

## Draft Regulations

### Draft Regulation

Dam Safety Act  
(2000, c. 9)

#### Dam safety

Notice is hereby given, in accordance with sections 10 and 11 of the Regulations Act (R.S.Q., c. R-18.1), that the Dam Safety Regulation, the text of which appears below, may be made by the Government upon the expiry of 45 days following this publication.

The purpose of the draft Regulation is to carry out the provisions of the Dam Safety Act. It is divided into five chapters. Chapter I sets out general provisions and includes the method for determining the height of a dam and its impounding capacity.

Chapter II concerns the register of dams that must be established and maintained by the Minister.

Chapter III deals exclusively with high-capacity dams. It is divided into seven parts covering dam classification, minimum safety standards, dam operations, the dam safety review, safety programs, applications for authorizations and the fees payable by high-capacity dam owners.

Chapter IV covers low-capacity dams. It lists the information the developer or dam owner must provide when declaring the construction, structural alteration or removal of a dam to the Minister, as well as the documents that must be submitted with the declaration.

Lastly, Chapter V contains the coming-into-force provision of the Regulation as well as special provisions in respect of dams considered existing dams on the date of coming into force of the Act.

Further information on the draft Dam Safety Regulation may be obtained by contacting Jean-Luc Ducharme, Ministère de l'Environnement, Centre d'expertise hydrique du Québec, édifice Marie-Guyart, 675, boulevard René-Lévesque Est, aile René-Lévesque, 2<sup>e</sup> étage, boîte 28, Québec (Québec) G1R 5V7; telephone: (418) 521-3825, ext. 4114; fax: (418) 643-6900; or by e-mail: jean-luc.ducharme@menv.gouv.qc.ca.

Any person having comments to make on the matter is asked to send them in writing, before the expiry of the

45-day period, to the Minister of the Environment, édifice Marie-Guyart, 30<sup>e</sup> étage, 675, boulevard René-Lévesque Est, Québec (Québec) G1R 5V7.

ANDRÉ BOISCLAIR,  
*Minister of the Environment*

#### DAM SAFETY REGULATION

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## Dam Safety Regulation

Dam Safety Act  
(S.Q., 2000, c. 9, ss. 6, 14, 15, 16, 17, 19, 20, 21, 24,  
29, 31, 36, 1st par., subpars. 1, 4, 5 and 6, and 37)

**CHAPTER I**  
GENERAL

1. This Regulation applies to all dams referred to in the Dam Safety Act (2000, c. 9).

2. The height of a dam is the vertical distance between the lowest point of the natural surface of the ground at the downstream toe of the dam and the uppermost point of the top of the dam.

3. The impounding capacity of a dam is the total volume of water stored in the reservoir measured at the full supply level. Where bathymetric data to measure it with greater precision is unavailable,

(1) the impounding capacity of a dam built across a watercourse is equal to the product of the backflow length multiplied by one-half the reservoir depth and by the average width of the body of water formed by the dam; and

(2) the impounding capacity of other dams is equal to the product of the surface area of the reservoir multiplied by the reservoir depth.

The reservoir depth is the vertical distance between the lowest point of the natural surface of the ground at the downstream toe of the dam and the full supply level.

4. For the purposes of this Regulation, unless the context requires otherwise,

“existing dam” means a dam completely constructed by the date of coming into force of the Act or under construction on that date, as well as a dam construction project for which the developer had, on the date of coming into force of the Act, the required approval under the Watercourses Act (R.S.Q., c. R-13); (*barrage existant*)

“full supply level” means the maximum normal operating water surface level of a reservoir; (*niveau maximal d’exploitation*)

“project” means the complex of structures impounding the water of a single reservoir that are owned by the same person; (*aménagement*)

Any lake referred to in the Répertoire toponymique du Québec or in any of its supplements is deemed to be a reservoir.

**CHAPTER II**  
REGISTER OF DAMS

5. The register of dams shall contain the following information and documents:

(1) the official name of the dam as established by the Commission de toponymie du Québec and the particulars of its location;

(2) the name and address of the dam owner;

(3) the year the dam was built and, where applicable, the year any structural alteration was made to the dam;

(4) the dam uses;

(5) a description of the dam including the dam type, foundation type, dam height, impounding capacity and reservoir depth;

(6) the hydrologic and hydraulic data in respect of the dam, including the full supply level, discharge capacity, reservoir surface area and backflow length, reference to any upstream or downstream structures and, where the dam is part of a project, reference to the other structures forming part of the project; and

(7) one or more photographs of the dam;

For a high-capacity dam within the meaning of section 4 of the Act, the following information must also be entered in the register of dams:

(1) the dam class established in accordance with Division I of Chapter III and

(a) the seismicity zone in which the dam is located determined in accordance with the seismic zone map in Schedule I;

(b) the dam condition and discharge facilities reliability ratings established under subparagraphs 3 and 4 of the first paragraph of section 15 and section 16; and

(c) the dam failure consequence category determined under sections 18 and 19;

(2) the safety check flood for the dam established under section 22, 23 or 24;

(3) the year of a planned safety review and the year it was carried out; and

(4) the year in which there was any change in the use of the dam likely to affect its safety and, where applicable, the year of the permanent stopping or a temporary stopping of its operation.

The information referred to in clauses *b* and *c* of subparagraph 1 of the second paragraph shall be approved by the dam owner before it is entered in the register of dams unless it is taken from a report or study made under the responsibility of an engineer.

6. The dam owner shall, within three months of the dam commissioning date, send the information or documents required for the preparation of the register of dams to the Minister, unless an application for authorization or a declaration has been filed under the Act with respect to the construction of the dam.

7. The dam owner shall notify the Minister as soon as possible of any change affecting the accuracy of the information in the register of dams. The owner shall also send any information or document required for the updating of the register of dams to the Minister within three months of receiving a request therefor.

8. The Minister shall make any information or document in the register of dams available upon written request.

The public shall also have access to all or a part of the register of dams through the Internet.

9. The register of dams in electronic format or an extract therefrom may also be made available to any representative of a local municipality, regional county municipality, urban community or of the Kativik Regional Government upon written request.

## CHAPTER III HIGH-CAPACITY DAMS

### DIVISION I DAM CLASSIFICATION

10. Every dam shall be classified in terms of its potential hazard to life and property on the basis of the product of the numerical value of its vulnerability (*V*) calculated under section 13, multiplied by the numerical value of the consequences of dam failure (*C*) determined under section 17, to which “*P*” is the assigned value in the formula “ $P = V \times C$ ”.

11. Following are the dam classes based on the value determined in accordance with section 10, in addition to the class referred to in the second paragraph:

“ <i>P</i> ” value	Dam class
$P \geq 120$	A
$70 \leq P < 120$	B
$25 \leq P < 70$	C
$P < 25$	D

A dam in the Very Low Consequence category under sections 18 and 19 is a Class E dam if the “*P*” value determined under section 10 is less than 70. The consequence category must be certified by an engineer following a characterization of the area that would be affected by a failure.

Where a dam consists of different sections, each section shall be assessed individually and the dam class shall be that of the section with the highest “*P*” value.

12. The classification of a dam shall be reviewed, on the Minister’s initiative, at least once a year.

A dam owner may, at any time, request a review of the classification of the structure if a report or study made under the responsibility of an engineer is submitted with the request.

#### Dam vulnerability

13. The vulnerability of a dam is measured by multiplying the arithmetic mean value of the constant physical parameters (*C<sub>p</sub>*) by the arithmetic mean value of the variable parameters (*V<sub>p</sub>*).

14. The constant physical parameters to be considered are the dam height, dam type, foundation type and

impounding capacity. The points assigned to each parameter are based on the characteristics of the dam and are determined in Schedule II.

There can be only one height and one impounding capacity for each dam, even where the dam consists of different sections.

Where there is more than one type of foundation in a section of a dam, the points assigned to the foundation type parameter for that section of the dam shall be the highest of the points assigned to the different foundation types.

15. The variable parameters to be considered are

(1) the dam age, that is, the number of years since its construction;

(2) the seismic zone in which the dam is located, determined in accordance with the map appearing in Schedule I;

(3) the dam condition, which shall be assessed by considering its physical state and structural condition, the quality and the effectiveness of maintenance, aging, possible effects of external factors such as frost or earthquake and any dam design or structural defects. At the completion of the assessment, the dam condition shall be rated “very good”, “good”, “satisfactory” or “poor or unknown”; and

(4) the reliability of the discharge facilities of the dam, which must at all times and in all conditions allow the discharge of the inflow flood for which the dam was designed. In assessing reliability, the operating condition of the gates, gate-lifting mechanisms and auxiliary power supplies shall be considered. The time required to put the gates and gate-lifting mechanisms into operation as well as any vulnerability to debris likely to lessen the dam’s discharge capacity shall also be considered. At the completion of the assessment, the reliability of the discharge facilities shall be rated “satisfactory” or “unsatisfactory or unknown”.

The points assigned to each variable parameter are based on the characteristics of the dam and are determined in Schedule III.

16. For the purposes of assessing the reliability of discharge facilities, the sections of a dam that do not contain such facilities shall be given the same rating as the sections that do. If the discharge facilities in one section are rated “unsatisfactory or unknown”, that rating shall apply to every other section of the dam.

Where there is more than one dam on the rim of a single reservoir, the structures that are not equipped with discharge facilities shall be given the same rating as the dams that are so equipped. If the discharge facilities of a dam or a section of a dam are rated “unsatisfactory or unknown”, that rating shall apply to every other dam located on the rim.

### Dam failure consequences

17. For the purposes of section 10, the numerical value of the consequences of a dam failure (C) is based on the failure consequence category determined under sections 18 and 19. The points assigned to each category are determined in Schedule IV.

18. The consequence category of a dam failure shall be determined on the basis of the characteristics of the area that would be affected by a dam failure in terms of population density and extent of downstream established infrastructure and services, barring exceptions, and shall take into account, from among a number of dam failure scenarios, the one that would result in the highest consequence category.

In the scenario where the dam fails during a flood period, the affected area would be the area whose inundation would be totally attributable to the dam failure.

The consequence categories based on the characteristics of the area that would be affected by a dam failure are:

Characteristics of the Affected Area	Consequence Category
Uninhabited area containing minor infrastructures such as: — a forest road, mining road, colonization road or private road; — a second dam in the Very Low Consequence category;	Very Low
Occasionally inhabited area containing less than 10 cottages or seasonal residences; OR Area containing infrastructures or services of lesser importance such as: — a local road; — a second dam in the Low Consequence category; — cultivated farmland or a farming business; — seasonal commercial facilities without lodging or providing lodging for less than 25 persons or consisting of less than 10 lodging units (for example, 10 cottages, 10 campsites, 10 motel rooms);	Low

Characteristics of the Affected Area	Consequence Category
Permanently inhabited area containing less than 10 residences; OR Area containing medium-sized infrastructures or services such as: — a national highway (numbered from 100 to 199) or regional highway (numbered from 200 to 399) — a second dam in the Moderate Consequence category; — power distribution lines (voltage less than 34.5 kV); — a railway line (local and regional); — an industry with less than 50 employees; — a main water intake upstream or downstream of the dam supplying a municipality or an industry; — year-round commercial facilities providing lodging for less than 25 persons or having less than 10 lodging units; — seasonal commercial facilities providing lodging for 25 persons or more or having 10 or more lodging units;	Moderate
Permanently inhabited area containing 10 or more residences and less than 2000 inhabitants; OR Area containing significant infrastructures or services such as: — an autoroute (highway numbered from 1 to 99); — a second dam in the High Consequence category; — a school or a hospital; — power transmission or secondary transmission lines (44 kV or higher) or a distribution substation; — railway lines (main lines: transcontinental and transborder); — an industry with 50 to 499 employees; — year-round commercial facilities providing lodging for 25 persons or more or containing 10 or more lodging units;	High
Permanently inhabited area with a population of 2000 or more; OR Area containing major infrastructures or services such as: — an industry with 500 or more employees; — a dangerous substances storage site, an industrial park; — a second dam in the Very High Consequence category.	Very High

For the purposes of the above table, “commercial facilities” means a golf course, bicycle trail, cross-country ski trail, snowmobile trail, campground, outfitting operation, outdoor recreation centre, holiday camp, tourist complex or any other similar sports or recreational facility.

19. Where a dam failure would isolate an area without inundating it, the failure consequence category determined under section 18 may be higher.

In that event, the characteristics of the isolated area in terms of population density and extent of infrastructure or services shall also be considered in determining the dam failure consequence category insofar as a consideration of those factors would result in a higher consequence category than the one originally determined.

20. The characterization of an area that would be affected by a failure shall be based on the following documents, prepared under the responsibility of an engineer:

(1) for a High or Very High Consequence dam, a dam failure study, including inundation maps; or

(2) for a Moderate Consequence dam, rough inundation maps.

For other dams, inundation maps are not required for the characterization of the area that would be affected.

## DIVISION II MINIMUM SAFETY STANDARDS

### §1. Flood resistance

21. For the purposes of this subdivision, unless the context requires otherwise,

“erodible dams” means dams of the following types: concrete gravity embankment, earth-filled timber or steel sheet-pile cribs, concrete or steel sheet-pile barrier upstream of an earthfill dam, rockfill weir, rockfill dam with upstream earth-filled core or with concrete facing, earthfill dam as well as, if they are not designed for overtopping, stone-filled timber or steel sheet-pile cribs and timber buttresses (cribs or dead shores); (*barrages susceptibles d'érosion*)

“safety check flood” is the flood that the dam must withstand under extreme conditions, accepting some damage and a reduction in safety factors but without causing dam failure; (*crue de sécurité*)

“safety freeboard” means the vertical distance between the safety check flood level and the low point of the top of the dam. (*revanche de sécurité*)

22. Subject to section 24, the characteristics of a dam must ensure resistance to not less than the safety check flood described in the table below corresponding to the failure consequence category of the dam determined under sections 18 and 19.

Consequence Category	Safety Check Flood Recurrence Interval
Very Low or Low	1: 100 years
Moderate	1: 1000 years
High	1: 10 000 years or ½ PMF
Very High	Probable maximum flood (PMF)

23. For a dam of which at least half the inflow is controlled by a dam operated upstream, subject to section 24, the safety check flood shall be the highest of

(1) the safety check flood determined under section 22; or

(2) the lesser of the 10 000-year flood and the inflow equivalent to the maximum discharge capacity of the upstream dam together with the local inflows.

Where there is more than one dam located on the same watercourse upstream of the dam in question, the flow to be considered for the purposes of subparagraph 2 of the first paragraph is the flow equivalent to the maximum discharge capacity of the upstream dam with the greatest discharge capacity together with the local inflows, taking into account the flood routing by the other dams located between the upstream dam with the greatest discharge capacity and the dam for which the safety check flood is being determined. This also applies if the upstream dams are located on different watercourses; however, in that event, the flow that must be considered is the total flow obtained by adding, for each watercourse, the flow equivalent to the maximum discharge capacity of the upstream dam with the greatest discharge capacity, taking the local inflows and flood routing into account.

This section does not apply to existing dams that are Very Low or Low Consequence dams under sections 18 and 19.

24. The safety check flood determined for a given dam under section 22 or 23 may be less if a dam failure during the passage of such a flood would not affect the natural waterflow; the safety check flood may not, however, be less than the maximum flood that would affect the natural waterflow in the event of a dam failure during a flood period.

25. Realistic and conservative assumptions and methods based on current knowledge and standards must be used to estimate the safety check flood for a given dam and to assess the dam's capacity to control it.

26. The safety freeboard for an erodible dam must be 1.5 metres unless the dam requires additional protection against waves, freezing or any other adverse conditions that could affect the water level; however, if the failure consequence category of the dam under sections 18 and 19 is Very Low or Low, the freeboard may be 1 metre.

The safety freeboard for an existing dam must be 1 metre unless the failure consequence category of the dam under sections 18 and 19 is Very Low or Low, in which case the freeboard may be less if it can be established that an existing freeboard of between 0.5 metres and 1 metre is adequate given the hydrologic and hydraulic characteristics affecting the watercourse or the reservoir.

The surface of the natural ground enclosing the reservoir must be at least as high as the safety freeboard and be composed of matter or material that will in all circumstances keep it stable and ensure the watertightness of the reservoir.

27. Any impervious component of an erodible dam must be at least 0.5 metres higher than the safety check flood level unless the dam is an existing dam, in which case the component may be the same height as the safety check flood level or higher.

## §2. Earthquake resistance

28. Every dam must be designed to remain stable during the earthquake loading to which it may be subjected in the zone in which it is located.

29. Realistic and conservative methods and assumptions based on current knowledge and standards must be used to assess the structural and foundation stability of a dam in earthquake conditions. Calculations shall be based on the full supply level and take into account the liquefaction potential of the dam and its foundations. If the dam is a rockfill free weir, rockfill weir or earthfill dam, the calculations shall also take into account any rapid drawdown that may occur as part of the normal operation of the dam.

The seismic factors (k) to be applied in the pseudostatic analysis vary according to the seismic zone in which the dam is located and are indicated at the bottom of the map appearing in Schedule I.

30. This subdivision does not apply to dams in the Very Low Consequence category under sections 18 and 19 nor to dams in the Low Consequence category under those sections located in seismic zone 1, 2 or 3.

### DIVISION III DAM OPERATIONS

#### §1. *Impounded water management plan*

31. An impounded water management plan must be drawn up for every dam or project before its commissioning. The plan shall describe all the procedures to be followed by the owner for the safe management of the impounded water during flood periods, in particular during situations in which lives or property located upstream or downstream are at risk.

The plan must include

(1) a description of the hydrographic network upstream and downstream of the dam, including flood estimates and the catchment lag time as well as, where applicable, reference to other structures in the network that may affect the operation of the dam or whose operation it may affect and a quantification of the impact;

(2) dam management procedures, including

(a) operational constraints relating to the safety of persons or property located upstream or downstream of the dam during normal operation and during flood periods;

(b) the full supply level and the safety check flood level;

(c) the level at which the reservoir overflows at its lowest point;

(d) the storage curve and the stage discharge curve with respect to the water level; and

(e) if there are any inhabited areas near the dam, the upstream and downstream flood limits, expressed in terms of level. Downstream flood levels may also be expressed in rate of flow;

(3) a description of the measures that will be taken by the owner to manage the reservoir water during flood periods. The description shall include the procedures to be followed when the flow reaches the lower flood limit, that is the level at which property may be affected by the discharged water; and

(4) a description of the communications strategy for providing information on potential hazards to the authorities responsible for public safety, the other dam owners in the hydrographic system, the enterprises and the inhabitants that will ultimately be affected by the implementation of the impounded water management

plan in situations likely to endanger life or property located upstream or downstream of the dam.

For the purposes of subparagraph 1, clause *a* of subparagraph 2 and subparagraph 3 of the second paragraph, the floods that must be considered, up to the safety check flood established for the dam under section 22, 23 or 24, are the twenty-year flood, one-hundred-year flood, thousand-year flood, ten-thousand-year flood and the probable maximum flood (PMF).

32. The owner is required, at all times, to make all necessary amendments to the impounded water management plan in the event of any change affecting the procedures set out in the plan or the information contained therein.

33. The impounded water management plan must be updated whenever a new dam safety review is required.

It must also be updated when applying for an authorization for the structural alteration of the dam, for a change in use likely to affect its safety or for the permanent or temporary stopping of the operation of the dam.

34. As soon as possible after the preparation, amendment or updating of an impounded water management plan, the dam owner shall forward the plan to the local municipality in which the dam is located. The Minister shall be notified of the transmission.

So that residents may be informed of the impounded water management plan, every local municipality shall keep the plan at its office where it may be consulted and copies of it made.

35. This section does not apply to a dam classified as a Class E dam under section 11.

#### §2. *Emergency action plan*

36. An emergency action plan must be drawn up before the commissioning of any dam. The plan shall set out the procedures to be followed for the protection of life and property upstream or downstream of the dam in the event of a dam failure in progress or imminent dam failure or to mitigate the effect of the failure; the plan must be compatible with any emergency preparedness plans or risk management plans that may have been established for the territory in which the dam is located.

The plan must include

(1) the names of the local municipalities and regional county municipality, urban community or any other regional body that would be affected by a dam failure;

(2) a general description of the area that would be inundated in the event of a dam failure, including the physical characteristics, the population, the public, private and transportation infrastructures in place and the land uses, in particular the industries located in the area, including those likely to contaminate the environment in the event of a failure;

(3) a study of the vulnerability of the dam consisting in an analysis of the risk and consequences of a dam failure and of the owner's ability to respond effectively in the event of such a failure. The study shall

(a) list the conditions that could lead to a dam failure, including a brief assessment of the consequences of each hazardous condition;

(b) identify, from among those listed, the situation that would cause, in terms of area, the largest inundation; and

(c) identify the internal and external human, material and organizational resources available in the event of a failure and indicate their location and their number;

(4) a description of prevention, potential dam failure detection and mitigation measures to be taken by the owner;

(5) a description of the emergency response by the owner in the event of a dam failure in progress or imminent dam failure, including

(a) warning and mobilization procedures;

(b) the notification procedure for warning authorities responsible for public safety and, if required, for alerting residents and coordination with the notification process established by the municipalities concerned;

(c) the administrative and operations centre; and

(d) the dam management procedures for the protection of lives and property; and

(6) a description of the procedure drawn up by the owner for keeping the emergency action plan up-to-date, for periodic testing of the plan and for testing specifically requested by the civil protection authorities, and for training all dam personnel involved in the emergency action plan, and, in particular, the person in charge of implementing the plan.

The provisional emergency action plan to be submitted in support of an application for authorization for the construction or structural alteration of a dam must in-

clude a specific response procedure in the event of a dam failure during the carrying out of the authorized work.

37. Where the failure consequence category of a dam determined under sections 18 and 19 is High or Very High, a summary and the results of a dam failure study, including inundation maps, made under the responsibility of an engineer must be appended to the emergency action plan.

Where the failure consequence category of a dam under those sections is Moderate, only rough inundation maps made under the responsibility of an engineer need be appended to the emergency action plan.

Every document appended to an emergency action plan forms an integral part thereof.

38. The owner is required, at all times, to make all necessary amendments to the emergency action plan in the event of any change affecting the procedures set out in the plan or the information contained therein, in particular with respect to the resources available in the event of a failure and the persons in charge of those resources.

39. The emergency action plan must be updated whenever a new dam safety review is required.

It must also be updated when applying for an authorization for a structural alteration of the dam, for a change in use likely to affect its safety or for the permanent or temporary stopping of the operation of the dam.

40. As soon as possible after the preparation, amendment or updating of an emergency action plan, including the provisional plan referred to in the second paragraph of section 73, the owner shall forward the plan to the local municipality in which the dam is located. The Minister shall be notified of the transmission.

So that residents may be informed of the emergency action plan, every local municipality shall keep the plan at its office where it may be consulted and copies of it made.

41. This subdivision does not apply to dams in the Very Low or Low Consequence category under sections 18 and 19.

### §3. *Monitoring*

42. The monitoring of a dam by the owner includes

(1) site inspections to detect and monitor the more apparent deficiencies and to determine the general con-



dition of a dam following major events such as floods, earthquakes and windstorms;

(2) regular inspections to ensure continuous monitoring of the dam. Regular inspections serve, among other things, to monitor known deficiencies, discover other deficiencies and uncover any deterioration and require a general inspection of the dam and its main components; and

(3) formal inspections to monitor the behaviour of the dam and to determine, by means of a comprehensive inspection, the condition of each of its components. Formal inspections serve, among other things, to monitor known deficiencies, discover other deficiencies and uncover any deterioration.

43. Unless a dam has deficiencies or deterioration necessitating closer monitoring, it must undergo a minimum number of inspections per year according to its classification determined under Division I of Chapter III, as follows:

Type of Inspection	Dam Classification and Behaviour									
	A		B		C		D		E	
	I	II	I	II	I	II	I	II	I	II
Site	—	1/M	—	1/2M	—	3/Y	—	2/Y	1/Y	1/Y
Regular	1/M	4/Y	1/2M	3/Y	4/Y	2/Y	2/Y	1/Y	—	—
Formal	1/Y	1/Y	1/Y	1/2Y	1/2Y	1/3Y	1/3Y	1/5Y	1/5Y	1/5Y

Legend: I: first years of the dam's operation when its behaviour is not stabilized  
 II: subsequent years of operation when its behaviour has stabilized  
 M: month  
 Y: year

The inspections that must be carried out yearly shall be carried out as evenly as possible over the twelve months of the year.

44. For the purposes of section 43, the inspection carried out during a safety review counts as a formal inspection, regular inspection and site inspection for the year in which it is carried out.

45. The qualification requirements for carrying out and, as the case may be, supervising a site inspection, regular inspection or formal inspection vary according to the type of inspection and the dam class determined under Division I of Chapter III.

(1) Class A: twelve inspections;

(2) Class B: six inspections;

(3) Class C: three inspections, unless the behaviour of the dam is not stabilized, in which case four inspections per year must be carried out;

(4) Class D: two inspections;

(5) Class E: one inspection.

A formal inspection counts as a regular inspection and a site inspection for the year in which the formal inspection is carried out. A regular inspection counts as a site inspection.

Taking the preceding rules into account, the type and frequency of inspections vary according to the class of the dam and the stability of its behaviour, in accordance with the following table:

Site inspections shall be carried out by a person who is familiar with the dam; site inspections of a Class A or Class B dam shall be carried out under the supervision of a civil-engineering technician or an engineer.

Regular inspections shall be carried out by a civil-engineering technician; regular inspections of a Class A or Class B dam must be carried out under the supervision of an engineer. Regular inspections of a Class C or Class D dam may also be carried out by a person familiar with the dam provided, however, that the inspection is carried out under the supervision of a civil-engineering technician or an engineer.

Formal inspections of any class of dam must be carried out by an engineer.

#### §4. Logbook

46. Every dam owner shall, from the dam commissioning date, establish and maintain a logbook in which activities and important events relating to dam safety are recorded in chronological order.

In addition to the information required by law, the logbook must contain

- (1) a brief description of every inspection, indicating the water level at each inspection;
- (2) a brief description of every safety review; and
- (3) a description of any maintenance, repair or structural alteration work to the dam.

The logbook must also contain, where applicable,

- (1) a description of unusual natural events, such as earthquakes, twenty-year or more floods, rainstorms or windstorms, landslides, floating islands, and ice conditions;
- (2) a description of events caused by human actions, such as vandalism, sabotage or work carried out near the dam that could affect its stability;
- (3) any deviation from operational constraints relating to dam safety established at the time of dam design or in a safety review, in particular with respect to the full supply level and filling and drawdown speeds;
- (4) a description of special activities, such as behaviour tests or investigations; and
- (5) a description of operations carried out, excluding regular flow controls.

The owner of an existing dam shall enter in the logbook, to the best of the owner's knowledge, the actions that have been taken and the significant events that have occurred from the dam commissioning date to the date of coming into force of the Act.

47. The project owner may establish and maintain either one logbook or several. Where a logbook pertains to more than one dam, each entry in the logbook must identify the dam to which it refers.

#### DIVISION IV DAM SAFETY REVIEW

48. The dam safety review conducted to assess the safety of a dam shall consist of a study in two parts, one

descriptive and the other analytical, that will include the findings of the engineer in charge of the review.

The descriptive part shall include

(1) the official name of the dam as established by the Commission de toponymie du Québec, and the particulars of its location, including geographic coordinates;

(2) the name and address of the dam owner;

(3) the name and position of the owner's representative responsible for dam safety;

(4) the name and address of the engineer in charge of the safety review;

(5) where applicable, the date of the last dam safety review;

(6) a brief description and history of the dam including

(a) geometric size;

(b) available data relating to

— geology, geotechnics and seismicity of the zone in which the dam is located;

— catchment hydrology and hydraulics characteristics at the time of dam design;

— climatic conditions that may have been a source of problems during construction of the dam; and

— foundation and building materials characteristics;

(c) the data, assumptions and analysis methods considered in the dam design and any subsequent modifications and, where applicable, those considered in the last safety review;

(d) important occurrences during dam construction that may affect the stability or safety of the dam;

(e) operating procedures established by the dam designer and those subsequently imposed by the owner;

(f) operational constraints relating to dam safety established at the time of dam design or in a safety review; and

(g) changes in land use planning and development since the construction of the dam and, if applicable, since the last safety review; and

(7) a description of the maintenance and repair work carried out since the last safety review or, failing such review, during the period deemed relevant by the engineer in charge of the review as well as an assessment of the impact of the work on the safety of the dam.

The analytical part shall include

(1) the results of the inspection carried out during the dam safety review, including the focal points of the inspection and comments on the observations and the deficiencies discovered, which must take into account the compiled results of each inspection since the last safety review or, failing such a review, for the period deemed relevant by the engineer in charge of the review;

(2) comments on the compiled results of each inspection since the last safety review or, failing such a review, for the period deemed relevant by the engineer in charge of the review. This heading shall include a brief description of monitoring instruments if the dam is so equipped, assessment of their condition, test results as well as comments on deficiencies discovered. It shall also include comments on the comparison between the test results and the estimated dam behaviour changes considered at the time of dam design or any considered subsequently;

(3) validation of the data, assumptions and analysis methods considered at the time of dam design or considered subsequently, including

(a) characterization or a review of the characterization of the dam site materials for dams that are classified Class A or Class B dams under section 11;

(b) a review of the impounded water management plan prepared in accordance with Subdivision 1 of Division III, where such a plan is required under that subdivision;

(c) a review of the operating procedures and operational constraints relating to dam safety and a reappraisal of the data, assumptions and analysis methods considered at the time of dam design or considered subsequently, taking into account the acquisition of supplementary data, extreme event occurrences and the minimum safety standards; and

(d) a review of the dam failure consequence category determined under sections 18 and 19;

(4) the structural and foundation static stability or, where required, dynamic stability calculations according to revised data and analysis methods based on current safety factors, including any stability calculations required under Subdivision 2 of Division II; and

(5) a validation of the functionality and adequacy of any safety devices with which the dam may be equipped, namely, discharge facilities, emergency systems, emergency detector systems and back-up systems.

The findings of the safety review study must set out the opinion of the engineer in charge of the review on the structural and functional safety of the dam, in particular with respect to compliance with the minimum safety standards, include the engineer's comments on the adequacy of inspections and identify the safety parameters to be applied in future inspections. The principal observations and the deficiencies discovered shall be described in the findings of the study as well as the remedial measures recommended by the engineer, in their order of priority.

49. The following documents, updated where required, form an integral part of the safety review study and must be appended thereto:

(1) a impounded water management plan in compliance with Subdivision 1 of Division III, where such a plan is required for the dam under that subdivision;

(2) according to the failure consequence category of the dam determined in accordance with sections 18 and 19,

(a) for a High or Very High Consequence dam, a dam failure analysis, including inundation maps;

(b) for a Moderate Consequence dam, rough inundation maps; or

(c) for a Low or Very Low Consequence dam, a document characterizing the area that would be affected by a dam failure;

(3) the structural and foundation stability calculations, including any calculations required under Subdivision 2 of Division II; and

(4) a list of the reference documents used in the dam safety review.

50. The first dam safety review shall be conducted, and the attendant study sent to the Minister, before the end of the tenth calendar year following the commissioning of the dam, subject to the provisions of sections 74 to 76 relating to existing dams.

51. A new dam safety review shall be conducted, and the attendant study updated and sent to the Minister, before the end of the tenth calendar year following the year in which the last safety review was conducted.

52. The Minister's decision under section 17 of the Act on the remedial measures the owner intends to take and the implementation schedule shall be made within six months after receipt the outline and schedule sent by the owner.

#### **DIVISION V** **SAFETY PROGRAMS**

53. The Minister may approve a safety program

(1) that covers all the dams belonging to the owner of at least ten dams;

(2) that includes, for each dam or project, provisions relating to

(a) impounded water management;

(b) emergency preparedness in respect of any dams covered by the program that are subject to the requirement of an emergency action plan under Subdivision 2 of Division III;

(c) monitoring;

(d) the dam safety review;

(e) the logbook;

(f) maintenance; and

(g) the administration of the safety program, in particular with respect to the persons in charge of its implementation, their training and their respective responsibilities; and

(3) that has been in effect, under the responsibility of qualified persons, for at least five years.

54. The Minister's decision under section 23 of the Act relating to a safety program shall be made within three months after receipt of the proposal.

55. The implementation of a safety program approved by the Minister exempts the owner from the provisions of this Regulation relating to

(1) the frequency of dam safety reviews;

(2) the updating frequency of impounded water management plans and emergency action plans; and

(3) the frequency, type and content of inspections as well as the qualification requirements for carrying out inspections.

#### **DIVISION VI** **APPLICATIONS FOR AUTHORIZATION**

56. The following information and documents, in addition to those required by the Act, must be submitted with an application for authorization for the construction or structural alteration of a dam:

(1) hydrologic and hydraulic studies made under the responsibility of an engineer;

(2) an impounded water management plan in compliance with Subdivision 1 of Division III, where such a plan is required under that subdivision for the dam to be constructed or undergo structural alteration;

(3) a provisional emergency action plan for the period of the construction or structural alteration work, where an emergency action plan is required under Subdivision 2 of Division III for the dam in question;

(4) the structural and foundation stability calculations for the dam to be constructed or to undergo structural alteration including, where applicable, the calculations required under Subdivision 2 of Division II;

(5) cost estimates of the planned work; and

(6) according to the type of authorization,

(a) for the construction of a dam: rough inundation maps, where the dam to be constructed is in the Moderate, High or Very High Consequence category under sections 18 and 19; or a document characterizing the area that would be affected by a failure, where the consequence category under those sections is Very Low or Low;

(b) for the structural alteration of a dam, where carrying out the planned alteration would enlarge the area that would be affected by a dam failure:

— a dam failure analysis, including inundation maps delineating the additional area that would be affected, where the failure consequence category of the dam under sections 18 and 19 is High or Very High; or

— rough inundation maps delineating the additional area that would be affected, where the dam failure consequence category under those sections is Moderate;

— a document characterizing the additional area, where the dam failure consequence category under those sections is Very Low or Low.

A \$200 deposit on the fees prescribed in section 61 must accompany the application for authorization. That amount will not be refunded under any circumstances.

57. An application for authorization for the removal of a dam must include

(1) the geographic coordinates and geometric size of the dam;

(2) a description of the planned work; and

(3) a description of the impact of the dam removal on the natural characteristics of the watercourse, its bed and its shores, indicating the natural characteristics prior to the carrying out of the planned work and prior to the construction of the dam.

58. The following information and documents must accompany an application for authorization for a change in use likely to affect dam safety or for the permanent or temporary stopping of the operation of a dam:

(1) an assessment of the effects of the proposed change or of the planned stopping of the operation on dam safety;

(2) the hydrologic and hydraulic studies made under the responsibility of an engineer;

(3) an impounded water management plan in compliance with Subdivision 1 of Division III, where such a plan is required under that subdivision for the dam in question;

(4) the structural and foundation stability calculations, including, if applicable, those required by Subdivision 2 of Division II; and

(5) where carrying out the project referred to in the application for authorization would enlarge the area that would be affected by a dam failure,

(a) a dam failure analysis, including inundation maps delineating the additional area that would be affected, where the failure consequence category of the dam under sections 18 and 19 is High or Very High;

(b) rough inundation maps delineating the additional area that would be affected, where the dam failure consequence category under those sections is Moderate; and

(c) a document characterizing the additional area, where the dam failure consequence category under those sections is Very Low or Low.

59. The Minister's decision under section 5 of the Act relating to the construction or structural alteration of a dam shall be made within six months after receipt of the application for authorization.

The Minister's decision under section 5 of the Act relating to the removal, a change in use or the permanent or temporary stopping of the operation of a dam shall be made within two months after receipt of the application for authorization.

The Minister shall render a decision under section 9 of the Act relating to a modification to the plans and specifications within ten days after receipt of the application.

60. The time limits referred to in section 59 run from the date on which the file on an application is complete.

## DIVISION VII FEES

61. The application processing fee for an authorization relating to the construction or structural alteration of a dam is based on the following table, taking into account the cost of the work requiring the authorization:

Cost of Work	Fee
Less than \$25 000	\$1000
\$25 001 to \$100 000	\$1000 for the first \$25 000, plus \$40 for each additional \$1000 or part thereof
\$100 001 to \$500 000	\$4000 for the first \$100 000, plus \$10 per additional \$1000 or part thereof
\$500 001 to \$1 000 000	\$8000 for the first \$500 000, plus \$4 for each additional \$1000 or part thereof
\$1 000 001 to \$10 000 000	\$10 000 for the first \$1 000 000, plus \$2 for each additional \$1000 or part thereof
\$10 000 001 to \$40 000 000	\$28 000 for the first \$10 000 000, plus \$1 for each additional \$1000 or part thereof
\$40 000 001 and up	\$58 000 for the first \$40 000 000, plus \$0.10 for each additional \$1000 or part thereof

The cost of the work includes the engineering fees and costs of the construction project or structural alteration project as well as the inherent materials and labour cost to carry out the work.

**62.** The application processing fee for an authorization for a change in use likely to affect dam safety or for the permanent or temporary stopping of the operation of a dam is \$200 per application for all classes of dams.

**63.** The application processing fee for an authorization for the removal of a dam is \$1000 for a Class A dam, \$500 for a Class B dam and \$250 for a Class C, D or E dam.

**64.** The file processing fee for the approval of an owner's outline of remedial measures established for a dam and implementation schedule is \$4000 for a Class A dam, \$2500 for a Class B dam and \$1000 for a Class C, D or E dam.

**65.** The application processing fee for the approval of a safety program subject to section 23 of the Act is \$10 000 per owner. The fee for the renewal of a program is \$2500.

**66.** The annual fee payable by a dam owner to cover the costs incurred in the administration of the Act is \$850 for a Class A or B dam, \$175 for a Class C or D dam and \$100 for a Class E dam.

The annual fee payable by the owner of a dam covered by a safety program under section 23 of the Act is 75% of the annual fee determined in the first paragraph for each dam covered by the program.

A change in a dam's classification shall not generate a fee adjustment for the year in which it occurs.

**67.** The fees prescribed in sections 61 to 66 must be paid within thirty days of the invoice date by certified cheque to the Minister of Finance.

**68.** The fees prescribed in sections 62 to 66 shall be adjusted on 1 January of each year on the basis of the percentage change in the Consumer Price Index for Canada published by Statistics Canada, which is calculated by determining the difference between the average monthly index for the twelve-month period ending on 30 September of the preceding year and the average monthly index for the same period of the second preceding year.

The adjusted fee shall be reduced to the nearest dollar if it contains a dollar fraction under \$0.50 and it shall be increased to the nearest dollar if it contains a dollar fraction of \$0.50 or more.

The Minister shall inform the public of the annual adjustment by a notice published in the *Gazette officielle du Québec* and by any other means the Minister may consider appropriate.

#### **CHAPTER IV** **LOW-CAPACITY DAMS**

**69.** The declaration of the construction or structural alteration of a dam must contain

(1) the name and address of the owner and the particulars of the dam location, including geographic coordinates;

(2) the impounding capacity of the dam;

(3) the hydrologic and hydraulic data and assumptions considered at the time of dam design; and

(4) the project description.

The project plans and specifications drawn up by an engineer must be submitted with the declaration.

**70.** The declaration of the removal of a dam must contain

(1) the name and address of the owner and the particulars of the dam location, including geographic coordinates; and

(2) a description of the proposed work.

#### **CHAPTER V** **SPECIAL PROVISIONS**

**71.** The owner of an existing dam shall, within three months of the coming into force of the Act, send to the Minister all information or documents required to prepare the register of dams referred to in Chapter II.

**72.** Any existing high-capacity dam with characteristics that do not comply with the minimum safety standards under Division II of Chapter III at the date of coming into force of the Act must be brought into conformity with those standards by the deadline indicated in the outline of remedial measures and implementation schedule approved by the Minister under section 17 of the Act, unless the dam underwent structural alteration before that date that was duly authorized under section 5 of the Act.

**73.** The owner of an existing high-capacity dam shall, no later than the date by which the study attendant to the first dam safety review must be sent to the Minister under section 74, 75 or 76, prepare

(1) an impounded water management plan in compliance with Subdivision 1 of Division III of Chapter III, where such a plan is required under that subdivision for the dam in question; and

(2) an emergency action plan in compliance with Subdivision 2 of Division III of Chapter III, where such a plan is required under that subdivision for the dam in question;

However, a preliminary emergency action plan, including rough inundation maps, must be prepared within twelve months of the coming into force of the Act for any dam referred to in subparagraph 2 of the first paragraph. The plan must contain a brief summary of the information referred to in section 36, if it is available at the time.

**74.** Subject to the provisions of sections 75 and 76, the first dam safety review of an existing high-capacity dam shall be conducted, and the attendant study sent to the Minister, within the time limit indicated below, computed from the date of coming into force of the Act; the time limit varies according to the dam failure consequence category under sections 18 and 19 and the dam condition and discharge facilities reliability ratings under subparagraphs 3 and 4 of the first paragraph of section 15 and section 16.

For a High or Very High Consequence dam, the time limit is

(1) three years, where the condition of the dam is rated satisfactory or poor or unknown or where the reliability of the discharge facilities is rated unsatisfactory or unknown; or

(2) four years, where the condition of the dam is rated good or very good and the reliability of the discharge facilities is rated satisfactory.

For a Moderate Consequence dam, the time limit is

(1) five years, where the condition of the dam is rated satisfactory or poor or unknown or where the reliability of the discharge facilities is rated unsatisfactory or unknown; or

(2) six years, where the condition of the dam is good or very good and the reliability of the discharge facilities is rated satisfactory.

For a Low Consequence dam, the time limit is

(1) seven years, where the condition of the dam is rated satisfactory or poor or unknown or where the reliability of the discharge facilities is rated unsatisfactory or unknown; or

(2) eight years, where the condition of the dam is rated good or very good and the reliability of the discharge facilities is rated satisfactory.

For a Very Low Consequence dam, the time limit is

(1) nine years, where the condition of the dam is rated satisfactory or poor or unknown or where the reliability of the discharge facilities is rated unsatisfactory or unknown; or

(2) ten years, where the condition of the dam is rated good or very good and the reliability of the discharge facilities is rated satisfactory.

**75.** The first dam safety review of an existing high-capacity dam for which approval was granted under the Watercourses Act less than five years before the date of coming into force of the Act shall be conducted, and the attendant study sent to the Minister, by no later than

(1) the expiry of the time limit determined under section 74; or

(2) the end of the tenth calendar year after the approval.

**76.** A safety review whose content complies with Division IV of Chapter III conducted less than five years before the coming into force of the Act may be substituted for the first safety review referred to in section 74 if the attendant study is sent to the Minister within two years of the coming into force of the Act and an outline of the remedial measures to be taken, in addition to the documents listed in section 49, is appended thereto. The outline must indicate the remedial measures that have been taken and detail the scheduled measures.

A new safety review referred to in the first paragraph must be conducted, and the attendant study updated, ten years after the coming into force of the Act. Thereafter, a new dam safety review must be conducted and the attendant study updated in accordance with section 51.

**77.** This Regulation comes into force on the fifteenth day following the date of its publication in the *Gazette officielle du Québec*.





**SEISMIC ZONES**

Direction de l'hydraulique et de l'hydrique  
November 2000

**SEISMIC COEFFICIENTS**

<b>Zone</b>	<b>Seismic Coefficient (k)</b>
1	0.05
2	0.10
3	0.15
4	0.25
5	0.30

**SCHEDULE II**

(s. 14)

**CONSTANT PHYSICAL PARAMETERS (C<sub>p</sub>)**  
 (Dam vulnerability numerical values)

Dam height

<b>Height (m)</b>	<b>Points</b>
≤5	1
10	2
20	3.5
30	4.5
40	5.0
50	5.8
100	8.0
160 or more	10.0

The points for intermediate heights shall be determined by considering that the points vary linearly between the various height values, except a dam 5 m or lower, which is always assigned 1 point.

Dam types

<b>Dam Type</b>	<b>Points</b>
Concrete gravity	5
Concrete gravity embankment	3
Concrete arch	1
Stone-filled timber or steel sheet-pile cribs	6
Earth-filled timber or steel sheet-pile cribs	10

<b>Dam Type</b>	<b>Points</b>
Concrete buttresses	3
Timber buttresses (cribs)	8
Timber buttresses (dead shores)	9
Free weir – concrete shield	7
Rockfill free weir	8
Concrete or steel sheet-pile barrier upstream of an earthfill dam	6
Rockfill weir	4
Rockfill dam with – concrete facing – upstream earthfilled core	3
Steel sheet-piling	7
Earthfill	10

## Foundation types

<b>Foundation Type</b>	<b>Points</b>
Competent rock	1
Treated weathered rock	2
Untreated weathered rock	3
Moraine/clay	4
Treated moraine	6
Treated alluvial deposits	8
Alluvial or unknown deposits	10

## Impounding capacity

<b>Capacity (10<sup>6</sup>m<sup>3</sup>)</b>	<b>Points</b>
≤1	1
50	3
1000	5
2000	6.5
5000	8
6000 and over	10

For any other type of dam, an equivalence with the dam type in the table with the closest characteristics shall be established

The treatment includes all the methods meant to reduce the permeability of the foundation and increase its resistance to internal erosion or its bearing capacity

The points for intermediate capacities shall be determined by considering that the points vary linearly between the various values of impounding capacity, except an impounding capacity of 1 000 000 m<sup>3</sup> or less, which is always assigned 1 point.

**SCHEDULE III**

(s. 15)

**VARIABLE PARAMETERS (V<sub>p</sub>)**  
(Dam vulnerability numerical values)

Dam age

<b>Concrete Dam</b>	
<b>Age (years)</b>	<b>Points</b>
0	1
5	1.5
10	2
20	3
40	7
50	9
55 and over	10

This category includes the following dam types: concrete gravity, concrete gravity embankment, concrete arch, stone-filled or earth-filled steel sheet-pile cribs, concrete buttresses, free weir – concrete shield, rockfill dam with concrete facing, steel sheet-piling.

The points for intermediate dam ages shall be determined by considering that the points vary linearly between the various age values.

<b>Embankment Dam</b>	
<b>Age (years)</b>	<b>Points</b>
0	8
5	7.5
10	6.5
15	5
20	4
25	3
30	2.5
40	2
50	1.5
60 and over	1

This category includes the following dam types: concrete barrier or steel sheet-piling upstream of earthfill dam, rockfill dam with upstream earth-filled core and earthfill.

The points for intermediate dam ages shall be determined by considering that the points vary linearly between the various dam age values.

<b>Timber Dam</b>	
<b>Age (years)</b>	<b>Points</b>
0	1
5	1.5
10	2

This category includes the following dam types: stone-filled or earth-filled timber cribs and timber buttresses (cribs or dead shores).

The points for intermediate dam ages shall be determined by considering that the points vary linearly between the various dam age values

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**Timber Dam**


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Age (years)	Points
20	8
30 and over	10

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**Rockfill Free Weir**


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Age (years)	Points
≤5	5
10	6
15	7
20	8
25	9
30 and over	10

This category includes the following dam types: rockfill free weir and rockfill weir.

The points for intermediate dam ages shall be determined by considering that the points vary linearly between the various dam age values, except a dam of five years or less, which is always assigned 5 points.

**Seismicity**

Seismic Zone	Points
1	1
2	2
3	6
4	8
5	10

**Reliability of discharge facilities**

Reliability	Points
Satisfactory	1
Unsatisfactory or unknown	10

**Dam condition**

Condition	Points
Very good	1
Good	3
Satisfactory	5
Poor or unknown	10

- Very good: The dam does not show evidence of any deficiency or has minimal confined deterioration considered normal or of no consequence.
- Good: The dam shows evidence of only minor deterioration or deficiencies that do not affect the proper operation of its components.
- Satisfactory: The dam shows evidence of deterioration requiring repairs without however immediately endangering the structure ; a dam in this state requires maintenance and repair work in the immediate or near future without which the dam would become increasingly vulnerable. The dam may also show evidence of deficiencies which do not affect its immediate safety but which require close monitoring.
- Poor or unknown: The dam shows evidence of single or multiple severe deterioration that could affect its stability or make certain parts inoperable or the dam shows evidence of serious deficiencies likely to endanger its safety or the condition of the dam cannot be ascertained.

#### **SCHEDULE IV**

(s. 17)

#### **DAM FAILURE CONSEQUENCE NUMERICAL VALUES**

<b>Consequence Category</b>	<b>Points</b>
Very Low	1
Low	2
Moderate	3
High	5
Very High	8

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