

**DOW 3.1.4 – GUIDANCE FOR
DAM ENGINEERING ASSESSMENT REPORTS**

New York State Department of Environmental Conservation

DEC Program Policy

Issuing Authority: Mark Klotz	Title: GUIDANCE FOR DAM ENGINEERING ASSESSMENT
Date Issued:	Latest Date Revised: New
Originator: Alon Dominitz – Dam Safety Section	

***** NOTICE *****

This document has been developed to provide Department staff with guidance on how to ensure compliance with statutory and regulatory requirements, including case law interpretations, and to provide consistent treatment of similar situations. This document may also be used by the public to gain technical guidance and insight regarding how the department staff may analyze an issue and factors in their consideration of particular facts and circumstances. This guidance document is not a fixed rule under the State Administrative Procedure Act section 102(2)(a)(i). Furthermore, nothing set forth herein prevents staff from varying from this guidance as the specific facts and circumstances may dictate, provided staff's actions comply with applicable statutory and regulatory requirements. This document does not create any enforceable rights for the benefit of any party.

Preliminary DRAFT

Table of Contents

I.	Summary:	1
II.	Policy:	1
III.	Purpose and Background:	2
IV.	Responsibility:	2
V.	Procedure:	2
VI.	Related References:	7

I. Summary:

Title 6 of New York Rules and Regulations, Part 673.13 (“Part 673.13”) requires the preparation of an Engineering Assessment Report, which must be submitted to the New York State Department of Environmental Conservation (“Department”).

This policy provides guidance to dam owners and engineers on the preparation of, and DEC staff on the review of, Engineering Assessment Reports pursuant to Part 673.13.

II. Policy:

The life-cycle of a dam consists of several phases, starting with construction and initial filling and transitioning to alternating periods of normal operation and maintenance, repairs, and upgrades. This cycle continues until the dam is breached or removed, or fails. For a dam to continue to serve its intended function, it must be maintained. As conditions change over time, repairs and perhaps reconstruction and/ or upgrade of the dam, for example increasing the spillway capacity, may become necessary.

A dam is a part of a dynamic system, with various forces continuously acting upon it, such as ice, flooding, earthquakes, erosion, animal burrowing, woody root penetration, and sediment accumulation. Downstream developments can affect the hazard class of a dam, upstream developments can change the way the watershed behaves during runoff events, and science and technology evolve to modify best practices and regulatory criteria over time.

The release of water stored by a dam in an uncontrolled manner represents a potential danger to downstream lives, property and the environment. As such, the dam owner must develop and implement a dam safety program. Part 673 requires that an owner’s dam safety program that is appropriate to the dam’s hazard classification. Those for Class C (High Hazard) or Class B (Intermediate Hazard) dams consist of periodic safety inspections and engineering assessments, along with an Inspection and Maintenance Plan (“I&M Plan”) and an Emergency Action Plan (“EAP”). An I&M Plan template is available on the Department’s web site. Requirements for the preparation of an EAP are described in the Department’s publication “DOW 3.1.3 – Emergency Action Plans for Dams”. Periodic safety inspections and engineering assessments are intended to provide an independent review of an existing structure and the owner’s dam safety program, identify any deficiencies or gaps in knowledge, and determine the steps and schedule necessary to correct the deficiencies.

When deficiencies are identified, the dam owner must categorize them either as issues that can be resolved through regular or enhanced maintenance, or whether repairs and/or upgrades are required. Conditions requiring additional or continued monitoring should also be identified. Maintenance is work involved in the routine or regular upkeep of a dam, and includes, for example, debris removal, mowing grass, cleaning trash racks, and exercising valves. Repairs or upgrades generally consist of more extensive or intrusive work, which if performed improperly could endanger the structure, and therefore must be performed under the supervision of a professional engineer (“PE”), in accordance with a formal design, and require a dam safety permit issued by the Department through its Division of Environmental Permits, in pursuant to Parts 608 and 621. Although maintenance does not require a Dam Safety permit, it could require other types of permits, such as a Construction Stormwater permit, from the DEC.

Safety inspections and engineering assessments include many of the components that would be required as part of a permit application for repair or upgrading of the dam. The difference is that regular inspections and assessments are an evaluation of the *existing* structure against current dam safety criteria, whereas the Engineering Design Report, plans and specifications required for a permit must evaluate the *proposed* repairs and/or upgrades to the structure. In either case, the dam and appurtenant structures should be considered as part of an integrated system, and must function together to safely fulfill their water impounding function.

III. Purpose and Background:

It is the purpose of this guidance to inform owners, engineers, and DEC staff regarding the procedures, content, and format for dam safety engineering assessment reports as required by 6NYCRR Part 673.

Part 673 requires owners of Hazard Class B (Intermediate Hazard) and Class C (High Hazard) dams, and, at the Department's discretion, dams assigned a Condition Rating of Unsafe or Unsound, to perform an Engineering Assessment of their dam on a regular basis.

This guidance represents the professional judgment of the Department's Dam Safety Section's engineers. The guidance is applicable for the average dam in an average situation. Where unusual conditions exist, it is the duty of the dam owner's engineer to highlight any deviation from the Department's guidance and provide the specific engineering rationale for said deviation. Cost alone is not an acceptable rationale.

IV. Responsibility:

The dam safety program within the Bureau of Flood Protection and Dam Safety will interpret and maintain this policy.

V. Procedure:

The Engineering Assessment Report must, at a minimum, include the following:

1. Hazard classification evaluation
2. Complete Safety Inspection
3. Evaluation of the dam's spillway capacity
4. Evaluation of the dam's structural stability
5. Evaluate Outlet works (reservoir drain) capacity
6. Review of the dam's Emergency Action Plan, and
7. Provide a conclusion as to whether the dam is in conformance with current dam regulations and safety guidance.

The tasks normally associated with performing a dam safety Engineering Assessment can be divided as follows:

- A. File review
- B. On-site Engineering Inspection and Investigation

- C. Engineering review, calculations, and conclusions
- D. Engineering Assessment Report Generation
- E. File report with Department and retain a copy with owner's records

The assessment should determine the condition of the dam relative to the appropriate safety criteria. It should identify deficiencies and recommend, as appropriate, remedial repairs, operational restrictions, monitoring, and/or modifications. The assessment should also identify any analyses and/or studies needed to assess and determine solutions to identified deficiencies.

The engineering assessment must be performed by a professional engineer registered to practice in New York State and possessing appropriate experience in evaluation of dams of type, size, and location to be assessed. The dam Engineering Assessment Report must be submitted to the Department in accordance with the schedule detailed in Part 673.13. The owner must retain a copy of the dam Engineering Assessment Report with their records of the dam.

A. Records Review

Perform a review of existing dam information. The engineer must analyze the dam's design, construction, and operational records to become fully acquainted with the present physical features as well as construction and performance history of the dam.

An owner may have a recently performed engineering assessment of the dam. At the owner's and engineer's option, the engineer may review the report for applicability to current standards and safety criteria and adopt all or parts of past reports. If an engineer does accept the analysis in any previous report, the engineer must state that the report's assumptions, analyses, or other accepted components have been reviewed and are acceptable to demonstrate compliance with selected criteria (as applicable). The engineer or owner may also choose to disregard previous assessments and perform a completely new assessment.

There may be multiple information sources, including, but not limited to, the following:

Owner's Dam File:

The owner should have a file for the dam that might contain dam design information and various reports generated when the dam was designed or rebuilt; hydrology, hydraulics, geology, inspections, etc. Operational records, if available, may contain vital information that should be reviewed in detail. The review should include review of the existing I&M Plan, results of past inspections, and maintenance work completed and/or planned. Finally, this part of the review should include a review of the dam's Emergency Action Plan, with particular attention to the inundation map. Part 673, effective August 19, 2010, requires the owner to retain pertinent records on a dam, and authorizes DEC to inspect those records.

Department's Dam Safety File:

The Department maintains a file for most dams in the state. While the DEC file may contain similar information to that contained in the owner's dam file, it can often provide supplementary information.

Note: Due to the security-sensitive nature of certain information on dams, the dam owner must submit a written request to the Department's Dam Safety Section ("DSS") asking for release of the specific file from Dam Safety to the owner's engineer. Contact information for DSS is available in Section E. of this document.

B. On-site Engineering Inspection and Investigation

The Engineer should perform at least two specific on-site activities; a hazard classification reconnaissance and a thorough dam safety inspection. Additional on-site investigations; i.e., soil borings, test pits, topographic and boundary surveys, etc., may be necessary dependent on what additional information is required to complete the engineering assessment. Interviews with maintenance personnel and other people familiar with the dam are also recommended.

Hazard Classification Reconnaissance

The dam's hazard classification influences the regulatory and design standards for the dam and is therefore a critical component to the assessment. A dam's hazard classification will typically dictate spillway capacity criteria, which in turn affects much of the remainder of the assessment, as well as the EAP requirements.

The first step in determining a dam's hazard classification is to perform a review of the downstream area of the dam. Before beginning the field reconnaissance, the engineer should become familiar with the dam's features and setting through a desktop review of the downstream area using readily accessible data such as USGS 7 ½ minute quadrangle maps, recent orthoimagery, and similar tools to determine potential downstream features that may be impacted by the dam's failure flood wave. The engineer can then perform the downstream field investigation to verify the buildings, roads, railroad, environmentally sensitive areas, etc. that will be within the flood wave's path. In most cases, field work will also be necessary to assess potential impacts and recommend a hazard classification.

The engineer should also review the local planning board's records to identify if proposed downstream development may impact the dam's future hazard classification. Draft planning documents will not impact the current hazard classification but may provide an indicator of future changes that could affect the classification and design standards.

The Engineering Assessment Report should include a written description of the hazard classification review, description of potential downstream impacts, and a recommended hazard classification in accordance with the hazard classification regulations at Part 673.5 and applicable NYS DEC guidance.

Dam Safety Inspection

The dam safety inspection is a comprehensive examination of the visible physical features of the dam and its appurtenant structures. The dam safety inspection requirements are presented in 6NYCRR Part 673.12(d). The visual inspection should comment on previously observed deficiencies, including the deficiencies' progression or advancement and identification of continuing or new corrective actions, as necessary,

with recommendations and a schedule. Corrective actions and recommendations may be deferred until after the technical analysis.

All observations and unusual features should be recorded, regardless of how insignificant they may seem. Photographs are a permanent record of the condition of the dam and provide a means to compare dam conditions at different points in time. Photographs are a required element of the Dam Safety Inspection Report.

A good source of information for conducting a dam safety inspection can be found in the Department's "An Owners Guidance Manual for the Inspection and Maintenance of Dams in New York State" which can be found at <http://www.dec.ny.gov/lands/4991.html>. Other references can be found on the Internet.

Underwater inspections may be required if the condition or design of underwater features is not well known. If necessary, an underwater inspection should be conducted as part of the Safety Inspection.

Other On-Site Investigations:

It may be necessary to conduct various investigations to verify assumptions that are used in the Engineering Assessment Report, i.e. subsurface investigation to obtain data for the dam's stability assessment, or determining the source of potential seepage.

C. Engineering Review, Calculations, and Conclusions

Following completion of the records review and on-site investigations, the engineering review can commence. The engineering review consists of:

1. Hazard Classification,
2. Hydrology Assessment,
3. Hydraulic Assessment,
4. Stability Assessment,
5. Conclusions and Recommendations.

Each of these tasks is described below.

1. Hazard Classification

Using information obtained during the on-site hazard classification reconnaissance and other information; i.e., topographic maps, orthoimagery, etc. (and following the Department hazard classification guidance) a hazard classification for the dam needs to be determined. If the dam is already classified as a Class C-high hazard dam, and there is no disagreement that there will be probable loss of life if the dam were to fail, it is not necessary to spend a great deal of effort on this portion of the assessment. If the assessment results in the dam's hazard classification changing, all documents supporting the hazard classification change must be included in the report. An electronic copy of all models used, not just the model's results, must be made a permanent part of the engineering assessment.

2. Hydrology Assessment

Given a dam's hazard classification, the inflow design storm can be determined, see Section 5.3 and Table 1 of the Department's "*Guidelines for the Design of Dams, Revised January 1989* ("*Guidelines*")". If existing dam documents contain a viable hydrologic study, that hydrologic study can be utilized. All assumptions and analyses used in the study need to be independently verified and all models employed need to include the latest hydrologic criteria applicable to the field of dam safety engineering, many of which are reflected in the *Guidelines*.

Note: As stated in the 1989 *Guidelines*, HMR-33 has been replaced by HMR-51 and 52, which are the applicable models for determining the Probable Maximum Flood in New York. If the dam is a high hazard dam and the hydrology model employed to determine the Probable Maximum Flood was HMR-33, the Probable Maximum Flood should now be determined using HMR- 51/52. HMR-33 is not accepted.

The Department does not have a preferred hydrology model for determining the inflow design storm, but any model used should be appropriate for the geographic and hydrologic setting of the dam being studied. The Engineering Assessment Report needs to include both the input and output pages for the model and should include an electronic copy of the model for the Department's review.

3. Hydraulic Assessment

If the dam's record contains a viable hydraulic assessment that uses the appropriate inflow design flood, that hydraulic study may be utilized. All assumptions and analyses used in previous reports must be verified by the engineer performing the new assessment, if the engineer wishes to rely on them. If the inflow design storm is different than the previous studies, a new hydraulic analysis will be necessary.

The design criteria for the hydraulics study can be found in Section 6.0 of the "*Guidelines*". If a computer model is used to perform the hydraulic assessment, the input and output printout must be contained within the assessment and an electronic copy of the model must be provided to the department for its review.

4. Stability Assessment

If the dam's record contains a viable stability assessment, that stability study may be utilized. Even if previous loading assumptions are no longer valid, other parts of a previous stability assessment may be utilized if appropriate. Again, all assumptions and analyses used in previous reports must be verified by the engineer conducting the new assessment.

The design criteria for the stability study can be found in Section 10.0 of the "*Guidelines*". If a computer model is used to perform the stability assessment, the model's name, model version, and the input and output printout should be placed in the assessment and an electronic copy of the model must be included within the assessment and an electronic copy of the model must be provided to the department for its review.

The stability analysis depends on the existing subsurface geology and often requires a geotechnical investigation. Previous geotechnical investigations may be available from which to gather soil or rock parameters. The need for additional or new geotechnical investigations may also be indicated. The engineer performing the Engineering

Assessment must judge whether existing information is sufficiently reliable to determine the dam's stability. If there is visual indication that the dam may be in distress because of stability reasons, additional geotechnical investigations may be needed.

5. Conclusions and Recommendations

The Assessment Report should have a summary section that briefly discusses the data reviewed and provides a conclusion as to whether the dam is in conformance with current dam safety criteria. A list of the proposed recommendations, if any, necessary to bring the dam into conformance with applicable dam safety criteria and a schedule for completing the recommendations must be provided. The report should be reviewed with the dam owner before it is submitted to the Department.

D. Engineering Assessment Report Generation

The Engineering Assessment Report should be compiled in a 3-ring binder and should contain the results of the on-site investigations, dam safety inspections, engineering assessments, and other data or reports. All previously published dam specific hydrology, geology, hydraulic, stability, etc. reports used or referenced should be made a part of the assessment report, and may be included as an appendix. The cover page must show the Dam Name, State Dam ID#, the town/city/village and county in which the dam is located, date of the Assessment, and the name and New York PE number of the engineer who performed the Assessment, and the name and signature of the dam owner.

The Assessment Report must be stamped and signed by a professional engineer registered to practice professional engineering in New York State.

E. File Report with Department and Retain a Copy with Owner's Records

One stamped and signed copy of the completed Engineering Assessment Report, as well as an electronic copy on CD, must be submitted to the following address:

New York State Department of Environmental Conservation
Division of Water - Dam Safety Section
625 Broadway, 4th Floor
Albany, NY 12233-3504

VI. Related References:

Dams shall be compared with safety criteria contained in:
"Guidelines for Design of Dams," NYS DEC, 1989.

<http://www.dec.ny.gov/lands/4991.html>

New York State Laws:

<http://public.leginfo.state.ny.us/menugetf.cgi?COMMONQUERY=LAWS>

Environmental Conservation Law 15-0507:

Structures impounding waters; structures in waters; responsibility of owner; inspection

Environmental Conservation Law 15-0503:

Protection of water bodies; permit

Executive Law Article 2-B:

State and Local Natural and Man-Made Disaster Preparedness

New York State Regulations:

<http://www.dec.ny.gov/regulations/regulations.html>

Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR):

Part 608 – Protection of Waters

Part 621 – Uniform Procedures (includes Emergency Authorization)

Part 673 – Dam Safety

Other Guidance Documents:

Guidance on Inspection and Maintenance of Dams is contained in the publication “Owners Guidance for the Inspection and Maintenance of Dams in New York” NYS DEC, June 1987, <http://www.dec.ny.gov/lands/4991.html>.

Guidance on Emergency Action Plans is contained in the publication “DOW 3.1.3 – Emergency Action Plans for Dams,” NYS DEC, June 2010, <http://www.dec.ny.gov/lands/4991.html>.