

AER 2023 Dam Safety Program Report

Regulatory Oversight of the Structural Integrity of Energy Sector Dams

April 2024

Alberta Energy Regulator

AER 2023 Dam Safety Program Report: Regulatory Oversight of the Structural Integrity of Energy Sector Dams

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Suite 1000, 250 – 5 Street SW

Calgary, Alberta

T2P 0R4

Telephone: 403-297-8311

Inquiries (toll free): 1-855-297-8311

Email: inquiries@aer.ca

Website: www.aer.ca

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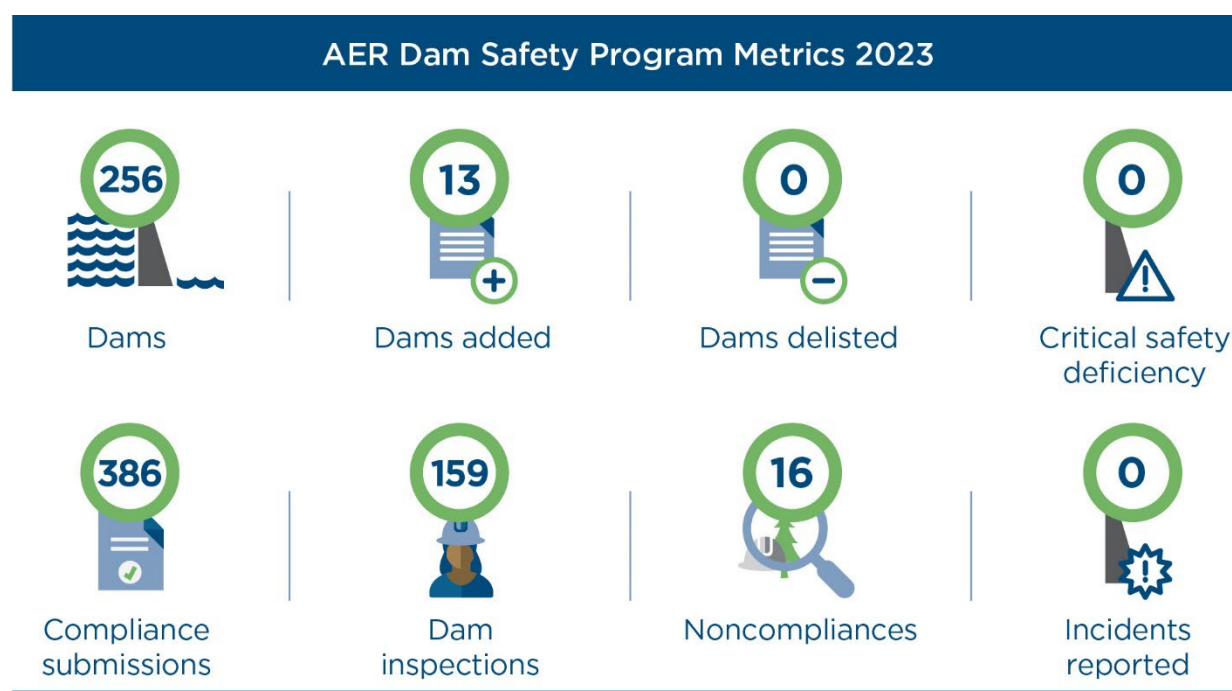
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Executive Summary

The AER dam safety program is designed to ensure compliance of energy dams throughout their entire life cycle, encompassing everything from design and construction to operations and eventual decommissioning or closure. This dam safety report outlines the compliance of dam structural integrity as per the [Alberta Dam and Canal Safety Directive](#) for the year 2023. It summarizes the activities carried out and program metrics achieved during this period. This report underscores the commitment by the AER to transparency and accountability by providing public access to information regarding the outcomes of the program, aligning with the recommendations outlined in the 2015 Auditor General of Alberta’s report [Systems to Regulate Dam Safety](#).



The number of dams under AER jurisdiction increased by 13, reaching a total of 256 by the end of 2023. We received 386 dam-related regulatory submissions and conducted 159 dam inspections. Notably, no critical safety deficiency, which could potentially lead to dam failure, were identified. Four safety deficiencies were reported, and one observation was identified. A total of sixteen notices of noncompliance were issued, seven pertaining to a high-consequence dam and nine related to significant-consequence dams. All noncompliances were administrative in nature, primarily involving failures to submit or update required documentation.

1 Introduction

In March 2014, the AER assumed responsibility from the Government of Alberta to regulate dams used in the development of Alberta’s energy resources. The AER dam safety program was developed to meet the recommendations of the 2015 Auditor General of Alberta’s report [Systems to Regulate Dam Safety](#) and continues to evolve. Figure 1 presents a timeline of notable regulatory milestones of the AER’s dam safety program.



Figure 1. Timeline of notable regulatory milestones

2 Background

Dams related to energy resource development are regulated under Part 6 of the [Water \(Ministerial\) Regulation](#) and the [Alberta Dam and Canal Safety Directive](#). These regulatory documents set the requirements dam owners must fulfil to design, construct, operate, manage, decommission, close, or abandon a dam.

2.1 What is a Dam?

A dam is defined in section 1(1)(h) of 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 states that a dam is regulated if it has a live storage capacity of 30 000 cubic metres or more and is greater than 2.5 metres high. Additionally, dams containing flowable tailings or structures with a consequence classification of “significant” or higher (see below) are also subject to the regulation’s dam safety requirements regardless of their height or live storage capacity. Multiple dams may be in place to form a single reservoir or pond, as shown in figure 2.

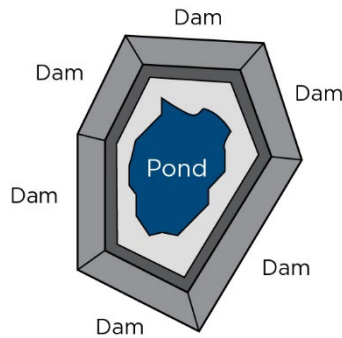


Figure 2. A pond retained by multiple dams

2.2 Consequence Classifications

In Alberta, regulatory requirements for a dam are based on its “consequence classification,” which reflects the consequences should the dam fail. This is determined by a qualified professional retained by the dam owner and must be reviewed and accepted by the AER.

The directive specifies five consequence classes: low, significant, high, very high, and extreme. The classes are based on three categories for incremental consequence of failure: (i) loss of life; (ii) environmental and cultural values such as fisheries, wildlife habitat, endangered species, unique landscapes, and cultural sites; and (iii) infrastructure, economics, and other property, including public transportation and commercial facilities. Dams are classified based on the most severe potential consequence of failure among these three categories. Refer to table 1, which is adapted from schedule 1 of the [directive](#).

Table 1. Consequence classification considerations

| Classification | Loss of life | Environment and cultural values | Infrastructure, economics, and other property |
|-----------------------|---------------------|---|---|
| Extreme | More than 100 | Major loss to critical sites. Restoration or compensation impossible. | Extremely high losses affecting critical infrastructure or some severe damage to residential areas. |
| Very High | 100 or fewer | Significant damage to critical sites. Restoration or compensation possible but impractical. | Very high losses affecting important infrastructure or some severe damage to residential areas. |
| High | 10 or fewer | Significant damage to important sites. Restoration or compensation highly possible. | High losses affecting infrastructure or some severe damage to scattered residential buildings. |

| Classification | Loss of life | Environment and cultural values | Infrastructure, economics, and other property |
|----------------|----------------|--|--|
| Significant | Low potential | No significant damage to important sites. Restoration or compensation highly possible. | Low losses affecting limited infrastructure or some damage to locations used irregularly for temporary purposes. |
| Low | No possibility | Minimal short-term damage and no long-term damage. | Minimal losses mostly limited to dam owner's property. |

3 Dams in Alberta

At the end of 2023, there were a total of 256 dams in Alberta linked to energy development. Most extreme- and very-high-consequence dams are associated with oil sands development in the Fort McMurray area. Conversely, lower-consequence dams are more commonly associated with coal mines and oil and gas development, primarily situated in western Alberta. The province-wide distribution of dam locations is illustrated in appendix 1. Note that for clarity in this depiction, dams have been grouped by the pond they impound. Detailed information for each pond is available in the interactive [Dam and Pond Map Viewer](#). The number of dams by consequence classification is provided in figure 3.

Over time, the number of dams has consistently increased due to several factors, including new projects, additional fluid needs at existing projects, and the re-evaluation of existing structures meeting the criteria of regulated dams. The change in numbers over the last three years is shown in figure 4. In total, thirteen dams were added in 2023, with no dams removed or delisted. A dam may be delisted if it has been decommissioned or closed or no longer meets the definition of a dam under the regulation. For instance, a dam might be replaced with a flow-through channel as part of an approved decommissioning plan. Out of the thirteen newly added dams, eleven were new structures that received approvals, while two were previously unidentified structures.

Oil sands tailings represent the predominant volume among all impounded fluids, accounting for at 96.6% of the total approved capacity across all energy sector dams (see figure 5). The remaining volume, listed in descending order, comprises fresh water, process-affected water, and coal tailings. The distribution of dams in each fluid category is illustrated in figure 6.

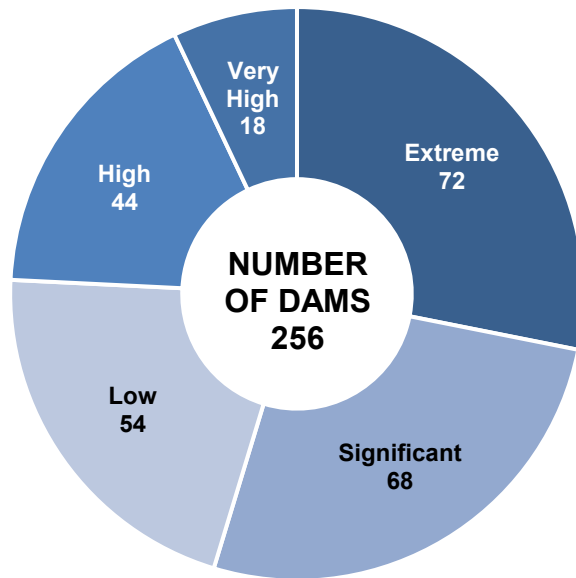


Figure 3. Number of dams by consequence classification as of December 2023

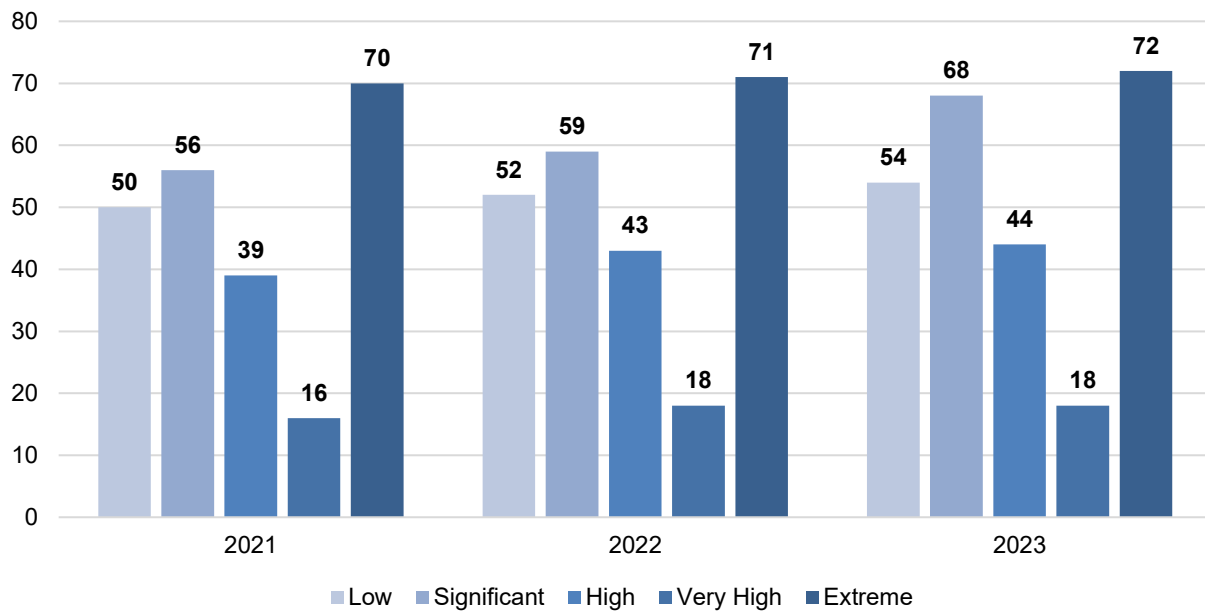


Figure 4. Distribution of the number of dams based on consequence classification over the past three years

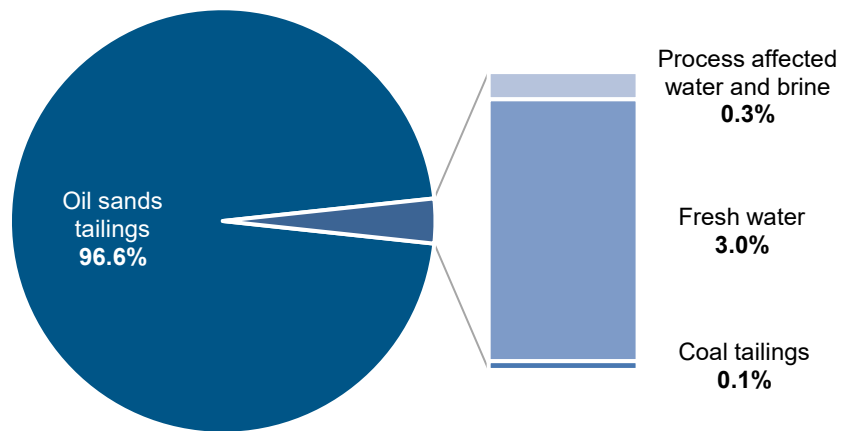


Figure 5. Volumes of impounded fluids as percentage of total volume capacity

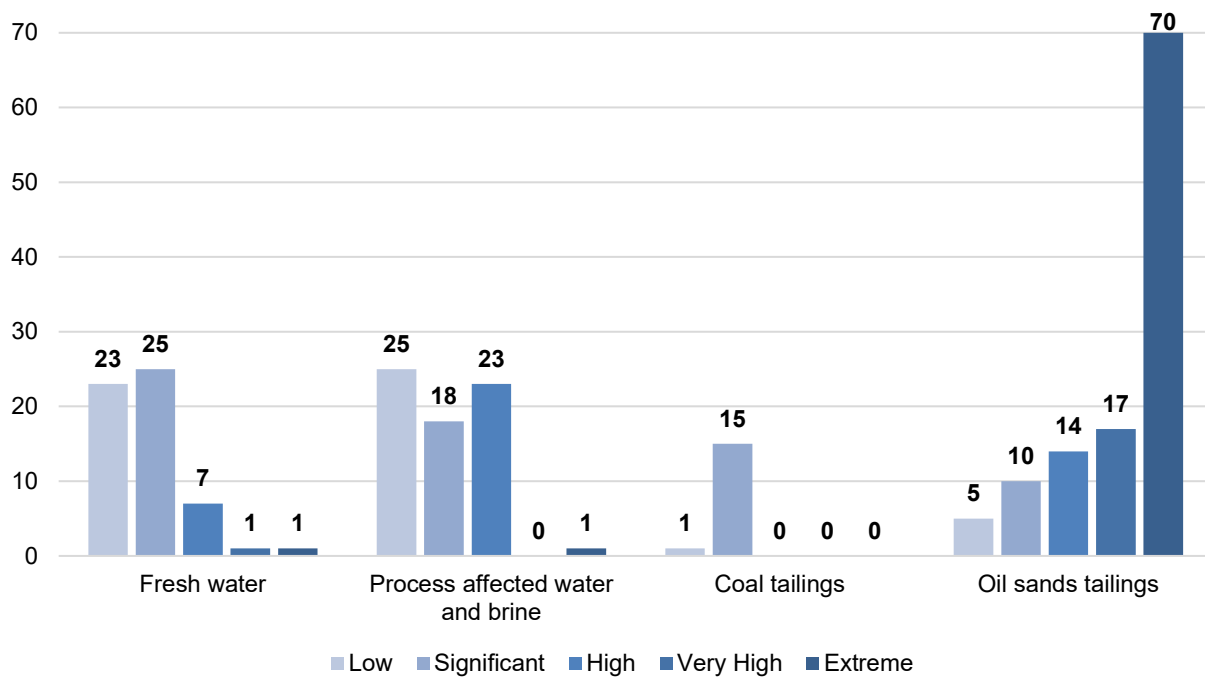


Figure 6. Distribution of dam consequence classifications by impounded fluid type

4 Program Activities

Dam safety program activities conducted by the AER include field inspections, incident response, reviews of regulatory submissions, tracking of safety deficiencies, and ensuring compliance with regulatory requirements. A summary of the core program components and their designated frequencies is presented in table 2 below. All program activities are tracked to ensure objectives are met, and performance metrics are reported to AER leadership.

Table 2. Core program components and their frequency by consequence classification

| Consequence | Proactive inspections | | | Annual performance review | Major document updates* | | |
|-------------|-----------------------|---------------|---------------|---------------------------|---------------------------------|---------------|----------------|
| | Every year | Every 3 years | Every 5 years | | Every 3 years | Every 5 years | Every 10 years |
| Extreme | ✓ | | | ✓ | ✓ | | |
| Very High | ✓ | | | ✓ | ✓ | | |
| High | | ✓ | | ✓ | | ✓ | |
| Significant | | | ✓ | ✓ | | | ✓ |
| Low | | | ✓ | ✓ | Only when requested by the AER. | | |

* "Major Documents" are those required by the directive, including consequence assessments, safety management plans, emergency management plans, and safety reviews. Refer to the directive for a more detailed description of each document type.

4.1 Field Inspections

Our annual dam inspection plan is scheduled according to the frequencies outlined in table 2. According to Alberta Environment and Parks Ministerial Order 10/2019, all dams retaining tailings are required to be inspected by the AER annually irrespective of their consequence classification. Additional inspection priorities may be identified throughout the year based on incident notifications or results from the review of regulatory submissions.

In 2023, a total of 159 dam inspections were completed: 152 planned and 7 reactive. The reactive inspections were prompted by intense rainfall in the foothills of western Alberta. Despite no reported dam-related incidents during these severe weather events, dam safety engineers proactively conducted inspections to ensure the integrity of the dams. All inspection results were communicated to dam owners.

4.2 Incident Response

Dam owners are required to report any safety incident at a dam that has the potential to become a hazardous condition to the dam or pose a risk to the downstream environment. Reportable incidents may include controlled or uncontrolled releases of the reservoir, overtopping, excessive seepage, failure of equipment, or contraventions of regulatory requirements. Dam incidents are uncommon, due in part to stringent dam safety regulatory requirements.

As noted in last year’s report, the AER responded to one dam-safety-related incident in 2022. This incident prompted the issuance of notices of noncompliance and initiated an investigation by the AER. The noncompliances related to this incident have been addressed through an AER-approved action plan. The investigation has been concluded; refer to the [compliance dashboard](#), reference number 2022-047, for further information.

4.3 Regulatory Submissions Review

Regulatory submissions include all documents a dam owner is required to provide under the directive. Notable submissions include the annual performance review report; dam safety report; emergency management plans (EMPs); operation, maintenance, and surveillance (OMS) manual; and consequence classifications.

We received 386 dam safety regulatory submissions in 2023, as summarized in table 3 and figure 7.

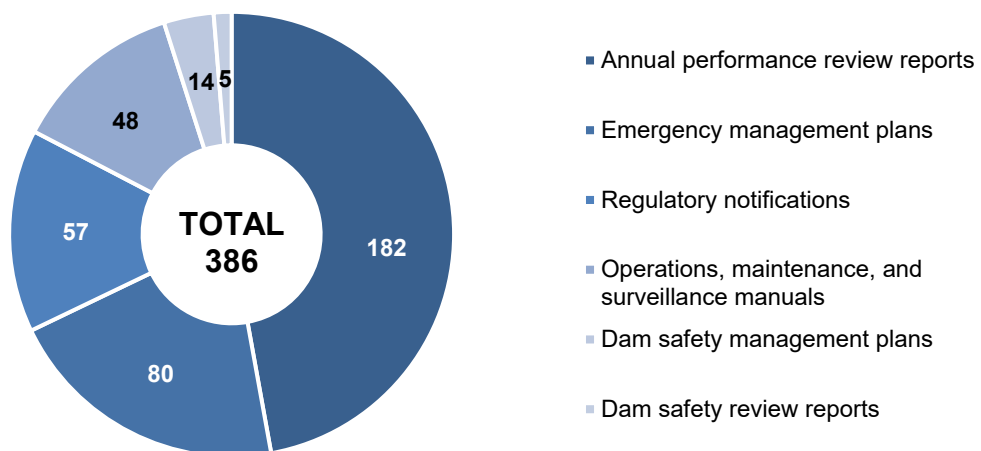


Figure 7. Breakdown of regulatory submissions received in 2023

Table 3. 2023 dam safety regulatory submissions, by consequence classification

| Submission* | Low | Significant | High | Very high | Extreme |
|---|------------|--------------------|-------------|------------------|----------------|
| Annual performance review report | 53 | 62 | 38 | 7 | 22 |
| Regulatory notifications | 7 | 5 | 12 | 13 | 20 |
| Operations, maintenance & surveillance manual | 3 | 9 | 14 | 2 | 20 |
| Emergency management plan | 9 | 8 | 20 | 6 | 37 |
| Dam safety review report | 0 | 0 | 1 | 0 | 4 |
| Dam safety management plan | 0 | 12 | 1 | 1 | 0 |

* Regulatory submissions may include one or more dams

4.4 Safety Deficiencies and Observations

Dam owners are accountable for the safety of their structures. The regulation outlines the responsibilities and accountabilities for dam owners and persons responsible. Throughout the lifespan of a dam, qualified professionals monitor and assess its performance to ensure it meets expected design criteria; report to the AER on observations, hazardous conditions, and safety deficiencies; and implement risk mitigation plans. Hazardous conditions may also be identified by the AER dam safety engineers while conducting dam safety inspections or submission reviews.

A “safety deficiency” indicates a hazardous condition that has the potential to develop into a critical safety issue or deficiency over time. On the other hand, a “critical safety deficiency” means a hazardous condition with the potential to cause imminent failure. Under the directive, owners are required to actively monitor for hazardous conditions and promptly address them to mitigate associated risks. These deficiencies must be reported to the AER. Additionally, during their evaluation of the annual performance report and field inspections, AER dam safety engineers may identify significant concerns that could develop into safety deficiencies. These concerns are categorized as “observations” (see table 4), are documented, and brought to the owner’s attention to ensure that appropriate actions are taken.

In 2023, no critical safety deficiencies were documented, four safety deficiencies were reported, and one observation was identified. As indicated in table 4, all safety deficiencies and observations identified in 2023 have either been addressed or are being managed in accordance with approved action plans. Additionally, all safety deficiencies identified in 2022 report have been successfully addressed and closed as per their approved action plans.

Table 4. Summary of safety deficiencies and observations in 2023

| Safety deficiency/ observation | Dam Consequence classification | Issue | Response |
|---|---------------------------------------|---|---|
| Safety Deficiency Seepage within perimeter ditch | Extreme | Active seepage was identified in the perimeter ditch. | Monitoring. Seepage was assessed and an approved remedial plan will be implemented if seepage condition deteriorates. |
| Safety Deficiency Material not meeting design specifications | Extreme | Field investigation identified zone of lower strength material within the high specification zone of the dam. | Resolved. Remedial plan was approved by the AER and implemented by the operator. |
| Safety Deficiency Erosion gully at toe of dam | High | Fresh water discharged from a pipe created a large erosion gully at the toe of the dam. | Resolved. Erosion gully was repaired. |
| Safety Deficiency Insufficient flood handling capacity | Significant | Insufficient flood handling capacity that could result in adverse downstream structural and environmental impacts. | In Progress. Hydrotechnical assessment completed. Remediation planning in progress. |
| Observation Turbid flow from a drainage pipe | Significant | Turbid water was observed flowing from a drainage pipe of a freshwater reservoir suggesting potential internal erosion. | Resolved. As assessment concluded that the turbidity was related to reservoir-bottom-dwelling plants with no evidence of internal erosion. |

4.5 Compliance Assurance

As outlined in *Manual 013*, a notice of noncompliance is issued when the AER identifies a failure to comply with regulations. This notice communicates to the dam owner that their facility does not meet a specific regulatory requirement, and it requests prompt action to address the noncompliance. It may also ask for a detailed explanation of the reason for the noncompliance and the measures being considered to prevent its reoccurrence. For noncompliances that can be corrected, the AER requests written confirmation from the regulated party once compliance has been restored.

In 2023, the AER issued sixteen notices of noncompliance to dam owners, as summarized in table 5. All noncompliances identified in 2023 are currently being addressed by the dam owners, and either compliance has been achieved or is in progress. Among these sixteen notices, seven were related to high-

consequence dams, and the remainder were associated with significant-consequence dams. Additionally, all noncompliance identified in the 2022 report have been successfully addressed and closed as per their approved action plans.

On June 28, 2023, the AER issued an order to Prairie Mines & Royalty ULC under sections 140 and 241 of the [Environmental Protection and Enhancement Act \(EPEA\)](#) and section 135 and 136 of the [Water Act](#). This order included instruction to submit a completed decommissioning, closure, and abandonment plan for their significant-consequence dam at the Obed coal mine by July 31, 2024. For more detailed information, refer to the [compliance dashboard](#).

Table 5. Summary of noncompliances in 2023

| Category | Type* | Consequence classification | Number issued | Status | |
|---|--|----------------------------|---------------|---------------|-------------|
| | | | | Now compliant | In progress |
| Failure to submit documents | Dam safety review | High | 2 | 1 | 1 |
| | | Significant | 2 | 0 | 2 |
| | Annual performance review | Significant | 1 | 1 | 0 |
| | Operations, maintenance, and surveillance manual | High | 1 | 0 | 1 |
| | | Significant | 2 | 0 | 2 |
| | Dam safety management plan | High | 1 | 0 | 1 |
| Significant | | 1 | 0 | 1 | |
| Failure to comply with requirements around document content and major updates | Operations, maintenance, and surveillance manual | High | 1 | 0 | 1 |
| | | High | 2 | 0 | 2 |
| | Emergency management plan | Significant | 3 | 0 | 3 |
| Total | | | 16 | 2 | 14 |

* Refer to the directive for a more detailed description of each document type.

5 Communication and Engagement

The AER dam safety program includes strategies for communicating and engaging with various stakeholders, including dam owners, the public, academia, and the Government of Alberta. Our approach involves external outreach and education initiatives, active involvement in technical committees and associations, endeavors aimed at strengthening the regulatory framework governing dams in Alberta, and continuous communication with dam owners through our inspection activities.

5.1 Committees, Associations & Initiatives

The AER dam safety engineers participate in technical committees and associations that facilitate the sharing of expertise and experiences of dam safety experts from Alberta, Canada, and around the world. These include technical committees and working groups of the Canadian Dam Association (CDA), meetings hosted by the Dam Integrity Advisory Committee (DIAC) of the Alberta Chamber of Resources, and the Technical Committee on Climate Change Adaptation of Dams of the Canadian Standards Association (CSA). The CDA publishes technical guidelines on best practices related to dam safety, the DIAC promotes best practices for the management of dams in Alberta, and the CSA develops standards in a wide range of areas, including dam safety. These forums ensure that Alberta is leading when it comes to providing regulatory oversight of dams.

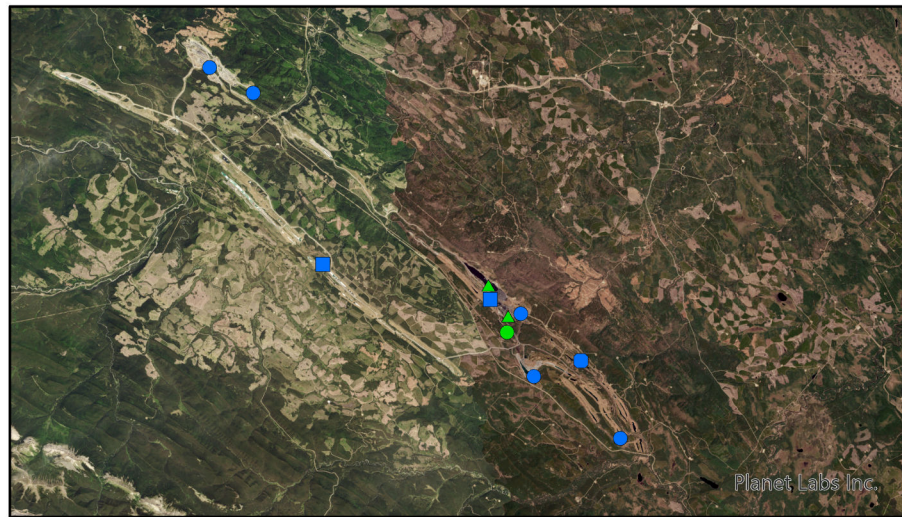
5.2 External Outreach & Education

External outreach and education are provided to stakeholders using a variety of forums and tools.

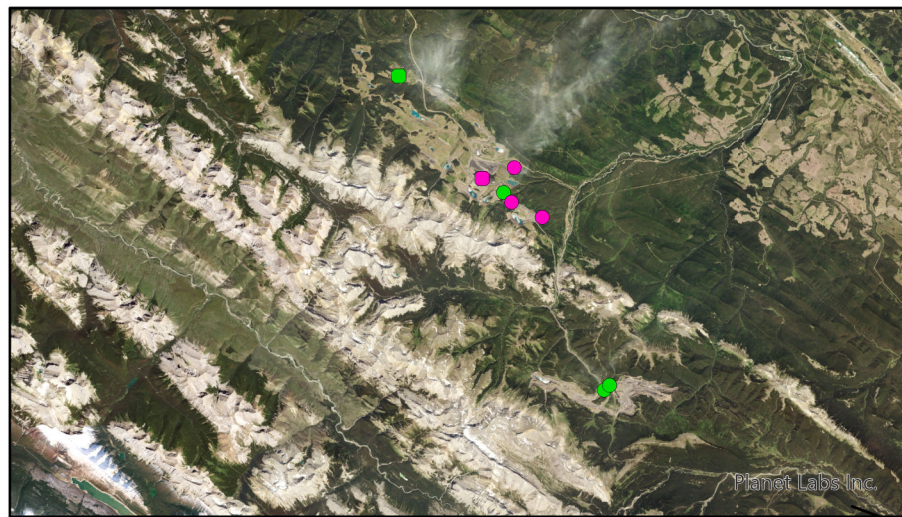
The AER's website provides information on ponds and their dams, the regulation of dams, and this [annual dam safety report](#). The AER maintains an interactive map that provides the location of all ponds regulated by the AER, in addition to specific information such as dam owner, dam height, fluid storage volume, fluid type, and authorization documents.

Presentations provided by the AER dam safety engineers allow the AER to inform stakeholders on the dam safety regulations in Alberta and the AER dam safety program. In 2023, the AER participated as an instructor in a short course on design and assessment of mine waste structures organized by the University of Alberta.

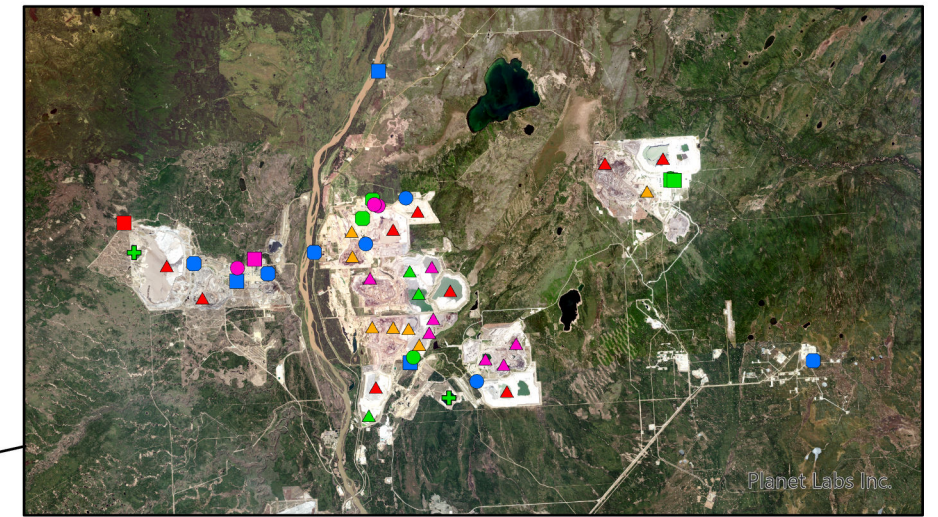
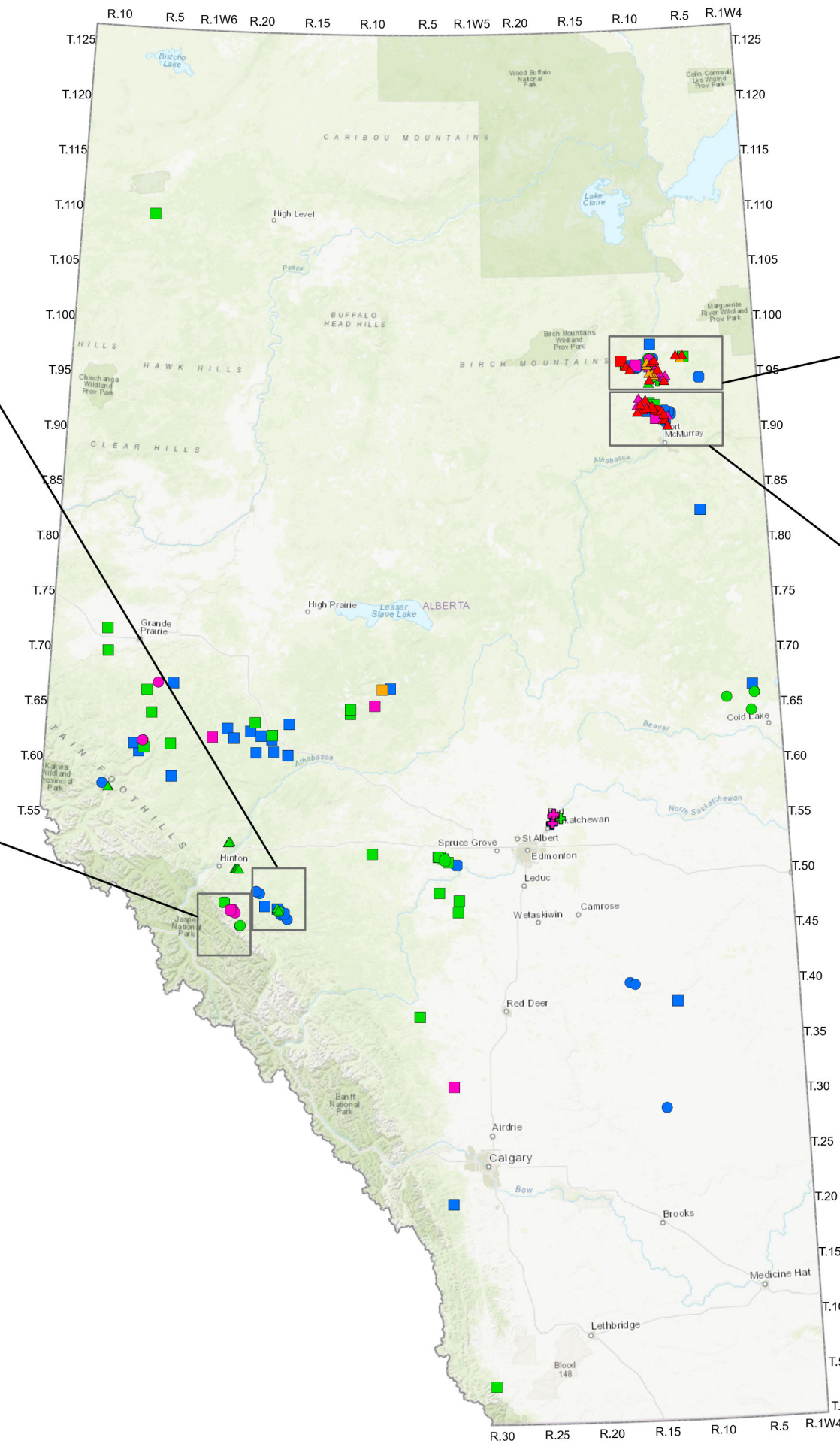
Appendix 1 Alberta Pond and Dam Consequence Classification Map



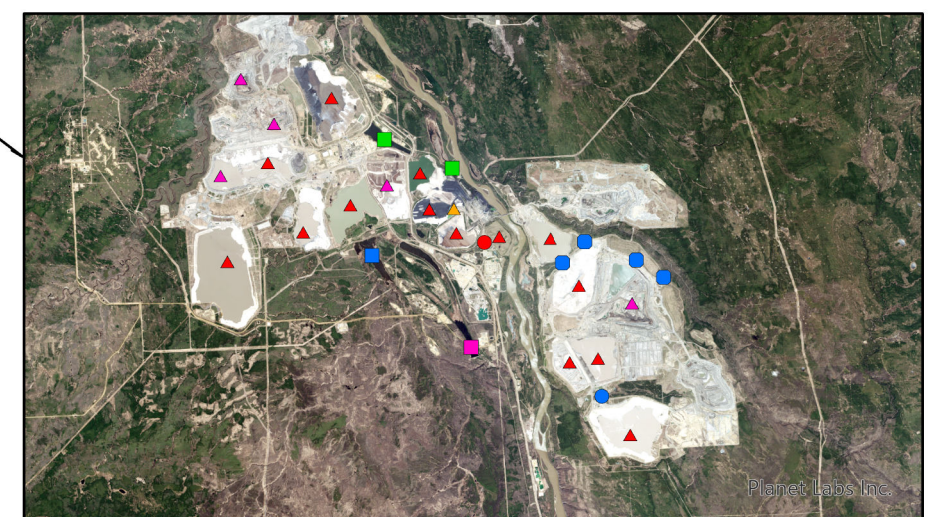
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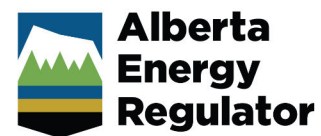
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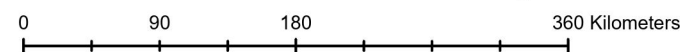


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Consequence and Fluid Type for Regulated Ponds

- | | | | | | |
|--|---|---|--|---|---------|
| ■ Extreme | ■ Very High | ■ High | ■ Significant | ■ Low | ⊕ Brine |
| ○ Process Affected Water | □ Raw Water | ○ Storm Water Runoff | △ Tailings | | |



1:5,000,000

The AER does not warrant the accuracy or completeness of the information contained in this map and is not responsible for any errors or omissions in its content and accepts no liability for the use of this information.

Date: 4/8/2024