4.500 SAFETY OF HYDROELECTRIC DAMS

4.505 APPLICABILITY

This rule applies to dams that are under the jurisdiction of the Public Utility Commission pursuant to 10 V.S.A. § 1081.

4.510 Size and Hazard Classifications

(A) Dams shall be categorized by size. The size category shall be determined by height or storage, whichever gives the larger size category. The height of a dam and its storage shall both be established with respect to its maximum storage potential, measured from the natural bed of the water course to the maximum water storage elevation. For the purpose of determining size category, the maximum water storage elevation shall be considered to be the height above streambed as defined in section 4.521(B).

Category	Storage (ac-ft)	Height (ft)
SMALL	<1,000	<40
MEDIUM	≥1,000 and <50,000	≥40 and <100
LARGE	≥50,000	≥100

(B) Dams shall also be classified by hazard potential. The hazard potential classification of a dam pertains to potential loss of human life or property damage in the area downstream of the dam in the event of failure of the dam.

Classification	General Definition
HIGH	Dams where failure or mis-operation will probably cause loss of human life.
SIGNIFICANT	Dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or other impacts. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
LOW	Dams where failure or mis-operation results in no probable loss of human life and low economic and environmental losses.
MINIMAL	A dam that meets the "low" hazard definition, above, but is only capable of impounding less than 500,000 cubic feet.

The following additional guidance is provided and shall apply to dams subject to this rule:

Classification	Loss Categories	Criteria
HIGH	Direct Loss of Life	Probable or Certain (oneor more) (extensive downstream residential, commercial, or industrial development)
	Property Losses	Not considered for this classification
	Lifeline Losses	Not considered for this classification
	Environmental Losses	Not considered for this classification
SIGNIFICANT	Direct Loss of Life	None expected
	Property Losses	Major or extensive public and private facilities
	Lifeline Losses	Disruption of essential or critical facilities and access
	Environmental Losses	Major or extensive mitigation required or impossible to mitigate
LOW	Direct Loss of Life	None expected
	Property Losses	Private agricultural lands, equipment and isolated non-occupied buildings, non-major roads.
	Lifeline Losses	No disruption of services – repairs are cosmetic or rapidly repairable damage
	Environmental Losses	Minimal incremental damage
MINIMAL		Same as LOW hazard, above

(C) Any dam may be reclassified to another hazard class by means of a petition brought by the owner or operator of the dam, the Department of Public Service, on the Commission's own motion, or by a petition brought pursuant to section 1095 of Title 10 of the Vermont Statutes Annotated. A proceeding based upon such a petition shall be a contested case for purposes of Chapter 25 of Title 3 of the Vermont Statutes Annotated. When determining whether to reclassify a dam's hazard classification, the Commission shall systematically assess the four loss types in the following order: life, property, lifeline, and environmental losses.

(1) Direct Loss of Life. Loss of life potential is to be established based on available mapping, engineering judgement, and inundation mapping of the area downstream of the dam. Analyses of loss of life potential shall consider the extent of development and associated population at risk, time of flood wave travel, flow depth and velocities, and warning time.

(2) Property Losses. Property losses are evaluated by assessing both direct economic loss to downstream properties due to dam failure, and indirect economic impact due to loss of dam services (i.e., impact on a community due to loss of water supply or flood control protection). Public, commercial, and private property losses shall be considered, including damage to bridges, roads, utilities, downstream dams, buildings, and homes.

(3) Lifeline Losses. Indirect threats to life caused by the interruption of lifeline services due to dam failure shall be considered. This includes loss of access to medical and emergency facilities, loss of access to utilities such as drinking water, wastewater and power supply, or loss of communication infrastructure. The importance of the lifeline and anticipated outage shall be considered.

(4) Environmental Losses. Environmental impact downstream caused by the incremental flood wave produced by dam failure shall be considered. The assessment of environmental loss shall consider the damage that would normally be expected as a result of the magnitude flood event under which the dam failure occurred. If environmental losses are reversible or expected to mitigate or self-remediate within five years, they shall be considered Low or Minimal. If major or extensive mitigation is required or losses are severe or permanent, they shall be considered Significant. Examples of Significant environmental losses include release of hazardous or toxic material in sediment accumulated behind a dam, release of hazardous or toxic material from landfills or storage facilities caused by a dam failure, release of wastewater, release of high levels of accumulated sediment, mine tailings, loss or long term impact to threatened or endangered species habitat, or other natural resource concerns determined by the Commission with consultation from the Vermont Agency of Natural Resources.

(5) Dam in Series. If an upstream dam failure has the capability to create failure of a downstream dam because of its incremental flood wave, it shall have the same or higher hazard potential classification as the downstream dam.

(D) Unless reclassified pursuant to the foregoing procedure, a dam's hazard class shall be that identified in the Vermont Dam Inventory maintained by the Vermont Department of Environmental Conservation, pursuant to 10 V.S.A. § 1108.

4.515 Inventory

The Commission shall maintain at its offices an inventory of all dams in the state which are subject to the Commission's regulatory jurisdiction under 10 V.S.A. § 1105. It shall be the duty of each owner or operator, upon request, to inspect such inventory and inform the Commission of any inaccuracies or omissions. In addition, it shall be a continuing duty of each

owner or operator to inform the Commission of any change made to the height, storage, installed capacity, or ownership of a dam.

4.520 Safety Inspection

4.521 Definitions

For purposes of this Rule:

(A) "Independent consultant" means any person who:

(1) Is approved by the Federal Energy Regulatory Commission to do inspections pursuant to 18 C.F.R. Chapter I Part 12 Subpart D; and

(2) Is not, and has not been within two years before being retained to perform an inspection under this subpart, an employee of the owner or operator or its affiliates or an agent acting on behalf of the owner or operator or its affiliates. Having been retained to perform an inspection shall not constitute having been an employee or agent.

(B) "Height above streambed" means:

(1) For a dam with a spillway, the vertical distance from the lowest elevation of the natural streambed at the downstream toe of the dam to the maximum water storage elevation possible without any discharge from the spillway. The maximum water storage elevation is the elevation of the spillway crest or the top of any gates or flashboards, whichever is higher. If the spillway is determined to be inadequate, under standards of or accepted by the U. S. Army Corps of Engineers, the maximum water storage elevation will be the elevation of the non-overflow section of the top of the dam;

(2) For a dam without a spillway, the vertical distance from the lowest elevation of the natural streambed at the downstream toe of the dam to the lowest point on the crest of the dam.

(C) "Dam" means any artificial barrier, including its appurtenant works, that is capable of impounding water, other liquids, or accumulated sediments.

(1) A dam includes an artificial barrier that meets all of the following:

(a) previously was capable of impounding water, other liquids, or accumulated sediments;

(b) was partially breached; and

(c) has not been properly removed or mitigated.

(2) A dam shall not mean:

(a) barriers or structures created by beaver or any other wild animal as that term is defined in 10 V.S.A. § 4001;

(b) transportation infrastructure that has no normal water storage capacity and that impounds water only during storm events;

(c) an artificial barrier at a stormwater management structure that is regulated by the Agency of Natural Resources under 10 V.S.A. Chapter 47;

(d) an underground or elevated tank to store water otherwise regulated by the Agency of Natural Resources;

(e) an agricultural waste storage facility regulated by the Agency of Agriculture, Food and Markets under 6 V.S.A. Chapter 215;

(f) above or below grade tanks, vessels, or storage chambers of steel or concrete construction used to store wastewater;

(g) dug ponds created by excavating below grade and constructed without artificial barriers or outlet structures, which pose no threat to life, property, lifelines, or the environment downstream from the pond;

(h) any structure related to a wastewater treatment facility permitted by the Agency of Natural Resources pursuant to 10 V.S.A. § 1263, excluding wastewater ponds and lagoons impounded by a dam;

(i) levees, meaning any earthen embankment, floodwall, or structure along a water course whose purpose is flood risk reduction or water conveyance; or

(j) any other structure identified by the Department of Environmental Conservation by rule.

(D) “Lifeline” means a structure or service indispensable for maintaining or protecting life, including but not limited to key transportation links such as bridges or highways; power supply lines; potable water connection or supply; or sanitary sewer connection.

4.522 Applicability

(A) Safety Inspection shall be required of any dam:

(1) That is more than twenty-five feet in height above streambed or that has a gross storage capacity of more than 750 acre-feet; or
(2) That has a significant or high hazard potential or is determined by the Commission to require inspection under this Rule.

(B) The owner of any dam which must be inspected by an independent consultant pursuant to regulation by the Federal Energy Regulatory Commission, or which is inspected for safety by employees or agents of the Federal Energy Regulatory Commission, may file with the Commission a copy of the report of such inspection. Unless otherwise determined by the Commission, such filing shall satisfy the inspection requirement of this Rule.

(C) The owner of any dam included in the description set forth in subsection (A), but which is not inspected pursuant to Federal Energy Regulatory Commission regulations as defined in subsection (B), must file a report of an independent consultant as defined in the ensuing sections of this Rule.

4.523 Exemption

(A) Upon written request from the owner or operator, the Commission may grant an exemption from the requirement for inspection (or any part of that requirement) in extraordinary circumstances that clearly establish good cause for exemption.

(B) Good cause for exemption may include the finding that the dam in question meets the criteria for low hazard potential as defined by section 4.510(B).

4.524 Initial Reports

The initial inspection and report under this rule shall be completed not later than:

(A) For dams which are inspected pursuant to Federal Energy Regulatory Commission rule, a copy of the most recent inspection report shall be filed within ninety days of the effective date of this Rule.

(B) For dams not subject to federal inspection requirements:

(1) For dams in the large size category or the high hazard class, two years from the effective date of this rule.

(2) For all other dams to which the inspection requirement applies, three years from the effective date of this rule.

4.525 Time of Subsequent Inspections and Reports

(A) General rule. After the initial inspection and report under this subpart, subsequent inspections under this subpart must be completed and the reports on them filed at the following intervals:

(1) For dams which are inspected pursuant to Federal Energy Regulatory Commission rule, within thirty days of the availability of each scheduled inspection report.

(2) For dams not subject to federal inspection requirements:

(a) Five years for dams classed as large or high hazard under section 4.510;
(b) Ten years for dams classed as medium or of significant hazard.

(B) Extension of time. For good cause shown, the Commission may extend the time for filing an independent consultant's report under this subpart.

4.526 Specific Inspection Requirements

Scope of inspection. The inspection by the independent consultant shall include:

(A) Due consideration of all relevant reports on the safety of the dam made by, or written under the direction of, federal or state agencies or made by other consultants;

(B) Physical field inspection of the project works and review and assessment of all relevant data concerning:

(1) Settlement;

(2) Movement;

(3) Erosion;

(4) Seepage;

(5) Leakage;

(6) Cracking;

(7) Deterioration;

(8) Seismicity;

(9) Internal stress and hydrostatic pressures;

(10) The functioning of foundation drains and relief wells;

(11) The stability of critical slopes;

(12) Regional and site geological conditions.

(C) Specific evaluation of:

(1) The effects of overtopping of non-overflow structures;

(2) The structural adequacy and stability of structures under all credible loading conditions;

(3) The relevant hydrological data accumulated since the dam was constructed or last inspected under this subpart;

(4) The history of the performance of the dam through analysis of data from monitoring instruments; and

(5) The quality and adequacy of maintenance, surveillance, and methods of operations for the protection of public safety.

(D) Evaluation of spillway adequacy. The adequacy of any spillway must be evaluated by considering hazard potential which would result from failure of the project works during flood flows.

(1) If structural failure would present a hazard to human life or cause significant property damage, the independent consultant must evaluate the ability of project works to withstand the loading or overtopping which may occur from a flood up to the probable maximum flood or the capacity of spillways to prevent the reservoir from rising to an elevation that would endanger the project works.

(2) If structural failure would not present a hazard to human life or cause significant property damage, spillway adequacy may be evaluated by means of a design flood of lesser magnitude than the probable maximum flood, if the report of the independent consultant pursuant to subsection 4.527 provides a detailed

explanation of the basis for the finding that structural failure would not present a hazard to human life or cause significant property damage.

4.527 Report of the Independent Consultant

General requirement. Following inspection of a project development as required under this subpart, the independent consultant shall prepare a report, and the owner or operator shall file two copies of that report with the Commission. The report shall conform to the provisions of this section.

(A) General information in the initial report. The first report filed under this subpart for any dam shall contain:

(1) A map of the region indicating the location of the dam;

(2) Plans, elevations, and sections of the dam;

(3) A summary of the design assumptions, design analyses, spillway design flood, and the factors of safety used to evaluate the structural adequacy and stability of the dam; and

(4) A summary of the geological conditions that may affect the safety of the project works.

(B) Information required for all reports. Any report of an independent consultant filed under this subpart shall contain the information specified in this paragraph:

(1) Analyses. The report shall:

(a) Analyze fully the safety of the dam and the maintenance and methods of operation of the development in light of the independent consultant's reviews, field inspections, assessments, and evaluations described in subsection 4.526;

(b) Identify any changes in the information and analyses required by paragraph (a) of this subsection that have occurred since the last report by an independent consultant and analyze the implications of those changes; and

(c) Analyze the adequacy of existing monitoring instruments, periodic observation programs, and other methods of monitoring project works and conditions affecting the safety of the project or project works with respect to the dam.

(2) Recommendations. Based on the independent consultant's field observations and evaluations of the project works and the maintenance, surveillance, and methods of operations of the dam, the report shall contain the independent consultant's recommendations regarding:

(a) Any corrective measures necessary for maintaining the integrity of the structures, for improving methods of operation of the dam, or for improving maintenance or surveillance procedures; and

(b) A reasonable time to carry out each corrective measure.

(3) Dissenting views. If the inspection and report were conducted and prepared by more than one independent consultant, the report shall clearly indicate the substance of any dissenting views concerning the analyses or recommendations of the report that may be held by any individual consultant.

(4) List of participants. The report shall identify all professional personnel who have participated in the inspection of the project or in preparation of the report and shall identify the independent consultant who directed those activities.

(5) Statement of independence. The independent consultant shall declare that all conclusions and recommendations in the report are made independently of the owner or operator and its employees and representatives.

(6) Signature. The report shall be signed by each independent consultant responsible for the report.

4.528 Review

Every five years the Commission shall conduct a review of the exemptions of dams which have been exempted from periodic inspection pursuant to 4.522(A) or 4.523. Such review shall focus on changed conditions concerning each dam which may indicate that inspection ought to be required.

4.530 Corrective Measures

4.531 Emergency Corrective Measures

If, in the course of an inspection, an independent consultant discovers any condition for which emergency corrective measures are advisable, the independent consultant shall immediately notify the owner or operator, and the owner or operator shall report that condition to the Commission and take corrective action as required under subsection 4.532.

4.532 Taking Corrective Measures After the Report

(A) Corrective plan and schedule.

(1) Not later than sixty days after the report of the independent consultant is filed with the Commission, or fifteen days in the case of emergency corrective measures reported pursuant to 4.531, the owner or operator shall submit to the Commission two copies of a plan and schedule for designing and carrying out any corrective measures that the owner or operator proposes.

(2) The plan and schedule may include any proposal, including taking no action, that the owner or operator considers a preferable alternative to any corrective measure recommended in the report of the independent consultant. Any proposed alternative must be accompanied by the owner or operator's complete detailed analysis and evaluation in support of that alternative.

(B) Carrying out the plan. The owner or operator shall complete all corrective measures in accordance with the plan and schedule submitted to the Commission, as approved or modified by the Commission.

(C) Notwithstanding the above, if corrective action is required by any federal agency, including the Federal Energy Regulatory Commission, and the owner or operator complies with the instructions provided by such federal agency, such compliance shall constitute sufficient action under this section.

(D) Extension of time. For good cause shown, the Commission may extend the time for filing the plan and schedule required by this section.

4.540 On-going Care

4.541 Reporting of Safety-related Conditions

(A) Oral report. An owner or operator shall report to the Commission by telephone any condition affecting the safety of a dam, as defined in subsection (C) of this section. The oral report shall be made as soon as practicable after that condition is discovered, without interfering with any necessary or appropriate emergency repair, alarm, or other emergency action.

(B) Written report. Following the initial oral report required in subsection (A), the owner or operator shall submit to the Commission a written report on the condition affecting the safety of the dam. The written report shall be submitted within thirty days and shall contain such information as the Commission directs including:

(1) The causes of the condition;

(2) A description of any unusual occurrences or operating circumstances preceding the condition;

(3) An account of any measure taken to prevent worsening of the condition;

(4) A detailed description of any damage to the dam and the status of any repair;

(5) A detailed description of any personal injuries;

(6) A detailed description of the nature and extent of any property damages; and

(7) Any other relevant information requested by the Commission.

(C) "Condition affecting the safety of a dam" means any condition, event, or action which might compromise the safety, stability, or integrity of the dam or its ability to function safely for its intended purpose, or which might otherwise adversely affect life, health, or property. Conditions affecting the safety of a dam include, but are not limited to:

(1) Unscheduled rapid draw-down of impounded water;

(2) Failure of any facility that controls the release or storage of impounded water, such as a gate or a valve;

(3) Failure or unusual movement, subsidence, or settlement of any part of a dam;

(4) Unusual concrete deterioration or cracking, including development of new cracks or the lengthening or widening of existing cracks;

(5) Piping, slides, or settlements of materials in any dam, abutment, dike, or embankment;

(6) Significant slides or settlements of materials in areas adjacent to reservoirs;

(7) Significant damage to slope protection;

(8) Unusual instrumentation readings;

(9) New seepage or leakage or significant gradual increase in pre-existing seepage or leakage;

(10) Sinkholes;

(11) Significant instances of vandalism or sabotage;

(12) Natural disasters, such as floods or earthquakes;

(13) Any other signs of instability.

4.542 Commission Action

On the basis of any oral or written report made under this section, the Commission may order the owner or operator to take any action reasonably required to correct the condition or conditions reported. The Commission may retain a consultant to inspect any dam and, if the inspection reveals any unsafe condition which the owner or operator should have discovered and reported, may require the owner or operator to pay the cost of the inspection.

4.543 Emergency Plans

(A) The owner or operator of any dam which is required to maintain an emergency action plan by the Federal Energy Regulatory Commission shall file a copy of the Commission's approval letter for its most recent plan.

(B) The copy of the emergency action plan approval letter shall be filed within sixty days of the adoption of this rule, or within thirty days of an owner's receipt of such letter, whichever is later.

(C) The owner of a dam which is classified as high or intermediate hazard, but which is not required by the Federal Energy Regulatory Commission to maintain an emergency action plan, may be required by the Commission to develop a plan to protect lives and property downstream. Any plan so developed shall be filed with the Vermont Emergency Management Division.