reclamation and closure plans required under sections 10.1.1, 10.1.2, 10.1.16 and 10.6.3 of this code shall (a) be prepared taking into consideration the health and safety of the public and persons involved in the work, (b) be designed so as to make it as practicable as possible in the future to mine zones affected by the plan, (c) be designed to protect the land and watercourses, and (d) be prepared in consideration of the HSRC Guidance Document, by qualified professionals or persons who in the opinion of the chief inspector are qualified to perform the work.
10.1.19	Exceptions	(1) Sections 10.1.2 through 10.1.17 of this code do not apply to placer mines, sand and gravel pits, and quarries unless required by the chief inspector (2) Sections 10.1.8, 10.1.9 and 10.1.10 of this code do not apply to mines with respect to which the chief inspector has received an application for a permit before the date on which this subsection comes into force.
10.4.1	Updated Plans	(1) After commencement of operations, mine plans, including programs for reclamation and closure, shall be updated, at a minimum, every 5 years. (2) Reclamation plans shall outline progressive reclamation activities for the 5 years following the date on which the plans are updated in accordance with subsection (1). (3) After commencement of operations, the water balance and water management plans under section 10.1.12 of this code shall be reconciled annually and updated as required.

TABLE B1: 2016 CODE PROVISIONS RELATING TO TSFS (CONTINUED)

Section	Title	Text
10.4.2	Governance	(1) The manager of a mine with one or more tailings storage facilities shall (a) develop and maintain a Tailings Management System that considers the HSRC Guidance Document and includes regular system audits, (b) designate a TSF qualified person for safe management of all Tailings Storage Facilities, (c) establish an Independent Tailings Review Board, unless exempted by the chief inspector, (d) review annually the tailings storage facility risk assessment to ensure that the quantifiable performance objectives and operating controls are current and manage the facility risks, (e) maintain tailings storage facility emergency preparedness and response plans integrated into the Mine Emergency Response Plan required under section 3.7.1 of this code, and (f) ensure document records for key information are maintained and readily available for tailings storage facilities. (2) The composition of an Independent Tailings Review Board established under subsection (1) (c) shall be commensurate with the complexity of the tailings storage facility in consideration of the HSRC Guidance Document. (3) The manager shall submit the terms of reference for the Independent Tailings Review Board including the qualifications of the board members to the chief inspector for approval. (4) The terms of reference for the Independent Tailings Review Board shall be developed or updated as required in consideration of the review under subsection (1) (d).
10.4.3	Register of Tailings Storage Facilities and Dams	(1) The manager of a mine with one or more tailings storage facilities shall maintain a Register of Tailings Storage Facilities and Dams. (2) The register shall be reviewed and updated at least annually.
10.4.4	Annual Reporting	The owner, agent or manager shall submit one or more annual reports in a summary form specified by the chief inspector or by the conditions of the permit by March 31 of the following year on the following: (a) reclamation and environmental monitoring work performed under section 10.1.3 (e) of this code; (b) tailings storage facility and Dam Safety Inspections performed under section 10.5.3 of this code; (c) a report of the activities of the Independent Tailings Review Board established under section 10.4.2 (1) (c) of this code that describes the following: (i) a summary of the reviews conducted that year, including the number of meetings and attendees; (ii) whether the work reviewed that year meets the Board's expectations of reasonably good practice; (iii) any conditions that compromise tailings storage facility integrity or occurrences of non-compliance with recommendations from the engineer of record; (iv) signed acknowledgement by the members of the Board, confirming that the report is a true and accurate representation of their reviews; (d) a summary of tailings storage facility and dam safety recommendations including a scheduled completion date; (e) performance of high-risk dumps under section 10.5.5 of this code; (f) updates to the tailings storage facilities register as required; (g) other information as directed by the chief inspector.
10.4.5	Other Reporting	The owner, agent or manager shall submit the following periodic reports with the annual reporting in a form specified by the chief inspector or by the conditions of the permit by March 31 of the year following their completion: (a) mine plan, reclamation plan and closure plan updates under section 10.4.1 of this code; (b) Dam Safety Review reports performed under section 10.5.4 of this code; (c) "as built" reports for tailings storage facilities and dams under section 10.5.1 of this code.

TABLE B1: 2016 CODE PROVISIONS RELATING TO TSFS (CONTINUED)

Section	Title	Text
10.5.1	Construction of Tailings and Water Management Facilities	(1) The manager shall submit issued for construction drawings, specifications and quality assurance/quality control plans as well as a summary construction schedule to the chief inspector prior to commencing construction of a tailings storage or water management facility. (2) The manager shall ensure that the initial operation of a tailings storage or water storage facility does not commence until an "as built" report under subsection (3) certifying that the facility was designed in accordance with this code and constructed according to design has been submitted to the chief inspector and a permit has been received. (3) The manager shall prepare "as built" reports for each stage of construction of a tailings storage or water storage facility that include, as a minimum, the following: (a) geotechnical foundation conditions; (b) geometry; (c) quality assurance/quality control data prepared by a Professional Engineer. (4) The manager shall ensure that the engineer of record has certified that the tailings storage facility or dam has been constructed in a manner consistent with the design and specifications and that the structures are suitable for the intended use.
10.5.2	Operations, Maintenance and Surveillance (OMS) Manual	(1) An Operations, Maintenance and Surveillance Manual shall be prepared by one or more qualified person and submitted to the chief inspector prior to operation of the Tailings Storage Facility or dam. (2) The Operations, Maintenance and Surveillance Manual shall be reviewed by the engineer of record and approved by the manager prior to implementation. (3) All employees involved in the operation of a tailings storage facility or dam shall be trained and qualified, based on the OMS requirements, prior to commencing work at the facility. (4) The Operations, Maintenance and Surveillance Manual shall be reviewed annually and revised as required during operations of a tailings storage facility or dam.
10.5.3	Annual Dam Safety Inspection	Tailings storage and water management facilities and associated dams shall be inspected annually and a report shall be prepared by the engineer of record in consideration of the HSRC Guidance Document
10.5.4	Dam Safety Reviews	A Dam Safety Review Report on the tailings storage, water management facilities and associated dams shall be prepared by an independent Professional Engineer in consideration of the HSRC Guidance Document at least every 5 years or as directed by the chief inspector.
10.6.6	Impoundments	(1) The long-term stability of exposed slopes of impoundments shall meet the criteria provided in the design at the time of permitting or as determined by the engineer of record. (2) Impoundments not operated for a period of 12 or more months may be declared as closed by the chief inspector.
10.6.7	Closure of a Tailings Storage Facility or Dam	(1) Prior to closure or upon declared closure of a tailings storage facility or dam, the manager shall submit a final detailed closure plan to achieve the approved end land and water use objectives. (2) The closure plan shall include a detailed construction cost estimate, schedule and monitoring plan for implementation. (3) The closure plan shall be prepared by one or more qualified professionals in consideration of the HSRC Guidance Document.
10.6.8	Tailings Storage Facility Closure OMS Manual	(1) The manager shall submit a Tailings Storage Facility Operations, Maintenance and Surveillance Manual for closure and review and update the plans regularly to reflect significant ongoing changes during closure. (2) The Tailings Storage Facility Operations, Maintenance and Surveillance Manual shall include requirements for monitoring and shall define appropriate resources and staffing to carry out the works and monitoring associated with closure.
10.6.10	Permanent Spillways	Permanent spillways shall be designed by a Professional Engineer in consideration of the HSRC Guidance Document and installed prior to the completion of closure of the tailings storage facility or dam.

TABLE B1: 2016 CODE PROVISIONS RELATING TO TSFS (CONTINUED)

Section	Title	Text
10.6.11	Permit Amendment or Variance After Closure	The manager of a tailings storage facility or dam that has completed closure but not achieved the release of permit obligations may apply for permit amendments or variances including but not limited to reduced frequency of monitoring, Dam Safety Inspections and Dam Safety Reviews.
10.6.12	Landforms	The manager of a tailings storage facility or dam that can be considered a landform may apply to the chief inspector for the release of permit obligations under the *Mines Act*.
10.6.13	Reactivation of Impoundment	The owner, agent or manager may make an application for a permit to reactivate a closed or abandoned impoundment

TABLE B2: TERMS AND AVAILABLE DEFINITIONS IN PART 10 OF THE CODE

Term introduced in Part 10	Code section (1st occurrence)	Definition provided in Code?	Code Definition	Definition provided in HSRC Guidance Document (if applicable)
breach and inundation study	10.1.11	No		
consequence classification	10.1.7	No		(3.4) consequence classification table
construction cost estimate	10.6.7	No		
construction phase	10.1.3	Partial	"construction" includes any activity involving the erection, modification, or dismantling of any structure or building and any road building associated therewith.	
dam	10.1.3	Yes	"dam" means a barrier on the surface preventing uncontrolled release of either water, slurry or solids or a barrier underground to prevent the uncontrolled flow of water, slurry or solids.	(3.4) notes that liquefiable solids may be held by dams and that natural ground can be a dam but does not define the word "dam"
design hydrologic event	definition of "inflow design flood"	No		
engineer of record	10.1.5	Yes	"engineer of record" means the Professional Engineer who is retained under section 10.1.5 (1) of this code.	(2.1) Is a qualified and competent engineer with experience commensurate with the consequence classification and complexity of the facility.
environmental design flood	10.1.8	Yes	"environmental design flood" means the hydrological event that is to be managed without release of untreated water to the environment.	
failure runout assessment	10.1.11	No		
independent tailings review board	10.4.2	No		(2.1) Made up of independent subject matter experts not currently involved in or responsible for the design, operation or construction of the facility.
inflow design flood	10.1.8	Yes	"inflow design flood" means the flood into the impoundment resulting from the design hydrologic event.	
issued for construction drawings	10.5.1	No		
landform	10.6.12	Yes	"landform" means a designated structure that can be considered to have a risk profile similar to the surrounding environment.	
operational phase	10.1.3	No		

TABLE B2: TERMS AND AVAILABLE DEFINITIONS IN PART 10 OF THE CODE (CONTINUED)

Term introduced in Part 10	Code section (1st occurrence)	Definition provided in Code?	Code Definition	Definition provided in HSRC Guidance Document (if applicable)
operations, maintenance and surveillance manual	10.5.2	No		(4.4) Detailed discussion of purpose
overall downstream slope	10.1.9	No		
probable maximum flood	10.1.8	Yes	"probable maximum flood" means the hypothetical most severe flood that may credibly be expected to occur at a particular location resulting from the seasonal maximum combination of precipitation and snowmelt.	
quantifiable performance objectives	10.1.3	Yes	"quantifiable performance objectives" means measurable monitoring parameters that are identified and required to be maintained within predetermined limits for tailings storage facility safety.	
return period	10.1.8	No		
site characterizations	10.1.4	No		(3.3.2) Reference to EGBC guidelines
static factor of safety	10.1.10	No*		
summary construction schedule	10.5.1	No		
tailings	10.1.3	Yes	"tailings" means the residue remaining from the preparation of a concentrate of minerals or coal.	
tailings management system	10.4.2	No		(4.8) Defines how the mine will manage the tailings storage facility.
tailings storage facility	10.1.3	Yes	"tailings storage facility" or "TSF" means a facility that stores tailings.	
TSF qualified person	10.1.13	Yes	"TSF qualified person" means the person designated under section 10.4.2 (1) (b) of this code.	(2.1) Develops and implements the tailings and water management plans for the TSFs under their supervision.
TSF risk assessment	10.4.2	No		(3.2) Discussion of elements of a risk assessment
water balance	10.1.12	No		
water management facility	10.1.4	No		
water management plan	10.1.12	No		
water reservoir	10.6.14	No		
water storage facility	10.5.1	No		

* A definition is provided, but refers to an alternate usage of the term

TABLE B3: AMBIGUOUS CODE PROVISIONS

Code section	Requirement	Code text	Ambiguity
10.1.4(1)	Design standards	Impoundments, tailings storage facilities and water management facilities and dams shall be designed by a Professional Engineer.	The role of the EoR in design and whether one is required during design (given the Code's requirement for retaining an EoR for TSFs and dams, not TSF and dam designs), especially given the role of consequence classification in design and the requirement that the EoR make this determination.
10.1.4(2)	Design standards	The Professional Engineer shall develop design criteria for each facility referred to in subsection (1) that considers the HSRC Guidance Document.	
10.1.7	Consequence classification	The consequence classification for a tailings storage facility shall be determined by the engineer of record…	
10.1.8	Seismic/flood design criteria	Seismic and flood design criteria for tailings storage facilities and dams shall be determined by the engineer of record…	
10.1.9	Design downstream slope	For a tailings storage facility design that has an overall downstream slope steeper than 2H:1V, the manager shall submit justification by the engineer of record…	
10.1.10	Minimum static factor of safety	For a tailings storage facility design that has a calculated static factor of safety of less than 1.5, the manager shall submit justification by the engineer of record…	
10.1.5(2)	Engineer of Record - Professional responsibility for assurance	The engineer of record, as a qualified professional, has professional responsibility for assuring that a tailings storage facility or dam has been designed and constructed in accordance with the applicable guidelines, standards and regulations.	What is meant by "professional responsibility" and who (the Ministry or EGBC) determines this; what constitutes assurance and who (the Ministry or EGBC) determines this; which guidelines and standards are considered applicable and who (the Ministry, EGBC or the EoR) determines this; the EoR is a professional engineer by definition but this introduces the phrase "qualified professional" which is also defined; how the "professional responsibility" of the EoR with respect to regulations interacts with the overall statutory responsibility which applies to all mine employers, managers, owners, officers, agents etc.
10.1.6(3)	Duty to report safety issues	If the manager does not provide the report under subsection (2) in a timely fashion, the engineer of record shall report the issue to the chief inspector.	Who determines what constitutes a "timely fashion"; whether the Ministry or EoR has authority over the manager to determine a "timely fashion".

TABLE B3: AMBIGUOUS CODE PROVISIONS (CONTINUED)

Code section	Requirement	Code text	Ambiguity
10.1.13	QPOs	The manager shall ensure that quantifiable performance objectives for a tailings storage facility are determined and reviewed by the engineer of record and the TSF qualified person.	Whether the review required applies only during design or is also meant to apply throughout the TSF lifecycle.
10.1.19(2)	Exceptions	Sections 10.1.8, 10.1.9 and 10.1.10 of this code do not apply to mines with respect to which the chief inspector has received an application for a permit before the date on which this subsection comes into force.	Unclear when this applies given the broad definition of "mine" in the *Mines Act* and the range of activities on a mine that are subject to permits issued by the Chief Inspector.
10.4.2(1)(f)	Governance—key information	(1) The manager of a mine with one or more tailings storage facilities shall (f) ensure document records for key information are maintained and readily available for tailings storage facilities.	What constitutes key information and who makes this determination.
10.4.2(2)	ITRB composition	The composition of an Independent Tailings Review Board established under subsection (1) (c) shall be commensurate with the complexity of the tailings storage facility in consideration of the HSRC Guidance Document	How to determine "commensurate with the complexity" of TSF.
10.4.1(3)	Update to water balance/ water management plan	After commencement of operations, the water balance and water management plans under section 10.1.12 of this code shall be reconciled annually and updated as required.	"updated as required"; "updated as required"; "revised as required"; none of these phrases specify the party responsible for determining what triggers constitute "as required."
10.4.2(4)	ITRB TOR update	The terms of reference for the Independent Tailings Review Board shall be developed or updated as required in consideration of the review under subsection (1) (d).	
10.5.2(4)	OMS manual update	The Operations, Maintenance and Surveillance Manual shall be reviewed annually and revised as required during operations of a tailings storage facility or dam.	

TABLE B3: AMBIGUOUS CODE PROVISIONS (CONTINUED)

Code section	Requirement	Code text	Ambiguity
10.5.1(3)	As-built reports	The manager shall prepare "as built" reports for each stage of construction of a tailings storage or water storage facility that include, as a minimum, the following:	How stages of construction are delineated, especially when a TSF is continuously being built through operation of the facility (e.g. cyclone sand dam raises).
10.5.1(4)	Certification	The manager shall ensure that the engineer of record has certified that the tailings storage facility or dam has been constructed in a manner consistent with the design and specifications and that the structures as suitable for the intended use.	What does "certified" entail; whether this certification is related to the assurance in 10.1.5(2); what defines consistency with design (e.g. prescriptive or outcome based).
10.5.2(2)	OMS Manual review	The Operations, Maintenance and Surveillance Manual shall be reviewed by the engineer of record and approved by the manager prior to implementation.	What triggers review [by the EoR] or approval [by the manager] in the absence of an explicit requirement for any party to implement the Manual.
10.5.3/10.5.4	Annual Dam Safety Inspections / Dam Safety Reviews	Tailings storage and water management facilities and associated dams shall be inspected annually… A Dam Safety Review Report on the tailings storage, water management facilities and associated dams shall be prepared…	"Water management facilities" is not defined; the limits of "associated dams" are not clear; why the term "Dam Safety Review" is used when both TSFs and "water management facilities" may not include dams.
10.6.1	Notice of stopping work	The owner, agent, or manager shall provide written notice of not less than 7 days to an inspector of intention to stop work in, on, or about a mine.	What constitutes stopping work and whether this is any work or all work; how work relates to the definitions of mining activities in the *Mines Act*.
10.6.2(1)	Actions when ceasing operation	If a mine ceases operation, the owner, agent, or manager shall (a) continue to carry out the conditions of the permit, and (b) carry out a program of site monitoring and maintenance.	Whether ceasing operation is the same as stopping work; what is required of the program of site monitoring and maintenance.

TABLE B3: AMBIGUOUS CODE PROVISIONS (CONTINUED)

Code section	Requirement	Code text	Ambiguity
10.6.6	Closure of impoundments	(1) The long-term stability of exposed slopes of impoundments shall meet the criteria provided in the design at the time of permitting or as determined by the engineer of record. (2) Impoundments not operated for a period of 12 or more months may be declared as closed by the chief inspector.	What differentiates an "exposed" slope from an unexposed slope; whether "time of permitting" would include a permit amendment under 10.6.2(2)(a) or only the "original" permit; EoRs are required for dams, not impoundments (which usually, but not necessarily, include dams); what constitutes not operating an impoundment.
10.6.8(1)	Tailings Storage Facility Closure OMS Manual	The manager shall submit a Tailings Storage Facility Operations, Maintenance and Surveillance Manual for closure and review and update the plans regularly to reflect significant ongoing changes during closure.	Redundancy with 10.5.2 OMS requirement; "review and update regularly"; unclear what triggers 10.6.8 vs 10.5.2; no other "operational" requirements (e.g. Dam Safety Inspections) have "closure" equivalents.
10.6.10	Permanent spillways	Permanent spillways shall be designed by a Professional Engineer in consideration of the HSRC Guidance Document and installed prior to the completion of closure of the tailings storage facility or dam.	How this is expected to apply to TSFs that do not require permanent spillways by design (e.g. dry stack); how the responsibilities of the EoR interact with this requirement.

TABLE B4: CODE REQUIRED DOCUMENTATION RELATED TO TSFS

Required Report	Code Section	Requirement Type	Specified Action
Design Criteria	10.1.4(2)	Maintain	Developed by P.Eng. and in consideration of the HSRC Guidance Document
Site characterization	10.1.4(3)	Maintain	Carried out by P.Eng. and in consideration of the HSRC Guidance Document
Notification of EOR assignment or change	10.1.5(3)	Notify	Notify the Chief Inspector
Duty to Report Safety Issue at TSF	10.1.6	Submit	Report to the Chief Inspector
Consequence Classification	10.1.7	Maintain	Determined by the EoR in consideration of the HSRC Guidance Document
Design Slopes Justification	10.1.9	Submit for approval	Submit justification by the EoR and receive authorization from the Chief Inspector
Factor of Safety Justification	10.1.10	Submit for approval	Submit justification by the EoR and receive authorization from the Chief Inspector
Breach and Inundation Study/Failure Runout Assessment	10.1.11	Maintain	Prior to commencing operations, or as required by the Chief Inspector
Water Management Plan	10.1.12	Maintain	Prepared by a qualified person
Quantifiable Performance Objectives	10.1.13	Maintain	Determined and reviewed by the EoR
Annual Reconciliation of Water Balance and Water Management Plans	10.4.1(3)	Maintain	Reconciled annually and updated as required, submission of updated plans required by section 10.4.5(1)
Tailings Management System	10.4.2(1)(a)	Maintain	Develop and maintain, and consider the HSRC Guidance Document
Assignment of TSF QP	10.4.2(1)(b)	Maintain	Designate
TSF Risk Assessment	10.4.2(1)(d)	Maintain	Review annually
TSF Emergency Preparedness and Response Plan	10.4.2(1)(e)	Submit	Integrate into the Mine Emergency Response Plan required under section 3.7.1, submission required under section 3.7.1
ITRB Qualifications	10.4.2(2)	Submit for approval	Submit with Terms of Reference
ITRB Terms of Reference	10.4.2(3)	Submit for approval	Submit, for approval by the Chief Inspector
Register of TSFs and Dams	10.4.3	Maintain	Maintain, review and update at least annually
TSF Annual DSI Summary	10.4.4(b)	Submit	Section 10.5.3 requires preparation of DSI by the EoR in consideration of the HSRC Guidance Document, section 10.4.4 requires submission in a summary form
ITRB Annual Activities Report Summary	10.4.4(c)	Submit	Submit in summary form a report of the activities of the ITRB
Annual Summary of TSF or Dam Safety Recommendations	10.4.4(d)	Submit	Submit summary of recommendations including a scheduled completion date
Annual TSF and Dam Registry Updates Summary	10.4.4(f)	Submit	Submit updates to the register in a summary form

TABLE B4: CODE REQUIRED DOCUMENTATION RELATED TO TSFS (CONTINUED)

Required Report	Code Section	Requirement Type	Specified Action
Mine Plan Update	10.4.5(1)	Submit	Submit updated plans required under section 10.4.1, to be updated at a minimum every 5 years
Dam Safety Review	10.4.5(b)	Submit	Section 10.5.4 requires preparation by an independent engineer in consideration of the HSRC Guidance Document, Section 10.4.5 requires submission to the Chief Inspector
TSF, WSF issued for construction drawings and schedule	10.5.1(1)	Submit	Submit, prior to commencing construction
TSF, WSF or Dam As-built Report	10.5.1(2)	Submit	Submit, prior to commencing operation
OMS Manual	10.5.2(1)	Submit	Prepared by a qualified person and submitted to the Chief Inspector
OMS Manual Updates	10.5.2(4)	Maintain	Reviewed annually and revise as required
Closure of TSF or Dam Report	10.6.7	Submit	Prepared by qualified professional(s) in consideration of the HSRC Guidance Document, submit prior to closure or upon closure
TSF Closure OMS	10.6.8	Submit	Submit, review and update regularly

APPENDIX C: CODE REVIEW COMMITTEE

In July 2015, a committee was appointed to review the Code (pursuant to Section 34 of the *Mines Act*), and determine how best to implement the 26 recommendations made in the reports of the Independent Expert Engineering Panel and the Chief Inspector of Mines following their investigations into the August 4, 2014 tailings breach at the Mount Polley Mine.

The Code Review Committee was chaired by the Chief Inspector of Mines and included an equal number of representatives nominated by First Nations, mine labour unions and industry. The review consisted of three separate committees: an overarching Code Review Committee and two sub-committees that provided technical reviews for tailings storage facilities (TSFs) provisions and specific sections of the health and safety parts of the Code.

More information, including news releases, related to the 2015–2017 Code Review Committee is available on the Code Review website,[5] along with the Terms of Reference[4] for the Committee. The Code Review Committee also produced a summary entitled, "Update on the Implementation of Recommendations from the Expert Panel Report and the Chief Inspector of Mines Investigation Report",[25] which included a table of the recommendations and how they were addressed through Code revisions.

Following the July 2016 updates to the TSF portion of the Code, the Ministry commissioned international engineering, geoscience and environmental consulting firm Klohn Crippen Berger to complete a third-party comparison of mining legislation and guidelines in British Columbia, Montana and Alaska. The Jurisdictional Review[26] found B.C.'s requirements for mining to be equal to or more stringent than those in Montana or Alaska.

In 2019, the Ministry established a Standing Code Review Committee,[27] following recommendations from the Mining Job Task Force,[28] to ensure that mining continues to be one of the safest heavy industries in B.C. and that provincial regulations remain current and respond to rapid pace of change in the industry. The Standing Committee membership has equal representation from indigenous nations, industry and labour.

Mount Polley Investigation Reports

The Expert Panel Report and the Chief Inspector of Mines Investigation Report referenced above may be found at the following links:

- The Mount Polley Independent Expert Engineering Investigation and Review Panel[1] (IEEIRP)
- The Chief Inspector of Mines' Investigation[2]

APPENDIX D: JURISDICTIONAL SCAN

KLOHN CRIPPEN BERGER REPORT

Klohn Crippen Berger

Mine Audits and Effectiveness Unit

Ministry of Energy, Mines & Petroleum Resources

Audit of Code Requirements for Tailings Storage Facilities

Jurisdictional Scan

M09954A05.730

September 2020

Klohn Crippen Berger

September 4, 2020

Mine Audits and Effectiveness Unit
Ministry of Energy, Mines & Petroleum Resources
300 - 1810 Blanshard Street
Victoria, BC
V8T 4J1

Glenn Finlay, P.Eng.
Mines Auditor, Permitting

Dear Mr. Finlay:

Audit of Code Requirements for Tailings Storage Facilities
Jurisdictional Scan

KCB is pleased to present this report documenting our jurisdictional scan of regulatory frameworks for Tailings Storage Facilities.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

David Willms, P.Eng.
Senior Geotechnical Engineer, Associate.

DW:jc

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Mine Audits and Effectiveness Unit

Ministry of Energy, Mines & Petroleum Resources

Audit of Code Requirements for Tailings Storage Facilities

Jurisdictional Scan

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1 INTRODUCTION

The Mine Audits and Effectiveness Unit (the Audit Unit) within the Ministry of Energy, Mines & Petroleum Resources (EMPR) is carrying out an audit of the regulatory framework for Tailings Storage Facilities (TSF) in British Columbia (BC). The Audit Unit wants to understand how the regulatory framework for TSFs in BC compares to other jurisdictions with active mining industries. As part of the audit, KCB has prepared a comparison of regulatory frameworks. This comparison is referred to here as the Jurisdictional Scan, and has the following objectives:

- compare the regulatory frameworks of BC with other jurisdictions;
- assess if BC has a “world class” framework; and
- identify areas where BC’s regulatory framework could be improved.

To achieve these objectives this Jurisdictional Scan included the following elements:

- selection of jurisdictions for comparison;
- selection of comparison criteria;
- presentation of jurisdictional comparison data; and
- recommendations for improvements to the Health, Safety and Reclamation Code for Mines in BC (the Code).

2 SELECTION OF JURISDICTIONS

Based on discussions with the Audit Unit, eight (8) mining jurisdictions have been selected for comparison. Table 2.1 presents the selected jurisdictions, including a description of selection rationale and high-level business context.

Table 2.1 Regulatory Jurisdiction Selection and Mining Industry Business Context

Jurisdiction	Selection Rationale	Jurisdictional Mining Industry Business Context		
		Mining as % of GDP	Main Mining Commodities	Active Mines (approximate number)
BC, Canada	• Forms the baseline for comparison.	3%	Coal, copper, molybdenum, gold, silver, zinc	21
Alberta, Canada	• Considered a progressive regulatory framework by practicing professionals within the industry. • TSF framework was recently updated to address performance-based risk-informed design.	27% (1)	Coal, oilsands	29
Quebec, Canada	• Canadian jurisdiction with mature mining industry. • Distinct legal approach and environment.	1%	Copper, diamonds, iron, zinc, lithium, nickel, gold, phosphate, rare earths	27
Montana, USA	• Considered in the 2016 Code review, and since updated. • Considered a progressive regulatory jurisdiction.	6%	Copper, molybdenum concentrates, palladium, platinum	12
Alaska, USA	• North American jurisdiction adjacent to BC with mature mining industry. • Reputation as a strong regulator.	4%	Gold, lead, silver, zinc	8
New South Wales, Australia	• International jurisdiction with mature mining industry. • Considered the progressive regulatory jurisdiction in Australia by practicing professionals within the industry.	7%	Coal, iron-ore, gold, copper, silver, lead, zinc	74
Peru	• South American country with a mature mining industry.	11%	Copper, gold, silver, zinc, lead, tin	70
Brazil	• Potential source of new insights and lessons learned resulting from the recent dam failures in 2015 and 2019.	2%	Iron ore, phosphate, copper, gold, lead, nickel	132

Notes:
1. This is for the mining and energy subsectors (i.e., oil, gas, related services, and refining; which includes Oilsands mines).

3 COMPARISON CRITERIA

The TSF regulatory framework in the different jurisdictions are compared based on broad categories selected in consultation with the Audit Unit. Table 3.1 presents the comparison categories.

Table 3.1 Jurisdictional Scan Comparison Categories

Regulatory Framework Comparison Categories		
Primary	**Secondary**	
Legal Framework	• Legislation/Act [1] • Regulation [2] • Guideline [3]	
Design	• Dam Break • Consequence classification • Geotechnical • Hydrotechnical • Closure	
Governance	• Management systems • Operations and controls • Risk management	• Roles, responsibilities, and accountabilities defined[4] • Engineer of Record (EoR) • TSF Responsible Person • Independent Technical Review Board (ITRB) • Operation, Maintenance, and Surveillance (OMS) manual • Pre-defined action plans • Risk assessment • Emergency response
	• Environment and community	
	• Documentation/auditing	

Notes:
1. Per GoC (2020), "Legislation refers to written laws, often referred to as Acts or statutes, which are enacted by Parliament, the legislative arm of government."
2. Per GoC (2020), "Regulations are a form of law, sometimes referred to as subordinate legislation, which define the application and enforcement of legislation. Regulations are made under the authority of an Act, called an Enabling Act."
3. Per GoC (2020), "Guidelines are departmental documents that are used to interpret legislation and/or regulation. Although they may be derived from legislation and are often used to advise how one might comply with a regulation, guidelines do not have the force of law."
4. Noted hereafter simply as "Accountability defined".

These comparison categories were selected to assess the aspects of jurisdictional regulatory frameworks that contribute to "safe TSFs". Each jurisdiction's regulatory framework is assessed, in general, and with respect to these comparison categories by evaluating the following hypothesis statements (referred to herein as criteria):

- Criteria 1: The regulatory framework is aligned with "best practices".
- Criteria 2: The prescriptive elements of the regulatory framework are reasonable and flexible enough to allow for site-specific solutions or innovation.
- Criteria 3: The regulatory framework includes key components of "safe design".
- Criteria 4: The regulatory framework includes key components of "good governance".

To test these criteria, it is helpful to pose example questions, which are provided in Appendix I.

For the assessment and comparison of regulatory frameworks in the jurisdictions, KCB, in consultation with the Audit Unit, started with the key elements for TSF safety and developed a general framework based on our understanding of good standard practices. Each jurisdiction, including BC, was assessed using this general framework.

4 JURISDICTION COMPARISONS

4.1 Jurisdictional Summaries

Tables 4.1 to 4.8 present summaries of the regulatory framework in each jurisdiction which are organized according to the Table 3.1 categories and based on the results of desktop studies, interviews with industry professionals, as well as KCB's experience and judgment. Each jurisdiction summary table (i.e., Table 4.1 to Table 4.8) includes:

- An interpretative summary – a paragraph summarizing the effectiveness of the jurisdictional regulatory framework; and
- A simplified comparison criteria assessment – factual and interpretative responses to the comparison criteria (on a simplified basis/for select aspects) in relation to the comparison categories (refer to Table 3.1).

In reference to the *Legal Framework* comparison category, the following simplified criteria assessment questions are posed and addressed (i.e., with consideration of Criteria 1):

- Does the jurisdictional regulatory framework provide guidance for safe design/good governance?
- Does the jurisdictional regulatory framework specifically address TSFs?

In reference to the *Design* and *Governance* comparison categories, the following simplified criteria assessment questions are posed and addressed (i.e., with consideration of Criteria 2 to 4):

- Is the specified comparison category (or aspect) addressed in the regulatory framework and is it a regulatory requirement (i.e., as opposed to a consideration)?
- What is the general degree of flexibility of the comparison category (or aspect)?

The general degree of flexibility is intended to indicate whether an aspect of a jurisdictional regulatory framework is generally interpreted to be "prescriptive" or "outcome-based":

- "prescriptive" approach: the regulatory framework (i.e., typically the regulations) defines specific requirements and the associated acceptance criteria that the TSF owner must demonstrate are met.
- "outcome-based" approach: the TSF owner sets specific rationale, approach and acceptance criteria to demonstrate the achievement of general requirements/acceptance criteria described by the regulatory framework.

There are advantages and disadvantages to the degree of flexibility adopted and which is preferred is dependent on the regulatory element and jurisdictional context under evaluation.

In general, an advantage of the "prescriptive" approach is that it provides both the TSF owner and regulator with clearly defined requirements and expectations. However, "prescriptive" elements can lead to inflexibility which could limit TSF owner initiative/innovation to try for better safety

performance. In addition, the regulator can be viewed as accepting or taking away responsibility from the TSF owner.

An "outcome-based" approach generally has the advantage of allowing for more flexibility in meeting safety requirements/objectives and more clearly places dam safety responsibility with the TSF owner (i.e., promotes safety culture, ownership, and innovation). An "outcome-based" approach has a greater potential for inconsistency as varied technical approaches, methods and acceptance criteria would be applied to achieve the general dam safety requirements. This leads to increased requirements for technical competency within the regulatory and TSF owner teams.

The degree of flexibility is a subjective indicator and is included herein primarily to provide a simple way to evaluate Criteria 2.

Table 4.1 Jurisdictional Summary – British Columbia, Canada

Interpretative Summary						
British Columbia's regulatory framework was updated in response to the dam failure at Mount Polley and therefore, contains specific references to tailings facilities and the dam safety risks posed by them. The regulations generally align with the Canadian Dam Association (CDA) Dam Safety Guidelines (CDA 2013), with minor differences. There are prescriptive elements for design criteria, but there are mechanisms to depart from those if there is strong justification.						
Regulatory Framework				**Simplified Criteria [1] Assessment**		
Comparison Category			**Reference**	**Provides guidance for safe design/ governance?**		**Specifically addresses TSF's?**
Legal Framework	Legislation/Act		Mines Act (February 28, 2017) • No mention of TSFs	Yes (Code)		Yes (Code and HSRC Guidance Document)
	Regulation		Code (February 2017) • Applies to mining dams and specifically discusses tailings facilities • Other water dams covered by BC Dam Safety Regulations.			
	Guideline		HSRC Guidance Document (July 2016). • Referred to in the Code. • Specifically discusses tailings facilities Other Guidelines (Outside the Legal Framework): • CDA 2007 (2013 Update) • CDA 2014 Mining Bulletin			
				Addressed?	**Requirement?**	**General degree of flexibility [2]?**
Design	Dam break		• Code (10.1.11) – Dam break is required.	Yes	Yes	Outcome-based (general requirements and acceptance criteria are provided).
	Consequence classification		• Code (10.1.8) – Uses a modified version of the CDA framework.	Yes	Yes	Outcome-based (categorization specified, but approach/methods are not)
	Geotechnical		• Code (10.1.9) – Design slopes 2H:1V (minimum). • Code (10.1.10) – Static Factor of Safety (FoS) ≥1.5. • Code (10.1.4) – Characterization to consider HSRC Guidance Document. • Code (10.1.8) – Minimum seismic criteria.	Yes	Yes	Prescriptive (specific flood, seismic, stability Factor of Safety (FoS), foundation characterization, and minimum downstream slope angle design criteria are provided).
	Hydrotechnical		• Code (10.1.8) – Minimum flood criteria.	Yes	Yes	Prescriptive (specific flood criteria are provided, based on consequence classification) .
	Closure		• Code (10.6.8) – Final closure plan and Operation, Maintenance, and Surveillance (OMS) manual. • Code (10.6.10) – Permanent spillway. • Code (10.6.11) – Reduced requirements. • Code (10.6.12) – Landforms. • Code (10.7.20) – Water quality/treatment.	Yes	Yes	Outcome-based (closure plan required but specific design aspects are not provided).
Governance	Management systems / Operations and controls / Risk management	General	• Code (10.1.11) – Requires a water balance and water management plan. • Code (10.4.1) – Annual water balance reconciliation. • Code (10.4.2) – Refers to Tailings Management System (TMS). • Code (10.4.3) – Indicates a dam registry is required. • Code (10.5.1) – Issued for Construction (IFC) drawings, as-built, certification of design and construction. • Code (10.4.2) – Refers to Tailings Management System (TMS).			
		Accountability defined	• Code (10.4.2) – Refers to roles and responsibilities.	Yes	Yes	Prescriptive (sets out a specific roles and responsibilities).
		EoR	• Code (10.1.5) – Required to have an EoR.	Yes	Yes	Prescriptive (sets out a specific listing of responsibilities).
		TSF Responsible Person	• Code (10.4.2) – Qualified Person (QP).	Yes	Yes	Outcome-based (general listing of responsibilities).
		ITRB	• Code (10.4.2) – Refers to ITRB.	Yes	Yes	Prescriptive (sets out a specific listing of responsibilities).
		OMS manual	• Code (10.5.2) – OMS and related training required.	Yes	Yes	Prescriptive (detailed content requirements provided within regulatory documentation and by reference to Mining Association of Canada (MAC) "Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities" (MAC 2019b) .
		Pre-defined action plans	• Code (10.1.13) – Quantified Performance Objectives (QPO's).	Yes	Yes	Outcome-based (general requirements and acceptance criteria provided).
		Risk assessment	• Code (10.4.2) – Annual risk assessment review.	Yes	Yes	Outcome-based (general requirements and acceptance criteria provided).
		Emergency response	• Code (3.7.1, 10.4.2) – Maintain ERP.	Yes	Yes	Prescriptive (template and specific requirements are provided).
	Environment and community		• Code (10.1.17) – Mine, environmental, reclamation and closure plans must consider public safety and the protection of land and watercourses.			
	Documentation/auditing		• Code (10.4.2) – Maintain documentation. • Code (10.5.3) – Annual Dam Safety Inspection (DSI). • Code (10.5.4) – Dam Safety Review (DSR) every 5 years. • Code (10.4.4) – Terms of Reference (ToR) and ITRB summary report.			

Notes:
1. Refer to the four (4) criteria (hypothesis statements) presented in Section 3 (supported by Appendix I).
2. The definitions, description and intent of the "General degree of flexibility" is provided within the first page of Section 4.1.

Table 4.2 Jurisdictional Summary – Alberta, Canada

Interpretative Summary						
Alberta's dam safety regulatory framework was updated in 2018 and is documented in the Alberta Dam and Canal Safety Directive (Directive; Dec. 2018). The Directive presents requirements for dam safety management throughout its life cycle (i.e., design to closure) which are primarily performance or outcome based, with few prescriptive technical requirements. Safety criteria, such as stability, seepage, and seismic are required but minimum criteria (e.g., FoS, design earthquake, etc.) are not specified.						
Regulatory Framework					**Simplified Criteria [1] Assessment**	
Comparison Category			**Reference**		**Provides guidance for safe design/ governance?**	**Specifically addresses TSF's?**
Legal Framework	Legislation/Act		Water Act (Alberta Environment and Parks, 2017)		Yes	Yes
	Regulation		Water (Ministerial) Regulations – Alberta Regulations 205/1998 • Amendments up to and including Alberta Regulation 253/2018, effective December 12, 2018. • Applies to both water dams and tailings dams.			
	Guideline		Alberta Dam and Canal Safety Directive (December 11, 2018). • Applies to both water dams and tailings dams.	Other Guidelines (Outside the Legal Framework): • Alberta Dam Safety is currently updating the following Provincial Guides (tentative titles): (i) Guide for Routine Inspection and Maintenance of Earthfill Dams and Canals with a Low Consequence Classification; (ii) Guide for Preparing an Operations, Maintenance and Surveillance Manual; and (iii) Guide for Preparing an Emergency Management Plan		
					Addressed?	**Requirement?**	**General degree of flexibility [2]?**
Design	Dam break		• Safety Directive (3.2): - Dam break is required.		Yes	Yes	Prescriptive (specific assessment methods and acceptance criteria are provided).
	Consequence classification		• Safety Directive (Schedule 1) - Outlines criteria for consequence classification, which is a modified version of the CDA 5-level framework. • Regulations (34.1) and Safety Directive (3.4) – Consequence classification is not effective until it is accepted by the Director. • Safety Directive (3.5) – For existing tailings dams with a low consequence classification prior to the Directive being issued, their classification is deemed to have a consequence classification of significant until the dam owner obtains a different accepted classification in accordance with the Directive.		Yes	Yes	Prescriptive (specific assessment methods and acceptance criteria are provided).
	Geotechnical		• Safety Directive (5.2, 5.3 and 5.4) – Outlines minimum site investigation requirements. • Safety Directive (5.5) – Design must be commensurate with the risk to factors at risk posed by the dam, using best available technology and best available practices. Design can apply either a standards-based approach or a performance-based approach that uses quantifiable performance objectives. • Safety Directive (5.6) – Discusses target stability criteria. Minimum target factors of safety are NOT specified. Instead, the dam owner must demonstrate that the target stability criteria and selected factors of safety used in the design of a dam will meet a number of specified objectives (e.g. consistent with local industry and best practices, selected with oversight by independent qualified professionals, supported by a comprehensive risk management system, etc.). • Safety Directive (5.7 and 5.8) – Discusses seismic analysis – minimum criteria are NOT specified. Instead, dam owner must demonstrate that the structures are stable under the applicable design seismic loading conditions that are consistent with best practice and commensurate with the accepted consequence classification of the structure.		Yes	Yes	Outcome-based (presents general requirements, but specific acceptance criteria (e.g., target FoS) are not provided).
	Hydrotechnical		• Safety Directive (5.5) - Minimum inflow design floods are NOT specified. Instead, the dam design must be commensurate with the risk posed by the dam, and the best available technology and best available practices in hydraulic and hydrological science must be applied to estimate the inflow design flood and its characteristics.		Yes	Yes	Outcome-based (presents general requirements, but specific acceptance criteria (e.g., minimum inflow design floods (IDF)) are not provided).
	Closure		• Safety Directive (9.1, 9.2, 9.3, 9.4, 9.5) – Cessation/resumption of operations for more than 365 consecutive days. • Safety Directive (9.6, 9.7, 9.8, 9.9, 9.10, 9.11) – Decommissioning, closure and abandonment.		Yes	Yes	Prescriptive (specific requirements and acceptance criteria for cessation/resumption and closure planning).
Governance	Management systems / Operations and controls / Risk management	General	• Safety Directive (4.1, 4.2, 4.3, 4.4, 4.5) – Safety management plan is required for significant to extreme consequence structures. The dam owner must provide a copy of this plan when requested by the Director. • Safety Directive (5.17) – Construction completion report is to be submitted to the Director. • Safety Directive (5.15, 5.16) – Construction quality assurance plan (for high to extreme consequence structures) and quality control plan are to be submitted to the Director. • Safety Directive (8.1, 8.2) – Notifications of information change or safety incidents.				
		Accountability defined	• Accountability included in definition of Engineer of Record and Designer of Record (DoR) roles.		Yes	No	Prescriptive (sets out a specific listing of responsibilities).
		EoR	• Engineer of Record and Designer of Record roles and responsibilities defined but are not stated to be explicitly required.		Yes	No	Prescriptive (sets out a specific listing of responsibilities).
		TSF Responsible Person	• Roles and responsibilities are defined (but are not stated to be explicitly required) for the DoR, operations manager, safety manager, which are comparable in intent to TSF Responsible Person.		Yes	No	Prescriptive (role and responsibilities described in detail).
		ITRB	• ITRB is not included in the regulatory framework.		No	No	Not included in the regulatory framework.
		OMS manual	• Safety Directive (6.1, 6.2, 6.3) – Operations, Maintenance and Surveillance.		Yes	Yes	Prescriptive (specific requirements and acceptance criteria are provided).
		Pre-defined action plans	• Safety Directive (5.5) – Quantitative Performance Objectives are required if the design basis uses a performance-based approach.		Yes	Yes	Outcome-based (general requirements and acceptance criteria provided).
		Risk assessment	• Safety Directive (5.22) – Formal risk assessment is required to be conducted and submitted to the Director, whenever a critical safety deficiency is identified, or an established quantifiable performance objective is not met.		Yes	Yes	Outcome-based (general requirements and acceptance criteria provided).

Interpretative Summary						
Alberta's dam safety regulatory framework was updated in 2018 and is documented in the Alberta Dam and Canal Safety Directive (Directive; Dec. 2018). **The Directive presents requirements for dam safety management throughout its life cycle (i.e., design to closure) which are primarily performance or outcome based, with few prescriptive technical requirements.** **Safety criteria, such as stability, seepage, and seismic are required but minimum criteria (e.g., FoS, design earthquake, etc.) are not specified.**						
Regulatory Framework				**Simplified Criteria [1] Assessment**		
Comparison Category			**Reference**	**Provides guidance for safe design/ governance?**		**Specifically addresses TSF's?**
		Emergency response	• Safety Directive (7.1, 7.2, 7.3, 7.4) – Emergency management plan is required for significant to extreme consequence structures.	Yes	Yes	Prescriptive (specific requirements and acceptance criteria are provided).
	Environment and community		• Safety Directive (92.3) – Information required for Environmental Impact Assessment.			
	Documentation/auditing		• Safety Directive (1.4) – Retention of records. • Safety Directive (5.18) – Requirement to undertake assessments/evaluations for significant to extreme consequence structures. • Safety Directive (5.19) – Annual engineering inspection is to be submitted to the Director for significant to extreme consequence structures, unless annual performance review (5.20) or dam safety review (5.21) has been conducted during the previous 12 months. • Safety Directive (5.20) – Annual performance review is to be submitted to the Director for significant to extreme consequence structures. • Safety Directive (5.21) – Safety review is to be conducted and submitted to the Director, every 5 years for very high to extreme consequence structures, every 7 years for high consequence structures and every 10 years for significant consequence structures.			

Notes:
1. Refer to the four (4) criteria (hypothesis statements) presented in Section 3 (supported by Appendix I).
2. The definitions, description, and intent of the "General degree of flexibility" is provided within the first page of Section 4.1.

Table 4.3 Jurisdictional Summary – Quebec, Canada

Interpretative Summary							
Quebec's legal framework mainly regulates water retaining structures constructed on Quebec's hydrographic network. **Regulated dams are classified based on structural vulnerability and consequence of rupture and are subject to typical governance requirements such as operating manuals, emergency response plans and monitoring procedures.** **The framework for design and operation of tailings dams and waste dumps is provided as part of ministerial guidelines for mine operation and closure; these guidelines contain geotechnical, hydrotechnical and environmental criteria. Compliance with these guidelines may be required as part of a mine's existing operating permit or to obtain ministerial approval for new permits.** **In addition, under Quebec's Mines Act, all mines must submit a closure plan and obtain ministerial approval for the plan.**							
Regulatory Framework						**Simplified Criteria [1] Assessment**	
Comparison Category			**Reference**			**Provides guidance for safe design/ governance?**	**Specifically addresses TSF's?**
Legal Framework	Legislation/Act		• Dam Safety Act (November 2019). • Mining Act (December 2019). • Environmental Quality Act (December 2019). • None of the above-mentioned Acts note tailings storage facilities (TSFs).			Yes (Directive 019)	Yes
	Regulation		Dam Safety Regulations (October 2019). • Applies to dams on named waterways. • No mention of tailings facilities but is written in a general way to capture tailings and water dams.				
	Guideline		Directive 019 (March 2012): • Guidance document that is often used as a regulatory document during permitting processes. There is some grandfathering of TSF requirements – particularly for older closed facilities. Specifically discusses tailings facilities. Guidelines for Preparing Mine Closure Plans in Quebec (November 2017): • Guidance document to facilitate preparation of a mine closure plan including TSF's. • Under the Mining Act, the Ministry's approval of the mine closure plan is required to undertake mining operation or exploration.		Other Guidelines (Outside the Legal Framework): • CDA 2007 (2013 Update) • CDA 2014 Mining Bulletin		
						Addressed?	**Requirement?**	**General degree of flexibility [2]?**
Design	Dam break		• Dam Safety Regulations (Section 18) – Dam break is required. • Dam Safety Regulations (Section 10) – Inundation maps to be attached to the Emergency Plan.			Yes	Yes	Outcome-based (general requirements and acceptance criteria are provided; specific methods are not provided).
	Consequence classification		• Dam Safety Regulations (Section 10 to 19) – Classification system is based on the vulnerability of the dam as well as the consequences of failure (for dams that fall under the Dam Safety Act). • For "Directive 019" dams, classification is by the type of waste retained only (high or low risk tailings) – mostly affecting the Environmental Design Flood (EDF).			Yes	Yes	Prescriptive (specific assessment methods and acceptance criteria are provided).
	Geotechnical		• Guidelines for Preparing Mine Closure Plans in Quebec (Table 2) – FoS requirements. • Directive 019 (Section 2.9.3.1) - Minimum seismic design earthquake criteria: 1:2,475 AEP.			Yes	Yes	Prescriptive (specific assessment methods and acceptance criteria are provided; particularly seismic design criteria and minimum stability FoS).
	Hydrotechnical		• Directive 019 (Section 2.9.3.1) - EDF – 1:2,000 AEP (high risk tailings). • Directive 019 (Section 2.9.3.1) - EDF – 1:1,000 AEP (for low risk tailings). • Directive 019 (2.9.2.1) - Freeboard criteria – 1 m normal freeboard during the EDF • Dam Safety Regulations (Section 14) - Inflow Design Flood (IDF) requires a Probable Maximum Flood (PMF) capable spillway.			Yes	Yes	Prescriptive (specific flood criteria are provided, based on consequence classification).
	Closure		• Mining Act (Section 101) – must submit a closure plan. • Dam Safety Regulations (Section 1.1) – Consequence classification should be assigned according to CDA (2014) • Mine Closure Plan Guidelines (Table 2) - contains FoS requirements • Mine Closure Plan Guidelines (Section 4.6.1) – Minimum seismic criteria for long term water retaining structures (MCE). • Mine Closure Plan Guidelines (Section 4.6.1) – IDF for long term water retaining structures: PMF • Mine Closure Plan Guidelines (Section 9.1) – Post Closure stability monitoring and maintenance.			Yes	Yes	Outcome-based (limited guidance specific to tailings dams is provided).
Governance	Management systems / Operations and controls / Risk management	General	• Dam Safety Regulations (Section 30 to 32) – Impounded Water Management Plan.					
		Accountability defined	• Owner responsibilities are described.			Yes	No	Prescriptive (sets out a specific listing of responsibilities).
		EoR	• Not included in the regulatory framework.			No	No	Not included in the regulatory framework.
		TSF Responsible Person	• Not included in the regulatory framework.			No	No	Not included in the regulatory framework.
		ITRB	• Not included in the regulatory framework.			No	No	Not included in the regulatory framework.
		OMS manual	• Dam Safety Regulations (Section 41) – Minimum monitoring and surveillance requirements. • Dam Safety Regulations (Section 54) – Dam Safety Program covering OMS activities.			Yes	Yes	Outcome-based (general requirements and acceptance criteria are provided).
		Pre-defined action plans	• Not included in the regulatory framework.			No	No	Not included in the regulatory framework.
		Risk assessment	• Dam Safety Regulations (Section 9) – Dams must be classified by vulnerability (probability of failure) and consequence of failure.			Yes	Yes	Outcome-based (general requirements and acceptance criteria are provided).

Interpretative Summary						
Quebec's legal framework mainly regulates water retaining structures constructed on Quebec's hydrographic network. **Regulated dams are classified based on structural vulnerability and consequence of rupture and are subject to typical governance requirements such as operating manuals, emergency response plans and monitoring procedures.** **The framework for design and operation of tailings dams and waste dumps is provided as part of ministerial guidelines for mine operation and closure; these guidelines contain geotechnical, hydrotechnical and environmental criteria. Compliance with these guidelines may be required as part of a mine's existing operating permit or to obtain ministerial approval for new permits.** **In addition, under Quebec's Mines Act, all mines must submit a closure plan and obtain ministerial approval for the plan.**						
Regulatory Framework				**Simplified Criteria [1] Assessment**		
Comparison Category			**Reference**	**Provides guidance for safe design/ governance?**		**Specifically addresses TSF's?**
		Emergency response	• Dam Safety Regulations (Section 54) – Emergency Action Plan. • Dam Safety Regulations (Section 10) – Emergency Plan.	Yes	Yes	Outcome-based (general requirements and acceptance criteria are provided).
	Environment and community		Environment Quality Act: • Section 2.1.1 – Final effluent water quality parameters and monitoring frequency. • Section 2.3.2 – Groundwater water quality parameters and monitoring frequency. • Supported by Directive 019 (all sections).			
	Documentation/auditing		• Dam Safety Regulations (Section 36) - Training on ERP – Dam Safety Assurance (DSA) and DSR. • Dam Safety Regulations (Section 5) – required register of dams. • Dam Safety Regulations (Section 41) – DSI frequency. • Dam Safety Regulations (Section 48) – DSR frequency noted. • Dam Safety Regulations (Section 46) – Logbook of safety inspections, reviews and incidents.			

Notes:
1. Refer to the four (4) criteria (hypothesis statements) presented in Section 3 (supported by Appendix I).
2. The definitions, description and intent of the "General degree of flexibility" is provided within the first page of Section 4.1.

Table 4.4 Jurisdictional Summary – Montana, USA

Interpretative Summary						
The law of Montana is organized under the Montana Code Annotated (MCA). Mining is regulated under Title 82 of the MCA which specifically discusses tailings storage facilities (TSFs). Regulated TSFs are not classified based on consequences of failure; rather all TSFs are regulated equally and require design provision for the Maximum Credible Earthquake (MCE) and Probable Maximum Flood (PMF). All TSFs require a senior ranking agent hold ultimate responsibility and the formal declaration of an EoR. Typical governance requirements such as operating manuals, emergency response plans and monitoring procedures, and independent review are stipulated as well as detailed requirements for TSF design documents to be approved prior to permit issuance. One such permitting requirement is that the Independent Review Panel (panel) review and "agree" with the TSF design prior to permit issuance which could introduce an unintended level of liability on the panel. The panel is then disbanded and not maintained for annual oversight like in other jurisdictions. Overall, the MCA requirements are consistent with recognized international tailings management best practice guidelines and appear well organized and easy to interpret.						
Regulatory Framework				**Simplified Criteria [1] Assessment**		
Comparison Category			**Reference**	**Provides guidance for safe design/ governance?**		**Specifically addresses TSF's?**
Legal Framework	Legislation/Act		• Constitution of Montana – Article IX – Environment and Natural Resources – Section 1(3) and 2(1).	Yes (MCA)		Yes
	Regulation		Montana Code Annotated (MCA) 2019: • Title 82: Minerals, Oil, and Gas; Chapter 4: Reclamation; Part 3: Metal Mine Reclamation • Section 82-4-375 to 82-4-381 specifically discusses tailings storage facilities (dry stacks and filtered tailings are exempt).			
	Guideline		No specific guidelines referenced other than "current engineering best practices".			
				Addressed?	**Requirement?**	**General degree of flexibility [2]?**
Design	Dam break		• MCA (82-4-376-2n) - Dam breach analysis is required at permitting stage.	Yes	Yes	Outcome-based (general requirement provided only)
	Consequence classification		• No specific consequence classification scheme defined or reference. All TSFs are treated equally.	No	No	Not included in the regulatory framework (all TSF's treated equally).
	Geotechnical		• MCA (82-4-376) - Requires all TSFs to be designed to withstand the 1 in 10,000-year earthquake or maximum credible earthquake (MCE). • MCA (82-4-376) - Factor of Safety criteria is consistent with CDA (2014) criteria and specifically requires the use of undrained strength analysis.	Yes	Yes	Prescriptive (specific requirements and acceptance criteria are provided).
	Hydrotechnical		• MCA (82-4-376) - Requires all TSFs to be designed to store the probable maximum flood (PMF) above maximum operating level plus freeboard for wave action. • MCA (82-4-376) - Floods less than the PMF but still greater than the 1 in 500-year, 24-hour event are only acceptable with agreement from the ITRB.	Yes	Yes	Prescriptive (specific requirements and acceptance criteria are provided).
	Closure		• MCA (82-4-376) - Requires closure plan in design document with aim for maintenance free closure prior to permitting, including plans for post closure monitoring and retention of ITRB and EoR.	Yes	Yes	Outcome-based (general requirements and acceptance criteria are provided).
Governance	Management systems / Operations and controls / Risk management	General	• MCA (82-4-378) - Requires Construction Quality Assurance (CQA) to be provided by the EoR firm.			
		Accountability defined	• MCA (82-4-379) - Requires senior ranking agent at site level to hold ultimate responsibility for TSF.	Yes	Yes	Outcome-based (specific requirement noted, but roles and responsibilities not defined
		EoR	• MCA (82-4-375) - Required to have an external EoR (individual) with written acceptance of role, duties/qualifications are well defined and includes a duty to report safety issues.	Yes	Yes	Prescriptive (sets out a specific listing of responsibilities).
		TSF Responsible Person	• Not included in the regulatory framework.	No	No	Not included in the regulatory framework; however, ultimate responsibility for the dam is defined (refer to "Accountability defined" row).
		ITRB	• MCA (82-4-377) - Required to have an ITRB (must have at least 3 members approved by regulator); duties are well defined. ITRB is only to review the TSF design document for permit application.	Yes	Yes	Prescriptive (sets out a specific listing of responsibilities).
		OMS manual	• MCA (82-4-379) - Requires a TSF OMS Manual certified by the EoR prior to permitting. OMS Manual to be reviewed annually with updates certified by the EoR. Requirements appear consistent with MAC 2019 OMS Guide.	Yes	Yes	Prescriptive (specific requirements and acceptance criteria are provided).
		Pre-defined action plans	• MCA (82-4-379) – TSF OMS Manual includes pre-defined action plans.	Yes	Yes	Outcome-based (general requirements and acceptance criteria are provided).
		Risk assessment	• MCA (82-4-376-2n) - Requires a failure modes and effects analysis or other appropriate detailed risk assessment, and an observational method plan addressing residual risk.	Yes	Yes	Outcome-based (general requirements provided).
		Emergency response	• MCA (82-4-379) - Requires an emergency preparedness and response plan certified by the EoR and based on the failure modes and effects analysis or other appropriate risk assessment. To be reviewed annually with updates certified by the EoR.	Yes	Yes	Outcome-based (general requirements provided).
	Environment and community		• No specific mention of interaction with environment and communities other than design requirements to protect the public and the environment from harm.			
	Documentation/auditing		• MCA (82-4-375) - EoR Declaration and Reporting. • MCA (82-4-376) - TSF Design Documents. • MCA (82-4-377) - ITRB Summary Report for TSF Design Review. • MCA (82-4-379)- Required to have periodic review of TSF by panel similar to ITRB (same members recommended) at 5-year intervals. Duties/scope are well defined and mimic EGBC requirements for Dam Safety Reviews. • MCA (82-4-380) - 5-year Periodic Review Summary Reports • MCA (82-4-381) - Inspection Report by EoR.			

Notes:
1. Refer to the four (4) criteria (hypothesis statements) presented in Section 3 (supported by Appendix I).
2. The definitions, description, and intent of the "General degree of flexibility" is provided within the first page of Section 4.1.

Table 4.5 Jurisdictional Summary – Alaska, USA

Interpretative Summary						
The law in Alaska is organized under Alaska Statute Title 46 Chapter 17, and the Alaska Administrative Code (AAC) (Title 11, Chapter 93). Under the Statute, the Alaska Department of Natural Resources (ADNR) must employ an engineer to "supervise the safety of dams and reservoirs" in Alaska. The ADNR has developed the Alaska Dam Safety Program (ADSP) to oversee dam regulation in the state. The ADSP has developed a set of guidelines (ADNR 2017) with the stated objectives of the Guidelines is to "establish a consistent basis for communication between ADNR, dam owners, operators, and various other entities involved in the design, construction, operation and regulation of dams in Alaska". TSFs are only mentioned with respect to closure in the AAC; however, the Guidelines make it clear that TSFs fall under purview of ADSP and a chapter is devoted to them. The Guidelines require that stringent design criteria be adopted for TSFs, commensurate with the highest consequence classification outlined in the AAC. There is a strong emphasis in the Guidelines on exercising engineering judgment in these decisions.						
Regulatory Framework					**Simplified Criteria [1] Assessment**	
Comparison Category			**Reference**		**Provides guidance for safe design/ governance?**	**Specifically addresses TSF's?**
Legal Framework	Legislation/Act		• Statutes: "Supervision of Safety of Dams and Reservoirs" Alaska Statute 46.17		Yes (ACC/ANDR)	Yes
	Regulation		Alaska Administrative Code "Dam Safety" Title 11 AAC 93 Article 3 (Sections 151 to 201): • Tailings dams are mentioned in 11 AAC 93.171 – understood as described in the Guidelines (See below) that these regulations apply to TSFs in Alaska.			
	Guideline		Alaska Department of Natural Resources (ADNR) Dam Safety Department has prepared a set of guidelines: • "Guidelines for Cooperation with the Alaska Dam Safety Program – Draft Revision" – July 2017 – herein referred to as "the Guidelines".	Other Guidelines (Outside the Legal Framework): • None. Some guidelines are referenced for discrete technical guidance (e.g. FEMA, USACE)		
					Addressed?	**Requirement?**	**General degree of flexibility [2]?**
Design	Dam break		• 11 AAC 93.164 - Required for the Emergency Action Plan for Class I and Class II hazard classification dams.		Yes	Yes	Outcome-based (general requirements and acceptance criteria are provided; specific methods are not provided).
	Consequence classification		• 11 AAC 93.157 - Three categories for dams: Class I (high; probable Loss of Life); Class II (significant); Class III (low). • The Guidelines require that tailings dams be designed as if they were Class I dams; mine process and contact water dams designed as if they were Class II dams, at a minimum.		Yes	Yes	Outcome-based (general requirements and acceptance criteria are provided).
	Geotechnical		• 11 AAC.93.171 - General requirements (including structural stability analysis; seismic performance assessment, etc.) that must accompany an application for a new dam are described in the Statutes. No prescriptive values are given for earthquake return periods, FOS, etc. • Minimum design FOS are not specified in the regulations or the Guidelines. Guidelines discuss FOS and require design engineer to exercise judgment; prescriptive values are not given. • The Guidelines provide guidance on appropriate earthquake design ground motions (return periods) to select based on the dam consequence classification.		Yes	Yes	Outcome-based (presents general requirements, but specific acceptance criteria (e.g., target FoS) are not provided).
	Hydrotechnical		• 11 1AAC 93.195 - Outlines what is required in the design reports. An IDF must be defined, the spillway must be designed to route the IDF, and the magnitude of the IDF must be linked to the dam hazard classification. • The Federal Emergency Management Agency's (FEMA) Federal Guidelines for Dam Safety - Selecting and Accommodating Inflow Design Floods for Dams (FEMA 94) are mentioned as a reference for guiding selection of IDF. • The Guidelines summarize the FEMA reference which mentions return period events for IDF: (100-yr appropriate for Class III dams; maximum standard for dams of any consequence classification is PMF; other standards could be applied depending on incremental hazard evaluation). • The Guidelines mention that TSFs may be designed without spillways, and stresses importance of a detailed water balance.		Yes	Yes	Outcome-based (presents general requirements, but specific acceptance criteria (e.g. design flood) are not provided; min./max. standards are provided).
	Closure		• 11 AAC 93.172 - Requires an application be submitted for closure that is in effect the detailed closure design/plan. • 11 AAC 93.172(6) - Requires a description of TSF failure modes during closure; description of expected long-term performance (e.g. tailings consolidation; seepage rates; drain down, etc.); financial assurance adequate to provide sufficient money to pay for post-closure monitoring, operations, maintenance and inspection. • 11 AAC 93.172 - Requires a failure modes review be carried out for TSFs as part of closure planning • The Guidelines require that the TSF be "designed" for closure and provides details on expectations and considerations.		Yes	Yes	Outcome-based (general requirements and acceptance criteria are provided).
Governance	Management systems / Operations and controls / Risk management	General	• The Guidelines - Annual water and tailings management plan • 11.AAC.93.177 - Incident reporting				
		Accountability defined	Guidelines - Owner: ultimately responsible for the safety of the dam.		Yes	Yes	Outcome-based (role requirement noted, but roles and responsibilities not defined. Owner has ultimate responsibility for the dam).
		EoR	Guidelines - Engineers of Record and Other Professionals: responsible for aspects of the design		Yes	Yes	Prescriptive (sets out responsibilities within the various dam safety functions).
		TSF Responsible Person	The Guidelines request that the Owner designate an employee as individual responsible for serving as a Technical Services Team Manager who leads all aspects of the tailings management system at the mine		Yes	No	Outcome-based (equivalent role requirement noted)
		ITRB	Guidelines - ITRB: recommended for TSFs; ITRB reports to be provided to ADNR		Yes	No	Outcome-based (general guidance provided).
		OMS manual	• 11 AAC 93.197 - Owner must prepare an OMS Manual • The Guidelines provide details on training programs to be included in the OMS program		Yes	Yes	Prescriptive (specific requirements and acceptance criteria are provided).
		Pre-defined action plans	• The Guidelines – OMS Manual should have procedures for when significant changes or unusual conditions occur (essentially TARPs).		Yes	No	Outcome-based (general guidance provided).
		Risk assessment	• The Guidelines require that a failure modes assessment be carried out for dam hazard consequence assessment. • 11 AAC 93.172 - Requires a failure modes review be carried out for TSFs as part of closure planning.		Yes	Yes	Outcome-based (general guidance provided).

Interpretative Summary						
The law in Alaska is organized under Alaska Statute Title 46 Chapter 17, and the Alaska Administrative Code (AAC) (Title 11, Chapter 93). Under the Statute, the Alaska Department of Natural Resources (ADNR) must employ an engineer to "supervise the safety of dams and reservoirs" in Alaska. The ADNR has developed the Alaska Dam Safety Program (ADSP) to oversee dam regulation in the state. The ADSP has developed a set of guidelines (ADNR 2017) with the stated objectives of the Guidelines is to "establish a consistent basis for communication between ADNR, dam owners, operators, and various other entities involved in the design, construction, operation and regulation of dams in Alaska". TSFs are only mentioned with respect to closure in the AAC; however, the Guidelines make it clear that TSFs fall under purview of ADSP and a chapter is devoted to them. The Guidelines require that stringent design criteria be adopted for TSFs, commensurate with the highest consequence classification outlined in the AAC. There is a strong emphasis in the Guidelines on exercising engineering judgment in these decisions.						
Regulatory Framework				**Simplified Criteria [1] Assessment**		
Comparison Category			**Reference**	**Provides guidance for safe design/ governance?**		**Specifically addresses TSF's?**
		Emergency response	• 11 AAC 93.164 - Owner must prepare an Emergency Action Plan (EAP) and update it at least annually for Class I and Class II dams. • EAP must be exercised. The Guidelines provide details on the scope of these exercises.	Yes	Yes	Outcome-based (general requirements provided).
	Environment and community		• Not mentioned.			
	Documentation/auditing		• 11 AAC 93.159 - Safety inspection reports every 3-years • 11.AAC.93.171 - Design, construction, and as-built packages • 11 AAC 93.193 - Design, construction and inspection documents must be sealed by engineer with > 5 years of experience and sufficient work experience. • The Guidelines: Annual safety inspection reports required for TSFs; Annual instrumentation report			

Notes:
1. Refer to the four (4) criteria (hypothesis statements) presented in Section 3 (supported by Appendix I).
2. The definitions, description and intent of the "General degree of flexibility" is provided within the first page of Section 4.1.

Table 4.6 Jurisdictional Summary – New South Wales, Australia

Interpretative Summary						
New South Wales (NSW) is considered a leading regulatory framework in Australia. The regulations generally follow ANCOLD, though ANCOLD is not explicitly referenced. The NSW dam safety regulatory framework generally uses an outcome-based approach with a few select prescriptive elements. The dam safety methodology generally follows from an assessment of the societal/individual risk rating and consequence categorization.						
Regulatory Framework					**Simplified Criteria [1] Assessment**	
Comparison Category			**Reference**		**Provides guidance for safe design/ governance?**	**Specifically addresses TSF's?**
Legal Framework	Legislation/Act		• Dam Safety Act (2015). • Mining Act (1992). • No mention of tailings facilities.		Yes (Regulations/NSW Gazette 094)	Yes
	Regulation		The Dam Safety Regulations (2019): • regulate "declared dams" which are dams that are currently or will become more than 15 m in height or would result in a major or catastrophic level of severity of damage or loss in a dam failure either currently or in the future. • No mention of tailings facilities but is written in a general way to capture tailings and water dams.			
	Guideline		• NSW Gazette 094 (2019). • Covers risk and consequence of tailings facilities.	Other Guidelines (Outside of the Legal Framework): • ANCOLD 2019.		
					Addressed?	Requirement?	General degree of flexibility [2]?
Design	Dam break		• Dam Safety Regulations (Clause 7) – Dam break is required. • Dam Safety Regulations (Clause 35) – Inundation maps to be attached to the Emergency Plan		Yes	Yes	Prescriptive (specific assessment methods and acceptance criteria are provided).
	Consequence classification		• Dam Safety Regulations (Clause 7) – Must be updated at least once every 15 years. • Consequence categorization methodology based on NSW Gazette 094 (informed by ANCOLD).		Yes	Yes	Prescriptive (specific assessment methods and acceptance criteria are provided).
	Geotechnical		• Not in regulation, informed by ANCOLD.		No	No	Not included in the regulatory framework.
	Hydrotechnical		• Not in regulation, informed by ANCOLD.		No	No	Not included in the regulatory framework.
	Closure		• Not in regulation, informed by ANCOLD.		No	No	Not included in the regulatory framework.
Governance	Management systems / Operations and controls / Risk management	General	• Dam Safety Regulations (Clauses 13 and 19) – Duty to report safety issues. • Dam Safety Regulations (Clause 12) – Dam Safety Management System.				
		Accountability defined	• No accountability definition in regulation.		No	No	Not included in the regulatory framework.
		EoR	• No EoR requirement in regulation.		No	No	Not included in the regulatory framework.
		TSF Responsible Person	• Dam Safety Regulations (Clause 24) – Competent person must check work involving dam design.		Yes	Yes	Prescriptive (sets out a specific listing of responsibilities).
		ITRB	• No ITRB requirement in regulation.		No	No	Not included in the regulatory framework.
		OMS manual	• NSW Gazette 094 - Operations and maintenance plans to include (NSW 2019, Section 9) – operating procedures and controls for "normal, abnormal and extreme loading operation conditions", details of event triggers and response and reporting protocols, corrective and preventative maintenance, incident reporting and public safety. • Dam Safety Regulations (Clause 9) – Operations and Maintenance Plans		Yes	Yes	Prescriptive (specific requirements and acceptance criteria are provided).
		Pre-defined action plans	• NSW Gazette 094 - Operations and maintenance plans to include (NSW 2019, Section 9) – operating procedures and controls for "normal, abnormal and extreme loading operation conditions", details of event triggers and response and reporting protocols, corrective and preventative maintenance, incident reporting and public safety.		Yes	Yes	Outcome-based (general guidance provided).
		Risk assessment	• Dam Safety Regulations (Clause 14) – Risk management framework.		Yes	Yes	Prescriptive (specific requirements and acceptance criteria are provided for the risk management framework).
		Emergency response	• Dam Safety Regulations (Clause 10) – Emergency plans must include description of failure modes and impacts (for high and extreme consequence), emergency exercises to be conducted.		Yes	Yes	Prescriptive (specific requirements and acceptance criteria are provided).
	Environment and community		• Dam Safety Regulations (Clauses 15) – Assessment of societal and individual risk rating. • Environmental components not in regulations, informed by ANCOLD.				
	Documentation/auditing		• Dam Safety Regulations (Clauses 13 and 19) – Duty to report safety issues. • Dam Safety Regulations specify the following are required: Annual report on compliance with dam safety standards, reports and records, OMS (annual updates, or every five years for low or very low consequence), EPRP, compliance notices and other general documents. • Clause 27 – All records must be kept. Audits and reviews of dam safety management system must be done.				

Notes:

1.Refer to the four (4) criteria (hypothesis statements) presented in Section 3 (supported by Appendix I).
2.The definitions, description and intent of the "General degree of flexibility" is provided within the first page of Section 4.1.

Table 4.7 Jurisdictional Summary – Peru

Interpretative Summary						
The regulations in Peru and the associated guidelines are prescriptive and generally related to design, construction, operation, and closure. Most are focused on the environmental law and require "guarantees" or "assurance" of physical and chemical stability as "technical requirements." This includes studies before and during operation, the need "to avoid failure" under seismic, liquefaction, and large-deformations, measures to avoid spillage and manage ARD, contact vs. non-contact water, air and water pollution, and groundwater from an established water balance. The regulations mention the life cycles of the dams as per international regulations but are ambiguous to establish a similar framework to other regulations. The governmental structure and responsibility are sometimes unclear due to the number of documents.						
Regulatory Framework				**Simplified Criteria [1] Assessment**		
Comparison Category			**Reference**	**Provides guidance for safe design/ governance?**		**Specifically addresses TSF's?**
Legal Framework	Legislation/Act		• Law 28611: Ley General del Ambiente [General Law of the Environment] (2005) • Law 28090: Ley regula cierre de minas [Regulatory Law for Mine Closure] (2003) • DS-014-92-EM: Ley General de Minería [General Mining Law] (1992)	Yes (Guide for the management of mining tailings)		Yes
	Regulation		• DS-018-92-EM: Reglamento de Procedimientos Mineros [Mining Procedures Regulation] (1992) • DS-040-2014-EM: Reglamento de protección y gestión ambiental para las actividades de explotación, beneficio, labor general, transporte y almacenamiento minero [Environmental Protection and Management Regulations for Mining Activities, Beneficiation, General Labor, Transportation and Storage] (2014) • DS-010-2010-MINAM: Límites Máximos Permisibles para la descarga de efluentes líquidos de Actividades Minero – Metalúrgicas [Maximum Allowable Limits for the discharge of liquid effluents from Mining – Metallurgical Activities] (2010) • DS-33-2005-EM: Reglamento para el cierre de minas [Regulations for the Closure of Mines] (2003) • DS-014-2017-MINAM: Aprueban Reglamento del Decreto Legislativo N° 1278, Decreto Legislativo que aprueba la Ley de Gestión Integral de Residuos Sólidos [Approved Decree Regulation Legislative No. 1278, Legislative Decree that Approves the Law of Integral Management of Solid Waste] (2017). • DS-014-2017-MINAM does not specifically mention tailings facilities but is applicable to them. • DS-024-2016: Aprueban Reglamento de Seguridad y Salud Ocupacional en Minería [Approved Regulations for Occupational Health and Safety in Mining] (2016). • DS-023-2017: Modifican diversos artículos y anexos del Reglamento de Seguridad y Salud Ocupacional en Minería, aprobado por Decreto Supremo Nº 024-2016-EM [Modifications to various articles and annexes of the Health and Safety Regulations Occupational in Mining, approved by Supreme Decree No. 024-2016-EM] (2017).			
	Guideline		• RD-035-95-EM/DGAA – EIA: Guías ambientales para la elaboración de EIAs [Environmental Guidelines for the Preparation of EIAs] (1995). • RD-019-97-EM/DGAA: Guía para el Manejo de relaves mineros [Guide for the Management of Mining Tailings] • DGAAM-MINEM, 2006: Guía para la elaboración de planes de cierre de minas [Guide for the Preparation of Mine Closure Plans] • MINEM, 2000: Guía de Fiscalización Ambiental [Environmental Control Guide] (2000). • Other Guidelines (outside of the Legal Framework) (refer to Note 3)			
				Addressed?	**Requirement?**	**General degree of flexibility [2]?**
Design	Dam break		• Does not appear to be included in the regulatory framework.	No	No	Not included in the regulatory framework.
	Consequence classification		• DS-014-2017-MINAM (Appendix 2) – Environmental consequence classification, not specific to tailings facilities. • DS-040-2014-EM (Article 126 and Terms of Reference) – Requires environmental consequence classification	Yes	Yes	Prescriptive (specific assessment methods and acceptance criteria are provided).
	Geotechnical		• DS-014-2017-MINAM (Chapter 2. Article 15 Item g) – Geotechnical studies must be conducted (requirements and criteria are not provided). Documents such as the Guide - Slope Stability of Solid Residue from Mining Activities (1998) are typically followed, though they are not referenced by the regulation. • DS-040-2014 (Chapter 3. Article 77, Article 26, and Article 41.O. Item I.2) - Está prohibida la construcción de presas de relave con el método aguas arriba. [The construction of tailings dams with the upstream method is prohibited.] • RD 440-96-EM/DGM and RD 224-97-EM/DGM – Specify that tailings deposits should be evaluated under static, pseudostatic, and long-term seismic stability conditions, as well as for 500-year floods for tailings placed in a creek crossing. These regulations also specify that the corrective actions to guarantee their stability should be carried out. The frequency of these assessments is not specified.	Yes	Yes	Outcome-based (presents general requirements, but specific acceptance criteria (e.g., target FoS) are not provided)).
	Hydrotechnical		• DS-014-2017-MINAM (Chapter 2. Article 15. Item g)– Hydrotechnical studies must be conducted (requirements and criteria are not provided). • DS-010-2010-MINAM - Maximum allowable limits for the discharge of liquid effluents from mining – metallurgical activities.	Yes	Yes	Outcome-based (presents general requirements, but specific acceptance criteria (e.g. design flood) are not provided).
	Closure		• Law 28090 – Ley regula cierre de minas [Regulatory Law for Mine Closure] • DS-33-2005-EM - Reglamento para el cierre de minas [Regulations for the Closure of Mines] (2003) • DS-040-2014-EM (Title 4, Chapter 1, Article 37) – Discusses closure plans referencing DS-33-2005-EM. • DGAAM-MINEM, 2006 - Guía para la elaboración de planes de cierre de minas [Guide for the Preparation of Mine Closure Plans]	Yes	Yes	Prescriptive (general requirements and acceptance criteria are provided)
Governance	Management systems / Operations and controls / Risk management	General				
		Accountability defined	• No accountability definition in regulation.	No	No	Not included in the regulatory framework.
		EoR	• No EoR requirement in regulation.	No	No	Not included in the regulatory framework.
		TSF Responsible Person	• DS-014-2017-MINAM (Article 89.2(d) and 89.3(c))- Qualified Person defined and required.	Yes	Yes	Outcome-based (role requirement noted, but responsibilities not defined).
		ITRB	• No ITRB requirement in regulation.	No	No	Not included in the regulatory framework.
		OMS manual	• DS-040-2014-EM (Article 153) – States staff should be trained in the plans (emergency response plan, environmental management plan, etc.) relevant to their roles. • DS-014-2017-MINAM (Article 99(e)) – Operation manual is required (criteria and requirements not stated). • DS-024-2016-EM and DS-023-2017-EM - Regulations for mining occupational health and safety programs.	Yes	Yes	Outcome-based (general requirements provided).

Interpretative Summary						
The regulations in Peru and the associated guidelines are prescriptive and generally related to design, construction, operation, and closure. Most are focused on the environmental law and require "guarantees" or "assurance" of physical and chemical stability as "technical requirements." This includes studies before and during operation, the need "to avoid failure" under seismic, liquefaction, and large-deformations, measures to avoid spillage and manage ARD, contact vs. non-contact water, air and water pollution, and groundwater from an established water balance. The regulations mention the life cycles of the dams as per international regulations but are ambiguous to establish a similar framework to other regulations. The governmental structure and responsibility are sometimes unclear due to the number of documents.						
Regulatory Framework				**Simplified Criteria [1] Assessment**		
Comparison Category			**Reference**	**Provides guidance for safe design/ governance?**		**Specifically addresses TSF's?**
		Pre-defined action plans	• No pre-defined action plans in regulations.	No	No	Not included in the regulatory framework.
		Risk assessment	• DS-040-2014-EM (Article 50 and 90) – Risk assessment is required for the emergency response plan. Environmental risk must be managed accordingly. • DS-014-2017-MINAM (Article 15(f)) – A Disaster Risk Assessment Report must be prepared by a professional registered in the National Registry of Evaluators of Risk administered by the National Center of Estimation, Prevention and Reduction of the Risk of Disasters (CENEPRED).	Yes	Yes	Outcome-based (general requirements provided)
		Emergency response	• DS-040-2014-EM (Article 50) – Emergency response plan must be developed with input from the risk assessment and alert levels.	Yes	Yes	Outcome-based (general requirements provided)
	Environment and community		• DS-040-2014-EM (Title 4) – Details environmental studies to be conducted. • MINEM, 2000 – Provides guidance on environmental control measures.			
	Documentation/auditing		• DS-024-2016-EM and DS-023-2017-EM – Regulations containing documentation requirements (annual mining report, emergency preparedness and response plan, occupational health and safety program, etc.). • DS-014-2017-MINAM (Article 90) – Dam register requirement. • MINEM 2000 – Provides guidance for reducing environmental impacts of mining operations, including recommended documentation.			

Notes:

1. Refer to the four (4) criteria (hypothesis statements) presented in Section 3 (supported by Appendix I).
2. The definitions, description and intent of the "General degree of flexibility" is provided within the first page of Section 4.1.
3. Other guidelines:
   Protocol - Monitoring of Air Quality and Emissions, Monitoring of Water Quality Guide - Water Management in Mine Operations, Acid Rock Drainage Management (1995), Environmental Impact Study (1995), Environmental Management Program and Modifications (1995), Guide - Tailings Management (1995), Revegetation of Disturbed Areas by Mining Activities (1995), Closure and Abandonment of Mines (1996) (outdated and withdrawn), Leaching Pad Environmental Projects, Mining Exploration in Peru (1995) (outdated and withdrawn), Drilling and Blasting Operations in Mining , Guide - Cyanide Management, Guide - Chemical and Reactive Products Management, Guide - Noise Management, Slope Stability of Solid Residue from Mining Activities (1998), Non-metal Mining Management, Ore Management and Transport, Environmental Inspections, Mine Closure, Air Quality Impacts, Water Quality Impacts, Cover Design for Mine Residues , Underground Tunnel Plug Design, Stability of Crown Pillars, Closure Plans for Passive Mine Components, Uranium Workers and Environment Protection, Environmental Classification, Formulation of Environmental Impact Statement, Preparing Semi-detailed Environmental Impact Studies, Development of an Environmental Adaptation and Management Program, Terms of Reference for Semi-Detailed Environmental Impact Studies, Community Relations Guide

Table 4.8 Jurisdictional Summary – Brazil

Interpretative Summary						
In Brazil, mining dams are governed within their regulation if they are ≥ 15 m high; have a total fluid storage capacity ≥ 3 million m^3; and/or store hazardous waste (according to applicable technical standards). Following the Fundao Dam failure, the Brazilian mine tailings dam regulator, the National Mining Agency, published Ordinance No. 70,389 which established requirements for periodic dam safety reviews, as well as, revisions to the National Mining Dams registry, the tailings dam classification criteria, and emergency action plan requirements. In February 2019, Brazil issued "Resolution No. 4" in response to the Feijao failure. Resolution No. 4 provided stability design criteria guidance and prohibited the construction of mining dams by the upstream construction method in Brazil.						
Regulatory Framework				**Simplified Criteria (1) Assessment**		
Comparison Category			**Reference**	**Provides guidance for safe design/ governance?**		**Specifically addresses TSF's?**
Legal Framework	Legislation/Act		• Mining Code (1967). • Federal Law No. 12,334 (Sept. 2010); established Dam National Safety Policy (PNSB).	Yes (Guide for the management of mining tailings)		Yes
	Regulation		• Federal Law 9406 (2018) – replaced Mining Regulation (1968). • Ordinance No. 70.389 (May 2017).			
	Guideline		• Norma Brasileira [Brazilian Standard] - ABNT NBR 13028 (Nov. 2017): Mineracao – Elaboracao e apresentacao de projeto de barragens para diposicao de rejeitos, contencao de sedimentos e reservacao de agua – Requisitos [Mining - Elaboration and presentation of dams project for waste disposal, sediment containment and water reserve – Requirements] • Diario Oficial Da Uniao - Resolution No. 4 (Feb. 2019):			
				Addressed?	**Requirement?**	**General degree of flexibility (2)?**
Design Standards	Dam break		• Ordinance No. 70.389 - Indicates that flood study maps need to be prepared by qualified personnel.	Yes	Yes	Outcome-based (general requirements and acceptance criteria are provided; specific methods are not provided).
	Consequence classification		• Ordinance No. 70.389 - Documents the dam classification system, which includes a classification matrix that comprises a risk category (CRI) and associated potential damage (DPA). The CRI number is derived based on the facility characteristics, performance and safety plans. The DPA number scores the potential consequences of an unwanted event. Classifications of "A" (highest hazard) to "E" (lowest hazard) are derived from the selected CRI and DPA scores.	Yes	Yes	Prescriptive (specific assessment methods and acceptance criteria are provided).
	Geotechnical		• ABNT NBR 13028 (Table 1) - Minimum Factors of Safety (FoS) set for Mining Dams: ○ End of Construction: FoS ≥ 1.3 ○ Normal operating condition with steady state seepage and normal reservoir level: FoS ≥ 1.5 ○ Maximum operating level and seepage level: FoS ≥ 1.3 ○ Rapid drawdown of the reservoir: FoS ≥ 1.1 ○ Normal operating condition with steady state seepage: Downstream FoS ≥ 1.5; Between berms FoS ≥ 1.3 ○ Seismic loading with maximum reservoir level: FoS ≥ 1.1 (this has been interpreted as pertaining to pseudostatic FoS) • ABNT NBR 13028 - *"Minimum FoS to be determined by deterministic stability analyses and should consider loading conditions, drained and undrained, for each material. For undrained loading conditions, stability analyses may be carried out in terms of total stresses, utilizing undrained shear strength, or in terms of effective stresses, utilizing effective shear strength parameters and estimated pore pressures…In stability analyses using undrained strength parameters, the minimum safety factors should be established by the designer, based on good engineering practices."* • A minimum FoS for post-liquefied conditions is not included in regulations. • Diario Oficial Da Uniao - Resolution No. 4 (Feb. 2019): banned upstream tailings dams. Was in response to Feijao failure. This document also included further guidance on minimum FoS: "*The FoS should not be below 1.3 for soils that are susceptible to liquefaction and considering undrained strength.*" • ABNT NBR 13028 - Earthquake criteria: 1/475-year return period seismic event	Yes	Yes	Prescriptive (specific requirements and acceptance criteria are provided).
	Hydrotechnical		• Ordnance 70.389 - Lists hydrotechnical study structure • ABNT NBR 13028 – Lists hydrotechnical design criteria	Yes	Yes	Prescriptive (specific requirements and acceptance criteria are provided).
	Closure		• Ordnance 70.389 – Must submit a closure document prepared by a legally qualified professional to be removed from the Sistema Integrado de Gestão de Segurança de Barragens de Mineração (SIGBM) dam register • No other closure design/planning appears to be included in regulations.	No	No	Not included in the regulatory framework.
Governance	Management systems / Operations and controls / Risk management	General	• Ordnance 70.389 – Dams will be registered by the owner into the SIGBM dam register to be integrated into the National Registry of Mining Dams • Ordnance 70.389 - Required to maintain as-built documentation.			
		Accountability defined	• Does not appear to be included in the regulatory framework	No	No	No accountability definition in regulations.
		EoR	• Does not appear to be included in the regulatory framework	No	No	No EoR definition in regulations.
		TSF Responsible Person	• Does not appear to be included in the regulatory framework	No	No	No Responsible Person definition in regulations.
		ITRB	• Does not appear to be included in the regulatory framework	No	No	No ITRB definition in regulations.

Interpretative Summary						
In Brazil, mining dams are governed within their regulation if they are ≥ 15 m high; have a total fluid storage capacity ≥ 3 million m^3; and/or store hazardous waste (according to applicable technical standards). Following the Fundao Dam failure, the Brazilian mine tailings dam regulator, the National Mining Agency, published Ordinance No. 70,389 which established requirements for periodic dam safety reviews, as well as, revisions to the National Mining Dams registry, the tailings dam classification criteria, and emergency action plan requirements. In February 2019, Brazil issued "Resolution No. 4" in response to the Feijao failure. Resolution No. 4 provided stability design criteria guidance and prohibited the construction of mining dams by the upstream construction method in Brazil.						
Regulatory Framework				**Simplified Criteria [1] Assessment**		
Comparison Category			**Reference**	**Provides guidance for safe design/ governance?**		**Specifically addresses TSF's?**
		OMS manual	• Ordnance 70.389 - Requirements for real-time dam instrumentation monitoring, including video surveillance. • Ordnance 70.389 – Internal training should occur at least every six months	No	No	The development of an OMS manual does not appear to be included in the regulatory framework. Surveillance measures (such as real-time instrumentation and video monitoring) are included in the regulatory framework and are a requirement. These are prescriptive (specific requirements are provided).
		Pre-defined action plans	• Ordnance 70.389 - Required to define and implement instrumentation alert and response (action) plans.	Yes	Yes	Outcome-based (general requirements are provided).
		Risk assessment	• Ordnance 70.389 - Risk management is built into the dam classification system. • ABNT NBR 13028 – Requires a risk analysis	Yes	Yes	Prescriptive (specific requirements are provided).
		Emergency response	• Ordnance 70.389 - Emergency Action Planning is required based on the dam classification (DPA score). • Ordnance 70.389 - Based on the classification and inundation maps, a self-rescue zone (ZAS) and secondary security zone (ZSS) is delineated.	Yes	Yes	Prescriptive (specific requirements are provided).
	Environment and community		• Ordnance 70.389 – Environmental impacts considered in dam classification system • Ordnance 70.389 – An alarm system must be installed in communities within the dam inundation zone			
	Documentation/auditing		• Ordnance 70.389 – Dams will be registered by the owner into the SIGBM dam register to be integrated into the National Registry of Mining Dams • Ordinance 70.389 - Periodic Dam Safety Review requirements are specified, with frequencies that depend on the DPA dam classification rating. • Ordnance 70.389 - Semi-annual audits required (first half can be internal; second half by third party). • Ordnance 70.389 - Required to maintain as-built documentation.			

Notes:

1. Refer to the four (4) criteria (hypothesis statements) presented in Section 3 (supported by Appendix I).
2. The definitions, description and intent of the "General degree of flexibility" is provided within the first page of Section 4.1.

4.2 Comparison Summary

Table 4.9 presents a summary of the data from Tables 4.1 to 4.8 (i.e., jurisdiction summary tables) to support a high-level comparison of the regulatory frameworks. The Legal Framework is not discussed further in Table 4.9.

Table 4.9 Jurisdiction Comparison Summary Table

Comparison Category		Jurisdictions	Simplified Criteria Assessment		
			Addressed in regulations? (Yes = ✓ No = ✗)	Regulatory requirement? (Yes = ✓ No = ✗)	General degree of flexibility? (Outcome-based = O Prescriptive = P)
Design	Dam break	British Columbia, Canada	✓	✓	O
		Alberta, Canada	✓	✓	P
		Quebec, Canada	✓	✓	O
		Montana, USA	✓	✓	O
		Alaska, USA	✓	✓	O
		New South Wales, Australia	✓	✓	P
		Peru	✗	✗	N/A
		Brazil	✓	✓	O
	Consequence Classification	British Columbia, Canada	✓	✓	O
		Alberta, Canada	✓	✓	O
		Quebec, Canada	✓	✓	P
		Montana, USA	✗	✗	N/A
		Alaska, USA	✓	✓	O
		New South Wales, Australia	✓	✓	P
		Peru	✓	✓	P
		Brazil	✓	✓	P
	Geotechnical	British Columbia, Canada	✓	✓	P
		Alberta, Canada	✓	✓	O
		Quebec, Canada	✓	✓	P
		Montana, USA	✓	✓	P
		Alaska, USA	✓	✓	O
		New South Wales, Australia	✗	✗	N/A
		Peru	✓	✓	O
		Brazil	✓	✓	P
	Hydrotechnical	British Columbia, Canada	✓	✓	P
		Alberta, Canada	✓	✓	O
		Quebec, Canada	✓	✓	P
		Montana, USA	✓	✓	P
		Alaska, USA	✓	✓	O
		New South Wales, Australia	✗	✗	N/A
		Peru	✓	✓	O
		Brazil	✓	✓	P

Comparison Category			Jurisdictions	Simplified Criteria Assessment		
				Addressed in regulations? (Yes = ✓ No = ✗)	Regulatory requirement? (Yes = ✓ No = ✗)	General degree of flexibility? (Outcome-based = O Prescriptive = P)
Design	Closure		British Columbia, Canada	✓	✓	O
			Alberta, Canada	✓	✓	P
			Quebec, Canada	✓	✓	O
			Montana, USA	✓	✓	O
			Alaska, USA	✓	✓	O
			New South Wales, Australia	✗	✗	N/A
			Peru	✓	✓	P
			Brazil	✗	✗	N/A
Governance	Management systems/ Operations and controls/ Risk management	Accountability defined	British Columbia, Canada	✓	✓	P
			Alberta, Canada	✓	✗	P
			Quebec, Canada	✓	✗	P
			Montana, USA	✓	✓	O
			Alaska, USA	✓	✓	O
			New South Wales, Australia	✗	✗	N/A
			Peru	✗	✗	N/A
			Brazil	✗	✗	N/A
		EoR	British Columbia, Canada	✓	✓	P
			Alberta, Canada	✓	✗	P
			Quebec, Canada	✗	✗	N/A
			Montana, USA	✓	✓	P
			Alaska, USA	✓	✓	P
			New South Wales, Australia	✗	✗	N/A
			Peru	✗	✗	N/A
			Brazil	✗	✗	N/A
		TSF Responsible Person	British Columbia, Canada	✓	✓	O
			Alberta, Canada	✓	✗	P
			Quebec, Canada	✗	✗	N/A
			Montana, USA	✗	✗	N/A
			Alaska, USA	✓	✗	O
			New South Wales, Australia	✓	✓	P
			Peru	✓	✓	O
			Brazil	✗	✗	N/A
		ITRB	British Columbia, Canada	✓	✓	P
			Alberta, Canada	✗	✗	N/A
			Quebec, Canada	✗	✗	N/A
			Montana, USA	✓	✓	P
			Alaska, USA	✓	✗	O
			New South Wales, Australia	✗	✗	N/A
			Peru	✗	✗	N/A
			Brazil	✗	✗	N/A

Comparison Category			Jurisdictions	Simplified Criteria Assessment		
				Addressed in regulations? (Yes = ✓ No = ✗)	Regulatory requirement? (Yes = ✓ No = ✗)	General degree of flexibility? (Outcome-based = O Prescriptive = P)
Governance	Management systems/ Operations and controls/ Risk management	OMS manual	British Columbia, Canada	✓	✓	P
			Alberta, Canada	✓	✓	P
			Quebec, Canada	✓	✓	O
			Montana, USA	✓	✓	P
			Alaska, USA	✓	✓	P
			New South Wales, Australia	✓	✓	P
			Peru	✓	✓	O
			Brazil	✗	✗	N/A
		Pre-defined action plans	British Columbia, Canada	✓	✓	O
			Alberta, Canada	✓	✓	O
			Quebec, Canada	✗	✗	N/A
			Montana, USA	✓	✓	O
			Alaska, USA	✓	✗	O
			New South Wales, Australia	✓	✓	O
			Peru	✗	✗	N/A
			Brazil	✓	✓	O
		Risk assessment	British Columbia, Canada	✓	✓	O
			Alberta, Canada	✓	✓	O
			Quebec, Canada	✓	✓	O
			Montana, USA	✓	✓	O
			Alaska, USA	✓	✓	O
			New South Wales, Australia	✓	✓	P
			Peru	✓	✓	O
			Brazil	✓	✓	P
		Emergency response	British Columbia, Canada	✓	✓	P
			Alberta, Canada	✓	✓	P
			Quebec, Canada	✓	✓	O
			Montana, USA	✓	✓	O
			Alaska, USA	✓	✓	O
			New South Wales, Australia	✓	✓	P
			Peru	✓	✓	O
			Brazil	✓	✓	P

5 ANALYSIS AND POTENTIAL CODE IMPROVEMENTS

A TSF regulatory framework should provide clear, effective and appropriately flexible processes and methods (i.e., legal framework) that promote well-managed and safe TSFs.

Clear and effective regulatory frameworks produce the intended result (i.e., safe TSFs) and are accessible, transparent and understood by TSF owners, regulators, and the public. The concept of degree of flexibility (i.e., prescriptive vs. outcome-based) was introduced in Section 4.1. Appropriate flexibility for a particular regulatory element can vary by jurisdiction, based on:

- hazards that are distinctive to a jurisdiction (e.g., high seismicity, high precipitation); and/or
- the sophistication, capacity and level of technical competency within the regulatory and TSF owner teams.

A strong regulatory framework should capture the following elements:

- Governance systems;
- Dam break assessments to inform the development of design criteria;
- Geotechnical characterization and assessment;
- Hydrotechnical assessment and design elements/systems to safely manage water;
- Protection of the environment and communities;
- Risk characterization and inclusion of preventative controls (i.e., design elements and operational practices) and mitigative controls (i.e., emergency response plans) to manage the assessed risks;
- Designs and plans for long-term closure (i.e., sustainable dam safety); and
- Documentation (i.e., design reporting, operating manuals) and change management systems.

The challenge with assessing the relative strengths and/or areas for improvement of a regulatory framework is determining what is effective, appropriate, or adequate for each TSF management element (including the degree of flexibility). Each regulatory jurisdiction assessed herein tackles this differently. For example, the Montana, Alaska and Alberta regulatory frameworks address each of the above-noted elements; however, while Montana takes a prescriptive approach to each of these elements, Alaska and Alberta take a more outcome-based approach (and Alaska more so than Alberta).

BC's regulatory framework also includes all of the above-noted elements. Relative to the other jurisdictions considered, KCB have observed areas where the BC framework compares favorably in general, but includes specific aspects that could be improved. In general, potential improvements are associated with increasing the level of details in the regulatory guidance or adjusting the degree of flexibility of an element, which often comes with additional considerations for implementation. These perspectives are presented in Table 5.1.

Table 5.1 BC Regulatory Strengths and Considerations for Potential Improvement

Regulatory Framework Comparison Categories		Strength/ Potential Improvement	Description
Primary	**Secondary (Aspect)**		
Legal Framework	Legislation, Regulation, Guideline	Strength	The overall legal framework of the BC regulatory framework is comparatively concise and clear. The Code provides concise regulatory mandates, specific to TSF management, with reference to the HSRC Guidance Document for additional details and clarifications (i.e., to further inform TSF owner implementation).
Design	Geotechnical	Strength	The BC regulatory framework is relatively unique with respect to its recognition of the need and importance of site characterization. This is generally an underrepresented aspect in other regulatory frameworks.
	Dam Break/ Consequence Classification	Potential Improvement	The BC regulatory framework requires that each TSF have a dam consequence classification and that a dam breach and inundation study (dam break) "*conformant to CDA requirements be conducted to support the dam classification (HSRC, 2016. 10.1.10)*".[1] The guidance on dam break and consequence classification methods and acceptance criteria within the CDA guidelines are understandably general in nature. To improve the consistency of approach and clarity on requirements for TSF owners in BC, the HSRC Guidance Document could be updated to include improved guidance on dam break methodology and acceptance criteria for establishing a consequence classification using a dam break. Due to the evolving state of practice on dam break methodology, the HSRC Guidance document is a more appropriate place than the Code to provide this guidance. The Alberta regulatory framework could be reviewed to inform an update to this aspect of the Code and/or the HSRC Guidance Document. The Alberta regulatory framework provides options for acceptable methodologies and minimum requirements for completing a dam break and determining the consequence classification. Within GoA (2018), Sections 3.2 and 3.3 (especially, clauses (4) and (6) of Section 3.2) provide requirements/elements that could be considered for inclusion in the HSRC Guidance Document.
	Design Requirements and Criteria	Potential Improvement	The BC regulatory framework includes relatively specific (prescriptive) geotechnical and hydrotechnical requirements and design (acceptance) criteria (i.e., flood, seismic, stability FoS, and minimum downstream slope angle). For the majority of BC's TSFs this approach is an appropriate strategy. However, in some cases this lack of flexibility may limit TSF owner initiative/innovation to try for better safety performance and/or demonstrate acceptable dam safety by alternative means (i.e., based on site-specific conditions). Within the Alberta regulatory framework, target stability criteria and selected factors of safety must be justified,[2] and the design:

[1] HSRC Guidance Document Section 3.4 (pg. 20)

[2] GoA (2018) Section 5.6 (Target stability criteria and selected factors of safety must be justified).

Regulatory Framework Comparison Categories		Strength/ Potential Improvement	Description
Primary	Secondary (Aspect)		
			• *"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 risk to factors at risk posed by the dam, using the best available technology and best available practices"* • *"must use and apply either a standards-based approach or a performance-based approach that uses QPO's (quantifiable performance objectives)".* [3] The Alaskan regulatory framework provides relatively specific methodologies and requirements for TSF dam design but indicates that the design (acceptance) criteria shall be justified by the designer.[4] The Alaskan Dam Safety Guidelines emphasize that engineering judgement be exercised in selecting design criteria and appropriate methods to demonstrate these criteria are met. With reference to the examples set by the Albertan and Alaskan regulatory frameworks, we recommend that the BC regulatory framework maintain the existing "minimum design criteria" approach (e.g., FoS ≥ 1.5) but provide greater freedom for TSF owners to propose alternative design criteria and/or use a performance-based approach (i.e., with QPO's). To achieve this, the option to use an alternative design approach should be clearly stated in the Code.
	Closure	Potential Improvement	With respect to the closure of a TSF (or dam), the BC regulatory framework includes the requirement for a TSF owner to: • Include a TSF closure plan with Mine Acts Permit Applications (MAPA); • Submit, prior to closure, a "*final detailed closure plan to achieve the approved end land and water use objectives*", including detailed construction plans (costs, schedule and monitoring plans); • Develop a TSF closure OMS (and carry out on-going management requirements); and • Install a permanent spillway prior to TSF closure completion. The Code also includes several general clauses that support TSF life cycle change management (i.e., cessation, reactivation, permit amendment, landform status, etc.). The BC regulatory framework includes the key elements required to support the closure life cycle stage of TSF management. However, except for the guidance provided on the Reclamation and Closure plan (within the HSRC Guidance Document), limited details are provided to guide TSF owners regarding suitable methodologies and acceptance criteria for

[3] GoA (2018) Section 5.5 (Dam or canal design requirements).
[4] ADNR (2017) Chapter 6 (Designing a Dam in Alaska) and Chapter 15 (Dams at Mines and Tailings Storage Facilities).

Regulatory Framework Comparison Categories		Strength/ Potential Improvement	Description
Primary	Secondary (Aspect)		
			achieving TSF closure requirements documented in the Code. These additional details could be included in the HSRC Guidance Document to improve the consistency of approach and clarity on requirements for TSF owners in BC. The Alberta regulatory framework includes specific requirements and acceptance criteria for both TSF cessation/resumption[5] and TSF decommissioning/closure.[6] The Alaska regulatory framework also contains effective guidance pertaining to the closure of TSFs, primarily in the form of general requirements and considerations.[7] Both the Alberta and Alaska regulatory frameworks provide example content which could be reviewed to inform regulatory updates in BC (primarily within the HSRC Guidance Document). Mandating the disclosure of cessation/resumption plans promotes TSF owner recognition of a future change in TSF management requirements (i.e., change management) and any associated changes in OMS controls (i.e., risk management). Cessation/resumption planning and reporting requirements, informed by GoA, 2019 (Sections 9.1 to 9.5) and ANDR, 2017 (pg. 15-12), could be clearly stated within the Code as a requirement of Annual Reporting (i.e., Code Section 10.4.4). The actual operating, maintenance and surveillance requirements could be included in the operational period OMS or closure OMS (per Code Section 10.6.8). Effective TSF reclamation and closure planning begins during the initial TSF design phases. We recommend that, in addition to requiring TSF closure plan submission with a MAPA, the HSRC Guidance Document (preferably Section 3.3) clearly state that TSF designs need to include considerations and/or criteria for closure. The Alaskan regulatory framework (i.e., ANDR, 2017; Section 15.3.4) provides several points of effective guidance in this area; selected excerpts are presented below: • *"…it is imperative that the initial design and construction address the detail necessary to ensure the long-term safety of the structure after closure, sometimes referred to as designing for closure.* • *Designing for closure requires forward-looking and creative thinking at the conceptual stage of the project; landform design models must be developed to the extent necessary to ensure that any work in the foundation of the system that may be needed to accomplish the future objectives can occur during the original construction; for example, a robust underdrain may be required for long-term stability."*

[5] "cessation" and "resumption" refers to the temporary suspension or restriction of TSF operations and the intent to resume TSF operations, respectively. Cessation differs from active closure (CDA 2014) in that it is undertaken with the intention of resuming operations in the foreseeable future.
[6] GoA (2018) Part 9 (Decommissioning, Closure, Abandonment, etc.).
[7] ANDR (2017) Chapter 15 (Dams at Mines and Tailings Storage Facilities), Section 15.3.4 (Closure).

Regulatory Framework Comparison Categories		Strength/ Potential Improvement	Description
Primary	Secondary (Aspect)		
			The specific requirements and acceptance criteria set out in Sections 9.6 to 9.10 (especially Section 9.6 (2) and 9.8) of GoA (2018), as well as, the more general considerations provided in Section 15.3.4 of ANDR (2017), provide content to inform improvements to Section 5 (Reclamation and Closure) of the HSRC Guidance Document.
Governance	Duty to Report	Strength	The duty to report safety issues at TSFs, including empowerment of the EoR to act in the best interest of public safety, is comparatively unique (i.e., relative to other jurisdictions) and is a strength of the BC regulatory framework.
	Accountability	Potential Improvement	In Montana, all TSFs require a senior ranking agent of the company hold ultimate responsibility. This is similar to the Accountable Executive in the MAC "A Guide to the Management of Tailings Facilities" (MAC 2019a). This could be added to the Code.

6 CLOSING

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of the Audit Unit in EMPR (Client) for the specific application to the Audit of Code Requirements for Tailings Storage Facilities and it may not be relied upon by any other party without KCB's written consent.

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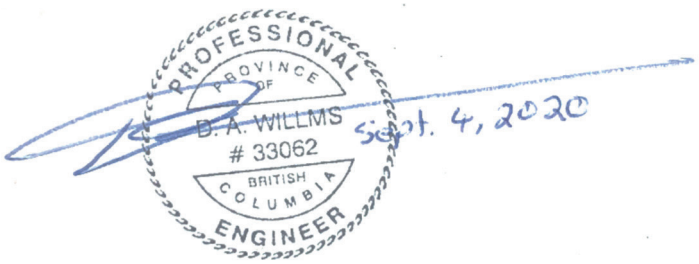

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APPENDIX I

Jurisdictional Scan Criteria Example Questions

Appendix I
Jurisdictional Scan Criteria Example Questions

This appendix presents example questions which follow from the four (4) comparison criteria "hypothesis statements" introduced in Section 3 of the main document.

Criteria 1: The regulations are aligned with "best practices".

- Are the regulations aligned with "best practices"? Which ones? How are "best practices" defined?
- Do the regulations reference guidance for key components of safe design and good governance (is the guidance adequate?)

Criteria 2: The prescriptive elements of regulation are reasonable and flexible enough to allow for site-specific solutions or innovation.

- Do the regulations contain prescriptive elements of design and are the prescriptive elements appropriate?
- What are the main prescriptive elements in the regulation or guidance referred to by the regulations? For example, in the BC Guidance Document the key prescriptive elements are: Downstream slopes of 2H:1V, Factor of Safety of 1.5, flood criteria, and earthquake criteria.
- Are the regulations more (or less) conservative than required by the practice guidelines?

Criteria 3: The regulations include key components of "safe design".

- Do the regulations include key components of "safe design"?
- Is a dam break study required?
- Is an appropriate consequence classification system required?
- Are appropriate geotechnical design criteria required?
- Are appropriate hydrotechnical design criteria required?
- Are designs required to address closure?

Criteria 4: The regulations include key components of good governance.

- Do the regulations include key components of good governance?
- Are the reporting requirements clearly defined?
- Are the roles and responsibilities of the key individual clearly defined?
- Is an EoR required?
- Is a Qualified Person required?
- Is an ITRB required?

- Are accountability and authority defined?
- Is a Tailings Management System (TMS) required?
- Is there good guidance on the TMS?
- Are the type, frequency, and scope of inspections and review appropriately defined?
- Is a risk assessment required?
- Is a risk assessment methodology defined?
- Is a detailed OMS Manual required?
- Is there good guidance on the OMS Manual?
- Do the regulations require that specific, measurable performance objectives are established and met?
- Are pre-defined action plans required, i.e., Trigger Action Response Plans (TARPS)?
- Is engagement with the community required?
- Are appropriate environmental protections required?
- Is an Emergency Response Plan required?
- Is review, training, documentation and testing of the ERP required?
- Is closure planning and costing adequately addressed?

APPENDIX E: DAM SAFETY REGULATION

The Dam Safety Regulation[29] of the Water Sustainability Act sets requirements and best practices for all aspects of dam design, construction, operation, maintenance, removal and decommissioning of dams. The Dam Safety Regulation came into effect on February 29, 2016, replacing the former B.C. Dam Safety Regulation (2000).

Regulated dams require a water licence under the Water Sustainability Act[30] and Water Sustainability Regulation,[31] and must meet the requirements specified in the Dam Safety Regulation. The Water Sustainability Act was brought into force on February 29, 2016 to ensure a sustainable supply of fresh, clean water that meets the needs of B.C. residents today and in the future.

The Memorandum of Understanding regarding the regulation of impoundments and diversions on a mine site is available online.[32] The MoU states:

The purpose of this memorandum is to define the role of [the Ministry of Energy, Mines and Low Carbon Innovation], [the Ministry of Forests, Lands, Natural Resource Operations and Rural Development], and [the Ministry of Environment and Climate Change Strategy] in the siting, design, construction, operation, maintenance, abandonment, reclamation, and regulation of impoundments [including TSFs] diversions on a mine site, in order to protect the public, the environment and the users of water in the affected watershed.

As discussed in Section 1.3 of the audit report, the Code and the Dam Safety Regulation contain many similar requirements for TSFs that include dams. Table E1 lists some of these similar requirements side-by-side for the reader to compare. This is not intended to be an exhaustive list of areas where the Code and Dam Safety Regulation may directly or indirectly require similar, overlapping or inconsistent requirements for dams, but to represent those areas that were most relevant to the findings, conclusions and recommendations of the audit.

TABLE E1: COMPARISON OF SELECT CODE PROVISIONS WITH THE DAM SAFETY REGULATION

Subject	Health, Safety and Reclamation Code for Mines in BC	Dam Safety Regulation
Definition of Dam	"dam" means a barrier on the surface preventing uncontrolled release of either water, slurry or solids or a barrier underground to prevent the uncontrolled flow of water, slurry or solids	"dam" means (a) a barrier constructed for the purpose of enabling the storage or diversion of water diverted from a stream[1] or an aquifer, or both, and (b) other works that are incidental to or necessary for the barrier described in paragraph (a)
Exclusions Based on Size, Capacity or Consequence of Facility	None	Section 2(1) Unless otherwise ordered under subsection (2), this regulation does not apply to a dam that meets both of the following criteria: (a) the dam is less than 7.5 m in height; (b) the dam is capable of impounding at full supply level a maximum total storage volume of water in the reservoir of the dam of 10 000 m3 or less.
		Section 7 This Part [Part 3] applies in relation to a dam if the dam meets the criteria set out in one or more of the following paragraphs: (a) the dam is (i) 1 m or more in height, and (ii) capable of impounding at full supply level a total storage volume of water in the reservoir of the dam greater than 1 000 000 m3; (b) the dam is (i) 2.5 m or more in height, and (ii) capable of impounding at full supply level a total storage volume of water in the reservoir of the dam greater than 30 000 m3; (c) the dam is 7.5 m or more in height; (d) the dam has a classification of significant, high, very high or extreme.

TABLE E1: COMPARISON OF SELECT CODE PROVISIONS WITH THE DAM SAFETY REGULATION (CONTINUED)

Subject	Health, Safety and Reclamation Code for Mines in BC	Dam Safety Regulation
Engineer of Record	Section 10.1.5 (1) The manager shall ensure that a Professional Engineer is retained as the engineer of record for each tailings storage facility and dam under their management. (2) The engineer of record, as a qualified professional, has professional responsibility for assuring that a tailings storage facility or dam has been designed and constructed in accordance with the applicable guidelines, standards and regulations. (3) The manager shall notify the Chief Inspector of the retained engineer of record, of changes in the engineer of record, and the notification shall include an acknowledgement by the engineer of record.	Section 27 (1) If the comptroller or a water manager considers it advisable to obtain independent expert advice in relation to an issue respecting a dam or works relating to a dam, the comptroller or water manager may order an owner of the dam to retain an independent expert, satisfactory to the comptroller or water manager, who has qualifications and experience described in subsection (2), to prepare a written report on resolving the issue. (2) An independent expert retained under subsection (1) must have the following qualifications and experience: (a) in the case of an issue respecting a dam, qualifications and experience in dam design, construction and analysis or in dam operation and maintenance, as appropriate; (b) in the case of an issue respecting works relating to a dam, qualifications and experience in hydraulic, hydrological, geological, geotechnical, mechanical or structural engineering or other discipline, as appropriate.
OMS Manual	Section 10.5.2 (1) An Operations, Maintenance and Surveillance Manual shall be prepared by one or more qualified person and submitted to the chief inspector prior to operation of the Tailings Storage Facility or dam. (2) The Operations, Maintenance and Surveillance Manual shall be reviewed by the engineer of record and approved by the manager prior to implementation. (3) All employees involved in the operation of a tailings storage facility or dam shall be trained and qualified, based on the OMS requirements, prior to commencing work at the facility. (4) The Operations, Maintenance and Surveillance Manual shall be reviewed annually and revised as required during operations of a tailings storage facility or dam.	Section 8 (1) An owner of a dam for which there is not already an operation, maintenance and surveillance manual and that has a classification of significant, high, very high or extreme must (a) prepare a manual, in the form and with the content specified by the comptroller or a water manager, that describes the operation, maintenance and surveillance procedures for the dam, and (b) submit the manual to a dam safety officer for acceptance by the dam safety officer. (2) Subject to subsection (3), an owner of a newly constructed dam must comply with subsection (1) as soon as practicable and, in any event, no later than 60 days, after completion of the construction of the dam. (4) An owner of a dam for which there is an operation, maintenance and surveillance manual must, no less frequently than is specified in item 8 of the table in Schedule 2 for the classification of the dam, (a) review and, if necessary, revise the operation, maintenance and surveillance manual, and (b) submit to a dam safety officer, for acceptance by the dam safety officer, (i) a record setting out the revisions, if any, or (ii) a written report advising that no revisions are necessary. (6) An owner of a dam must follow the operation, maintenance and surveillance manual, if any, for the dam.

TABLE E1: COMPARISON OF SELECT CODE PROVISIONS WITH THE DAM SAFETY REGULATION (CONTINUED)

Subject	Health, Safety and Reclamation Code for Mines in BC	Dam Safety Regulation
Dam emergency plan	10.4.2(1)(e) (1) The manager of a mine with one or more tailings storage facilities shall (e) maintain tailings storage facility emergency preparedness and response plans integrated into the Mine Emergency Response Plan required under section 3.7.1 of this code	9 (Dam Emergency Plan) (1) An owner of a dam for which there is not already an emergency plan and that has a classification of significant, high, very high or extreme must (a) prepare a plan, in the form and with the content specified by the comptroller or a water manager, that includes (ii) a record describing the actions to be taken by the owner if there is an emergency at the dam, and (iii) a record containing information for the use of the local emergency authorities for the dam for the purpose of preparing local emergency plans under the Emergency Program Act, and (b) submit the plan to a dam safety officer for acceptance by the dam safety officer. (2) Subject to subsection (3), an owner of a newly constructed dam must comply with subsection (1) as soon as practicable and, in any event, no later than 60 days, after completion of the construction of the dam. (6) An owner of a dam must, promptly after a plan prepared for the dam under subsection (1) is accepted by a dam safety officer, deliver a copy of the record described in subsection (1) (a) (ii) to each local emergency authority for the dam. (7) An owner of a dam for which there is an emergency plan must, no less frequently than is specified in item 6 of the table in Schedule 2 for the classification of the dam, (a) review and, if necessary, revise the names and contact information in the records described in subsections (4) and (5) of this section, and (b) submit to a dam safety officer, for acceptance by the dam safety officer, (i) a record setting out the revisions, if any, or (ii) a written report advising that no revisions are necessary. (8) Subject to subsection (7), an owner of a dam for which there is an emergency plan must, no less frequently than is specified in item 8 of the table in Schedule 2 for the classification of the dam, (a) review and, if necessary, revise the emergency plan, and (b) if the record is revised, submit the revised record to a dam safety officer for acceptance by the dam safety officer. (9) Despite subsection (8), if the classification of a dam for which there is an emergency plan changes to a classification that is more severe in consequence, an owner of the dam must comply with subsection (8) (a) and (b) as soon as practicable after the owner becomes aware of the change of classification or on or before a later date specified by a dam safety officer. (10) If a record described in subsection (1) (a) (ii) for a dam is revised under this regulation, an owner of the dam must, promptly after the revision is accepted by a dam safety officer, deliver a copy of the revised record to each local emergency authority for the dam.

TABLE E1: COMPARISON OF SELECT CODE PROVISIONS WITH THE DAM SAFETY REGULATION (CONTINUED)

Subject	Health, Safety and Reclamation Code for Mines in BC	Dam Safety Regulation
Consequence Classification	10.1.7 The consequence classification for a tailings storage facility shall be determined by the engineer of record in consideration of the HSRC Guidance Document.	Schedule 1 (Dam Classification) bclaws.gov.bc.ca/civix/document/id/complete/statreg/40_2016#Schedule1
Dam Safety Inspections and Review	10.5.3 Tailings storage and water management facilities and associated dams shall be inspected annually, and a report shall be prepared by the engineer of record in consideration of the HSRC Guidance Document 10.5.4 A Dam Safety Review Report on the tailings storage, water management facilities and associated dams shall be prepared by an independent Professional Engineer in consideration of the HSRC Guidance Document at least every 5 years or as directed by the Chief Inspector.	Schedule 2 (Minimum Frequency of Safety Activities) bclaws.gov.bc.ca/civix/document/id/complete/statreg/40_2016#Schedule2

APPENDIX F: INDUSTRY BEST PRACTICE

For the purpose of the Audit on Code Requirements for TSFs, industry best practice was defined by aggregating guidance and reference materials in use by professionals working on TSFs in B.C. at the time of the audit. The following publications by Canadian Dam Association (CDA), Mining Association of Canada (MAC) and Engineers and Geoscientists B.C. (EGBC) were selected based on their use as reference materials in 2018 Dam Safety Inspection (DSI) reports, their use as references in the Code Guidance Document, their being updated versions of referenced documents, and being referred to during interviews with EoRs and Ministry staff:

- Canadian Dam Association "Dam Safety Guidelines" 2013[33] (not available publicly without purchase)
- Canadian Dam Association "Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams" 2014[34] (not available publicly without purchase)
- Mining Association of Canada "Developing an OMS Manual for Tailings... Facilities" 2011[35] and 2019[36]
- Mining Association of Canada "A Guide to the Management of Tailings Facilities" 2017[37] and 2019[13]
- Engineers and Geoscientists B.C. "Site Characterization for Dam Foundations in BC" 2016[12]
- Engineers and Geoscientists B.C. "Legislated Dam Safety Reviews in BC" 2016[11]

As discussed in the Audit Report, industry best practice is continually evolving and as a result may suggest changes to the regulatory framework as changes in industry best practice become widely adopted. Two recently released publications that seek to inform industry best practice include:

- "Global Industry Standard on Tailings Management"[38] (Global Tailings Standard), released on August 5, 2020, by the United Nations Environmental Programme, Principles for Responsible Investment and the International Council on Mining and Metals; and,
- "Safety First: Guidelines for Responsible Mine Tailings Management"[17] (Safety First Guidelines), released on June 30, 2020, by MiningWatch Canada and EarthWorks.

Section 1.4 of the audit report discusses the Code in comparison to industry best practice. The report also includes a discussion of the Code in relation to the Global Tailings Standard and the Safety First Guidelines. This appendix summarizes the comparison of relevant Code requirements to the contents of industry best practice documents, the Global Tailings Standard and the Safety First Guidelines.

Table F1 below lists provisions in the updated Code that are related to TSFs and comparable to industry best practice, the text of the provision, and a discussion regarding how that text relates to industry best practice as defined in the audit, the Global Tailings Standard and the Safety First Guidelines. Text in the table is colour-coded to assist with interpreting the table:

- **Orange** text indicates areas where the Code requirements meet or exceed the standard set by (i.e. are more prescriptive or stringent), or are aligned with the intent of, the indicated document(s); and,
- **Blue** text indicates areas where the Code requirements do not meet the standard set by (i.e. are less prescriptive or stringent), or are otherwise not aligned with the intent of, the indicated document(s).

The following qualifications should be kept in mind while reviewing this appendix:

- The information presented in Table F-1 is a matter of both objective and subjective opinion. This table is not meant to be read as an exhaustive or authoritative comparison of the documents in question, but as support for the more general findings, conclusions and recommendations presented in the Audit Report;
- Read on its own, this comparison is not intended to imply that the Code should be amended to address any or all the noted differences, or that areas of alignment are immune from further regulatory review; and,
- This analysis compares individual Code provisions against the above documented sources because the basis of the audit is the 2016 Code revisions. This analysis does not highlight areas where the Code is silent on requirements contained in the documented sources.

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.1.3 Application Requirements	The application shall include the following unless otherwise authorized by the chief inspector:	This statement is a preamble to the subsequent requirements.		
10.1.3(d)	a mine plan including			
10.1.3(d)(vii)	designs and details for tailings storage and a description of proposed quantifiable performance objectives,	Requiring designs and quantifiable performance objectives (QPOs) is **aligned** with best practice.	Requiring designs and QPOs is **aligned** with Principles 4, 5 and 7.	Requiring designs and QPOs is **aligned** with Guidelines 1, 6 and 8.
10.1.3(e)	a program for the environmental protection of land and watercourses during the construction and operational phases of the mining operation, including plans for	This statement is a preamble to the subsequent requirements.		
10.1.3(e)(i)	prediction, identification and management of physical, chemical, and other risks associated with tailings storage facilities and dams,	Risk management is **aligned** with best practice.	Risk management is **aligned** with the Standard.	Risk management is **aligned** with Guidelines 4-8.
10.1.3(f)	an alternatives assessment for the proposed tailings storage facilities that assesses best available technology	The Code definition of best available technology is **aligned** with best practice.	The Code definition of best available technology is **aligned** with language in Principle 3.	The definition of best available technology in the Code is **not aligned** with Guideline 5.
10.1.3(h)	a closure plan for the tailings storage facility	A closure plan is **aligned** with best practice.	A closure plan is **aligned** with Principle 5.	A closure plan is **aligned** with Guidelines 1 and 10.
10.1.4 Design Standards				
10.1.4(1)	Impoundments, tailings storage facilities and water management facilities and dams shall be designed by a Professional Engineer.	The use of professional engineers to design these facilities is **aligned** with best practice.	The use of professional engineers to design these facilities is **aligned** with the Standard's definitions for "engineer of record" and "design engineer."	Specifying who will design structures is not a feature of the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines.

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.1.4(2)	The Professional Engineer shall develop design criteria for each facility referred to in subsection (1) that considers the HSRC Guidance Document.	Having a professional engineer develop design criteria is **aligned** with best practice.	Having a professional engineer develop design criteria is **aligned** with Principle 4 and the definitions of "engineer of record" and "design engineer."	The Guidelines prescribe design criteria and does not allow these to vary, so, by allowing design criteria to be determined by a third party on a site-specific basis, the Code is **not aligned** with the Guidelines.
10.1.4(3)	Site characterizations for support of the design of a tailings storage facility or dam shall be carried out by a Professional Engineer and in consideration of the HSRC Guidance Document.	Requiring site characterization by a professional engineer to support design is **aligned** with best practice.	Requiring site characterization to support design is **aligned** with Principle 2. Specifying who completes the site characterization is not a feature of the Standard.	Requiring site characterization to support design is **aligned** with Guideline 7. Specifying who completes the site characterization is not a feature of the Guidelines.
10.1.5 Engineer of Record				
10.1.5(1)	The manager shall ensure that a Professional Engineer is retained as the engineer of record for each tailings storage facility and dam under their management.	Requiring an "engineer of record" for TSFs is **aligned** with best practice.	Requiring an "engineer of record" for TSFs is **aligned** with Principle 9.	The role of "engineer of record" is not a feature of the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines.
10.1.5(2)	The engineer of record, as a qualified professional, has professional responsibility for assuring that a tailings storage facility or dam has been designed and constructed in accordance with the applicable guidelines, standards and regulations.	This definition of the professional responsibility of the engineer of record is **aligned** with best practice.	Professional responsibility is not a feature of the Standard; therefore, the Code may be **more prescriptive** than the Standard.	The role of "engineer of record" is not a feature of the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines.
10.1.5(3)	The manager shall notify the chief inspector of the retained engineer of record, of changes in the engineer of record, and the notification shall include an acknowledgement by the engineer of record.	Requiring the "engineer of record" to acknowledge their role is **aligned** with best practice.	Requiring a plan for managing changes to the "engineer of record" and acknowledgement by the EoR is **aligned** with Principle 9.	The role of "engineer of record" is not a feature of the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines.

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.1.6 Duty to Report Safety Issues at Tailings Storage Facilities				
10.1.6(1)	The engineer of record shall immediately notify the manager in writing of any unresolved safety issue that compromises the integrity of a tailings storage facility.	Written reporting of safety issues is **aligned** with best practice.	A process for addressing safety concerns is **aligned** with Principle 12.	Notification of safety issues is **aligned** with Guidelines 9 and 12.
10.1.6(2)	If the engineer of record and manager are unable to resolve the safety issue, the manager must report the issue to the chief inspector and provide a copy of the report to the engineer of record.	Specific triggers for reporting to regulators are not a feature of these documents; therefore, the requirement to report to the regulator is **more prescriptive** than best practice, the Standard and the Guidelines.		
10.1.6(3)	If the manager does not provide the report under subsection (2) in a timely fashion, the engineer of record shall report the issue to the chief inspector.			
10.1.7 Consequence Classification	The consequence classification for a tailings storage facility shall be determined by the engineer of record in consideration of the HSRC Guidance Document.	The requirement to determine the consequence classification and the referenced classification scale is **aligned** with best practice.	The requirement to determine the consequence classification is **aligned** with Principle 4.	The requirement to determine the consequence classification is **aligned** with Guideline 4 but the Code uses a classification scale that is **not aligned** with the Guidelines, which classify any potential loss of life as an Extreme event. The role of "engineer of record" is not a feature of the Guidelines.
10.1.8 Seismic and Flood Design Criteria				
10.1.8(1)	Seismic and flood design criteria for tailings storage facilities and dams shall be determined by the engineer of record based on the consequence classification determined under section 10.1.7 of this code in consideration of the HSRC Guidance Document, subject to the following criteria:	Determining seismic and flood design criteria by consequence classification is **aligned** with best practice.	Determining seismic and flood design criteria by consequence classification is **aligned** with Principle 4.	Determining seismic and flood design criteria by consequence classification is **aligned** with Guideline 4 but, as noted above, the classification scales are different.

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.1.8(1)(a)	for tailings storage facilities that store water or saturated tailings,	This statement is a preamble to the subsequent requirements.		
10.1.8(1)(a)(i)	the minimum seismic design criteria shall be a return period of 1 in 2475 years,	A minimum seismic return period of 1:2475 is **more stringent** than best practice.	A minimum seismic return period of 1:2475 is **more stringent** than the minimums presented in the Standard, which vary by consequence classification.	Allowing a seismic return period of 1:2475 is **less stringent** than the minimum return period of 1:10000 in Guidelines 4 and 7.
10.1.8(1)(a)(ii)	the minimum flood design criteria shall be a return period 1/3rd of the way between the 1 in 975-year event and the probable maximum flood, and	The minimum flood return period here is **more stringent** than best practice.	The minimum flood return period here is **more stringent** than the minimums presented in the Standard, which vary by consequence classification.	Allowing a flood return period of 1:975 or less is **less stringent** than the minimum return period of 1:10000 in Guidelines 4 and 7.
10.1.8(1)(a)(iii)	a facility that stores the inflow design flood shall use a minimum design event duration of 72 hours;	Designing for inflow design flood and flood duration is **aligned** with best practice. A minimum duration of 72 hours is **more prescriptive** than best practice, which does specify a minimum.	Minimum inflow design flood duration is not a feature of the Standard or the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines.	
10.1.8(1)(b)	for tailings storage facilities that cannot retain water or saturated tailings,	This statement is a preamble to the subsequent requirements.		
10.1.8(1)(b)(i)	the minimum seismic design criteria shall be a return period of 1 in 975 years, and	Seismic design criteria for unsaturated tailings are not a feature of best practice; therefore, doing so in the Code may be **more prescriptive** than the Best Practice	A minimum seismic return period of 1:975 is **more stringent** than the minimums presented in the Standard.	Allowing a seismic return period of 1:975 or less is **less stringent** with a minimum return period of 1:10000 in Guidelines 4 and 7.
10.1.8(1)(b)(ii)	the water management design shall include an assessment of tailings facility erosion and surface water diversions as well as measures to prevent impounded tailings from becoming saturated that consider the consequence classification as determined under section 10.1.7 of this code.	Specific considerations for unsaturated tailings are not a feature of best practice or the Standard; therefore, doing so in the Code may be **more prescriptive** than Best Practice.		Managing water and preventing unsaturated tailings from becoming saturated is **aligned** with Guidelines 5 and 6.

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.1.8(2)	The environmental design flood criteria shall be determined by a Professional Engineer in consultation with other qualified professionals.	Prescriptive discussions of environmental design flood criteria, including who should determine the criteria, are not a feature of these documents; therefore, doing so in the Code may be **more prescriptive** than these documents.		
10.1.9 Design Slope	For a tailings storage facility design that has an overall downstream slope steeper than 2H:1V, the manager shall submit justification by the engineer of record for the selected design slope and receive authorization by the chief inspector prior to construction.	The specification of a minimum downstream slope is not a feature of best practice; therefore, doing so in the Code may be **more prescriptive** than best practice.	The specification of a minimum downstream slope is not a feature of the Standard; therefore, doing so in the Code may be **more prescriptive** than the Standard	The slope in the Code is **less stringent** with Guideline 6 which requires a slope of 1V:5H or shallower.
10.1.10 Minimum Static Factor of Safety	For a tailings storage facility design that has a calculated static factor of safety of less than 1.5, the manager shall submit justification by the engineer of record for the selected factor of safety and receive authorization by the chief inspector prior to construction.	The static factor of safety in the Code is **aligned** with best practice.	The specification of a minimum static factor of safety is not a feature of the Standard; therefore, doing so in the Code may be **more prescriptive** than the Standard	The static factor of safety in the Code is **aligned** with Guideline 6, but the Code is **not aligned** with pseudo-static and annual probability of failure requirements also in Guideline 6.
10.1.11 Breach and Inundation Study/ Failure Runout Assessment	A tailings storage facility shall have a breach and inundation study or a failure runout assessment prior to commencing operation, or as required by the chief inspector.	The requirement for these studies before operation is **not aligned** with best practice. Best practice requires that these studies occur before or concurrently with design.	The requirement for these studies before operation is **not aligned** with Principle 2. Principle 2 requires that these studies initially occur before design as part of the knowledge base.	The studies required are **aligned** with Guidelines 14 and 15 and are also generally required to determine consequence as in Guideline 4.
10.1.12 Water Balance and Water Management Plan				
10.1.12(1)	The manager shall ensure that a tailings storage facility has a water balance and water management plan for the permitted life of mine that is prepared by a qualified person.	Requiring a water management plan is **aligned** with best practice.	Requiring a water management plan is **aligned** with Principle 5.	Requiring a water management plan is **aligned** with Guideline 6.
10.1.12(2)	The manager shall notify the chief inspector if any unpermitted discharge of water occurs or is required.	Triggers for reporting to regulators in relation to permits are not a feature of these documents as they are not regulatory documents.		

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.1.13 Quantifiable Performance Objectives	The manager shall ensure that quantifiable performance objectives for a tailings storage facility are determined and reviewed by the engineer of record and the TSF qualified person.	Requiring numeric performance objectives and review by the engineer of record is **aligned** with best practice.	Requiring numeric performance objectives and review by the engineer of record is **aligned** with Principle 7.	Numeric performance objectives are **aligned** with Guideline 8 but the role of the "engineer of record" is not a feature of the Guidelines.
10.1.14 Underground Openings and Workings				
10.1.14(1)	Tailings storage facility designs that use underground openings shall comply with 6.14.1 of this code. [6.14.1: The manager shall ensure that no structure for impounding water, restraining saturated material or confining air under pressure in any underground roadway or opening is constructed unless the plans and specifications have been prepared by a registered professional engineer.]	The use of professional engineers for TSF design is **aligned** with best practice.	These requirements are not a feature of the Standard because the Standard explicitly limits itself to TSFs that are on the surface or in an open pit; therefore, doing so in the Code may be **more prescriptive** than the Standard	Specific requirements for who completes a design are not a feature of the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines.
10.1.14(2)	Tailings storage facility designs shall consider the potential effects on and interactions with underground workings.	Requiring designs to consider the effects on underground works is **aligned** with best practice.	Requiring designs to consider the effects on underground works is not a feature of the Standards or the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines.	
10.4.1 Updated Plans				
10.4.1(3)	After commencement of operations, the water balance and water management plans under section 10.1.12 of this code shall be reconciled annually and updated as required.	Annual updates to management systems are **aligned** with best practice.	Annual updates to management systems are **aligned** with Principle 5.	Annual updates to management systems are **aligned** with Guideline 8.
10.4.2 Governance				
10.4.2(1)	The manager of a mine with one or more tailings storage facilities shall	This statement is a preamble to the subsequent requirements.		

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.4.2(1)(a)	develop and maintain a Tailings Management System that considers the HSRC Guidance Document and includes regular system audits,	Creating management systems for TSFs is **aligned** with best practice.	Creating management systems for TSFs is **aligned** with Principle 6.	Creating management systems for TSFs is **aligned** with Guideline 8.
10.4.2(1)(b)	designate a TSF qualified person for safe management of all Tailings Storage Facilities,	Identifying personnel responsible for TSF management is **aligned** with best practice.	The role of the "TSF qualified person" is **aligned** with Principle 8.	The role of a "TSF qualified person" is not a feature of the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines.
10.4.2(1)(c)	establish an Independent Tailings Review Board, unless exempted by the chief inspector,	Requiring an Independent Tailings Review Board (ITRB) is **aligned** with best practice.	Requiring an ITRB is **aligned** with Principle 8.	Requiring an ITRB is **aligned** with Guideline 9.
10.4.2(1)(d)	review annually the tailings storage facility risk assessment to ensure that the quantifiable performance objectives and operating controls are current and manage the facility risks,	The requirement for an annual risk review is a **more stringent** than best practice.	The requirement for annual reviews of risk assessments is **aligned** with Principle 7 and 10.	An annual risk review is **aligned** with the annual Dam Safety Review required by Guideline 9. Dam Safety Reviews would normally include a risk assessment.
10.4.2(1)(e)	maintain tailings storage facility emergency preparedness and response plans integrated into the Mine Emergency Response Plan required under section 3.7.1 of this code, and	Establishing emergency plans is **aligned** with best practice.	Establishing emergency plans is **aligned** with Principle 13.	Establishing emergency plans is **aligned** with Guideline 13.

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.4.2(1)(f)	ensure document records for key information are maintained and readily available for tailings storage facilities.	Keeping documents readily available is **aligned** with best practice.	The documentation required is **aligned** with the documentation required by the Standard, but not requiring public release of some or all these documents is **not aligned** with the Standard.	The documentation required is **aligned** with the documentation required by the Guidelines, but not requiring public release of some or all these documents is **not aligned** with the Guidelines. The language of Guideline 14 suggests that the intent is for proactive publication, but this is not explicit; if proactive publication is not the intent then the Code is **aligned** via freedom of information.
10.4.2(2)	The composition of an Independent Tailings Review Board established under subsection (1) (c) shall be commensurate with the complexity of the tailings storage facility in consideration of the HSRC Guidance Document.	Setting ITRB composition based on complexity of the TSF is **aligned** with best practice.	Setting ITRB composition based on complexity of the TSF is **aligned** with Principle 8.	The Guidelines do not speak to the composition of the ITRB beyond the requirement that the members be "competent" and independent per Guideline 9; therefore, doing so in the Code may be **more prescriptive** than the Guideline
10.4.2(3)	The manager shall submit the terms of reference for the Independent Tailings Review Board including the qualifications of the board members to the chief inspector for approval.	Submission of the terms of reference for an ITRB to the regulator is not a feature of these documents as they are not regulatory documents.		
10.4.2(4)	The terms of reference for the Independent Tailings Review Board shall be developed or updated as required in consideration of the review under subsection (1) (d).	Contents of the terms of reference for an ITRB are not a feature of these documents; therefore, doing so in the Code may be **more prescriptive** than the documents		
10.4.3 Register of Tailings Storage Facilities and Dams	(1) The manager of a mine with one or more tailings storage facilities shall maintain a Register of Tailings Storage Facilities and Dams. (2) The register shall be reviewed and updated at least annually.	The specific need for a register is not a feature of these documents, though the requirement for someone to be aware of all TSFs and dams for which they are responsible is **aligned** with all these documents.		

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.4.4 Annual Reporting	The owner, agent or manager shall submit one or more annual reports in a summary form specified by the chief inspector or by the conditions of the permit by March 31 of the following year on the following: reclamation and environmental monitoring work performed under section 10.1.3 (e) of this code; tailings storage facility and Dam Safety Inspections performed under section 10.5.3 of this code; a report of the activities of the Independent Tailings Review Board established under section 10.4.2 (1) (c) of this code that describes the following: a summary of the reviews conducted that year, including the number of meetings and attendees; whether the work reviewed that year meets the Board's expectations of reasonably good practice; any conditions that compromise tailings storage facility integrity or occurrences of non-compliance with recommendations from the engineer of record; signed acknowledgement by the members of the Board, confirming that the report is a true and accurate representation of their reviews; a summary of tailings storage facility and dam safety recommendations including a scheduled completion date; updates to the tailings storage facilities register as required; other information as directed by the chief inspector.	The documentation required is **aligned** with the documentation required by best practice.	The documentation required is **aligned** with the documentation required by the Standard and the Guidelines, but not requiring public release of some or all these documents is **not aligned** with the Standard and the Guidelines.	

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.4.5 Other Reporting	The owner, agent or manager shall submit the following periodic reports with the annual reporting in a form specified by the chief inspector or by the conditions of the permit by March 31 of the year following their completion: mine plan, reclamation plan and closure plan updates under section 10.4.1 of this code; Dam Safety Review reports performed under section 10.5.4 of this code; "as built" reports for tailings storage facilities and dams under section 10.5.1 of this code.	The documentation required is **aligned** with the documentation required by best practice.	The documentation required is **aligned** with the documentation required by the Standard and the Guidelines, but not requiring public release of some or all these documents is **not aligned** with the Standard and the Guidelines.	
10.5.1 Construction of Tailings and Water Management Facilities				
10.5.1(1)	The manager shall submit issued for construction drawings, specifications and quality assurance/quality control plans as well as a summary construction schedule to the chief inspector prior to commencing construction of a tailings storage or water management facility.	The documentation required is **aligned** with the documentation required by best practice.	The documentation required is **aligned** with the Standard.	The documentation required is **aligned** with the documentation required by Guideline 14. However, the Code does not require these documents to be publicly released, which is **not aligned** with Guideline 14.
10.5.1(2)	The manager shall ensure that the initial operation of a tailings storage or water storage facility does not commence until an "as built" report under subsection (3) certifying that the facility was designed in accordance with this code and constructed according to design has been submitted to the chief inspector and a permit has been received.	The documentation required is **aligned** with the documentation required by best practice.	The documentation required is **aligned** with Principle 6.	The documentation required is **aligned** with the documentation required by Guideline 14. However, the Code does not require these documents to be publicly released, which is **not aligned** with Guideline 14.

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.5.1(3)	The manager shall prepare "as built" reports for each stage of construction of a tailings storage or water storage facility that include, as a minimum, the following: (a) geotechnical foundation conditions; (b) geometry; (c) quality assurance/quality control data prepared by a Professional Engineer.	The documentation required is **aligned** with the documentation required by best practice.	The documentation required is **aligned** with the Standard.	The documentation required is **aligned** with the documentation required by Guideline 14. However, the Code does not require these documents to be publicly released, which is **not aligned** with Guideline 14.
10.5.1(4)	The manager shall ensure that the engineer of record has certified that the tailings storage facility or dam has been constructed in a manner consistent with the design and specifications and that the structures are suitable for the intended use.	Certification of TSFs or dams is not a feature of these documents therefore, doing so in the Code may be **more prescriptive** than the documents		
10.5.2 Operations, Maintenance and Surveillance (OMS) Manual				
10.5.2(1)	An Operations, Maintenance and Surveillance Manual shall be prepared by one or more qualified person and submitted to the chief inspector prior to operation of the Tailings Storage Facility or dam.	The documentation required is **aligned** with the documentation required by best practice.	The documentation required is **aligned** with the Standard.	The documentation required is analogous to the Adaptive Management Plan required by Guideline 8 and is **aligned** with the documentation required by Guideline 14. However, the Code does not require these documents to be publicly released, which is **not aligned** with Guideline 14.
10.5.2(2)	The Operations, Maintenance and Surveillance Manual shall be reviewed by the engineer of record and approved by the manager prior to implementation.	Review of the OMS Manual by the engineer of record is **aligned** with best practice	Support of the OMS Manual by the engineer of record is **aligned** with Principle 6.	The use of the "engineer of record" is not a feature of the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines.

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.5.2(3)	All employees involved in the operation of a tailings storage facility or dam shall be trained and qualified, based on the OMS requirements, prior to commencing work at the facility.	The requirement to train personnel involved in the tailings management system is **aligned** with best practice.	The requirement to train personnel involved in the tailings management system is **aligned** with Principle 6.	The requirement to train personnel based on the OMS Manual is not an explicit feature of the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines. However, the need to train personnel is implied in the requirement for an Adaptive Management Plan under Guideline 8.
10.5.2(4)	The Operations, Maintenance and Surveillance Manual shall be reviewed annually and revised as required during operations of a tailings storage facility or dam.	The requirement for annual review of the OMS Manual is **more stringent** than best practice. Best practice considers these reviews as part of Dam Safety Reviews which may not occur every year.	Annual review of the OMS Manual is **aligned** with Principle 6.	Annual updates to the OMS Manual are **aligned** with the annual Dam Safety Review in Guideline 9. Dam Safety Reviews would normally include updating the OMS Manual as required.
10.5.3 Annual Dam Safety Inspection	Tailings storage and water management facilities and associated dams shall be inspected annually and a report shall be prepared by the engineer of record in consideration of the HSRC Guidance Document	Annual inspection of the TSF by the engineer of record is **aligned** with best practice.	Annual inspection of the TSF by the engineer of record is **aligned** with annual performance reviews required under Principle 15.	Annual inspections (except as related to adherence to design per Guideline 7) or the use of the "engineer of record" are not featured in the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines.
10.5.4 Dam Safety Reviews	A Dam Safety Review Report on the tailings storage, water management facilities and associated dams shall be prepared by an independent Professional Engineer in consideration of the HSRC Guidance Document at least every 5 years or as directed by the chief inspector.	A set minimum frequency for Dam Safety Reviews is **more prescriptive** than best practice and the Standard. Requiring an independent Professional Engineer/technical specialist to conduct the review is **aligned** with best practice and the Standard.		Performing Dam Safety Reviews every five years is **less stringent** than Guideline 9, which requires these reviews annually. Requiring an independent party to conduct the review is **aligned** with Guideline 9.

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.6.6 Impoundment				
10.6.6(1)	The long-term stability of exposed slopes of impoundments shall meet the criteria provided in the design at the time of permitting or as determined by the engineer of record.	Requiring stability to be maintained at designed values during closure and post-closure is **aligned** with best practice.	Requiring stability to be maintained during closure and post-closure is **aligned** with Principles 5 and 6.	Requiring stability to be maintained at design criteria is potentially **not aligned** with Guideline 10, which requires failure to be impossible.
10.6.6(2)	Impoundments not operated for a period of 12 or more months may be declared as closed by the chief inspector.	Procedural regulatory matters are not a feature of these documents.		
10.6.7 Closure of a Tailings Storage Facility or Dam	(1) Prior to closure or upon declared closure of a tailings storage facility or dam, the manager shall submit a final detailed closure plan to achieve the approved end land and water use objectives. (2) The closure plan shall include a detailed construction cost estimate, schedule and monitoring plan for implementation. (3) The closure plan shall be prepared by one or more qualified professionals in consideration of the HSRC Guidance Document.	A closure plan is **aligned** with best practice.	A closure plan is **aligned** with Principle 5.	A closure plan is **aligned** with Guidelines 1 and 10.

TABLE F1: COMPARISON OF CODE TO INDUSTRY BEST PRACTICE, THE GLOBAL TAILINGS STANDARD AND THE SAFETY FIRST GUIDELINES (CONTINUED)

Code Reference	Code Text	Comparison of Code to Best Practice	Comparison of Code to Global Tailings Standard	Comparison of Code to Safety First Guidelines
10.6.8 Tailings Storage Facility Closure OMS Manual	(1) The manager shall submit a Tailings Storage Facility Operations, Maintenance and Surveillance Manual for closure and review and update the plans regularly to reflect significant ongoing changes during closure. (2) The Tailings Storage Facility Operations, Maintenance and Surveillance Manual shall include requirements for monitoring and shall define appropriate resources and staffing to carry out the works and monitoring associated with closure.	The requirement for OMS Manuals and ongoing monitoring and resourcing for closed TSFs is **aligned** with these documents.		
10.6.10 Permanent Spillways	Permanent spillways shall be designed by a Professional Engineer in consideration of the HSRC Guidance Document and installed prior to the completion of closure of the tailings storage facility or dam.	The use of professional engineers to design these facilities is **aligned** with best practice.	The use of professional engineers to design these facilities is **aligned** with the Standard's definitions for "engineer of record" and "design engineer."	Specifying who will undertake to design structures is not a feature of the Guidelines; therefore, doing so in the Code may be **more prescriptive** than the Guidelines.
10.6.11 Permit Amendment or Variance After Closure	The manager of a tailings storage facility or dam that has completed closure but not achieved the release of permit obligations may apply for permit amendments or variances including but not limited to reduced frequency of monitoring, Dam Safety Inspections and Dam Safety Reviews.	Procedural regulatory matters are not a feature of these documents.		
10.6.12 Landforms	The manager of a tailings storage facility or dam that can be considered a landform may apply to the chief inspector for the release of permit obligations under the *Mines Act*.	Procedural regulatory matters are not a feature of these documents.		
10.6.13 Reactivation of Impoundment	The owner, agent or manager may make an application for a permit to reactivate a closed or abandoned impoundment	Procedural regulatory matters are not a feature of these documents.		

APPENDIX G: COMPLIANCE VERIFICATION AND ENFORCEMENT

EMLI Mine Inspectors regularly conduct field inspections and desk-based reviews to make sure mines are complying with the *Mines Act*, the Code, other regulations under the *Mines Act*, and site-specific *Mines Act* permit conditions. Some inspections are specialized, including geotechnical inspections, while others are more general in scope.

Inspectors have authority to enter a mine and have a worker or management representative accompany them during the inspection. In the course of conducting an inspection, the Inspector may access and review any records, equipment, machinery or area of the mine that is relevant to verifying compliance. Where a non-compliance is identified, the Inspector may utilize several tools to bring the proponent into compliance, including orders.

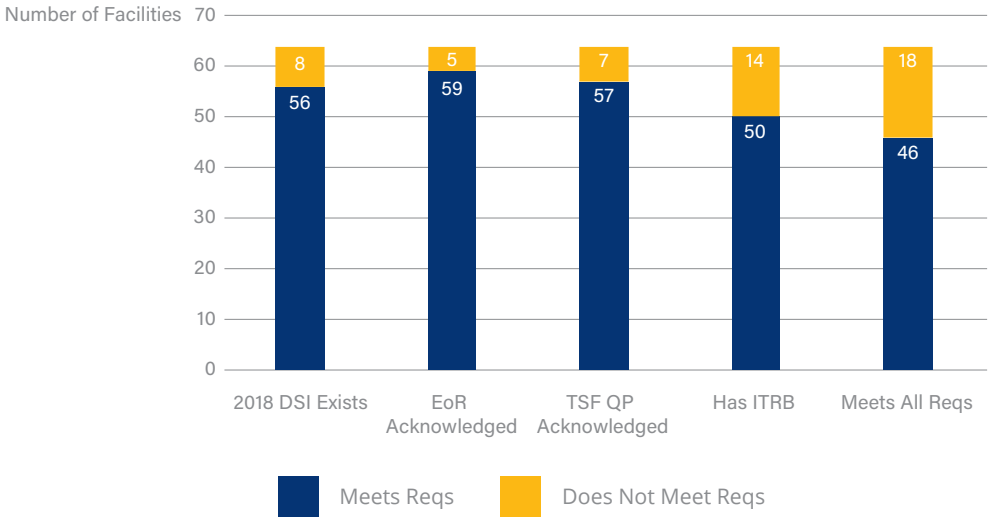
Past inspection reports, including orders, warnings and advisories, are available on the BC Mines Information Website.[21] This website also includes *Mines Act* permits, which often contain conditions related to geotechnical requirements. The Ministry publishes the Annual Report of the Chief Inspector of Mines,[39] which summarizes information from the previous year, including statistics on inspections and incidents.

Past Ministry enforcement actions, including Administrative Monetary Penalties and offence prosecutions[40] are also available on the BC Mines Information website.

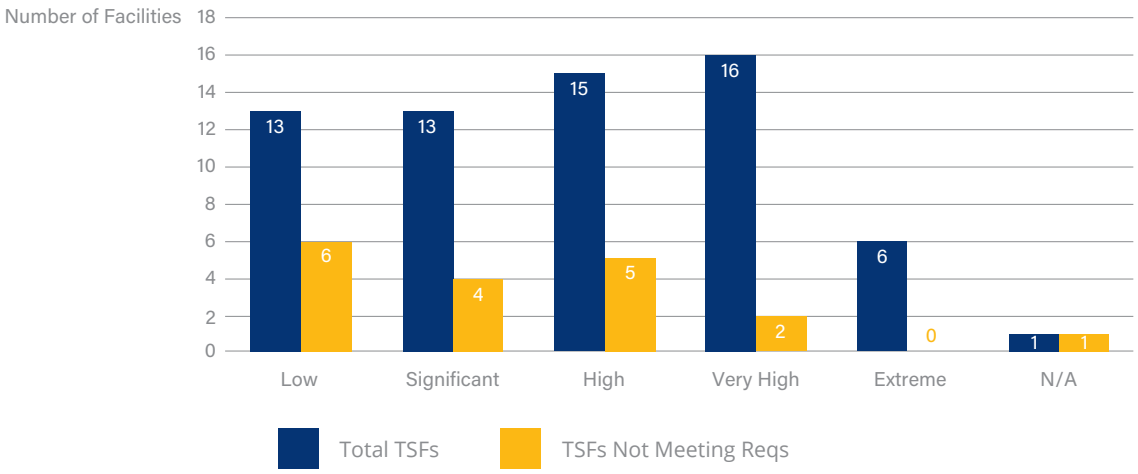
The audit presents the statistic that 72% of the TSFs examined were compliant with four Code requirements as of March 2020. Chart G-1 below shows how many TSFs are compliant with each and all the examined requirements (namely, completing a 2018 Dam Safety Inspection [DSI] report, having an EoR, having a TSF Qualified Person [QP] and having an ITRB).

CHART G-1: COMPLIANCE SUMMARY

Compliance Summary



TSFs by Consequence Rating



Ministry Policies

Section 3 of the audit report discusses Ministry compliance verification and enforcement actions as well as policies and plans regarding these actions. Many policies and plans, along with additional detail about compliance and enforcement, are available on the Mining Compliance & Enforcement[41] website.

The Compliance and Enforcement Policy[42] is intended to enhance compliance verification and enforcement consistency across B.C. by providing guidance to Ministry inspectors on the tools available to them and how those tools can be used as part of a risk-based, escalating enforcement program.

Other Ministry procedures referred to in Section 3 of the Audit Report that are not available on the Mining Compliance & Enforcement website include:

- **Ministry Inspection Procedures** (April 2009): Includes general mine inspection routines and procedures to be followed by inspectors, including a specific section on Geotechnical Inspections which includes procedures related inspection frequency and tailings impoundments.
- **Mine Inspection Procedure** (September 2018): From Purpose section: "This procedure outlines the requirements of the mine inspection process and is intended to provide guidance to mines inspectors."
- ***Mines Act* Order Writing Procedure** (Version 1.0, February 2019): From Purpose section: "The procedure is intended to provide Inspectors of Mines with the direction and guidance required to write clear, concise and enforceable orders In addition to the requirements established by the *Mines Act*, orders must be consistent with the procedure and guidelines."