Alberta Energy Regulator

AER Dam Safety Program

2019 Report

May 2020

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1 Introduction

We are responsible for regulating energy resource developments under the specified enactments. The AER regulates energy resource related dams under Part 6 of the *Water (Ministerial) Regulation* and the *Alberta Dam and Canal Safety Directive*. These regulatory documents set out the requirements dam owners must fulfil to design, construct, operate, manage, decommission or close, and abandon a dam.

This report summarizes the activities and outcomes of the program for the calendar year 2019. The purpose of the program is to regulate the safe impoundment of fluids and minerals through the entire life cycle of tailings and water storage facilities at energy resources developments. This is achieved through the effective application of surveillance, technical reviews, and assessments.

2 Background

A dam is defined in the regulation as "a barrier that is designed and is or is to be constructed for the purpose of retaining, storing or diverting water, including water containing another substance, fluid waste or flowable tailings…and includes all other works associated with such a barrier." Section 27(1) of the regulation defines which dams are subject to the dam safety requirements in the regulation.

In the context of dam safety, the AER considers ponds to be storage facilities for water, including water containing any other substance (e.g., tailings, brine) that comprises one or more dams. The relationship between a pond and its dams is illustrated in figure 1.

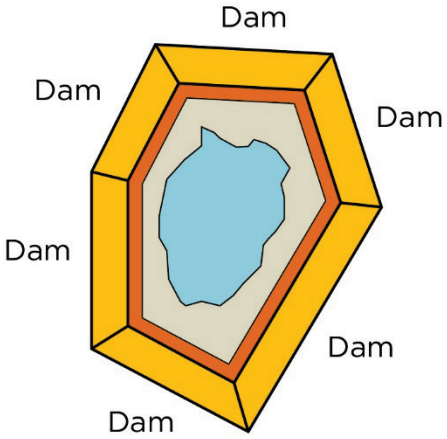

Figure 1. Storage facility (referred to as a pond) and its dams.

The consequence of failure classification (consequence classification) of dams is based on the incremental risks posed by the dam's failure. The directive specifies that dam consequence classifications are determined by considering the incremental consequence of dam failure in three categories, namely (i) loss of life; (ii) environmental and cultural values; (iii) infrastructure, economics, and other property. Dams could be classified as low, significant, high, very high, and extreme consequence based on the most severe potential consequence among the above three categories in accordance with Schedule 1 of the directive.

3 Ponds and Dams in Alberta

As of December 2019, we regulate 202 dams that form 132 active ponds (figure 3 at the end of the report, table 1). Lower-consequence dams can be found in western Alberta associated with coal mines and oil and gas development. The majority of the very-high- and extreme-consequence dams are associated with oil sands development and are located in the Fort McMurray area. Additional information on each pond is available on the AER's interactive Dam and Pond Map Viewer (https://extmapviewer.aer.ca/DamSafety/index.html).

A breakdown of Alberta ponds and dams by consequence classification and energy sector are provided in tables 1 and 2. Figure 2 shows types of fluids impounded by these dams.

Table 1. Number of ponds and dams by consequence classification.

Consequence classification	Ponds	Dams
Extreme	24	68
Very high	8	18
High	22	25
Significant	40	49
Low	38	42
Total	**132**	**202**

Table 2. Number of ponds and dams by energy sector.

Energy sector	Ponds	Dams
Coal	30	33
In situ	5	5
Oil and gas	29	31
Oil sands	68	133

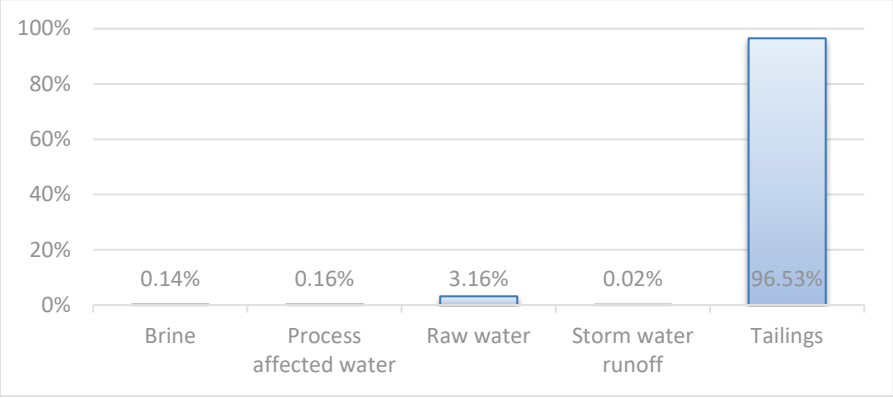

Figure 2. Per cent distribution of fluid type volumes impounded by dams regulated by the AER

In 2019, four dams were moved from operating to inactive status: three are oil sands dams and one is a coal sector dam. One of the oil sands dams was a storm water runoff pond that was permanently removed from service by filling the pond with backfill. The other two were temporary in-pit tailings dams that were submerged with tailings as per the approved operating plan. The in-pit tailings are stored in larger ponds by higher dams. These dams are fully decommissioned and abandoned. For the coal mine dam, a small storm water runoff pond dike crest was lowered 10 to 20 centimetres such that it no longer met the definition of a regulated dam. This pond is still operating.

4 Surveillance Activities

4.1 Field Inspections

Each year, a surveillance plan is developed to prioritize inspections. The surveillance plan includes scheduled inspections (table 3) and other inspections identified as priorities by the dam safety team. Inspection priorities may change throughout the year based on incident notifications or reviewing submissions. As needed, an AER dam safety engineer assesses changes to the surveillance plan and modifies inspection priorities accordingly.

Table 3. Minimum inspection frequency for all dams by consequence classification and fluid type, as mandated by Alberta Environment and Parks Ministerial Order 10/2019.

Consequence classification	Inspector required	Inspection frequency	
		Tailings ponds	All other ponds
Extreme and very high	Geotechnical engineer	Every year	Every year
High	Geotechnical engineer	Every year	Every 3 years
Significant	Inspector	Every year*	Every 5 years
Low	Inspector	No mandated frequency	Every 5 years

* The *Alberta Dam and Canal Safety Directive* states that all dams storing tailings will have a minimum consequence classification of "significant" until otherwise reassessed.

In 2019, AER engineers and inspectors completed 63 field inspections of the 132 ponds which included all extreme and high consequence ponds and all ponds containing tailings. Field inspections are completed by AER geotechnical engineers, dam safety engineers, and qualified inspectors. The results of all field inspections were communicated to dam owners and, if required, discussions were initiated for follow-up actions or response. A breakdown of the number of planned and completed pond and dam inspections by energy sector is provided in table 4.

The differences between completed and planned inspections are a result of changing conditions. One coal sector pond listed in the 2019 surveillance plan did not require an inspection because it no longer met the criteria for a regulated dam under the regulation. In this case, the owner requested and obtained approval for closure of the dam under the directive. Two oil and gas sector ponds were not ready for inspection in 2019 due to delays in construction. One oil and gas sector inspection was added to the surveillance plan

related to an incident (see section 4.3) and the subsequent identification of a storage facility that had not been approved as a dam. One oil sands pond was also not ready for inspection in 2019 due to a delay in construction.

Table 4. Planned and completed AER inspections by energy sector

Energy sector	Planned	Completed
Coal	9	8
In situ	0	0
Oil and gas	12	11
Oil sands	45	44

4.2 Technical Reviews

In 2019, we completed 152 technical reviews of submissions related to dam safety. As necessary, subject matter experts from other fields within the AER are consulted if the scope of the review requires considerations beyond geotechnical or dam safety engineering. A summary of the number and type of dam safety submissions reviewed in 2019 is presented in table 5.

Table 5. 2019 dam safety submissions reviewed, by energy sector

Submission	Coal	In situ	Oil & gas	Oil sands	Total
Annual performance reviews	4	3	12	58	**77**
Dam safety reviews	6	1	1	9	**17**
Notifications	3	1	5	16	**25**
Design (or update) reports	1	1	6	11	**19**
Dam safety management plans	0	0	6	1	**7**
Operations, maintenance, and surveillance manuals	0	0	4	3	**7**

4.3 Safety Deficiencies

Any safety deficiency or critical safety deficiency identified during a technical review or an AER inspection is tracked in an internal registry and monitored by staff until addressed by the dam owner. A safety deficiency is a defect, insufficiency, or other condition that has the potential to contribute to or develop into a critical safety deficiency over time. A critical safety deficiency has the potential to lead to an imminent failure.

One critical safety deficiency was identified as a result of an incident reported by the owner. In May 2019, a coal mine dam owner reported excessive water seepage at the toe of one of their impoundments used for clarifying surface runoff before releasing to the environment. The owner determined the seepage resulted from water flowing through a previously unknown 50 mm diameter pipe, buried within the retaining structure. The dam owner grouted the pipe to prevent further flow. It was later determined that the retaining structure where the outflow developed met the definition of a dam under the regulation. As a

result, the owner applied for an amendment of the approval under the *Water Act* to include the newly recognized dam. A notice of noncompliance was issued. All necessary actions required by the dam owner have since been resolved.

In 2019, AER inspections and technical reviews of annual performance reviews and dam safety reviews identified six safety deficiencies and two safety deficiencies updates from 2018. A summary of all the safety deficiencies identified in 2019, or that were identified previously and updated in 2019, are listed in table 6. Not all safety deficiencies result in a notice of noncompliance (see *Manual 013: Compliance and Enforcement Program*), depending on how the deficiency is resolved. But all safety deficiencies are tracked within our internal database until evidence is provided that the risk has been mitigated by the dam owner or a subsequent inspection closes this finding.

Table 6. Summary of safety deficiencies identified or updated in 2019.

Safety deficiency	Description
Excessive water seepage outflow	**Critical Safety Deficiency** – Outflow resulted from water flowing through a previously unknown 50 mm diameter pipe buried within the retaining structure
Operator error	A dam owner notified the AER that, due to an operator oversight, approximately 3050 m^3 of tailings were not contained to the beach and flowed into another section of the dam.
Liner damaged	A dam owner identified damage to a pond liner that was caused by a blockage of the surface water drainage ditch.
Displacement	Slumping of a natural slope above a dam abutment was disclosed to the AER.
Displacement	A displacement on the downstream slope of a dam and erosion of organic material was disclosed to the AER.
Toe erosion	Toe erosion of a dam was disclosed to the AER.
Erosion gullies	The AER identified a large erosion gully and evidence of slope creep movements at the abutment of a dam during the field inspection.
Crest underbuilt (update from 2018)	A dam owner previously disclosed that LiDAR data indicated a dam crest was underbuilt. A survey was completed and determined the crest was vertically underbuilt and sections of the spillway were vertically overbuilt.
Crest settlement (update from 2018)	Settlement of a dam crest was identified by a dam owner. Similar displacements have occurred in previous years.

5 Communication and Engagement

The program includes strategies for both internal and external communication and engagement. This includes awareness and information sessions, training, reporting, development of manuals or guidelines, Internet-based information resources, and participation at conferences or with dam safety related associations and institutions.

External communication and engagement are intended to provide awareness of dam safety requirements and assessments to the public, dam owners, the Government of Alberta, and to maintain AER involvement with relevant associations related to dam safety.

5.1 Dam Owners

In addition to routine communications with industry regarding the regulation of dams, two specific initiatives were undertaken in 2019:

- Industry information sessions were hosted for oil sands and coal industry dam owners (June and July). The sessions focused on the *Alberta Dam and Canal Safety Directive* and ongoing developments of the dam decommissioning, closure, and abandonment framework.
- Oil sand and coal tailings dam owners were provided an opportunity to review a draft of *Manual 019: Decommissioning, Closure, and Abandonment of Dams at Energy Projects* in November 2019.

5.2 Associations Related to Dam Safety

We support associations and committees that are focused on dam safety. Our dam safety team is involved with the Canadian Dam Association (CDA) (https://www.cda.ca/) committees and working groups. The CDA publishes technical guidelines on best practices for dam safety. The team also participates in meetings hosted by the Dam Integrity Advisory Committee (DIAC) of the Alberta Chamber of Resources (https://www.acr-alberta.com/). DIAC is focused on best practices for dams (hydroelectric, tailings, and smaller water dams) in Alberta.

5.3 Dam Safety Information Available to the Public

The AER maintains a website that provides relevant and timely data and information to stakeholders. Information on dams, the regulation of dams, and AER activities are available in the information portal at https://www.aer.ca/providing-information/by-topic/dams.html.

The AER maintains an interactive map of dams and ponds related to energy development at https://extmapviewer.aer.ca/DamSafety/index.html. The interactive map is available to the public and provides information about ponds, including dam heights, fluid storage volumes, fluid types, and authorization documents.

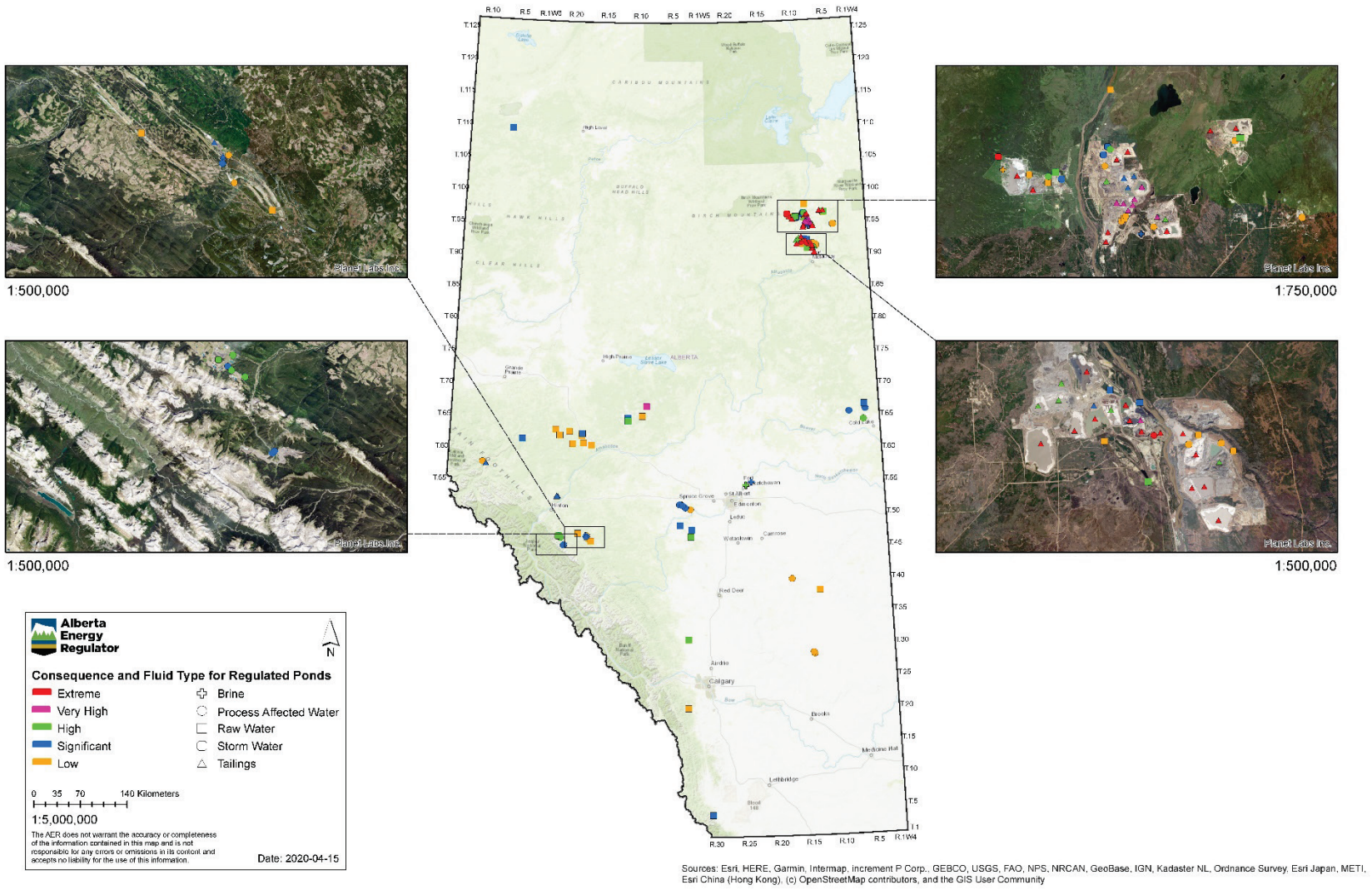

Figure 3. Map with the location of ponds and dams in Alberta by consequence classification