HAZARD CLASSIFICATION AND LEGACY DAMS

POLICY/GUIDELINES | REG_04.2023

NORTH Dakota | Water Resources
Be Legendary.

Effective Date: 06/02/2023

POLICY OUTLINE

1 POLICY STATEMENT

The Department of Water Resources (Department), in order to fulfill its authority to permit and manage dams in North Dakota, continually reviews the state of the national dam safety practice through a North Dakota lens in order to promote sound water resource management while upholding public safety and property protection.

This Policy identifies the metrics used by the Department to associate appropriate dam hazard classifications based on the potential impacts due to dam failure.

As a part of the continual review of national dam safety practices, the Department may occasionally initiate modifications to rules, statues, or policy in support of public safety and property protection.

This Policy identifies the process the Department will use to associate a hazard classification to a dam and communicate potential hazard classification adjustments to dam owners. This Policy additionally implements a new Legacy dam designation for exiting dams where a hazard classification adjustment may be necessary.

This Policy provides an open and transparent process for all Dam Owners on Department review and decision-making related to the hazard classifications of dams.

1.1 POLICY AUTHORITY OR IMPLEMENTATION

This Policy garners authority from North Dakota Century Code (N.D.C.C.) §§ 61-03-21.2 and 61-16.1-38, as well as North Dakota Administrative Code (N.D.A.C.) article 89-08 and will be implemented through the Regulatory Division Dam Safety Program's construction permit application and permit requirements.

1.2 ACCEPTANCE OR ENFORCEMENT

The Department reserves the right to change this policy as necessary to ensure the Department fulfills its statutory duties.

The Department reserves the right to return any application submitted under this Policy to the applicant for correction if it does not comply with the Policy's intent or is insufficient for the Department to make an informed decision.

The Department reserves the right to enforce this Policy per the process outlined in N.D.C.C. §§ 61-03-21.2 and 61-16.1-38, as well as N.D.A.C. article 89-08.

1.3 APPEALS

Decisions may be appealed per the process outlined in N.D.C.C. § 61-03-22.

1.4 POLICY DEVIATIONS

The Department reserves the right to deviate from Policy as deemed appropriate and within requirements outlined in N.D.C.C. or N.D.A.C.

Policy deviations from applicants including alternate modeling assumptions and methods may be considered by the Department if the applicant can justify why the outlined elements of this Policy are not necessary or applicable. Such a deviation will not be granted without significant justification. Additionally, a deviation request does not guarantee that a deviation will be granted, and any work performed to pursue such a deviation request will be solely at the applicant's expense.

1.5 DEPARTMENT CONTACT

Please contact the Department's Regulatory Division at (701) 328-4956 or dwrregpermits@nd.gov for questions regarding this Policy or the ND Dam Safety Program.

2 PRE-APPLICATION CONSULTATION

The Department strongly encourages pre-application consultation prior to application submittal. Early consultation between the applicant, the applicant's representative(s), and the Department will support early understanding and compliance with this policy to limit unexpected project costs or delays.

3 HAZARD CLASSIFICATION REVIEW

The Department will perform a hazard classification review on all new dams and existing dams when a permittable action occurs.

Hazard classification analyses completed by the Department or by the Dam Owner, must be completed by, or under the direct supervision of, a Professional Engineer registered and in good standing in North Dakota.

The outlined model requirements are intended to represent the minimum dam breach model requirements. A Dam Owner may elect to complete more detailed dam breach modeling than what is described as long as the intent of this Policy is met as determined by the Department.

The potential to cause loss of human life in the event of a dam breach downstream of a dam is a primary factor in determining a dam's hazard classification, and is based on two metrics:

- The potential presence of people at the time of dam breach, and
- Dam breach flooding lethality.

These metrics along with additional considerations that can be applied to determine hazard classification are outlined below.

3.1 DAM BREACH MODEL

The following metrics apply for Department and Dam Owners modeling a dam breach to inform a hazard classification review. Deviations from these model assumptions are subject to Department approval under Section 1.4:

a. Assume a starting water surface elevation at the crest of the top of dam, or at the maximum reservoir level reached by the Probable Maximum Flood (PMF), whichever is less.

b. Assume no additional reservoir inflow.

c. Assume no coincident flooding downstream of the dam.

d. Either assume an internal erosion breach where the failure mode is due to piping or sediment moving with flowing waters out of the dam creating a void within the dam or use NRCS TR-60 methods to derive the breach hydrograph.

e. Use a 2-dimensional model, including the use of survey or Light Detection and Ranging topographic information.

f. Dam breach model limits must extend downstream to a point where there are no additional impacts from the dam failure that would affect the hazard classification of the dam.

3.2 PRESENCE OF PEOPLE

The potential presence of people is an important metric to evaluate downstream risks to evaluate hazard classification and is based on the following:

3.2.1 STRUCTURES

All habitable structures, including single- and multi-family dwellings, trailers, and mobile homes; commercial, industrial, and agricultural buildings regularly occupied by workers or the public; and recreational facilities with overnight stays possible are assumed to be occupied. This excludes out-buildings that are occupied on an occasional or inconsistent basis.

3.2.2 ROADS

The likelihood of people being present is based on a roadway's Annual Average Daily Traffic (AADT) count.

AADT information can be obtained from the North Dakota Department of Transportation (DOT).
(https://www.dot.nd.gov/business/maps-portal.htm#trafficcountsstateandcity)

The most recent traffic count data available should be used. If the traffic level of a particular roadway is in question and AADT data is unavailable, reasonable assumptions may be made based on the best available data.

3.2.3 RAILROADS

The likelihood of people being present is based on the rail line's freight or passenger designation, and average number of trains per day.

The average number of trains per day and the type of rail line (passenger, freight, etc.) can be determined using U.S. Department of Transportation Railroad Crossing Inventory Forms, which can be obtained from the Federal Railroad Administration.
(http://fragis.fra.dot.gov/GISFRASafety/)

3.3 FLOODING LETHALITY

Flooding lethality evaluates the severity of flooding and the likelihood of conditions being present that could cause loss of human life. This evaluation is based on presence and use of structures, roads, and railroads as detailed below. Deviations from these methods are subject to Department approval under Section 1.4.

3.3.1 STRUCTURES

Evaluate potential flooding lethality at the occupied structures and facilities described in Section 3.2.1.

a. The evaluation is based on outputs from the breach model completed in Section 3.1 and selected lethality charts for structures contained in *ACER Technical Memorandum No. 11 – Downstream Hazard Classification Guidelines (ACER 11)*, U.S. Bureau of Reclamation, 1988 (see Appendix A).

b. The depth-velocity-flood danger relationships in Appendix A are divided into three zones: a low danger zone where loss of life is improbable, a high danger zone where loss of life is probable, and a judgement zone where engineering judgement must be used to determine if loss of life is probable.

c. If lethal conditions are not present, then economic losses are assumed to occur due to the flooding and the dam may be classified as medium hazard if there are no other hazards to be considered.

3.3.2 ROADS

Roads are assumed to be impacted if overtopped at any depth. The potential for roads to be overtopped is based on the breach model completed in Section 3.1. If the road is determined to be impacted, the following criteria will be used to determine loss of human life:

a. AADT< 500 vehicles: No probable loss of human life. Dams that impact roads in this category will be classified as low hazard if there are no other hazards to be considered.

b. U.S. Highways, State Highways, or roads with AADT 500–2,000 vehicles: Transportation disruptions, potential economic impacts, but loss of human life unlikely. Dams that impact roads in this category will be classified as medium hazard if there are no other hazards to be considered.

c. Interstates or roads with AADT > 2,000: Probable loss of human life.

d. If AADT data is unavailable for a road, reasonable assumptions may be made based on the best available data, or alternatively a Dam Owner may obtain a traffic count to facilitate a hazard classification decision.

3.3.3 RAILROADS

Railroads are assumed to be impacted if overtopped at any depth. The potential for a railroad to be overtopped is based on the breach model completed in Section 3.1. If any railroad is impacted, the dam will be classified as medium hazard or high hazard. If the railroad is determined to be impacted, the following criteria will be used to determine loss of human life:

a. Freight line: Probable loss of human life if 10 or more trains per day.

b. Passenger Rail Line: Probable loss of human life if active line.

3.4 ALTERNATE METHODS

The following alternate methods may be used by the Department and Dam Owner to inform a hazard classification review, as appropriate and as described below:

3.4.1 USE OF A 1-DIMENSIONAL MODEL

a. Survey or Light Detection and Ranging topographic information should be used.

b. The other requirements described in Section 3.1 apply.

c. The presence of people is evaluated as described in Section 3.2.

d. Flooding lethality is evaluated based on flooding depth only.

e. For homes and other habitable structures, loss of human life is assumed if the inundation depth is greater than 2 feet. Inundation at any depth is assumed to result in economic losses.

f. For roads and railroads, loss of human life is assumed if the road or railroad meets the criteria outlined in Sections 3.3.2 and 3.3.3.

3.4.2 SIMPLIFIED HAZARD CLASSIFICATIONS

a. A simplified analysis is generally only applicable to situations where the hazard classification is obvious and indisputable. If downstream consequences are not clear, a more detailed analysis must be performed.

b. The hazard classification is determined by field investigations and a review of available data, such as recent aerial imagery and topographic data. Basic engineering calculations may also be used in some cases.

c. No breach model is required for determining the hazard classification if the dam is concluded to be high hazard. (Note that the inundation map produced from a breach analysis will still be required for the Emergency Action Plan).

d. The use of this simplified option to justify anything other than a high hazard classification is limited to dams with a maximum storage capacity at the top of the dam of less than 200 ac-ft.

3.5 ADDITIONAL CONSIDERATIONS

The following points provide further discussion and interpretation of the division between the hazard classification categories:

a. If failure of a dam would result in probable loss of human life, then the dam should be classified as high hazard.

b. If failure of a dam would not result in probable loss of human life, then the dam should be classified as either medium or low hazard.

c. Failure of a low hazard dam could cause impacts including inundation of agricultural land, minor roads as described in Section 3.3.2(a), out-buildings other than residences, and isolated unoccupied oil well pads.

d. If failure of a dam would result in greater losses than those associated with a low hazard dam but would not result in probable loss of human life, then the dam should be classified as medium hazard. This would include economic losses such as damage to homes, commercial or industrial facilities (including large oil and gas facilities), public utilities, roadways as described in Section 3.3.2(b), railroads as described in Section 3.3.3, or lifeline facilities. Economic losses are assumed to occur if these types of structures are inundated to any degree, or roads or railroads are overtopped by any amount.

e. Policy deviations are subject to Department approval under Section 1.4.

4 CHANGE IN HAZARD CLASSIFICATION

Upon the adoption of this policy and any future updates to statutes or policy, the Department will perform hazard classification reviews for all medium and high hazard dams and low hazard dams at least 20 feet in height, in order to determine those dams with a potential for hazard classification change.

The Department's findings will be developed and communicated to Dam Owners at no cost to Dam Owners.

4.1 DEPARTMENT REVIEW

The review will be based upon dam hazard classifications in N.D.A.C. § 89-08-01-01, as well as Department guidelines and this Policy for hazard classification methodology.

Prior to beginning a review, the Department will provide notice to the Dam Owner on record of the pending review and its necessity.

The Department's review will utilize available information in performing the analysis. If the Department determines available information is insufficient, the Department will collaborate with Dam Owners to ensure efficiency and accuracy of analysis.

4.2 DEPARTMENT FINDINGS

The Department will communicate initial findings of potential change of hazard classification to the Dam Owners of such dams on record at the Department.

a. The Department will work with Dam Owners to assure that any additional information that may impact hazard classification analysis is included in the hazard classification review. Additional information may be submitted up to 90 days after the initial notice.

b. The Department will consider Dam Owner responses and provide a final determination to Dam Owners within 60 days of the response period closure.

4.3 DEPARTMENT APPEALS

If a Dam Owner disagrees with the Department's findings of a revised hazard classification, the Dam Owner may

a. Perform further analysis in accordance with the Department's Dam Design Guidelines to recommend a different hazard classification for Department review and approval.

b. Request a deviation under Section 1.4.

c. Appeal the Department's decision under Section 1.3.

4.4 LEGACY DESIGNATION

If the hazard classification of an existing dam results in a higher classification solely as a result of any Department-initiated modifications to rules, statutes, or policy, the dam will be placed in Legacy status. Legacy status will remain in effect and the Department will not require compliance activities until such time as a permittable action under N.D.C.C. § 61-16.1-38 is before the Department.

The Legacy designation is only applicable to the permitting jurisdiction of N.D.C.C. § 61-16.1-38, and compliance with all other appropriate sections of N.D.C.C. and N.D.A.C. is expected by the Department.

A Legacy designation may be removed or otherwise modified at the Director’s discretion due to public or life safety concerns.

5 DEFINITIONS

As used in this Policy, the following definitions are critical for interpretation and understanding:

a. **Legacy:** Existing dams temporarily exempt from Department of Water Resources' dam design criteria based on hazard classification change due Department-initiated modification to rules, statutes, or policy.

b. **Dam:** As defined in N.D.A.C. § 89-08-01-01 and otherwise in Department policy.

c. **Dam Owner:** The person or entity responsible for the maintenance, operation, and repair of a Dam.

d. **Dam Hazard Classification:** Codified in N.D.A.C. § 89-08-01-01 and in Department policy. This Section of N.D.A.C. was updated in 2023 to reflect the most recent state of the national dam safety practice. The updated definitions are as follows:
   - "High-hazard dam" means a dam with high-hazard potential where failure or misoperation will probably cause loss of human life.
   - "Low-hazard dam" means a dam with low-hazard potential where failure or misoperation results in no probable loss of human life and low economic loses.

     "Medium-hazard dam" means a dam with medium-hazard potential where failure or misoperation results in no probable loss of human life but can cause economic loss, disruption of lifeline facilities, or can impact other concerns.

e. **Permittable Action:** Any action to construct a new dam, or modify an existing dam, that requires a construction permit from the Department to be obtained as outlined in N.D.C.C. § 61-16.1-38 and N.D.A.C. ch. 89-08-02. Routine maintenance that restores a dam to its original design is not a permittable action.

6 POLICY HISTORY

Policy Adopted: 06/02/2023. REG_04.2023 was developed alongside N.D.A.C. updates effective January 2023.
Previous Revision(s): No Policy Revisions Available

APPENDIX A

Figure 1: Depth-Velocity-Flood Danger Level Relationship for Houses Built on Foundations (Bureau of Reclamation, 1988)

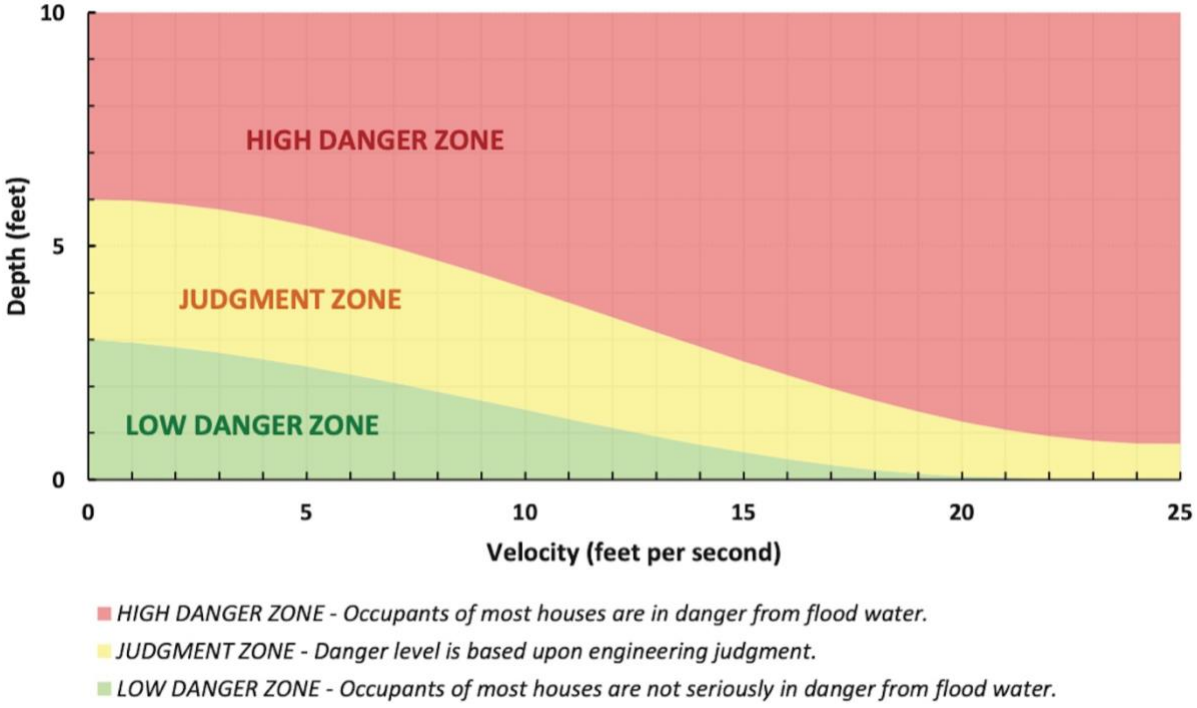

Figure 2: Depth-Velocity-Flood Danger Level Relationship for Mobile Homes (Bureau of Reclamation, 1988)