New York's Dam Safety Program

by Alon Dominitz

Over the past few years, natural disasters such as Hurricanes Katrina and Rita have focused national attention on the need to evaluate the safety of water infrastructure such as dams. Dam incidents in Massachusetts, New Jersey, and Hawaii, as well as closer to home, have raised the public's concern about the condition of our dams. Central New York saw record-setting floods in June and July 2006, and the lower Hudson Valley may have experienced record flooding in April 2007. These storms, and several lesser but still very significant floods over the past few years, together with increasingly strong predictions that global warming will result in increased storm intensities in New York, point to the need for strong attention to our flooding protection infrastructure and planning. Dams are an important resource, providing water supply, flood control, hydroelectric power, and recreational opportunities. But, like any important component of our infrastructure, dams must be maintained, and periodically rehabilitated, to ensure their continued safe and reliable operation.

New York State's Dam Safety Program dates back to the early 1900's, when regulation of dams was under the authority of the State Engineer's office. The program maintains a computerized inventory of dams, along with map and file records dating back to 1900, and in some cases earlier. The state's inventory of dams includes over 5,500 dams.

The Dam Safety Section is a part of the NYS Department of Environmental Conservation, Division of Water. The state's Dam Safety Program is defined primarily in Environmental Conservation Law (ECL) 15-0503 and 15-0507. These sections of the ECL define permitting requirements for dams, the responsibilities of dam owners, and the state's authority to ensure dam safety.

Dam Hazard Levels

Dams are classified in terms of potential for downstream damage if the dam were to fail. High Hazard dams are those whose failure could cause loss of human life, or interrupt critical infrastructure such as an interstate highway. Intermediate Hazard dams are dams whose failure could cause damage to homes and important utilities, severe environmental damage, or other serious economic damage. Low Hazard dams are dams whose failure could cause no more than damage to isolated buildings and local roads, or minor environmental or economic damage. The state's inventory of dams contains over 5,500 dams of which over 380 are "High Hazard" dams.

Engineering criteria for dams are contained in DEC's "Guidelines for Design of Dams." Every dam is unique and must be evaluated individually by the design engineer and the Dam Safety Section but, in general, High Hazard dams are subject to the most stringent engineering design criteria because the consequences of failure can be so severe. But even Low Hazard dams must be able to survive most conditions that a dam is likely to see. For instance, even a Low Hazard

Photo by Alon Dominitz, NYSDEC

Concrete overflow spillways may become worn over time.

Work on dams is exempt from dam safety permitting if the dam meets any of the following criteria, which are found in ECL 15-0503:

- Height is less than six feet, regardless of impoundment capacity
- Potential impoundment capacity is less than one million gallons, regardless of dam height
- Dam height is less than 15 feet, and maximum impoundment capacity is less than three million gallons.

The dam's height is measured from the highest point on the dam to the lowest point on the downstream side and the dam's impoundment capacity is measured assuming the reservoir elevation is equal to the highest point on the dam.

dam should be able to safely pass the inflow from a 100-year storm.

Inspection and Enforcement

The Dam Safety Section performs visual inspections of dams as part of its technical regulatory activities, to check that the owner is conducting proper inspection and maintenance of the dam and visually checks the overall condition of the dam. Engineers also review historic records and other available information on the dam. Dam Safety Section engineers will often conduct the inspection with the dam's owner. The Dam Safety Section will share its inspection findings with a dam owner, but it's important to understand that DEC's inspection is not a substitute for a comprehensive inspection program by the owner.

When the Section identifies deficiencies, which pose a threat to life, property or natural resources, the DEC works with the dam owner to ensure that necessary remedial measures are undertaken. The DEC tries first for voluntary compliance by the dam owner. When an owner is uncooperative, and if conditions warrant, the DEC will seek a binding schedule, as part of a Consent Order or a Commissioner's Order. Ultimately, the DEC can gain the authority to perform the work with its own resources, and recover costs from the owner, if the owner fails to comply with the Order.

When the DEC finds that a dam poses an imminent threat to life and property, such that time does not allow for standard enforcement procedures, the Department can issue a Commissioner's Summary Abatement Order. In the case of an immediate threat, with a cooperative owner and concurrence from appropriate parties, the DEC can issue an authorization for emergency work pursuant to the Uniform Procedures Act.

When the Dam Safety Section receives notice of an emergency condition at a dam, the DEC tries to work with the dam owner and local and state public safety officials to prevent a sudden release of the dam's impoundment. It's important to understand that in some cases a dam failure cannot be prevented, and those downstream must be notified and, if necessary, evacuated.

An up-to-date Emergency Action Plan (EAP) can help dam owners and public safety officials provide a more efficient response to a dam emergency. Guidance on developing an EAP can be found in the DEC's document, "An Owners Guidance Manual for the Inspection and Maintenance of Dams in New York State," and in FEMA's guidance on developing a dam EAP (see Resources). All High Hazard dams should have an EAP that is complete, accurate, and current.

Permits

In New York State, there is no dam safety operating permit program, but work on a dam, including construction, reconstruction, repair, or removal, is subject to permitting requirements. Normal maintenance activities generally don't need a Dam Safety Permit, but may be subject to other permits from the Department because of their potential impact on water quality.

The dam safety provisions of the Environmental Conservation Law were most recently modified in 1999. Those modifications raised the size thresholds for dams requiring permits, so that more of the smallest, least risky dams are not subject to the permit application requirements for dam safety (See box left).

When work on a dam needs a permit, engineers in the Dam Safety Section conduct a technical review of the work to check that the resulting structure will meet the appropriate safety criteria, and that the design is consistent with modern engineering techniques. All applications must include an engineering design report, plans, and specifications. The design must be by a New York State registered professional engineer, and stamped by that engineer. As with all construction projects, the quality of the project depends on the experience and attention to detail of the design engineer.

The Dam Safety Section will also require the applicant to identify the engineer who will be responsible for construction oversight of the project, and for a schedule of construction inspection by that engineer. As with the project's design, the experience of the contractor and engineer, and careful attention to quality, are critical to a successful project. If full-time inspection will not be provided, the construction engineer is expected to personally inspect the project at least during critical times of the construction. At the end of the project, the Dam Safety Section requires a certification from the construction

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Photo by Alon Dominitz, NYSDEC

Earthen dams should be maintained with a grass cover.

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engineer that the project was constructed under his/her care and in accordance with the approved plans. As-built documents for the project, including stamped drawings, are also required. For some projects, the Dam Safety Section will not allow refilling of the reservoir until after a satisfactory inspection.

Owner Responsibility

Regardless of regulatory obligations, a safety program is an important and cost-effective tool for any dam. As recent dam failures around the nation point out, even a relatively small dam failure can be costly in terms of dollars, or even lives. Consistent inspection and maintenance, and an up-to-date Emergency Action Plan, are the best ways to avoid a costly dam failure.

An effective inspection program is essential for identifying problems and providing safe maintenance of a dam. An inspection program should involve three types of inspections:

1. Periodic technical inspections
2. Periodic maintenance inspections
3. Informal observations by facility personnel as they operate the dam

Technical inspections must be performed by specialists familiar with the design and construction of dams and should include assessments of structure safety. Technical inspections, sometimes called formal inspections, are performed by a licensed professional engineer experienced in dam safety evaluation. Maintenance inspections are performed more frequently than technical inspections in order to detect, at an early stage, any developments which may be detrimental to the dam. They involve assessing operational capability as well as structural stability, and are performed on a regular schedule, as well as after the dam has experienced unusual conditions, such as a severe storm or earthquake. The third type of inspection is actually a continuing effort by onsite facility personnel (dam tenders, powerhouse operators, maintenance personnel) performed in the course of their normal duties. Education of new personnel is required to assure the continued effectiveness of these inspections.

Visual inspections performed on a regular basis are one of the most economical means a dam owner can use to assure the safety and long life of a dam. Visual inspection is a straightforward procedure that can be used by any properly trained person to make a reasonably accurate assessment of a dam's condition. The inspection involves careful examination of the surface and all parts of the structure, including its adjacent environment. The equipment required is not expensive, and the inspection usually can be completed in less than one day.

Future Directions

Although DEC has broad authority to ensure dam safety, the Environmental Conservation Law revisions of 1999 gave DEC additional authority to promulgate regulations that define an owner-responsible dam safety program. DEC is currently developing those regulations. As with design requirements, it is expected that a dam's safety program will have more components and be more detailed as the dam's hazard classification increases.

In the summer of 2006, the Department presented a discussion draft of the proposed regulations at three public meetings around the state. Provisions being considered in the regulations include:

- Requirements for record keeping
- Mandatory inspection and maintenance plans
- Scheduled inspection by a Professional Engineer working for the owner

Photo by Richard Coriale, NYSDEC

A dam should have a functional drain in case of emergency and to facilitate maintenance.

Photo by Albert Ash, NYSDEC

Clearing debris from spillways is an essential part of an inspection and maintenance program.

- Scheduled reassessment of a dam to confirm that it meets modern safety criteria
- Emergency Action Plans
- Disclosing the presence of a dam when property is transferred
- Verification of a dam's hazard classification
- Demonstration of financial assurance, collectible by the Department if the Department has to conduct remedial work at a dam
- Annual certification that the dam's inspection and maintenance plan, emergency action plan, and other requirements are being met

Many dams continue to be an important component in the infrastructure that enables our modern lifestyle. The DEC is committed to working with dam owners and engineers to ensure the continued safe use of these structures where appropriate, or their removal or breach where those options make sense.

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